*The Asian Journal of Experimental Chemistry,* (June, 2011); Vol. 6 Issue (1) : 35-37

*Research Paper :*

# Ecofriendly liquid detergents based on malenised vegetables oils

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## ABSTRACT

Malenized linseed oil suitable for use in liquid detergent has been synthesized. The reaction conditions such as mole ratio, temperature, time of reaction and use of catalyst have been standardized to get a product with desired HLB ratio, viscosity and solubility. A standard liquid detergent mainly based on sodium laurel sulphate, sodium laurels ether sulphate, Acid slurry and Alpha olefin sulphonate has been prepared, in successive compositions acid slurry and alpha olefin sulphonate has been replaced by neutralized malenized linseed oil by 50 to 100 per cent. A comparison of our maleic based detergents with commercial samples shows that maleic treated oils give excellent foaming, surface tension reduction and detergency properties. The raw material cost of our novel liquid detergents in reasonable and they can be tried on pilot scale and commercial scale production. The special feature of these liquid detergents is freedom from conventional linear alkyl benzene sulphonate and sodium tripoly phosphate so they can be labelled as ecofriendly products for green environment.

**KEY WORDS :** Liquid detergent, Malenised oil, Physio-chemical properties of liquid detergent.

**How to cite this paper :** Dhakite, Pravin A., Gogte, B.B. and Phate, B.W. (2011). Ecofriendly liquid detergents based on malenised vegetables oils. *Asian J. Exp. Chem.*, **6** (1): 35-37.

**Received :** *04.01.2011;* **Revised :** *25.04.2011;* **Accepted :** *18.05.2011*

Malenised vegetable oils have been used in various industrial products like wall finishes[1], water thinnable paints, electro deposition paints[3] water thinnable primers[4] and printing inks[5]. We have already used malenized oil for production of liquid detergent as well as lotions. Polymeric surfactants are an exciting new addition to the existing product range of surfactants. Polymeric Surfactants when incorporated into detergent they offer following performance features.

- Ca and Mg sequesterization
- Clay soil disperancy
- Calcium carbonate inhibition
- Prevention of soil redeposit ion
- Fabric anti incrustation..

In the present work experimental conditions have been worked out for getting a novel resin based mainly on linseed oil and maleic anhydride. The experimental conditions have been set up to get desired molecular weight, HLB ratio and desired characteristics. Novel catalysts sodium bisulphate and hydrochloric acid have been used in preparation of malenised oil.

The reaction of maleic anhydride when we heat the oil, a part of linolinic acid is converted to 9, 11,13 octadecatrionoic acid by condensation, this conjugated acid reacts with maleic anhydride by Diels Alder reaction. Maleic anhydride reacts with linolinic acid

The other reaction is direct addition of maleic anhydride at active methylene group

All the reaction is expected to give a useful active material for detergents. The high acid value copolymers have been neutralized with KOH to get water soluble composition with high surfactant activity.

## EXPERIMENTAL METHODOLOGY

### Experimental:

### The reactor:

The preparation of malenised oil was carried out in a glass reactor. The reactor consists of two parts. Lower part of the reactor is round bottom vessel with very wide mouth. The upper part of the reactor is its lid having four necks with standard joints. A motor driven stirrer was inserted in the reactor through the central neck, while another neck was used for thermometer a condenser was fitted with the reactor through the third neck. The fourth neck was used for dropping the chemicals into the reactor. An electric heating mantle having special arrangement for smooth control of the temperature (+2) has been used. A regulator controlled the speed of the stirrer with help

Procedure: Total Charg-1.5Kg
Coconut Oil +Maleic Anhydride + Sodium bisulphate+ Sodium bisulphate
↓
Mixed all ingredients add to the reactor
↓
Heat up to 200$^0$C
↓
Maintain Temperature for 1hour
↓
Heat at 230$^0$C for 3Hrs
↓
Maintain temperature for another 30 minutes at 150$^0$C
↓
Cool at 60$^0$C
↓
Thin down the resin if required with Isopropyl Alcohol.

Total time of Heating: 4 Hrs and 30 minutes

**Flow sheet 1: Heating schedule of malenized oil (% by weight)**

of clamps.

**Preparation of malenised oil :**

Initially linseed oil, maleic anhydride and catalyst were taken in glass reactor. The mass was heated slowly and steadily to 200$^0$C at about half an hour. This temperature was maintained for one hour. The reaction temperature was then raised to 230$^0$C and reaction was continued steadily for two hours at this temperatures. Now steadily reaction temperature was lowered down to 150$^0$ C and the reaction was continued at this temperature for two hours. The acid value and viscosity was observed periodically and reaction is terminated when desired acid value and viscosity was attained. Batch was with drawn carefully and weighted to get per cent yield.

**Neutralization of malenised vegetable oil:**

100 g of Novel copolymer was heated to 70$^0$ C. he calculated amount of KOH was added to novel Polymer with constant stirring so as to get slightly alkaline solution of polymer with pH 7.5.

**Table A : Composition of novel malenized oil (% by weight)**

| Ingredient | Batch No.1 ($M_1$) | Batch No.2 ($M_2$) |
|---|---|---|
| Linseed oil | - | 86 |
| Maleic anhydride | 15 | 10 |
| Coconut oil | 85 | - |
| Phthalic anhydride | - | - |
| Citric acid | - | - |
| Benzoic acid | - | 02 |
| Oxalic acid | - | 02 |
| Sodium bisulphate | 1.5 | - |
| Sodium bisulphite | 0.5 | - |
| HCl | 1 | - |

## EXPERIMENTAL FINDINGS AND ANALYSIS

Table 1 gives composition of selected novel polymers with desired properties. The major ingredient of polymer is Coconut oil, while minor ingredients are maleic anhydride. The catalysts used are sodium bisulphate and sodium bisulphate has been used as a solvent. The time of heating is 6hr at 220$^0$C.

The physiochemical properties of these polymers are given in Table 1. The acid value indicates the acid group of maleic anhydride react with –OH group of coconut oil to form esters. The color and consistency of the polymer is acceptable for commercial use. The polymers are soluble in water, alcohol and NaOH. The surface tension data indicates significant lowering of surface tension by novel polymers The HLB value[9] of products indicates it utility as ingredient in detergent compositions.

**Table 1 :Physico-chemical properties of Malenized oil**

| Sr. No. | Test | $M_1$ | $M_2$ |
|---|---|---|---|
| 1. | % solid | | |
| 2. | Acid value | 35.06 | 38.67 |
| 3. | Viscosity | | |
| 4. | Color | | |
| 5. | Consistency | | |
| 6. | Solubility | alcohol | alcohol |
| 7. | pH value | | |
| 8. | Molecular weight | | |
| 9. | H.L.B. ratio | | |
| 10. | Saponification value | | |
| 11. | Ester value | | |
| 12. | Epoxy value | | |

**% detergent of original polymer**

| Conc. | $M_1$ | $M_2$ |
|---|---|---|
| 0.1 | | |
| 0.25 | | |
| 0.5 | 75.0 | 77.5 |
| 1.0 | 93.0 | 95.0 |
| 2.0 | | |
| 3.0 | | |

Table 3 shows individual response of various ingredients towards foam height[8], surface tension[10] and detergency[11]. In all the samples testing has been done at 1 per cent solution in distilled water. The foam chacteristics of the entire conventional actives are excellent, the other ingredients shows poor foaming chacteristics except sorbitol.The prepared polymers have lower tendency of foaming. There is a significant change in surface tension

of various individual ingredients; the polymers have also show significant reduction in surface tension but not equivalent to conventional actives.

The detergency evaluations[11] test shows that conventional actives like alpha olephine sulphonate, linear alkyl benzene sulphonate, sodium laurel sulphate have same range of detergency 80 to 85. Sodium carbonate and sodium per borate have also play vital role in soil removing. Polymer-1 and 2 also give soil removing chacteristics. The soil removing chacteristics of novel polymers are 75 to 80 per cent of conventional actives like liner alkyl benzene sulphonate.

The compositions of liquid detergents are shown in table no.4. The polymer M-1 and M-2 have been used in liquid detergent compositions LD-2, LD3, LD-5 and LD-6.All the compositions containing 10 per cent glycerol and sorbitol, and 20 per cent of polymer shows excellent detergency chacteristics.

The samples have foaming characteristics[8] equivalent to commercial sample the reduction in surface tension is also appreciable and comparable to commercial sample the special features of formulation are freedom from petroleum based actives.

**Conclusion:**

The following conclusion stands confirm in the light of above research

– Linseed oil can be modified to get malenized oil with desired acid value, viscosity and HLB value.

– Malenized oil synthesized using linseed oil has huge potential in replacing petroleum origin nonrenewable materials used in various daily commercial products.

– Role of catalyst plays an important factor in synthesis of Malenized oils. It is clear that small amount HCL gives an excellent polymer which can be further modified and used for various formulations. Also it is clear that presence of catalyst in the reaction has a very positive role. Due to addition of catalyst, Malenized oil has higher acid value, viscosity and HLB ratio as compared to other synthesized malenized oil without catalyst.

– The final field of malenized oil is 95-98 per cent.

– The higher acid value of malenized oil is helpful in making water thinnable composition. We can neutralize these resins with sodium hydroxide and potassium hydroxide, malenized oil neutralize by potassium hydroxide have been used in various liquid detergents formulations.

– Based on the HLB value, viscosity, clarity and color, malenized oil is selected for further use an surface active agent or active material in formulations of liquid detergent formulation.

– Finally, we conclude that commercial production and use of the wonderful malenized oil can solve the problem of environment pollution caused by petroleum products and a variety of modified linseed oil can be made available for industrial products

– Malenized oil sample has proved to be very much suitable for pilot plant studies, it contents almost 74 per cent of raw material of vegetable origin and the results obtained are very much satisfactory.

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**REFERENCES**

1. **Phate, B.W.** and Gogte, B.B. (2005). *Paint India*, **LV** (3) : 71.
2. **Gajbhiye, P.G.** and Gogte, B.B. (2005). *Chemical Engg. World*, **40** (5) 92.
3. **Lambourne, R.** (1987). Paint and surface watinghs: Theory & practice, ellis horwood limited, New York, 440.
4. **Kharkate, S.K.** and Gogte, B.B. (2005). *Surface Waiting Australia*, **42**(4, 91).
5. **Sawant, V.D.** (2000). *Paint India* , **LV**(50) : 79-80.
6. **Irja, Piirma** (1992). *Polymeric Surfactants, Surfactant Series*, **42**, Marcel Dekker Inc, New York.
7. **Garrelt, H.E.** (1972). surface active chemicals programmer Press, New York.
8. **Jellinia, Stephan** (1982). *J. Encyclopedia of Chemical Technology*, 20, Johm Wiley & sons, New York, 1982, p-750.
9. **Harris, J. C.** (1984). Detergency Evaluation and Testing Intors Science Publisher in, New York, 1984.
10. A STM standard method 6.01, dl 639.70 (for acid value) of organic coating material), Published by the American society for testing material, Philadelphia, 1981.
11. **Jellinia, Stephan** (1982). J. Encyclopedia of Chemical Technology, 20, John Wiley & Sons, New York, 1982, p-780.

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