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ECOFRIENDLY LIQUID DETERGENTS BASED ON LINSEED OIL AND ROSIN

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ABSTRACT
A novel short oil alkyd has been synthesized based on linseed oil, phthalic and maleic anhydride and rosin. In this work, efforts were made to replace the conventional active matter linear alkyl benzene sulphonate (LABS) by polymeric surfactant (Alkyd resin) in detergent composition and so they can be labeled as ecofriendly polymers. An ecofriendly alkyd resin polymer based on linseed oil and rosin was synthesized and used with sodium lauryl sulphate (SLS) instead of LABS for detergent formulation. The proposed composition can be easily prepared in existing alkyd resin manufacturing plant. Various analytical parameters like surface tension, foaming properties and detergency on solid cloths were studied and were found to be at par or sometimes better than commercial samples..

Keywords: Alkyd resin, polymeric surfactant, powder detergent.

INTRODUCTION

Today human race is looking forward to increase longevity with a desire to live long and enjoy the life at its best and the solution for that is preservance of health. Among the various factors essential for preservance of health, pollution free environment stands at top. This pollution free environment is possible only when we conserve the nature. The demand for ecofriendly products is growing continuously in the last two decades. Polymeric materials play a prominent role in everyday life and have been essential to a variety of industries. Now a days most commercially available polymers are derived from non renewable resources and account for approximately 7% of worldwide oil and gas fuel. Considering the continuous depletion of fossil feed stock, dramatic fluctuations in the oil price and environmental issue, academic and industrial researches are devoting increasing attention and efforts to the utilization of renewable resources as raw material for the production of polymeric material. The most widely used renewable raw material include polysaccharides, wood ,proteins and plant oils. Among these , vegetable oils are the most widely used renewable resources due to their low toxicity, inherent biodegradability, ready availability and relatively low price. Rosin is a residual obtained from the distillation of pine exudates. It is also abundantly available and widely used in large number of industrial products like paints, detergents ,cosmetics and pharmaceuticals.

In the present research Authors have successfully used sorbitol[1-4] in liquid detergents. In this work experimental conditions have been worked out for getting a novel resin based on vegetable products like linseed oil[5] and rosin[6]In this study efforts were made to replace from detergents the conventional active matter linear alkyl benzene sulphonate formulation by polymeric surfactant.. The reduction and removal of polyphosphates for getting ecofriendly detergents are only possible because of polymeric surfactants. Rosin a major ingredient of alkyd resin polymeric surfactant is a surface–active agent[7].

The polymeric surfactant based on vegetable oil and rosin will be certainly biodegradable and ecofriendly as they are from renewable vegetable sources.

EXPERIMENTAL

Synthesis of Alkyd Resin[8]

Linseed oil, rosin, all the ingredients except phathalic anhydride are taken initially in a standard glass reactor of two litres capacity fitted with tafflon stirrer, thermometer and temperature control arrangement ± 2^{0}C. Xylene and 1-butanol (3:1) were used as solvents. Details of heating schedule and order of addition of reactants are given in Table 2.

Preparation of Liquid Detergent Samples

The various detergent ingredients and the composition of various liquid detergents are shown in table 3. Required amount of novel resin and their ingredient like Sodium lauryl sulphate , sodium lauryl ethyl sulphate , Sorbitol and Sodium suphate are taken in 500 ml beaker and homogenized by running the stirrer for about half an hour. A clear solution of liquid detergent was obtained after one hour. This solution was filtered and

packed in superior grade air tight container. Liquidr detergents were prepared by varying the percentage of resin from 0 to 10%. Sodium lauryl slphate and Sodium lauryl ether sulphate has been used to have better foaming and cleaning properties. Table No.4 and 5 gives information about foaming characteristics, surface tension and stain removing of soil and tea stains. Our samples are on par or sometimes even better than commercial product which has been tested simultaneously. The testing has been done as per standard methods. Percentage detergency was also determined by using standard soiling technique for cotton and tericot cloth. For measurement of reflectance, standard digital reflectance meter has been used.

Surface Tension[9]

The surface tension of powder detergent was measured using stalagmometer.

Foam Volume[10]

Foam is a cause of dispersion of gas in relatively small amount of liquid. This was measured by using mechanical agitation in a closed vessel. Foam characteristics were measured in terms of volume by Bubble cylinder method.

Detergency Test:-This includes the following steps.

Preparation of soil medium[11]

The soil medium is prepared with following composition. The mixture carbon black (28.4%)and lauric acid (17.9%)and mineral oil (17.9%) was taken in a pestle mortal and grind thoroughly for 1-2 hours to get fine grinding and smooth filling. About 2gm of above paste was mixed well with 500ml of carbon tetra chloride and used for soiling of fabrics

Fabric Washing[12]

The solution of 1% concentration of powder detergents in distilled water was prepared. These solutions were heated to 60% and stained fabrics were dipped in it for five minutes. Then to and fro hand washes were given with equal strokes. After washing the test materials were rinsed in running tap water, dried and ironed. The same experiment was carried in exactly same manner with commercial detergent sample. The % detergency was found out by using Lambert and Sanders formula.

$$\% \text{ Detergency} = \frac{(Rw-Rs)}{(Ro - Rs)} \times 100$$

Where, Rw = Washed fabric

Rs = Soiled fabric and

Ro=Standard original fabric.

The reflectance was measured with an electro reflectance photometer with filter R-46 and calibrated against MgO standard.

Table-1: Composition and Heating Schedule of Novel Polymer

Ingredients	**% by weight**	**Order of addition of reactants**	**Time of heating in Hrs: Mins**
Linseed oil	17.0	Linseed oil, rosin, glycerol, catalyst, maleic anhydride, benzoic acid.	
Rosin	34.0	Heat at 170^{0}C	1:00
Glycerol	25.0	Heating at 248^{0}C	2:10
Maleic anhydride	5.0	Cool to 230^{0}C	0:20
Phthalic anhydride	14.0	Slowly cool to 80^{0}C	1:00
Benzoic acid	3.0	Stage B:-Add phthalic anhydride and 5% solvents (3:1) Xylene: Butanol. Heat to 225	1:00
Sodium bisulphate	1.5	Continue reaction further at 225^{0}C	4:00
Sodium bisulphite	0.5	Cool to 80^{0}C and remove the product	
% Yield	93	Total time in Hrs:mins	9:30

Table-2: Formulation of Detergent Powders Based on Novel Polymer

Ingredients	**LD_1**	**LD_2**	**LD_3**	**LD_4**	**LD_5**
Acid slurry	**10.0**	**-**	**-**	**-**	**-**
Resin	**-**	**2.5**	**5.0**	**7.0**	**10.0**
SLS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**
AOS	**7.5**	**7.0**	**7.0**	**7.0**	**7.0**
Sorbitol	**10.5**	**10.5**	**10.5**	**10.5**	**10.5**
Sodium sulphate	**5.0**	**6.0**	**7.0**	**10.0**	**10.0**
SLES	**10.0**	**10.0**	**3.0**	**10.0**	**10.0**
Water	**54.5**	**61.0**	**64.5**	**52.5**	**54.5**

ABBREVIATIONS:-

SLS - Sodium lauryl sulphate
SLES - Sodium lauryl ether sulphate
AOS - Alpha Olefins

Table 3: Study of Surface Tension at 0.5% and Foam Volume of Detergent Samples at 5 and 10 minnutes.

Foam is measured using standard cylindrical method and expressed in terms of volume Cm^3

Detergent Samples	**Surface Tension (Dyne/cm)**	**% Reduction in Surface Tension**	**Foam volume at 0.5%**	
LD1	17.83	75.2	400	390
LD2	24.51	65.9	340	330
LD3	25.28	64.8	175	170
LD4	24.14	66.4	150	140
LD5	24.14	66.4	165	160
Commercial	20.97	71.4	410	390

Table 4:-Evaluation of Detergency at 1% Concentration

Detergent Samples	**For Soil Stain**	
	Cotton (% detergency)	**Tericot (% detergency)**
LD1	71.1	62.4
LD2	77.1	74.5
LD3	82.2	63.5
LD4	79.5	69.8
LD5	80.3	70.0
Commercial	91.1	87.0

RESULTS AND DICCUSSION

1) The composition of novel polymer is given in Table No.1. A large quantity of rosin has been used. Rosin gives good foam, solubility and brilliant appearance to various soap and detergent compositions. However we are using large proportion of rosin which will also act as a chain stopper for alkyd synthesis. The cooking schedule has been standardized. The time of heating was 9:30 hours.
2) The composition of liquid detergents is given in Table No 2.The concentration of polymers is varied from 0-10%.The concentration of all the other ingredients has been maintained at a constant level. Sorbitol helps to give smooth and pleasant feel.SLES was used as foaming agent.
3) The foam volume measured at various concentrations is given in Table No 4.The samples have moderate foaming capacity but reduction in surface tension is appreciable. The detergents give excellent detergency from 70-80%. The data indicates that rosinated novel polymers have all the desired characteristics at 0.5% concentration. Various cloths like cotton and tericot give positive results for Soil stain removal.

CONCLUSION

The following conclusions stand confirm in the light of above experimental work

1) A novel polymer can be prepared based on rosin, linseed oil, maleic anhydride and glycerol. The order of reaction, time of heating, cooking schedule and catalyst has been standardized. The method of cooking is simple, easy to operate and without complications..Normally polymer cooking requires heating schedule of 12-15 hours while our heating schedule is of 9 hours 30 minutes. This is certainly saving time and energy.
2) Many alkyd resin plants are lying idle and not in use. These alkyd resin plants can produce alkyds in the same set up without much investment.
3) The manufacturing cost is less which is quite encouraging.
4) As the percentage of resin is increasing foaming characteristics are supperessed. These moderate foaming detergents can also be used in washing machines, floor

cleansers and also other industrial operations where foam is not needed.

5) All the samples do not contain Sodium tripolyphosphate which reduces lake and water pollution.
6) In our samples there is no use of any active matter of petroleum origin. All majority of ingredients are of vegetable origin. So they can be labeled as ecofriendly compositions.
7) Foam volume of various samples is less ,hence it saves water,yet these samples have excellent detergency characteristics comparable to commercial samples.

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