



SYNTHESIZED AND CHARACTERISATION POLYMERIC MATERIALS BASED ON COCONUT OIL, ROSIN & MALEIC ANHYDRIDES

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Abstract- Polymeric materials are used in detergent formulations since thirty five years, for performing useful functions like adsorption on fabric, surface, clay soil dispersancy and removal of Ca and Mg ions by sequestration. In the present work, rosinated alkyds have been synthesized based Coconut oil, Rosin & Maleic anhydrides. The entire samples have been analyzed for physicochemical characteristics like acid value, HLB ratio, viscosity, oxirane-oxygen value and molecular weight. The spectroscopic studies indicate the presence of free acid, ester, ether and free hydroxyl groups in the polymer structure. Use of polymeric materials in detergent gives good foam height, cleansing capability and stain removing characteristics such formulations can be easily prepared and compared with the commercial samples. An alternative production line has been suggested for existing alkyd resin plants and some formulations which are technically excellent, environmentally viable option and yet cost effective has been identified for pilot plant production .

Keywords- Polymeric materials. Rosinated Alkyds, Alkyds resin

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Introduction

A novel polymeric surfactant based on coconut oil^[1], maleic anhydride^[2] and rosin^[3] has been synthesized, technically it is a rosinated short oil alkyd resin^[4]. Short oil alkyd resin has been successfully used as polymeric materials in various powder and liquid detergents. Coconut oil is an edible oil with enormous industrial use extracted from the kernel or meat of matured coconut harvested from the coconut palm. Rosin is the residue obtained from the distillation of pine exudates. It is abundantly available and widely used in a large number of industrial products like paints, detergents, cosmetics and pharmaceuticals In this piece of research work, the mole ratio, catalyst and heating schedule has been standardized to get an alkyd resin with molecular weight⁵ in the range of 3000 to 5000. The conditions have been worked out to get desired acid value^[5], hydrophilic-lipophilic balance^[6], viscosity^[7], oxirane-oxygen value^[8] molecular weight^[9] and solubility characteristics.

Then synthesis polymers have been used in powder and liquid

detergents. The idea is to develop an ecofriendly, cost effective and technically sound powder and liquid detergents based mainly on renewable resources. It is observed that the utilization of coconut oil, rosin based polymer for the synthesis of detergent is economically and environmentally viable option

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.

1. Ca and Mg sequestration
2. Clay soil dispersancy
3. Calcium carbonate inhibition
4. Prevention of soil redeposit ion
5. Fabric anti incrustation

Experimental Setup for Synthesis of Alkyd Resin

Synthesis of Polymer: The reaction was carried out in a 2 litre capacity glass reactor with four opening. At first 50% of total amount of coconut oil, rosin and catalysts were heated slowly at

80^o±20C for half an hours then slurry of remaining 50% coconut oil and maleic anhydride with glycerol were added in about 15 minutes.

First the contents were heated at 130^oC for two hours. This initial heating allows maleic anhydride to sublime and reacts with rosin and oil. Now the temperatures was brought to 80^oC and xylene:butanol solvent (3:1 by weight) was added. Now the temperature as raised slowly to 200^oC. Then the reaction was continued for 2 hours. At the end all the solvents were completely eliminated by slowly evaporation at 90^oC. Acid value and viscosity was observed periodically.

Table 1- Composition of Novel polymers

Sr. No	Ingredient	% By weight (AR-4)
1	Coconut oil	25
2	Maleic anhydride	12.5
3	Rosin	52.5
4	Glycerol	10

Neutralization of Polymers

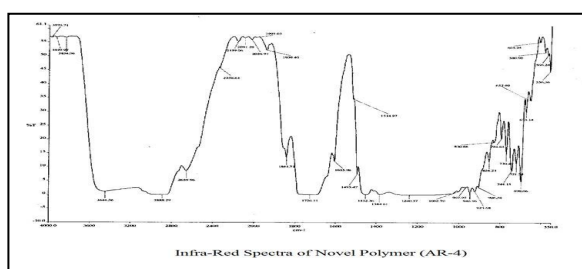
The prepared polymer was neutralized by 30% solution of KOH. During neutralization, temperature of the polymer and 30% KOH solution was maintained at 60^oC. Small slots of 5 to 10 ml of 30% KOH solution was added till we get desired pH.

Methods of Physicochemical Analysis

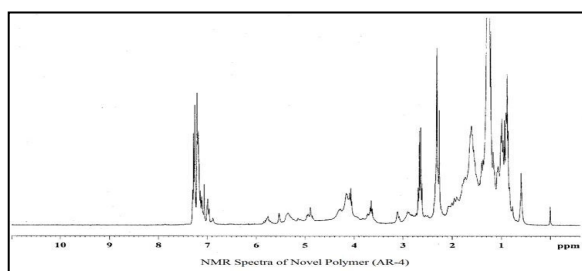
Table 2- Physicochemical Analysis of Novel Rosinated Alkyd Resins based on coconut oil and rosin

Polymers (AR-4)	Analysis
Acid Value	38.73
Color	Dark brown
Consistency	thick
H.L.B.	13.82
Mol. Wt.	5000
Viscosity	297
Oxirane-oxygen value	12.8

Spectroscopic Study of Novel Polymer¹⁰⁻¹¹



Spectra 1- Infra-Red Spectra of Novel Polymer (AR-4)



Spectra 2- NMR Spectra of Novel Polymer(AR-4)

Table 3- The IR-spectral data of Novel Polymer AR-4

Stretching	AR-4	Literature
O-H stretch	3444.36	3300-3700
C-H stretch	2888.29	2500-3000
C=O stretch	1726.11	1700-1750
C=C Stretch	1640	
C-O stretch	1160	1070/1250
C-H Bend	721.54	700-900

Table 4- The NMR-spectral data of Novel Polymer AR-4

Alkyd Polymer Peaks (AR-4)	Types of Proton	Literature Value (ppm)
0.9, 1.0	R-CH ₃ (primary)	0.9
1.2, 1.3	R ₂ -CH ₂ (aliphatic)/ Cyclohexane	1.3
1.6	R ₃ CH	1.5
2.3, 2.6	HC-COOR (Ester)	2-2.6
3.5	HC-OR(Ether)	3.3-4
4.1	HC-OH	3.4-4
4.3	RCOO -CH (ester)	3.7-4.1
4.9, 5.4, 5.8	C=CH(vinyllic)/ Cyclo diene	4.6-5.8
6.9, 7.3	Ar-H(Aromatic)	6-9

Results and Discussion

In our laboratory, replacement of petroleum based linear alkyl benzene sulphonate (LABS) with natural products like vegetables oil, rosin, starch, sugar have been investigated by earlier researchers. They found that the short oil alkyd resin based on rice brain oil, linseed oil and higher proportion of rosin give excellent liquid, powder and cake detergent. Coconut oil is known to give hard, stable, and free lathering soaps while rosin soaps were also used in earlier soap preparations for improving solubility, free lathering, shine and bright appearance to soap. In this context, we decided to device and design alkyd composition based mainly on rosin, coconut oil and glycerol which are mainly of vegetables origin.

Results and discussion is given below

1. The physicochemical properties of polymer AR-4 are given in Table 2. The acid value of the samples is 38.43. It is observed that the higher acid values correspond to the compositions containing higher proportions of maleic anhydride. The value indicates the definite esterification of acid groups of maleic anhydride and alcoholic groups of glycerol.
2. The H.L.B. value of the products strongly shows that the novel polymer can be used in making liquid, powder and cake detergent. The sample is soluble in carbon tetrachloride.
3. The viscosity of sample is appreciably high and shows that polymerization has occurred to a considerable range.
4. The oxirane-oxygen content is quite high indicating presence of ethoxy groups in the molecule. These ethoxy groups arise because of reactions of OH groups in glycerol and OH in triglycerides to form ethoxy rings. These ethoxy groups will give exceptional properties to these alkyd polymeric surfactants.
5. The analysis of IR spectra of Novel Polymer helps to identify the presence of carboxylic group, free hydroxyl group, ether as well as ester group. NMR spectra of Novel Polymer reveal the presence of aromatic and aliphatic protons, ester and ether groups.

Conclusion

A useful novel polymer of desired molecular weight and acid value can be prepared based on higher proportions of rosin and smaller proportions of coconut 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 a heating schedule of 12 to 15 hours while our heating schedule is of 6-8 hours duration. This is certainly saving time and energy.

The physicochemical analysis of novel polymers shows that the acid value is 38.43 and HLB ratio is 13.82. Polymers with higher acid value are easy to neutralize. So we can convert this polymer into water soluble product. The HLB ratio indicates the possibility of these novel polymers in preparation of liquid, powder and cake detergents.

The Molecular weight of the samples is 5000, which is ideal for using as a polymeric surfactant.

The analysis of IR spectra of Novel Polymer helps to identify the presence of carboxylic group, free hydroxyl group, ether as well as ester group in the polymeric moiety. NMR spectra of Novel Polymer show the presence of aromatic protons, aliphatic protons and aliphatic group attached to heteroatom.

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