ETEES 2020

Abstract Book

2nd International Conference on

Emerging Trends in Earth and Environmental Sciences

March 04 – 06, 2020

COLLEGE OF EARTH & ENVIRONMENTAL SCIENCES
University of the Punjab Lahore 54590, Pakistan

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March 04-06, 2020

VENUES*:*

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About ETEES 2020

Environmental hazards have emerged as serious global challenge threatening social and economic infrastructures. Anthorpogenic activities and over exploitation of resources, over the last century, have significantly deteriorated the natural ecosystem of the earth leading to severe destruction of the environment. This has resulted in devastating environmental conditions such as desertification of cultivated lands, contamination of groundwater, silting of dams, water logging, salinity and contamination of agricultural soils. The management and maintence of environment is critically essential for human survival as well as all other forms of biodiversity. Therefore, the impending destruction of the ecological infrastructure needs urgent attention. Scienists across the globe have recognised the need and importance of saving the environment and are striving to address environmental issues in order safeguard the planet and resources. Similarly, scientists from Pakistan are also making huge efforts and contributions in combating issues of pollution and climate change in pursuit of providing a safe and healthy environment for our future generatiosn.

Increased environmental degradation in Pakistan is resulting in an economic loss of over Rs. 365 billlion annually. Urbanization, industrialization and non-exponential growth in population are further aggravating the issue. Similar to other parts of the world, the current major environmental challenges in Pakistan include climate change, water scarcity, energy shortage, pollution (air, water, soil, plastic) and improper waste management, salinity and water logging, use of syntheric pesticides in agriculture practices, deforestation, excessive loss of biodiversity and many more. Addressing environmental issues at all social and economic levels is the need of the hour in achieving sound and sustainable development along with healthy environment.

The College of Earth and Environmental Sciences (CEES) is one the premier institutes in Pakistan covering the disciplines of Environmental Sciences, Applied Hydrology, Tourism and Hospitality Management, Gemomatics, and Occupational Health and Safety Management; offering academic degrees at graduate, post graduate and doctoral level. The CEES team is pleased to announce the 2nd International Conference on “Emerging Trends in Earth and Environmental Sciences (ETEES 2020) to be held on 4^{th} – 6^{th} March, 2020 in Lahore Pakistan. The main aim of the Conference is to provide a platform and create opportunities for renowned scientists, researchers and professionals from all over the world and Pakistan to share their valuable insights, research fiundings and experiences in order to collectively solve the issues of climate change and environmental degradation.

The Second International Conference on "Emerging Trends in Earth and Environmental Sciences" [2020] is organized by College of Earth & Environmental Sciences (CEES), University of the Punjab, Lahore, Pakistan, to provide a knowledge exchange platform for Researchers, Engineers, Academicians, Planners and key environmental stakeholders of Pakistan. Participants from different fields of science can benefit by actively participating in the discussion and exchange of latest research interventions and problem solving techniques. It is anticipated that over 200 participants from Pakistan and more than 10 delegates across the globe will attend the thought provoking keynote lectures and oral presentations. The scope of this conference is to address issues and advancements in different fields related to Earth and Environmental Sciences. The conference is hosted by University of the Punjab, the mother institute of higher education in Pakistan.

WELCOME MESSAGE FROM CONFERENCE PATRONS

Patron in Chief: **Prof. Dr. Niaz Ahmad Akhtar**

Vice Chancellor, University of the Punjab Lahore, Pakistan

Distinguished Guests, Ladies and Gentlemen,

As the Vice Chancellor, University of the Punjab; it is a pleasure to express my deep Patronage for the Second International Conference on "Emerging Trends in Earth and Environmental Sciences"ETEES-2020" being hosted by CEES. Pakistan is currently facing severe environmental challenges. Addressing these issues in true spirit with potential solutions through research is the need of the hour. I hope this season's gathering of scientists on the occasion of "ETEES-2020" will avail opportunities for discussing interventions and solutions for combating environmental problems. I welcome all the international and national delegates to University of the Punjab and wish all the luck to the organizers.

Patron: **Prof. Dr. Sajid Rashid Ahmad**

Principal, CEES, University of the Punjab Lahore Pakistan

Distinguished Guests and Colleagues,

It gives me immense pleasure to welcome professors, scientists, experts and students from all participating countries including Pakistan, who are associated with earth and environmental sciences, to the Second International Conference on "Emerging Trends in Earth and Environmental Sciences"ETEES-2020". As the Patron, I am very pleased to point out our commitment to play leading role in the field of earth and environmental sciences at national level based on multilateral collaboration with international scientists. I would like to extend my thanks to all the team members who have worked hard in making this event possible, the funding agencies including Higher Education Commission Islamabad, Punjab Higher Education Commission Lahore, Pakistan Sciences Foundation Islamabad and sponsors in all categories who have helped us to keep down the costs of "ETEES-2020".

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PLANERY TALKS

THE ROLE OF EARTH AND ENVIRONMENTAL SCIENCES TO SOLVE INTERCONNECTED GLOBAL CHALLENGES AND EMERGING TRENDS IN ASIA AND THE PACIFIC REGION

Shahbaz Khan

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The Asia and the Pacific region needs to respond to inter-connected, socio-economic and environmental sustainability challenges, including: climate change and disaster impacts; threats to oceans (acidification, resource depletion, pollution); intensifying ecological footprints and biodiversity loss; water scarcity and water quality deterioration; massive population growth and urbanization. UNESCO - a United Nations specialized agency created to establish the "intellectual and moral solidarity of mankind" contributes to the building of peace, the eradication of poverty, and sustainable development and intercultural dialogue through education, the sciences, culture, communication and information. The current recognition by the global community of the pivotal role played by science, technology, and innovation (STI), knowledge-sharing and capacity development, and science-based policy development for addressing those global challenges opens up unique opportunities for earth and environmental scientists.

The related emerging trends in Asia and the Pacific region, which can affect achievement of peace and sustainable development include:

- Urbanization and Sustainable Development
    - Where is urbanization happening?
    - What are the most vulnerable cities?
    - Can interdisciplinary solutions address complex problems?
- Climate Change
    - What are the most vulnerable areas?
    - Is there a role for advocacy to influence the private sector?
- Rising Inequalities
    - How will the poor of tomorrow differ from poor of today?
    - What vulnerable groups should we focus on, in a world of limited resources?
- The Fourth Industrial Revolution
    - How will the economic landscape in Asia-Pacific region?
    - How will I4.0 affect the communities you serve?
    - How to dialogue with national governments on the issue?
    - What is your value proposition?

UNESCO is responding to these emerging trends through international and intergovernmental Earth and Environmental Science programs supported by a global network of UNESCO designated sites, specialized centers and academic chairs forming a global network of leading experts. This needs new expertise for science-based systems solutions for resilient societies to achieve the Sustainable Development Goals (SDGs).

COMPOSTING OF BIO-WASTES: CHALLENGES, OPPORTUNITIES AND CONCERNS

Cunha-Queda, A.C.

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ABSTRACT: Circular bioeconomy aims the development of sustainable products recovering valuable components from bio-waste materials. In fact, the recycling of bio-waste is an important step for the recovery of organic matter and production of soil organic amendments. One bioenergetics process for this purpose is composting, which can be applied from home to industrial level. Composting is a controlled aerobic bioconversion of mixed organic bio-waste into a valuable product, the compost. During process raw organic materials such as food wastes, green residues, and organic fraction of municipal wastes are transformed to humic-like substances. To obtain high quality products is essential the collection of separate bio-waste and apply an efficient treatment to stabilise organic matter. Challenges in waste management have been reported by several authors and are promising for the use of composts. Bernal refers that five main challenges have been identified in waste management in agroecosystems: to improve nutrient availability and soil cycling; to develop technologies for nutrient re-use; to reduce contaminants and improve food safety; to mitigate environmental emissions; and to enhance soil health and function. Another possibility is the recovery of substances from wastes or/and composts such as the recovery of humic-like substances from low quality composts. This work aims to present the most important aspects of composting process, their impacts on the quality of compost as well as the biotechnological use of products as soil organic amendments or as a resource to produce high value substances.

Keywords: Composting, Soil, Organic Matter, Bio-waste, Circular Bioeconomy.

CHEMISTRY OF STRATOSPHERIC OZONE: CHALLENGES AND SOLUTIONS

Jamil Anwar

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ABSTRACT: Ozone is potential pollutant if present in troposphere. But in stratosphere where it is present naturally in maximum concentration, it is considered as a shield because it consumes highly harmful UV radiations including UV B & C. Since the end of the last century scientists discovered a constant depletion in the stratospheric ozone layer due to anthropogenic activities. In 1976 atmospheric researchers worried the world that if the depletion remained continued with the same rate then the showers of UV radiations from sun shall be more intensified which is a potential threat to all types of living things and different ecosystems of the globe. In this talk we shall discuss the reasons of the continuous depletion especially in a particular time of the year and on a particular region of the globe i.e. Antarctica. Concerned chemical, physical and thermal parameters shall be discussed along with the latest situation of Ozone Hole. Involvement of different chemical species like CFCs and some free radicals in the depletion process, and their alternatives shall also be discussed keeping in view their safety and effectiveness. The concept of Polar stratospheric clouds (PSCs) and Polar vortex (PV) is very important while understanding the depletion phenomenon so the formation and their role will also be discussed. Considering the stratospheric ozone depletion is a complicated system, in present talk all essential chemical and thermo-physical parameters will be discussed to raise the awareness among young environmental researchers.

Keywords: Stratosphere, Ozone, Polar Stratospheric Clouds, Polar Vortex, UV Radiation

ORAL PRESENTATIONS

OCCUPATIONAL HEALTH AND SAFETY: OHS-1

RISK OF ARSENIC EXPOSURE FROM DRINKING WATER ON HUMAN HEALTH OF DISTRICT D.G KHAN, PAKISTAN.

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ABSTRACT: Arsenic contaminated drinking water is a serious health threat for a climatically vulnerable county like Pakistan. In order to analyses the amplitude of this threat, one-hundred and forty-one groundwater samples were randomly collected and analyzed for different physio-chemical parameters across District Dera Ghazi Khan of Pakistan. A schematic approach is followed and one sample was collected from the source-end while two samples were collected from consumer-end. Each scheme was estimated and parameters were compared with World Health Organization (WHO) standards. This study concluded that 82% of water samples found within the prescribed limits of WHO while 18% were not, and thus reported unsafe for drinking purpose. The percentage concentration in unsafe samples was: Fluoride (2%), Arsenic (12%), Nitrate (14%), TDS (18%), Hardness (24%), Calcium (57%), and Sulphates (63%). No significant change in water quality observed between source and consumer ends. Furthermore, Regression Correlation showed weak relationships (r2=0.14) between Arsenic and pH parameters at source point. Other parameters with Arsenic showed insignificant Regression Correlation. Risk assessment revealed a low possible health risk to the population of District D.G Khan for arsenic at source 0.38<1 (mean) and consumer ends 0.33<1 (mean) when compared with WHO standards. It may increase with time if remain neglected. The treatment plant is suggested to avoid negative human health impacts.

Keywords: Heavy Metals, Water Pollution, Contamination

OCCUPATIONAL HEALTH AND SAFETY: OHS-2

ASSESSMENTS OF NEEDLE STICK INJURIES IN HEALTH CARE WORKERS IN HOSPITALS OF DISTRICT GUJRAT

***Mohsin Abbas and Sidra Yahqoob**

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ABSTRACTL: The purpose of the study is to assess the needle stick injuries in Gujrat and safe injection practice in health care workers. The data were collected from the two stages sampling. Modified questionnaire of World Health Organiztion (WHO) 2005 was administered by health care workers through interviewing them, 127 health care workers that are working were observed. The data was analyzed in SPSS (version 21). The data revealed that the safety behaviour of the health care workers was poor with high safety knowledge and awareness towards needle stick injuries with mean score 0.5 among other studied variable significant association was found between job title, age group, work shift, work experience, injection usage per day and needle stick injuries in last year with studied variables. The study concluded that the rate of NSI is high and most of the NSI occur in medical staff is due to the ignorance of the safety behavior in hospitals. The safety behavior can improve and NSI can be reduced NSI training workshops, and strictly implementation of guidelines and policy.

Keywords Needle sticks injuries, safety knowledge, safety awareness, safety behavior, occupational exposure, safety management

OCCUPATIONAL HEALTH AND SAFETY: OHS-3

ASSESSMENT OF EXISTING OCCUPATIONAL HEALTH & SAFETY (OHS) PRACTICES IN SURGICAL INSTRUMENT MANUFACTURING INDUSTRY IN DISTRICT SIALKOT

***Mohsin Abbas and Momina Habib Ullah**

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ABSTRACT: Occupational safety and health is multidisciplinary approach of safety and elevation of workers health by eliminating occupational factors and environment that hazardous to health and safety at work place .An experiential study was undertaken to assess physical, chemical hazards, existing control measures and occupational health and safety (OHS) services of small –medium-and large-sized (SML) surgical instruments manufacturing industries. Data was collected by survey from 20 SML industries located at Sialkot, Punjab Pakistan, through questionnaire. Collected data was analyzed using SPSS (statistical package for social sciences) software. Descriptive statistics (mean and standard deviation), graphs and then inferential statistics techniques (Pearson correlation and simple regression) were used. Results revealed that existing control measure are not good in small and medium sized industries as compared to large sized industries. OHS services were not provided due to lack of consideration and information and deficiency of industrial safety and health expertise. The percentage of workers exposed to severe levels in the small units is 40%. Therefore; Pakistani SMEs need to pay a serious attention towards proper implementation of the OHSMs.

Keywords: Occupational Health, Safety, Hazards, Control Measures

OCCUPATIONAL HEALTH AND SAFETY: OHS-4

THE PREVALENCE OF RESPIRATORY ILLNESSES AMONG THE WORKERS OF CRUSHING INDUSTRY IN PAKISTAN: A CROSS SECTIONAL STUDY

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ABSTRACT: Respiratory illnesses are considered as the main cause of work-related diseases in Pakistan which occurs mostly in the form of cardiovascular diseases, occupational asthma, COPD, neurotoxicity, different types of cancers, hearing loss due to noise, psychological and skin disorders. The major contributors of these illnesses are dusty occupations. The crushing industries are the backbone of construction sector and provide employment to almost 0.5 million people. The lack of literature on respiratory illnesses shaped the rationale of the present study. A cross-sectional survey was conducted in a large crushing unit located in the province of Punjab. The main survey encompasses questionnaire and few measurements including chest expansion measurement and peak flow obstruction. Apart from direct exposure to crushing dust, different factors like sociodemographic, tobacco use, indoor air quality and occupational health and safety components were analyzed to find out the risk association of any respiratory illness. The bivariate and multivariate analyses were done in SPSS. The result discussed four main types of respiratory illnesses. The prevalence of diseases was reported in percentage such as chronic bronchitis, chronic asthma, chronic rhino sinusitis, peak flow obstruction and any other form of respiratory illness as 15, 20, 24, 42 and 53% respectively. The significant predictors were occupation category in the industry, job duration of 25 years or more and working hours more than 36 hours a week. Among different socio-demographic variables, lower education level, rural residence and use of non LPG fuels were strongly associated with higher risks. Another important predictor was the use of tobacco (cigarette or any other form) which was significantly associated with chronic asthma [OR 2.79], chronic bronchitis [OR 5.38], and peak flow obstruction [OR 5.38]. Poor compliance with OHS practices was significantly associated with higher occurrence of various diseases. Compliance with OHS measures with training and awareness can be a short-term solution. But for a holistic approach, changes in living standards and linking of socioeconomic inequalities are needed.

Keywords: Occupational Health, Safety, Respiratory Diseases

OCCUPATIONAL HEALTH AND SAFETY: OHS-5

EXPOSURE OF BRICK KILN WORKERS TO HEAVY METALS AND ITS IMPACTS ON HUMAN HEALTH IN DISTRICT DERA ISMAIL KHAN (KPK) PAKISTAN

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ABSTRACT: Brick kiln (BK) dust is the main cause for heavy metals (HMs) origin and responsible for oxidative stress and associated health problems in the workers. For this purpose, the current study was planned to investigate the soil in surrounding of brick kilns for Heavy metals (Cr and Pb) toxicity in BK dust and its adverse impacts on worker's blood. Further with ultimate impacts on antioxidant activities and health problems at different exposed brick kiln workers. A Total of 47 samples of blood with exposed and control groups were collected for HMs and antioxidant activities. A significant higher level ($p<0.05$) of alanine aminotransferase (ALT), Alkaline Phosphatase (ALP), Cr and Pb for all exposed groups were observed as compared to control group resulting in liver cell damages and other health problems. Moreover, the activity of SOD, Catalase and Malondialdehyde in relation with HMs (Cr and Pb) for different exposed groups were increased by 66 % and 75 % and 107% as compared to control. A positive correlation of MDA, SOD and Catalase were revealed with Cr and Pb in most of the exposed brick kiln workers and Total protein content showed negative Correlation with Cr and Pb, while Protein content were lowered by 21% as compared to control group. From the questionnaires-based studies, the exposed brick kiln workers, revealed the sign of respiratory disorders such as (asthma, whoop, gasping), eczema, liver and kidney problems.

Keywords: Brick Kilns, Heavy Metals, Exposure

OCCUPATIONAL HEALTH AND SAFETY: OHS-6

DUST-BOUND METALS EXPOSURE MAY TRIGGER OXIDATIVE STRESS AMONG CHROMITE MINE WORKERS IN BALOCHISTAN, PAKISTAN.

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ABSTRACT: Exposure to heavy metals have been associated with generation of reactive oxygen species (ROX) giving rise to oxidative stress in occupational and environmental settings. Chromite mining is an important economic sector in Balochistan province and has been so far neglected research area to address the associated health implications among the workers involved with this profession. In this regard, a systematic study was designed comprising 110 chromite mine workers stratified into loaders, extractors and operators along with 30 controls to find out association between dust-bound metals exposure with resultant oxidative stress. Urinary creatinine adjusted metals levels were used as main biomarker of metals exposure. Results revealed elevated urinary levels of Chromium (Cr) (58.74±8.6) along with Pb (43.69±4.3, Cd 27.77±2.6 and Ni 18.98±3.0) µg/g creatinine among underground extractors. Associating metals with oxidative stress resulted in elevated malondialdehyde (MDA) levels among ore extractors suggesting high levels of lipid peroxidation (62.28±5.52 nM/dL). Furthermore, blood Catalase (CAT) and Superoxide Dismutase (SOD) were significantly correlated ($P<0.05$) with urinary metals levels among chromite mine workers. Findings suggested that workers associated with chromite mines were found under oxidative stress as a result of certain metals exposure (Cr, Pb and Ni) influencing health parameters including blood pressure, headache, fatigue that in turn may trigger individual susceptibility towards adverse genetic and non-genetic health implications giving rise to the need for exposure control measures in the mining activity areas.

Keywords: Chromite mining, Chromium, Heavy metals, Occupational exposure, Biomarkers, Oxidative stress, Antioxidants, Blood MDA, Pakistan

OCCUPATIONAL HEALTH AND SAFETY: OHS-7

HEALTH RISK ASSESSMENT OF DUST EXPOSURE IN PEOPLE LIVING NEAR INDUSTRIAL AREAS

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ABSTRACT: To date limited information are available concerning unintentional productions, screening, profiling, and health risks of toxic metals in ambient and occupational environment. Literature reveals that dust is a neglected environmental matrix scarcely investigated for toxic metals. To our knowledge, this is the first study to investigate the concentrations and health risks of metals (Cu, Cr, Co, Ni, Pb, Cd) in indoor dust of major industrial estates (Lahore, Gujarat, Gujranwala, Sialkot, Peshawar and Karachi in Pakistan. The concentration of Cu 12 µg/g > Cd 5.9 µg/g >Pb 2.1 µg/g > Cr1.9 µg/g > Ni1.5 µg/g > Co 1.29 µg/g. health risk posed via dust inhalation contaminated via toxic metals was significant for copper and Pb. The adverse health outcomes to the industrial workers or residential colonies penetrating around industrial hubs were in the form of breathing problems with problems of coughing and congestion through or some part of year and Abnormal level of blood CP. Abnormal Hb, platelets and white blood cell content were more prominent in industrial workers as compared to the residing population . However, marked differences were observed in control verses exposed population. The toxic metals content in dust particles could be correlated ($p>0.05$) in the form of health issues reported in questionnaire and analytical data collected from population working and residing near industrial hubs.

Keywords: Industrial Hubs, Dust, Toxic Metals, Health Risk

OCCUPATIONAL HEALTH AND SAFETY: OHS-8

COMPARISON OF SOCIAL COMPLIANCE PERFORMANCE REPORTING TRENDS AMONG NATIONAL AND MULTINATIONAL COMPANIES LISTED WITH PAKISTAN STOCK EXCHANGE

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ABSTRACT: Various stakeholders or interested parties (ranging from owners to community) and other relevant stakeholders or interested parties have different business interests or concerns. Due to globally expressed concerns, pressure is building up on corporations to share non-financial performance data with the interested parties as required by the Global Reporting Initiative (GRI) Standards related to Corporate Governance and Sustainability Performance (CGSP). This study was undertaken to determine trends of sharing social compliance performance information by companies with other stakeholders. For analysis, 26 best performing national companies (NC) declared by the Securities & Exchange Commission of Pakistan (SECP) during 2013 to 2017, in various sectors, like Oil & Gas Production, Oil & Gas Marketing, Chemicals, Fertilizer, Cement, and Food & Personal Care Products and 4 Multinational corporations (MNCs) operating in Pakistan were evaluated. Publicly available information, like Annual Reports, CSR Reports, Sustainability Reports of the selected companies was used to determine the extent these companies share OHS and employee welfare related information with other interested parties, per requirements of GRI Standards. Also, comparison was made between MNC and NC for their compliance to GRI and to determine if MNC follow the same Standard of reporting as being practiced in their country of origin. Results shows only one NC included up to 40 % information in the annual report submitted to the Securities & Exchange Commission of Pakistan (SECP) and made it available on their websites. The website of other 5 NC shared only limited GRI required information. None of the MNCs shared any information separately for their Pakistan activities, though SECP code requires to report CGSP as per Annex-1 of SRO 1216 (I)/2017, the Listed Companies (Code of Corporate Governance) Regulations, 2017, annually. It is recommended that SECP must include Social Compliance performance reporting requirements in Annex-A and ensure compliance.

Keywords: Global Reporting Initiative (GRI), Corporate Governance and Sustainability Performance (CGSP), Securities & Exchange Commission of Pakistan (SECP), Multinational corporations (MNCs), National Companies (NC)

OCCUPATIONAL HEALTH AND SAFETY: OHS-9

PREVALENCE OF WORK-RELATED MUSCULO-SKELETAL DISORDERS AND WORKSTATION CONFIGURATION AMONG SUPER MARKET CASHIERS

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ABSTRACT: Repetitive strain injuries, back pain and postural disorders are the most prevalent Musculo-skeletal disorders especially among super market cashiers. The basic purpose of this study is to analyze the work-related MSD's and influence of workstation design among cashiers. Moreover, we examined workstation configuration that includes layout and design of workstation, sitting and standing format and height of work surface as they are main factors in determining WMSDs in supermarket cashiers. Data collected from 15 different super markets among which 100 participants were assessed. Participants were provided with questionnaires that require information regarding their job history and demographics. These participants were evaluated based on physiological and psychological factors with self-designed questionnaire including Modified Nordic Questionnaires using Likert scale. Besides Symptom Checklist (SCL-90) was also administered. Three different work groups including Cashiers work, Picking work and Delicatessen work were formed. Moreover, the effects of their specific work demands on their overall health were examined. During survey, it was assessed that the factors which affect the cashiers work include layout design (front facing, side facing, left/right handed and counter checkout), height of the work surface and standing or sitting formats of cashiers. The occurrence of Musculo-skeletal symptoms was estimated by finding out the height of the work surface, counter design and layout. According to Ontario Safety and Health Association (OSHA) the height of counter station should be 50.8cm (20inches) from the ground. The data analysis was performed by SPSS software. High workstation height and prolonged standing patterns increases the incidence of back pain and limb disorders. The study shows that there is a huge workload differences among three work groups. Due to strenuous work activities, picking workers showed more postural disorders. Data suggested that repetitive hand movement and poor workstation layout and design increases the risk of work related Musculo-skeletal disorders among supermarket workers. Moreover, cashiers were encouraged that good counter design is helpful to cashier's health and work performance.

Keywords: Ergonomics, Occupational Diseases, Occupational Health

OCCUPATIONAL HEALTH AND SAFETY: OHS-10

EFFECTS OF SHIFT WORK ON FATIGUE & ACCIDENT IN MANUFACTRING INDUSTRY

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ABSTRACT: Our modern society continues to moves towards a 24/7 around the clock work schedule. Since the industrial revolution and the discovery of electric light, working after dark is a common trend. In several industries shiftwork-systems around-the-clock have been developed to ensure continuous services, production or manufacturing. Today, working late nights or evenings is as ordinary as working at daytime. Working in night shift requires awaking and effects sleep quality which further result in chronic fatigue. Fatigue affects every worker in industry to some degree. There are few jobs that have an inherently higher risk of fatigue due to shift work. In addition, the timings of work shifts have been increased; 12-hour shifts and longer have been in practice at many workplaces. The aim of the study was to investigate the fatigue risk due to working in rotating shifts through Fatigue & Risk Indices calculator (FRI) and the number of safety incidents in which fatigue could have been a casual factor.

This paper uses Fatigue and Risk Indices to assess the probable fatigue and risk associated to shiftwork schedule. In this cross-sectional descriptive study, 400 industrial workers were selected by convenient sampling method. Here, 200 workers are in permanent day shift while other 200 worker are in rotating shifts. Data was gathered using timesheets survey and analyzed by SPSS & Excel. The methodology involved the calculation of a 'Fatigue Risk Index' and it was further intended to use the index to assess changes in work patterns and to determine whether any aspect of the work pattern was likely to increase levels of fatigue. Five factors are associated for calculation of fatigue and risk indices, namely: (time of day, shift duration, rest periods, breaks and cumulative fatigue), the scores from each factor were added to provide an overall index for fatigue.

Findings indicated a significant difference between day shift and rotating shift workers in fatigue levels and accidents. Employer and workers should become aware of fatigue associated with shift work and have to find solutions in order to prevent fatigue that ultimately leading to accidents and further to maintain their health. Therefore, it is suggested that the daily sleep required per 24 hours on average is 08 hours. This is an important coping strategy to shift workers, particularly those working early starts, late finishes or night shifts, where sleep is normally disturbed and reduced well below eight hours.

Keywords: Shift work, Fatigue Risk Index, Sleep Disturbance, Accidents, Coping Strategies.

OCCUPATIONAL HEALTH AND SAFETY: OHS-11

OCCUPATIONAL STRESS ASSESSMENT AMONG MEDICAL AND PARAMEDICAL STAFF IN TERTIARY CARE HOSPITALS BASED ON OBSERVATIONAL STUDY

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ABSTRACT: Occupational stress is a work-related disorder resulting from a combination of exposure to environmental stressors, internal stressors and inadequate adaptive skills. Work-related stress is a common concern among doctors, particularly residents working in tertiary care hospitals. In Pakistan, both medical and paramedical staff face many stressors because of their high job demand, dealing with multiple patients, excessive duty hours and strict rules and regulations. The objective of the study was to measure occupational stress among hospital employees involving different parameters. The observational study was conducted in tertiary care hospitals in Punjab, Pakistan. The sample size of the study included 138 hospital employees with 71 medical staff/doctors and 67 paramedical staff. Study duration was about 6 months from September 2019 to January 2020. Data collection was primary and it was obtained by face to face interviewing. A detailed structured questionnaire using likert scale was used to collect the data and stress levels were evaluated ranging from 1-5. The current study presented that the medical staff revealed more stress than paramedical staff, with House Officers/ Internees and Medical Officers/ Postgraduate Residents showing the most stress levels. The most significant factors leading to stress were related to tasks and roles, poor environment and working conditions, bad management and lack of justice/ fairness. Analysis of demographic characteristics showed that males faced greater stress than females and people of age group $\leq$ 30 years showed more stress value than other age groups. It is shown that moderate experienced (5-10 years) employees were more sensitive to stress at job than other groups. Data also showed that the employees of public hospitals bear more stress than those working in private hospitals.

Keywords: Occupational Stress, Stressor, Hospital Employee, Resident, Paramedic.

OCCUPATIONAL HEALTH AND SAFETY: OHS-12

PHYSIOLOGICAL AND PSYCHOLOGICAL IMPACT OF NOISE POLLUTION ON THE WORKERS OF ALLAHWASAYA TEXTILE AND FINISHING MILLS

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ABSTRACT: This research study deals with the occupational noise in the environment and occupational noise or industrial noise is the major issue in the textile mills. The study is carried out in the textile industry to evaluate the noise problems and effects of noise on the health of the workers. Industrial noise causes the physical, physiological and psychological impacts in the workers. The main objectives of my study to measured the intensity of noise in the different section of the textile industry and to analysis and evaluate the effects of noise on the worker's health are working in the different section of the industry. Digital sound level meter used for the measurement of the intensity of noise in the various sections of the textile mills and data collecting through questionnaire and interview. Current publication on the effects of noise seriously reviewed and intensity of noise determined by the variety of scientist are presenting in this research paper. At the end of the result shows that noise pollution is responsible for physical, physiological, psychological impacts in the industrial workers. High level of noise is responsible for damage the quality of the worker's health and reduced the capability for doing their jobs as well. Questionnaire results show that different health issues arise due to high noise because mostly workers are working in high noise area. At the end it is recommended that noise control methods applied and provide the personal protective equipments to the workers for their personal safety.

Keywords: Risk Assessment, Textile Industry, Noise Pollution

OCCUPATIONAL HEALTH AND SAFETY: OHS-13

ANALYSIS OF HEALTH AND SAFETY MANAGEMENT, CONDITIONS IN THE CONSTRUCTION SECTPOR OF PAKISTAN

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ABSTRACT: This study assessed, analyzed occupational health and safety management, conditions in the construction sector of Pakistan. A self-designed questionnaire was developed to feed research statistics collection requirements, moreover, an interview was conducted from experts in the construction sector. Both types of methods qualitative and quantitative were employed in order to accomplish the aims of this research. Total of 174 completed questionnaires was received against the self-designed questionnaire addressing construction industry particularly specific and high-risk activities causing construction accidents. Participants against this questionnaire were with a range of construction job roles (e.g. HSE, Construction Team) along with a variety of experience and different qualification level. Majority of the respondents agreed that specific construction-related legislation is either not available or irrelevant and lacking with current construction health and safety requirements. Similarly, the majority were inclined towards agreement while staying neutral for education and training, supervision in different activities, provision of a Safe System of Work (SSOW), provision of resources, well maintained and inspected equipment or tools. In conclusion absence of legislation and enforcement is evident, training and awareness, supervision for work activities, resources for safety in the job tasks, provision of inspected and maintained equipment along with the provision of SSOW are the key areas requiring significant attention and improvement. Hence recommendations against all above areas should be achieved to improve health and safety (H&S) management and conditions in the construction sector of Pakistan.

Keywords: Occupational Health and Safety, Safety Practices, Review, Construction

OCCUPATIONAL HEALTH AND SAFETY: OHS-14

STUDIES FOR THE HEALTH RISK ASSESSMENT AMONG WORKERS OF FUEL STATION OF LAHORE AND GUJRAT DISTRICTS

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ABSTRACT: The present work is the part of the detailed study with reference to the Benzo(a)pyrene exposure among petrol pump workers. The study was carried out in Lahore and Gujrat cities. Survey of petrol pumps was conducted using structurally designed questionnaire for the assessment of certain health parameters, work and socioeconomic profile and identification of hazards present at workplace. One to one interview and measurement of various health parameters was carried out for randomly selected total 1000 workers. It included 900 respondents working in 107 petrol filling stations (exposed group) of Lahore and Gujrat districts, Punjab from 17 to 60 years of age. Only those workers and petrol pumps were included in the study that gave their consent. Besides 900 petrol pump workers, data and samples of 100 workers included peons and security guards working in various offices and schools (non-exposed) belonging to more or less same socioeconomic status were considered for comparison purpose. Personal information of workers such as; age, residential area of the workers, types of transport used by them, marital status, educational level and income was collected. Health profile was assessed by asking questions about the diseases they are suffering from, dietary and personal hygiene and cigarette smoking habits. Height and weight were measured for the calculation of body mass index (BMI) and blood pressure was also recorded. Occupational information was gathered for the nature of job, working hours per day, duration of job. Detailed information was also collected with reference to the usage of personal protective equipment (PPE), types of PPE, hazards awareness, emergency preparedness and trainings. The data was statistically analyzed and compared on the basis of various parameters including age groups, types of job, working hours and cigarette smoking habits etc. It was peculiar to note that workers of the age of 17 years were working at pumps. Regarding the disease profile 80% were found to be diseased in exposed group with highest evidence of cough and chest pain (82%). Other diseases like skin problems and headache was the common complaint. BMI and blood pressure was more or less was same in both groups with variation from low to high range depending of age. It was noteworthy that most of the workers had long working hours per day generally working for 12 hours (50.22%) and particularly the one belonging to exposed group were working even for 24 hours every day (22.66%). Cigarette

smoking was higher in exposed group with 37% and 27% were found to be smoking in non-exposed groups. Alarming situation was found with reference to the usage of PPE as 87% of the exposed group i.e. petrol pump workers in both cities were not using any PPE. Various health hazards were evident at petrol stations settings with very high level and frequency of physical (56.21%) and chemicals hazards (87.03%). The results of this study are depictive of the fact that low socioeconomic status, less education, lack of awareness, no use of PPE, personal hygiene and smoking habits are contributory factors. Results of the other component of this study pertaining to BaP in blood and hair revealed that the petrol pump workers are likely to get occupational exposure to PAHs like BaP and other such substances in their workplace because of many reasons especially due to ignorance, nonuse of PPE, ineffective regulations, lack of monitoring as well as the faulty working practices. The results of the study are significant and provide enough evidence with reference to the health and safety issues at the petrol pumps in Pakistan. It also advocates for the formulation of specific rules for petrol pump workers.

Keywords: Health Risk Assessment, Hazard Assessment, PPE

ENVIRONMENTAL GEOLOGY: EG-01

SEDIMENTS ASSESSMENT FOR ARSENIC SOURCE DELINEATION: HOLOCENE ALLUVIAL AQUIFERS OF INDUS DELTA, SINDH, PAKISTAN

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ABSTRACT: Groundwater arsenic contamination is recently reported in the alluvial aquifers of Indus deltaic plain. Since the source of arsenic is believed to be natural as widely reported in other deltaic aquifers of same age (Holocene), it is imperative to evaluate the soil characteristics for identifying the sources of arsenic and its mobilization mechanism. For this purpose, 49 soil samples were collected from near aquifer sites in all three talukas of Tando Muhammad Khan district. Visual analysis revealed that soil is light grey in color with fine texture ranging from silt to silty-clay. The X-ray diffraction study reveals the occurrence of quartz, mica and clay minerals in all collected soil samples. Plagioclase feldspar is second dominant mineral group in the order of albite (calcian) >albite>albite (disordered) = anorthite > anorthite (sodian) = anorthite (disordered). Calcite is major carbonate mineral which is detected in 40 out of total 49 soil samples. The occurrence of other occasional minerals includes amesite, nitro-calcite, rutile and zinnwaldite. The frequency of micaceous minerals in collected samples is in the order of clinochlore> polylithionite> Biotite > phlogopite> muscovite. Polylithionite is found in about half of the total soil samples, where most of the aquifers contain arsenic >20 µg/L (Khan, 2014). Phlogopite is observed in seven soil samples which are also associated with clinochlore. On the other hand, biotite is found in 14 sediment samples collected from Tando Muhammad Khan and Bhulri Shah Karim talukas and muscovite occurs in three soil samples of Tando Muhammad Khan taluka. It can be concluded from present study that fine-grained phyllosilicates have strong affinity for arsenic retention. These sediments are important source of arsenic Indus delta and other deltaic plains of the world.

Keywords: Arsenic, Sediments, Alluvial Aquifers, Holocene, Indus Delta.

ENVIRONMENTAL GEOLOGY: EG-02

NEW RESULTS OF PHYSICAL MODELLING OF THE SALT RANGE AND POTWAR PLATEAU: EVOLUTIONARY STRUCTURAL MODEL

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ABSTRACT: Centrifuge modeling is a powerful technique that replicates a variety of complex geological structures, which provide crucial constraints on the determination of structural histories and deformation mechanisms in different fold-thrust belts around the world. In the present research centrifuge-modelling technique is used to mimic and experimentally simulate the dynamics of the Salt Range and Potwar Plateau (SR/PP) to better constraint their disparate structural style along the strike. For the purpose of modelling, the SR/PP stratigraphy has been segregated into four mechanical units, the Salt Range formation, carapace unit (platform sequences), Rawalpindi Group, and Siwalik Group. In models the four stratigraphic units are constructed of thin layers of plasticine and silicone putty, rest on a rigid base plate (represents the crystalline basement of the Indian plate) at a linear scale ratio of ~10-6 (1mm=1km) and deformed in a centrifuge at 4000g. To replicate the kinematic evolution of the SR/PP, the models are deformed in stages and monitored through a TV connected by a closed-circuit camera, attached to the centrifuge machine. Modelling result demonstrate that variation in the structural style along the strike in the SR/PP can be attributed to the mechanically weak Neoproterozoic salt horizon and geometry of an underlying basement ramp system.

Keywords: Modeling, Geological Structures, Salt

ENVIRONMENTAL GEOLOGY: EG-03

CAMBRIAN STRATIGRAPHY AND SEDIMENTOLOGY OF THE CYANOBACTERIA-DOMINATED MICROBIAL CARBONATES IN THE NORTH CHINA PLATFORM

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ABSTRACT: The study describes the diverse macro-, meso-and microfabrics of microbial carbonates deposited on the northern margin of the North China Platform during the Miaolingian-Furongian interval. During the first transgression of Paleozoic in the Cambrian, shallow-marine facies were deposited in most areas of the platform, which favored diversified biological reproduction inside the framework of microbial carbonates. The microbial carbonates in the selected sections of Shanxi, Liaoning, Inner Mongolia and Hebei provinces occur in Xuzhuang, Zhangxia, Gushan, Changshan and Fengshan formations. Based on the facies stacking patterns and cyclicity in the chronostratigraphic context, these formations are divided into six third-order depositional sequences. The shift in sedimentary strata from mixed tidal flat facies at the base of the Xuzhuang Formation to the overlying ramp carbonate deposits shows retrogradation under the second-order transgressive process, which deposited plentiful carbonate microbialites during the Miaolingian-Furongian interval. Compared to the development and abundance of thick oolitic banks during the Miaolingian, the profusion of calcirudites and massive biohermal microbialites in the Furongian represents the sedimentation style of the skeleton-poor stormy sea of the North China Platform.

Petrographic observation led to identification of eleven microfacies through the carbonate strata, which are grouped into six facies associations sited on a carbonate ramp. The high density preservation of calcimicrobes is chiefly observed in the microbial boundstone microfacies deposited in inner ramp open marine environments, which counts for the major proportion of the studied microbialites. The well-preserved calcimicrobes include *Girvanella, Subtifloria, Botomaella, Renalcis, Tarthinia and Epiphyton,* which confirm the recovery phase of microbial carbonate abundance and the cyanobacterial calcification episode of Cambrian-early Ordovician. A substantial increase in the diversity and abundance of calcimicrobes in the microbialite microfabric from Miaolingian to Furongian is observed in the study area. Furthermore, the recovery of *Epiphyton* from the Furongian microbialites refutes the possible decline of *Epiphyton* at the end of Miaolingian for this part of the North China Platform.

Keywords: Calcified cyanobacteria; Miaolingian; Furongian; Microbialites; North China Platform.

ENVIRONMENTAL GEOLOGY: EG-04

GIRAFFA REMAINS FROM GHUNGRILLA LOCALITY OF CHINJI FORMATION, SIWALIKS, PAKISTAN

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ABSTRACT: New *Giraffa* remains have been discovered from Ghungrilla locality of Chinji Formation, Siwaliks, pakistan. This Middle Miocene locality is present in Chinji Formation of Lower Siwalik with estimated age ca. 14.2-13.2 Ma. The present study consists of specimens of the family Giraffidae and can be referred *Giraffa priscilla*. It includes fragments of mandibles and maxilla and isolated dentitions. The studied specimens are characterized in having broad crown, obliquely present cusps/conids, strong styles/stylids and well-developed median ribs. It differs from other giraffid by having less reduced posterior half and strong pillar like metastyle. The studied specimens compared with the relevant samples housed in different Paleontological Museums in Pakistan and other foreign countries. *Giraffa priscilla* is endemic to the Chinji Formation of the Siwaliks, it is unknown from outside this region.

Keywords: Lower Siwaliks, Chinji, Ghungrilla, Middle Miocene, Giraffa Priscilla

ENVIRONMENTAL GEOLOGY: EG-05

EVALUATION OF ACID ROCK DRAINAGE POTENTIAL IN THAR COAL DEPOSIT AND MITIGATION/REGULATION OF ACID GENERATION, THAR BLOCK II, PAKISTAN

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ABSTRACT: Acid Rock Drainage (ARD – also known as Acid Mine Drainage – AMD) describes the formation of acid when sulfide bearing mine wastes (principally pyrite) are exposed to oxidizing conditions, typically in the presence of water, due to groundwater, rain and run-off. Stratigraphically, Thar region is mainly divided into 03 sedimentary formations which are overlaid on granitic igneous body. Thar coal deposit which is of low rank lignite grade is found in various coal seams within the oldest sedimentary formation (Bara – Eocene/Pliocene). As it is widely known that the major source of sulfur in coal deposits is due to the presence of pyrite mineral which is the main contributing factor in acid generation and spontaneous combustion. Acid Rock Drainage possesses major environmental risk in Thar Coal Mine (Block II) as generated acidic water from pyrite may seep downward and contaminate dune sand aquifer which is main source of domestic water utilization in Thar. This study is aimed to evaluate the Acid Rock Drainage Potential of Thar coal deposit along with the mitigating and controlling methods of acid generation from lignite coal mining operations at Thar Block II. The Acid Generation Potential test results carried out on the samples collected from all 03 sedimentary formations i.e. Bara - coal bearing (oldest), subrecent and dune sand (youngest) reveals that coal and carbonaceous claystone layers from bara formation are potential acid forming and are prone to acid rock drainage. Meanwhile, waste layers from dune sand and subrecent formation are classified as non-acid forming rocks. Samples were also tested for Acid Neutralizing Capacity in order to assess if any material type has the tendency to neutralize acid so that it can be used as a foundation/seal layer or shall be sequentially dumped with PAF (Potential Acid Forming) rocks. Acid neutralizing capacity results indicate that dune sand formation and sand lens from sub-recent formation has moderate to strong acid neutralization capacity.

Keywords: Acid Generation Potential; Acid Forming Rock; Acid Neutralizing Capacity; Bara Formation; Pyrite; Thar Coal

ENVIRONMENTAL GEOLOGY: EG-06

ENGINEERING AND PETROGRAPHIC PROPERTIES OF DOLERITES AGGREGATE OF KIRANA HILLS OF SARGODHA, PUNJAB, PAKISTAN

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ABSTRACT: Kirana, Rabwa and Chiniot areas of Punjab province, Pakistan have a number of isolated hills jutting out of a flat alluvial plain. These rocks are Upper Proterozoic in age. The exposed volcano-sedimentary sequence is slightly metamorphosed (lower greenschist facies). The Kirana Hills are the main resource of aggregate in southern and middle Punjab. These aggregates are used in sub base, base course, in rail ballast, as rip rap and for cement and asphalt concrete.The main lithologies in Kirana Hills are dolerites, rhyolites, lithic greywackes, volcanogenic slates and quartzwackes.This paper deals only with the dolerites. Petrographic composition and engineering properties as well as adhesion has been studied and discussed. Dolerite aggregates have excellent engineering properties.They can also be used for sub base, base course and rip rap material. However, quartzites, lithic greywackes, volcanogenic slates and rhyolites which can be used for these purposes are available in the area, therefore dolerites should not be used because they are the only good source of asphalt concrete and specially for the wearing course (since it gives a good road grip and resists polishing) in Punjab province with an area of 205344 sq. km. Dolerites should be reserved for cement and asphalt concrete. Petrographic studies show that dolerites do not have Alkali Silica Reaction Potential and are hydrophobic and can be used for cement as well as asphalt concrete. This area has total estimated 3097.3 million tons of reserves of all types of aggregates.The aggregate resource map of this important area is being presented for publication for the first time.

Keywords: Kirana Hills, Dolerites, Engineering Properties, Petrography

ENVIRONMENTAL GEOLOGY: EG-07

EVALUATION OF KALABAGH BRIDGE TERRACE AND MARI INDUS GRAVEL AS AN AGGREGATES

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ABSTRACT: Fifteen samples of coarse aggregates from Kalabagh Bridge Terrace and Mari Indus Gravel were studied for ASR/ASt R Potential and some of these samples were evaluated for their engineering properties. All the studied samples show excellent physical, engineering and chemical properties as aggregates for cement concrete. They conform to ASTM/BS/AASHTO standards used in this thesis. The petrographic characteristics of these samples were studied in detail. Quick Mortar Bar Tests were also carried out on selected samples in order to evaluate them for Alkali Aggregate Reaction Potential. There is a clear contradiction between the petrographic results and the widely used Quick Mortar Bar Tests carried out under ASTMC 1260-01.The petrographic tests and inservice behaviour both show alkali aggregate reaction potential of Kalabagh Bridge Terrace and Mari Indus Gravel. However, Quick Mortar Bar Test (ASTMC 1260-94) shows that the Kalabagh Bridge Terrace and Mari Indus Gravel are innocuous.In conclusion, the standard Quick Mortar Bar Test (ASTMC 1260-94), which is being used worldwide to evaluate ASR/ASt R Potential of aggregates, cannot be solely relied upon to take decisions regarding the ASR/ASt R Potential of aggregates. Studies carried out in other parts of the world tend to reach the same conclusion. Failure of this standard test has generally been linked to strained quartz-bearing rocks and mylonites. In this work it is shown that this widely accepted test may also fail where the reactive materials are reconstituted microcrystalline acid to intermediate volcanics and even low grade meta-argillites and metagreywackes.

Keywords: Kalabagh Bridge Terrace, Mari Indus Gravel, Engineering Properties, Petrography.

ENVIRONMENTAL GEOLOGY: EG-08

ENVIRONMENTAL HEALTH & SAFETY ISSUES ASSOCIATED WITH INDUSTRIAL ACTIVITY IN INDUSTRIAL ESTATE LAHORE

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ABSTRACT: The association between human well-being, economic development and reaching an ecological future has a complex and wide intellectual history. Environmental health and safety (EHS) signifies the identification, proper valuation and prevention of different health hazards in a work place and it also implies the maintenance of working capacity of employees. On the other hand, ergonomics unifies all these problems to improve the health and competency of employees. Industrial Estate was selected for this particular research purpose and was further divided into three subzones for assessment and monitoring purpose. Industrial Estate was initiated to deal with the issues concerning industrialization as a whole instead of individual problems. Two main methods for the collection of data were used. Specialized checklist regarding EHS practices and by surveying the site area from EHS views point. The respective measures of the activities were also kept in view to address the overall scenario of the industrial area. Other methods for data collection may also include review of complaints and accidental reports, interviews etc. The comparison of monitoring report of Ambient Air quality and water quality revealed that most of the results were in compliance with the international standards of WHO and national standards of PEQs. The PM10 was exceeding the limit which was defined in the PEQS. The graphs depict the current situation of the air and water quality in the different areas of the industrial site. The risk assessment matrix has also highlighted the zones with the major issues of the industrial estate. However, there were many factors that indicated that EHS compliance with organizational SOPs required improvement in implementation of EHS practices.

Keywords: Environmental Health & Safety; Industrial safety, Risk Assessment, Water Quality, Ambient Air Quality, Occupational Hazard, Monitoring

ENVIRONMENTAL GEOLOGY: EG-09

TRACE ELEMENTAL COMPOSITION OF COALS OF SALT RANGE, PUNJAB AS A PROXY TO RECONSTRUCT THE DEPOSITIONAL ENVIRONMENT

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ABSTRACT: Detailed geochemistry of coals of salt range (CIS (eastern and central part) and Trans-Indus salt range) Punjab were studied to develop the understanding of depositional environment (provenance, paleoclimate, sedimentation and facies origin). Coals samples of selected mines were analyzed for proximate, trace elements, mineralogy and $\delta 13C_{(org)}$ isotopic signatures. Sampled coals were categorized as lignite to sub-bituminous type. Among the 18 tested trace elements average concentrations of As, Co, Cr, Pb, Sr, Th, V, and Zn were significantly higher in both lignite and hard coals of CIS salt range. However, hard coals of trans-Indus salt range had higher concentrations of As, Cd, Cr, Cu, Pb, Th, V and Zn. The value of stable $\delta^{13}C$ isotope determines less enrichment of organic matter in these coals. Geochemical and isotopic signature of coals of both CIS and trans-Indus salt range were more or less same, which revealed the same depositional environment. Reconstruction of depositional environment based on different trace elemental ratios revealed that in the late carboniferous period, the peat swamp produced the coals under the active delta sedimentary system, which is influenced by sea land transitional zone. Moreover, sedimentation of coal deposits occurred during oxic, arid to semi-arid hot and warm climatic conditions. Based on the enrichment factor overall results concluded that Ag, As, Cd, Co, Cr, Pb, V, and Zn were significantly enriched in indigenous coals that need to be considered during coal utilization in developmental sector.

Keywords: Trace Elements, Environmental Deposites, Heavy Metals

ENVIRONMENTAL GEOLOGY: EG-10

LAKI LIMESTONE SUITABILITY ASSESSMENT FOR ROAD AGGREGATE USING LOSS ANGELES ABRASION VALUE (LAAV) AND AGGREGATE IMPACT VALUE TESTS

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ABSTRACT: Construction raw material is essential part of construction industry. The suitability of construction material is mainly depending upon the engineering properties of rock. Aggregate strength is one of the most important mechanical property of aggregate. Los Angeles Abrasion Value (LAAV) and Aggregate Impact Value (AIV) are the two tests, which are used to determine the strength of coarse aggregate. Nooriabad is an Industrial area which lies on super highway between two large cities (Karachi and Hyderabad) of Sindh Province. Many crushing plants (including asphalt plant) are operating in this area. These crush plants are the main suppliers of aggregate for two mega projects i.e. DHA city and Bahria town. Besides, M-9 Motorway project of CPEC is also being fed by the aggregate from the same source area. Laki limestone is quarried up to 4-5 feet depth from surface which is used as an aggregate material by various construction companies. Twenty limestone samples were collected from various crushing plant sites for assessment. Samples were tested for the determination of Loss Angeles Abrasion Value (LAAV) and Aggregate Impact Value (AIV) which were found about 25.3 % and 8.1% respectively as an average LAAV values are within the permissible limit. AIV of all the samples are less than 20% which shows that Laki limestone is suitable to be used as construction aggregate.

Keywords: Limestone, road aggregate, Abrasion Value, Impact Value, Nooriabad.

ENVIRONMENTAL ISSUES POSED BY PESTIFEROUS AQUATIC MIDGES (DIPTERA: CHIRONOMIDAE): A GLOBAL PERSPECTIVE AND SELECTED RESEARCH HIGHLIGHTS

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ABSTRACT: Adult Chironomidae emerging from some urban natural or man-made aquatic habitats have increasingly posed a variety of nuisance and economic problems, and in some situations, medical problems to humans in different parts of the world. Although there are an estimated 10,000 or more species of chironomid midges worldwide, less than 100 species have been reported to be pestiferous. Among midge control methods, numerous laboratory and field studies have been conducted on the use of organochlorines, organophosphates (OPs), pyrethroids, and insect growth regulators (IGRs). Field use of OP insecticides, such as chlorpyrifos, temephos, and others has generally resulted in larval control for 2-5 weeks or longer using economical application rates. Frequent use of some insecticides has caused increased tolerance to these insecticides in several midge species. The IGRs, diflubenzuron and methoprene, provide alternate means for midge control. These IGRs in some situations suppressed adult midge emergence by >90% at rates <0.3 kg AI/ha. A number of parasites and pathogens have been reported from midges in different parts of the world. *Bacillus thuringiensis* serovar. *israelensis* is effective against some midge species, but at rates at least 10x or higher established for mosquito larvicidal activity. The flatworm, *Dugensia dorotocephala*, and some fish species offer a good potential for midge control in some situations. In large habitats covering hundreds or thousands of hectares, information on the basic ecology of larval midges and adult behavior is essential for formulating midge control criteria.

Keywords: Chironomidae, Environmental Issues, Fish Species

TREE SURVEY IN CEMETERIES: AN INITIAL STEP TOWARDS A CLEAN AND GREEN PAKISTAN

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ABSTRACT: Vegetation in cemeteries is a valuable, cost effective and viable solution to gobble-up the concentration of air borne particulates in the urban environment. The present study has been carried out for the first time in the smog prone city (Lahore) with the objective to examine the potential of green cover in the urban cemeteries. The current research consists of two data sources. The first source is Muslim and the second is of a Non-muslim (Christian) Cemetery. Field assessment was carried out in cemeteries using global positioning system. The observation data of tree assessment was used in terms of trees diversity and their physical condition. Results of the study showed that the both cemeteries are deficient in tree cover. Thus, it was concluded from the findings that the unsatisfactory state of tree diversity can neither maintain the surrounding environment by absorbing carbon dioxide nor defeat the particulate matter. Moreover, the present study will prove a valuable source of information for researchers, urban foresters and policy makers to manage and monitor trees, to quantify the carbon sequestration level and to minimize the burning issues of environmental pollution. On the basis of the above findings, it is recommended to the concerned government bodies to plant healthy air purifiers in Lahore as much as possible to protect the environment of this metropolitan city as well as to achieve the goal of clean and green Pakistan.

Keywords: Air purifiers, Carbon Sequestration, Green Pakistan, Particulate Matter, Smog

A PRELIMINARY STUDY ON SOME DYE YIELDING PLANTS OF LAHORE

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ABSTRACT: Plant based natural dyes are in great demand these days to boost up green economy. This study has been carried out in Lahore, Pakistan which is well known as the city of gardens. A wide diversity of plants was available in Lahore and amongst those, some indigenous plants were recognized as dye bearing plants. The collected, identified and evaluated plants demonstrated that a total of 23 plant species belong to 19 different plant families. Eco-friendly aqueous method was adopted for the extraction of dye from indigenously available plants and evaluated their dyeing potential on leather substrate. Pre-mordanting technique was adopted using copper sulphate and oxalic acid mordants. Results of selected plants were arranged in alphabetical order according to their botanical, local and family name and tabulated with the dyed leather specimens. Analysis of results depicted that a variety of shades were obtained with the natural dyes extracted from different parts of selected plants. During the course of this study, it was found that dye extraction from flowers is relatively easy, fast and low cost. More detailed scientific studies need to be carried out yet for the sustainable utilization of dye yielding urban plants.

Keywords: Biodiversity, Leather Dyeing, Natural Dye, Urban Plants

URBAN FORESTRY IN THE MEGA CITIES FOR THE RESTORATION OF ECOSYSTEMS

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ABSTRACT: The observed incremental trends of temperature globally and increase in temperature with reference to Pakistan needs attention in the current scenario. The expansion of the mega cities due to the economic development of the urban centers generated the current scenario of the disruption in the ecosystems. The overloading of the particular areas and the increased pressure on the existing infrastructure is deteriorating the whole environmental quality. The introduction of additional facilities in the existing systems of the urban centers not only disturbing the local ecosystems rather destroying that can be observed in the deteriorating environmental conditions of the area. These activities are generating the disbalance and adverse climatic conditions in the form of heat waves/ cold episodes. The decrease in green spaces in result of planning for additional population has negatively impacted the cities profiles. This study is focused on the designing/ planning of urban green spaces in the form of urban jungle in the mega cites for the restoration of ecosystems. These plantations will modify the micro climate and improves the temperature in addition to air quality. The restoration of ecosystems through the addition of urban jungle will enhance the habitability of the spaces in the urban centers.

Keywords: Urban Jungle, Megacities, Restoration, Ecosystems

URBAN JUNGLE: A CLIMATE MODIFIER IN THE URBAN AREAS

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ABSTRACT: The expansion of the cities due to rapid urbanization is one of the major contributor in the modification of the micro climate of the areas that plays important role in the overall climatic changes of any region. The densification of the population of the areas due to urbanization in the third world countries is one of the major indicators in the climate change. The increased demands and pressures on the existing infrastructures created a chaotic situation and presents a complex scenario by making places inhabitable. The urban expansion and laying of new infrastructure mostly including the concrete surfaces has eaten up the Lahore City, once known as the city of gardens. This research is focused on the introduction of green areas in the form of Urban Jungle to modify the micro climate of the areas that finally shall be contributing in the overall temperature reductions of the region. The whole study is based on the identification of the potential areas for introducing the plantations at different locations in the City of Lahore and preparation of their design/ planning for execution for future modifications in the regional climatic conditions. The plantation and vegetation are one of the sustainable solution suggested as the mitigation measures for overall reduction in the temperature of the region.

Keywords: Urban Jungle, Junk Space, Urban Green Space, Open Space, Public Space

ROLE OF *GOMPHRENA GLOBOSA, NEMESIA STRUMOSA* AND *IMPATIENS BALSAMINA* IN THE BEAUTIFICATION AND RESTORATION OF ENVIRONMENT

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ABSTRACT: Environmental horticulture is the use of plants for improving the quality of environment and life such as pollution reduction, oxygen production, energy conservation while maintaining the aesthetic beauty of nature. The natural diversity and beauty are constantly being affected by continuously increasing urbanization. The present study is focused on the role of floral ground covers (*Gomphrena globosa, Nemesia strumosa* and *Impatiens balsamina* belonging to the families Amaranthaceae, Scrophulariaceae and Balsaminacaea) in the restoration and beautification of environment. Three growth media including cocopeat, mixture of leaf manure (LM) and farmyard manure (FYM) 50% each and mixture of 50% cocopeat, 25% LM and 25% FYM were used. The growth of *Gomphrena globosa, Nemesia strumosa* and *Impatiens balsamina* were studied in the different light intensities that is full sun, partial shade and full shade. *Gomphrena globosa* showed best results of 92% germination in partial shade with LM and FYM media, *Nemesia strumosa* gave 98% germination in cocopeat, LM and FYM media with full sunlight and *Impatiens balsamina* showed 95% germination results in the same growth media as in *Nemesia* in all shades of light. These flowers can be used to beautify all environments with respective shades of light as shown by the results. *Impatiens* proved to be the best for the beautification and restoration of environment as it didn't require any specific condition of light.

Keywords: Environmental Horticulture, Environmental Restoration, *Gomphrena globosa, Nemesia Strumosa, Impatiens Balsamina*.

RESIDENTS' CHOICE: A CASE STUDY OF A HERITAGE SITE IN VIEW OF ITS ECONOMIC BENEFITS

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ABSTRACT: Green spaces are significant in growing and populated urban cities. The current study was done to assess the economic value of a heritage site in urban city of Lahore. Total Economic Value (TEV) of Lahore Fort- a World heritage site was derived to highlight the importance. A contingent valuation (CV) questionnaire was designed and data was collected by face –to- face interviews of 250 respondents on site in the age group 18 to above 70. The types of question used in the study were open-ended, close ended and double bounded. Two groups of visitors were asked directly what they were willing to pay for the preservation of Lahore Fort. The mean Willingness to Pay (WTP) values for the preservation of Lahore Fort was calculated as 31/- PKR and 413/- PKR for visitors and foreign visitors respectively. The study verified the applicability of CVM to the valuation of a world heritage site in Pakistan and revealed that the greatest value of this site is in its local role as neighborhood treasure and urban green space. This is, as a nation, our responsibility to preserve Lahore Fort as long as it is possible, in order to handover this national heritage to the next generations.

Keywords: Economic Values, Sustainability, Economic Benefits

ANALYSIS OF ENVIRONMENTAL EDUCATION CONTENT IN SOCIAL STUDIES 6-8 GRADE'S TEXTBOOKS

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ABSTRACT: Environmental Education (EE) is the process that helps individuals to become more aware of environmental issues in society and leads responsible individuals to take serious steps for solving those issues. However, EE has not been taught in Pakistan as a single subject throughout schooling. Therefore, it is important to cover EE concepts in other subjects. Social Studies (SS) is the core subject where EE concepts can be incorporated as its focus on societal issues and environmental issues are also societal issues. The purpose of this study is to analyse the EE content in the SS 6-8 grade textbooks developed by the Sindh Textbook Board (STB) Jamshoro. A list of EE concepts was developed after a rigorous review of the literature on EE. The content analysis tool was used to look at EE concepts in the SS textbook. Three steps were used in this study, first EE concepts were developed, second, SS curriculum was reviewed and finally, findings were written. The results reveal that EE content is the only 7% in the SS textbooks of grade 6-8 which is an alarming situation for the EE. Moreover, there was not any single chapter is dedicated to the EE content. It is recommended on the basis of results that curriculum developers and the policymakers should focus on integrating EE concepts in the SS curriculum. The focus of integrating EE concepts should be developing a positive attitude among children towards solving environmental issues and problems.

Keywords: Environmental Education, Textbooks, Social Studies, Content Analysis

A COMPARATIVE STUDY ON THE EVALUATION OF SICK BUILDING SYNDROME AT VARIOUS WORKPLACES IN LAHORE

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ABSTRACT: The indoor environmental quality of the workplace plays a significant role in determination of workers' health as one by third part of the day is spent working in offices. A poor indoor environmental quality can have a negative impact on workers' health and may cause symptoms of a building related sickness known as Sick Building Syndrome. The objective of this study was to evaluate and compare the impact of physical, chemical, psychosocial and occupational variables on SBS in three different office buildings. Three office buildings taken for this study: a private sector office, a government sector office, and a public mall. The data for this purpose was gathered with the help of structured questionnaire, and focal person interviews. The indoor air quality and indoor environmental quality parameters such as temperature, noise and lux levels were also monitored using their respective instruments. Lastly, a Sick Building Syndrome score (SBS) was also calculated; higher score reflected greater symptoms of sick building syndrome. Most reported SBS symptoms for each of the three offices included tiredness in the range of 46.15-44.4%, anxiety (42.31-50%), and frustration (23%-46.15%). SBS score were calculated to be 2.45, 2.85 and 4.45 for public mall, private office, and government sector office, respectively. The results compel green building designing and regular maintenance of indoor cleanliness, use of green spaces and proper ventilation system for the prevention of prevalence of SBS in office buildings.

Keywords: Anxiety, Environmental Quality, Indoor Air, Occupation, Public Sick Building Syndrome.

ECOTOURISM POTENTIAL IN PAKISTAN SPECIALLY NORTHERN AREAS

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ABSTRACT: Ecotourism or nature-based or green tourism covers all types of tourism that contribute to sustainable (eco-friendly) socio-economic development. It is economic growth that is socially and environmentally sustainable based on policies that lead to sustain and develop the environmental resource base. The natural and cultural heritage constitute resource base for tourism which is not possible without conserving and strengthening natural and cultural environment. The ecotourism is to sustain the mountain landscape and cultural heritage. Though, Pakistan has been declared as one of the leading tourism destinations for the current year, but the tourism industry remains in infancy stage. There is tremendous scope to expand ecotourism industry in Northern Areas which is home to over 100 peaks above 7000 in Karakoram-Himalyan-Hidukush ranges and 60 glaciers plus 20 lakes. This paper discusses a way forward for ecotourism development which mean travel to mountainous areas that conserve the environment and sustain the wellbeing of local people. In order to promote ecotourism, it is necessary that projects should be community based initiative, where business enterprises are owned and managed by the local people.

Keywords: sustaibilty, ecofriendly, ecotourism, community development and natural resources

CROSS SECTIONAL STUDY OF KNOWLEDGE, ATTITUDES AND PRACTICES OF LANDSCAPE PROFESSIONALS IN LAHORE: ARE WE ENVIRONMENTALLY FRIENDLY?

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ABSTRACT: Widespread urbanization leading to environmental deterioration and depletion of our natural resources will ultimately jeopardize the survival of all species including humans. Huge resource hungry landscapes consume resources and add to pollution and loss of biodiversity. Adherence to sustainable principles and practices is an important tool in preservation of our threatened environment. A cross sectional study including 150 private and public gardeners, landscape designers/horticulturists and architects equally divided into 3 groups of 50 individuals each recruited from 26 different locales of Lahore was undertaken to evaluate knowledge, attitudes and practices towards eco-friendly landscaping. Data was collected with an 85-item validated proforma addressing 8 areas of ecosystem services viz. Eco-friendly landscaping, water, nutrients, pesticides, soil, landscape equipment, plants and waste generation recorded as frequency/percentages on a 5-point Likert scale. Chi-square test with Monte Carlo simulation followed by post hoc analysis with Marascuilo procedure was used for data analysis using SPSS version 19 and Excel Stat 7.5. A p value $\leq$ 0.05 was considered significant for all analyses. A correct knowledge of concepts was seen in 62.8%, a positive attitude in 76.5% and eco-friendly practice of landscape designing in only 54.8%. Architects had a better knowledge and positive attitude compared to the other two groups but their practices were similar to the other participants. Private and public sector participants were comparable in all analyses. This study has identified important issues in designing, planning and maintenance of landscapes in Lahore. An urgent paradigm shift is needed to introduce and implement the principles of eco-friendly practices if environment and landscape ecology of this region is to be protected and restored.

Keywords: Eco-friendly, Ecosystem, Environment, Landscape, Sustainable.

PREDICTION OF FOOD SECURITY LAND USE FUTURE THREAT OF USING THE MARKOV CHAIN & CELLULAR AUTOMATA BASED MODEL FOR LAHORE DIVISION PUNJAB, PAKISTAN

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ABSTRACT: For investigation of environmental management practices and urban planning policies we profoundly require to model predictions for future expansions and urban transitions. Markov chain-based model and Cellular Automata (CA) was implemented in order to predict urban growth. Future growth of Lahore Division Punjab, Pakistan was predicted using Land Change Model (LCM) by principles of CA and Markov chain analysis used for Geographical Information System. Lahore Division was chosen for growth prediction because it's the most important city in densely populated Punjab province. To produce Land Use Land Cover (LULC), remote sensing satellite data from 2000 to 2019 was taken and LCM was applied for predictions. Image representation is provided as a transition from past to present, and future predicted images are also presented. Tabular form is used to present change in areas as well. Better decisions and improved policies can be made for sustainable land use planning by implementing the results of the study.

Keywords: Food Security, Landuse Landcover, GIS, Remote Sensing

STUDY OF INTER-POPULATION WING SHAPE VARIATIONS IN BATS FROM PUNJAB, PAKISTAN USING GEOMETRIC MORPHOMETRICS ANALYSIS

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ABSTRACT: The cryptic diversity of bat fauna in Pakistan demands to incorporate an efficient and reliable approach for morphological species identification. The present study is therefore a first ever effort to exploit the use of Geometric Morphometric methods towards analyzing the size and shape differences among four geographically isolated population groups of insectivorous bat species (Pipistrellus coromandra) from different locations of Punjab, Pakistan. Specimens were collected from areas including Kahna District, Lahore (KA) and Head Baloki District, Kasur (HB) in the East of Punjab, District, Sargodha (SA) in the North West of Punjab and District, Gujranwala (GJ) in the North of Punjab. Wing measurements of 5 selected parameters from each specimen were taken. Twelve well defined landmarks to quantify the variation in right wing of bats were analyzed using geometric morphometric tools. The results of external measurements for wing overlapped for most part among the different studied population groups. Fur colour photographs displayed in the inter-population had shown visible change from dark brown to light brown giving an indication of more morphological differences. Regarding the Geometric Morphometric results wing-shape differences were found to dominate in inter-population as compared to intra-population which clearly reflects the effects of habitat factors on the bats populations phenotypically. The wireframe for the first two PCs indicated an overall shape change trend with the displacement of landmark points representing the expansion along the upper wing margins in PC1 compared to PC2. The current study has successfully explored the power of Geometric morphometric in reflecting the variations in wing shape among different populations of bats species (Pipistrellus coromandra).

Keywords: Geometric, Morphometric, Species Identification,

ENVIRONMRNTAL SUSTAINABILITY VIA RENEWABLE RESOURCES

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ABSTRACT: Renewable resource utilization for energy production via eco-friendly protocols is the most critical and extremely demanding research these days. Biomass waste material is the only renewable and carbon-economic material in this regard. We have introduced a green, eco-safe and highly economic method using ionic liquids as solvents for effective biomass processing. A high 28 % cellulosic dissolution and 78 % sugars formation was achieved at optimum conditions so far. Various analytical methods like FTIR, ^{1}HNMR, UV, SEM, TGA, XRD were performed to characterize synthesized green solvents as well as cellulose and sugar products obtained after processing of renewable feedstock in ionic liquid.

Keywords:

GIS AND REMOTE SENSING: G&RS-01

GIS BASED FACTORS ANALYSES TO INVESTIGATE ARSENIC ELEVATED CONCENTRATION IN LAHORE AQUIFER

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ABSTRACT: Fresh and contamination free water is important for social and economic development of urban centers globally. Urban water supply system in developing countries has many issues regarding quality and quantity. The present study focused to investigate arsenic level in groundwater and its relationship with various selected factors i.e. demography density, lithology and static water level. Over hundred union councils and more than two hundred groundwater samples were collected from Water and Sanitation Authority (WASA), Lahore and digital elevation model (DEM) was downloaded from USGS website. Geospatial techniques were employed to develop various models of the selected parameters and computed the relationship among the factors with elevated arsenic value. Vertically depth was divided into three layers; highest arsenic concentration value was observed in the shallow layer of the first aquifer as compare to the deeper parts of the first aquifer. The wells depth range over 750ft show lowest arsenic concentration 16.26mgL-1 while 2nd layer containing well depth less than 600ft show high arsenic concentration average value 22.15mgL-1. It is observed that high populated and lands with agriculture activities have elevated arsenic concentration in both shallow and deep aquifers. These factors are contributing to deteriorate surface and groundwater resources which are serious threat for general community. Only treated water for drinking and domestic purpose is proposed, concern department must find alternative water resources for second biggest city of Pakistan, because groundwater is depleting rapidly and quality reducing significantly.

Keywords: Arsenic, Geospatial Techniques, Well Depth, Landuse

GIS AND REMOTE SENSING: G&RS-02

GEOSPATIAL APPLICATIONS FOR TOPOGRAPHIC STUDIES BASED UPON BEDROCK GEOLOGY: A CASE STUDY OF ZIARAT DISTRICT, BALUCHISTAN, PAKISTAN

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ABSTRACT: The present study is aimed to determine, quantify, and evaluate the relationship between the topography and bedrock geology of Ziarat district, Baluchistan, using advance geospatial techniques. Area of the study consists of several sedimentary sequences. These sedimentary sequences contain moderately to weekly consolidated sandstone and shale ranging in age from Jurassic to Pleistocene. Datasets for this study were acquired from a 12.5 m composite Digital elevation model and the digital Geological map of the Ziarat district. In order to determine the topographic changes based upon bedrock geology, slope angle map, relief map, hillshade map and composite maps were developed. Using the numeric values of slope angle and relief, histogram charts were drawn for each of the sandprone and shale-prone units. The interpretation of the frequency histograms showed that sandprone units have overall high slope angles, while shale-prone units have comparatively lower slope angle due to maximum erosion of shales than the sandstone in the field. Sample means were also observed using t-test including pooled (equal variance) and Satterthwaite (unequal variance) for their statistically significant differences. Lineaments were identified on the hillshade map which were caused by different geological processes like river incision and tectonic processes including faults etc. Based on these multiple evidences (histograms charts, mean slope angle/relief, appearance on the relief and slope angle map, it is concluded that the topography of any area is majorly controlled by the lithology, composition, strength, compactness, lithification or collectively the geology of bedrock (Shale vs Sandstone in the present study). However, there are number of other factors that can play role to affect the topography of a defined region. The results are very significant, and it would not be easy to quantify and evaluate these finding using conventional field methods due to the subtle topographic expressions of the study area. GIS provides a range of tools and analysis for all these researches. In the Geological context, GIS mapping represents a detailed structural and lithological result regarding the landscape of the region, which is difficult to detect using conventional methods.

Keywords: GIS, DEM, Topography, Geology, Sedimentology

GIS AND REMOTE SENSING: G&RS-03

GEOSPATIAL CRIME ANALYSIS IN SOUTHERN HARIPUR TEHSIL, DISTRICT HARIPUR, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT: This study was conducted in Southern Haripur Tehsil, District Haripur, province Khyber Pakhtunkhwa. The objective of this research was to study the crime types, their causes and factors causing increment in crimes in the study area. This study is aimed to suggest, direct the crime analysts and policy makers to evaluate, prevent and control crimes through planning. GPS based crime type data were collected in the field through the predesigned questionnaire, interviewing with the 54 respondents of local community at 43 accessible locations. ArcGIS 9.3 was used for geospatial analysis for crime mapping. According to the respondents, the crime victims were found mostly local (69%) and traveler (46%). Crime types were found as theft (91%), murder (35%) and kidnap (13%). Crime committing time was analyzed early morning (5%), afternoon (12%) and midnight (83%).Crime causes were found as poverty (55%), ignorance (30%), property issues (8%) and others i.e. Marriage and addiction (7%). Dominant theft crimes were found in Jabri union. In short, poverty was found the major cause of crimes. Geographical Information System (GIS) proved very useful tool for crime mitigation and mapping. To mitigate these challenges; Government should produce employment opportunities by developing local industry and tourism etc.

Keywords: Crime Analysis, Global Positioning System, Remote sensing, Geographical Information System, Questionnaire

GIS AND REMOTE SENSING: G&RS-04

IMPACT ASSESSMENT OF WATER QUAILTY ON HUMAN HEALTH USING GIS: A CASE STUDY OF BAHAWALNAGAR

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ABSTRACT: Groundwater is the major source of drinking water in rural as well as in urban areas and over 94% of the drinking water demand is met by groundwater. The available surface water resources are inadequate to meet all the water requirements for drinking, irrigation and industrialization purposes, In order to assess the water quality, Water samples were collected from Bahawalnagar district. Present study intended to assess and compare the ground water quality with WHO standards and its related diseases in study area using GIS. Geospatial techniques were utilized to measure the spatial distribution of groundwater quality parameters. A total of 84 samples (33 from Bahawalnagar city, 26 from Dounga Bounga, and 25 from Minchinabad) were conducted. The quality of ground water was examined for physiochemical parameter such as pH, Electric Conductivity, Alkalinity, Total Dissolved Solids, and Turbidity in laboratory of Public Health and Engineering Bahawalnagr. The situation was much worse in Dounga Bounga region. Out of all the samples, 63 % of samples were found to be contaminated as per laboratory tests. The percentage of contaminated samples varies amongst regions where in Minchinabad, Dounga Bounga, and Bahawalnagar city 32 %, 96 %, and 63 % of samples were found to be contaminated respectively. Laboratory examination of water parameters also shows the fact of significant contamination in ground water. EC, TDS, Hardness, pH etc, were considerably high from WHO permissible limits. This poor water quality caused serious waterborne diseases such as diarrhea, cholera, etc. Many people living in the region suffered severe illness as per data collected from District Health Authority Bahawalnagar. Regular water quality monitoring should be carried out; more water filter plants should be installed by local government to save local people.

Keywords: Spatial Distribution, Water Quality Parameters, WHO Standards, Waterborne Diseases.

GIS AND REMOTE SENSING: G&RS-05

GEOGRAPHICAL VARIABILITY IN GROUNDWATER ARSENIC CONCENTRATIONS IN INDUS BASIN, PUNJAB

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ABSTRACT: For understanding the geographical variability in arsenic (As) levels on regional scale, a blanket survey was conducted along selected transects in Upper Indus Basin, Punjab using field test kits. Over the span of 3 years (2015-2018), 20,790 wells have been tested for groundwater As levels. More than 79% of tested wells were found to have As levels within WHO prescribed limit (10 µg/L), while 21% of the wells had levels more than 10 µg/L. Out of these 21% tested wells, 11% met the criteria for National Environmental Quality Standards of 50 µg/L (NEQS).

The results show elevated As concentrations along Ravi floodplain as compared to Chenab and Jhelum floodplains and doabs (Rachna, Chaj, Bari, Thal). Out of 3382 wells tested along Ravi floodplain, 34% had As levels within WHO limit, 26% wells were safe with regard to NEQS while remaining 40% samples had As levels higher than 50 µg/L. A patch of safe zone was identified from Sahiwal district and onwards before Ravi River falls into Chenab River. This zone have 76% of the wells within WHO levels for As. For sediment As speciation, As XANES were utilized which show arsenic to be present in the form of arsenate in solid phase. No clear-cut association between solid phase As was found with groundwater levels. Good correlation was found between solid phase Fe/Mn against As concentrations along floodplains but still there are various different factors that control partitioning of As between solid and aqueous phase.

Keywords: WHO Standards, Floodplain, Water Wells, Concentration

GIS AND REMOTE SENSING: G&RS-06

UTILIZATION OF REMOTELY SENSED THERMAL INFRA-RED SENSOR FOR DERIVING AIR TEMPERATURE OVER LARGE HETEROGENOUS SURFACE

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ABSTRACT: Air temperature (Ta) is a very dynamic process and it may have variations on very small spatial and temporal scale. It is considered as one of the most significant variable in climate research and global changes. Ta controls many biological and physical processes among the lithosphere, hydrosphere, atmosphere and biosphere. Its spatio-temporal variations and trends have obvious impacts on various hydro-meteorological variables, growth of plants and animal species, energy consumption and life style/food habits of the inhabitants of a particular area. Ta may be closely linked with matter and energy exchanges in the soil-plant-atmosphere continuum. Ta is changing at different rates across the world.

Ta is measured at ground-based sensors at 2 meters height above the ground. Usually ground-based sensors are not enough or evenly distributed in countries like Pakistan, hence unable to represent a large geographical area. Therefore, remote sensing data may be utilized in order to cover large spatial coverage in data poor areas for Ta analysis. However, no satellite sensor provide direct Ta data. Therefore, in this study a methodology has been proposed to estimate Ta through various regression functions from satellite-based (Landsat 7 ETM+) land surface temperature (LST) via Thermal Infra-red (TIR) sensor. Only two ground stations (PMD and PAF Base Peshawar) data were available in the study area so analyses were separately carried out for both these sites. From the analysis, it was found that linear regression function was the best possible model to estimate air temperature in both summer and winter seasons with more precision and accuracy. The correlation statistics show that Pearson correlation coefficient is more strong in summer with r = 0.78 and 0.62, and show moderate results in winter season with r = 0.59 and 0.78 at PMD and PAF Base Peshawar, respectively. The remotely sensed spatio-temporal trend analysis shows obvious difference among the air temperature trend in urban, suburban and rural parts of the study area. High Ta about 6-8 degree Celsius increase have been observed clearly in urban areas followed by suburban areas especially in the years of 2007 and 2017. Low Ta was recorded in the rural areas and the lowest temperature was recorded in the years of 2007 and 2010 during winter season. Air temperature shows increasing trend throughout the whole study period. Ta was recorded low at densely vegetated areas as compared to the areas with sparse vegetation cover. Due to the process of evapotranspiration, vegetation leave a cooling effect on the

surrounding area. Correlation of Ta with vegetation shows good results in summer than in winter season. At last, accuracy assessment was applied to the results obtained in order to check the applicability of the model used at both ground stations. Validation results showed that the model presented plausible results.

Keywords: Remote Sensing/GIS, LST, Air Temperature, Landsat-TIR, Spatio-temporal.

GIS AND REMOTE SENSING: G&RS-07

ADVANCE GEOSPATIAL TECHNIQUES FOR REAL TIME SMART FIBER MONITORING AND DEPLOYMENT SYSTEM (SFMDS)

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ABSTRACT: Telecom Industry is the major utility supposed as the forth pillar of basics needs in the fastest growing economical world, previously, the network is being managed by using coax cable technology, DSL and many other conventional techniques. Advancement in Fiber Optic in telecommunication industry raises the customer demands in terms of services. Fiber has capacity to deal with triple play services at once (voice, Video and IPTV) at quality level. Researchers and field experts are with the opinion, biggest challenge is the cost on the civil work to remove the traditional HFC, Coax cable with the fiber along with the newly deployment, therefore, it is needed that the latest trends and technologies should adopt in telecommunication sector to automate the business process of the organization at enterprise level. Geospatial technology plays a vital role in telecommunication industry in terms of planning, scheduling, and monitoring as well as in Operation Maintenance. This project is done as a pilot on the capital city of Pakistan, Islamabad covers the area 906 Sq.Km, provides the extensive tools of Fiber Optic network planning, monitoring, scheduling and integration by using a Centerline and decentralize approach to build enterprise databases and RIA which opens a new era in research and development of GIS role in utility sector. The project was aimed at the system automation, new customer installation along with its fiber length detail by using rich internet Application which is very useful and cost effective solution for the companies as well as for the customer satisfaction along with the quality of service. The solutions are provided by using Open Source (Geoserver and Postgres) as per OGC Standards along with ESRI (ArcMap) products. There are some limitation of open source in terms of tools and data development along with the cost of ESRI products which is being high. It is suggested that this cost effective solutions should be adopted in telecommunication sector for system automation and to increase the efficiency in infrastructure deployment.

Keywords: Digital subscriber line, Hybrid fiber Coaxial, Rich Internet Applications, Open Geospatial consortium.

GIS AND REMOTE SENSING: G&RS-08

SPATIAL ASSESSMENT OF SNOW LEOPARD HABITAT USING RS & GIS TECHNIQUES

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ABSTRACT: Snow leopards are essential component of Alpine ecosystem of Central Asia and South Asia but are listed as endangered due to its presence in remote areas. These beautiful cats are different from all other types of cats and found at about 3,000-4,000m altitude in coniferous forests and high elevated pastures of Central Asia and Southern Asia. The main purpose of this study was to identify the snow leopard habitat in Pakistan and assess its current population status in Pakistan. Khunjerab National Park was selected for this project as now this is the only region where snow leopards are found and conserved. Firstly, the information was collected about the current habitat pattern and population status through secondary sources like from International Union for Conservation of Nature (IUCN) website while satellite imagery of mid resolution was obtained from freely available source of USGS website. However, high resolution satellite imagery was directly obtained from Google Earth Pro. Whereas, Erdas Imagine 2014 was used for layer stacking and to assess the habitat suitability pattern using unsupervised classification. In addition, threats to snow leopard habitat in Pakistan were also assessed. In this study the current population is observed which is about 300-420 individuals in Pakistan according to IUCN. Results revealed that Khunjerab National Park is the only region of Pakistan, where these beautiful cats are now found. The results showed current situation of snow leopard in KNP and according to about 60% of KNP region is most suitable for these beautiful cats. Results also shown that receding of snow line in this region due to rapid climate change is also causing decrease in their habitat region. This study aided not only in assessing the suitable area for snow leopard habitat but also helped to understand the threats and needs to preserve such endangered species.

Keywords: Snow Leopard, Endangered, Habitat.

GIS AND REMOTE SENSING: G&RS-09

GROUNDWATER POTENTIAL MAPPING USING REMOTE SENSING TECHNIQUES AND WEIGHTS OF EVIDENCE GIS MODEL: A CASE STUDY OF DISTRICT RAWALPINDI, PUNJAB

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ABSTRACT: In the present study, remote sensing techniques, GIS models and field measurements are integrated to identify and map groundwater potential zones at District Rawalpindi, Punjab Province, Pakistan. The study area is located in the Upper Punjab, Hilly areas of Punjab. It is characterized by insignificant primary porosity and permeability and is mainly covered by massive and altered gneissose granites, diorite, and gabbro and metamorphosed basalts. Lithology, rainfall, lineament density, drainage density, slope steepness and landuse/landcover are the main hydrogeological parameters defined to be related to the groundwater storage in the study area. They are prepared using the processed satellite data and integrated using weights of evidence and index overlay GIS models to generate groundwater potential zones map. Within the GIS model, those parameters are assigned values of 30, 20, 15, 15, 10 and 10, respectively, as score values. The resulting groundwater potential zone map for district Rawalpindi is categorized into three main classes (high, moderate and low groundwater potential zones) based on pixel values. The results of this study indicate that the lower parts of the district Rawalpindi are the most promising areas for groundwater occurrences and contain both high and moderate potential zones. High groundwater potential zones are located at the north of the main study area. They are characterized by loose wadi deposits, flat areas, gentle slope (ranges between 0 and 5 degrees), low drainage density (100 D/30 km2) and shallow water table (water table is 7 m from the ground surface). The present study proved: (1) the usefulness of the processed remote sensing satellite imageries for generating several indirect groundwater parameters; (2) the usefulness of weights of evidence and index overlay GIS models for the integration process and the production of groundwater potential zone map along the study area.

Keywords: Remote Sensing, Groundwater, GIS Models, Hydrological Parameters

GIS AND REMOTE SENSING: G&RS-10

CROP WATER BUDGETING USING REMOTE SENSING AND GIS

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ABSTRACT: Punjab irrigation system is based on the principal of supply based system. Climate change, horizontal spread of agriculture land, and rise in cropping intensity are playing significant role in reduction of annual irrigation supplies. It is very clear that canal supplies are insufficient to meet crop demand. Rainfall contributes partially and groundwater considerably to meet the gap left by canal supplies. Canals are operated on rotation by allocating water on eight daily intervals and often groups of canals are run turn by turn on fixed priority basis in case of shortfall. The present study is conceptualized to develop a model for the intelligent use water resources for agriculture in Punjab. Primary objectives are to distribute water efficiently by monitoring crop water budget on near real time basis and avoid unguided abstraction of groundwater. Adequacy has been considered more important into the water allocation process to avoid crop water stress. Remote sensing technology has been used to monitor crop water budget using freely available satellite imagery, and open source data and technology. Crop water use commonly known as evapotranspiration (ET) in remote sensing language along with crop yield, soil water retention and crop water deficit have been calculated at the farm level, by using the surface energy balance algorithm for land (SEBAL). Resultant crop water budget statistics have been compared with government agencies data and have been found very accurate to rely upon. SEBAL outputs will allow irrigation managers to allocate canal water based on crop demand by keeping an eye on weather forecast and the available water in storage dams. It will also allow irrigation managers to release an advice for farmers to abstract required proportion of groundwater use at appropriate time.

Keywords: Irrigation, Canal Supply, Crop Monitoring, Remote Sensing, SEBAL Model

GIS AND REMOTE SENSING: G&RS-11

HYPSOGRAPHICAL AND CLIMATE CHANGE ANALYSIS OF CHANGING SNOW COVER IN ASTORE RIVER BASIN FROM 2009 TO 2019 USING MODIS AND SRTM DATA

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ABSTRACT: Agriculture based economy of Pakistan is highly dependent on the snow and glacier melt water supplies from the Upper Indus River Basin. It is essential to address the dynamics of glaciated ice under changed climate scenarios (global warming). The Astore River basin is located in the northern areas of Pakistan with latitude and longitude range of 34º-45' to 35º-38' and 74º-24' to 75º-14' respectively. Astor River basin has only 4–5% of its area above 5000 m elevation and glaciers at lower altitudes are melting in the face of accelerating global warming. Normalized Difference Snow Index (NDSI) algorithm was developed in Python-arcpy to identify and quantify the snow using Moderate Resolution Imaging Spectroradiometer (MODIS) sensor having 721 bands. A decreasing trend in snow cover was found from 2009 to 2019. Hypsographical analysis of snow cover showed that snow cover is decreasing with decreasing of elevation, and below 3500 meter above mean sea level (m.a.s.l) snow cover is decreasing rapidly. The data of temperature and precipitation were also corelated with changing snow cover in the region. It is need of time to conduct a comprehensive study for monitoring of snow cover under the accelerating global warming conditions.

Keywords: Glaciers, Global Warming, NDSI, MODIS, Temperature.

GIS AND REMOTE SENSING: G&RS-12

IDENTIFICATION OF IRRIGATION POTENTIAL AREAS, USING MULTI-CRITERIA ANALYSIS IN KHYBER DISTRICT, PAKISTAN

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ABSTRACT: This study explores the opportunities for irrigated agriculture in Khyber district; former federally administered tribal area (FATA). Agriculture continues to be most important economic activity in Pakistan and former FATA is no exception. However, agriculture in the semi-arid Khyber District continues to suffer a decline due to excessive reliance on rainfall, which is drastically insufficient. Khyber District have large expanses of fertile land, however, farmers are highly depend on unpredictable rain fed agriculture, which has low productivity and food insecurity. There are a number of rivers in the region where great prospects exist for irrigated farming. Geographical Information Systems (GIS) based multi-criteria analyses are crutial to map the irrigation potential. Current study focused on different variables including soil texture, perennial rivers, land cover, topography and dams. For this study data were collected from diverse sources including Google earth images, top sheets, landuse landcover, soil texture map of FATA, SRTM 30 Meter. The collected data were analyzed by using Multi Criteria analysis in Arc GIS 10.2.2 by using MIF technique. The results of this research revealed that there is great potential for irrigated farming in the study area. Potential land for this purpose were divided into three categories i.e. highly suitable which consisted of 678 Km², or 26% of the total area, 1044 Km² representing 40% were moderately suitable to irrigation while the rest 698 km² representing 27% were considered least suitable for irrigation. Likewise, 204 Km² representing 7% were deemed unsuitable for irrigated agriculture mostly consisting of barren rocks. The results also illustrated how GIS as a tool can be used in the exploration of water resources in a scientific approach, thus making decision-making easier and more accurate.

Keywords: Dams, GIS, Irrigation, land use/land cover, MIF, Multi Criteria analysis, Reclaimed area, Rivers, Suitability

GIS AND REMOTE SENSING: G&RS-13

CROP CLASSIFICATION USING SENTINEL-2 IMAGERY BY DEVELOPING CROP PHENOLOGY BASED ON NDVI THRESHOLDS (CASE STUDY OF DISTRICT SAHIWAL)

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ABSTRACT: Pakistan is an agronomic country with a variety of crops grown in two crop seasons namely Rabi and kharif. The contribution of agriculture sector to Gross Domestic Product is (21%) and it is ranked the highest contributor. The huge amount of manpower is required for the agriculture management in Pakistan. Crop area and yield estimation were being performed through Girdawari which was stopped in 2003 by irrigation department. Revenue department performs this task now but not at the field level which was being done by the irrigation department. However, remote sensing can be used as a good alternate for the better management and monitoring of crops, and yield and cropped area estimation. It is very important to identify cropped area to have accurate crop classification and yield statistics. Sahiwal district was chosen as study area because it contains variety of crops and has most fertile land in Punjab. This study intended to classify different crops with the integration of satellite data and crop calendar of the study area. Sentinel-2 satellite product is used to identify and monitor multiple crops due to its high spatial as temporal resolution. NDVI is widely considered and accepted as a good indicator for monitoring crop health and growth. This study examines the temporal behavior of vegetation indices (NDVI) to identify multiple crops of both Rabi season (Wheat, Potato, Spring Maize, Fodder) and Kharif season (Cotton, Autumn Maize, Rice Orchards and Sugarcane) and their growth stages in Sahiwal district. The study has been performed on Kharif 2018 season and Rabi 2018-19 season. Phenological profile of each crop was obtained based on the vegetation health index i.e. NDVI and crop calendar. The NDVI for each image was calculated and stacked according to its growing season i.e. from the time of sowing to harvesting. The iterative self-organizing (ISO Data Model) unsupervised classification was performed on stacked NDVI images according to the crop calendar to obtain the phenological profile. The subsequent NDVI phenological profiles were then compared with crop calendar of the study area to classify crops. The resultant crop classification has been verified in the field and with crop reporting service data and it is observed 88 % accurate for Kharif 2018 and 85% for Rabi 2018-19. It indicates the competence of the adopted method in providing a fast, cost-effective and reliable data in comparison with the traditional cropped area estimation methods.

Keywords: NDVI, Remote Sensing, Crop Classification, Phenology

GIS AND REMOTE SENSING: G&RS-14

URBAN ENVIRONMENT RANKING BY USING GEOSPATIAL TOOLS AND TECHNIQUE– A CASE STUDY OF PUNJAB, PAKISTAN

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ABSTRACT: Increasing urban population is increasing environmental and associated socio-economic problems. Due to the exponential urban growth, environmental sustainability has become more challenging as felt never before. This study provide an analysis framework of grading cities by using parameters such as air quality (PM2.5, NO_2), urban heat island, green spaces, water quality (Nitrate, TDS, Fluoride), industrial pollution, forests, floods and solid waste data. The spatial data was developed by using ground truthing information, satellite images and secondary data sources which were assessed through evaluating of spatial existence criteria, variability in spatial and temporal directions, accessibility and measurability of data. Analytical Hierarchy Process (AHP) was used for environmental ranking of ten major cities of Punjab, Pakistan. The research results include susceptibility levels which were used for classification of cities at high or low environmental risks. It is concluded from analysis that Gujranwala city's population is at highest environment risk, Lahore found moderately and Sahiwal found restrained susceptible in environmental ranking. However, most of the cities as Sialkot, Faisalabad, Multan and Rawalpindi found slightly susceptible. The least developed cities such as DG Khan, Bahawalpur, and Sargodha were not ranked at risk when it comes to environment degradation which appears to be due to low density of population and industries. The research concludes that AHP is an efficient technique for the ranking of cities and can be used for monitoring development of cities over regular intervals of time.

Keywords: Susceptibility, Analytical Hierarchy Process (AHP), Sustainability, Environment

GIS AND REMOTE SENSING: G&RS-15

ANALYSIS OF MULTI SPECTRAL IMAGES ON CURRENT & FUTURE DYNAMICS OF URBAN LANDUSE CHANGES AND ITS IMPACT ON LAND SURFACE TEMPERATURE

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ABSTRACT: The rapid increase in urban growth has a dominant effect on the landuse land cover by replacing the vegetation cover with residential and commercial activities and their related infrastructure; this upsurges the land surface temperature (LST). Rapid urban growth has occurred in Faisalabad City due to enhanced geographic and economic growth. The objective of the study is to investigate the effect of land use land cover changes on LST using remote sensing and GIS techniques. This study depends on data from three Landsat images (including Landsat 5- TM, landsat-7 and Landsat OLI_TIRS-8) with 10 years' interval starting from 1999, 2009 and 2019. In ArcGIS environment, supervised classification was used to compute land use/cover categories, and to generate the land surface temperature (LST) maps and the results were then used in Markov model for future prediction of the land surface temperature for the study area. Satellite imageries were also used to generate the normalized difference vegetation index (NDVI), normalized difference built-up index (NDBI), normalized difference bareness index (NDBAI) and normalized difference water index (NDWI) maps in order to identify their relationship of the land surface temperature. Linear regression analysis was used in ArcGIS environment to generate relationships between LST with NDVI, NDBI, NDBAI and NDWI. The study outcome proves that the changes in land use/land cover have a dominant role in the rapid increase of land surface temperatures. The highest temperatures are associated with barren land and built-up areas, ranging from 46◦C, 50◦C, 53◦C while lower temperatures are related to water bodies and forests, ranging from 21◦C, 29◦C, 31◦C respectively, in 1999, 2009 and 2019. This study also proves that NDVI and NDWI show negatively with low temperatures while NDBI and NDBAI correlate positively with high temperatures which indicate that removal of vegetation boosts the land surface temperature and areas with dense vegetation cover and larger water bodies have lower land surface temperature values.

Keywords: GIS, Remote Sensing, NDVI, Markov, Land Surface Temperature, Vegetation Cover

GIS AND REMOTE SENSING: G&RS-16

GIS-BASED ANALYTICAL ANALYSIS OF COASTAL DIVERSITY AT KARACHI

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ABSTRACT: The coasts of mega cities around the globe are widely exposed to the human activities which impose ecological and environmental degradation of coastal environment and wetland biodiversity. This study was aimed to analyze the changes of coastal belt features including built-up land cover, vegetation cover and interrelationship of coastline morphology at frontal coast Karachi. We have utilized the satellite images of Landsat-5 TM and Landsat8 OLI/TIRS to abstract coastal features from imageries using likelihood supervised classification, unsupervised algorithms and spectral principal component analysis. These approaches helped to interpret coastal features and change matrices of thematic raster provide quantitative estimates. In this study, the spatial changes were addressed with explicit references to Karachi Shipyard, Karachi Port, PNS Himalaya, Sandspit, Bundal Island and Far Island, for the period of 2010-2018. Conclusions: It is highlighted that the coastal environment of frontal coast Karachi is under serious threats mainly engendered by anthropogenic activities (growing urbanization along the coast, draining untreated industrial-domestic waste into the sea, cutting of mangrove forests, poor maintenance of coastal features etc). Hence, the applied sciences and modern imaging technologies led us to assess the environmental changes which may contribute in mitigation plans for coastal features.

Keywords: Landsat, Mangroves, Land use changes, Karachi, Satellite Images.

GIS AND REMOTE SENSING: G&RS-17

MODELLING OF SEISMICITY IN SOUTHERN AND COASTAL SINDH USING GIS TECHNIQUES

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ABSTRACT: Introduction: The Sindh and adjacent coastal towns are resting over intraplate regions of Indian plate surrounded by active fault lines. This study is focused on GIS-based mapping and modelling of earthquakes observed during historic records and recent era. The earthquake's data revealed that several devastating earthquakes reported back 980 A.D originated from the coastal and adjacent areas of Sindh i.e. Kutch, Bhambore, Allah Bund, Bhuj. The residents of Karachi & Hyderabad region remotely watched the ground shakings of recent earthquakes in Hindukush & Kashmir. While the urban centers of Karachi, Hyderabad and surroundings have been jolted by consequential amplitudes of Mw 7.7 Bhuj earthquake of 2001, Mw 7.7 Awaran of 2013, Mw 8.1 Makran earthquake of 1945, Mw 7.2 Dalbandin earthquake of 2011, Mw 7.6 Quetta earthquake of 1935, etc. Apropos to urban growth, recent earthquake events, increasing inter-seismic gap for a major event, and developing patterns of seismicity after Awaran earthquake of 2013, careful earthquake studies using updated data are necessary. This integrated approach of this study present spatial patterns of earthquakes, seismicity characteristics of active faults i.e. max credible moment magnitude, focal depth, b-value, fault creeping velocity, etc. These variables are utilized to compare the potential of key fault lines in southern Sindh. Conclusions: It is pertinent to conclude that the southern and coastal Sindh areas are under a threat of a future earthquake. This reveals vulnerable zones and active fault lines in recent time. The seismicity analysis may help to reckon the seismicity potential of key faults which may contribute to design safe civil- engineering projects in the shed of emerging trends of develop world.

Keywords: Earthquake, Geographical Information System (GIS), Kernel Density, Tectonic Junction, Sindh.

GIS AND REMOTE SENSING: G&RS-18

DEFINITION OF URBAN LIMITS USING INTEGRATED SPATIAL APPROACH - PUNJAB LOCAL GOVERNMENT ACT 2019

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ABSTRACT: To promote good governance, transparent decision-making and for effective delivery of services, government establish an elected local government system to devolve political and administrative boundaries at local level. The local Government boundaries are defined by the size of population and do not have any relationship with the natural boundaries i.e. contiguous built up of the cities. In 2019, the Provincial Assembly of the Punjab passed two pieces of legislation: the Punjab Local Government Act 2019 (PLGA-19) and the Punjab Village Panchayats and Neighbourhood Councils Act 2019 (VP&NCA-19). The recent change of LG system incorporates the spatial characteristics of urban and rural areas. This paper deals with the delineation of urban boundaries using GIS and Remote Sensing datasets. A model study of Kot Radha Kishan was conducted to define a set of rules for delineation of Urban Limits and Panchayats. To resolve the gaps in functional and local government boundaries of 2013; we developed a new methodology which incorporated urban contiguity, functional city limits, past city expansion trends and future anticipated limits for eight years, field surveys, consultations with the Demarcation Committees at Local Level lead to delineation of LG local areas. As a result of Provincial level spatial assessments; 319 urban areas (previously 194) and 136 Tehsil Councils have been identified and notified by the Local Government of the Punjab. This GIS based approach for definition of urban limits and electoral boundaries is an important step towards transparent and efficient approach.

Keywords: Delineation, Urban Limits, Geospatial Techniques, Population

GIS AND REMOTE SENSING: G&RS-19

IDENTIFICATION OF GREEN SPACES TO SEQUESTRATE THE CARBON AND INCREASE TREE COVER OF LAHORE

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ABSTRACT: Lahore City is currently choking on air pollutants caused by increased release of carbon and decreasing Sequestration. Factors like smog, driven in part by smoke from bricks kiln and steel mills, burning of rice stubble and garbage, growing numbers of vehicles on the road and large-scale losses of trees as the expanding city makes way for new roads and buildings. The bad air quality is resulting in increase of death rates, causing cancers, strokes and heart disease, stunting children's growth and development, and even reducing our intelligence. In this paper, the researchers have analyzed current green cover of Lahore using GIS and remote sensing techniques. It has been observed that the tree cover of Lahore has decreased from 4.5% in 1990 to less than 1% in 2019, compared to requirement of atleast 15% for a sustainable city. On the other hand, industrial development is accelerating, which is resulting in deterioration in air quality. The researchers further analyzed potential of further tree plantation in parks, forest lands, river banks, drains, canals, roadside corridors, ring road and housing schemes. It has been estimated that further 3,494,530 number of plants can be planted which will provide carbon Sequestration of more than 76,000 tons per year. The study also addresses the United Nations developed Sustainable Development Goals (SDG) 2030 that, which aims to "Make cities and human settlements inclusive, safe, resilient and sustainable" and "to combat climate change and impacts" (United Nations, 2015). The research is also helpful for Government of the Punjab in enforcement of recommendations by the Smog Commission.

Keywords:
Urban Forestary, Plantation, Tree Cover, Sustainable City

GREEN CHEMISTRY: GC-01

EVALUATION OF DIFFERENT NON-WOOD RAW MATERIALS AS AN ALTERNATIVE OPTION FOR PAPER PRODUCTION

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ABSTRACT: Both wood and non-wood based fibers are used for the manufacture of paper, pulp and packaging material to meet the ever increasing demand of paper and packaging worldwide. Approximately 80% of the demand is met through the wood from forest which ultimately contributes to deforestation and green house gas emissions. Therefore the world is in dire need to shift from the wood-based fibrous resources to the non-wood fibrous materials. In this study four different types of fibrous agriculture and ornamental plant residues (bamboo sheaths, rice husk, corn husk and bagasse) were investigated in order to bring in more sustainable and environmental friendly resources for paper production. Physical and chemical characterization of the samples was performed to determine the suitability of these fibers in paper production. The results showed the cellulose content (w/w basis) present in selected fibers such as bamboo sheaths, bagasse, rice husk and corn husk was 57%, 40.6%, 24.2% and 18.5% respectively. Paper was produced at different temperature, cooking time, agitation time, dose of binding agent and fiber ratio to obtain the optimized conditions. Paper produced from bagasse fiber showed best results among the rest, followed by paper from bamboo sheaths; in term of tensile strength, brightness, tear strength and absorptive capacity at 30 minutes cooking time, 160^0C cooking temperature, 15 minutes agitation, 15% NaOH, 5g $CaCO_3$ (Filler) and 5g starch (binding agent). This research highlights the potential of nonwood agriculture residues as sustainable alternatives of woodbased fiber for paper production as well as a viable way to utilize residues that statistically end up being dumped or burned and also reduce the problem of wastewater load due to pulping and bleaching, solid waste management, deforestation and GHG emissions.

Keywords: Sustainable Alternatives, Non-Wood based Fibers, Solid Waste Management, Paper Production, Green House Gas Emissions.

GREEN CHEMISTRY: GC-02

SORPTION OF PHENOL FROM SYNTHETIC AQUEOUS SOLUTION BY USING *DARACANA SANDERIANA* BASED ACTIVATED CARBON

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ABSTRACT: The major source of organic pollutant in wastewater is due to industrial activities. These primary organic pollutants react with surrounding environment and forms secondary pollutants that persist for a longer period. In present study adsorption techniques has been carried out on the surfsace of activated carbon prepared by *Daracana sanderiana* (known as lucky bamboo) for phenols eliminations. The activated carbon (AC) was characterized by FTIR and proximate analysis before and after activation through simultaneous physical and chemical activations. Different doses of activated carbon and modified forms of AC like furnace treated, acid treated were used for elimination of phenols from synthetic aqueous solution. Maximum removal efficiency was found by acid treated AC at 0.2 g dose with contact time of 1 hour, 120 rpm at natural pH as compared to furnace treated AC. To optimize adsorption process anthracite coal was added to acid treated AC that enhanced its adsorbent ability. The FTIR spectrum gave information about the appearance of functional groups on the surface of the adsorbent after treatment. It is concluded that adsorption of phenol by using activated carbon and anthracite coal is an effective treatment method.

Keywords: Daracana Sanderiana, Phenols, Activated Carbon, Efficiency, Adsorption

GREEN CHEMISTRY: GC-03

MEDIUM CHAIN LENGTH POLY (3-HYDROXY ALKANOATES) SYNTHESIS BY HALOPHILIC BACTERIA

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ABSTRACT: Poly (3-hydroxyalkanoates) are natural analogues of synthetic polyesters and far more beneficial and eco-friendlier. PHAs are synthesized by bacteria under various growth conditions mostly nitrogen limitation and excess of carbon. PHAs are biodegradable and biocompatible, but with their various benefits we face some challenges i.e., cost production. Different strategies have been employed to reduce their production cost and among those one is to use unsterile medium for their growth and use cheap carbon sources.

In this study we isolated bacterial strains form various localities of Pakistan such as Tatta Pani Azad Jammu &Kashmir, Karachi Mangrove forest and Khewra Salt mines. Eight bacteria strains belonging to Bacillus sp., and halophiles were isolated having the ability to produce mcl-PHA. Glucose, waste glycerol and Palmitic acid were used as carbon sources. Bacterial strains were able to accumulate as much as 60% PHA intracellularly. Extracted and purified PHA was than analyzed by FTIR. Absorption peeks at 1720 cm^{-1} indicated presence of carbonyl functional group and hence confirmed production of mcl poly (3- hydroxyalkanotes).

Keywords: MCL Poly (3- hydroxyalkanoates), Bio-Plastics, Biodegradable, Biocompatible

GREEN CHEMISTRY: GC-04

APPLICATION OF *PSIDIUM GUAJAVA* LEAVES BIOCOMPOSITES WITH POLYANILINE FOR BIOSORPTION OF TARTRAZINE DYE FROM WATER

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ABSTRACT: In this research work Polyaniline composites with *Psidium guajava* leaf powder was prepared and used for Tartrazine dye removal. It was characterized by different techniques, like: UV-Vis, FTIR and SEM. In UV-Vis spectra the presence of two peaks of samples indicates benzenoid and quinoid presence. In FTIR different vibrational bands gives information about structure and presence of different functional groups present in samples. SEM gives information about surface topography and particle size of PANI and composites. Then it was used for removal of Tartrazine dye (TZ) from water. Experimental data was analysed by different isotherms Langmuir, Freundlich and Temkin. Maximum adsorption capacities is 4.22 mg/g following Pseudo-second order kinetic model. So, it can be employed on larger scale for dye removal efficiently.

Keywords: Tartrazine Dyes, Biocomposites, Biosorption, Water Treatment.

GREEN CHEMISTRY: GC-05

MICROWAVE ASSISTED SPECTROPHOTOMETRY DETERMINATION OF DRUG BY USING ECOFRIENDLY REAGENT IN PURE AND PHARMACEUTICAL FORMULATIONS

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ABSTRACT:" Synthetic substances and solvents utilized in investigation of drugs crumble the earth as well as human health. So attempts should be made to minimize or eliminate the utilization of obnoxious chemicals and solvents. The objective of study is to develop the green spectroscopic method using new ecofriendly chromogenic reagent for the evaluation of drug in pure and commercial dosage forms. Both heating systems (conventional and microwave assisted procedures) are used for the development of color. All the reaction conditions and different statistic parameters for the proposed methods have been studied. The method is found to be rapid, precise and accurate and can be successfully used for the determination of antihistamines in pure and pharmaceutical"formulations.

Keywords: Environment, Drug, Microwave, Spectrophotomerty

GREEN CHEMISTRY: GC-06

ACTIVATION OF NATURAL COAL FOR SOLID PHASE EXTRACTIVE PRECONCENTRATION OF PB(II) IONS PRIOR TO ITS TRACE DETERMINATION IN AQUEOUS SAMPLES BY FAAS

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ABSTRACT: Natural coal was collected from Thar coal field, block IX in Province Sindh, Pakistan. The Thar coal was modified to Activated Thar Coal Adsorbent (ATCA) by reacting with concentrated H_2SO_4, which enhanced its porosity by dehydration as concentrated H_2SO_4 is strongly dehydration agent. The surface oxidation of coal was carried out by refluxing in concentrated HNO_3. The ATCA was subjected to FT-IR spectrometer for characterization, which revealed the presence of C=O and COOH moieties onto its surface. The ATCA was applied as an efficient adsorbent and packed in column for Pb(II) ions adsorption. A quantitative recovery (≥ 95.583.0%) of Pb(II) ions was noted at pH 7.0, ATCA amount packed in column: 400 mg, sample volume: 400 mL (flow rate: 2.0 mL min^{-1}) and eluent: 5.0 mL of 0.5 mol L^{-1} HCl (flow rate: 1.0 mL min^{-1}). The limit of detection (LOD): 0.0321 μg L^{-1} and Limit quantification (LOQ): 0.108 μg L^{-1} were noted by bank recording for 15 replicates with preconcentration factor (PF) of 80. Total saturation capacity of the column for the adsorption of Pb(II) ions was found to be 152.5 mg g^{-1}. A linear response was observed with regression equation of $y = 0.0934x + 0.0411$ and $R^2 = 0.9903$ for concentration ranging 0.5-5.0 mg L^{-1} (before preconcentration). Similarly, a linear response was also observed with regression equation of $y = 7.4358x + 0.0429$ and $R^2 = 0.9902$ for concentration ranging 0.005-0.050 mg L^{-1} (after preconcentration). The experimental PF was 79.6, which is the ratio (7.4358/0.0934) of slopes of the regression equations. The method worked well on real water samples.

Keyword: Thar coal, Preconcentration, Pb(II) ions, Solid phase Extraction, FAAS

GREEN CHEMISTRY: GC-07

INVESTIGATION OF OXIDATION MECHANISM OF FLUOXETINE; AN ANTIDEPRESSANT DRUG, BY GLASSY CARBON ELECTRODE AND ITS ELECTROCHEMICAL DETECTION BY MOLECULAR IMPRINTED POLYMER MODIFIED GLASSY CARBON ELECTRODE

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ABSTRACT: Fluoxetine, a selective serotonin re-uptake inhibitor drug, is widely used to treat depression, nervous anorexia, autism and bulimia nervosa. The electrochemical behaviour of this drug at a glassy carbon electrode (GCE) was studied in aqueous solution using voltammetric techniques. Subsequently, a sensitive and selective electrochemical sensor based on a novel molecular imprinted polymer (MIP)/GCE was produced which used itaconic acid and N, N-methylene-bis acrylamide as functional monomer and crosslinking agent, respectively. The precipitation polymerization enabled drop coating of a reproducible MIP layer on the GCE as a renewable affinity surface for fluoxetine detection. The binding efficiency and selectivity of the MIP affinity sites for the target molecule was demonstrated through an increase in DPV peak current response in comparison with a non-imprinted polymer layer (NIP)/GCE. Conditions for MIP formation, loading and incubation, respectively, were optimised to improve the analytical response of the (MIP)/GCE combination. Under optimised conditions, the variation of fluoxetine concentration from 4.99×10^{-7} to 3.38×10^{-5} mol L^{-1} gave a linear correlation, with detection and quantification limits of 115.01 μg L^{-1} and 383.38 μg L^{-1} respectively. The method was employed to analyse fluoxetine extracted from blood serum.

Keywords: Fluoxetine, MIP, GCE, DPV

ENVIRONMENTAL MICROBIOLOGY: EMB-01

REMOVAL OF ORGANIC CARBON AND MICROBIAL CONTAMINATION THROUGH SOIL COLUMN

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ABSTRACT: Natural filtration can be a cost-economic method for surface water treatment. A cylindrical column filled with soil, taken from canal bank, was used for removal of organic carbon and microbial contamination from canal water. The canal water (KB Feeder Canal) was transported and stored in 500 ml autoclaved bottle for every other day and water was passed through column at a flow rate of 4.56ml/min at the room temperature. The idea was to assess the extent of degradation of microbial contaminants during natural soil filtration. Along with removal efficiency of pathogens, following parameters were also monitored: total organic carbon, total nitrogen, turbidity and total suspended solids (TSS). Total four (4) pathogens viz. Total Coliform, E. Coli, Salmonella Typhi, Vibrio cholerae were measured in the influent and effluent of the laboratory column. The rates of degradation of contaminants and pathogen removal obtained during this study can be used to develop a predictive model for biological, physical and chemical contaminants removal. Column tests were also performed in the lab for evaluation of bio-clogging potential of the canal bank soil. The soil column was found to be effective for removal of pathogens and the removal efficiency of pathogens were observed above 98%. The removal efficiency of TOC and TSS were found 50% and 95%, respectively. The results revealed that natural soil filtration at the bank of a canal can be efficient method for production of drinking quality water.

Keywords: Organic Carbon, Water quality, Total Nitrogen, Microbial contamination, Soil Column.

ENVIRONMENTAL MICROBIOLOGY: EMB-02

BIOLOGICAL CONTROL OF *HAEMONCHUS CONTORTUS* BY ABOMASAL BACTERIA IN SMALL RUMINANTS

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ABSTRACT: Livestock contribute quite a handsome share to the total GDP of Pakistan. Small ruminants have significant role in the livestock sector. Haemonchosis is a parasitic disease of small ruminants that adversely affect the livestock production. *Haemonchus contortus* is one of the most prevalent nematode parasites that infects abomasum of small ruminants. This parasite reduces milk production, overall growth and sometimes causes death of the infected animals. Evaluation of biocontrol potential of some abomasal bacterial isolates, against *H. contortus* has been investigated in this study. Out of which three isolates Comamonas *testosteroni*, *Comamonas* diangduensis, *Pseudomonas weihenstephanesis* showed significant effect against the nematode L3, adult and egg hatch inhibition assays. Various concentrations of metabolites from these bacteria were prepared and applied in different treatments compared with control. In case of adult mortality assay, 50% metabolites of *C. testosteroni* and *P. weihenstephanesis* showed 46% adult mortality, whereas *C. jiangduensis* showed 40% mortality. It was observed that decreasing the concentration of bacterial metabolite, lowers the nematode mortality. The lowest metabolite concentration, the minimum nematode mortality rate was recorded at the lowest metabolite concentration of all the bacterial isolates. The same trend was observed in egg hatch inhibition assay, where the higher concentration of bacterial metabolites showed 100% inhibition of *H Contortus*. contortus egg. It was concluded that the effect of bacterial metabolites against *H. Contortus* was dose dependent for their activity against nematode L3, adult and egg hatch inhibition.

Keywords: Small ruminants, *H. contortus*, abomasum, fecal samples, bacterial metabolites

ENVIRONMENTAL MICROBIOLOGY: EMB-03

HEAVY METAL TOLERANCE AND BIOSORPTION CAPACITY OF LACTIC ACID BACTERIA

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ABSTRACT: Heavy metals particularly cadmium is a class of elements having less biological role but show extreme toxicity. Heavy metals accumulate in the soft tissues of the body and upset the normal functioning of internal organs. Atmospheric deposition of cadmium, mining activities and the application of cadmium-containing fertilizers on farm land may lead to the contamination of soils and increased uptake through the ingestion. Cadmium is present in almost all foods, but the concentrations vary depending upon the type of food and level of environmental contamination. The average cadmium intake from food generally varies between 8 to 25 µg per day. Smoking is another major source of cadmium exposure. Cadmium has long half-life (10-30 years) in tissues, particularly the kidneys. Lactic acid bacteria are beneficial microbial fauna. LAB are gram-positive, catalase-negative, generally nonsporulating, nonmotile, nontoxic and rod shaped bacteria. They have low guanine cytosine (GC) content. Bioremediation is a natural process that involves the use of biological entities to remove metals. Among LAB most of the strains have ability to resist the heavy metals and may also be used as the remedy of heavy metals poisoning. The objective of present study is to evaluate and compare the cadmium tolerance and removal ability of lactic acid bacteria. Twenty-five strains were selected on the basis of initial screening for lactic acid production and identified using morphological and biochemical characteristics. During initial screening, twenty strains exhibited resistance in the presence of different concentration of cadmium chloride and 10 best strains were selected. MIC of selected strains ranged from 3.4 µg/ml to 7.6 µg/ml. Broth contaminated with 5 µg/ml of $CdCl_2$ was inoculated with strains. After 24 hours, cells were separated by centrifugation. Cd levels were determined in spin broth and cells. A significant reduction in Cd level in LAB cultured broth was recorded from 1.12 µg/ml to 1.9 µg/ml. Similarly, Cd level were recorded from the broth contaminated with Cd without the inoculation of LAB and absorption level of Cd was recorded from 1.9 µg/ml to 2.6 µg/ml. Results showed that all the strains reduce cd from media and strain *Pediococcus spp*. could reduce 57 % of Cd. This strain may have application in pharmaceutical or animal farming industry for protection against cadmium toxicity and have potential to be a probiotic candidate for food and i*n vivo* control of cadmium bioaccumulation. Animal trial for reduction of Cd through LAB is also under process.

Keywords: Heavy Metals, Minimum Inhibitory Concentration, Bioaccumulation, Bioremediation

ENVIRONMENTAL MICROBIOLOGY: EMB-04

IDENTIFICATION OF ANTIBIOTIC-RESISTANT BACTERIA IN SANITARY SYSTEMS IN THE PUBLIC PRIMARY SCHOOLS OF HYDERABAD DISTRICT, PAKISTAN

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ABSTRACT: Antibiotics can treat many deadly bacterial diseases effectively. A large percentage of antibiotics prescribed worldwide in outpatient settings are unnecessary, whereas around 30% of antibiotics prescribed in the United States are not warranted. In developing countries like Pakistan, antibiotics can be purchased without a doctor's prescription, hence many patients' purchase antibiotics and other medicines on the advice of unqualified and unauthorized people such as pharmacists, friends and family. However, rapid increase in community-acquired antibiotic-resistant infection has been observed in Pakistan. School setting may be particularly important as large number of children are together and sanitation or hand washing may not be sufficient to interrupt fecal oral transmission. Possibility that community acquisition of AR infections due to fecal oral transmission routes may pose serious threats to the health of children in schools. The microorganisms carrying resistance genes for advanced antibiotics are present in human wastes. This study has identified the presence of these enteric bacteria in sanitary systems of the primary schools of District Hyderabad, Pakistan. We considered primary schools of Hyderabad district, registered with education and literacy department. 45 schools (Public and Private) were selected randomly. This study comprises of two parts, the wash facilities assessment followed by school latrine sampling for antibiotic resistance. Antibiotics resistances was analyzed using streak and spread method at National Water Quality lab, USPCASW also called antibiotic sensitivity method. The second part of this study was achieved using a (survey) i.e. research questionnaire consisting of five major sections related to general information about the school, water, sanitation, hygiene and drainage, respectively. The results found that Azithromycin and Cefixime were more resistant to E. Coli and KEC bacteria's as compare to Meropenem and Ciprofloxacin. However Meropenem was 92% susceptible to be resistant to E. coli and 81% to KEC. According to the comparison results between public and private schools, the findings revealed that the selected antibiotics were more resistant to both pathogens in private schools rather than in public schools. Sixty percent schools were found with no interventions related to the wash factors. Overall assessment of wash facilities on the basis of recorded data, found as of poor quality.

Keywords: Antibiotics, Sanitary Systems, E. Coli.

ENVIRONMENTAL MICROBIOLOGY: EMB-05

ISOLATION OF BACTERIAL FAUNA FROM FEACAL SAMPLE OF WILD ANIMALS AT DIFFERENT CAPTIVE SITES FOR THEIR BETTER MANAGEMENT AND WELBEING

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ABSTRACT: Current research work has been designed to isolate and identify the feacal microbial fauna of wild animals that would be possible cause of different infectious diseases. A total of 72 fresh fecal samples of different groups of captive animals (carnivores, herbivores and omnivores) were collected from four captive areas i.e. Lahore Zoo, Jallo Wildlife Park, Safari Zoo Lahore, and Marghazar Zoo Islamabad. Different biochemical tests were applied on the fecal samples to identify the feacal microbial load. The results indicated that 54% of samples were fermenter and 46% were non-fermenter species of bacterias. A total of 09 strains of bacterias including gram positive (Staphylococcus aureus, Enterococcus, Staphylococcus spp) and gram negative (E.coli, Salmonella spp, Citrobacter freundii, Pseudomonas, Klabisella, Coliform spp), obtained from captive areas are all pathogenic. In carnivores group the highest CFU value was found in female Jaguar i.e. $7.2x10^3$ and lowest was of cub Lion that was $1.6x10^3$, both animals were from Safari Zoo Lahore. In herbivores, highest CFU was found in male Spotted Deer, $9.25x10^3$ and least was of male Vervet Monkey, $0.5x10^3$ (both animals from Lahore Zoo). In omnivores, highest CFU was found in male Brown Beer (in Marghazar Zoo, Islamabad), $5.35x10^3$ and least was of Gibbon (Lahore Zoo), $0.9x10^3$. These findings will be help to zoo veterinarians to upgrade the existing preventive and curative practices of captive animals for control of diseases in future.

Keywords: Feaces, Microbs, Wild Animals, Captive Sites

ENVIRONMENTAL MICROBIOLOGY: EMB-06

ROLE OF BIOSURFACTANT PRODUCING BACTERIA ISOLATED FROM PRODUCED WATER IN HYDROCARBON DEGRADATION

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ABSTRACT: Biosurfactants are surface active naturally occurring compounds which are produced by microorganisms that have several applications in petroleum, pharmaceutical and agricultural industries. Produced water is a major waste water stream of petroleum industry which is produced during petroleum extraction from subsurface in which hydrocarbons are found as a main environmental pollutant. Present study is focused on production of biosurfactants from indigenous bacteria, isolated from produced water collected from three selected sites of Eastern Potwar, Punjab, Pakistan. Forty seven bacteria were isolated out of which five (F1, F3, F20, F23 and C16) were selected on the basis of high optical densities of 0.7, 70% oil and grease reduction potential and maximum CFU/ml of $\geq 3 \times 10^6$. The Gen Bank accession numbers obtained for F1, F3, F20, F23 and C16 were MH424576, MH161599, MH424577, MH424578 and MH424579, respectively. The weights of biosurfactants (in g/l) produced from F1, F3, F20, F23 and C16 were 0.52, 0.93, 1.58, 0.52 and 1.56, respectively. F20 showed maximum biosurfactant production of 1.58 g/l. F1, F3, F20, F23 and C16 showed emulsification (%) of 6.00, 6.33, 6.66, 6.00 and 6.33 and Rf-values of, 0.6, 0.61, 0.6, 0.64 and, 0.61, respectively.

Keywords: Produced water, Biosurfactant, Hydrocarbons, Emulsification.

ENVIRONMENTAL MICROBIOLOGY: EMB-07

STRUCTURAL AND MUTATIONAL ANALYSIS OF HEMAGGLUTININ PROTEIN OF H9N2 VIRUS ISOLATED DURING 2016 TO 2018 FROM COMMERCIAL POULTRY IN PAKISTAN

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ABSTRACT: Avian influenza A virus subtype H9N2 has affected the poultry industry in Pakistan since last two decades and has caused the immense financial losses to the poultry farmers. Influenza viral surface protein hemagglutinin binds to sialic acid on the surfaces of upper respiratory tract cells and helped in internalization of virus. Hemagglutinin being attachment factor and fusion protein plays an integral role in virus infectivity. In this study, we have isolated different strains of H9N2 virus from birds of various poultry farms in Punjab, during 2016 to 2018. Hemagglutiningene of these strains was amplified using RT-PCR and sequenced to perform the mutational analysis. Phylogenetic analysis revealed that all isolated H9N2 strains belong to B2 sub-lineage. A comparative analysis with Y- 280 lineage demonstrated that hemagglutinin of H9N2 virus does not have any human related pathogenic sites. Multiple sequence alignment of reference and isolated hemagglutinin protein sequences showed that HA1 has acquired greater number of mutations as compared to HA2 region. Substitution at 377 Ser to Gly has caused the dislocation of secondary helix in HA2 region in comparison to ancestors. Other substitutions at positions 520-521 Gly-Thr to Glu-Asp in peptide turn of C terminal hydrophobic regions of HA2 region has also been observed. These findings will be helpful for designing of inhibitory factors against H9N2 influenza virus. We suggest that further experiments are needed to infer the factors associated with pathogenicity of hemagglutinin of H9N2 virus prevailing in the Pakistan.

Keywords: Influenze Virus, Poltary Forms, Hemagglutinin

ENVIRONMENTAL MICROBIOLOGY: EMB-08

WHEAT STRAW AMENDMENT HAS IMPROVED THE MICROBIAL ACTIVITY AND CARBON USE EFFICIENCY IN AZO DYES CONTAMINATED SOIL

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ABSTRACT: Textile effluents contain a mixture of different dyes including reactive, disperse, vat, direct, acid and sulphur dyes. Effects of textile effluents are reported on soil microbial activity, functions and quality. However, a little is known about how these textile dyes individually influence the soil properties or other soil quality indicators. Organic matters are generally known to increase the microbial and enzymatic activities in soil. Therefore, a laboratory incubation study was conducted to investigate the effects of above listed textile dyes both in the presence and absence of wheat straw. Wheat straw was added as economical organic matter amendment in this study. The present investigation was mainly focused on (i) respiration (ii) microbial biomass carbon (iii) water soluble carbon (iv) pH (v) electrical conductivity (vi) ammonium-N and (vii) Nitrate-N of soil. The results showed that addition of wheat straw with different dyes had increased the microbial activity. Reactive and direct dyes particularly had increased the electrical conductivity of soil probably due to their salinity. Soil respiration data also indicated that the effect of dyes had not imposed significant variation in respiration however the wheat straw amendment had increased the soil respiration. The microbial biomass carbon was increased in the soil with wheat straw amendment. This study needs further work to calculate the amount of dyes decomposed in soil so that half-life of the dyes can be calculated.

Keywords: wheat sraw, textile waste, microbial activity and electrical conductivity

ENVIRONMENTAL MICROBIOLOGY: EMB-09

ALLEVIATION OF CHROMIUM TOXICITY RELATED WITH INCREASED GROWTH AND PHOTOSYNTHESIS AND DECREASED IN OXIDATIVE STRESS OF CASTOR BEAN WITH COMBINED APPLICATION OF CITRIC ACID AND CR-RESISTANT MICROBES

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ABSTRACT: There is found a very inadequate work done on chromium toxicity against the plants because its up-taking behavior is changed for "secondary metabolites" and "essential nutrients". On the castor bean plant, hydroponic experiment was carried out to note the citric acid effect and also it was performed by applying various kinds of microbes like "*Bacticlus subtitlrs*" and "*S aures*" in order to carry out Cr phytoremediation. Many different amounts of chromium (0, 100, 200 µM) and citric acid (0, 2.5 and 5mM) were used both alone as well as in combination. Results showed that elevated amounts of chromium (specifically 200 µM) minimized the growth as well as biomass because it induced the oxidative markers. When citric acid was applied in an exogenous way, then plant growth was improved, as photosynthesis improved by the activity of enzymes like superoxide dismutase, guaiacol peroxidase, catalase and ascorbate peroxidase, due to the fact that they decreased the Cr toxicity. The oxidants were countered by the increased antioxidants and it showed that for offsetting the stress injuries, there is found effective potential in castor bean plants treated with citric acid, for decreasing the H_2O_2, electrolyte leakage and malanodialdehyde levels. Moreover, there is numerous work to be carried out in terms of phytoremediation by using microbes because they carry out heavy metal phytoremediation very effectively.

Keywords: Chromium; Citric acid; Microbes; Castor bean; Antioxidant enzyme; Phytoextraction

ENVIRONMENTAL MICROBIOLOGY: EMB-10

ANTI TICK ACTIVITY OF *CARICA PAPAYA* PLANT EXTRACT AGAINST *ARGAS PERSICUS* IN POULTRY

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ABSTRACT: The population of Pakistan is increasing rapidly and this trend reflects that the demand of animal protein will increase proportionately. Under these circumstances, poultry may be the only readily available and an economic source of animal protein. Ectoparasites like ticks are obligate external parasite of reptiles, birds and mammals. Ticks bites and ticks borne diseases continue to be a serious public health problem throughout the world. *Argas persicus* is a soft tick which infests poultry globally. Tick eradication, vegetative modifications and chemotherapy are widely used methods to control tick infestation. Plant extracts are used as alternative new safe methods for tick control. Plant extracts have various effects against ticks such as reducing tick feeding, molting, fecundity and viability of eggs. The present study was conducted in district Kohat, Khyber Pakhtunkhwa, Pakistan to evaluate the in vitro toxic potential of *Carcia papaya* plant extract against *Argas persicus* in poultry. The mortality of *A. persicus* was examined after treatment with methanolic extract of *C. papaya* at different concentrations (0.5 g / 100 ml to 2.5 g / 100 ml). Highest mortality rate was recorded to be 60% at 1.5 g /100 ml while lowest i.e. 14.2% was recorded at 1 g / 100 ml solution after 6 hours. Highest mortality rate was recoded to be 83.33% at 1 g/ 100ml while lowest i.e. 28.57 % was recorded at 1 g/ 100ml solution after 12 hours. Highest mortality rate was recorded to be 85.71 % at 2 g / 100 ml while lowest i.e. 28.57 % was recoded at 1 g / 100 ml solution after 18 hours. Thus, *Carcia papaya* extract can be effectively used for eradication of *A. persicus* in poultry.

Keywords: Poultry, plant extract, *Argas persicus*, *Carica papaya*, district Kohat.

ENVIRONMENTAL MICROBIOLOGY: EMB-11

ASSESSING THE ROLE CHROMIUM RESISTANT *BACILLUS SUBTILIS* ISOLATE B3 IN ALLEVIATION OF CHROMIUM STRESS IN WHEAT PLANT CULTIVATED ON METAL CONTAMINATED SOIL

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ABSTRACT: In recent decades, soil contamination with toxic metals such as chromium has emerged as a serious threat to environment. This is because chromium is widely being used in various industrial processes such as tanning and chrome plating etc. However bioremediation can be used an efficient and environmentally benign approach to address this issue. In this study, *Bacillus subtilis* isolate B3, a chromium resistant bacterium, was used to evaluate its effect on wheat physiobiochemical responses and chromium uptake under metal spiked soil. It was observed that chromium stress reduced the overall plant growth, chlorophyll contents, biomass and relative moisture contents through oxidative damage (electrolyte leakage, hydrogen peroxide etc). However bacterial has improved all these factors contributing increase in chlorophyll a production up to 27%, chlorophyll b production up to 49%, ascorbic acid production in leaves up to 50%, soluble protein up to 72% in wheat plants grown on 50mg Kg^{-1} soil. These suggested that *Bacillus subtilis* isolate B3 had reduced the overall oxidative stress caused by the presence of chromium in soil, therefore might be useful candidate for bioremediation of chromium contaminated soils.

Keywords: Chromium, *Bacillus subtilis*, Metal Pollution, Bioremediation.

BIOREMEDIATION: BR-01

BIO-ASSIMILATION OF PB AND ZN IN ANIMALS CONSUMING CONTAMINATED LEAFY FEED

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ABSTRACT: Heavy metals are major contaminants in the food chain with serious consequences to human and animal health. Use of wastewater for irrigation and addition of fertilizers, pesticides, etc. for getting high yield are responsible for accumulation of heavy metals in soil and plant system. Experiments were conducted to link the transition of heavy metals from soil-plant to animal system, i.e. bio-assimilation. For this reason, spinach was grown in metal contaminated soil and fodder crops were grown in wastewater irrigated fields. These soils were loaded with high concentration of heavy metals and pose serious health risk for both humans and animals. For the assessment of Pb and Zn, rabit blood sampling was done after 1, 7 and 14th days after feeding and fodder sampling was done by quadrate method. Buffalos and cows feeding on contaminated fodder were tagged to collect milk samples from the same cattle after every interval. Spinach and fodder were fed to rabbits and cows/ buffaloes, respectively. Bio-assimilation of Pb and Zn in spinach and the rabbits fed on that spinach was assessed. Similarly, milk of cows/buffaloes feeding on contaminated fodder was evaluated for heavy metals. For the assessment of heavy metals in blood and essential organs, i.e. liver, kidneys and bones of rabbits and cows/buffaloes milk, samples were analysed on atomic absorption spectrophotometer (AAS). It was found that significant amount of metals was assimilated in bones and essential organs of the rabbit and in cows/buffalo milk consuming contaminated spanich and fodders, respectively.

Keywords: Contamination, Soil, Effluents, Toxicity, Fodder, Animals

BIOREMEDIATION: BR-02

PHYTOREMEDIATION POTENTIAL OF GIANT REED (Arundo donax) USING BIOCHEMICAL AND MOLECULAR APPROACHES

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ABSTRACT: Giant reed (A. donax) a high biomass wetland plant is considered a representative accumulator for various pollutants including heavy metals like As, Cd, Cu, Cr, Zn, Pb etc. In the current study, giant reed potential and genetic response was evaluated in heavy metals polluted soils of southern KP, Pakistan. Giant reed nursery was transplanted in the pots filled with polluted soil of the study area and grown for a period of 45 days. The grown plants were harvested and subjected to various elemental, physiological, biochemical parameters and molecular study. For analyzing the concentration of metals in soil and plants, samples were acid digested and analyzed through atomic absorption spectrophotometer. Results of the study showed significant metal accumulation in giant reed plants of contaminated soils and reduced physiological parameters i.e. (chlorophy ll content, plant height, plant fresh weight) as compared to plants grown in control soil. Antioxidants activity of superoxide dismutase (SOD), peroxidase (POD), ascorbate peroxidase (APX) and catalase (CAT) significantly increased both in plants root and shoot of contaminated soil. Oxidative stress markers like malondialdehyde (MDA) and hydrogen peroxide H_2O_2 also enhanced in plants of contaminated soil. Molecular study of the genes like amidase and, glutathione reductase showed highest expression in plants of contaminated soil compared to plants of control soils. Therefore, the study confirms that giant reed is a promising metal tolerant and accumulator plant for the phytoremediation of heavy metals polluted soils.

Keywords: Heavy Metals, Giant Reed, Antioxidants, ROS

BIOREMEDIATION: BR-03

BIOTRANSFORMATION OF TOXIC SELENIUM OXYANIONS INTO NONTOXIC ELEMENTAL FORM BY *T. AESTIVUM* USING BIO-FERTILIZERS

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ABSTRACT: Selenium is a metalloid found in Earth's crust abundantly in many oxyanion forms i.e. selenide and selenite, and also in conjugation with other compounds i.e. sodium selenite. It possess a special place in biochemistry being micronutrient and toxic metal at the same time. This happens accordingly as its oxidation state changes. In current study, *T. aestivum* in conjugation with bio-fertilizers was used to transform the Toxic sodium selenite into elemental non-toxic selenium form. Microbial strains were isolated from far areas of Punjab showing maximum selenite resistance and reduction potential. Strains showed upto 85% sodium selenite reduction grown in field experiments, leaving traces of selenite only. This study shows the significant results and can be used to bioremediate highly polluted areas with no side effects.

Keywords: Bio-remediation, Bio-rransformation, Selenium, Toxicity, *T. Aestivum*

BIOREMEDIATION: BR-04

REDUCING PESTICIDE APPLICATION IN CONTROLLING SOIL BORNE FUNGAL PATHOGENS THROUGH INDUCED SYSTEMIC RESISTANCE

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ABSTRACT: This study was planned to investigate an ecological safe method to manage soil borne diseases in crops. We used two indigenous Bacillus strains including *B. fortis* 162 and *B. subtilis* 174. The bacterial strains were primed with tomato plants and the soil was made sick using active cultures of *Fusarium oxysporum* f. sp. *Lycopersici*, the causal agent of *Fusarium* wilt. Both the strains significantly supported plant growth and helped in decreasing soil borne disease. However, a little variation was observed in this and *B. subtilis* showed more effective results in comparison to the *B. fortis*. The studies were extended to the evaluation of the total phenolics and defence related enzymes in treated plants to have an idea for the physiological changes after defence induction. Overall findings depict that the tested bacterial strains forced the plant to activate their defence system. In the next step fractions from *B. subtilis* 174 metabolites were investigated for potential ISR (Induced systemic resistance) determinant/s. Intra-cellular metabolites and cell free culture filtrates of selected bacterium were analyzed for their capability to induce systemic resistance in tomato under greenhouse conditions. In contrast to intra-cellular metabolites, cell free cultural filtrates (CFCF) elicited ISR in tomato plants as they showed significant reduction in disease index. These CFCF were then fractionated by a series of organic solvents and purified. These fractions were then tested for inducing systemic resistance in tomato using test tube bioassay. ISR determinates were found to retain in ethyl acetate fraction that was then subjected to column chromatography and portioned into ten sub-fractions by step wise elution method. GCMS (Gas Chromatography Mass Spectroscopy) analysis of ISR active sub-fraction confirmed the presence of four compounds out of which phthalic acid dimethyl ester proved as ISR determinant of *B. subtilis* IAGS174.

Keywords: ISR, *Lycopersici*, GCMs, intra-cell metabolism and cell cultural filtrates

BIOREMEDIATION: BR-05

USE OF MACROALGAL BASED HYDRO-CHAR FOR ARSENIC (AS) REMOVAL

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ABSTRACT: Hydrothermal carbonization (HTC) is a thermal conversion method to convert biomasses into carbonaceous material under a mild condition. In the current study, HTC is used as a method of treatment to pretreat red macroalgae for the preparation of hydro-char. The HTC process was carried out at 200^{o}C for 5 hours. The porous carbon product was filtered, washed and dried at 120^{o}C for 5 hours. Prepared hydro-char activated by ferric chloride FeCl3. Activated hydro-char was put into a desiccator for its characterization (Scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) and Fourier transform infrared radiation (FTIR)). Batch adsorption study was conducted under fixed conditions. In each test a fixed concentration of hydrochar (0.01 g/l) was added to the solution. Results indicate that with the increase in initial As concentrations (50 to 250 mg/l) arsenic removal efficiency also increase, maximum adsorption was achived at pH 6 avaried between 5 to 10 and with increase in adsorbent dosage, arsenic removal efficiency also increase, but adsorption capacity decreased at agitation speed were 200 rpm. Agitation speed of arsenic concentrations after treatment were determined by using inductively coupled plasma mass spectrometry (ICP-MS). Moreover, the pseudo-second order model interpret the adsorption kinetics for activated hydro-char, while the adsorption equilibrium best described by the Freundlich and Langmuir Isotherm.

Keywords: Hydrothermal carbonization, contamination, X-Ray spectroscopy and adsorption kinetics

BIOREMEDIATION: BR-06

A PILOT SCALE STUDY OF MICROBIAL DEGRADATION OF PHENOL WITH RYEGRASS

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ABSTRACT: Anthropogenic activities enhance the level of toxic pollutants in the water like insecticides, pesticides and petroleum hydrocarbons. Petroleum is the backbone of global economy. Hydrocarbons composition include resins, asphaltenes, aromatics and saturated hydrocarbons. Current study is focusing on phenol, as phenol is a major concern among aromatics because of its solubility in water. Phytoremediation is a cost effective method for the removal of contaminants but most of the plants are susceptible to it. Four efficient bioreactors were designed in order to compare the phenol degradation in the presence of microbes, plants and inoculated plants. Ryegrass is capable to degrade the hydrocarbons but cannot grow well in that environment so do not actively support phytoremediation. To enhance the efficiency of ryegrass, consortium of two endophytes (*Pseudomonas putida* and *Pseudomonas aeruginosa*) has been introduced. The concept of using consortium of selected endophytes promoted the degradation of phenol. In addition, the consortium accelerated seedling emergence, promoted plant growth rate under adverse conditions. Dose of 250mg/L of phenol was applied in each bioreactor and monitored its degradation after every 6 hours through UV visible spectrophotometer. The results demonstrate the potential of the consortium for helping plants to tolerate stress from phenol and to improve phytoremediation of phenolic pollutants.

Keywords: Phenol, ryegrass, endophytes, biodegradation

BIOREMEDIATION: BR-07

UPTAKE AND TOXICITY ASSESSMENT OF ANTIBIOTIC IN PLANT

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ABSTRACT: The world population has been increasing at an exponential rate, thus need for basic life necessities is also increasing by many folds, leading to ever highest industrialization, urbanization and development. Another implication of such high population is high food demand and supply that further demands a higher water supply, but due to increased anthropogenic activities and increased population, water scarcity has become a major issue throughout the world. As a solution, water re-use for various purposes has become a common practice, including agriculture, as it is a water intensive activity. Such wastewater when used for agricultural purposes, brings a lot of harmful and unwanted constituents to the agricultural plants, an important one being antibiotics. The antibiotics when come in contact with plants can become a cause of various detrimental effects to the crop, effecting the yield negatively, and such crops when consumed can also cause negative impacts on human health. The current study is an effort towards assessing such harmful effects of antibiotics on crop plant, whereby, maize crop is irrigated with ciprofloxacin containing water to assess the uptake quantity of ciprofloxacin by the fruit of the plant, and its impacts on overall health and yield of the plant. The plant is assessed for various physical and chemical parameters like root and shoot length, number of fruit on plant, carbohydrates, proteins, and plant toxicity. The uptake of ciprofloxacin by the plants in comparison to control is also being assessed using high performance liquid chromatography. The high concentrations of ciprofloxacin are expected to have negative impacts on the plant health, causing increased toxicity, and reduced fruit quality in nutritional terms.

Keywords: Antibiotics, Ciprofloxacin, Agriculture, Maize, Plant Growth

BIOREMEDIATION: BR-08

MODIFIED STRAWBERRY CALYX AS AN EFFICIENT ADSORBENT FOR NI(II) IONS ADSORPTION: A CENTRAL COMPOSITE DESIGN APPROACH FOR MULTIVARIATE SORPTION OPTIMIZATION

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ABSTRACT: In this study, the discarded cap leaf (calyx) of strawberry was converted to adsorbent, and chemically modified by reacting with 0.5 mol L^{-1} HCl for the uptake of Ni(II) ions from environmental aqueous samples. Multivariate sorption optimization was carried out by Central Composite Design (CCD) model, contained 18 experiments. Removal of Ni(II) ions was achieved 98.5% at pH 8.0, sorbent dose 70 mg, concentration of Ni(II) ions 50 mg L^{-1} and shaking speed 100 rpm, shaking time 95 min at temperature 25°C. The interactive effect of two factors on the response was studied. ANOVA reveals that the numerical value of P is less than 0.05 for all effects except two factors i.e. adsorbent dose and shaking time, which indicated that all the null hypothesis are rejected except interactive effect of adsorbent dose and shaking time. Langmuir and Dubinin-Radushkevich (D-R) isotherms fitted well to adsorption data with R^2 of 0.995 and 0.989, respectively. Monolayer sorption capacity of adsorbent for uptake of Ni(II) ions was found to be 45.3±0.4 mg g^{-1}. The sorption energy was found to be 14.81 kJ mol^{-1} which indicated that Ni(II) ions was adsorbed onto the adsorbent chemisorption or ion exchange in basic medium. The method was applied on real environmental aqueous samples for the removal of Ni(II) ions.

Keywords: Strawberry, Calyx waste, Removal, Ni(II) ions, Adsorption, Equilibrium, CCD model

BIOREMEDIATION: BR-09

REMOVAL OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTION USING EGG SHELLS, DATE STONES AND PAPAYA SEEDS

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ABSTRACT: Water pollution is serious concern due to large quantity of colored wastewater discharged from various industrial processes i.e. textile, leather, tanning, paper and cosmetics and no proper treatment methods are being used to decolor such wastewater. Untreated liquid effluents are discharged in water-related ecosystems i.e. lakes, ponds, rivers, streams and the effects are very serious on aquatic life, fish gills, flora and fauna as they reduce the ability of light to reach deep down in water resulting in decrement of biological oxygen demand in water bodies. Therefore, the treatment of colored-wastewater is very significant before discharge. The conventional treatment options are very expensive and time consuming. The textile dyes can be removed through adsorption using cost effective and eco-friendly adsorbents. This study was aimed to test the potential of agricultural waste like eggshells, date stones, and papaya seeds and their effects on dosage, pH, concentration, contact time and speed. The characterization of adsorbents was assessed by Fourier Transform Infrared Spectroscopy (FT-IR), Scanning Electron Microscopy (SEM), and Energy Dispersive Spectroscopy (EDS). The results were analyzed using kinetic study model showing on maximum time Qe-Qt (mg g^{-1}) following pseudo-first-order kinetic model and pseudo-second-order kinetic model, maximum value Qe (mg g^{-1}) calculated with Log value best fitted adsorption isotherms Langmuir and Freundlich adsorption isotherms, respectively. Studied adsorbents i.e. eggshell, date palm stones, and papaya seeds depicts promising potential and prove themselves as cost-effective alternative of commercial activated carbons for the removal of methylene blue dye from textile wastewater.

Keywords: Methylene Blue; Wastewater Pollution; Adsorption; Eggshell; Datestones; Papaya Seeds.

BIOREMEDIATION: BR-10

CEIBA PENTANDRA (L.) GAERTN FOR THE REMOVAL OF RESIDUAL OIL FROM OILY-WATER EMULSION

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ABSTRACT: Fixed bed column studies were carried out to evaluate the performance of natural *Ceiba pentandra* (L). Gaertn. (kapok) for residual oil removal from oily-water emulsion under varying flow rate (5-20 ml/min) and packing density (0.02-0.08 g/cm^3). A multilevel factorial design based on chemical oxygen demand (COD) and turbidity of the effluent was developed. COD reductions of more than 99% and turbidity reduction ranging from 92.9- 95.8% were observed at all packing densities and flow rates. The results suggest that kapok fiber can be used as a low-cost alternative for the removal of residual oil from POME.

Keywords: *Ceiba pentandra*; residual oil; Packed-bed column; Factorial design

BIOREMEDIATION: BR-11

ANAEROBIC DEGRADATION OF MUNICIPAL ORGANIC WASTE AMONG OTHERS COMPOSTING TECHNIQUES IMPROVES N CYCLING THROUGH WASTE-SOIL-PLANT CONTINUUM.

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ABSTRACT: This study aimed to examine the effect of composting techniques of municipal organic solid waste (MSW) for (i) total carbon (C), nitrogen (N) losses, and changes in its chemical characteristics during composting phase and (ii) value of the composted materials as fertilizer when applied to vegetables. Treatments included: aerobic composting (AC), anaerobic composting (ANC), co-composting (CC) and open dumping (OD) for 4 months. During the composting phase, about 61, 50, 35, and 13% of the initial N was lost from CC, AC, OD, and ANC, respectively. The respective values in case of total C loss were 17, 13, 14 and 11%. After field application, about 41% of the applied organic N was mineralized from ANC material, whereas the respective values for OD, CC and AC were 25-26, 15-16, and 12-19%. Consequently, dry matter (DM) yield and vegetable N uptake from the resultant compost were in the order ANC>OD>CC>AC. Moreover, vegetable apparent N recovery (ANR_f) was the highest from ANC (spinach: 36 and carrot: 45%) followed by OD (26 and 34%), CC (18 and 26%) and AC (18 and 24%) material. When composting N losses were taken into account during calculations, about 31-39, 17-22, 9-10, and 7-12% of the N collected from filth depots ended up in plants from ANC, OD, CC and AC, respectively. We concluded that ANC results in least C and N losses during the composting phase and greatest N mineralization in the soil, which enhanced vegetable yield, N recovery and thereby the N cycling through waste-soil-plant continuum.

Keywords: Co composting. Organic solid waste, recovery, mineralization and waste soil plants

BIOREMEDIATION: BR-12

TOXICITY EVALUATION OF TANNERY EFFLUENT REMEDIATED BY CONSTRUCTED WETLAND TECHNOLOGY ON *CTENOPHARYNGODON IDELLA*

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ABSTRACT: Aquatic pollution caused by industrial effluents is an emerging environmental issue. It has caused deleterious impacts on the environment including humans by disrupting the balance of the ecosystem. Among all the agricultural industries, tanneries are the most polluting ones due to heavy use of toxic organic and inorganic compounds during leather processing, most of which find their way into rivers, lakes, and streams thus exerting adverse effects on aquatic life, particularly on fish. Considering the huge concentrations of pollutants present in tannery effluents, toxicity evaluation is of prime importance. Therefore, bioassays are usually employed to assess the acute toxicity of industrial effluents and efficiency of effluent cleanup technologies; as it provides a thorough response of test species to the substances present in test media. In the present study, the toxic effects of tannery effluent at different concentrations, before and after treatment by constructed wetlands (CWs) on common grass carp (*Ctenopharyngodon idella*) were studied for 96hin laboratory conditions. During this period, mortality, 96 h-LC50and acute toxicity of *C. idella* were calculated. In addition to this, observations on change in morphological and behavioural patterns were also made every 24 h. Raw tannery effluent changed the morphology, physiology, and behavioural response of fish. Moreover, fish exposure to raw/untreated effluent had 100% mortality and high acute toxicity, due to the presence of high concentrations of Cr. Effluent treatment by CWs significantly reduced its toxicity. Hence, it is highly recommended to use CWs for tannery effluent treatment, for safety of the environment.

Keywords: Biotoxicity test; treated tannery effluent; mortality; acute toxicity; LC-50; behavioural response; grass carp

ENVIRONMENTAL RISK ASSESSMENT – THE ONLY WAY-OUT FOR A SAFE REDEVELOPMENT OF BROWNFIELDS

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ABSTRACT: The world has marked an alarming milestone in demographics i.e. the Urban Millennium in 2007. Although the advent of industrial revolution introduced the blessing of mass production, it also resulted in corresponding escalation of 'mass' consumption. This led to change the face of the Earth as well as the landscape of the built environment, thereby exploiting the natural environment more than human history ever noticed. The current situation is still not far different on the ground, even though social pressures, environmental legislation and regulations, government policies, climate change challenges and global sustainable development agenda have been exponentially rising, thereby pushing to construct on brown-fields and spare green-fields. However, brownfields are generally contaminated or have a potential of contamination, thus redevelopments of them requires to establish the degree of existing safety or remediation if not sufficiently safe for a given redevelopment. This is where the approach of environmental risk assessment comes in. Based on further expanding of the aforesaid background, this speech is to focus on crucial concepts and components of risk assessment and management. Also, the state-of-the-art is presented, along with highlighting implications in terms of limitations and their types regarding risk assessments. Landfill is used as typical case of contaminated site, whereas a landfill is a multi-pollutant not only in terms of it yields unwanted products of landfill gas, leachate and ground instability but also potentially adversely impacts on biotics and abiotics including atmosphere, hydrosphere, lithosphere and technosphere/anthrosphere. Areas for further research and innovative development are also brought to light.

Keywords: Risk Assessment, Risk Analysis, Landfills, Brownfield, Greenfield, Contaminated Land, Sustainable Development, Climate Change

ARSENIC-FLUORIDE AND SEWAGE CONTAMINATED AQUIFERS IN SINDH PROVINCE OF PAKISTAN AND IMPACT ON HUMAN HEALTH

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ABSTRACT: Present study is based on microbiological and physico-chemical analyses of 781 groundwater samples collected from tube wells and hand pump wells in twenty districts of Sindh. Study area lies within latitudes 24. 74'-28. 03' N and longitudes 67.58'-70.24'E in Indus deltaic alluvial plain, covered by organic rich fine grained (Holocene) sediments and medium to coarse grained dunes covered older alluvium of Thar, eroded from western Himalaya by Indus river. Groundwater is highly saline with TDS contents ranging between 500-3776 mg/l, caused by semi-arid to arid climate, low annual precipitation and sea water intrusion in coastal Thatta and Badin districts. Besides, 20 to 90% aquifers were found swage contaminated and Ecoli positive due to unlined sanitation, open air excretion and roaming animals, common in rural areas of Sindh. Furthermore, elevated concentrations of arsenic (10-500 ppb) in groundwater were found in districts of Thatta, Matiari, Tando Allayar, Tando Mohammad Khan, Dadu, Nowshero Feroz and Ghotki, which are flanked by meandering Indus river. Whereas, fluoride (0.5-3.0 mg/l) contaminated aquifers were marked in Thar Parker, Badin, Umarkot, Sukkur, Sanghar, Larkana, and Kambar Shahdadkot districts. Mineralogical study of surface sediments from aquifer sites revealed presence of arsenic and fluoride bearing detrital quartz, biotite, muscovite, calcite, dolomite and anorthite. Moreover, leaching of arsenic and fluoride from aquifer sediments into groundwater was triggered by microbial contamination under near neutral to alkaline pH (6.5-7.5) and alkaline pH (7.8-8.6) conditions respectively. As a result, local people were found suffering from gastroenteritis, diarrhea, dysentery, vomiting, hyper pigmentation, skin lesions, dental and skeletal fluorosis.

Keywords: Pigmentaion, arsenic, flourides, diseases, ground water and health risk

ENVIRONMENTAL MONITORING AND RISK ASSESSMENT: EM&RA-03

ENVIRONMENTAL ASSESSMENT – A TOOL FOR SUSTAINABLE DEVELOPMENT IN PAKISTAN

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ABSTRACT: Environmental Assessment (EA) is a planning and management tool developed during last quarter of previous century to foresee the environmental and social impacts of new development projects. The tool helps to eliminate or reduce adverse impacts and to augment positive impacts, giving the environment its due place in the decision making process by evaluating the environmental consequences of a proposed project. In Pakistan EA process began with the promulgation of Pakistan Environmental Protection Ordinance, 1983 (PEPO-83) but it took momentum after promulgation of Pakistan Environmental Protection Act, 1997 (PEPA-97). Preparation of Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) reports for new projects is the outcome of EA process. Presently Environmental Protection Agencies in each province, Gilgit-Baltistan (G-B) and Azad Jammu and Kashmir (AJK) are processing IEE and EIA reports submitted by the proponents of new projects for obtaining environmental clearance (No Objection Certificate - NOC). The overall objective of this paper is to appraise the environmental process in Pakistan which was started about 37 years back. The specific objectives are to: analyze the extent of the process in meeting its set objectives by identifying bottlenecks and assessing effectiveness and deficiencies of the process and Suggest recommendations for improvement in the process. The paper presents the results of a Desk Study conducted by authors based on their experience while preparation of IEE/EIA reports and dealing with various Environment Protections Agencies (EPAs) for obtaining NOCs of the projects on behalf of proponents. The study results lead to conclude that: Environmental Assessment Process still has space for improvement towards expectations set in PEPA-97 and The proponents of the new projects have realized the importance of this statutory process with the passage of time and are willing to invest for preparation of IEE/EIA reports. EPAs have gained good experience to evaluate the IEE/EIA reports but there is need to strengthen their in-house capacity by inducting highly qualified staff and to condense the cumbersome procedure being adopted for evaluating the reports and issuance of NOCs. The rules and regulations framed under PEPA-97 require improvement to meet the challenges of sustainable development and changing climate threats.

Keywords: Environmental impact assessment, sustainability, social issues and environment protection

ENVIRONMENTAL MONITORING AND RISK ASSESSMENT: EM&RA-04

RECENT EMERGING CHALLENGES OF CONTAMINANTS IN CONTEXT TO HUMAN AND ENVIRONMENTAL HEALTH

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ABSTRACT: Pakistan being 5th largest population on earth and one of the top 10 effectee from climate change, generates 1.32 million tons of plastic waste every year (0.1 kg/capita/day) (with frequent discard in water reservoirs). In the context of Pakistan, where water scarcity is approaching alarming levels and country has been declared as 3rd most affected country facing acute water shortage (by IMF), waterborne contaminations are insidious. In light of the aim of Basel Convention COP 14, 2019, that is, to step up reduction, recyclability and collection of plastic waste in developing countries, and UNEA 4's resolution to accelerate towards a global binding agreement on plastic pollution; current project seeks to establish a comprehensive dataset for microplastics in freshwater ecosystem of Pakistan i.e. "Indus River System". This river system being one of the largest river basins of the world is not only responsible for supporting a large biodiversity, but also is the dominant source of water provisions for drinking, domestic usage, agriculture and hydropower Projects. Study conducted under the head of project reveals that the extent of plastic contamination in waterways of Pakistan is alarming. These plastic loads apart of devastating the aesthetic beauty of water repositories was found harmful for the fishes who were found dead at the banks, chocked with plastic ingestion. The migratory birds especially those found in Lake view region of Islamabad were observed feeding on the degraded plastic. The presence of plastic was found mostly prevailed by Low density polyethylene (LDPE), polystyrene (PS) and Polyethylene Terephthalate (PETE or PET). Conclusions suggest that sides of the lakes on the opposite side of the wind direction suffer severe pollution load and degradability, whereas, the water sideways frequently flooded by water offered lesser time for degradation but more accumulation. Sediments were found laden with films from LPDE, PVC (Poly vinyl chlorides) and PS. The fractionation of the sizes revealed that smaller the size fractions higher the microplastic concentration observed, revealing a significant human intake concentration around the served populations. The study also appraises the determination of ecological hazards and potential consequences for human health and encourages the need for development of better management strategies in the country regarding plastic pollution.

Keywords: Plastic, Pollution, Aquatic, Contamination, Migratory Birds.

ENVIRONMENTAL MONITORING AND RISK ASSESSMENT: EM&RA-05

HEALTH RISK ASSESSMENT OF POTENTIALLY TOXIC HEAVY METALS IN ECOSYSTEM ALONG RIVER CHENAB, PAKISTAN

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ABSTRACT: Pathogenic microorganism in water is one of the thoughtful and alarming situation for the developing countries like Pakistan, causing harmful effect on humans, aquatic life and specially leads to mortification of water. Chenab river is the major source of irrigation that meets the agriculture, domestic, industrial water needs of its nearby region. Six districts in Punjab dump untreated industrial effluents and urban waste water into the Chenab River, which poses a serious threat to ecosystem and also on community. From district Gujrat water and soil Samples (n=19) were collected from the different sites of the river and nearby soil for the pathogenic analysis of its water and soil quality and its impact on plants, also fish samples of *Cirrhinus reba*, *Catla catlab* were taken for the assessment of heavy metals like arsenic and chromium. Most of the samples collected from water and soil indicates the presence of E-Coli and total coliform in the samples of water and soil which ultimately transfer to the agricultural vegetation along the river. The carcinogenic metals in aquatic life and pathogens in water and soil indicate serious health effects in population along river Chenab.

Keywords: Pathogenic microorganism, ecosystem, Carcinogenic Metals, Industrial Effluent

ASSESSMENT AND MONITORING OF AMBIENT AIR QUALITY OF WASTE DUMPING SITES LOCATED NEAR LAHORE

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ABSTRACT: Declining of ambient air quality and increasing levels of noise pollution is an emerging concern in Pakistan. The present study was carried out to estimate ambient air quality and noise levels at open dumping sites. The monitoring was done during two seasons i.e. pre-monsoon and post-monsoon. The results were presented in graphical form. The assessment revealed that the average concentration of monitored parameters CO_2, CO, NO_2, SO_2, PM_{10} and Noise in pre-monsoon season was observed to be 493.38±26.11, 14.788±2.536 ppm, 91.64±28.06 µg/m^3, 23.74±3.74 µg/m^3, 383.2±253.8 µg/m^3 and 67.69±10.46 dB (A) respectively whereas in post-monsoon season it was 268.3±35.3, 10.63±3.70 ppm, 61.13±15.41 µg/m^3, 20.250±1.982 µg/m^3, 142.3±56 µg/m^3 and 69.13±10.27 dB (A) respectively. The results showed that in some areas the air quality was not satisfactory the reason was that those sites were nearer to the roadsides (Ring Road). Pollutants were also arising from the heavy loaders that carry municipal solid waste towards and away from the open spaces. Data was also presented with help of maps. In comparison to both seasons the ambient air quality was worse during pre-monsoon season than the post-monsoon. The reason was that after monsoon most of the pollutants washed away with rain. The whole station is the full of activity that a large number of vehicles travel on daily routine. In addition to this it was observed that there is direct relationship with the time of the day, traffic load, vehicular emission and emissions from the landfills. The current situation of ambient air quality and noise level at the study area revealed that authorities must carry out monitoring the management and reduction of traffic load, maintenance of vehicles and compliance with standards.

Keywords: Ambient Air, Waste Dumpsites, Carbon Dioxide (CO_2), Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}), Noise Level

EVALUATION OF ENVIRONMENTAL INFLUENCE OF ARSCENIC COMPOUNDS ON PATIENTS SUFFERING FROM TYPE 2 DIABETES

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ABSTRACT: Diabetes is a condition in which people suffer due to insufficient insulin or the body get resistant to the insulin. In diabetic condition the beta cells activity restricted and lower quantity of insulin produced in the pancreas. Diabetes has been divided into different types but we have focused on type 2 diabetes. There are many agents working behind diabetes. Physical inactivity, intake of meal that is high in carbohydrates and fats, obesity and inhalation of different chemicals found in the environment. Arsenic is the chemical that act as diabetogenic agent as it effect the functioning of pancreatic beta cells and also cause insulin resistance through several ways like oxidative stress by the production of free radicals in the body and also due to the disturbance of protein hormone that disrupt insulin sensitivity. In the conducted research we have studied the link between arsenic and type 2 diabetes. Initially sample survey was done of the sample size of 100 and then the glucose levels of the patients estimated in order to confirm that the person is diabetic. Then different parameter including AST, ALP, AST, Creatinine, Bilirubin, Urea, HBA1c estimated. Then the main parameter of the research (Arsenic) was evaluated. All the parameters including glucose level was higher in diabetic patients. These results were compared statistically between normal and diabetic groups. The standard value of arsenic level in human body is 10-12ng/ml. In the conducted research work average of arsenic level in control group was 6.82ng/ml but in diabetic group it was 56.6ng/ml. By comparing values of these two groups statistically, it has been observed that the arsenic levels in diabetic group are far higher than the control group and the value of diabetic group is exceeding than the standard value. So, arsenic level was higher in diabetic persons and working as diabetic agent. There should be no residence near rice paddies or any arsenic rich area. Promote the usage of PPE "personal protective equipment" in order to avoid arsenic exposure.

Keywords: Arscenic, Type 2 Diabetes, Environmental Factors

IMPACT OF ENVIRONMENTAL RISK FACTORS ON THE CARDIOVASCULAR DISEASES

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ABSTRACT: Environmental exposures has very crucial role in cardiovascular diseases. Risk factors for cardiovascular diseases are additive and can be dichotomized into two classes "modifiable" and "non modifiable". Modifiable risk factors for cardiovascular diseases may include smoking, lack of exercise, diet, obesity, high blood pressure, high cholesterol levels, unhealthy diet, diabetes whereas age, gender, family history may be included in non-modifiable risk factors. The present study is based on the impacts of environmental risk factors on cardiovascular diseases like changes in nutritional and lifestyle choices, exposure to toxins and tobacco smoke and chemicals. A data of 88 patients was collected which suggested that in Pakistan, most of the patients do not have proper lab investigations which may affect their disease management. Patients demography, lifestyle, hypertension, diabetes and smoking were the studied parameters. Only 28.4% of patients have lab data regarding blood cholesterol among which 22.7% having normal and 5.7% having high cholesterol values. Similarly, 39.8% of total patients have blood glucose data, among which 15.9% have normal, 14.8% have low and 9.1% have high blood glucose levels. Among 10.22% smokers only 2% complianed with medicines. Out of 73.9% patients who were using restricted food, 26.1% complained and among 65.9% patients who performed regular exercise, adherence was only 25 %. By addressing these factors and providing patients with proper knowledge, patient health outcomes can be enhanced.

Keywords: Environment, Risk Factors, Cardiovascular diseases, Environmental Awareness.

HUMAN EXPOSURE TO HEAVY METALS THROUGH ROAD-DUST IN VARYING TRAFFIC INTENSITY ROADS OF LAHORE

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ABSTRACT: Over the past few decades, Earth has become increasingly contaminated through airborne particles. Human exposure to such harmful particles has also dramatically risen. Dust particles are one of these airborne substances. If these particles are inhaled by humans, these can pose damaging effects on their health. There is a lack of information regarding heavy metals in road dust of Pakistan and their relationship with environmental factors. Thus, a study was crucial to determine the concentration of common heavy metals Cd, Cu, Ni, Pb and Zn in the road dust of Lahore. The basic aims of the article were to calculate the heavy metal concentration in roadside dust and to assess the influence of urban traffic on the heavy metal content in road dust. For this purpose, three roads of varying traffic were selected including Defence Road (Low Traffic), Wahdat Road (Medium Traffic), and Ferozepur Road (High Traffic). Systematic sampling was performed to collect dust from the three mentioned roads early in the morning. Zipped polythene bags were used to store the samples and labeled them. Samples were brought to the laboratory for further analysis by FAAS (flame atomic absorption spectroscopy). The results showed that, except for Ni (135 mg/kg) and Pb (98 mg/kg), the concentration of metals Cd (0.63 mg/kg), Cu (49.3 mg/kg), and Zn (52.6 mg/kg) were not higher in the mentioned three roads than the recommended values. The highest concentration was found on Ferozpur Road followed by Wahdat Road, with the least concentration on Defence Road. This indicates the level of concentration is directly proportional to the level of traffic. Exposure assessment was done according to the different ways of exposure to human namely inhalation, ingestion, and contact. The values of Hazard Quotient (HQ) were safe for adults, that is the elements do not pose ill health effects to adults. However, Pb has a higher HQ value (greater than 0.1) that is unsafe for toddlers. With the increasing population and number of vehicles, the number of heavy metals in the road-dust also tends to increase. There is a need to shift towards gaseous and more environmental friendly fuels from liquid fuels. Green areas and use of public transport can also help in minimizing the concentration of heavy metals. Regular monitoring of heavy metals in road-dust is recommended, along with air sampling to detect seasonal variations.

Keywords: Road Dust, Exposure Risk, Human Health, Heavy Metals, Traffic Intensity

ASSESSMENT OF HEAVY METAL CONTENTS IN DIFFERENT SAMPLES OF OIL AND WATER BASED PAINTS

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ABSTRACT: Most harmful health impacts of anthropogenic activities at small-scale sectors may not be immediately evident, but they appear much later in the lives of exposed population. Despite the availability of replacements for lead, chromium and cadmium compounds in paints manufacturing companies continue to develop paints with elevated concentrations of these metals. As the population continues to develop and there is continuous change from oil-based to water based paints, the sales and use of the product will improve human and environmental exposure to these metals.

For this study, a total of 25 samples were taken from Lahore city: ten water based paints, ten oil based paints (enamel), and five decorative paints were analyzed for the concentration of lead (Pb), chromium (Cr), and cadmium (Cd). Paint samples from various companies, registered with and without standards were collected. Samples were digested with acid using a hotplate and heavy metal concentrations were identified by using Atomic Absorption Spectroscopy (AAS).

Highest lead concentration (53.3 mg/l) was observed for sample 2 (furniture paint). Highest level of lead (0.184 mg/l) was analyzed for sample 4 (oil paint), and highest chromium level (15.29 mg/l) was observed for sample 7 (furniture paint). The data was subjected to statistical analysis through IBM SPSS Statistics 20.0.

These detected heavy metals are among priority metals of the European Union (EU) owing to enhanced danger of occupational exposure to animals and vulnerable groups such as children, women, people with suppressed immune system, and aged individuals. Therefore, it is necessary to determine the concentration of heavy metals in the paints and replace them with safer alternatives. Results of this and other similar study can be used by environmental protection agencies to regulate the sale and distribution of paints with high heavy metal content.

Keywords: Decorative paints, Heavy Metals, Oil paints, Heavy Metal Toxicity, Water Paints

APPORTIONING OF SELECTED HEAVY METALS IN ENVIRONMENTAL STRATA OF AJK, PAKISTAN

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ABSTRACT: Current study focused on some selected heavy metals in ground water, stream water, soil, human nails and hair samples collected from selected sites of the state of Azad Jammu and Kashmir (AJK). Special dispersal patterns of heavy metals elements exposed not only the possible impacts of density of human population and topographies of the soil and associated events contribute to ecological pollution through the heavy metals in AJK. The concentration of heavy metals detected in all the soil samples found below than standard guidelines set by European Union (EU) for soil. In the samples of ground water, stream water, higher concentration of heavy metals recorded than the standards guidelines suggested by World Health Organization (WHO). In human nails and hair samples the concentration of heavy metals also calculated above the safe guidelines advised by, England, Italy and Japan. The water and human being are receiving metal contamination due to several factors in the study area most remarkable are the human activities for agriculture, domestic/industrial discharge of waste water into the river without any treatment and road developments projects. Heavy metals through river water can make a big risk to human health and aquatic life by the process of bioaccumulation and bio-magnification.

Keywords: AJK, Heavy Metals, Environment, Toxicity

HEALTH AND ENVIRONMENTAL RISKS AWARENESS OF ARTIFICIAL SWEETENERS IN SELECTED POPULATION

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ABSTRACT: This study focuses on the identification of five persistent sweeteners namely; acesulfame (ACE), sucralose (SUC), saccharin (SAC), and cyclamate (CYC) while emphasizing on the health and environmental risks awareness being caused by the overconsumption of artificial sweeteners among the general public in Lahore (Pakistan).

A general survey was conducted among selected population in Five Tehsil of Lahore. A total of 67% of the sampled population uses artificial sweeteners for diabetes management. The Diabetes Prevalence Survey of Pakistan has divulged pervasiveness of diabetes as 16.98 percent which makes 35.3 million people among the adult population. Moreover, Pakistan has 2.8% share in the sugar consumption worldwide with 28.5Kg per capita consumption rate.

The response gathered by the selected sampled population was analyzed against four demographic factors including age, gender, background and education. One way ANOVA analysis was performed using SPSS 21.0 against all four demographic factors. The results showed wide variation in responses with respect to age and education having significant values less than 0.05.

This study clearly highlights lack of awareness regarding the health and environmental impacts associated with the overconsumption of artificial sweeteners. The loopholes in proper legislative framework, weak enforcement of environmental regulations and insufficient information of natural alternatives to the sweeteners are the major problems identified.

Therefore, it can be concluded that awareness campaigns about the impact of artificial sweeteners and their natural alternatives will not only reduce health impacts but will cut down environmental concerns associated with the sweetener industry.

Keywords: Overconsumption, Diabetes, AGE, Gender Variation

CASE STUDY OF AIR QUALITY OVER NORTHEASTERN PAKISTAN DURING WINTER SEASON OF 2014 TO 2019

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ABSTRACT: Air pollution during winters over northeastern (NE) Pakistan (71–74.5°E, 28–34°N) is a serious challenge that effects human health, climate and daily life. We use the Modern-Era Retrospective analysis for Research and Applications, V. 2 (MERRA-2) and satellite observations to quantify the last decade trend and interannual variation of aerosol during winter time over NE Pakistan. Aerosols (sulfate, black carbon (BC), and organic carbon (OC)) are retrieved from MERRA-2 during 2014 to 2019. This study provided a unique opportunity to reveal temporal and spatial air pollution levels in mega cities in NE Pakistan. This study analysed the air pollution characteristics during winter, 2014 to 2019 in four mega cities including national and provincial capital cities in NE Pakistan. Average over November from 2014 to 2019, over NE Pakistan, AOD values were in the range of 0.5-0.8. Aerosol concentrations during wintertime over NE Pakistan showed increasing trend during 2014 to 2017 and decreasing trend 2018 and 2019. Our results have dominant intimation for the effectiveness of air quality control approach in Pakistan

Keywords: Aerosols, Urban Air Pollution, Winter

A REVIEW ON CURRENT KNOWLEDGE AND FUTURE PROSPECTS OF SHORT CHAIN CHLORINATED PARAFFINS IN THE ENVIRONMENT: A NEGLECTED AREA OF RESEARCH IN SOUTH ASIA

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ABSTRACT: Short Chained Chlorinated paraffins (SCCPs) are a one of the emerging group of persistent organic pollutant (POPs) which are widely used as plasticizers, coolants, lubricants and flame retardants. The production and use of SCCPs along with other CPs has quadrupled after the ban on Polychlorinated biphenyls (PCBs) because they are the suitable alternatives. It is estimated that the worldwide production of SCCPs is more than165,000 tons/year with China and Europe being the major producers. Because of their omnipresence and adverse health effects on human and environment, the production, usage and release of SCCPs has been targeted for elimination globally through international treaties such as Stockholm convention. Among analytical techniques the main sources of errors are sample preparation and pretreatment which can be minimized by using proper blanks and analytical grade solvents. While soxhlet extraction is the most widely used technique, accelerated solvent extraction and ultrasound assisted extraction are considered more green instruments. The identification and quantification instrument for SCCPs yet known is gas chromatography electron capture negative ionization mode of mass spectrometer. This review article summarizes global comparison of studies which reflects that reasonable number of studies have been conducted in China, Japan, Korea, Europe, USA and Canada but very few studies has been reported from South Asian region. This comparison depicted that large amount of SCCPs is present in China's environment since it is the largest manufacturer and consumer. Various degradation techniques using UV, catalysts and bioremediation have been proposed to alleviate the residence time of SCCPs in environment. These solutions are recommended to avoid negative consequences such as bioaccumulation and biomagnification of SCCPs in species. Moreover, the toxicity of SCCPs has been linked to lethal concentration, liver toxicity, developmental toxicity, cancer, metabolism disrupting effects along with hormonal imbalance, and the impairment of immune system. Therefore, this critical review urges the need of intensive research on status, distribution and fate of SCCPs in South Asian countries like Pakistan, India, and Bangladesh where, the plastic industry is blooming day by day without knowing the harmful effects on health they are posing to public.

Keywords: POPS, Distribution, Toxicity, Detection, Regulation

GLOBAL LAKES AND WETLANDS UNDER THE CHANGING SCENARIO OF EL-NIÑO SOUTHERN OSCILLATIONS AND ANTHROPOGENIC DRIVERS

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ABSTRACT: Wetlands are complex and diverse ecosystems substantially contributing to natural capital. These ecosystems play a critical role in hydrological regime of biogeochemical cycles and provides habitat to biodiversity. Wetlands provide strong linkage to the carbon cycle by acting both as carbon source and sink. All ecosystems are vulnerable to unprecedented changes observed due to natural phenomenon like climate and climate oscillations and human driven changes like drainage and conversion of land. Projected variations in natural and anthropogenic scenarios are likely to alter wetland dynamics by substantially impacting the hydrological conditions conversely modifying ecosystem functioning. This study focuses on monitoring the probable impacts of land use change and El-Niño Southern Oscillations (ENSO) variations on wetlands dynamics by analysing the magnitude and extent of global wetland inundation trends during the study period. The fractional surface inundation, a product of microwave dataset is used to study the trend and inter-annual variability of surface water extent in global lakes, rivers, reservoirs and wetland classes. Between 1995 to 2015, the average rate of increase observed in global waterbodies and wetlands demonstrate 5608.5 km2 per year increment in surface inundation. However, 3 periods of significant inter-annual variability have been observed during 21 years; where the maximum contribution of 2.37 million km2 inundation has been recorded during the strong El-Nino year of 2010. Swamps flooded forests and coastal wetlands has shown the most significant increasing inundation trends providing a connection to thermal expansion and glaciers and ice sheets melting fitted to climatic warming. Our study results showed a positive lag correlation between Nino 3.4 and surface inundation. Moreover, lakes, rivers, reservoirs and wetlands have revealed varying responses to different anthropogenic drivers like cropland, natural vegetation and urban land. Most significant correlation have been presented between different wetlands and natural vegetation, shrub/grasslands, urban land and barren land. Through this study the extent of impact projected by climatic oscillations and anthropogenic drivers to water bodies and wetlands can be analysed for well-informed conflict management and decision-making practice for minimizing the human driven impact on natural water systems.

Keywords: surface inundation, wetland dynamics, land use land cover changes, remote sensing, ENSO.

TREATMENT TECHNOLOGIES: TT-01

CURRENT PRACTICES OF HOSPITAL HAZARDOUS WASTE MANAGEMENT AT RAWALPINDI AND ISLAMABAD

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ABSTRACT: Overlooking the dilemma of waste management is only exacerbating the Environmental threats and proper management of hazardous waste is rather more complicated in many resource constrained countries of the world. Hospital waste can be categorized as hazardous waste and prior its final disposal it requires proper treatment to reduce its detrimental impacts. Hospital waste consists of material such as syringes, sharp objects, bandages, intravenous drip bottles, blood bags and biomedical waste such as; organs and medical instruments. Current waste management practices in Rawalpindi/ Islamabad can be outlined as: 50% hospitals disposed off their hazardous waste by burning in incinerators, 50% of the waste is disposed off by dumping in municipal landfills and open burning. National Cleaner Production Center (NCPC) is acting as a unique entity that is providing incineration services to 230 healthcare facilities that include hospitals, clinics and labs in the vicinity of Islamabad, Rawalpindi and Chakwal exclusively. There are two incinerators with three chambers, each having incineration capacity of 150 kg/hour, the temperature range of the incinerators is 800˚C – 1,250˚C that ensures the complete combustion to mitigate all the potential toxins. To device any combating strategy, there is a need of proper data describing: methods used for waste management and factors hindering the disposal process. NCPC conducted the services based research to deduce the willingness of healthcare facilities to dispose off the waste in a proper manner, current practices of hazardous waste management of hospitals and the amount of hospital waste generated per month. Basically, the study depicted the regional data regarding the amount of hazardous waste being incinerated by NCPC and the fate of remaining hazardous waste of hospitals. According to recent study current situation of hospital waste management is disastrous and there are numerous health hazards associated with it, therefore incineration services is being provided to healthcare facilities in twin cities. The organization is acting as safeguard against the hazardous waste generated by infirmaries. Hence, this pioneering study would be providing all the data necessary for the proper optimization of incineration and how the organization improved the services over time. Although there are Hospital Waste Management rules, 2005 in accordance with Environmental Protection Act, 1997 which clearly states that every hospital shall be responsible for the proper management of the waste generated by it till its final disposal, yet implementation process is disregarded. NCPC reckoned that the issue prevails due to lack of awareness regarding sustainability, lack of green waste disposal facilities and the unwillingness of the healthcare facilities to spend funds on the proper waste disposal methods.

Eventually if the life threatening hospital waste is not managed properly, the Environmental impact could be catastrophic and if no quick action is taken it could result to various health disasters.

Keywords:

TREATMENT TECHNOLOGIES: TT-02

TYPE VII REFUSE DERIVED FUEL PRODUCTION FROM MUNICIPAL SOLID WASTE OF LAHORE , PAKISTAN

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ABSTRACT: Nowadays, there is an increase in energy demand and consequently depletion of natural resources. To fill this gap there is a need to explore alternative energy sources. Municipal Solid waste (MSW) can reduce emissions of greenhouse gases, displace the fossil fuels profitably and provide reliable, renewable, sustainable and promising energy source. It can also minimize the immense amount of municipal solid waste in a way that is environmental-friendly. The current study was carried out to evaluate Refused Derived Fuel (RDF) potential of MSW through gasifiaction process (Type VII-RDF). The sampling was carried out at RDF production facility, near Lakhodair Landfill site, located in the suburbs of Lahore, Pakistan. Paper and carboards, textiles, PET bottles, shopping bags, other combustibles and other plastics were segregated and subsequent analysis were carried out according to the American Society of Testing and Materials (ASTM) standards. Proximate analysis (i.e. moisture content (ASTM D 3173-11), volatile mater (ASTM D 3175-11), ash content (ASTM D 3174-12) and fixed carbon) and ultimate analysis were used for analystical purpose. The results portrayed higher volatile comustible matter in other plastics, i.e. 93.65 %. Paper and cardboards indicated the highest ash content of 7.42 %. The highest fixed carbon of 21.77 % was estimated in paper and cardboards. The feasible net energy content was shown by other combustibles, i.e. 59.05 MJ/kg. Heavy metal analysis specified that all waste components had compatible values of Cr, Cd, Pb, Ni and Cu with standards given by the *European use for responsible incineration and treatment of special waste.* Thus, MSW of Lahore, Pakistan depicts reasonable potential to be used as Type VII-RDF (Gasification). Furthermore, the flue gas analysis illustrates that MSW has substantial potential of producing RDF because waste samples emitted insignificant amount of flue gases, i.e. CO_2, NO and SO_2. Concluding, the use of MSW as an alternative fuel could be best option as it has no negative impact on the environment.

Keywords: Municipal Solid Waste, Refuse Derived Fuel, Gasification, Proximate Analysis, Net Calorific Value

TREATMENT TECHNOLOGIES: TT-03

ASSESSMENT OF ARSENIC CONTAMINATION IN DRINKING AND WASTEWATER SAMPLES OF DISTRICT KOHAT, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT: Arsenic (As) is one of the most toxic contaminants found in the environment. The present study was aimed at assessing water quality by determining the presence of As in both drinking and waste water samples collected from various sites of District Kohat, Pakistan. Thirty two groundwater samples were collected from groundwater sources including bore well, tube well and surface water that included canal water and Chennai. General physicochemical characteristics such as pH, Electrical conductance (EC) and Total Dissolved solids (TDS) of water samples were studied while Arsenic concentration was determined by the Kit method. Results revealed that the concentration of as ranged from 0 to above 50µg/L in different sources of drinking and wastewater. The highest concentration was recorded in Nehar Tube well (50-100µg/L). The As concentration was above WHO permissible limit (10µg/L) in Baina (25-50µg/L), Belitung tube well (TW) (50µg/L)), Nehar (25-100µg/L) and Chennai (50µg/L) in drinking water. The Arsenic Daily Intake (ADI) was found within a safe limit in University, Cement factory, Hangu and Belitung bore well (BW) while Nehar, Bellitang (TW) and Baina showed higher ADI values than rest of the studied area. The higher ADI values may cause health problems in the future in local people consuming As contaminated water. The area seems to be at risk due to As pollution, therefore, necessary remediation measures need to be taken to avoid health-related problems in the targeted areas of Kohat district.

Keywords: Arsenic, Wastewater, Drinking Water, Physicochemical Properties, Contamination

TREATMENT TECHNOLOGIES: TT-04

PIONEER ASSESSMENT REPORT OF PER-AND POLYFLUOROALKYL SUBSTANCES (PFASS) FROM TEXTILE WASTEWATER IN THE VICINITY OF LAHORE DISTRICT, PAKISTAN

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ABSTRACT: Per-and Polyfluoroalkyl Substances (PFASs) have been commercialized since 1950s and used in numerous applications related to textile, chrome plating, packaging, paper and firefighting industry. Particularly, companies are using these PFASs as surface active agent in their products (outdoor apparel) to achieve repellency against oil, stains and water. Textile Finishing Agents (TFAs) are copolymers having side-chain fluorpolymers (e.g methyl acrylate or perfluoralkyl acrylate). A survey was conducted from textile sector in Pakistan and TFAs were reported to be used in several compartments of industries to impart repellent properties. Once these have been employed then in aqueous phase there could be presence of unbound impurities and residues such as perfluoroalkyl carboxylates (PFCAs) and fluortelomer alcohols (FTOHs) that are eventually discharged into drains, which led towards several impacts on human health and environment. Recent published literature gave indication that these PFASs are still widely applied on fabric and detected concentration was typically in the range of several µg/m^2. Pakistan having biggest contribution in textile treatment not even a single report is available. In the present study several wastewater samples (*n=12*) were collected from the vicinity of textile industries in Lahore, Pakistan. All the samples from seven industries were tested for 20 different PFASs at Tsinghua University, Beijing, China. The detected concentration of PFASs was between 81-236 ng/ml. The short chains particularly perfluorobutanoic acid (PFBA; 56 ng/ml) were predominant. The mean detected concentration of PFOA was within limits. However the detected level of PFOS was 38 ng/L (> recommended USEPA limits). The detected profile of these long chains cannot be ignored. The present data showed that another emerging contaminant is getting prevalent in the environment. Its treatment techniques are expensive and its occurrence in the environment can cause carcinogenic risk and may inadvertently affect the human health.

Keywords: wastewater, Textile, Poly Fluoroalkyl, Finishing

TREATMENT TECHNOLOGIES: TT-05

EFFECT OF HRT ON COD REMOVAL FROM TANNERY WASTEWATER

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ABSTRACT: Leather tanning industry is one of the water intensive industry and result is release of contaminated wastewater. Membrane bioreactor is one of the emerging wastewater treatment technology. In this study Synthetic wastewater with composition like that of tannery wastewater in terms of COD and chromium content was used. The chromium was precipitated by chemical treatment with magnesium hydroxide and then subjected to treatment in a custom designed laboratory scale membrane bioreactor (MBR). The reactor was operated in batch mode at Hydraulic retention time (HRT) of 4, 6 and 8 hours. The results showed that the COD decreased at all HRTs. The COD decreased by 74, 85 and 93 percent at HRT of 4, 6 and 8 hours respectively. This shows that at increased HRT the COD reduction was also increased, which is consistent with the fact that the microorganisms in activated sludge have more time to decompose the contaminants. Although increased HRT is desirable for increased COD removal, but a balance between HRT and COD reduction is often maintained for the efficiency of treatment plant in terms of energy consumption. In our case HRT of 8 hours was found to be enough to meet environmental standards in terms of COD and turbidity.

Keywords: Tannery, Membrane Bioreactor (MBR), Chemical oxygen Demand (COD), Hydraulic Retention Time (HRT)

TREATMENT TECHNOLOGIES: TT-06

A STUDY BASED ON SPATIAL WATER ANALYSIS OF URBAN RIVER RAVI USING COST EFFECTIVE TECHNIQUE

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ABSTRACT: Urban environment is dealing with the water emergency due to irregular and insufficient pattern of rainfall which is one of the precarious causes of climate change. Alarming situation of low availability of fresh water is unable to quench the thirst of urban dwellers globally. On the other hand, the extensive biotic pressures are lifting up the effluents load into available water resources including urban River Ravi. During 21st century, when the developing countries are facing environmental challenges including Pakistan, there is an enormous need to adopt low cost techniques to monitor rivers health to analyze ground water reality in environmental and commercial context using spatial lens. The present research was carried out to assess the current scenario of River Ravi's water quality. For this purpose, spatial techniques sentinel 2A and 2B were employed which is one of the most efficient and effective tools for policy makers to communicate information for decision making as compared to other traditional time consuming techniques. Four environmental indices were included to focus and evaluate the water quality such as Normalized Difference Water Index (NDWI), Normalized Difference Turbidity Index (NDTI), Normalized Difference Chlorophyll Index (NDCI) and Water Surface Temperature. Results from spatial scenario exhibited the onerous environmental effects of River Ravi's water pollution and concluded with the recommendation to deal with this daunting problem.

Keywords: Biotic Pressure, Climate Change, GIS, River Ravi

TREATMENT TECHNOLOGIES: TT-07

HEAVY METAL CONTAMINATION IN WASTEWATER BODIES OF THE TWIN CITIES

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ABSTRACT: Heavy metal pollution in waters has been an issue of concern for a very long time now. The unchecked release of untreated waste from various point sources into surface and freshwater bodies has been a major contributor towards heavy metal contamination. Such water when reused for various purposes, especially irrigation, can contaminate the soil with heavy metal causing serious effects, and thus can become a health hazard for living beings, including humans. Another way, this heavy metal pollution is adding to the environmental problems. More importantly, addition of heavy metals is helping or contributing towards antibiotic resistance through co-resistance. Thus, the study is designed to evaluate heavy metal contamination prevalence in the area. Wastewater samples from various non-point sources are collected and tested for various physicochemical parameters using the APHA protocol for the various parameters, and heavy metal concentrations using atomic absorption spectrophotometer. Bacterial isolates from the samples are tested for resistance against various heavy metal and antibiotics using disk diffusion and well diffusion techniques, to help establish a relationship for co-resistance between the two resistances. The details of the results will be presented in the conference presentation.

Keywords: Heavy Metals, Wastewater, Physicochemical Properties, Resistance

TREATMENT TECHNOLOGIES: TT-08

EVALUATION OF ELECTROCOAGULATION AND CHEMICAL COAGULATION TREATMENTS FOR DYE REMOVAL IN TEXTILE INDUSTRIAL EFFLUENT

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ABSTRACT: The present research aims to study the removal of dye used in industrial textile dyeing processes. For this purpose, combined process comprising chemical coagulation and electrocoagulation techniques were used. In this research work both processes are integrated in a batch reactor to increase the efficiency of wastewater color removal from dyeing effluent compared with the treatments alone. After chemical coagulation ($MgCl_2$) was applied 40% color removal, 50% turbidity removal and 20% COD reduction was observed. With the electrocoagulation treatment a 62%, 51% and 50 % of color removal, turbidity removal and COD reduction were achieved, respectively. However; using the combined process, more than 80 % color removal, 60% turbidity removal and above 60% COD reduction could be attained. The synergistic associated to coupling both processes yielded increased removal of color, COD and turbidity efficiencies as compared with the results obtained with the single treatments. The decolorisation/colour and turbidity removal of dye were found to follow first order kinetics.

Keywords: Effluent, Electrocoagulation, Reactive Dyes, Color Removal.

TREATMENT TECHNOLOGIES: TT-09

CONCERNS, PRACTICES AND WILLINGNESS TO PAY FOR MUNICIPAL SOLID WASTE MANAGEMENT OF HOUSEHOLDS NEAR OPEN WASTE DUMPSITES OF LAHORE

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ABSTRACT: Immense increase in the population and generation of tons of solid waste every day is one of the highlighting issue of the time. Despite the presence of proper sites the uncontrolled and mismanaged waste is causing the garbage to be lying uncollected in the streets even in the residencies closed to dumpsites. This paper reveals the existing concerns of people related to open dumps, highlights the current disposal practices of the community inhabitants and their efforts to manage the waste with the authorities. The study employed the mix approach based on both in depth interviews and questionnaire surveys. A total of 150 respondents were questioned against the socioeconomic status, disposal practices and diseases originating from the mismanagement of solid waste. The regression model indicated the irregular dumping (0.85) as indicator for poor sanitary conditions of the area followed by the unattended bins (0.99) in the targeted area. Results showed the presence of diarrhea, stomach disorder, respiratory, skin allergy and hepatitis to be dominated in the area. Keeping in mind the aforementioned situation people are willing to pay for the management of waste in their area despite low economic status. Hence, Proper education, awareness, allotment of designated bins, proper monitoring of water and air quality and respective alternatives and establishment of dumpsites away from the residential areas could help prevent the public to be exposed to municipal diseases.

Keywords: Solid Waste, Open Dumping, Mehmood booti, Landfill, Disposal practice, Disease

TREATMENT TECHNOLOGIES: TT-10

ACIDIFIED COW DUNG-ASSISTED PHYTOEXTRACTION OF HEAVY METALS BY RYE GRASS FROM CONTAMINATED SOIL AS AN ECO-EFFICIENT TECHNIQUE

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ABSTRACT: Heavy metal contamination of soil is an alarming environmental dilemma all over the world. With increasing industrialization, it is the need of time to develop low-cost and eco-friendly remedial techniques for heavy metal contaminated soil. Phytoremediation is an emerging technique to remove heavy metals from contaminated soil for environmental sustainability. In the present study, rye grass was used for phytoextraction of lead and cadmium form contaminated soil. To enhance the bioavailability of heavy metals, cow dung was acidified by amending with elemental sulfur and molasses and also bioaugmented with SS-16 sulfur oxidizing strain to boost biological sulfur oxidation and four different acidified organic products (P1, P2, P3 and P4) were prepared with different pH. Pot experiment was conducted for a period of 60 days under Pb and Cd spiked soil for rye grass with the application of 10% slurry of each acidified organic product. Significant increase in root and shoot fresh mass as well as Pb and Cd accumulation in root and shoot of rye grass was recorded as compared to control and acidified organic product P4 was most effective as compared to other products. Bioconcentration and translocation factors of rye grass for Pb and Cd were also calculated. Acidified cow dung slurry (10%) also improved the antioxidative defense mechanism of rye grass. The results suggest that acidified organic products could be effective for phytoextraction of lead and cadmium form contaminated soil.

Keywords: Eco-efficient technique, Environmental sustainability, Acidified cow dung, Phytoextraction, Bioconcentration and translocation factors, Antioxidative defense mechanism

TREATMENT TECHNOLOGIES: TT-11

A STUDY ON KNOWLEDGE ATTITUDES AND PRACTICES ON SOLID WASTE MANAGEMENT IN UNIVERSITY STUDENTS

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ABSTRACT: Solid waste management is a serious issue in developing countries. It is an activity which is greatly affected by the behavior, awareness level and activities of general public. Developing countries are faced by the major challenge of sound waste management, especially at institutional level. In order to evaluate these variables in academic settings, a cross-sectional study was conducted on a study sample of 100 university students of undergraduate and graduate level, to determine their knowledge, attitude, and practices with respect to solid waste management. This objective was achieved by using a questionnaire based survey to evaluate the level of understanding, attitude score, and level of practices. Majority of the students showed a reasonable level of knowledge (70.25%), and attitude (66.3%) with respect to solid waste handling and management. However, lesser ratio of students demonstrated an average solid waste management practice level (59.7%). The study results also indicated that participants enrolled in higher degree program demonstrated an overall higher level of understanding (90%). On a whole, this study revealed that higher level of education, students' trainings and awareness session in university settings had a positive impact on over all knowledge, attitude and practices of solid waste management. This study recommends that academic institutions need to incorporate student education and training regarding solid waste management, not only at university level, but at primary and secondary school levels as well.

Keywords: Attitude, Awareness, Education, Knowledge, Practices, Student Values, Waste Handling

TREATMENT TECHNOLOGIES: TT-12

BIOGAS PRODUCTION FROM MUNICIPAL SOLID WASTE AND AGRICULTURAL RESIDUE USING DRY ANAEROBIC DIGESTION TECHNIQUE

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ABSTRACT: Biogas production from dry anaerobic digestion is potentially a cost-effective treatment of organic waste materials. Pollution problems and different types of diseases associated with current waste disposal systems can be handled through this technique effectively specially in developing countries. Different organic waste products can be utilized as co-substrates in co-digestion of biogas plant for the production and enhancement of biogas quantity. This study was carried out to assess the biogas production potential of various waste mixtures of wheat straw, rice straw, food waste and animal manure at higher dry matter contents in order to improve the efficiency of biogas production and a quality digestate which can be further processed for producing organic fertilizer. This research was carried out laboratory scale where 30 batch reactors were prepared in triplicates using glass bottles. These digesters were filled with different substrates (rice straw, wheat straw, food waste) based on pre-decide mixture ratios to assess the degradation and biogas production potential. Inoculum was collected from a biogas plant and was inserted in all these prepared batch digesters. These batch digesters were placed in oven at thermophilic temperature of 53^0C. Biogas was measured in all the digesters using syringe method over a period of 51 days and this data was used to calculate the ultimate biogas yield from all the various mixtures. The ultimate biogas yield in terms of VS was higher in low dry mass substrates as compared to high dry mass substrates. The biogas yield of low dry mass wheat straws was (84.5 L/kg VS) and high dry mass was (62.0 L/kg VS). While the biogas yield of low dry mass of rice straws was (124.0 L/kg VS) and high dry mass was (52.9 L/kg VS). The ultimate biogas production from low dry mass food waste was (78.2L/kg VS) and high dry mass was (45.0 L/kg VS). Same was the case with reactors where all substrates were mixed as the biogas yield was higher in low dry mass mixed waste (111.6 L/kg VS) and low yield was observed from high dry mass (86.7 L/kg VS). It was concluded that the higher dry matter (dry digestion) leads to reduction in the efficiency of biogas yield in terms of per kg of VS, however, the biogas yield in term of volume of produced biogas is higher from the higher dry matter mixtures which is beneficial for the economy of the biogas plants. Further research should be conducted on the optimization of biogas plants using dry digestion method so that efficient of the biogas production per kg of VS can be improved.

Keywords: Anaerobic digestion, Co-digestion, Co-substrate, Food waste, Rice straw, Wheat straw, Manure, Inoculum, Biogas

TREATMENT TECHNOLOGIES: TT-13

WASTE AMOUNT CHARACTERIZATION SURVEY OF MUNICIPAL SOLID WASTE GENERATED IN SAHIWAL PUNJAB, PAKISTAN

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ABSTRACT: In today's contemporary world, rampant urbanization, changes in living standards followed by other factors have made waste management a challenging task. In urban areas, per capita waste generation is being increased rapidly over time and its composition varies due to income levels, climatic conditions and social behavior. The present study was designed to analyze per capita waste generation, physical characteristics, household size and waste configuration of municipal solid waste created in the Sahiwal area during October 2018. Waste was collected from residential, commercial and from designated sites for eight consecutive days. All the data was recorded and analyzed through Microsoft Excel at regular interval. For all type of testing, ASTM standard method was used. The average household size from all income levels was about 6.0 whereas average per capita waste production was about 0.36 kg/capita/day that encompassed 0.44kg/c/d high-income area, 0.36 and 0.35kg/c/day of middle and low-income areas and 0.27kg/c/day for rural area. The accumulative specific gravity of al waste streams was about 204.15 kg/m^3. Moreover, waste that was collected in 16 different categories converted in to four major categories that revealed 60% organic and compostable, only 9% recyclable that might reduce to over 70% during secondary collection, 15% refuse derived fuel (RDF) and 16% earth fill material respectively. The waste amount characterization survey (WACS) is mandatory tool to design waste management services from collection to disposal. Sahiwal Municipal committee intends to build material recovery facility (MRF) in order to reduce burden of the dumping sites and overall collection to disposal expanses.

Keywords: Municipal Solid Waste, RDF, Waste Streams

TREATMENT TECHNOLOGIES: TT-14

POTENTIAL OF *PISTIA STRATIOTES, EICHHORNIA CRASSIPES* AND ALGAE FOR REMOVING CO AND NI AT VARIOUS CONCENTRATIONS

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ABSTRACT: Phytoremediation is a new emerging discipline to de-contaminate polluted water. Remediation of pollutants by plants is environmental friendly and cost effective technique. Present study focuses on ability of *Pistia stratiotes, Eichhornia crassipes* and algae for removing nickel (Ni) and cobalt (Co) from aquatic system. Efficiencies of these macrophytes were checked against Ni and Co (2mg/l and 4mg/l concentration for each metal) on lab scale under natural conditions for a period of fifteen days. Samples were collected and analyzed at 0, 5, 10 and 15 days. One-way ANOVA was applied to compare significance level of these plants for removal of these metals. *P. stratiotes, E. crassipes* and algae removed 90.5%, 90.6% and 87.5% at 2mg/l Ni concentration, while 94.55%, 98.1% and 80.25% respectively at 4mg/l Ni from water. Similarly, *P. stratiotes, E. crassipes* and algae removed 95.5%, 98% and 80% Co metal at 2mg/l concentration, but 91.5%, 99% and 79.75% respectively at 4mg/l concentration of Co. Results indicate that *E. crassipes* is more efficient for removal of both the metals at $p>0.005$. There was no change in color and biomass of these macrophytes but biomass of algae increased in both treatments (2 and 4mg/l) for both metals during 15 days' period.

Keywords: Phytoremediation, Heavy Metals,

TREATMENT TECHNOLOGIES: TT-15

BIOGAS PRODUCTION–A REVIEW ON FEEDSTOCKS, BIOCHEMICAL PARAMETERS, PROCESS TECHNOLOGY, BIOGAS AND DIGESTATE UTILIZATION

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ABSTRACT: The global energy demand is high and much of the need is fulfilled from fossil fuel resources. Fossil fuel reserves are depleting at a very faster rate and their burning increase the concentration of greenhouse gases in the environment, severely impacting all the biospheres. Recent studies refer the anaerobic digestion of energy crops, residues and waste as alternative and efficient technology which not only decrease the greenhouse gas emissions but also provide biofuel by sustainable waste management. Anaerobic digestion is a complex process comprising mainly of four stages i.e. hydrolysis, acidogenesis, acetogenesis/dehydrogenation, and methanation. All these stages are closely interlinked to each other. Each stage has its own unique or specific micro-organisms but very little is known about these methanogenic consortia. For biogas production, various types of digesters are used which can be classified into wet and dry fermentation systems. Commonly used are wet digester systems utilizing vertical stirred tank digester based upon the origin of feedstocks. Temperature fluctuations may affect the digestion process negatively, so it is necessary to maintain the constant temperature during the whole digestion process. Mesophilic conditions (35-42 ^{0}C) are more favorable for the digestion compared to thermophilic conditions (45-60 ^{0}C). Methane formation takes place at a relatively narrow pH range from about 6.5 to 8.5 with an optimum interval between 7.0 and 8.0. Micro-nutrients are required in very low concentration i.e. 0.05 to 0.06 mg/l. Only iron is required in high concentration i.e. 1-10mg/l. Nutrient ratio of C: N: P: S = 600:15:5:1 is found to be sufficient. All types of biomass except wood or other strongly lignified organic substances can be used as substrate. Pretreatment methods like mechanical, thermal, chemical, or enzymatic processes are used for enhancing the degradation rate of the substrate. For increasing the biogas yield and avoiding the formation of floating layers, hydrolytic enzymes can be used. Biogas is composed of methane, water vapor and carbon dioxide. Trace amounts of hydrogen sulfide and ammonia is also present. Gas upgrading and utilization in vehicle fuel, power plants, or injection into the natural gas grid is of increasing interest because the gas can be used in a more efficient way. The spent slurry can be utilized as organic fertilizers for agricultural crops, promoting sustainable biomass production due to increased availability of nitrogen, better short term fertilization effect and removal of pathogens.

This paper reviews the current state and perspectives of biogas production, including the feedstocks, biochemical parameters, process technology, biogas and digestate utilization.
Keywords: Biogas Production, Mesophilic, Thermophilic, Vehicle Fuel

SUSTAINABLE AGRICULTURE: SA-01

PHYTOPARASITIC NEMATODES IN SUSTAINABLE AGRICULTURE

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ABSTRACT: Plant parasitic nematodes are tremendous threat to agriculture production. *Meloidogyne* spp. including *M. incognita* and *M javanica* is destructive pests of field, vegetable, and fruit crops. Majority of the phytoparasitic nematodes feed on roots, ecto-endo parasitically. The extent and nature of symptoms initiated and yield damage caused during root feeding depends on the nematode-crop combination. Nematode-root-feeding induce root galling by *Meloidogyne* spp. the obligate sedentary parasites of vascular tissues; root lesions by epidermal feeders, cortical deformation by cortical feeders. Nematode-damaged-roots exhibit reduced root system with fewer feeder roots ultimately reduced plant foliage vigor. Nematode-root-damage reduces plant ability to extract water and nutrients, the result being lack of vigor and yield loss. We observed ca. 22.4% yield losses from 19 commercially grown vegetable crops. Damage ranged from 2% for cabbage to 45% for squash, which was 35%, 80%, and 46% higher than that from developed countries, USA, and India, respectively. The main reason for more losses in Pakistan appears related to unawareness of growers about the presence of nematodes and damage they cause. Another reason might be non-availability of resistant crop cultivars and nematicides. Recommended measures against nematode diseases include use of clean nematode free planting material, resistant varieties, and crop rotations to suppress nematode infestation. Integrated nematode management can be promoted through farmers-nematologists interactions, local production of bio-control agents and strict chemical pesticide regulations. Farmer's/grower's awareness and skills are equally important in minimizing nematode infestation and yield losses, to sustain the agriculture production.

Keywords: Plant Parasitic Nematodes, Root Damage, Yield losses, sustainable agriculture production.

SUSTAINABLE AGRICULTURE: SA-02

PHYTO-TOXICITY ANALYSIS IN WHEAT DUE TO OF FOOTBALL INDUSTRY WASTEWATER IRRIGATION ON WHEAT CROP

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ABSTRACT: Due to rapid and haphazard industrialization, the water pollution is increasing at an alarming. In Pakistan all the wastewater channels ultimately enters into the surface river water. This wastewater is used for irrigation, drinking and domestic tasks. Wastewater contain number of conventional and emerging contaminants which includes phenolics, acids, salts, dyes, heavy metals, antibiotics, pharmaceuticals products, personal care products ets. These contaminants has bio-accumulative tendencies for long term. These contamination pose serious threats to human and ecological health. Due to water scarcity the farmers are using industrial wastewater to irrigate edible crops. This study is designed to investigate the phyto-toxicity of football industry wastewater on edible crops (wheat). In the green house experiment the wheat seedlings were irrigated with football industry wastewater. All the pots were arranged in randomized block design with 3 replicates. Wheat plants were analyzed for physio-chemical and biochemical parameters. Results were very prominent and all the treatments differ significantly ($p > 0.05$), football industry wastewater exerted negative impact on wheat height (-25%), number of green leaves (-75%), shoot length (-20%), root length (-50%), fresh weight (-60%), chlorophyll a (-40%), chlorophyll b (-50%) and total chlorophyll (-43%). This might be due to the reason that there are certain traces of the metals that not only inhibit the enzymes for proper functioning but also disintegrate the chlorophyll contents of the plants. It is concluded from this research that industrial wastewater should not be used for irrigation, especially for edible crops. Detailed investigation on contaminant movement in soil, their uptake, and bioaccumulation should also be investigate to estimate clearly the quantum of environmental damage and risk.

Keywords: eco-toxicology, phytotoxicity, soil pollution

SUSTAINABLE AGRICULTURE: SA-03

TOXICITY ASSESSMENT OF HEAVY METALS POLLUTION IN SOILS OF SOUTHERN DISTRICTS OF KHYBER PAKHTUNKHWA USING EARTHWORM

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ABSTRACT: Soils pollution with heavy metals has become a common problem across the globe due to various geologic and anthropogenic activities which negatively influence the whole area i.e. flora, fauna, air, superficial and underground waters. Various bioassays markers i.e. crab, snake, plant and earthworm have been used to assess the toxicity of heavy metals contamination in soil. The aim of the present study to investigate various parameters i.e. physiology, histology and biochemical responses of earthworm induced by HMs contamination in soil. Earthworms were exposed for 14 days to HMs contaminated soil collected from southern districts (Kohat, Karak, Bannu, Lakki Marwat) of Khyber Pakhtunkhwa, Pakistan. Significant changes were found in physiology (Survival rate, weight) of earthworms in contaminated soil of all districts. Significant histopathological alteration i.e. necrosis, deformation, fusion of villi, loss of structural integrity were found in earthworm body wall and gastrointestinal tract. The biochemical markers viz. catalase (CAT), superoxide dismutase (SOD), peroxidase (POD) and malondialdehyde (MDA) level were measured. Results revealed that CAT, SOD, POD, H_2O_2, MDA level were significantly stimulated in all contaminated sites. The results indicate that heavy metals may pose potential physio-biochemical and histological toxicity to earthworms, and this information is of great significance for the rapid, accurate, low cost, and scientific ecological risk monitoring of soil systems.

Keywords: Heavy Metals, Earthworm, Physiology, Histology, Biochemical

SUSTAINABLE AGRICULTURE: SA-04

PHYTOTOXIC AND GENOTOXIC RESPONSE OF MAIZE (*Zea mays)* GROWN IN HEAVY METALS CONTAMINATED SOIL

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ABSTRACT: Soil polluted with heavy metals like cadmium (Cd), chromium (Cr), zinc (Zn) and lead (Pb) is an important issue around the world that are non-essential for plant and animal growth and are toxic even at low concentrations. The present study was designed to investigate heavy metals induced phytotoxic and genotoxic changes in maize grown in polluted soil collected from district Kohat (KT), Karak (KK), Bunnu (BN) and Lakki Marwat (LM) Khyber Pakhtunkhwa, Pakistan. All the physiological parameters such as root shoot length, fresh weight, dry weight and photosynthetic pigment (chlorophyll a,b) were reduced except germination percentage which was not affected. Similarly antioxidant enzymes Catalase (CAT), Ascorbic peroxidase (APX), Peroxidase (POD) and Super oxide dismutase (SOD) were up regulated due to generation of reactive oxygen species such as hydrogen peroxide (H_2O_2). The oxidative stress marker such as Malonaldehyde (MDA) were also up regulated. In randomly polymorphic DNA (RAPD) profile, following heavy metals polluted soil, approximately fourteen 10-mer oligonucleotides were analyzed for PCR amplification in which eight primers produced specific, stable and unique banding pattern. Total 22 polymorphic bands were detected generating eight RAPD primers. The indicated results included normal bands losses, emergence of new bands and variation in bands size and number of bands when compared to control. The present study reveals that DNA stability in maize is affected by heavy metals contaminated soil that was identified by RAPD markers and reduced the physiological growth of maize and up regulated the antioxidant enzymes.

Keywords: Heavy Metals, Maize, Antioxidants Enzymes, ROS, DNA Damage

SUSTAINABLE AGRICULTURE: SA-05

IMPORTANCE OF COLD FALLOW SEASON MANAGEMENT TO ENHANCE SOIL ORGANIC CARBON STOCK IN TEMPERATE PADDY SOIL

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ABSTRACT: In Korean mono-rice paddy soils, rice straw removal after rice harvesting under conventional management practices (CMP) results into rapid depletion of the soil organic carbon (SOC) stock which could severely compromise the soil sustainability and productivity. The deterioration in soil quality and productivity might have devastating effects on food security amid of the growing world population. We investigated the seasonal C balances by the net ecosystem carbon budget (NECB) method during the rice cropping season and the cold fallow season under CMP (no fertilizer and straw removal for fallow season; chemical fertilization for rice cultivation) for 3 years. To increase the soil SOC stock, barley and hairy vetch cover crops were sowed at the seed recommendation rates (barley, 180 kg ha^{-1}; hairy vetch, 90 kg ha^{-1}) during the cold fallow season and its biomasses were incorporated before rice cultivation. Initially, the influence of cover cropping and its biomass incorporation on total carbon input followed by mineralized C losses and SOC stock was investigated. Finally, soil quality was assessed by characterizing the soil microbial community structure. The harvest removal and mineralized C loss under CMP covered around 67 and 33% of the total C output, however, almost 94% of the mineralized C loss occurred through CO_2 emission during the cold fallow season. Cover cropping, and its biomass incorporation increased the NECB, but it also has increased the mineralized C losses by 140-170%. SOC depletion during cold fallow season was because of low C input and high mineralized C loss. Cover cropping, and its biomass incorporation increased the soil C stock by approximately 180 and 360% for hairy vetch and barley, respectively. Furthermore, it also improved significantly the soil microbial activity, which is an early indicator of soil quality. Therefore, cover cropping and its biomass application during the cold fallow season could be very useful soil management for increasing the soil C stock in temperate mono-rice paddy soil.

Keywords: Rice, Conventional Management, Carbon balance, Soil quality, Crop Productivity

SUSTAINABLE AGRICULTURE: SA-06

AMELIORATIVE ROLE OF *ACINETOBACTER* SP. CS9 AGAINST LEAD STRESS IN *BRASSICA RAPA L*

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ABSTRACT: Lead (Pb) toxicity caused due to various anthropogenic activities impedes a negative impact on physiochemical processes in plants growing in contaminated area. During current study, Pb stress (0, 50, 100, 200 mg Pb kg^{-1} soil) alleviation potential of *Acinetobacter* sp. CS9 was evaluated in *Brassica rapa L.* seedlings. Lead stressed seedlings exhibited significant reduction in growth parameters, photosynthetic contents and gas exchange parameters. The Pb toxicity enhanced malondialdehyde (MDA), proline (Pro) and hydrogen peroxide (H_2O_2) levels in *B. rapa***.** On the other hand, *Acinetobacter* sp. CS9 improved growth attributes, chlorophyll contents and gas exchange parameters in inoculated *B. rapa* plants under Pb stress. The Pb stress mitigation in inoculated *B. rapa* seedlings was ascribed to reduction in MDA content, H_2O_2 besides increased activity of Pro along with intonation of antioxidative enzymes. Moreover, bio-inoculated *B. rapa* exhibited reduction in translocation factor and Pb uptake. The growth-enhancing attributes of *B. rapa* such as siderophore production, phosphate solubilization, indole acetic acid synthesis and 1-aminocyclopropane-1-carboxylate deaminase activity probably induced growth enhancement and Pb tolerance in stressed *B. rapa* seedlings. Current study advocates that *Acinetobacter* sp. CS9 is capable to alleviate Pb toxicity and promote growth of assisted *B. rapa* seedlings.

Keywords: *Acinetobacter*; *Brassica Rapa*; Lead, Toxicity

SUSTAINABLE AGRICULTURE: SA-07

BIOMARKERS- BASED VARIABLE RESPONSES OF ROOTS OF TRANSGENIC COTTON CULTIVARS AND THEIR HYBRID LINE UNDER CADMIUM STRESS

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ABSTRACT: Amongst the wider list of heavy metals, cadmium (Cd) is the most toxic metals causing a number of problems in animals and plants. In plants, browning, rigidity and twisting of roots, reduction of shoots and root elongation, rolling of leaves and chlorosis as well as ultra-morphological alterations have been reported. To combat with such stressed situation, antioxidative metabolism become active. The present greenhouse experiment was carried out to study the growth responses and antioxidants status in roots of two transgenic cotton cultivars (J208; Z905) and their hybrid line (ZD14) under $CdCl_2.2.5H_2O$-stressed levels i.e. 0, 10, 30, 50 µM. All cultivars showed negative effects of Cd as revealed by various parameters such as root and shoot length, fresh biomass of root, leaf and stem. Cd accumulation capacity was in the order of J208 > ZD14 > Z905. Melondialdehyde (MDA) contents were statistically significant at 10 and 50 μM Cd with respect to related controls in the parental cultivars and the hybrid cotton cultivars. For hydrogen peroxide (H_2O_2), similar tendency was observed in all the cultivars. Superoxide dismutase (SOD) activity mean data showed increase and overall decrease was recorded in catalase (CAT). Variable responses of ascorbate peroxidase (APX) could be noted. Parental and hybrid lines root tips ultra-structures were greatly affected by Cd different concentration level. Over all J208 ultra structure was most affected followed by Z905 and ZD14. These markers revealed that both parental lines (J208; Z905) and their hybrid cultivar (ZD14) variably responded to various concentrations of Cd.

Keywords: Heavy Metals, Biomerkers, Antioxidative Metabolism Cadmium Stress

SUSTAINABLE AGRICULTURE: SA-08

PREFERENCES AND TRENDS IN CONSUMPTION OF ORGANIC AGRICULTURAL PRODUCTS BASED ON SOCIO-ECONOMIC CLASSES

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ABSTRACT: Consumption of organic agricultural products has been increased globally since the last two decades as an aspect of health consciousness, culture, lifestyle as well as the environment. Nowadays individuals have become very particular about the products they are consuming, due to impacts of constantly changing climatic conditions, air pollution and excessive use of chemicals (pesticides and fertilizers) in food production. Thus, organic agricultural products are gaining impetus around the globe. These products are referred to as environmentally sustainable and safe for health. Therefore, this study aimed to explore the consumer level of awareness, knowledge, attitude, and behavior towards organic agricultural food products in Lahore, Pakistan. This study also explored the factors affecting the overall purchase intention of consumer. For this purpose, a self-administered questionnaire approach was used to collect data from a sample size of 280 individuals around the region. Analysis of data was accompanied by using various statistical tools like multivariate analysis using SPSS 21.0. Results obtained indicate that one of the major factors for the consumption of organic agricultural products was health consciousness due to the increasing rate of health disorders. Another factor that contributed to increased purchase was culture and lifestyle, especially among upper-middle and elite classes. However, perceived expensiveness and availability of these products found to play an important role as major barriers that affected the buying behavior of the consumer. It was further concluded that there is a need to create awareness of the role of green farming in environmental sustainability besides health concerns. Moreover, role of this research lies in providing strategies to cut down major obstructions faced by the consumer while purchasing organic goods.

Keywords: Organic Agricultural Products, Consumer Behavior, Environmental Sustainability, Health Concerns, Green Farming

SUSTAINABLE AGRICULTURE: SA-09

SEED PRIMING WITH TRIACONTANOL IMPROVES GROWTH OF *CORIANDRUM SATIVUM* THROUGH MODULATION OF PHOTOSYNTHETIC AND ANTIOXIDATIVE SYSTEM

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ABSTRACT: Triacontanol (TRIA) improves growth of plants subjected to various stresses. The current study was performed to evaluate the cadmium (Cd) stress alleviation potential of TRIA in *Coriandrum sativum.* Plants affected by Cd toxicity (2.5 Mm as $CdCl_2$) showed decreased root length, shoot length, besides lower level of photosynthetic pigments and soluble protein contents. Moreover, Cd stress reduced chlorophyll content (Chl, Chl*a* and Chl*b*), photosynthetic activity and net photosynthetic rate (Pn). Similarly, Cd toxicity increased electrolyte leakage (EL) in addition to biosynthesis of reactive oxygen species (ROS) and malondialdehyde (MDA) contents. Pre-sowing seed treatment (seeds priming) with TRIA (0, 5µm/L) for 15 hours reduced Cd toxicity causing oxidative stress and improved root and shoot growth in developed seedlings. Significantly reduced Cd concentrations were observed in root and shoot tissues of TRIA treated *C. sativum* plants. Nevertheless, TRIA augmented biosynthesis of soluble protein and photosynthetic contents. Furthermore, activity of stress responsive enzymes such as *Superoxide dismutase* (SOD) and catalase (CAT) was improved in TRIA treated plants. These results advocate that seed priming with TRIA improves plant tolerance and mitigates Cd toxicity by modulation of photosynthetic and enzymatic activity in *C. sativum* plants.

Keywords: Oxidative Stress, Photosynthetic, Toxicity, *C. sativum* plants

SUSTAINABLE AGRICULTURE: SA-10

GROWTH AND PRODUCTION POTENTIAL OF QUINOA (CHENOPODIUM QUINOA WILLD.) UNDER VARYING DOSES OF SOIL APPLIED UREA

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ABSTRACT: Quinoa (Chenopodium quinoa Willd.), a lesser-known food and feed crop is gaining acceptance in Pakistan. It is being cultivated to develop its production technology under local conditions. A balanced fertilization ensures the maximum economic return. Therefore, a field experiment was proposed to optimize the dose of nitrogenous fertilizer on the phenology and production potential of quinoa, at Agronomic Research Area, University of Agriculture, Faisalabad during November 2012. The experiment was laid out in Randomized Complete Block Design (RCBD) with split plot arrangement keeping three promising genotypes (HMB-3, HMB-4 and HMB-5) in main plot and four nitrogen levels (80, 100, 120, 140 $kgha^{-1}$) in subplot with three replications. Data regarding phenology, growth, yield and quality of quinoa was recorded and analyzed using fisher analysis technique and treatment means were compared at 5 % probability level of significance. Results revealed that all the growth and yield related traits such as leaf area, leaf area index, leaf area duration, crop growth rate, net assimilation rate, total dry matter, plant height, stem diameter, number of leaves per plant, number of branches per plant, number of panicles per plant, main panicle length, main panicle weight, sub panicles weight and thousand grain weight were maximum for genotype HMB-4 and minimum for genotype HMB5 among three genotypes. While in cease of nitrogen levels an increasing trend, in growth and yield components was recorded with in nitrogen levels from 80 to 140 kg N ha^{-1} except main panicle weight, sub panicles weight and thousand grain weight which were maximum at 100 kg N ha^{-1}. However interaction was non-significant except biological yield, economic yield and harvest index which were maximum for genotype HMB-4 at nitrogen level of 100 kg ha^{-1}. Nitrogen application also increased leaf chlorophyll content (40.124 mg g^{-1}Fresh wt.) and total phenolics (9.2976 mg g^{-1}fresh wt.) when soil was fertilized with 140 kg N ha^{-1} and 80 kg N ha^{-1} respectively. Soil invigoration with 100 kg N ha^{-1} was found best to attain maximum economic yield of quinoa.

Keywords: Growth, Yield and Yield Components, Quality, Quinoa, Urea

SUSTAINABLE AGRICULTURE: SA-11

MULTI NUTRIENT ENRICHED COMPOST USE FOSTERS SOIL PHOSPHORUS DYNAMICS; AN INITIAL ASSESSMENT OF SWITCHING TO INTERCROPPING FROM MONOCROPPING IN SEMI-ARID AGRICULTURE

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ABSTRACT: In semi-arid regions, soil phosphorus (P) dynamics need a better understanding under cereal-legume intercropping, particularly with integrated use of organic-inorganic fertilizers. To investigate the changes in various soil P fractions as well as the changes in microbial and rhizospheric indicators, a field experiment was established for two consecutive years (2016-2017) by comparing cereal-legume intercropping with correspondent monoculture. Experimental treatments included no fertilizer addition (Control), organic amendment (Compost), mineral fertilizers (NPK) and multi-nutrient enriched compost (NPKEC). From 2016 through 2017, easily available P (NaHCO3-Po; NaHCO3-Pi) and moderately available (NaOH-Po; NaOH-Pi) fractions in soil were greatly enhanced by NPKEC application, particularly with intercropping. Among non-available P fractions, NPK application increased inorganic P (HCl-Pi) but had no effect on organic P (HCl-Po) across both years. However, both non-available P fractions were reduced with NPKEC application, particularly in the intercropping, compared to sole NPK application. Soil total P fraction showed a consistent increase over both years in the intercropping system with NPKEC application. A strong intercropping effect was observed for soil microbial and rhizosphere P indicators, with NPKEC addition over both years. Application of compost as well as NPKEC induced identical effects on rhizosphere soil pH; however, decrease in pH was significant compared to control and NPK treatments. Our results demonstrate that addition of multi-nutrient enriched compost also improved microbial and rhizosphere indicators related to P cycling. Above all, competitive potential of legume-cereal intercrops enhanced when multi-nutrient enriched compost was applied, and consequently led to higher P fertility in these P limited soils.

Keywords: Legume-cereal, Waste recycling; Organic amendment; Nutrients cycling; Rhizosphere

SUSTAINABLE AGRICULTURE: SA-12

ABIOTIC STRESS TOLERANCE IN RICE

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ABSTRACT: Rice is staple food of more than half of the World population. Global warming is an increasing challenge for crop breeding and agricultural production. Abiotic stresses such as drought, salinity, extreme temperatures, soil erosion, water scacity, reduction in nutrients, flood and oxidative stress are serious threats to agriculture and result in the deterioration of the environment. Among these, dorught and salinty is the severe stress to reduce the yield. To draw the complete picture of plant heat signaling system, it is very important to find the missing links between the temperature cue, the actual sensing and the subsequent response. Furthermore, better understanding and introduction of resistant genes and proper utilization of other breeding techniques which protect plants from drought and salinity to enhance the production of the crop in stressed environment. Application of different strategies may be helpful for increasing the yield production of the rice crop such as identification of quantitative trait loci (QTLs), pyramiding genes and genetic transformation under drought and salinity environment condition. Coventional and molecular breeding approaches may be useful for introgression of important genes in to new rice lines for the development of resistant varieties. This project will also help the breeders to start a new breeding program by using resistant plant material for developing new commercial rice varieties to strengthen the economy of the country. Germplasm collection and enhancement is also a major step for the development of new genetic material. We will produce new varieties with new genes which will be responsible to increase the rice production under stress environment to full fill the food requirements of human being. On the other hand, abiotic stress tolerances in rice will also the major step to increase the yield potential of the rice crop in Pakistan. The main aim of the project is to start up rice development program and help to elevate rice research level as well as suitable variety selection in Pakistan.

Keywords: Rice, Abiotic, Stress, Drought, Salinity, Breeding, Germplasm

SUSTAINABLE AGRICULTURE: SA-13

EFFECT OF DIFFERENT PHOSPHORUS (P) SOURCES ON GROWTH, OXIDATIVE STRESS, ANTIOXIDANT RESPONSE AND CADMIUM AND P UPTAKE BY WHEAT

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ABSTRACT: A study was performed to explore the impacts of different phosphorus (P) sources on the cadmium (Cd) uptake in wheat in a complete life cycle study. The different P sources includes diammonium phosphate (DAP), single superphosphate (SSP), and nitrophose (NP) at a rate of 0, 500 and 1000 mg/kg of soil of each source. The soil used was anthropogenically contaminated with Cd due to the irrigation of sewage water. The wheat was grown till maturity after the application of P levels from different sources. The results showed that P application enhanced the plant height, spike length, shoot dry weight, root dry weight and grain yields depending upon the P levels and sources being maximum in 100 mg/kg P in the form of DAP. The P sources and levels also improved the photosynthesis and selected antioxidant enzyme activities and diminished the oxidative stress as was observed in the reduced levels of hydrogen peroxide, malondialdehyde and electrolyte leakage. P levels reduced the Cd concentrations in wheat tissues and increased the P concentrations in plants. Our results showed that DAP might be used in Cd contaminated soils for the safe food production in the soils.

Keywords: DAP, SSP, NP, Cadmium, Antioxidant Enzymes

SUSTAINABLE AGRICULTURE: SA-14

24-EPIBRASSINOLIDE INDUCED NUTRITIONAL ORCHESTRATION IN *CUCUMIS SATIVUS* UNDER CADMIUM TOXICITY THROUGH MODULATION OF NON-ENZYMATIC ANTIOXIDANTS AND GENE EXPRESSION

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ABSTRAC: Current research was designed to evaluate the potential of 24-epibrassinolide (24-EBL) in mitigation of cadmium (Cd) induced stress in cucumber (*Cucumis sativus* L.). 24-EBL pre-treated seeds (1 µM, 5 µM and 10 µM) were grown in soil contaminated with 50 mg kg^{-1} cadmium. Cadmium stress reduced growth related attributes of *C. sativus* seedlings. Application of 24-EBL enhanced root length, shoot length and chlorophyll biosynthesis. The 24-EBL pretreatment modulated expression levels of plasma membrane H^+-ATPase genes of *C. sativus* including *CsHA2, CsHA3, CsHA4, CsHA8* and *CsHA9*. This biomolecule amplified the accumulation of antioxidants such as glutathione, proline, phenolics and flavonoids. The reduced Cd-uptake in 24-EBL treated *C. sativus* seedlings encouraged uptake of essential plant nutrients. Furthermore, conjugated increase of indole acetic acid (IAA) contents and ethylene production rate were observed in 24-EBL treated seedlings in a dose-dependent manner. The improved nutritional content in 24-EBL applied seedlings was ascribed to enhanced expression of H^+-ATPase regulating genes besides increased amount of non-enzymatic antioxidants in Cd stressed plants. The present novel study elucidates the potential of 24-EBL in improving nutritional content in cucumber plants by modulation of non-enzymatic antioxidants and gene expression.

Keywords: 24-epibrassinolide, antioxidants, cadmium, *Cucumis sativus*, nutrients

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-1

GLOBAL CLIMATIC CHANGES-A THREAT FOR WATER RESOURCES IN PAKISTAN

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ABSTRACT: Pakistan is an agricultural country having irrigation-based economy which puts it as the 8th largest food producing country where irrigated agriculture contributes more than 90% of food production and about 22% to GDP. To meet the food and fiber requirements of tremendously increasing population coupled with continuously reducing per capita surface water availability, Pakistan has become 4th largest user of groundwater after India, USA and China. At present almost 40-50% of irrigation water requirements as well as about 100% and 90% industrial and domestic water demands are met from groundwater due to uncertainties in surface water flows. There are about 1.2 million tubewells pumping groundwater which underpins the food-security and livelihood in the country. In this way groundwater has become a mainstay for economy of the country. Due to its immediate access and available on demand, the groundwater reservoir is serving as a buffer for droughts. Pakistan lies in heat surplus zone on the globe and is suffering adversely from the impacts of climatic changes including global warming. Climatic changes have altered the pattern of rainfalls, unprecedented floods and droughts have put the water resources of the country under stress and Pakistan has become 8th most climate vulnerable country although it is 135th in GHG emissions. Glaciers are melting and sea water levels are rising causing future low-flows and sea water intrusions in coastal areas. Droughts have led to the over-depletion of Indus basin aquifer. Pakistan has approved National Water and Climate Change Policies to cope with the situation. Recently Punjab Govt. has also approved the Punjab Water Policy (2018) and the Punjab Water Act (2019). Current threats of climatic changes to the water resources of Pakistan and steps required as the way-forward in this regard have been discussed in this paper.

Keywords: Global-Warming, Water-Resources, Groundwater, Climate-Changes

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-2

CLIMATE CHANGE IS AN OPPORTUNITY

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ABSTRACT: Climate change is occurring globally. Land and sea temperatures are rising, while precipitation patterns are changing, and climate-related extremes such as heat waves, heavy precipitation and droughts are increasing in frequency and intensity around the world. Climate change affects forestry, fishery, agriculture and human health by affecting the productivity of rainfed crops and forage, reducing water availability and changing the severity and distribution of crop and livestock diseases. Key industries such as tourism, fishing, agriculture, energy and water supply will have to adopt new and innovative approaches and solutions to mitigate and adapt to climate change, ensure resource security and contribute to the sustainable growth and economic development. Climate projections predict that climate change will continue for many more decades to come, increasing climate-related extremes. Businesses and governments are therefore realizing that they have to plan and build for resilience to climate change, directing procurement towards adaptation-related products, processes and services. Hence, climate change adaptation is offering a major business opportunity, especially for companies operating in the built environment, agri-food and energy production and supply, water infrastructure, finance, and health and climate services. With the extent and severity of climate-related extremes such as heat waves, the demand for cooling is expected to rise and accelerate, placing additional demands on energy supply and increasing the risk of electricity black outs. Similarly, projections from the Intergovernmental Panel on Climate Change provide warnings about declining water availability and increased drought risk in many regions around the world. Moreover, according to the United Nations, it will be necessary to produce 60% more food globally and 100% more in developing countries by 2050. When this is viewed in the context that currently, approx. 70% of freshwater resources are used for agri-food production, and as a result of increasing and competing demands, exacerbated by pollution and climate change-driven impacts, available freshwater resources are becoming increasingly stressed. Consequently, reducing the vulnerability of agri-food production systems to climate change and strengthening the adaptive capacity are important priorities to protect and improve the livelihoods of billions of people around the world. Furthermore, reducing emissions due to fossil fuels production and consumption that contribute to global warming is crucial to securing global wellbeing as well, and agri-food and energy sectors have tremendous potential for reducing emissions and inefficiencies while at the same time playing their important

roles in poverty reduction, and food and energy security. In short, agri-food and energy sectors are facing with significant climate change-driven challenges, which provide tremendous opportunities for cutting-edge knowledge, and innovative products, processes, services and policies. This keynote speech discusses the impacts of climate change on agri-food and energy innovation for strengthening the management of our precious resources into the future.

Keywords: Climate Change, Agri-Food, Energy, Innovation, Greenhouse Gas Emissions

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-03

CLIMATE CHANGE AND GROUNDWATER NEXUS; SPATIOTEMPORAL VARIATIONS BASED SYNOPTIC SCALE STUDY FOCUSING SOUTHERN REGION OF KP PROVINCE PAKISTAN

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ABSTRACT: Groundwater is an invaluable natural resource providing the major source of water for domestic, agriculture and industrial uses over the world. It is a vital source, supplying nearly a half of all water sources of the world for drinking purpose while about 40-43 % is used for irrigation. It has a major role in the sustainability of many world ecosystems and maintenance of hydrological cycle balances. The unprecedented changes in the global climate has effectively arisen many related changes in terrestrial processes. Resultantly, it has affected the hydrological cycle; by changing the surface water levels and groundwater recharge, as well as, a potential impact on quantity of groundwater. The 3rd and 4th Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) asserts that there has been little research approach on the potential effects of climate change on the groundwater studies, particularly in arid and semi-arid regions across the world. Besides, the sub-surface water-focused research, particularly the impact on groundwater in response to the present climate change and prospective sustainability of its resources has not been explored in focus. Hence, it is crucial to address climate change and groundwater nexus from the perspective of both present scenarios and prospective sustainability of water resources. Focusing the southern region of Khyber Pakhtunkhwa province-Pakistan, the present research evaluated the climate change and groundwater nexus on their co-variations based prospective impacts. Following the proposed integrative approach of Remote sensing (RS) and Geo-Information System Information (GIS), the preliminary data required for topography and related information, RS imagery data of groundwater from the Gravity Recovery And Climate Experiment (GRACE) is extracted for final processing in GIS and related simulations. The resultant analysis is retrieved as spatiotemporal variations based mapping and spatial co-variations based prospective-changes of groundwater resources relative to climatic variance. The successful completion of the study will be an applicable approach to enrich and determine the real-time data and knowledge of the climate anomaly and its variations based impacts on groundwater resources. The climatologists and environmentalists, hydrologists, and related policymakers equipped with these real-time findings will have a better understanding of the present and prospective scenario

to implement better planning and policies for sustainable water resources in the regions with high vulnerability to the climate change, particularly in arid and semi-arid regions of the world.

Keywords: Groundwater, Climate change, sustainability, Remote sensing, GIS

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-04

CLIMATE CHANGE IMPACTS ON PAST AND FUTURE WATER RESOURCES OF PAKISTAN: CURRENT STATE OF KNOWLEDGE, CHALLENGES AND OPPORTUNITIES

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ABSTRACT: In addition to overpopulation, rapid urbanization and fierce economic competition, climate change is an important factor for the socio-economic progress of developing countries. Climate change has the potential to severely affect water availability, agriculture, health, food security, power production, safety and overall wellbeing of these nations. Effects of climate change on hydrological cycles can put the sustainability of water resources at risk through floods, droughts and sea-level rise. Therefore, valid regional estimation of climate change and its impacts on water resources is highly needed. Many studies have been done in this regard for the third ice pole partly located in the north of Pakistan. In this review paper, methods and results of previous studies on past and future impacts of climate change on runoff and water resources in Pakistan are discussed, as well as their associated uncertainties and limitations, and suggestions for further research. This paper can be used as a guide for water managers regarding the current state of knowledge and for researchers to identify knowledge gaps and best available practices.

Keywords: Climate Change, Water Resources, Flood, Drought.

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-05

WATER SCARCITY UNDER CLIMATE CHANGE IN KUNHAR RIVER BASIN USING DIFFERENT APPROACHES

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ABSTRACT: Pakistan is becoming water shortage country due to depletion of water resources and hydrometrological conditions are becoming major cause. Drought, prevailing in different parts of the Pakistan. Kunhar River is major tributary of mangla watershed, which irrigated the major part of agriculture area of Punjab. The fixed and transient threshold level used to determine the water scarcity of Kunhar River on different time scale. Base on the threshold level, the water scarecity was determined of major tributary of Mangla watershed. The area of Kunhar River was divided into different zones. The threshold levels of runoff for Zones I and II were 320 and 363 mm using the Q80 fixed method, while the mean runoff amounts were estimated to be 79.95 and 55.61 mm, respectively. The transient threshold levels varied by month, and the duration of droughts in Zones I and II ranged from 26.39 to 78.98 days. The water scarcity of Kunhar River was determined through fixed and transient threshold. Drought, were observed in different seasons of this region. However, it is important to establish thresholds for hydrological variables and understand the climate change of the hydrological regime of the entire basin, so that policy makers and water managers can make sustainable water resource-management decisions for this region.

Keywords: Water scarecity, Drought, Kunhar River, Climate Change

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-06

PRODUCTION OF GASOLINE WITH HIGH QUALITY AND HIGH OCTANE NUMBER BY USE OF BIFUNCTIONAL CATALYST Pt / Re IN CATALYTIC REFORMING PROCESS

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ABSTRACT: The original function of process of platforming is to develop heavy naphtha (HSRN), coming from the atmospheric unit of distillation with a weak octane number (NO = 44), to obtain a mixture of fuels â number octane raised by catalytically supporting specific groups of chemical reactions. The installation is divided into two sections: Section hydrobon. Section platforming. The rafinat coming from the bottom of column 12C2 to feed the section platforming is divided into two parts whose flows are controlled and mixed with gas rich in hydrogen. Bottom of the column, we obtain stabilized reformat which is aspired by there pump to ensure the heating of the column whereas a part is sent towards storage after being cooled by the air cooler and the condenser. In catalytic catalyst of reforming, there is voluntarily associated a hydrogenating function-dehydrogenating, brought by platinum deposited, with an acid function brought by the alumina support. The mechanism of action of this bifunctionnal catalyst depends on the severity of the operation, of the quality of the load and the type of catalyst. The catalyst used in the catalytic process of reforming is a very elaborate bifunctional catalyst whose performances are constantly improved thanks to the experimental research supported on an increasingly large comprehension of the phenomena. The American company Universel Oil Petroleum (UOP) marketed several series of bimetallic catalysts such as R16, R20, R30 and R62 consisted latinum / Rhenium on an acid support consisted the alumina added with a halogenous compound (chlorine).

Keywords: Platforming, Amelioration, Octane Number, Catalyst.

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-07

IMPACT OF BELOW PAR SUPPLY OF ELECTRICITY ON SOCIO-ECONOMIC SECTOR OF PAKISTAN

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ABSTRACT: Pakistan's electricity demand is expanding with the quick development and unplanned rapidly increasing population of the nation. But unluckily the production of electricity by the country is not up to the mark. The rapid growth in population and low production of electricity have led to a huge gap between the two sectors of life. This gap has greatly influenced the socio-economic sector of the country. The impact of this gap on social sector has been investigated through quantitative and qualitative techniques of research and available secondary data. The results indicate that more than 95 percent population of the country has been facing issues due to this gap as there are issues in the provision of medical facilities, in the maintenance of temperature during extreme weather conditions and at places security issues have worsen. It has hampered the growth of economic sector as it has lowered down the efficiency of manufacturing sector, minimized the number of exports as well increased the investment cost of exports as a result manufacturing sector finding it really difficult to compete international market. That is responsible for closing of many industrial units and this has ultimately caused unemployment. Unemployment always results in social unrest and street crimes. In fact this gap is primarily responsible for the increased rate of crimes in urban and industrial centers of the country like in Lahore and Karachi. On the basis of this discussion it can be concluded that energy crisis has plagued all areas of Pakistan extending from economy to industry, farming to public activity, inflation to poverty and it is hampering national advancement in a radical way. This study recommends that Pakistan has been gifted by nature through numerous renewable sources of energy like solar energy, geo-thermal energy, wind energy and tidal energy etc. These are environment friendly and long lasting.

Keywords: Growing Population, Industrialization, Inflation, Exports and Renewable Energy Resources.

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-08

DISTRESSING ELECTRICITY CRISIS OF PAKISTAN

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ABSTRACT: Energy plays key role in most of the socio-economic issues of a country. Electricity in Pakistan lies at the heart of economic security, as it's the pre-requisite to generate most of the activities of the country. The main objective of the study is to highlight electric power as a big determinant of development and to find out the energy requirements and solutions from available energy resources. To achieve the objectives the study has focused on qualitative data collection as well the work is an exploratory study of the evolution of concept of energy crisis in Pakistan through tracing the evidences in the official data available. It proceeds towards the options and choices available for averting energy crisis. The data collected during this work reveals that Pakistan is generating 48 percent of its electricity from gas, 33 percent from hydel, 17 percent from oil, two percent from nuclear and one percent from coal. If we examine the figures, it is clear that Pakistan is underutilizing its natural resources to generate electricity. Thorough analysis of available evidences study stresses upon the fact that there must be conservation renewal resources like biomass, sugarcane etc. in to electricity and this conversion is too much easy and applicable in the province of Punjab as well in Sindh and this electricity can be used for many social as well economic activities. The study concludes that the country is passing through stressful phase of electric shortfall. It recommends that Pakistan must pay attention towards the use of alternative sources of energy to fulfill some part of its electric deficit, while in this regard an increase in the production of energy through nuclear resources and coal reserves can also be supportive.

Keywords: Economic Security, Distressing Phase, Alternative Sources and Electric Deficit.

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-09

INVESTIGATION OF GEOMETRY ON THE ENERGY EFFICIENCY OF A HOUSE IN LAHORE.

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ABSTRACT: Rapid increase in the globalization has a great impact on restructuring the energy efficiency of buildings specially houses in such a way which has resulted into the present day dependency upon mechanical means like electricity, regrigerators etc and thus a massive increase in the electricity consumption thus triggering in the energy crisis. The current architectural scnario in Lahore where climate is the biggest challenge has found to be more tilted towards beautifying the house forms and not the fuction or materials or the spatial planning is according to the local climatic challenges. The design and materials are not aiding in minimising the reliance on these mechanical means due to design failures that don't tend to control appropriate light or invite optimum wind inside the house that helps in maintaining the internal temperature of the house. The method adopted to conduct this research is secondary through literature study of previously done research followed by critical analysis and factors of the house form and shape change throughout time. The research also indicates that the architecture of the old Lahore was some what climatic proficient due to incoporation of certain passive design variables like geometric design of the house, courtyards, landscape and other factors related to open spaces in and aroundt the house.This researchis part of an ongoing phd research by the scholar to achieve the ideal geometry for an energy effcient house in Lahore hence proposing guideline for an energy efficient house design of the house in the semi arid climate of lahore. For this purpose an indepth study of the house forms and open spaces of the traditional and modern architecture of Lahore has been conducted from various times in Lahore of representable periods of different times.The resaecrh helps in concluding how geometry has triggered the reliance on active means hence increase in the energy consumption. This research will help for further research for setting guidelines for energy efficient guidelines for openspaces by the building authorities.

Keywords: Energy Efficient House, Climate Responsive, Geometry, Open Spaces, Passive Techniques.

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-10

INTEGRATING STRATEGIC ENVIRONMENTAL ASSESSMENT IN LAND USE PLANNING FOR RENEWABLE ENERGY PROJECTS IN PAKISTAN: STRENGTHS AND WEAKNESSES

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ABSTRACT: A major problem being faced in environmental assessment is the lack of integration with the processes of planning and decision-making at early stages. Environmental assessment of impacts at the traditional project levels does not provide adequate incentives and capacities for the incorporation of crucial environmental impacts at broader scales i.e. temporal or spatial. Strategic Environmental Assessment has been recognized as an essential tool for realizing goals of sustainability that surpass the undertakings of project level, i.e. Policies, Plans and Programs. This purpose of this review is to extend the theoretical as well as practical understanding of Strategic Environmental Assessment into land use planning with respect to the development of renewable energy projects. Developing countries, like Pakistan are heavily dependent on fossil fuels to meet the growing energy demand. With the imminent expansion of the power sector over the next few years, there is a dire need to shift towards renewable energy resources for power generation. Good governance of the renewable energy sector is a major issue in Pakistan influencing the sustainable development of energy, therefore, SEA is one such promising tool that can help steer towards the sustainable planning of this sector. The study builds on a theoretical framework to effectively integrate the principles of Strategic Environmental Assessment in land use planning, furthermore, providing step by step guidelines for its implementation. It further highlights the opportunities and constraints of Strategic Environmental Assessment in Spatial Planning.

Keywords:

CLIMATE CHANGE AND ENERGY MANAGEMENT: CCEM-11

SEASONAL VARIATION OF WATER QUALITY INDEX FOR RIVER RAVI: A CASE STUDY FROM UPSTREAM TO DOWNSTREAM OF LAHORE CITY

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ABSTRACT: A comparative cross sectional study was conducted in order to determine the seasonal variation in Water Quality Index- WQI of river Ravi extended from upstream to downstream of Lahore city. The river Ravi water quality at city of Lahore is major concern due to discharge of large quantities of sewage from the city. The quality of river Ravi was predicted as water quality index with measurement of 11 physico-chemical and biological parameters at three sampling locations during low and high flow season. The total of 12 samples (2 each station in each season) were collected from upstream – siphon to midstream Gulshan-e-Ravi to downstream-Chung and then analyzed by using APHA standard reference methods. The data for flows was taken from Shahdara Gauging Station. The WQI was calculated in accordance with method described by Canadian Council of Ministers of the Environment (CCME). The results of the water quality index shows that there is great variations between water quality Index with respect to difference in flows. The water quality index calculated at station 1 Siphon upstream of Lahore was 72.1 during high flow and 54.3 during low flow season. At station 2 Gulshane Ravi the WQI was 43.5 during high flow and 28.0 during low flow season. At downstream station 3 Chung the WQI found out to be 41.9 during high flow and 19.4 during low flow season. The study ultimately finds out that at upstream of Lahore at Siphon WQI was good during high flow but fair during low flow season. The WQI decreases from Siphon to midstream Gulshane Ravi and downstream Chung due to discharge of sewage from city of Lahore. The WQI found poor during both high and low flow season at the midstream and downstream of Lahore city.

Keywords: Water Quality Index WQI, Surface water, River Water Quality, Seasonal Flows, Wastewater, Lahore City, River Ravi

WATER RESOURCES MANAGEMENT: WRM-01

HYDROLOGICAL MODELLING NEEDS IMPROVEMENT IN THE HINDUKUSH-KARAKORAM-HIMALAYAS BASINS

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ABSTRACT: Millions of people rely on river water originating from snow- and ice-melt from basins in the Hindukush-Karakoram-Himalayas (HKH). One such basin is the Upper Indus Basin (UIB), where the snow- and ice-melt contribution can be more than 80%. Being the origin of some of the world's largest alpine glaciers, this basin could be highly susceptible to global warming and climate change. Precise predictions of future water availability for resource planning under a changing climate depends on significantly improved hydrological modelling, and is vital for the food and energy needs of downstream population. However, hydrological modelling has not received due attention in the HKH region. This study critically assesses available hydro-climatic data, and identifies five major drawbacks in the published hydro-climatic studies reviewed, even these appearing in well-reputed international journals. The main weaknesses in these studies are: i) use of over-estimated basin areas; ii) use of under-estimated precipitation data; iii) use of incorrectly-defined glacier boundaries; iv) use of under-estimated snow-cover data; and v) use of biased melt factors for snow and ice during the summer months. These inputs have either produced under-estimated modelled flows, implying severe water scarcity in the region, or have over-estimated modelled flows by over-estimating glacier melt contributions to total flows, although the proportions vary in different sub-basins of the UIB. These forecasts cannot therefore be used in policy making or to inform water resource development, and need revisiting. This study also suggests such detailed critical analysis of existing hydrological modelling studies, and their improvement in other regions of the world, particularly in the HKH region.

Keywords: Hydrological Modeling, Ice Melt, Water Resources, Hydro-Climatic

WATER RESOURCES MANAGEMENT: WRM-02

REUSE OF STORMWATER RUNOFF IN TEXTILE INDUSTRY: A SMART APPROACH FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT: Urbanization transforms many natural catchments into urban areas with highly impervious surfaces i.e. roads, bridges, streets and parking lots to meet the needs of modernization and industrialization. These impervious surfaces create considerable amounts of rainfall runoff due to reduction in infiltration rate of soil. Stormwater that would have previously infiltrated to recharge the aquifers now is stormwater runoff that rapidly drained out into receiving waters without any usage causing water scarcity in developing countries. In this research work an attempt is made to reuse the stormwater runoff in textile industry for sustainable development. Twenty-one stormwater samples were collected from an urban highway and analyzed for pH, TDS, Ec, Hardness, TSS, nutrients and heavy metals to determine physiochemical properties of highway runoff water. This water was used for dying of cotton fabric and washing fastness and crocking/ rubbing fastness tests were performed. The results were very close to that of dying with distilled water.

Keywords: Urbanization, Impervious Surfaces, Stormwater Runoff, Water Scarcity, Textile Dying, Sustainable Development.

WATER RESOURCES MANAGEMENT: WRM-03

EQUITABLE AND RELIABLE DISTRIBUTION OF WATER IN SECONDARY CANAL: A CASE STUDY OF MIR MINOR

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ABSTRACT: Proper and adequate supply of irrigation water to the crops is one of the main factor in growing crops and getting the maximum yield. The primary objective of the irrigation management is the maintain/provide equity of the distribution of irrigation water as per design discharge of the secondary canals i.e. as per crop requirement/demand among all stakeholders from head to tail reaches. However, it has been observed that distribution of water is not always uniform, which may also decreases the normal yield of crops. The appropriate amount of water required at the field as and when needed it will provide a good yield that can only be achieved by a perfect water measurement system. In this study, three locations/reaches viz. head, middle and tail of the Mir minor of Jamrao West branch in Mirpurkhas district Sindh, Pakistan, have been selected for installation of sensors which have been used to monitor the water flow variability with respect to time. A database of real-time water observations/availability flowing at these three locations of the selected secondary canal was made. This data show the actual water flows at all three sections, which informs the situation of mismanagement of discharge within the system. Continuous flow rate is helping the water managers (Farmers Organization representatives) to provide equal distribution of canal water among stakeholders at head, middle and tail reaches. The representatives of Farmers Organization has also been involved in the monitoring of the water flowing in the minor and so that they can management the water delivery to the watercourses/outlets to have equal and reliable water at their farm lands

Keywords: Index Terms - Adequate Supply, Equity and Reliable distribution, Real Time, Sensors

WATER RESOURCES MANAGEMENT: WRM-04

DESIGN OF REAL TIME GROUNDWATER LEVEL MONITORING NETWORK IN LOWER INDUS BASIN, PAKISTAN

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ABSTRACT: Groundwater monitoring has become a challenging task throughout the world. It requires significant investment and laborious work to successfully monitor the groundwater. Optimization of monitoring locations can reduce the cost and arduous work of groundwater monitoring goal. In this study a groundwater flow simulation model (MODFLOW, 2005) was calibrated for 42 stress periods. Spatial sampling of representative observation grids was performed using hexagonal pattern of spatial sampling, which were further prioritized by using principal component analysis (PCA) with threshold of 0.90. Inverse Distance Weighting (IDW) interpolation was performed for further refinement of the network. Finally, uncertainty for different network was carried out, which was quantified using the standard error for resulted potentiometric head surfaces. Calibrated model, having root mean square of 0.95 and absolute residual mean of 0.75 m, was able to replicate the hydro-dynamic behaviour of the study area. Spatial prioritization using hexagonal pattern of spatial sampling resulted in 195 points, which represented the study area with an average standard error of 0.1 m. These were further reduced by PCA, which resulted in total 135 optimal points. These 135 points represented the study area with an average standard error of 0.32 m. Final screening using water level classification of 135 points indicated 59 optimal points. Uncertainty assessment results showed that these 59 points can represent groundwater head of the study area with an average standard error of 0.48 m.

Keywords: Groundwater, Monitoring, Prioritization, Flow Simulation Model, Principal Component Analysis (PCA), Inverse Distance Weightage (IDW).

WATER RESOURCES MANAGEMENT: WRM-05

ANALYZING THE IMPACT OF HILL TORRENTS OF KOH E SULEIMAN MOUNTAINS ON THE FLOOD WATER OF RIVER INDUS

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ABSTRACT: Flash floods are found to be most devastating natural hazard in Pakistan. Westerly winds and concentrated rainfall in the catchment of rivers in monsoon intensifies the flood to an unmanageable extent. Pakistan being a developing country with limited resources has done so less in quantification of amount of rainfall being produced through these ungauged catchments. This study focuses on 10 ungauged hill torrents of Koh e Suleiman mountainous region in the vicinity of district DG Khan and Rajanpur. These hill torrents contribution to river Indus elevates the flood extent. They enter Sindh province upstream Guddu barrage and are playing havoc for the flood managers of Sindh. This study limits itself to analyze the hydrology of these hill torrents and provide an appropriate storage/ diversion strategy to enhance the spate irrigation of the study area. Hydrologic Engineering Centre, Hydrologic Modeling System (HEC-HMS) an event based semi distributed hydrological model with an extension of HEC-GeoHMS in ArcGis was used for delineation of streams and quantification of amount of rainfall being produced. Further non-parametric Gumble extreme value analysis type I distribution and Mann Kendall, and Sen's slope statistical analysis were done to analyze the rainfall trends. Uncertainty analysis was also performed to check the influence of different parameter being used in runoff quantification. The study concludes a total amount of volume that will be contributing in river Indus on 25, 50, 100, and 200 return period rainfall is 0.5, 0.6, 0.7, and 0.8 MAF respectively. Upon uncertainty analysis only curve no (CN) has significance affect as the upper and lower bound on 10% change is found to be 7.79 and -13.20. In the end study proposes 3 water storage potential sites on hill torrent Kaha, Vehova, and Sanghar with an estimated retention potential of 0.14, 1.14, and 1.13 MAF that will benefit both the districts in an optimizing potential for spate irrigation.

Keywords: Hill torrents, Hydrology, GIS, Ungauged Catchment, Flash Flood, Rainfall Runoff, Watershed.

WATER RESOURCES MANAGEMENT: WRM-06

A GROUNDWATER TREATMENT SYSTEM FOR REMOVAL OF BACTERIA AND ARSENIC AT HOUSEHOLD LEVEL

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ABSTRACT: Groundwater contamination is a serious concern in several regions of the world especially heavy metal contamination like Arsenic. Arsenic groundwater contamination is widespread affecting the lower income classes. This is because the effective decontamination technologies for arsenic removal are either energy intensive or costly. Therefore, there is a dire need to develop a cost-effective water treatment system for arsenic decontamination. Pakistan ranks 4th globally in arsenic affected countries. The rural areas of Punjab and Sindh are the worst affected areas in terms of arsenic groundwater contamination. Bacterial groundwater contamination is another issue that plagues Pakistan. It is also a leading cause of child mortality in the country. This research investigates the possibilities of constructing a water treatment system that simultaneously removes As, TSS and microbes in a cost effective and sustainable manner. Arsenic removal was done through precipitation and adsorption using metal salts. Batch experiments were conducted to determine the optimum dose for up to 3.0 mg/L As removal. Experimentation was done using water from arsenic affected areas of Punjab. Pakistan. Because of presence of iron along with arsenic the system also reduces iron in addition to arsenic. Both contaminants are removed to their WHO prescribed limits i.e. 0.3mg/L for Fe and 0.01mg/L for As. Low cost ceramic filters were used for filtration. The ceramic filter was also modified by changing its composition to enhance removal efficiency.

Keywords: Groundwater, Arsenic Remediation, Household Filtration System, Low cost.

WATER RESOURCES MANAGEMENT: WRM-07

QUALITATIVE ASSESSMENT OF ROOFTOP RAIN WATER HARVESTING SYSTEMS IN MONSOON SEASON IN LAHORE

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ABSTRACT: Rain water harvesting (RWH) is the most effective and economical technique to replenish the ground water. This study was designed to assess the quality of water recharged through rooftop rain water harvesting systems installed in Lahore by Pakistan council of research and water resources (PCRWR). Three rooftop rain water harvesting system installed in Punjab University Quaid-e-Azam campus, World Wild Life (WWF) office and University of Veterinary and Animal Sciences, Lahore were selected. The water samples were collected in monsoon season (July, August and September) from three points i.e. Rain gauge, rooftop and Recharge well, analyzed and compared with WHO drinking water quality standards. The results revealed that values of pH, conductivity, carbonates, bicarbonates, calcium, potassium, sodium, magnesium, nitrate, sulphate, copper and zinc, were within permissible limits while the total coliform, fecal coliform, turbidity and lead values exceed the standard limits. The quality of recharge well installed in UVAS is lower than PU and WWF recharge wells due to the presence of animals in vicinity and poor cleanliness conditions. It can be concluded that Rooftop RWH provides righteous quality of recharge wells if properly maintained and should be included in Master Planning and Decision Making of Lahore

Keywords: Rain water harvesting; Rooftop; recharge well; drinking water quality.

WATER RESOURCES MANAGEMENT: WRM-08

SPATIAL ANALYSIS OF WATER CRISES AND ITS MANAGEMENT IN GWADAR CITY BU USING GEO-INFORMATICS

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ABSTRACT: Water crisis is the condition when the available water cannot cater the needs of people. Gwadar city has been selected as a study area which is emerging as a game changer for Pakistan but it is facing severe water scarcity. People are relying on desalination plants and tankers for water. Objective of this study is to highlight the water crisis and its impacts on vegetation cover in study area. Landuse landcover classification has been performed to develop the landuse maps. Spatial interpolation techniques were employed to map the water level distribution. Results revealed a strong co-relation between landcover and groundwater table. Increase in built-up resulted with depletion of groundwater and vice versa. In order to overcome the scarcity, government needs to plant more desalination plants, water harvesting structures and some strategies to utilize the rainfall water for groundwater recharge and storage.

Keywords: Water Scarcity, Geospatial, Landuse Landcover, Interpolation, Vegetation

WATER RESOURCES MANAGEMENT: WRM-09

ASSESSMENT MORPHOLOGICAL CHANGES OF RAVI RIVER AT LAHORE CITY UTILIZING GIS TECHNIQUES

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ABSTRACT: Morphological changes are meant to be as changes in river's shape and its directions. In 1988, average rainfall of 400 mm was measured on the catchments of the River Sutlej, Ravi and Chenab. This rainfall caused severe flooding in river Ravi. To get control on this flood T-Head Spurs are built along the River Ravi in Lahore. This embankment is the main reason of River Ravi's morphological change and course from 1988 to 2018. This study aims to detect the changes in morphology in terms of Ravi River's direction, volume and to calculate the sinuosity of Ravi River at Lahore City along with the estimation of potential migration. Using GIS techniques to detect these morphological changes, overlay analysis is used to detect the directional changes of Ravi River. along with the changes, Sinuosity Index and potential migration are calculated by using Hawth's tool and Measure Distance tool. Within study period (1989 to 2018), overall shifting of Ravi River can be clearly seen from Southeast to Northwest with the passage of time along Lahore district. It is also found that the area of Ravi River decreases in the 30 years' time spam with the difference of 29.37 sq. kilometers. Whereas, the sinuosity of river Ravi is increasing and approaching, which means that the river Ravi is becoming straight or having less meanders with the passage of time. The findings of this study will rebound to the benefit of society in such a way that this study will be very much helpful to find out potential migration of Ravi River. This study also provides basic data in interpreting information about the vacant land along river Ravi which can be used in future for the development. More significant understating river's response in channel migration and this understanding is essential to set reliable targets for restoration efforts.

Keywords: Morphology; GIS; Ravi River; Sinuosity Index; Potential Migration.

WATER RESOURCES MANAGEMENT: WRM-10

USING GEO SPATIAL TECHNOLOGY IDENTIFY BANK EROSION BY THE INDUS RIVER IN VILLAGE RAKHWAN OF DAPHI MAKORI REVENUE CIRCLE, LAYYAH DISTRICT, PUNJAB, PAKISTAN

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ABSTRACT: Pakistan is one of those countries which is facing river bank erosion disaster. Punjab province has been highly affected by the bank erosion among four provinces of Pakistan. District Layyah of Punjab province suffers from Indus River flood inundation and its erosion at large.Village Rakhwan of district Layyah where erosion is behaving as continuous phenomenon has been selected as study area in this research..GIS & Remote sensing environment has been used to analyse the erosion in study area. Freely available satellite imagery is utilized to identify the erosion and inundation mapping. Results showed almost 75% of Rakhwan village land have been eroded so far. Most of village Rakhwan land is eroded after the 2010 sever flood. The study area provides a typical example of this dynamicity and devastation where large tracts of fertile agricultural land and densely settled villages have been eroded away, hundreds of people are rendered homeless and forced to migrate to other areas. In this study it has been identified that village Rakhwan's eroded land with farmer ownership during last 15 years using geospatial technology and mapping. This study also provided with amount of population displacement and effected livestock.

Keywords: Erosion, Inundation, GIS, Remote Sensing

WATER RESOURCES MANAGEMENT: WRM-11

ROLE OF GIS TECHNOOGY TO IDENTIFY SUSCIPTIBLE WATER INRUSH AREAS FOR PLANNING AND DESIGNING OF COAL MINES IN THE SALT RANGE, PAKISTAN

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ABSTRACT: GIS technology is an emerging discipline for management of natural resources and have significant socio-economic development impact. Coal mining is an important domain for socio-economic development wherein such an emerging technology is needed. Present research is focused on integrating different GIS data sources like Google Imageries, DEM data, geological maps, boreholes data and coal mines survey data in GIS environment for identification of susceptible water inrush areas in terms of highest to lowest water inrush zones. Subsequently the developed layers of potential water inrush zones were used for planning & designing of coal mines in a particular lease area in the Salt Range, Pakistan. Methodology is based on different GIS layers preparation from different data sources like Google images, DEM data and geological map and boreholes data in order to describe the zones of highest to lowest risk of water inrush into coal mines. For this, regional topography of the area is evaluated from DEM data by developing slope map which is analyzed with respect to geological map alongwith water depth contours maps. Results define the possibility of high to low lying water inrush zones. Findings of the study includes recommendations to avoid designing of coal mines in low lying areas which are at high risk due to water accumulation whereas moderate and high areas can be considered sustainable for coal mining. The GIS techniques are applied on a smaller leased out unit of a private mining company and the same can be adopted for rest of the coal mining areas of the Salt range for planning and designing of underground coal mines in future.

Keywords: GIS, Water Inrush, Coal Mines, Slope Map, Topography.

WATER RESOURCES MANAGEMENT: WRM-12

ENVIRONMENTAL IMPACT OF WATER QUALITY ON FISH PRODUCTION IN HALEJI LAKE, DISTRICT THATTA, SINDH, PAKISTAN

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ABSTRACT: The present studies to investigate the environmental impact of water quality on fish production in Haleji Lake, District Thatta, Sindh, Pakistan. During November 2017 to January 2018 the physicochemical parameter like temperature, pH, dissolved oxygen, Chloride, conductivity, salinity, and total dissolved solids were recorded fortnightly at 8:0AM in each sampling date through - out the study period. In the present study the temperature values were ranged between (20- 23C with mean 22±1.0), pH (7.3-7.9 with mean 7.62±0.09), DO (4.0 – 5.3 with mean 5.3±0.19), Chloride (0.311- 0.375 with mean 0.346±0.028) conductivity (950-1240with mean 1162.5±60.15), salinity (0.3) and total dissolved solid (410-549 with mean 525.7±19.13) from all the sampling sites. In current investigations on the relationship of length and weight of 6 different species were presented, total 140 fish were caught between September 2017 and March 2018 from Haleji Lake District Thatta, Sindh. *Notopterus chitala*, *Mastacembelus armatus*, *Notopterus notopterus*, *Channa punctatus*, *Aorihthyes aor* and *Oreochromis mossambicus* was enumerated at different length groups. The length weight relationships and correlation of co efficient was analyzed. In the present studies values of b varied from 3.74 *Notopterus chitala*, 2.97(*Mastacembelus armatus* 2.12 *Notopterus notopterus* 2.24 *Channa punctatus* 2.48 *Aorichthys aor* 3.89 *Oreochromis mossambicus.* The studies reveled that *Oreochromis mossambicus* showed better growth and pursued cube law (b=3.89) followed by *Notopterus chitala* (b=3.74) while *Mastacembelus armatus* (b=2.97). *Aorichthys aor* (b=2.48) and *Channa punctatus* (b=2.24) exhibited closed to ideal. L/W values and coefficient of condition showed ideal growth of six different species from Haleji Lake, District Thatta, Sindh, Pakistan. It is concluded that the different parameters used in the study revealed that the physico- chemical parameters in the Haleji Lake is considered to be safe limits (FAO 2012) and good to support the survival and production of aquatic environment especially fish.

Keywords: Freshwater Ecology, Physico-Chemical, Fish Production

WATER RESOURCES MANAGEMENT: WRM-13

FLUCTUATION ANALYSIS OF GROUNDWATER LEVEL AND IRRIGATION WATER QUALITY

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ABSTRACT: Human survival is based on the availability and quality of water, whether it's for drinking purposes or for irrigation purposes. Rapid increase in population has led to exploitation of groundwater resources resulting in the deteriorating quality of water and compromise on human health. Assessment of water quality especially ground water has become inevitable. The main focus of this study is to assess the suitability of groundwater for irrigation with related to quality and depth, for the study area of District Chiniot. Inverse Distance Weighting (IDW) interpolation technique has been used to generate groundwater depth and groundwater quality maps of years 2006-2014 for the pre and post monsoon inspections. Electrical conductivity (EC), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the chosen parameters for determining the suitability of water quality. Study area is classified into; suitable, moderate and unsuitable areas with respect to irrigation use of groundwater. Results have been compared for the whole investigation period for both pre and post monsoon readings. Results revealed that Suitable area with respect to water quality for irrigation purposes has reduced in 2014 when compared to the year 2006. Moderate area was increased in the investigation period whereas unsuitable area was reduced. When groundwater quality and depth were compared, results showed that the suitable area lies where the depth of groundwater table is deep to moderate but some areas with shallow groundwater depth also fall in the suitable quality. So, it is concluded that the groundwater depth affects the suitability of water quality for irrigation to greater extent but it is not universally acceptable for study area that areas having shallow groundwater table depth would have a poor water quality.

Keywords: GIS, Groundwater Depth, Groundwater Quality, Pre-monsoon, Post-monsoon, Inverse Distance Weighting.

NANOTECHNOLOGY: NT-01

SYNTHESIS OF GREEN SILVER NANOPARTICLES AND COMPARISON OF THEIR ANTIMICROBIAL EFFECTS

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ABSTRACT: Antibiotics are excessively used for the treatment of infections caused by the bacteria in humans, livestock and plants. The development of resistance by bacteria against the antibiotics have become a serious challenge and is spreading extensively due to direct discharge of antibiotics into the environment including the water bodies through different pathways like agricultural runoff, municipal wastewater discharge and leaching. Indiscriminate use and uncontrolled discharge of antibiotics into wastewater results in an increase in the resistance among bacteria through horizontal gene transfer and the spread of antibiotic resistant genes. This leads to a serious public health issue as the previously used drugs become ineffective against the resistant pathogenic bacteria. Nano-sized materials have gained much importance due to their high surface area to volume ratio and they have shown to exhibit excellent antimicrobial property due to their small size. Chemical methods for the synthesis of silver nanoparticles require the use of different toxic chemicals and large amount of energy. Synthesis of silver nanoparticles in an eco-friendly manner by using natural products like extracts of plants could be a useful alternative to antibiotics. In the present study, green synthesized silver nanoparticles were produced using extracts of two medicinal plants, *Azadirachta indica* (Neem) leaves and stem of *Tinospora cordifolia* (Gilo). Characterization of nanoparticles synthesized by green method was carried out and scanning electron microscope images showed the particle size to be in the range from 40-80 nm for neem and 46-85nm for gilo plant nanoparticles. These nanoparticles were compared for antimicrobial properties against selected bacterial strain. These silver nanoparticles synthesized using natural plants will be used as antimicrobial agent against different selected strains of antibiotic resistant bacteria isolated from environmental samples.

Keywords: Silver Nanoparticles, Green Synthesis, Azadirachta Indica, Tinospora Cordifolia, Antibiotic Resistance.

NANOTECHNOLOGY: NT-02

PREPARATION, CHARACTERIZATION AND DEGRADATION POTENTIAL OF POLYSTYRENE Fe-ZnO / CLAY NANOCOMPOSITE

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ABSTRACT: Polystyrene has important and exclusive mechanical, physical and chemical properties which make it feasible for various applications. It has vast range of applications in food packaging, telecommunication, building insulations and electronics industry. Whereas, this has caused serious threats to the land and marine environment. It accumulates in the ecosystem causing various pollution and waste management threats. Moreover, naturally it is unable to decompose. In the present work polystyrene Fe-ZnO/Clay nanocomposites were successfully prepared by co-precipitation method. Nanocomposites were prepared with five different loadings ranging from 0.01 – 0.05 g of Fe-ZnO /Clay which were analysed before and after soil burial of 30 and 60 days. Nanoparticles as well as the prepared nanocomposites were undergone various chemical and physical investigations including X-ray Diffraction (XRD), Thermogravimetric Analysis (TGA), Scanning Electron Microscopy (SEM), energy-dispersive analysis (EDX), Fourier Transform Infrared (FTIR), Elongation and Tensile strength Test. The IR spectra show a change in the molecular groups of composites after 60 days of soil burial which indicated oxidative degradation in samples with high particle loading. Similarly, SEM image revealed nanoparticles with average particle size of 183nm uniformly distributed along the nanocomposite layer. It also indicated a significant variation in the physical structure of the films. EDX analysis revealed a change in the chemical composition of the sample with highest nanoparticle loading after 60 days of soil burial. Consequently, the decrease in elongation and tensile strength after soil burial reflected the breaking of polymer chain, reduction in molecular weight and the production of free radical ions. All these factors caused deterioration of mechanical properties. Overall, the nanocomposite films with highest nanoparticle loading shown improved biodegradation as compare to pristine polystyrene.

Keywords: Polystyrene, Nanoparticles, Biodegradation, Waste Management.

NANOTECHNOLOGY: NT-03

AN ENVIRONMENT FRIENDLY AND ENERGY EFFICIENT NANOTECHNOLOGY FOR THE TREATMENT OF SLAUGHTERHOUSE WASTEWATER

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ABSTRACT: The slaughterhouse industry is one of the water intensive sector and generates massive amount of highly polluted wastewater of environmental concerns. In this research the application of sunlight assisted photocatalytic oxidation process has been used to treat slaughterhouse wastewater by using mobilized titanium dioxide and silver doped titanium dioxide as a catalyst by following standard sol gel method. The operating parameters (catalyst dose, pH and exposure time) governed the efficiency of the process in terms of BOD, COD and nitrogen degradation. An increase in catalyst dose and exposure time increased the degradation of slaughterhouse wastewater. However, process efficiency was decreased with elevating the pH. At optimal process conditions (catalyst dose of 1.5 g/l; pH=3; UV exposure time= 120 min), 50.11% BOD, 40.083% COD, 37.405% nitrogen degradation was achieved with titanium dioxide. Doping with silver metal increased the photo-response of titanium dioxide by reducing its large bandgap from UV (300-400 nm) to visible region (400-700nm) of solar spectrum which remarkably enhanced the efficiency of the process and resulted in 85.16% BOD, 73.07% COD and 62.68% nitrogen degradation at catalyst dose of 1.5 g/l, pH 3 and sunlight exposure time of 90 min. Longer treatment time significantly reduced the process efficiency, thus BOD, COD and nitrogen removal approached to 82.01%, 69.07% and 60.27% respectively at 150 min of sunlight exposure time. The entire findings revealed that the application of photocatalysis proved to be highly efficient and effective for the treatment of slaughterhouse wastewater. In addition, it will reduce the load of pollutants on fresh water bodies and ground water.

Keywords: Wastewater Treatment; Nanotechnology; Titanium Dioxide

NANOTECHNOLOGY: NT-04

SYNTHESIS AND APPLICATION OF MAGNETIC POLYURETHANE NANOCOMPOSITES FOR THE REMOVAL OF CADMIUM AND LEAD FROM WATER

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ABSTRACT: Polyurethane is a synthetic material used for the concentration and removal of both organic and inorganic materials because of their high efficiency for sorption of various ionic and neutral materials. Polyurethane foam and iron oxide nanocomposite was successfully prepared via polymerization of toluene diisocyanate and polyethylene glycol 1000 in the presence of 1%wt of iron oxide nanoparticles and characterized by FTIR. Atomic absorption spectrometer (AAS) was used to measure the removal efficiency of nanocomposite foam. Batch adsorption method was used to check the effect of various parameters such as adsorbent dosage, contact time, pH, temperature, initial concentration of Cd(II) and Pb(II) from their aqueous solution using crosslinked polyurethane(CLPU) and magnetic crosslinked polyurethane (MCLPU). When 0.5g of CLPU was used to treat 50mL of 50mg/L Pb(II) solution at pH 5 and 60ºC for 60 minutes the removal percentage was 73.18% while with 0.4g of MCLPU adsorbent the removal percentage was 87.13% on same conditions. For the adsorption of Cd (II), 0.4g of CLPU used to treat 50mL of 50mg/L Cd(II) solution at pH 6 and 60ºC for 40 minutes the removal percentage was 77.26% while with MCLPU was 82.06%. The equilibrium adsorption data was checked for Freundlich and Langmuir isotherm. The experimental data of both Pb(II) and Cd(II) were best fitted on Langmuir isotherm for both adsorbents. The kinetic parameters of adsorption process were studied using pseudo first order and pseudo second order kinetic models. The data of both metals indicates that adsorption process followed the pseudo second order kinetics. This research work suggests MCLPU as an effective adsorbent for removal Pb(II) and Cd(II) from water.

Keywords: Cross linked, Magnetic, Nanocomposite, Polyurethane Foam, Adsorption

NANOTECHNOLOGY: NT-05

PLANT BASED SILVER NANOCOMPOSITES FOR WATER TREATMENT

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ABSTRACT: The use of plant waste material in the synthesis of nanocomposites is an efficient and inexpensive way of getting rid of the usage of expensive chemicals. Use of plant materials in the synthesis of plant based nanocomposites is due to the fact that it gives rise to ecofriendly methods that desist from the addition of toxic chemicals into the environment. The present research focused on the synthesis of silver nanocomposites using powdered material of different therapeutically reported plants and the study of their water decontamination potential. Characterization techniques of X-ray diffraction XRD and Fourier transform infrared spectroscopy FT-IR had been used for characterizing nanocomposites. Waste water treatment was performed for adsorptiove removal of chromium. Optimization of various parameters like, pH, adsorbent dose and time of contact was done. Isothermal kinetics and thermodynamical study revealed that removal of chromium using silver nanocomposite was thermodynamically feasible process, followed langmuir adsorption model and pseudo second order reaction kinetics.

Keywords: Nanocomposites, Langmuir Adsorption, FTIR

NANOTECHNOLOGY: NT-06

REMOVAL OF ANTHRACENE USING SOIL-ACTIVATED CARBON COMPOSITE ADSORBENT IN A COLUMN STUDY

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ABSTRACT: Anthracene, a polycyclic aromatic hydrocarbon is carcinogenic compound found in the environment which is toxic for aquatic environment as well as human beings by inhaling or eating contaminated food. Natural treatment is cost-effective and cheap technique to remove organic pollutants from water. This study is focused on removal of anthracene from canal water (Kotri Barrage) with the help of soil and GAC (Granular Activated Carbon) as well as to compare the removal efficiency. Three columns are being operated simultaneously having dimensions (L= 25cm, D= 2.5cm), and canal water was spiked with 100 ppm solution and pumped through columns in downward position. One column is filled with mixture of prepared GAC (native species of *Mucuna Mutisiana*) and soil. However, the second and third column is filled with only soil and granular activated carbon respectively. It was found that in biochar column, samples are collected at outflow of the column at 15 min, 30, 45, 60 and 120 mins at constant flow rate of 5 ml/min at two different bed heights (3cm and 5cm). Initial concentration and flow rate was optimized and two columns filled with (soil) and (soil with biochar) pressure increased up to 1.5 bar while in biochar column the pressure remained zero due to particle size of adsorbent (1-2mm) and subsequently analyzed by UV/Vis Spectrophotometer. Biochar column shows 91% removal efficiency due to higher active sites. Moreover, in second column (only soil) and third column (soil and biochar) samples were collected in every hour which depicts 80 and 85% removal efficiency respectively and remediating canal water contaminated with polycyclic aromatic hydrocarbons (PAHs). Anthracene poses high risks to aquatic species and human health, hence must be eradicated from the environment and both biochar and soil are cheap, reliable and effective adsorbents removing polycyclic aromatic compounds. Moreover, no toxic chemicals were used in activation of it, therefore, can be used effectively for purification of water.

Keywords: PAHs, surface water, natural adsorbents, column study, water quality

NANOTECHNOLOGY: NT-07

APPLICATION OF TITANIA NANOPARTICLES TO STUDY THE NUTRIENTS MOBILIZATION AND GROWTH RESPONSE IN *ORYZA SATIVA*

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ABSTRACT: Due to the potential applications, nanotechnology is considered among the most important technological advancements for agricultural production. The study was conducted to determine the growth response and nutrient mobilization in *Oryza sativa* (rice) in response to the titania nanoparticles (TiO_2 NPs). The experiment was based on hydroponics to study the morphological parameters including root, shoot length and plant biomass. TiO_2 NPs were prepared through liquid impregnation method and optimized dosage of 100, 200, 300, 400, and 500 mg/L NPs was applied in five replicates. Maximum plant height was observed in 500 mg/L NPs treatment. Results showed that the pH and electrical conductivity of hoagland nutrient solution continuously decreased throughout the duration of experiment. Significant increase in the uptake of nitrogen and phosphorus was observed with increase in NPs concentration, whereas the potassium uptake was highest in a treatment with 500 mg NPs/L application. The chlorophyll content was highest in control followed by the treatment containing 400 mg NPs/L. Maximum percentage of carbohydrates was found as 23.03% per 100 mg of sample in a treatment with maximum amount of NPs. This study forms a baseline to further investigate the toxic effects of TiO_2 NPs and stress response mechanism of rice in hydroponics.

Keywords: Titania Nanoparticles, Nutrient Analysis, Plant Growth

NANOTECHNOLOGY: NT-08

COLLOIDAL STABILITY EVALUATION OF GOLD NANOPARTICLES SYNTHESIZED THROUGH AQUEOUS AND IONIC LIQUID ASSISTED OIL PALM LEAVES EXTRACT

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ABSTRACT: Gold nanoparticles (AuNPs) are extremely beneficial due to their manifold applications in environmental science, catalysis, medical and electronics. However, to apply these resourcefully, it is quite challenging to prepare those nanoparticles which are impressively resistant toward aggregation and retain their inventive properties in colloidal form. Therefore, present work was performed to synthesize AuNPs using aqueous and ionic liquid (IL) assisted extracts of oil palm leaves (OPL). The characterization of AuNPs was performed using UV-vis spectroscopy, Dynamic light scattering (DLS) and Transmission Electron Microscope (TEM). UV-vis spectra of prepared AuNPs using both IL and aqueous extracts showed strong characteristics surface plasmon resonance (SPR) peaks in the range of 525- 550 nm that confirmed the occurrence of bio-reduction reaction and effective formation of nanoparticles. To access the colloidal stability of AuNPs, prepared samples were periodically monitored for 5 weeks to observe any variation in absorbance, mean position of SPR peaks, particle size and zeta potential. Results revealed that AuNPs were highly stable with insignificant changes in these parameters from their initial values. However, colloidal stability of AuNPs was even better when IL assisted OPL extract was used to execute the bio-reduction reaction in comparison with aqueous extract. For that reason, it is established that aqueous and IL assisted OPL extracts is a simple, eco-friendly and sustainable approach to synthesize AuNPs with enhanced colloidal stability.

Keywords: Gold Nanoparticles; Oil Palm; Collidal Stability; Absorbance; Hydrodynamic Size; Ionic Liquids

NANOTECHNOLOGY: NT-09

SYNTHESIS OF ZINC OXIDE NANOPARTICLES AND THEIR FUNCTIONALIZATION WITH CHRYSIN: EXPLORATION OF ITS APPLICATIONS

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ABSTRACT: Metal oxide nanoparticles have a variety of applications in every field. Due to the increase in usage of nanomaterial due to enhance its catalytic efficiency and green environmental impact. Zinc oxide NPs have been synthesized by the most economical and easy chemical precipitation method. The structural properties were determined using XRD, FT-IR, SEM and EDX. Synthesized zinc oxide nanoparticles were further functionalized with an active flavone chrysin and characterized again for the change in structure and activity. A colorimetric sensor was developed by zinc oxide nanoparticles functionalized with chrysin (ZnO-ChR NPs) for detection of humic acid (HuA) based on changing in absorbance resulting from the color of solution change from yellow to white. The activity of ZnO-ChR NPs as a rapid colorimetric sensor was sufficient for detecting the biomass in soil and fertilizer content can be determined in the future.

Keywords: Zinc oxide, Green Synthesis, Nanoparticles, Chrysin, Humic acid, Sensor, Biomass.

NANOTECHNOLOGY: NT-10

PHOTOSENSITIZATION OF TiO_2 NANOFIBERS BY Ag_2S WITH THE SYNERGISTIC EFFECT OF EXCESS SURFACE Ti^{3+} STATES FOR ENHANCED PHOTOCATALYTIC ACTIVITY UNDER SIMULATED SUNLIGHT

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ABSTRACT: TiO_2 nanofibers, with mean diameter ~200 nm, were fabricated by electrospinning and successfully photosensitized with low bandgap Ag_2S nanoparticles of 11, 17, 23 and 40 nm mean sizes, with corresponding loading of 4, 10, 18 and 29 wt.% Ag_2S, respectively. 17 nm Ag_2S/TiO_2 nanofibers exhibited optimal activity in the photodegradation of methylene blue under simulated sunlight with pseudo-first order rate constant of 0.019 min^{-1} compared to 0.009 min^{-1} for pure TiO_2 nanofibers. In spite of greater visible-light absorption and reduced bandgap, larger than 17 nm Ag_2S nanoparticles exhibited sluggish photodegradation kinetics probably due to less photo-induced carriers generation in TiO_2 and reduced electron injection rates from the larger sized Ag_2S into TiO_2. Furthermore, a UV-O_3 surface treatment induced excess Ti^{3+} surface states and oxygen vacancies which synergistically enhanced the photodegradation rate constant to 0.030 min^{-1} for 17 nm Ag_2S/TiO_2 sample which is ~70% better than the previously reported for Ag_2S/TiO_2 hierarchical spheres. This was attributed to the efficient charge separation and transfer driven by increased visible-light absorption, bandgap narrowing and reduced electron-hole recombination rates. The present study demonstrates the potential utilization of Ag_2S/TiO_2nanofibers in filtration membranes for removal of organic pollutants from wastewater.

Keywords: Titania, Nanofibers, Electrospinning, Waste water Treatment

NANOTECHNOLOGY: NT-11

EFFICACY OF IRON OXIDE NANOPARTICLES FOLIAR APPLICATION ON WHEAT GROWN IN AGED CD CONTAMINATED SOIL UNDER TWO MOISTURE LEVELS

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ABSTRACT: Cadmium (Cd) has been considered as toxic heavy metal for plants and humans as well, but very limited data is available about the foliar application of iron nanoparticles (Fe NPs) to remediate the Cd contamination under different moisture levels in wheat (*Triticum aestivum L.)*. The purpose of this study was to determine the effects of foliar application of Fe NPs on growth rate, photosynthetic activities, Cd accumulation, antioxidant enzymes activities and yield of wheat with or without drought stress. The wheat was grown in Cd stressed soil at the rate of 25, 50 and 100mg/L of Fe NPs alone or combined with drought stress. The results revealed that the foliar spray of Fe NPs considerably enhanced the growth, physiology, and production of plant and reduced the Cd accumulation in aboveground biomass. The best results were obtained when Fe NPs applied in the highest concentration of 100 mg/L in normal moisture conditions. The least outcomes were observed in control treatment (0 mg/L) in limited water conditions. Foliar application of Fe NPs diminished the electrolyte leakage, hydrogen peroxide and malondialdehyde concentration whereas superoxide dismutase and peroxidase activities were increased significantly in wheat shoots than control. It was concluded that foliar application of Fe NPs is an efficient way to improve crop quality and production in Cd contaminated soil.

Keywords: Cadmium, iron**,** antioxidant enzymes activities, foliar application, malondialdehyde

NANOTECHNOLOGY: NT-12

SYNTHESIS OF ND-SUBSTITUTED $LA_2SN_2O_7$ PYROCHLORES NANOPARTICLES

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ABSTRACT: Pyrochlore structures show intensive potential in practical applications due to their structural stability along with their tunable lattice parameters. So, in this work, nanoparticles of neodymium substituted lanthanum stannate pyrochlores with compositional formula, $La_{2-x}Nd_xSn_2O_7$ (x = 0.0, 0.4, 0.8, 1.2, 1.6 and 2.0) was synthesized by cost effective sol-gel auto combustion method. The structural analysis confirmed the stable cubic pyrochlore phase with space group *Fd3m.* Field emission scanning electron microscope was used for morphological analysis of the sample which determined the size and shape of the grains in samples, which confirmed the synthesis of nanoparticles. Energy dispersive X-ray spectroscopy confirmed the stoichiometric compositions of the prepared series.

Keywords: X-ray spectroscopy, pyrochlore, mospholoigcal analysis and synthesis

NANOTECHNOLOGY: NT-13

ETHYLENE GLYCOL ASSISTED 3D FLORAL EVOLUTION OF $BIFEO_3$-BASED NANOSTRUCTURES

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ABSTRACT: Controlled growth of nanostructures plays a vital role in tuning the physical and chemical properties of functional materials for advanced energy and memory storage devices. Herein, we synthesized hierarchical micro-sized flowers, built by the self-assembly of highly crystalline, 2-dimensional nanoplates of Co and Ni doped $BiFeO_3$, using a simple ethylene glycol mediated solvothermal method. Pure $BiFeO_3$ attained scattered one-dimensional nanorods-type morphology having diameter nearly 60 nm. Co-doping of Co and Ni at Fe-site in $BiFeO_3$ does not destabilize the morphology; rather it generates 3-dimensinal floral patterns of self-assembled nanoplates. Unsaturated polarization loops obtained for $BiFeO_3$ confirmed the leakage behavior of these hexagonal perovskites. These loops were then utilized to determine the energy density of the $BiFeO_3$ perovskites.

ENVIRONMENTAL TOXICOLOGY: ET-01

MULTIPLE STRESSORS AND POLLUTANT EXPOSURE IN BIRDS

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ABSTRACT: Humans and wildlife are continuously exposed to complex cocktails of persistent legacy chemicals and new/emerging chemicals that contaminate the environment. Knowledge on effects and impacts of chemical mixtures on natural ecosystems is particularly necessary for the applied use of policy instruments. In addition, wildlife populations are exposed to both chemical mixtures and multiple environmental stressors in their environment, including habitat degradation, disturbance, climate change and emerging diseases. In this keynote lecture, I will focus on the use of birds to study these multiple stressors in a natural environment and under controlled exposure scenarios. The use of birds in ecotoxicology studies has a long history and monitoring activities and research programs are widely spread around the globe. The use of birds of prey is especially advantageous because of their high trophic position and thus biomagnification of many contaminants. These species have, in general, shown to be quite sensitive to environmental disturbances and are therefore interesting to study the effects of multiple stressors and environmental interactions.

In the international project NewRaptor (2014-2018) we have looked at emerging and legacy contaminants in birds of prey over a north-south gradient (from northern Norway to southern Spain). The influence of latitude, urbanization and agriculture land use on exposure patterns has been investigated. In addition, the analysis of stable isotopes of nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) was performed to further explain variation in exposure due to differences in diet and feeding area. In addition, quails and chickens have been used as model species for mixture exposure scenarios under controlled conditions. This has given interesting insights of the toxicity of emerging contaminants versus legacy contaminants. In August 2020, we will embark on a new international project "Pollution in the coastal wetlands of East Asia: cascading effects from littoral macroinvertebrates to migrating shorebirds" in collaboration with Prof. Klaassen (Deakin University, Australia). Our research will focus on the roles of pollution and disease in population declines of migrating shorebirds along the East Asian-Australasian Flyway. This project will build for a large part on previous work that has been carried out in my lab regarding interactions of pollutants and infectious disease exposure by my former post doc, now Assoc. Prof., Courtney Waugh (Nord University, Norway). Some highlights of this work will be presented as well as future plans to be carried out within the project.

Keywords: Exposure, POPs, Biomagnification, Stable Isotops

ENVIRONMENTAL TOXICOLOGY: ET-02

SEDIMENT CORE AS "END POINTS" FOR POPS ENRICHMENT IN LIMNIC SYSTEM

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ABSTRACT: Aquatic systems are considered as final reservoirs or sinks of Persistent organic pollutants (POPs) and inland waters such as lakes are very important integrators of terrestrial and atmospheric processes related to transport and deposition of POPs. In water body fate and distribution of POPs is defined by process occurring between water, sediments and biota. Due to hydrophobicity, POPs are not readily soluble in water and are preferentially partitioned into organic matter and lipid of sediments and fish respectively. In limnic system sediments are considered as end points for accumulation of POPs. Studies published during 2000-2019 on POPs (OCPs, PCBs, PBDEs) in sediment core from three different type of inland lakes i.e., glacial, remote/mountainous and urban lakes are reviewed. Though imposition of ban on production and usage of POPs has been placed around three to four decades ago but their concentrations remain high in environment due to illegal use, re-release from soils and glaciers, runoff and atmospheric deposition. These re-emissions are very significant and are considered as secondary source of POPs. Analyses of POPs in dated sediment cores enables the estimation of temporal trends of POPs. Dated sediment cores reveals the sources and local history about use and production of POPs. Emissions of POPs from local sources, ban on their production and re-emissions from secondary sources are reflected in level of POPs during different time period. Persistency and bio-accumulative potential of POPs are responsible for lethal diseases and environmental problems due to which these group of chemicals are termed as silent killer. The profiles and trend of organic contaminants in sediment can use to examine pollution mechanisms and local pollution history of POPs which are significant for predicting future pollution tendencies and assessing potential environmental risks.

Keywords: Limnic System, Persistent Organic Pollutants, Sediment Core, Glacial, Urban and Remote Lakes, Historic Deposition.

ENVIRONMENTAL TOXICOLOGY: ET-03

HEAVY METAL TOXICITY IN COMMERCIALLY IMPORTANT FISHES OF MANGLA DAM, AJK

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ABSTRACT: Mangla dam being the largest water reservoir of Pakistan covers the range of activities associated with its water as its water is used for land irrigation, industrial activities, agriculture, electric power generation, commercial fisheries and drinking. The Objective of this research was to determine the heavy metal concentration in vital organs of commercially important fishes of Mangla dam. The reserviour is home to 52 reported species that are supplied across the country and have significant impact on human health. Samples of six commercially important fishes Singhara (*Sperata seenghala*), Mali (*Wallagu attu*), Thella (*Catla catla*), Mori (*Cirrhinus cirrhosis*), Silver Carp (*Hypophthalmichthys molitrix*) and Gulfam (*Cyprinus carpio*) were collected from five different pockets of Mangla dam. To mineralize the oven dried powdered samples of dissected fish organs, an optimal digestion procedure requiring 6.0 mL perchloric acid, 2.0 mL nitric acid and 4.0 mL hydrogen peroxide was adopted. Flame Atomic absorption spectroscopy (FAAS) technique was used to analyze the presence of selected heavy metals in fish organs with their respective concentrations. Significant variation in heavy metal concentrations was observed at α=0.05 depending on fish species and organ studied with the help of statistical ANOVA. The mean heavy metal concentration was found as: Cu (22.39 mg/l), Cd (67.7 mg/l), Cr (5.86 mg/l) and Pb (9.33 mg/l). The average concentration of Cu in scales, gills, liver, and flesh of selected fish species came out to be 13.24 mg/l, 12.3 mg/l, 15.41mg/l, 13.86 respectively. Whereas the average concentration of other heavy metals in respective organs were in the following order: Cd (13.86 mg/l, 15.17 mg/l, 13.62 mg/l, 13.90 mg/l), Cr (9.25 mg/l, 10.4 mg/l, 9.29mg/l, 6.02 mg/l), Pb (10.14 mg/l, 10.06 mg/l, 5.90 mg/l, 6.02 mg/l) which shows that all concentrations were above the permissible limits as prescribed by the WHO. The high metal concentrations in edible fish pose serious threat to human population as they make up a major part of human dietary requirement. To minimize the health risks associated with heavy metals mitigatory measures should be taken.

Keywords: Heavy Metals, FAAS, Organs, Fish, Concentrations, Toxicity

ENVIRONMENTAL TOXICOLOGY: ET-04

EXPOSURE OF TOXIC TRACE METALS IN AQUATIC AND TERRESTRIAL BIRDS OF PAKISTAN

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ABSTRACT: To date, increasing concentration of trace metals in the environment and their subsequent health effects in living organisms has become a major threat. Therefore, present study was designed to investigate the concentration of trace metals such as Lead (Pb), Cadmium (Cd), Chromium (Cr) and Copper (Cu) in liver, pectoral muscle, pelvic muscle and blood of two terrestrial (Bank Myna; *Acridotheres ginginianus* and Jungle Babbler; *Turdoides striata*) and two aquatic (Grey Heron; *Ardea cinerea* and Cattle Egret; *Bubulcus ibis*) bird species collected from the premises of Lahore, Pakistan. The detection frequency of trace metals in collected samples were highest in Cd followed by Pb, Cr and Cu. In general, the concentrations of metals were highest in liver followed by pectoral muscle, pelvic muscle and blood. In general, the mean concentration (µg/g) of trace metals were higher in aquatic species compared to terrestrial species. Concentration of metals varied significantly ($P<0.05$) among organs however no significant difference ($P>0.05$) was observed among species except Cu ($P<0.05$). Further, no significant difference ($P>0.05$) of metals was observed between feeding guilds and habitat of the species. The increasing concentration of toxic trace metals in the birds reflects deteriorating environmental health as a result of greater metals exposure which must be reduced through proper legislation and strict implementation of laws.

Keywords: Toxic trace metals, Bioaccumulation, Bio-indicator, Pakistan, Bird

ENVIRONMENTAL TOXICOLOGY: ET-05

INVESTIGATION OF TOXICOLOGICAL IMPACTS OF CHLORPYRIFOS INSECTICIDE ON COLD WATER FISH *ONCORHYNCHUS MYKISS* IN OUTDOOR TEST SYSTEMS

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ABSTRACT: The intensive applications of chlorpyrifos (CPF) in agricultural production has resulted in deleterious effects on the environment, particularly on aquatic fauna. However, its impacts on cold water fish rainbow trout *(Oncorhynchus mykiss)* in their native habitat are scarcely known. Thus, present study was aimed to evaluate the responses of hematological parameters and antioxidant enzymes (superoxide dismutase and catalase), acetyl cholinesterase enzyme (AChE) inhibition, and histopathological alterations in liver and gill tissues of rainbow trout, when exposed to CPF. In total, 240 fingerlings were subjected to various CPF concentrations (2, 4 and 6 µg/L) for 24, 48, 72 and 96 hours (acute toxicity test) and 7, 14 and 21 days (sub-lethal toxicity test). Results revealed that increasing CPF concentration and exposure time has resulted in reduced erythrocyte count, hemoglobin concentration and hematocrit level, however, leukocyte count was increased. Additionally, decrease in AChE activity was also observed with increasing concentration. CPF concentrations at lowest exposure duration (7 days) induced slight increase of SOD and CAT activity while, the high exposure duration (14 and 21 days) exhausted the activity of antioxidant enzymes. Structural damages produced by CPF in liver tissues were; hyperemia, dilated central veins, sinusoids and degenerative changes, while the lesions observed in gill tissue were; curling of secondary lamella, cell degeneration, cell necrosis, narrowing of water channels, hyperplasia, oedematous changes, fusion of secondary lamella and sloughing. This investigation can provide insights to monitor CPF contaminated water, and toxicity assessment of aquatic fauna in their native habitat.

Keywords: Chlorpyrifos, *Oncorhynchus mykiss*, Antioxidant enzymes, Acetylcholine esterase, Hematological Parameters, Histopathology

ENVIRONMENTAL TOXICOLOGY: ET-06

ASSESSMENT OF ACUTE AND SUB-ACUTE TOXICITY OF LAMBDA CYHALOTHRIN ON GRASS CARP *(CTENOPHARYNGODON IDELLA)*

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ABSTRACT: Agricultural runoff and industrial effluents are directly contributing to surface water contamination. Pesticides that come from these sources are highly toxic for aquatic biota, causing life threat to fish and other organisms. Toxicity of pesticides might vary with the change in temperature. In case of lambda cyhalothrin pesticide, toxicity decreases with lowering temperature. The main objective of this study was to monitor change in LD_{50} of lambda cyhalothrin for fish with varying temperatures, as temperature influences toxicity of lambda cyhalothrin and assess the effects of pesticide on fish with the help of different biomarkers. Grass carp was selected as model organism for this study and acclimatized for the period of two weeks. 6 different glass aquaria were used. Each aquarium contained 8 fishes in 50 L water, and were not fed during 96-hour experiment according to OECD guidelines. Different doses of subject pesticide were applied to fish in order to check Lethal dose-50 (LD-50) at two different temperatures. Doses were applied between the range of 0.001µg/L to 4 µg/L. The results shown LD_{50} at 27ºC and 13ºC was 1.17µg/L and 1.5µg/L respectively. Different effects of subject pesticide on fish blood and tissues were also studied for sub-acute toxicity test. Results showed that blood protein and glucose levels increased with dose and time after 24 hours to 72 hours and decrease at 96 hours. There was significant difference (P<0.05) reported in values of experimental and control group. Triglycerides also showed some fluctuation with increasing time and dose concentration while ALT level increased with concentration and exposure time due to abnormal hepatic functions. Experimental values were significantly different (P< 0.05) than the control group. Oxidative stress on brain and gills was significantly higher (P< 0.05) in experimental group. Respiratory burst activity of dosed fish also had increasing trend with increased dose and prolonged exposure time as resulted values were significantly higher (P< 0.05) than control.

Keywords: LD-50, Lambda cyhalothrin, oxidative stress, pesticide toxicity, Biomarkers, respiratory burst

ENVIRONMENTAL TOXICOLOGY: ET-07

DETERMINATION OF AFLATOXIN CONTAMINATION IN BASMATI WHITE RICE SAMPLES COLLECTED FROM LOCAL SHOPS OF LAHORE, PAKISTAN

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ABSTRACT: Aflatoxins are the secondary metabolites produced from different fungal species i.e. *Aspergillus flavus* and *Aspergillus parasiticus.* These are carcinogenic substances which may contaminate food before harvesting and after harvesting of crop. The critical assessment of aflatoxin contamination in basmati white rice samples was done by enzyme linked immune-sorbent assay (ELISA) method. 50 basmati white rice samples were collected from local shops of Lahore, Pakistan. 25 samples were collected during summer (April-September) and 25 in winter (October-March) seasons. The results showed a miserable condition of the basmati white rice which is being available in local shops of Lahore. Overall 84% and 76% basmati white rice samples collected in summer and winter were found contaminated with aflatoxins respectively. In contaminated samples 44% in summer and 24% in winter were found beyond acceptable levels. Maximum contamination of aflatoxin i.e. 17.73±0.06 µg/kg was found in sample collected in summer which is beyond permissible limits of European Union i.e. 4 µg/kg (for total aflatoxins). The supply of white basmati rice in Lahore, Pakistan is alarmingly dreadful for human health as aflatoxin may cause cancer when exceeds from permitted levels. In order to improve the quality of food entities especially rice, effective management policies like quality assurance, monitoring, quality control, risk management and continual improvements should be ensured in entire scenario.

Keywords: Aflatoxin, ELISA, Basmati, White Rice, Quality Assurance

ENVIRONMENTAL TOXICOLOGY: ET-08

ANALYSIS OF VARIOUS HEAVY METALS IN WHEAT GRAINS, WHEAT FLOUR AND DUST COLLECTED FROM VARIOUS FLOUR MILLING SHOPS OF LAHORE, PAKISTAN

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ABSTRACT: Heavy metals are natural elements in the lithosphere which enter human food through industrial activities, or by agricultural practices such as the application of fertilizers and pesticides. Heavy metals are the root cause of various problems in human body. Loss of bones, kidneys damage, vascular disorders, developmental abnormalities and cancer are some of the well-known health problems associated with the heavy metals contamination. The present study was conducted to determine heavy metals (copper, cadmium, chromium and lead) concentration in a total of eighteen samples of wheat flours, wheat grains and wheat flour dust samples collected from five towns of Lahore viz; Yateem Khana, Samanabad, Chauburgi, Johar Town and Sodiwal Quarters over a period of two weeks. Atomic Adsorption Spectrophotometers (AAS) is used to analyze heavy metals from samples. Chromium was found to be the highest among all heavy metals in all the samples. Fifty percent of the samples exhibited high concentration of heavy metals, exceeding WHO/FAO permissible levels. Highest concentration of copper was observed for sample 10 of wheat flour dust (0.144 ppm); highest mean concentration of chromium was reported for sample 11, wheat flour dust (3.968 ppm), for which cadmium concentration was highest in the sample 2, wheat flour (0.329 ppm). Overall, average concentration of chromium was highest amongst all the analyzed heavy metals (3.49 ppm). Possible causes of chromium in wheat grains, wheat flour, and grain milling dust are the anthropogenic sources such as use of agrochemicals and industrial discharges. This study emphasizes that an assessment of food quality in terms of heavy metals, and regulation of agrochemical use is the need of time and it is only possible solutionwith an extensive monitoring and quality control procedures.

Keywords: Agrochemicals, Cereal Grains, Flour Dust, Grains, Heavy Metals.

ENVIRONMENTAL TOXICOLOGY: ET-09

IMPACT OF OCHRATOXIN-A ON FOOD SAFETY: A CASE STUDY OF MAIZE

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ABSTRACT: Food security and food safety are major concerns of the world and later one is more controversial due to presence of different types of contaminants that poses health hazards. The presence of mycoatoxins is considered to be the trade barrier in WTO regime due to deleterious nature. Aflatoxin (AF) and Ochratoxin-A (OTA), which are common in legumes and cereals. They are known to be carcinogenic, hepatotoxic, nephrotoxic, genotoxic, teratogenic and or immunosuppressive. Information about food-borne mycotoxins is far from complete, but enough is known to identify them as a serious problem in many parts of the world, not only in terms of health problems associated with them, but they equally cause significant economic losses. Maize is very much susceptible to fungal attack during growth stages, post-harvest, transport and even storage. Consumption of foodstuffs contaminated with mycotoxins can cause serious health complications in humans and animals. Information about food-borne mycotoxins is far from complete, but enough is known to identify them as a serious problem in many parts of the world, not only in terms of health problems associated with them, but they equally cause significant economic losses. Ochratoxin-A (OTA) is a mycotoxin produced by certain fungal species of the genera *Aspergillus* and *Penicillium* including P. *verrucosum*, A. *niger*, A. *carbonarius*, and A. *ochraceus*; across a large range of climates in multiple foodstuffs. Maize crop in tropical and sub-tropical areas is more susceptible for fungal attack due to high humidity and temperature in the environment. Maize varieties (Syngenta 6621, Ayub 4/28, Pioneer, Ayub 1/26, Ayub 5/31, Ayub 3/27 & Ayub 2/27) were grown at NIAB Farm and evaluated for the presence of OTA. OTA was determined by HPLC-RP in isocratic mode using Florescence detector (333, 470 nm). Maximum concentration of OTA was detected in Ayub 2/27 (218.25 µg/kg) whereas minimum in Pioneer (2.53 µg/kg). OTA was not detected in Ayub 1/26 and Ayub 3/27 respectively. European Union has established tolerable limit for OTA in maize 5 µg/kg and has classified OTA as a Group 2B human carcinogen by the International Agency for Research on Cancer (IARC) report 2015.

Keywords: Cereal, Mycotoxin, OTA, HPLC-RP, Tolerable limit, IARC

ENVIRONMENTAL TOXICOLOGY: ET-10

AFLATOXIN DETERMINATION AND PROXIMATE ANALYSIS OF SELECTIVE PROCESSED FOOD: BISCUIT, FRUIT CAKES AND NOODLES SAMPLES IN LAHORE, PAKISTAN

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ABSTRACT: Food safety and security is one of the biggest challenges among developed and developing countries of the world. The essential element for food security is improving food safety, which ensures when sufficient and healthy food is available to every individual. Baked goods such as biscuits, cakes and noodles are consumed by almost all age group individual. In order to ensure the safety of these food products the occurrence of aflatoxin and proximate composition of the selective samples were determined in this study. Methods used for this study was TLC (thin layer chromatography) for aflatoxin determination and standard method of the AOAC (Association of Analytical chemist) for the proximate composition of selective baked products. Total 60 samples (20 biscuits, 20 cakes, 20 noodles) of two different categories (packed or unpacked) were collected from different Areas of Lahore. % age of moisture, Ash content, crude fiber, crude fat, and crude protein for all the samples were determined and correlation of aflatoxins with each factor further analyze at ($p<0.05$) for significance. About 31.6% of total sample (19 samples) which includes 10% biscuit, 8.3% cakes and 13.3%. Noodles showed positive results for aflatoxin contamination. 89.4% of the contaminated samples were within the permissible limit except 2 samples (10.5%) showed results beyond permissible limit according to the European Union Regulation of 2010. These are one of the most toxic mycotoxin because they are carcinogenic, mutagenic, teratogenic and immunosuppressive in nature. According to IACR they are listed as group 1 carcinogens. The results provide a baseline information about presence of aflatoxins in processed food.

Keywords: Aflatoxin Contamination, Proximate Composition, TLC Method, Baked Items

ENVIRONMENTAL TOXICOLOGY: ET-11

PERFLUOROALKYL ACIDS: EMERGING POLLUTANTS IN THE ENVIRONMENT

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ABSTRACT: Perfluoroalkyl acids (PFAAS) are categorized as emerging contaminants because the information about their persistence, omnipresence, and toxic effects is available only since the last 15 years due to continuous improvement of liquid chromatography-tandem mass spectrometry ($LC–MS^2$) that is capable of quantifying these persistent organic pollutants in various matrices at trace levels. However, it would be better if another method could crosscheck LC measurements to avoid uncertainties due to background contamination. In the present study, therefore, both gas chromatography-mass spectrometry (GC–MS) and $LC–MS^2$ methods were developed for the determination of PFAAs in aqueous samples (Shafique et al., 2017c). A continuous monitoring of the aquatic environment is important for controlling and managing the transport of PFAAs and associated risks to human health and environment. One part of this work, therefore, described the sampling and analysis of water and sediment samples collected from different locations (mainly from the river Saale, and additionally a few samples from the Elbe, Pleiße, Weiße Elster flowing through Germany, and from the river Sosiani of Kenya). To our best knowledge, limited information was available regarding the concentration levels of PFAAs at the studied locations. Since PFAAs are non-biodegradable and usually have low vapor pressure, sorption in sediments plays a crucial role in determining their fate and transport behavior in the aquatic environment.

Keywords: Perfluoroalkyl Substances, Emerging Pollutants, GC-MS, LC-MS/MS, Sorption in Sediments.

ENVIRONMENTAL TOXICOLOGY: ET-12

AMMONIUM TOXICITY INHIBITS ROOT GROWTH OF LETTUCE IN HYDROPONIC UNDER CONTROLLED ENVIRONMENTAL CONDITIONS

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ABSTRACT: Ammonium (NH4+) toxicity is a significant ecological and agricultural issue, and an important phenomenon in crop production. NH4 + is a preferred nitrogen (N) source for many plant species and is a fundamental substrate for amino acid and protein synthesis in all living organisms, but it becomes toxic to cells when present in excess. In the present study, mineral nutrient solutions with different NH4 + concentrations were used to evaluate growth, yield and bioactive properties and composition of lettuce varieties. Experimental treatments were: 1) Dairy digestate (DD), 2) DD 50% + standard nutrient solution (NS) 50%, 3) standard nutrient solution and two lettuce varieties. DD (high in NH4 + conc.) significantly reduced crop growth and yield, however, enhanced phenolic, total antioxidants, vitamin B and flavonoids compared to standard nutrient solution (modified Hoagland solution). Newham produced higher leaf area and yield compared to Romaine. We observed significant reduction in lettuce root growth in DD and higher root morphological traits grown in NS. Presence of high NH4 + concentration in DD showed toxic effects that inhibited root growth of lettuce whereas, NS produced healthy roots with normal root morphological traits.

PLASTIC POLLUTION: PP-01

SURVEILLANCE OF PLASTIC POLLUTION ON ECOLOGICAL INTEGRITY OF RIVER RAVI AND RIVER CHENAB, PAKISTAN

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ABSTRACTL: Plastics are one of the most commonly used materials and a continuous rise can be observed in their production and consumption across the globe. Excessive and unwise use of plastic products and improper disposal of plastic waste is also prevalent in Pakistan. Many toxicological effects have been observed in different terrestrial and aquatic species either from the ingestion of plastics or due to leaching of plastic additives (e.g. BPA and phthalates). Micro-plastics (MPs) are the smaller plastic particles (< 5mm), generated intentionally (primary) or from the disintegration of plastic waste (secondary), that further enhance the ecological toxicity of plastic polymers. Due to ubiquitous presence of MPs in different environmental matrices, large surface area and affinity to bind with different environmental pollutants (e.g. PCBs, dioxins and pesticides), these particles serve as a carrier for different pollutants, thus enhance the toxicological effects. Keeping in view the global scenario of plastic pollution issue, the current study was designed to evaluate the occurrence and prevalence of MPs in freshwater ecosystems of Pakistan. Prime objectives of the study include quantification of MPs in water, sediments and fish from the Ravi and River Chenab (tributaries of Indus River) on seasonal basis. Initial results showed the presence of MPs in all the selected matrices. MPs level was high in River Ravi as compared to River Chenab. Pollution levels on the sampling sites located near Shahdra and Chung on River Ravi and Head Marala on River Chenab were high among the sites selected across these rivers. Fibers were the most abundant type of MPs, followed by fragments, films, foam and beads. Further investigations are still in progress and expected to produce a significant baseline data which will help authorities to devise efficient waste management strategies. Scientific community should conduct further comprehensive studies on the subject to analyze MPs level in various compartments and their health impacts on biodiversity. Government agencies and stakeholders should take concrete measures to ensure proper waste management and public awareness in order to eradicate plastic pollution, especially from the single-use plastics.

Keywords: Micro-Plastics, Plastic pollution, Freshwater, Riverine Ecosystem

PLASTIC POLLUTION: PP-02

ECOTOXICOLOGICAL ASSESSMENT OF BISPHENOL A (BPA) IN SOIL USING NATIVE SPECIES OF EARTHWORM

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ABSTRACT: Bisphenol A (BPA) is an artificial pollutant and a stern threat to soil ecosystems, used in the production of daily use polycarbonate plastics. Due to its high production and use, the compound has taken place in the soil, as revealed by literature. Owing to its estrogenic properties, the compound is characterized as toxic to the living organism and may affect the soil inhabitants. Hence, to assess the toxicity of Bisphenol A in the soil, we used a common soil inhabitant (i.e. earthworms) as a model organism. Because of their sensitivity to contaminants in soil, they are considered as excellent bioindicators. Earthworms were exposed to different concentrations (0mg/Kg, 1.5mg/Kg, 6mg/Kg, 12mg/Kg, 17.5mg/Kg and 50mg/Kg) of BPA for 15 days in soil. After 15 days of exposure, the lethality was checked. There found no dead earthworms. Physiological and histological analyses of the exposed earthworm revealed apparent changes with increased dosage of BPA. For determination of biochemical changes, oxidative stress markers (MDA, H_2O_2) and antioxidants enzymes (SOD, POD, CAT) were determined. An increased in the oxidative stress markers and antioxidants enzymes contents were found with increased concentration of Bisphenol A. Overall, the toxicity assessment indicated that the high sensitivity of earthworms to BPA and the oxidative stress markers and antioxidants enzymes can be used as biomarkers for the toxicological assessment of BPA using earthworms as stress indicators.

Keywords: Bisphenol A; *Eisenia Fetida*; Toxicity Test; Oxidative Stress; Antioxidants Enzymes; Histopathology

PLASTIC POLLUTION: PP-03

ASSESSMENT OF MICROPLASTIC POLLUTION IN WATER, SEDIMENTS AND FISHES COLLECTED FROM BALLOKI BARRAGE, RIVER RAVI

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ABSTRACT: Plastic products are produced in large number all over the world because of its versatile properties. Plastic breakdown into microplastics having size less than 5mm. These microplastics make their way towards waterbodies and its pollution in freshwater ecosystem is growing concern all over the world. Rivers are the freshwater bodies and directly receiving MPs from the catchment. The Ravi River receives MPs through sewage drains originating from different cities like Lahore, Sheikhupura, Gujranwala etc. This continuous discharge of MPs is degrading the river ecosystem. The present study was designed to analyse the MPs in water, sediment and fish samples collected from Balloki Barrage, Lahore. Samples were digested followed by extraction of MPs using density separator. Stereomicroscopic observation of these samples showed that microplastics were found in all the samples. Average number of MPs in water, sediments and fish samples were 183 MP/L, 278 MP/ kg and 33 MP/ individual respectively. Fibers were abundant in all the samples followed by fragments and sheets. Further, research needed to confirm the presence of MPs in different environmental media. People in the catchment areas should minimize the use of plastic and educate the people about the harmful impacts of plastics on human health as well as on environment.

Kewords: Baluki Barrage, Microplastics, Plastic pollution, River Ravi

PLASTIC POLLUTION: PP-04

PREVALENCE OF BISPHENOL A IN DAIRY PRODUCTS CONSUMED IN PUNJAB, PAKISTAN

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ABSTRACT: Bisphenol A (BPA), is building block of Polycarbonate plastics and known to cause endocrinal, developmental and metabolic abnormalities in animals as wel as humans being. Food especially dairy products are the major source of Bisphenol A entry in human body. In this direction, the present study was conducted to highlight the prevelance of BPA in dairy products, which may affect the human health. A total of thirty-five different types of dairy products (packaged and unpackaged) sampled from different areas of the Punjab. The detection of Bisphenol A was carried out through analytical technique of HPLC with fluorescent detector. The selected method resulted in good recovery rates from 81-90% with 0.1µg/ml limit of detection. Out of 35 samples tested, 15 samples showed the presence of BPA with minimum concentration detected was 0.003µg/g in packaged cream while the highest was detected to be 8.315µg/g in pure butter collected from Sheikhupura. Some of the detected concentrations were evidently greater than the tolerable daily intake (0.05µg/kg) set by EU. Thus, the analysis clearly showed the prevalence of BPA in dairy products could be related to plastic bags or containers. Further, move comprehensive researchers are are required for source identification of BPA.

Keywords: Environmental pollutnats, Bisphenol A, Dairy products, Plasticisors

PLASTIC POLLUTION: PP-05

AEROBIC BIODEGRADATION OF ENVIRONMENT FRIENDLY PLASTIC BAGS OF RENOWNED INTERENATIONAL, NATIONAL AND LOCAL BRANDS IN AN AQUEOUS ENVIRONMENT

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ABSTRACT: Plastic, it is a comprehensive name of different forms of polymers that are organic in nature. With the passage of time, the demand for polymers is harshly increasing. However the nondegradable plastic is made up of chemical fillers which have massive environmental vulnerabilities. While the degradable plastics have the natural ingredients like starch, orange peels, corn oil and other natural plants which make it green. Degradability of plastic depends on its biological reduction. Worldwide environmental buildup of plastic is just because of permanency of material used in it. So considering all these facts, it is the demand of the current period to take step to determine the degradation of the plastics. Some of the plastic, specifically carrying bags, labelled as green, give the possible solution to lessen their ecological destruction. Some renowned international, national and local brands claimed that the carrying bag they provide, are environment friendly. To prove, either this claim is justifiable or not, this study was conducted. Quite a lot of ISO standards to determine definite aerobic biodegradability of polymers have been bring out. Specifically ISO 14855-1 is the common method of test including some of the methods like FTIR, Aerobic Degradation, Titrimetric Analysis and/or others. In this study, standard procedure is followed to eradicate plastic bags by degrading it in the canal water.

Keywords: Anaerobic, Anaerobic Degredation, Polymers, Starch

PLASTIC POLLUTION: PP-06

MICROPLASTIC POLLUTION AS A GLOBAL CHALLENGE

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ABSTRACT: Microplastics (MPs, plastic dimensions <5mm) have recently emerged as an environmental nuisance afflicting harm to humans, environment and biota. With their ubiquity proven through their worldwide occurrence in all major ecosystems, MPs have been reported to persist, accumulate, translocate and cause carcinogenicity, teratogenicity and mutagenicity through inherited leachates. Apart from that microplastics also acts as a transmitter to pathogens and accumulators of hydrophobic contaminants from surroundings, hence pose a major threat. Albeit of a lack of consensus upon methodology and dimensions, a heavy reliance upon prevailing environmental factors such as wind dispersion currents, hydrodynamics, rainfalls and land-based sources, the distribution of types and abundance of microplastics is highly versatile, worldwide. Fiber strands originating from the laundry constitute the major form of microplastics found, with polyethylene and polypropylene types found most abundant worldwide. Expanded polystyrene is mainly prevalent in eastern and south-eastern Asia, especially in coastal regions of China. The impact regarded due to anthropogenic impacts and high plastic production. In contrary, the infrequently visited beaches from Spain as well as pristine Pyrenees mountains were also found abundantly contaminated, primarily due to atmospheric transportation and oceanic currents leading to high dispersion patterns. Oceans have been found to be the most contaminated environments with 5 major gyres filled with plastic. MPs in the ice cores in the Arctic Ocean region indicates that sedimentation of MPs occurred in the region. The types of microplastic items recorded were PA, PP, PS and PE. Although the dissemination of MPs in freshwater frameworks is obscure. Recent studies unveiling the occurrence of MPs in freshwater ecosystem (especially drinking water and groundwater) have raised alarming concerns. In the context of Pakistan, where water scarcity is approaching alarming levels and country has been declared as 3rd most affected country facing acute water shortage, such waterborne contaminations are insidious. Hence, it is imperative to establish a comprehensive dataset for Identification, characterization and quantification, source apportionment and spatial distribution of MPs in freshwater ecosystem of Pakistan, along with environmentally relevant concentrations that might prove harmful to biotic and human life. It is also crucial to appraise the determination of ecological hazards and potential consequences for human health and will encourage the need for development of

better management strategies in the country regarding plastic pollution. It is obvious that MPs are abundant throughout the globe, the impacts from this pollution are inevitable.

Keywords: Microplastics, Environmental Factors, Polyamides (PA), polypropylene (PP), Polystyrene (PS), and Polyethylene (PE), Gyres

PLASTIC POLLUTION: PP-07

A PRELIMINARY ESTIMATION OF PLASTIC CONSUMPTION PER CAPITA USING PLASTIC CALCULATOR

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ABSTRACT: The consumption of plastic at multiple tiers within society is a major global issue nowadays. Pakistan is a developing country and most of the people don't have awareness to reduce the use of plastic in their everyday life. Hence, it is necessary to gather information about the amount of usage of plastic in our daily routine. The basic aim of this study was to assess the plastic consumptions to highlight the current environmental burden. In this regards, a questionnaire based study was conducted in some major cities of Punjab viz; Lahore, Faisalabad, Jhang and Kasur were selected to find out the plastic consumption behavior, awareness level and concern of people regarding plastic pollution. A plastic calculator was developed to analyze the plastic usage within cities, income groups, on the basis of education, age, and family sizes. The data showed that high frequency of plastic (77.6 kg/year/person) was found in people between ages 31-40. The people belonging to Lahore are using 68.47 kg/year/person, while people living in Jhang are use 43.30 kg/year/person. Income based analysis showed that more the income more the use of plastic products, People having income above 100,000/Rs per month using 104.05 kg/year/person on an average. The current plastic consumption per capita in some cities of Punjab highlighted the alarming situation of plastic burden on the environment. Therefore, there is an urgent need to reduce the domestic consumption of plastic product for the sustainable future.

Keywords: Plastic Consumption, Calculator, waste generation, Plastic reduction, Sustainable future

PLASTIC POLLUTION: PP-08

INVESTIGATION OF THE EFFECT OF MIXING AGRICULTURE AND FURNITURE INDUSTRY WASTE TO PRODUCE COMPOST FROM ORGANIC FRACTION OF MUNICIPAL SOLID WASTE IN GUJRAT

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ABSTRACT: Municipal solid waste management is one of the major environmental problems in Pakistan due to improper waste management system. Bio-degradable waste contains high moisture content and naturally degradable material, therefore, when this organic waste decomposes, as a result of microbial activities, it causes the emission of certain gases and release of leachate which leads to several public health and environmental issues. Composting technique can be used as an alternative for the management and treatment of organic fraction of municipal solid waste. This research was conducted with the aim of mixing organic waste with different bulk wastes such as agriculture residues (wheat straw, Rice straw) furniture industry waste (saw dust) and animal manure, using the drum composting method. Purpose of addition of bulk wastes was to control the moisture content and leachate production and to provide optimum conditions for aerobic microbial activity. The experiment was carried out in 4 different Trials (Trial 1, Trial 2, Trial 3, and Trial 4) with different solid-waste to bulk-waste ratios. Trial 1 contained only Organic Waste (OW) and used as control, Trial 2 contained Organic Waste and Animal Manure (OW + AM), Trial 3 contained Organic Waste, Animal Manure and Agriculture Waste (OW + AM + AW) and Trial 4 contained Organic Waste, Animal Manure and Wood Waste (OW +AM + WW). All the trials were monitored for Temperature, moisture and pH using the standard methods throughout the 60 days of compositing experiment and a general variation in all trials was observed for these parameters. Leachate samples were collected and analyzed for pH, Electrical Conductivity (EC), Total Dissolved solids (TDS), Salts and Biochemical Oxygen Demand (BOD) Trial 1 and Trail 2 had higher BOD in leachate as compared to Trial 3 and Trial 4 which is suggesting that bulk agents addition to organic waste will lead to reduction in leaching of organic matter in leachate during the experiment to see the impact different trials on the quality of leachate production. Trial 1 and trial 2 produced more leachate due to high moisture and trial 3 and 4 has low leachate production due to bulk waste. After 60 days of composting process, analysis of compost quality was carried on the basis of Dry matter content, Organic Matter/Volatile solids, NH4-N & NO3-N content and Nitrification Index (NI) for all the four trials. The highest value of NH+4 was observed in Trial 3 and lowest in Trial 1 and this decrease in value occurred due to anaerobic condition in Trial 1. Based on these findings it was concluded that biodegradable Organic Solid Waste

alone produce very poor-quality compost and dangerous leachate. The quality of compost product was better in the trials where a combination of Organic Waste, agriculture residues (Wheat and Rice Straws) and animal manure was used. It is proposed that producing compost from Organic fraction of solid waste by mixing with the agriculture residues and animal manure could be a good way in resolving the solid waste management related issues especially in rural and semi-urban areas of Pakistan such as Gujrat district.

Keywords: Compost, Agriculture Waste, Organic Fraction, Nitrification Index, Leachate.

PLASTIC POLLUTION: PP-09

CHALLENGE OF MICROPLASTIC POLLUTION IN DRAINAGE SYSTEM OF LAHORE-PAKISTAN

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ABSTRACT: Plastic pollution in the freshwater bodies near urban centers has been identified as a key threat to the aquatic ecosystems. The presence of MPs has been reported in almost every component of the environment, and efforts are being made to identify and prevent their potential sources. The purpose of this study was to evaluate MPs pollution level in different drains and canals, and to quantify their daily MPs contribution into the Ravi River. Surface water and sediment samples were collected from twenty-three different sites and MPs were identified using a stereomicroscope. Highest concentrations of MPs were observed in the sullage carrier consisting 16,150 ± 80 MPs/m^3 in the water samples and 40,536 ± 202 MPs/m^2 in the sediment samples. Lowest concentrations were detected in the link canals with 190 ± 141 MPs/m^3 in the water samples and 683 ± 479 MPs/m^2 in the sediment samples. The concentration in the Ravi River was calculated to be 684 ± 473 MPs/m^3 in the water samples and 1,358 ± 1,290 MPs/m^2 in the sediment samples. The proportion of fragments was highest in the area corresponding to 56.11% in the water samples and 83.06% in the sediment samples. Fibers were the second most abundant MPs type with a relative proportion of 38.61% in the water samples and 11.82% in the sediment samples. Most of the fibers, fragments and beads were polyethylene (PE) while the sheets were composed of polypropylene (PP). Similarly, the foams isolated from the samples were composed of polystyrene (PS). This study was the first of its kind to evaluate the presence of MPs in the freshwater bodies of Pakistan and can serve as a baseline for the future studies.

Keywords: Microplastics pollution; freshwater microplastics; Ravi River; drain water

POSTER PRESENTATIONS

OCCUPATIONAL HEALTH AND SAFETY: P-OHS-01

EVALUATIN OF VEHICAL PARAMETER IN PSVs ON VARIOUS ROADS OF LAHORE

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ABSTRACT: Lahore is a fast-growing metropolis experiencing rapid growth in people and vehicle population. This unprecedented growth has led to urban sprawl, dependency on motorized transport, and increased public service vehicle demands throughout the city limits.This paper provides a critical analysis of the public service vehicle in Lahore based on detailed surveys and interviews with help of questioners. It presents an assessment of the functional performance of public service vehicle at various roads in lahore. The paper argues that study was conducted on PSVs running on various roads in Lahore. In this various parameters i.e. health level of driver's, educational level, working hours and road safety measures (head lights, tale lights, Indicators, brakes, fog lights and fitness certificate) were evaluated with the coordination of law enforcement agencies including National Highways and Motorway Police. Results revealed that majority of the PSVs observed, have almost all safety tools. Mostly drivers were found to be physically fit and they could comfortably perform their duty upto 8 hours per day efficiently. However, literacy rate among the drivers was very low (mostly were under matric). It concludes that development of urban transport policy is a first step towards managing existing and future PSVs in various roads of Lahore.

Keywords: Public Service Vehicle Occupational vehaviour, Road Accidents

OCCUPATIONAL HEALTH AND SAFETY: P-OHS-02

ASSESSING THE ENVIRONMENTAL IMPACTS AND WORKPLACE CONDITIONS OF SELECTED TEXTILE INDUSTRIES OF PAKISTAN

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ABSTRACT: The textile sector is a core part in many countries related to economical and employment factors for development of nations. The activities in these textile industries participate much to economic stability also cause adverse effect to environment. The processes of manufacturing textile are responsible for large consumption of water, energy, other organic and inorganic resources such as dyes, chemicals which will produce waste at the end. The burning environmental issues associated with untreated effluents which are directly discharged into surrounding water bodies. Other factors such as gaseous emissions, excessive odors etc. also considered to be environmental damage. The detailed study was performed for assessing environmental effect and the workplace conditions in selected textile industries of Lahore. It is an essential in term to prevent industrial disaster which may further lead to unfavorable results. Environmental Risk analysis was performed through quantitative and qualitative assessment techniques. The effluents discharges and gaseous emissions of the selected textile industries of Lahore were observed and measured. Result findings indicated the working environment's conditions in the workplace were not facilitative for maximum output and there was high level risk that may be happening to the workers from various hazards associated by in appropriate physical conditions. Over all the indoor and outdoor environmental parameters such as humidity, temperature, light and noise levels were below and above the permissible limits of NEQS (National Environmental and Quality Standards) at different places in each selected industry. Workers are unacquainted of the health, safety and environment protocols at workplace during work and there is an essential need to provide adequate awareness trainings relating environmental issues and health safety problems. This study aims to identify and analyze the environmental impacts and inadequate workplace conditions due to industrial activities and manufacturing processes in selected textile industries. Also take initiatives to minimize the environmental risks and workplace risks which are arises due to pollution and inadequate monitoring respectively.

Keywords: Environmental Impact, Environmental risk, Workplace, Textile sector, Effluent, Resource consumption, Gaseous emissions, NEQS.

OCCUPATIONAL HEALTH AND SAFETY: P-OHS-03

SAFETY CULTURE IN UNIVERSITY-A (FAISALABAD) AND UNIVERSITY-B (LAHORE) LABORATORIES: TWO UNIVERSITIES COMPARISON BY ASSESSING THE SAFETY BEHAVIOR AT DEPARTMENTS LEVEL

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ABSTRACT: Educational institutes like Universities, Colleges and Schools serve for excellence in education, nevertheless, complications of occupational health and safety in certain areas may weaken the designed goals. Occupational health and safety must be the obligation of every person in an organization or institution, irrespective of their job status and specification. Safety culture study or surveys are suggested as significant tools for estimating, evaluating and quantifying the efficacy and enhancement of safety programs direction. Therefore, the following study intentions to examine the perception students and scholars about safety in their laboratories for different universities (Sciences) and compare the results of both type of university Departments. For this purpose, two universities along with three departments (Agriculture, Environmental Sciences and Microbiology) have selected for study. In each department, students of different 1-4 years of study have targeted to study their perception on nine parameters which are 1. Incident reporting, investigations and analysis 2. Hazard and unsafe acts report 3. Work planning, PTW, journey management 4. Competency/Training – are workers interested? 5. Who checks safety on a day-to-day basis? 6. Who causes the accidents in the eyes of management? 7. How do safety meetings feel? 8. Balance between HSE and profitability? 9. Commitment level of workforce and level of care for colleagues. The focus is on older group of students in each department to answer the questionnaire that contain nine different regimes for evaluating the perception on Five Point Likert Scale which is further associated with Parker's Framework. 80 students will be targeted in which 25 are last year, 20 are 3rd year, 20 are 2nd year and 15 are 1st year students from each department. The statistical analysis applied to evaluate quantitative and qualitative results of data by Mean Square and Correlation Method by using SPSS. We found that Department of Environmental Sciences and Department of Agriculture from University-A has a strong Safety culture than same departments from University-B but on other hand Microbiology department of both universities have good safety culture and their students also promote lab safety and students are instructed to follow the rules. overall University-A Departmental laboratories are close to the safety scale and the students have known the safety culture norms also instructed by the university management in mannered way. further study can be on the safety culture of Agriculture departmental laboratories.

Keywords: Safety Behaviour, Lab. Safety, HSE,

ENVIRONMENTAL GEOLOGY: P-EG-01

EVALUATION OF LAWRENCEPUR SAND AS FINE AGGREGATE

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ABSTRACT: Lawrencepur Sand is the most popular and widely used fine aggregate deposit of Pakistan. Its grading generally corresponds to the zone 3 or 4 of BS: 882: 1983 and is, therefore, considered an excellent fine aggregate. However, some sand layers contain oversize particles and, therefore, require some processing to meet the desired grading. The petrographic tests (ASTMC 295-85) show that Lawrencepur sand has an Alkali Silica Reaction Potential if used with ordinary portland cement. The deleterious components are greywackes, schists, slate/phylite and acid to intermediate volcanics. The sand is composed of lithoclasts as well as mineral grains. Following are the modal analysis of components of Lawrencepur sand, 25.4%-41.6% quartz, 5.7%-8.3% quartzite, 0.6%-4.6% S-type granite, 2.1%-4.4% feldspar, 5.0%-7.7% mica, 5.30% greywacke group, 4.60% amphibolites, 4.0% schist, 3.30% phyllite/slate*, 1.30% iron ore, 0.30% sphene, 0.20% chert*, 0.20% tourmaline, 0.10% apatite and 0.10% zircon. The deleterious constituents are marked with an asterisk (*). The coarse sands and sands with abundant coarse particles are, therefore, generally potentially reactive with an ASR potential. Some parts of these sand deposits, specially the fine to medium grained varities, are low in lithoclasts and deleteriously reactive constituents and are, therefore, within safe limits.The Lawrencepur sand has been derived mostly from the Kohistan Island Arc and the Indian plate constituting the Higher and Lesser Himalayas. Contribution from the Gawachi Back Arc Basin and the Asian Plate is negligible as far as lithoclasts are concerned.

Keywords: Lawrencepur Sand, Engineering Properties, Petrography

SUSTAINABILITY AND PRESERVATION OF CHOBURGI, LAHORE

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ABSTRACT: Heritage tourism product is the most important element in attracting tourists from all across the world. World is now focusing on heritage tourism its sustainability and preservation to generate more revenue from tourism industry. Much of today's heritage tourism product depends on renovation and recreation of the ethnic and cultural traditions. In this regards many researches have been conducted and shows its importance and implementation. This research is unique in style. To show the importance of heritage and cultural tourism this research is going to target. This research study reveals the level of sustainability and the amount of preservation of the beautiful heritage site of Lahore (Choburgi). The research is conducted in the Choburgi Lahore to find out the real cause of negligence. The research questions point out the laxity of government as well as locals for not preserving the tourist's sites and the real cause of lack of attraction in Choburgi. What elements destroyed it and not seen by the officials. Important differences in perceived authenticity is observed among various groups of people. Moreover factors affecting heritage site, and lack of tourists, and what are the key tools to promote the heritage site and how to preserve it for the rest of the generations are observed.

Keywords: Sustainability, Preservation, Laxity, Renovation and Recreation, heritage

GIS AND REMOTE SENSING: P-G&RS-01

ASSESSMENT OF WATER AND SOIL PARAMETERS USING GEOSPATIAL TECHNIQUES. A CASE STUDY OF BOTANICAL GARDEN OF UNIVERSITY OF THE PUNJAB, PAKISTAN

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ABSTRACT: This paper presents an in depth analysis of geospatial characteristics of water and soil parameters and its impact on herbs productivity. The study area selected for research was Botanical Garden, University of the Punjab, Lahore Pakistan. Eleven soil samples and six water samples were collected from eleven sections and six sections of Botanical Garden respectively. Seven water parameters (EC, Ca, Mg, Na, CO3 , HCO3, and Cl) were studied while for soil (EC, pH, organic matter, K and P) were examined. All of the collected parameters were exported in GIS environment to produce the spatial distribution of these parameters. Interpolation maps were formed to show the spatial pattern of the selected water parameters while graphical representation was done for soil analysis. Directional Distributional ellipse (GIS statistical analysis) was performed to show the distribution of soil and water parameters. No abnormalities were found in the results which indicates that the soil and water is suitable for the productivity of plants and herbs found in the garden.

Keywords: Geospatial, Groundwater, Interpolation, Spatial Distribution

GIS AND REMOTE SENSING: P-G&RS-02

IMPACT OF URBANIZATION ON WATERCOURSES (OUTLETS) BY USING REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

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ABSTRACT: Lahore, a metropolis of Pakistan, has been experiencing rapid urban growth over the past few years. It is sprawling rapidly, which is causing several environmental and socio-economic problems. A major impact of this expansion is being observed in the form of an agricultural land which is used for housing schemes. The present research is an effort to evaluate urban expansion and its impact on watercourses (outlets) of Lahore, Pakistan. This study examined the spatiotemporal pattern of urban growth of the Lahore form 2000 to 2016 using remote sensing data and GIS techniques. Results revealed three landuse landcover types in Lahore (for 2000, 2008 and 2016). Second we examined the temporal pattern of urban land changes (Non-built-up to Built-up) across two time intervals (2000-2008 and 2008-2016).The result showed massive increase in population, effect the watercourses (outlets) which established the connection of agriculture land cut off with canal water which is the soul of fertile land. The integration of remote sensing and GIS techniques has proved to be efficient and more effective for monitoring urban expansion and making assessments of its impact on watercourses (outlets) of Lahore.

Keywords: Urban Growth, Agriculture Land, Spatial Temporal, Remote Sensing

GIS AND REMOTE SENSING: P-G&RS-03

SYNTHESIS AND OPTIMIZATION OF MOLECULAR IMPRINTED POLYMER AS SENSING PROBE FOR NITROPHENOL

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ABSTRACT: Nitrophenols are categorized as carcinogenic by US-EPA.A molecular imprinted polymer modified glassy carbon electrode was fabricated for sensitive and selective determination of 4-nitrophenol. This molecular imprinted polymer particle was prepared by precipitation polymerization. 4-nitro phenol was used as a template, methacrylic acid as a functional monomer, ethylene glycol dimethacrylate as a crosslinking agent and 2, 2-azobisisobutylnitrile as an initiator and methanol as a porogen. The imprinted and non-imprinted polymer articles were characterized by scanning electron microscopy (SEM) and Fourier Transformed Infrared spectroscopy (FTIR). The response of sensor was optimized towards p-nitrophenol detection and determination was investigated by differential pulse voltammetry. The sensor showed linear response in the concentration range 1×10^{-6} M to 5×10^{-4} M with a detection limit of 0.2uM.

Keywords: Nitrophenol, Imprinted Polymer, Differential Pulse Voltammetry

GIS AND REMOTE SENSING: P-G&RS-04

IMPACT ASSESSMENT OF VARIOUS INDICATORS AND PARAMETERS CAUSING URBANIZATION IN FAISALABAD USING GEOSPATIAL TECHNIQUES

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ABSTRACT: Over half of the World's population live in cities comprising less than 4% of the earth's globe, consuming three quarters of world's natural resources but also generate three quarters of pollution and waste. Urbanization gradually converts fertile land in to built-up for housing needs and many other environmental as well as management issues. Although urban development offers several advantages for overall prosperity but unplanned conversion has dominant negative impacts over benefits. Urban proximities attract industries and businesses, further enhancing development and widening the gap between urban and rural life. Socioeconomic, Physical, Proximity, Accessibility and Neighbourhood are the five most documented classes of motivating factors in urbanization studies. Faisalabad, once Lyallpur, the 3rd largest city of Pakistan is an industrial centre of Pakistan is also facing the issue of unplanned urbanisation. In this study we choose some factors from the most documented major categories of urbanization driving forces. All relevant factors could not be considered in one study, so the selection of urban factors to be considered for analyse is accomplished keeping in view the local dynamics of change and potential significance of these factors in the study area. This study was an effort to discover driving factors in Faisalabad District. Driving factors may vary in significance, regression analysis was performed to assess the significance of individual factor and collective significance of all factors using Ordinary Least Square (OLS) technique and to address spatial variation of driving factors significance. Geographic Weighted Regression (GWR) analyses were performed using ArcGIS Spatial Statistical Tools (ESRI). OLS regressions are quite helpful in finding the significance of each factor and combined significance of all factors. Results depicted that value of more 0.5 significance which is satisfactory and higher is certainly better. GWR analysis was normally performed using the same variables as in OLS but it incorporates geographical characteristics and in result enhances the accuracy of prediction model. The ultimate goal was to reduce pressure on urban areas by finding major driving factors in study area and investing accordingly in less developed areas to attract people for planned urbanization. Comparison of population growth data for year 1998 and year 2018 with selected physical and socioeconomic factors within same period revealed that Industrial Developments was a major factor of urbanization in Faisalabad district. It has also been observed that infrastructure and services are the major contributors

in urbanization process. Determining the significance of these factors and role in urbanization can help urban planners and government entities for policy making of controlled urbanization. It demands heavy government and private investment in building infrastructure that attract people in an effort of planned urbanization, so it is not reasonable to do it without getting clear picture which may result in loss of valuable resources.

Keywords: Urbanization, Regression Analysis, GRW Analysis, Geospatial Techniques

GIS AND REMOTE SENSING: P-G&RS-05

SCRUTINIZING THE IMPACTS OF LAND TRANSFORMATION ON LAND SURFACE TEMPERATURE: A REMOTE SENSING PERSPECTIVE

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ABSTRACT: Urban heat island (UHI) belongs to the phenomenon of high atmospheric and surface temperature occurring in the urban area than the surrounding rural area. The number of studies have shown that an increase in green spaces can significantly decrease the land surface temperature. Fewer studies, however, have investigated the effect of the green spaces on land surface temperature. This thesis aims to fill this gap by using advanced geospatial techniques in district Peshawar, Lahore, and Karachi. These metropolitan areas experiencing rapid urbanization that has resulted in remarkable urban and environmental problems i.e. environment, socio-economic development. In this study, LANDSAT imagery for the years 1990, 2000, 2010 and 2019 has been used to assess the thermal characteristics in the study area. The imagery of all the districts for the summer season has been processed to determine the relationship between LST and landcover. Results reveal a negative correlation exist between LST and green spaces in targeted district and positive correlation between land surface and built-up area. It has been observed that the land surface temperature of Karachi has increased from 40oc to 49 oc in last 30 years. Similarly results depicted that LST in Lahore has been increased from 37oc to 47 oc. The same is the case with Peshawar district which witnessed an increase of 11 oc in this time period. From the above results, it concluded that abrupt increase in urban expansion causing serious threats to the city environment in terms of increasing temperature. The study reveals that appropriate strategies are necessary for the sustainable management of the urban area. This research not only provided a methodology to assess effect of urbanization but also helpful in decision support for the planning and managing of the city.

Keywords*:* GIS, Remote Sensing, Land Surface Temperature, NDVI, Urban Heat Islands, UHI, LST, Landsat TM 5, Surface Temperature.

GIS AND REMOTE SENSING: P-G&RS-06

LANDFILL SITE SELECTION FOR MULTAN CITY USING GEOSPATIAL TECHNIQUES AND MULTI CRITERIA ANALYSIS

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ABSTRACT- In the past few decades, efficient and environmentally sustainable waste management system becomes the necessity in developing countries due to exponential rise in urban population. Landfill is one of the primary approaches practiced for disposal of solid waste. Siting a sanitary landfill has gained significant importance due to its negative impacts to the various environmental components. This study makes use of MCA in conjunction with GIS to site a new landfill in Multan city with an area of 30694.89 hectors, one of the urbanized cities in Pakistan. Seven evaluation criteria were taken into account in the siting process including built-up area, ground water sources, road network, surface water, cultivated land, gas pipeline/power line and protected area. Weight to each criterion was calculated by using AHP pairwise comparison matrix. Ultimately a suitability raster for each evaluation criterion is developed .These raster layers were spatially overlaid using ArcGIS 10.2 which results in a final raster that identifies suitability for landfill sites for disposing solid waste. The study yielded 2% of study area as suitable, 50% unsuitable and 48% less suitable. The analysis resulted with five potential sites, among them two sites were excluded as they were overlapped with flood extent of 2014. Although the adopted approach is good for Landfill site selection, however further field research is required for final selection of the landfill site. It was also evaluated that the approach may aid in siting Landfill in any study region and identifying the pros and cons of existing landfill sites.

Keywords: Analytical Hierarchy Process, Geographic Information System, Landfill, Multi Criteria Analysis, Multan.

GIS AND REMOTE SENSING: P-G&RS-07

TOP ROOF GREEN FLOORING IN HIGHLY DENSE METROPOLITAN AREA BY USING GEOSPATIAL TECHNIQUES

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ABSTRACT: In the Metropolitan area, rural desertion and the hasty urbanization after the 1950's led to complex environmental problems, such as the misuse of natural resources, the environmental pollution. Whereas, unstrained urban growth caused too much pressure on the existing setup, which are affecting buildings, public transportation, water quality and public health. Different studies reveal that the implementation of green roof technology can moderate environmental problems, through the reduction of heat flux and solar reflectivity, the minimization of buildings' energy consumption, the air pollution removal, the air cooling and the effective management of the urban heat island effect. Urban green areas provided a range of benefits for habitants and it can play an important role for the development of environmental, social and economic perspective. In this framework, the aim of this study is to evaluate the green roof potential and the quantification of its benefits over Ganj Kalan, Union council of Lahore city. In order to do so, very high spatial resolution satellite images were acquired along with vector data to distinguish buildup areas and calculate the ratio of NDVI from the satellite imagery. Temperature data were also classified to apply different ranges regarding high moderate and low and results were overlaid with the high temperature area and built up in order to identify the roofs which required the green roof flooring. According to analysis it has high potential for green flooring.

Keywords: Green Flooring, Classification, Vector Analysis, Spatial Resolution

GIS AND REMOTE SENSING: P-G&RS-08

MAJOR FACTORS OF URBANIZATION IN FAISALABAD, PUNJAB-PAKISTAN

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ABSTRACT: Over half of the World's population live in cities comprising less than 4% of the earth's globe, consuming three quarters of world's natural resources but also generate three quarters of pollution and waste. Urbanization gradually converts fertile land in to built-up for housing needs and many other environmental as well as management issues. Although urban development offers several advantages for overall prosperity but unplanned conversion has dominant negative impacts over benefits. Urban proximities attract industries and businesses, further enhancing development and widening the gap between urban and rural life. Socioeconomic, Physical, Proximity, Accessibility and Neighbourhood are the five most documented classes of motivating factors in urbanization studies. Faisalabad, once Lyallpur, the 3rd largest city of Pakistan is an industrial centre of Pakistan is also facing the issue of unplanned urbanisation. In this study we choose some factors from the most documented major categories of urbanization driving forces. All relevant factors could not be considered in one study, so the selection of urban factors to be considered for analyse is accomplished keeping in view the local dynamics of change and potential significance of these factors in the study area. This study was an effort to discover driving factors in Faisalabad District. Driving factors may vary in significance, regression analysis was performed to assess the significance of individual factor and collective significance of all factors using Ordinary Least Square (OLS) technique and to address spatial variation of driving factors significance Geographic Weighted Regression (GWR) analysis will be performed using ArcGIS Spatial Statistical Tools (ESRI). OLS regression would help finding the significance of each factor and combined significance of all factors. A value of more 0.5 significance is satisfactory, higher is certainly better. GWR analysis is normally performed using the same variables as in OLS but it incorporates geographical characteristics and in result enhances the accuracy of prediction model. The ultimate goal is to reduce pressure on urban areas by finding major driving factors in study area and investing accordingly in less developed areas to attract people for planned urbanization. Comparison of population growth data for year 1998 and year 2018 with selected physical and socioeconomic factors within same period revealed that Industrial Developments was a major factor of urbanization in Faisalabad District. Infrastructure and Services were also the major contributors in urbanization process. Determining the significance of these factors

and role in urbanization can help urban planners and government entities for policy making of controlled urbanization. It demands heavy government and private investment in building infrastructure that attract people in an effort of planned urbanization, so it is not reasonable to do it without getting clear picture which may result in loss of valuable resources.

Keywords: Urbanization, Geospatial Techniques, GWR Analysis, OLS Regression

GIS AND REMOTE SENSING: P-G&RS-09

IDENTIFICATION OF REQUIRED VEGETATION FOR HEAT BALANCE USING REMOTE SENSING AND GIS TECHNIQUES. A CASE STUDY OF LAHORE DISTRICT

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ABSTRACT: The rapid urbanization to accommodate exponential population growth is accelerating globally, pressurizing land surface and environment; as a result frequent Urban Heat Island (UHI, raised temperature pockets surrounding congested areas) events are becoming a global norms well as in Pakistan. Controlling UHI events by increasing vegetation is a noteworthy research topic and this thesis is focused on the UHI events in Lahore District and their relevance with vegetation by implying advance geospatial techniques. Lahore is an emerging metropolitan where rapid urbanization is engulfing existing gardens and cultivated lands thus resulting in frequent UHI events particularly in summer. Geospatial techniques are most reliable for such research as satellite images are excellent mapping resource for land cover and Land Surface Temperature (LST). Landsat satellite images of May (2003, 2010 & 2019) are used in this study for built up land& vegetation demarcation and to calculate LST. The NDVI (Normalized differentiated Vegetation Index) and NDBI (Normalized Differentiated Built up Index) are calculated for each year to identify the vegetated land and built up land areas. Percentage of Urban vegetation for each union council (274 in total) of Lahore district is calculated (years 2003, 2010& 2019) for final analysis. The temporal changes in vegetated area represent increase or decrease in different union councils of Lahore district. The relationship between LST and urban vegetation is examined for identifying UHI pockets. The results revealed a positive relation between congested urban areas & LST, and an inverse relation between vegetated areas and LST. The inappropriate proportion of vegetation in urban areas and rapid clearing of vegetation along with congestive planning are responsible for swiftly rising LST. The result shows that the major decrease in vegetation area are observed in North and central South side while major increase is in Central North and South side of the City. The maximum increase in vegetated area from 2003 to 2019 is observed in Union council 179 (Bhaseen Bata Pur) that is 3431 acres and the maximum decrease is observed in union council 25 (Bhamma Jhuggian) that is 314 acres. Appropriate strategies are necessary for sustainable management of urban area. This research not only provides a methodology to assess effect of urbanization but it will help as a decision support tool for the City/town planners.

Keywords: GIS, Remote Sensing, Land Surface Temperature, NDVI, Urban Heat Islands, UHI, LST, Landsat TM 5, Surface Temperature

GIS AND REMOTE SENSING: P-G&RS-11

GIS-BASED GEOSTATISTICAL ANALYSIS OF SOIL DATA: A CASE STUDY OF SIALKOT DISTRICT, PAKISTAN

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ABSTRACT: Geotechnical investigations are used in the design and planning phase of civil engineering projects. It plays a vital role in sustainable design for construction, but at the same time it increases the cost and construction time of the project. Existing data in the form of soil maps can save considerable time and expense. This study presents spatial interpolation of data obtained from geotechnical investigation reports of more than seventy different construction sites in Sialkot district to develop the soil maps for geotechnical characterization of study area using ArcGIS. The subsurface soil of the study area has been examined in terms of soil type and standard penetration (SPT-N) resistance. Zonation maps at different depths were developed by using the Inverse Distance Weighting (IDW) method in the Spatial Analyst extension of ArcMap. These maps can be used for quick estimation of soil type and strength and to prepare a preliminary ground model during feasibility stage of a proposed project in the study area, and hence making the project safer and economical.

Keywords: Geotechnical investigation, Geographic information system, Standard penetration test, Spatial interpolation.

GREEN CHEMISTRY: P-GC-01

ENVIRONMENTAL ISOLATES: A NATURAL SOURCE OF INNOVATIVE INSECTICIDES

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ABSTRACT: Mosquitoes are a potential vector of several tropical diseases, including numerous viral diseases: of 3,000 species existing, 100 are known to be vectors. Mosquitoes are known to transmit such diseases as malaria, dengue fever, filariasis *etc*. It is estimated that more than 700 million people died every year because of mosquitoes born diseases, thus are regarded public enemy number one, as reported by the World Health Organization (WHO). Synthetic chemical insecticides have been used for a long time in controlling mosquitoes, but their arbitrary use has given rise to numerous environmental problems particularly environmental pollution. The search for effective and biodegradable insecticides, including mosquito repellents, is of paramount importance. One of the potential source is microorganisms that are known to be used by communities in the management of insects. Five potent bacterial strains AB1, AB7, GB6, GB7 and GB8 were isolated from environmental sites. Bioactive compounds isolated from these environmental isolates, were subjected to antilarvicidal activity against *Anopheles* 3rd instar larvae to check their insecticidal effect. The experiment was performed following the protocol as described by WHO. The environmental isolates AB7, AB1 and GB6 showed 100% mortality and GB7 and GB8 showed 83% and 68% mortality at 1000ppm against *Anopheles* 3rd instar larvae after 24h. LC_{50} and LC_{90} were between 5 to 67ppm and 9 to 120ppm respectively. This study suggested that environmental isolates are rich source of natural insecticides. The effectiveness of these insecticides from environmental isolates demand further research to using a field trial to evaluate safety for environment.

Keywords: Environmental Isolates, Natural Insecticides, Antilarvicidal Activity, LC_{50} and LC_{90}, *Anopheles* Larvae.

GREEN CHEMISTRY: P-GC-02

SYNTHESIS OF ORGANIC ESTERS AND HYDRAZIDES USING CONVENTIONAL AND GREEN SYNTHETIC TECHNIQUE (ULTRASONIC)

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ABSTRACT: The present work describes the synthesis of esters from carboxylic acids and their respective hydrazide by conventional and green synthetic technique (ultrasonic).Various green metrics are applied on the reaction conditions adopted. Study showed increase in percentage yield of 82%-86% in green synthesis from conventional yield of 72%-77%. Other green metrics like atom utilization, carbon efficiency, reaction mass efficiency are calculated. Reaction mass efficiency showed maximum output in ultrasonic bath synthesis with results from 54-72%.Further work showed that sono-chemical reactions are energy efficient with values of energy consumption in range from 0.66- 0.88 (KWh) with that of conventional synthesis. (0.88-1.10 KWh)

Keywords: Green Chemistry, Organic Synthesis, Eco-Friendly Techniques, Ultrasonic Techniques.

GREEN CHEMISTRY: P-GC-03

EVALUATION OF FUNGITOXIC EFFECTS OF *AGERATUM CONYZOIDES* LINN

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ABSTRACT *Ageratum conyzoides* L. (AC) is an annual herbaceous plant belongs to the family Asteraceae. Extracts and metabolites from this plant have been found to possess pharmacological and fungicidal activities. Therefore the present study was designed to evaluate the antifungal activity of aqueous extracts of inflorescence, leaf, stem and root of *A. conyzoides* against the mycelial growth and biomass production of *Fusarium solani* (Mart.) Sacc., the causal organism of Fusarium wilt of Egg plant (*Solanum melongena* L.). Significant reduction in *F. solani* growth was observed due to aqueous extracts of different concentrations. Leaf extract proved to be more effective as compared to the other parts in the flask experiment. Further pot experiment was conducted for more conspicuous results by leaves of test plant. It was noticed that with the increasing concentration of leaf residue in the soil, disease incidence decreased significantly. The present study revealed that *A. conyzoides* have potential to control the growth of *F. solani*.

Keyword*:* *Ageratum conyzoides*, Antifungal activity, Aqueous extract, *Fusarium solani*, Mycelial Growth

ENVIRONMENTAL MICROBIOLOGY: P-EM-01

ISOLATION AND CHARACTERIZATION OF EXOPOLYSACCHARIDE PRODUCING BACTERIAL STRAINS FROM EXTREME ENVIRONMENTS

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ABSTRACT: Bacteria from extreme environments use exopolysaccharides for the purpose of their protection against various biotic and abiotic factors. These factors influence the diversity of bacteria surviving in that particular habitat as well. This study was planned to explore the diversity of exopolysaccharides (EPS) producing bacterial strains from extreme environmental conditions. Four samples were taken from different extreme environments i.e. Tatta Pani Hot Spring, Thar Desert, Chemical contaminated soil and garden soil. Strains were isolated by serial dilution method. These isolated colonies were characterized morphologically and biochemically. Screening for EPS producing bacteria was done on P- medium. Quantification of EPS was done by ethanol extraction method. For confirmation of EPS congo red agar, ring test and FTIR were performed. Total 57 bacterial strains were isolated from these samples by serial dilution method. Bacterial strain CS-5 exhibited maximum yield of 26.4g/L of EPS. The presence of EPS was further confirmed by congo red agar and ring test. FTIR analysis of this EPS confirmed the presence of various functional groups. Stressed environment causes the production of EPS by bacteria. These EPS produced by bacteria can help to replace synthetic products in various biotechnological industries such as biofertilizers, antivirals, biosurfactants and detoxificants.

Keywords: Bacterial Diversity, Exopolysaccharides, Extreme Environments, Biotechnology

BIOREMEDIATION: P-BR-01

A CASE STUDY ON EFFECT OF CADMIUM CONTAMINATION ON *SPINACEA OLERACEA* AND ITS IMMOBILIZATION AND UPTAKE BY PLANT IN RESPONSE TO ORGANIC AMENDMENTS

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ABSTRACT: Vegetables are usually irrigated with wastewater from several industries in Pakistan due to shortage of fresh water supplies. The wastewater from industries and municipal origins contains a variety of organic and inorganic contaminants including metals. It can lead to several bio-security issues and pose risks to human health. The aim of present study was to assess the effects of Cd stress from irrigation wastewater on spinach and subsequently development of a strategy to mitigate the stress. In this study, spinach was grown in earthen pots with cadmium (Cd) contaminated irrigation wastewater. The impacts of Cd on soil and plants were assessed using different physio-chemical analysis after di-acid digestion procedure. Two different organic amendments namely cow dung and wood charcoal were mixed into 2 kg soil (places in each pot) prior to sowing @ 20 and 30 t ha^{-1} to check the kinetics of Cd in soil and plants. Seeds of spinach (7-8 in each pot) were sown which were later thinned to 5 plants per pot after one week of germination. After three weeks with irrigation water (without Cd), then applied with Cd contaminated synthetic wastewater, 20 mL per week of 100 µM of metal Cd solution. After six weeks, plants were cut 5 cm above the top of the pot. At harvest, soil was sampled along with roots and leaves. Maximum herbage dry biomass was recorded for treatment receiving 30 t ha^{-1} of cow dung followed by charcoal. At the same rate of cow dung, the lowest uptake of Cd by spinach was recorded. Maximum Cd concentration was measured at treatment with metal alone control, while minimum of 0.016 mg kg^{-1} DM was at the highest level of cow dung in soil. The temperature at the trial place in green house was about 30 ^{0}C while no rainfall water was allowed to enter into the pots. The FTIR analysis of charcoal was conducted that showed peaks at 2250, 1000 and 2000 cm^{-1} showing C-C, C-O-C and C=C bonding, respectively. Overall, cow dung proved the best assimilator of Cd and the use of this bio-organic waste as a filter for wastewater treatment or soil conditioner is an innovative and emerging idea that needs further work and studies.

Keywords: Bioremediation, Spinacea Oleracea, Cow Dung, Phytoremediation, Cadmium

BIOREMEDIATION: P-BR-02

COMPOSTING OF MUNICIPAL SOLID WASTE BY DIFFERENT METHODS IMPROVED THE GROWTH OF VEGETABLES AND REDUCED THE HEALTH RISKS OF CADMIUM AND LEAD

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ABSTRACT: Reutilization of putrescible municipal solid wastes (MSW) in agriculture can provide valuable plant nutrients. However, it may pose serious non-carcinogenic health risks for a human when contaminants, especially the heavy metals in MSW, end up in plants through the waste-soil-plant continuum. This study examined the effects of composting methods viz. aerobically (AC), anaerobically (ANC), and aerobic-anaerobically (AANC) composted MSW material on (i) fertilizer value: vegetable yield, nitrogen (N) mineralization, and apparent N recovery (ANR); and (ii) associated health risks: selected heavy metal concentration, daily intake of metals (DIM), health risk index (HRI), hazard index (HI), and target hazard quotient (THQ) when applied to a loamy soil. All the aforementioned compost materials were incorporated into the sandy loam soil filled in pots and carrot and spinach were cultivated for 85 and 90 days, respectively. After soil application, between 51 and 56% of the applied organic N was mineralized from ANC material, while the values in case of AC and AANC were 26–31% and 34–40%, respectively. Consequently, dry matter yield and vegetable N uptake from composts were in the order ANC>AANC>AC ($P<0.05$). Further, vegetable ANR was the highest from ANC (56 and 56%) than AANC (42 and 45%), and AC (30 and 33%) for spinach and carrot, respectively ($P<0.05$). Interestingly, plant uptake of lead and cadmium was lowest from ANC as compared to AC or AANC ($P<0.05$), irrespective of the vegetable type. Consequently, DIM, HRI, and THQ for these metals were substantially lower in the former as compared to the latter compost materials. Further, HI from ANC material was 50% lower over the unfertilized control indicating the absence of non-carcinogenic human health risks via vegetable intake. This all indicates that from view point of sustainable waste recycling in agriculture, anaerobic composting is superior to the other composting methods.

Keywords: Composting, Anearobic Composting, Agricultural waste, Municipal Solid Waste, Sustainable Waste Recycling.

MONITORING OF ENVIRONMENTAL AND HUMAN HEALTH IMPACT ASSESSMENT OF PAINT INDUSTRY

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ABSTRACT: The research study was conducted on the monitoring of environmental and human health associated impacts of paint Industry. Environmental parameters of the proposed area were investigated along with the health status of the people working at the site and living in the vicinity. The paint industry is important in various perspectives because it is commonly used as a protecting material or as a decorative material for different objects and surfaces. Quality parameters of ground water, waste water, ambient air parameters and noise were studied and results were discussed. The NEQS standards were used to check either the findings of these parameters were within the range of NEQS or not. TDS, TSS, COD, BOD, Sulfates, Phenolic Compounds and PM_{10} were high and the level of noise was also slightly exceeds from the permissible limits. Respiratory Problems, Asthma, Heart trouble, coughing, nausea, dizziness, were the major health problem within the vicinity of industry. Environmental monitoring shows the condition of the atmosphere of the industry and health problems were also related to some of the parameters that were high in waste water or groundwater.

Keywords: Ambient Air Monitoring, Waste water, Groundwater, Noise, Human Health Impacts, NEQS.

PATTERNS OF GROUNDWATER POLLUTION ALONG INDUSTRIAL ZONES OF LAHORE, KASUR AND KALA SHAH KAKU: A COMPARATIVE ANALYSIS

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ABSTRACT: The present study is an in depth analysis of groundwater pollution along the industrial zones of Lahore, Kasur and Kala Shah Kaku. A total of forty (40) ground water samples were collected randomly from study area out of which twenty(20) were taken from Lahore, ten (10) were gathered from Kasur while ten(10) from Kala Shah Kaku. In order to evaluate the groundwater quality, different physical parameters (pH, TDS and Electric Conductivity) chemical (Calcium-magnesium, Sodium, Bicarbonates, Chloride) and metals (Cr, Cd, Zn, Pb, Mg and Ni) were analyzed and were compared with the prescribed limits of (WHO, 2011). The deduced results revealed that all the physio-chemical parameters were within the prescribed range of WHO, except EC that exceeded the permissible range of WHO. Based on mean values heavy metals in ground water samples followed the declining concentration (Mn> Zn>Cu>Cd>Cr>Pb>Ni). Manganese and Zinc were found to be in magnified concentrations. The results demonstrated that effluents discharged from various industries without treatment are a potential threat to underground water contamination. Thus, it is recommended that waste water treatment plants should be installed by these industries. Furthermore, strict government actions, effective environmental laws and social awareness programs must be undertaken.

Keywords: Heavy Metals, Physic-Chemical Parameters, Water Quality, Effluent, Discharge

HUMAN HEALTH RISK ASSESSMENT THROUGH GROUNDWATER POLLUTION USING GEO SPATIAL TECHNIQUES: A CASE STUDY OF KALA SHAH KAKU INDUSTRIAL COMPLEX

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ABSTRACT: The present study is an in depth analysis of Human Health risk assessment due to pollutants in groundwater of Kala Shah Kaku with reference to geospatial techniques. Total six ground water samples were collected from Hakeem Pura, Ravi Rayon, Mauza jair, Chak no 45 a, Dairy Chak no 45 (b) and Chak no 44 respectively. In order to evaluate the groundwater quality various physio-chemical parameters were selected including (EC, Ca, Mg, Na, Cl) and heavy metals including (Cr, Cd, Pb and Ni) were evaluated. Furthermore, questionnaire was designed in order to evaluate the human health risk assessment due to water contamination. The results from groundwater sample analysis revealed that all the physio-chemical parameters were within the permissible limit of WHO except EC that was found to be exceeding in some groundwater samples. The metals were found to be in magnified concentrations in all groundwater samples. The questionnaire results demonstrated that residents living in Kala Shah kaku were reported to be frequently ill with Waterborne diseases including Gastro and Hepatitis. Spatial variation of groundwater quality parameters were done by using Arc GIS 10.5. Interpolation and thematic maps were formed for the graphical representation of the results. Furthermore, statistical analysis was performed using SPSS version 18. Thus it was concluded from the results that the groundwater of Kala Shah Kaku industrial complex is not suitable for drinking as its contaminated with heavy metals due to the untreated effluent discharge from the nearby industries into the water bodies with further contaminate the groundwater after percolation.

Keywords: Groundwater, Heavy Metals, Health Risk, Exposure

SEASONAL VARIATION OF SULFATE AND ITS OPTICAL PROPERTIES IN KARACHI

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ABSTRACT: Estimation of sulfate and its optical properties is an important phenomenon to determine the environment pollution, climate change and to mitigate air borne diseases and problems over mega city of Karachi. Annual data of nine meteorological parameters is downloaded from the Giovanni which is official website of National Aeronautics and Space Administration (NASA) for the period of January 2018 to December 2018. For image acquisition, OpenGrADs software is used to generate the maps and results are interpreted by analyzing monthly variation of concentration of pollutants. It has been observed that concentration of sulfate is high in winter and low in summer season. Air masses move short distances in summer season and monsoon rainfalls wash the atmosphere which decrease concentration and optical thickness of sulfate in air. In winter season, very less rainfall and air masses movement occur which allows the accumulation of pollutants and cause urban haze, acid rain, smog along with hazardous effects to human health like respiratory diseases heart diseases etc. specially in Punjab and Sindh region. Uncontrolled urbanization in Karachi increased level of pollution which cause social, health and environmental issues. Proper urban planning, adaptation of green technologies is required to promote sustainable development and combat climate change.

Keywords: Climate Change, Desease Mitigation, Pollutants Concentration, Environmental Hazards

TREATMENT TECHNOLOGIES: P-TT-01

PHYSICO-CHEMICAL PROFILING OF DOMESTIC WATER SAMPLES FROM LAHORE

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ABSTRACT: The present investigation deals with the determination of physico-chemical parameters like pH, electrical conductivity, alkalinity, fluoride, chloride, nitrate and sulphate content of the domestic water samples obtained from Lahore. To this effect fifty three domestic water samples were collected from different localities of Lahore. The pH and conductivity of these water samples was determined potentiometrically. The alkalinity was determined by titration and chloride was determined by gravimetry. Fluoride, nitrate and sulphate were determined spectrophotometrically. The data thus obtained evidenced that most of the samples obtained from Lahore exhibited enhanced F- and Cl- levels than the permissible limits set by WHO and PAK-EPA. The levels observed for nitrate and sulphate were well below the safe limits. The correlation coefficient matrix for the data set from two cities evidenced significant positive and negative correlations among various parameters. On overall basis the samples were found to be unhygienic and thus need proper treatment prior to use.

Keywords: Domestic Wastewater, Chemical Analysis, Water Quality, Treatment

TREATMENT TECHNOLOGIES: P-TT-02

TREATMENT OF TEXTILE DYE EFFLUENT BY APPLICATION OF CHEMICAL COAGULATION AND ELECTRO COAGULATION FOR COD AND COLOR REMOVAL

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ABSTRACT: The study was carried out to check the effectiveness of combined chemical coagulation and electrocoagulation process in treating textile industry wastewater. Sample of textile dye effluent was collected from RustamTowel Industry located at GajuMatta**,** Lahore.Before treatment sample pH was maintained at 9 followed by chemical coagulation and electrocoagulation. Treatment efficacy was measured in terms of decolorization and chemical oxygen demand (COD) reduction. The color concentration of sample was measured by visible spectrophotometer. Parameters such as effect of coagulant dose and application of different voltages were under consideration.

Combined treatment process proved very effective in decolorizing the sample. The study showed increase in the pollutant removal on increasing the amount of coagulant ($MgCl_2$)**.**The chemical coagulation process showed 41% color removal efficiencyat minimum dose of 0.1g. While it removed 71% color at 0.35g dose. At minimum dose, chemical oxygen demand (COD) reduced to 774 (3.25%) and 299 (62.6%) reduction was observed at maximum dose as compare to sample.Further treatment by electrocoagulation enhanced the pollutant and color removal efficiency by 10-30%.COD and color removal efficiency of 80.5% and 83% were achieved by overall combined process (coagulation and electrocoagulation). Use of these combined processes is recommended effective for the removal of both organic and inorganic compounds from textile dye effluent.

Keywords: Textile Dye Effluent, Chemical Coagulation, Electrocoagulation, Color Removal, Chemical Oxygen Demand

TREATMENT TECHNOLOGIES: P-TT-03

INVESTIGATION OF THE EFFICACY OF ADAPTIVE TAKAKURA COMPOSTING METHOD AS AN ORGANIC FERTILIZER UNDER VARIED LAB CONDITIONS

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ABSTRACT: Takakura composting, is even an easier, safe and cheap process with a quality end product. The present study investigated about the potential of Takakura Home compost as an organic fertilizer. A total of 10 samples with different five treatments of EM solutions were prepared over temperature 27˚C and 37˚C for two weeks. Effect of temperature, pH, Moisture Content, organic matter, Total Organic Carbon (TOC), Potassium, Phosphate and Nitrogen were analyzed. On the basis of these results, a compost sample with best parameters was selected and prepared for a duration of 2 months. In addition, mold grown in compost was also identified as the strain of ***Aspergillus flavus.*** pH of all samples were in basic range (8.74 – 9.19), Moisture Content (M.C) from 22% to 25%. All the samples are organic (O.M 42% - 56%), TOC 24% - 33%. All the samples were phosphate depleted, Potassium and Nitrogen were also mention the range in some samples. Heavy metal analysis of final product were all in agreement with the European Standards. Results of the present study are suggestive that this method is safe and applicable to use for home and commercial purposes with some amendments.

Keywords: Heavy Metals, Organic Fertilizer, Compost

TREATMENT TECHNOLOGIES: P-TT-04

GIS BASED APPROACH FOR LANDFILL SITE SELECTION–KASUR CITY

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ABSTRACT: Solid waste management is a complex issue and it becomes more complex in developing cities where resources to manage sold waste are limited and community awareness regarding waste reduction and reuse/recycling is not enhanced. Local administrative authorities with many obstacles and less opportunities are unable to handle huge amounts of waste generated by ever growing population in urban areas. One relatively better solution for waste management in developing cities with lack of resources is building an open landfill site which can save city area from health issues created by unmanaged waste and keep the city clean. Open landfills cost less as compared to engineered landfills with advanced facilities of leachate prevention and collection of dangerous gases generated from chemical reaction in dumped waste. Kasur city is adjacent to Lahore, the capital of Punjab hence prone to urbanization and its population is increasing at a fast pace hence waste generation rate is evidently become high. To keep the city environment hygienic and healthy there is a need of better solid waste management. There are many open spaces all around the city of Kasur but most of the land is agricultural. Industrial activities are also very prominent in Kasur vicinity so its is a complex job to find an optimal site for dumping of waste keeping in mind all the limitations. GIS with its improved techniques regarding handling of geographic and related attribute data can play vital role in solving such spatial problems. The main criteria set for identification of suitable site for landfill is that it should be at least 5 KM away from city center and also away from surrounding villages where a fair number of people are living. Distance from roads was set 100 meters on both sides for highways and 30 meter for other roads. A 500 meters buffer was set for Railway line. Fresh water canals in the study area were assigned 500 meters buffer and streams/sewer given 300 m buffer on both sides. Land use classes exist in study area Settlements, Agricultural Area, Canals, Streams and Open Spaces. Open land is main target for building landfill if it meets all other criteria. Groundwater is very important and to prevent contamination the criteria for groundwater depth is set at 30 meters. In ArcGIS 10.5 all maps required were prepared and buffers of specified distances were applied which resulted in identification of area not suitable for landfill. This buffer of unsuitable area was subtracted from land use map of Kasur and the remaining areas are those which are suitable for building a landfill. Groundwater depth analysis of the remaining area separated the suitable and unsuitable land and only those areas where groundwater depth is higher than the specified value were further investigated to purpose the landfill site for Kasur City. Further research with more data related to geotechnical investigations and economic viability can improve the results.

Keywords: Landfill Site Selection, Urbanization, Groundwater, Arc GIS, Geospatial Techniques

TREATMENT TECHNOLOGIES: P-TT-05

COMPARATIVE PERFORMANCE EVALUATION OF OZONE OXIDATION AND PHYSICOCHEMICAL PROCESS FOR THE TREATMENT OF ELECTROPLATING WASTEWATER

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ABSTRACT: Various attempts have been made to assess the heavy metal content in electroplating wastewater, being discharged from large scale industrial units. In this study, basic wastewater characteristics such as pH, COD, BOD_5, and heavy metal concentration for Nickel (Ni), Cadmium (Cd), Chromium (Cr) and Copper (Cu) were determined and compared to the regulatory standards. The results showed that the concentration of heavy metals was found to be in the following order; Ni was 27.5726 mg/L, Cr was 60.1002 mg/L and Cu was 0.8083 mg/L whereas Cadmium was below detectable limit. Furthermore, a comparative evaluation has been presented of ozone oxidation and physicochemical process (coagulation and flocculation) in terms of their treatment efficiency for nickel containing electroplating wastewater. The efficiency of ozone treatment and coagulation and flocculation was evaluated in terms of removal percentage. The wastewater was treated with ozone and it was very effective for up to 30-40 minutes and achieved removal efficiencies of 42% and 26% for Ni and Cr respectively. However, in coagulation and flocculation, six beaker jar tests were conducted to remove Ni and Cr by using three different coagulants and non-ionic polyacrylamide. Among all these coagulants, Aluminum sulphate was found to be more effective in combination with polymer and achieved better removal efficiencies. The optimum removal efficiency was achieved at 90 mg/L dose of Aluminum sulphate and 100 mg/L of polymer for 98% and 99% removal of Ni and Cr respectively. Therefore, it can be concluded that the physiochemical process (coagulation and flocculation) was more efficient method as compared to ozone treatment.

Keywords: Oxidation, Physiochemical Process, Wastewater

CLIMATE CHANGE AND ENERGY MANAGEMENT: P-CCEM-01

ASSESSMENT OF WATER SUSTAINABILITY DUE TO CLIMATE VARIABILITY OVER THE HIMALAYAS WATERSHED

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ABSTRACT: Increasing population, economic growth and irregular distribution of water and other anthropogenic activities have put enormous burden on available freshwater resources. With the rise in population and industrialization in last century, the water demand has also ascended. Evenness has to be maintained between social, environmental and economic aspects to cope up with the rising demands. In this study we use the Reconnaissance Drought index (RDI) as an indicator to assess the water sustainability by using the Reliability-Resilience-Vulnerability Concept (RRV) over the Mangla watershed of Himalayas. The future climate projection data is divided into three period near future (2020-2045), Mid future (2046-2075) and far future (2076-2099) is use to evaluate the future sustainability of water in the watershed. The results show that the water sustainability is poor in the future and becomes vulnerable in the watershed which may affect the ecosystem of the watershed and disturb the hydrological cycle of the region.

Keywords: Reconnaissance Drought Index (RDI), Reliability-Resilience-Vulnerability (RRV), Sustainability, Climate Change.

CLIMATE CHANGE AND ENERGY MANAGEMENT: P-CCEM-02

SPATIO-TEMPORAL ASSESSMENT OF LAND COVER CHANGES AND IMPACTS ON CLIMATE CHANGE

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ABSTRACT: In 1990 the total forest cover of Earth surface was 30 percent but after that there was a decrease of 13 million hectors of the trees every year that means 78,000 square miles of the surface of forest has been removed annually for agricultural and other different purposes depending upon the type of location. The rising temperature of Earth is a result of vast emission of greenhouse gasses in the atmosphere which is directly proportional to the cutting of trees because forests are the carbon sinkers. In this study, district Mansehra, Pakistan was chosen as the study area. The main objectives of this research are to assess the extent and the changes in the rate of deforestation in Mansehra since last 20 years. It also examine the impacts of deforestation on the Climate by establishing and mapping the magnitude and rates of land cover changes that had occurred in the study area. Landsat satellite images were taken as secondary data and they were foremost for the classification process. Remote sensing data together with GIS techniques have made it conceivable to display and oversee remotely detected information in various scales. The images taken for classification are Landsat 5 TM for the year 1998 and 2008 and from Landsat 8 OLI/TIRS TM for the year 2017. Climatic data from 1988 to 2017 was collected from Pakistan Meteorological Department (PMD) of Mansehra District. The forest cover was 14% (601 Sq. Km) in 1998, 15% (668 Sq. Km) in 2008 and 5% (194 Sq. Km) in 2017. Taking everything together, anyway the results exhibit that some land cover types experienced extending rates and sizes of changes however in the others the inverse is legitimate, results revealed that the size and the rates of land cover changes for forest areas and barren land experienced an exceptional fluctuation in these 20 years. Maximum temperature of Mansehra increased at an alarming rate from 25.82° C in 1988 and 24.8° C in 1998 to 25.667° C in 2008 and 27.304° C in 2016 and 26.739° C in the year 2017. Mean minimum temperature showed fluctuation of 1° during these 30 years. In some years mean minimum temperature showed decrease from 12° to 11° and this change is not confined to a specific year. The rainfall was 5.129 mm in 1988 and then rainfall increased from 3.6 mm in the year 1998 when there was 14% forest cover to 4.8 mm in 2008 when there was 15% Forest Cover but declined to 2.9 mm in the year 2017 when there was only 5% forest left in Mansehra. Taking in to concern the importance of forests for global climate and the complexity of kinds of land cover in Mansehra, exploration of as well as working on other classification approaches

that might produce better results can be done. The research area could be explored more and future research could be prepared constructing on results of this study and refining its results, focusing on accurate delineation of dense forest area and even sparsely forest areas.

Keywords: Climate Change, Precipation, Temperature, GIS

CLIMATE CHANGE AND ENERGY MANAGEMENT: P-CCEM-03

SEASONAL VARIATIONS OF SULFATE OVER LAHORE DURING 2018

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ABSTRACT: Air pollution has become the major issue for developing countries like Pakistan. Very rare information is available related to level of pollution in different geographical areas. This study represents the modeling work to stimulate the variation of sulfate concentration over Lahore during 2018. The whole year data is collected from NASA using the Giovanni. OpenGrADS software is used to evaluate the results. temperature, relative humidity, precipitation, pressure, total aerosols were also noted during the research. These all parameters were abruptly change due to unwanted change in climate. Sulfate concentration was also high mostly in winters due to dry weather and shortage of rainfall. Thus different pollutants especially sulfates accumulate in the atmosphere and not dispersed. These all changes occur due to the anthropogenic activities. Most of sulphur dioxide comes from burning of fossil fuels, organic matter and from industrial unit. Sulfates particles emitting from the transportation vehicles get dispersed in the air. These particles combine with the oxygen in the air and form sulphur dioxide. Thus air quality of Lahore is not well for the living organisms. The quality of air in Lahore can be improved by regular air monitoring. It is the duty of government to highlight the status of air quality and its impact on public health on regular basis.

Keywords: Air Pollution, Sulphate Concentration, Air Quality Modeling

CLIMATE CHANGE AND ENERGY MANAGEMENT: P-CCEM-04

SEASONAL VARIATIONS OF BLACK CARBON AND ORGANIC CARBON OVER LAHORE IN 2018

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ABSTRACT: Black carbon and organic is source of the emission and exceeded concentration that have high effects over seasonal variation. All types of carbon are affecting the atmosphere but black carbon and organic carbon could have high negative impacts on the environment and people living over the affected area. Major health impacts that could occur are harmful effects on the cardiovascular system (the heart, blood, and blood vessels),cancer, even birth defects, respiratory diseases like asthma and people of lower socio- economic status. I worked on Lahore by software to observe the concentration of black carbon and organic carbon and their impacts annually over city. Two carbons play different roles and impacts such as biomass and bio fuel burning. Major component of black carbon is soot (a complex light-absorbing mixture) that also contains organic carbon. While the temporal resolution varies from monthly for small volcanoes to annually for biomass burning and aircraft emissions, and annual averages for land-based and ship emissions. I used software (Giovanni) to observe the emissions and concentration produced in different seasons of Lahore. Moreover, the impacts of noise produced on people living in Lahore were also studied such as anxiety, stress and communication interference etc. The concentrations of observed measures were also suggested to reduce the impacts of black carbon and organic carbon

Keywords: Black Carbon, Organic Carbon, Seasonal Variations

WATER RESOURCES MANAGEMENT: P-WRM-01

WATER CONSERVATION AND ITS STRATEGIES: A CASE STUDY OF EDUCATIONAL INSTITUTES AND RESIDENTIAL AREA OF HAYATABAD PESHAWAR

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ABSTRACT: Water conservation is the practice of using water to reduce the unnecessary water usage. Water conservation is very important because fresh water is limited as well as a costly. Conservation of this natural resource is critical for the environment and for all of us to live in this world. The purpose was to address the ongoing water shortage problem by making some lifestyle changes. For this purpose institutional conservation techniques was chosen. A survey was conducted at different institutes in Peshawar and residential area of Hayatabad, Peshawar.The data obtained from different institutes was analyzed. Then calculations were done for per capita usage of water. We conducted small awareness campaign and then calculated the per capita usage again. A noticeable of reduction of water usage was observed. The research methodology was involved survey, interviews and questionnaire to know the problems and then calculation of water usage. The conclusion of this study is that there is lack of awareness among the people which leads to water wastage. This is the main reason for water shortage and improper management is also the second cause of this shortage. Finally generalization of this strategy is suggested to the other urban cities of Pakistan for the awareness campaign among the people to conserve the water.

Keywords: Water Resources, Conservation Practices, Survey, Awareness

CLIMATE CHANGE AND ENERGY MANAGEMENT: P-CCEM-05

EFFECTS OF SMOG AND USE OF CATALYTIC CONVERTOR TO COMBAT IT

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ABSTRACT: Air Pollution has become a great threat to developing countries. Pakistan is also a developing country that faces the effects smog every year for the past five years. Many solutions are provided yet of which none were implemented or applicable. Primarily, 75% of carbon monoxide emissions come from automobiles. This study aims upon finding a relation between smog and use of catalytic convertor to mitigate it catalytic convertor is used in conventional motorbikes. A study was conducted between the emission from two bikes. One which had catalytic convertor installed other was a conventional motorbike. The data for emission was collected for a month and then a table was formed. This was done in the vicinity of Lahore, Pakistan to measure the pollutants an automobile makes. The use of other devices was also used to measure emissions in real-time. So, it was observed that a catalytic convertor transforms around 98% of the harmful fumes produced by an engine into less harmful gases. The incomplete combustion of the fuels in the engine paves a way for the production of products like carbon monoxide, hydrocarbons, and particulate matter. So, the catalytic convertor is inserted in the silencer of the motorbike which will not only control the formation of these gases which results in smog formation but the engine efficiency and mileage will also be enhanced. To sum up, motorbike which had catalytic convertor produced less emission than compared to a conventional bike. More study and research is yet to be done in finding the applicability of catalytic convertors in motorbikes and mitigation of SMOG.

Keywords: SMOG, Catalytic Convertor, Air Pollution,

NANOTECHNOLOGY: P-NT-01

SYNTHESIS OF TIO_2/SNO_2 NANOCOMPOSITE FOR THE PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE DYE

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ABSTRACT: Nanocrystalline TiO_2 nanoparticles and TiO_2/SnO_2 nanocomposites were synthesized by sol-gel method. The composites were prepared in different molar ratios and characterized by FTIR. The photocatalytic efficiency of simple titania was compared with the prepared composites for the degradation of methylene blue dye. It was observed that both the composites showed better photocatalytic efficiency than simple titania. The composite containing higher titania content, however, exhibited best activity and up to 98% dye degradation was observed after 120 min at 12 pH.

Keywords: Photocatalytic Degradation, Methylene Blue, Nanocomposites, Sol-Gel Method

NANOTECHNOLOGY: P-NT-02

EXTRACTION OF PHYTOCHEMICALS FOR THE SYNTHESIS OF COPPER NANOPARTICLES FROM THE LEAVES AND FLOWERS OF *PARTHENIUM HYSTEROPHORUS L.*

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ABSTRACT: The present study revealed the synthesis of copper nanoparticles from the leaves and flowers extracts of *Parthenium hysterophorus* L. The plant extracts were prepared in polar solvents i.e. distilled water and ethanol and analyzed for different phytochemicals such as total phenols, alkaloids, Protein contents, and also for free radical scavenging activity. Total phenols of *P. hysterophorus* leaves and flowers was found to be 9.0 ± 0.15 mg/g and 16.3 ± 0.77 mg/g respectively and free radical scavenging activity were analyzed to be 72.58 ± 0.54 % and 76.56 ± 0.56 % respectively. Alkaloid precipitates were analyzed by gravimetric method and revealed 1.204 ± 0.10 % alkaloid in leaves and 0.302 ± 0.09 % in flowers. Protein contents were found to be 67.5 ± 0.75 mg/g in *P. hysterophorus* leaves and 84.5 ± 0.64 mg/g in flowers. By using these phytochemicals present in plants copper nanoparticles were prepared. The prepared copper nanoparticles were characterized by SEM (scanning electron microscopy) and UV-Visible spectroscopy. The size and UV-Vis spectra of *P. hysterophorus* leaves and flowers were found to be within the range of 170-190 nm and 180- 210 nm, and highest peak values at around 260 nm and 280 nm respectively. For this approach, it is suggestive that this rapid synthesis of nanoparticles would be proper for developing a biological process for mass scale production.

Keywords: Copper Nanoparticles, Phytochemicals, SEM, Parthenium Hysterophorus L.

ENVIRONMENTAL TOXICOLOGY: P-ET-01

DETERMINATION OF AFLATOXINS AND ANALYSIS OF PROXIMATE COMPOSITION OF POULTRY FEED COLLECTED FROM DIFFERENT AREAS OF MULTAN

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ABSTRACT: The prevalence of Aflatoxins in poultry feed (starter, grower, finisher, layer, broiler and breeder crumbs) collected from ten different locations of Multan city, were analyzed for their Aflatoxin content by thin layer chromatography (TLC). A mixture of Chloroform and water was used for the extraction of aflatoxin from the sample. Instantly 5- and 10-mL sample was spotted on TLC plate with the help of capillary tube. Spot 5 mL standard on the edge of TLC plate as an internal standard. Develop the plate in diethyl ether (first mobile phase) TLC tank containing 50ml diethyl ether. Remove the plate from TLC tank after development with ether then let it dry. Further, redevelop the plate with (1:9) (v/v) acetone-chloroform (second mobile phase). It was observed that 90% of the samples were contaminated with aflatoxins out of which 52% of samples were beyond the limits (20ppb) set by USFDA. In positive samples the concentration of aflatoxins ranged from 15.27 to 32.36(ppb) mean ($18.45 \pm 10.23 ppb$).The proximate analysis for determination of moisture content, ash content, crude protein, crude fat and crude fiber of feed samples was done according to the standardized method to correlate Aflatoxins with composition of the feed. The results regarding Aflatoxin B1 indicated maximum mean value (32.36ppb) in broiler crumbs and minimum (15.27ppb) in layer chick starter. The moisture content revealed that there was positive correlation (r=0.88) between moisture and Aflatoxin B1. Other parameters had negative correlation with aflatoxin B1 protein(r=-0.25), fiber(r=-0.14), fat(r=-0.44), ash(r=-0.33). It is concluded from present study that the samples had a significant level of toxin, that might become threat for poultry industry. As the results revealed that the incidence of contamination was greatly affected by the moisture level of feed, therefore the moisture must be kept reduced to minimize such harmful risk of toxin contamination.

Keywords: Aflatoxins, Poultry Feed, Thin Layer Chromatography, Moisture

PLASTIC POLLUTION: PP-01

SPATIAL DISTRIBUTION OF MICROPLASTICS (MPS) IN URBAN SOIL OF LAHORE, PAKISTAN

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ABSTRACT: Plastic pollution has become a major issue all over the world due to rapid urbanization and extensive use of plastic products. Most of the research has been conducted on MPs in marine and freshwater ecosystems and a very little is known about MPs in soils. Keeping this in view, the objective of this study was to highlight the spatial distribution of MPs in top soils of different land use types of Lahore. In this regard, 40 samples were collected from eight different land use groups. After collection, the samples were sieved through 5mm mesh sized sieve. These samples were further subjected to acid digestion to burn the organic matter. MPs were segregated through density separation and identified under stereomicroscope. The range of MPs in top soils of Lahore varied from 1,750 to 12,200 MPs/Kg with an average of 4482.5 ± 2314.9 MPs/kg. The highest numbers of MPs were present in the Industrial areas while the lowest numbers of MPs were found in soil samples of agricultural area. The fibers were present abundantly in each sampling site and beads were only identified from dumping sites. The present study was first study in Pakistan to explore the MPs in soil of Lahore. Further investigations needed to develop strategies for MP management.

Keywords: Microplastic pollution, Urban soil, Rhizosphere, Spatial distribution