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PREPARATION OF OIL / WATER EMULSIONS OF PARAFFIN AND BEES WAXES WITH WATER

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Abstract: The wax emulsions have a great industrial importance as these are used in various fields like protective coatings of fruits, seeds, cemented material, paper boards etc. They showed great water repellency, lubrication, sewability and finishing to the first product when applied to knitting yarn in textile industry. In present work a few useful emulsions are prepared by using paraffin and bees waxes. A variety of emulsifiers and stabilizers were checked to serve the purpose. The best sprayable emulsions were obtained using stearic acid triethanolamine and oleic acid triethanolamine as emulsifiers. Application on cemented materials was also checked.

Introduction

The term wax encompasses a large range of naturally occurring and synthetic materials constituted from high fatty acid esters (typically C_{36} C_{50}) or polymers (molecular weight 700 - 10,000) that differ from fats in being harder and less greasy. The term wax should be rather seen as a generic term for materials that are solids at 20°C, varying in consistency from soft and plastic to hard and brittle. Chemically, a wax is a type of lipid that may contain a wide variety of long chain primary alcohols and fatty acids, usually distinguished from fats by the lack of triglyceride esters of glycerine (propane-1,2,3-triol). Paraffin waxes are hydrocarbons, mixture of alkanes usually in a homologous series of chain lengths. Paraffin waxes refers to the solids with n = 20-40. Paraffin wax is unaffected by most common chemical reagents and has high electrical resistivity (10^{13} 10^{17} Ωm). Due to its immence properties it has many industrial and domestic applications like coating of cemented materials, textile fibers etc.

Jinhhuan[1] and co-workers prepared emulsion by using paraffin wax which is applicable in washing, cleaning and polishing cars without water. Cui[2] and his co-workers prepared emulsion mixing slack wax, neurtal oil, ethoxylated nonylphenol, oleic acid, $HOCH_2CH_2NH_2$ and balanced water. Hayase[3] prepared wax emulsion useful in skin care products containing sorbitan monostearate, stearic acid, biphenyl alchohol, self emulsified glycerine monostearate, paraffin wax, squalene, Bu paraben, sodium N stearyl-2-glutamate, Me paraben, concentrated glycerine, dipropylene glycol, retinal palmitate and water. Klaws and Ute[4] prepared wax emulsion comprising essentially an emulsion of high melted paraffin wax, an amine salt of carboxylic acid, water and optionally alkyl polyglycol ether. The emulsion was applicable to underground attachments and carriageway pavements as soil stabilizing agent. Tadahiko ad Yoshika[5] manufactured an emulsion for coating the constructed materials, consisting of Me chloride, paraffin wax, nonprotic polar solvent and vinyl acetate emulsion particle parts. Kimno[6] and co-workers prepared an emulsion consisting of paraffin wax, mircocryst. wax, polyethylene nonylphenyl ether and water. The emulsions thus formed used in cleaning booths which involves

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spreading and spraying the emulsion on booth interiors forming a layer and then spreading the warm water to melt the layer and to remove residual coating after the coating process. Reo and Johnson[7] prepared a useful emulsion by using carnauba wax, acetaminophen ganular and triglycerylmonostearate. The emulsion formed was applicable as pharmaceutical coatings with rapid dissolution and enhanced long term stability for the pharmaceutically active ingredients. Ottboni and Ryan[8] formed and aqueous paraffin wax emulsion used as water repellent coating on panels. Morton[9] and co-workers prepared an oil based furniture wax emulsion and the resultant product was easily applicable over an article of furniture with longterm durability and did not attract dust.

In present work conditions are optimized for preparing industrial emulsion from paraffin as well as bees wax, which could be used as "moisture retainer" in cement structures.

EXPERIMENTAL WORK

Reagents Used: Paraffin wax; bees wax; stearic acid; oleic acid; boric acid; borax; NP9; triethanolamine (All reagents are of commercial grade).

Methodology: 5.5 g of paraffin wax or bees wax was taken in 250 mL conical flask and melted it at 70 °C, heated continuously to attain the temperature 80 – 90 °C of melted wax. 2.5 g stearic acid was then added to the melted wax followed by the addition of 1.5 g triethanolamine at a constant stirring rate of 5 rpm. Then 90.5 g of distilled water (which was pre-heated at the same temperature 80 – 90°C) was added slowly and with continued stirring for 5 – 7 minutes. Prepared emulsion was cooled down and stored at room temperature in stoppered vessel.

Following the same procedure different emulsion have been prepared by changing the emulsifier stabilizer (*i.e.* stearic acid, oleic acid, oleic acid triethanolamine, NP9, NP9 triethanolamine, borax, borax triethanolamine, boric acid, boric acid triethanolamine), varying their compostions for both paraffin and bees wax individually, the stablility and water repellency of prepared emulsions were also checked.

The prepared emulsion was passed through a series of tests in order to confirm its oil in water emulsion phase and its stability. Following tests were performed;

- Dilution test
- Conductivity test
- Dye Solubility test
- Cobalt chloride test
- Stability test (on 2 month storage)

The prepared emulsion was compared with commercially available wax emulsion used in textiles.

Results and discussion: The wax emulsions are applicable to a large number of fields of life. These are used for coating of citrus fruits. Oranges and other citrus fruits coated with wax emulsions show less weight loss and better water resistance. A potential use of wax emulsions is in spraying on seeds / fertilizers which help in protecting the seeds from moisture loss and aiding in the release properties of the fertilizers. These are also used as protective coatings on timber and wood articles providing abrasion resistance, water proofing, weathering, anti-blocking properties and softness of touch. Wax emulsions are also extensively applied in paper manufacturing where there is a need to

decrease the penetration rate of liquids in to paper, cupboard and paperboard structure. Wax emulsions also give better water repellency, lubrication, sewability and finishing to the final product when applied to knitting yarns in textile industry.

Various combinations of emulsifiers stabilizers *i.e.* stearic acid; stearic acid triethanolamine; oleic acid; oleic acid triethanolamine; boric acid; boric acid triethanolamine; borax; borax triethanolamine; NP9; NP9 triethanolamine have applied for emulsification of waxes (paraffin and bees wax). Emulsion prepared from stearic acid triethanolamine and oleic acid triethanolamine for both paraffin and bees wax were found stable at room temperature. The emulsions were sprayable and can easily applied to cemented and other material to encapture moisture and to enhance water repellent property. While stearic acid and oleic acid alone *i.e.* in the absence of triethanolamine were not suitable for emulsification similarly triethanolamine alone had no effect for emulsification. Boric acid and borax were also employed as emulsifiers, both found to be not suitable for wax emulsification. Boric acid in combination with triethanolamine formed emulsion stable only for two minutes in hot state. NP9 in combination with triethanolamine formed emulsion stable only for one minute in hot state. NP9 alone had no effect on emulsification of both the paraffin and bees waxes. The concentrations of all the tested combinations have varied in order to get the optimized condition for emulsification of waxes.

Conclusion: Now conclusion can be made from the results obtained that stearic acid/ triethanolamine and oleic acid/ triethanolamine are suitable emulsifiers for emulsification of paraffin and bees wax. The emulsions formed are stable at room temperature and can stored at ordinary temperature in any environment. Moreover the emulsions formed are sprayable and form persistent fine film when applied on cemented material. The film formed was found water repellent and can encapture moisture in cemented material for complete setting of cement.

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