LOW FOAMING ECOFRIENDLY DETERGENTS BASED ON LINSEED OIL AND RESIN FOR DETERGENT

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ABSTRACT

A novel short oil alkyd has been synthesized based on linseed oil, phthalic and maleic anhydride and rosin.. The parameters for mole ratio, reaction temperature, type of catalyst and the time of heating has been studied. 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. The present compositions were on par or sometimes better than conventional commercial formulations when compared on analytical parameters like surface tension, foaming properties and detergency on solid cloths.

Keywords: Alkyd resin, polymeric surfactant, powder detergent.

INTRODUCTION

Vegetable oils have been used in various industrial products like wall finishes[1],water thinnable, paints[2],electrodeposition paints[3],water thinnable primers[4]and printing inks[5].Most of the conventional detergents contain artificial fragrances which are petroleum based.There are some disadvantages of using petroleum fragrances.the extraction process of petroleum will cause ecological and environmental damage. As we know the price and availability of petroleum products is souring every year, we must think of alternative vegetable products. India has a vast capacity of manufacturing alkyd resin which is used in surface coating industries. The per capita consumption of detergent is much higher than paints; therefore alkyd resin plants can produce alkyds in the same set up

without much investment. The use of polymeric additives in detergent is common since last 25 years with little alterations. The important characteristics of polymeric surfactant are adsorption on fabrics, Ca and Mg sequesterization,CaCO3 inhibition, fabrics anti- incrustation and soil disperancy and removal[6]. Authors have successfully prepared novel polymeric surfactant based on vegetable products like vegetable oil[7], rosin[8] and sorbitol[9]. The reduction and removal of polyphosphates for getting ecofriendly detergents are only possible because of polymeric surfactants. Earlier polymeric surfactant was used only as an additive while authors used resin as a total substitute of linear alkyl benzene sulphonate (LABS) successfully. Rosin a major ingredient of alkyd resin polymeric surfactant is a surface–active agent[10].

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

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 ± 2^0C. 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 Powder Detergent Samples

The various detergent ingredients and the composition of various detergents powders are shown in table 3.The ingredient in the powdered form are weighed and mixed thoroughly in a tray. Whole mass is then mixed thoroughly. This mixture is then poured in a mixing pot and worked for twenty minutes. After mixing the homogeneous mass thus obtained is taken out in a tray and kept in open air for drying. After

complete drying the solid mass thus formed is ground again in a mixer to get homogenized detergent powder. Four different powder detergents compositions have been prepared as detailed in table 3. Powder detergents were prepared by varying the percentage of resin from 0 to 20%.Small amount of 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

The surface tension of powder detergent was measured using stalagmometer.

Foam Volume

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[14]

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

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 24^{8}0C	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: Analysis of Novel Polymer

Property	Observations
Acid value	20.2
% solids	92
Viscosity by ford cup No 4 at 30^0c	120

Table-3: Formulation of Detergent Powders Based on Novel Polymer

Ingredients	S_1	S_2	S_3	S_4	S_5	S_6
Sodium carbonate	66.3	63.0	60.0	68.9	49.0	56.0
STPP	6.0	5.0	5.0	5.1	5.0	5.0
EDTA	0.1	0.1	0.1	0.1	0.1	0.1
Novel Polymer	-	8.0	10.0	0.2	23.9	20.0
Sorbitol	3.6	3.0	2.9	2.8	4.0	3.0
Sodium sulphate	3.6	3.0	2.9	3.0	3.0	3.0
Urea	2.4	2.0	2.2	2.0	2.1	2.0
SLS	3.6	-	-	-	-	-
SLES	2.4	-	-	-	-	-
Moisture	12.0	15.9	12.9	9.9	14.9	10.9

ABBREVIATIONS:-

SLS - Sodium lauryl sulphate

SLES - Sodium lauryl ether sulphate

EDTA - Ethylene diamine tetra acetic acid

STPP - Sodium Tripolyphosphate

Table 4: Study of Surface Tension and Foam Volume of Detergent Samples.

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%	
S_1	21.9	69.5	400	140
S_2	31.5	56.2	20	10
S_3	31.5	56.2	20	18
S_4	25.2	64.9	20	15
S_5	25.9	69.5	10	10
S_6	25.9	64.9	10	10
Commercial	22.8	68.2	400	180

Table 5:-Evaluation of Detergency at 1% Concentration

Detergent Samples	For Tea Stain		For Soil Stain	
	Cotton (% detergency)	Tericot (% detergency)	Cotton (% detergency)	Tericot (% detergency)
S_1	73.8	73.0	74.7	70.2
S_2	78.2	78.7	76.0	72.1
S_3	80.5	82.8	79.9	77.8
S_4	81.2	84.3	75.2	86.5
S_5	88.6	91.2	83.1	90.2
S_6	84.2	86.1	77.9	88.4
Commercial	94.0	95.1	97.4	95.0

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 detergent powders is given in Table No 3.The concentration of polymers is varied from 0-20%.The concentration of all the other ingredients has been maintained at a constant level. EDTA helps in Ca and Mg sequisterization. Sorbitol helps to give smooth and pleasant feel.

3) The foam volume measured at various concentrations is given in Table No 4.The samples have low foaming capacity but reduction in surface tension is appreciable. The detergents give excellent detergency from 80-90%. 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 Tea and 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) Samples S_2,S_3,S_4,S_5andS_6 do not contain SLS andSLES.Therefore their cost is less so they are recommended for commercial use.
4) These low foaming powder detergents can also be used in washing machines, floor cleansers and also other industrial operations where foam is not needed.
5) All the samples contain less percentage of 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 very less,hence it saves water,yet these samples have excellent detergency characteristics comparable to commercial samples.

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