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FLOOR CLEANER BASED ON SUGAR BASED POLYMER

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Abstract - *In the present work sugar based polymer containing higher proportion of organic acids (20%) have been synthesized by special technique. Polyethylene Glycol 400 has been incorporated to improve the stain removing and dirt removing capacity. The polymers have been systematically analyzed and incorporated in floor cleaning composition to the extent of 2 to 15%. Floor cleaner based on sugar polymer have been analyzed and compared with commercial products. Techno economically viable floor composition have been identified and recommended for pilot scale trials.*

***Key Words*: *Floor cleaner, Polyethylene Glycol 400,* Sugar *polymer, Stain remover* etc…**

1.INTRODUCTION

The house hold cleaners like floor cleaners are used to remove normal inorganic organic soil such as dust, sand, mud, street dirt oils, fats and greases present on the surface of the floor. Generally, they are alkaline in nature(pH=8.0). Many cleansers keep the pH acidic in order to remove water deposits, minerals and rust. The main ingredients of surface cleaners are surfactants, builders, solvents and antimicrobials. In the present floor cleaner compositions high amount of citric acid has been incorporated in sugar polymer and isopropyl alcohol has been used as a solvent. The attempt is to maintain antimicrobial activity by using citric acid and alcohol. We have already studied the antimicrobial activity of liquid glucose based polymers. We have already studied the use of carbohydrate based polymers in detergent powder[1], liquid detergent[2], Hand wash[3] and Floor cleaner[4]. So here a specific attempt has been made to design a floor cleaner based mainly on sugar and citric acid based polymer. The formulation does not use any high amount of petroleum based surfactant it also does not utilize polluting substances like sodium Tripolyphosphate. The product is the alkaline so it will not harm ceramic tiles.

1.1 Synthesis of sugar polymer in laboratory:

The synthesis of polymer was carried out in a glass rector of two litre capacity. Lower part of the reactor is a round bottom flask of two litre capacity 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 the thermometer. A condenser was fitted with the reactor through third neck and the fourth neck was used for closing the chemicals in reactor. The reactor was heated by an electric heating mantle having special arrangement for smooth control of temperature (±2^{0}C) of the reactor. A regulator controlled the speed of stirrer. The reaction vessel and its lid were tied together with the help of clamps.

STEP 1: - All the ingredients were converted into a homogeneous dispersion (or slurry) which has got excellent flow and reasonable mobility.
STEP 2: - The mass was slowly heated to 80^{0}C in about 15 minutes. The reactant contents were then raised to desired temperature of 120^{0}C in about 20 minutes. The reactor charge was monitored for flow, homogeneity and acid value.
STEP 3: - After attaining desired characteristics which take normally three hours at 120^{0}C. The heating was stopped and the reactor content was cooled to 80^{0}C.
STEP 4: - The batch was withdrawn and filtered through a strainer and stored in tightly closed transparent bottles.

The polymer samples were analyzed for their physicochemical properties by standard methods (5-10.)

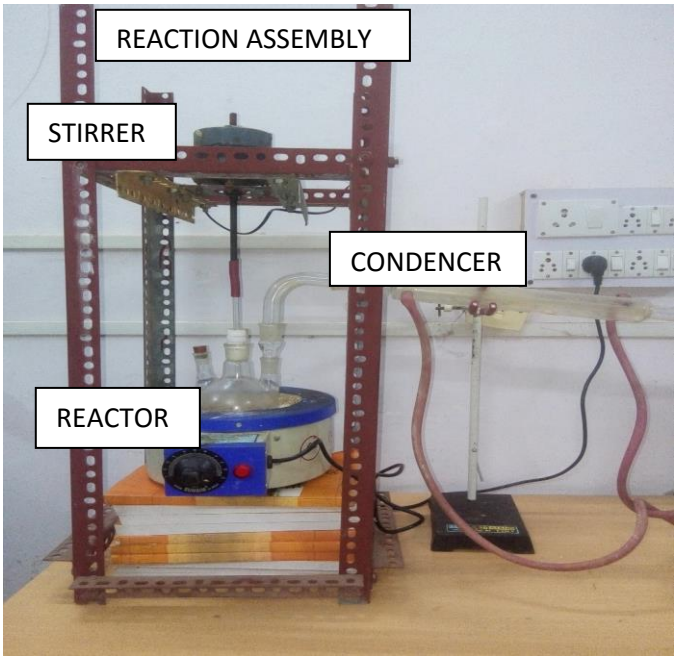

Fig: Photograph of Reactor

1.1 Preparation of soil stains for tiles

Components	% by weight
Carbon	28.4
Coconut oil	35.8
Lauric acid	17.9
Mineral oil	17.9

The mixture of carbon black and lauric acid along with mineral oil is taken in pastel mortar. Coconut is added slowly to form thick paste. All the components are grinded in pastel mortar to get a fine grinding.

1.2 Properties of soil solution:

Add 100 grams of soil in 100 grams of above paste mixed it well in use it for dirty tiles sample preparation. A uniform coat should be applied by brush on tile and kept overnight for drying (tile size 20cm ×20cm).

1.3 Cleaning of tile by floor cleaner:

Swap the tile with 1% solution of floor cleaner. Allow it to dry

The method has been set by experimentation based on standard method of soiling cloth and cleaning of soiled cloth.

Table 1: Synthesis of sugar based polymer

Name		S1	S2	S3
Ingredient by Wt %	Sugar	42	42	42
	Distilled water	25	25	25
	Polyethylene Glycol 400	10	10	10
	Maleic anhydride	-	10	10
	Phthalic anhydride	-	10	-
	Citric acid	20	-	-
	Sodium bisulphate	03	03	03
	Oxalic acid	-	-	10

Table 2: Physicochemical analysis of polymers

Name	S1	S2	S3
Acid value	120.2	148.4	140.57
% solid by weight	72.8	76.98	75.72
Density gms/cm	0.998	1.262	1.0088
Viscosity by ford cup No 4 at 30^0C	150	225	240
Surface tension by stalagmometer method (Dynes/cm)	57.04	72.0	38.4
H.L.B ratio	16.68	17.77	17.06
Cleaning performance on tiles	Excellent with shine	Good	Excellent

Table 3: Composition of floor cleaners based on sugar polymers

Sr. No.	Ingredients %By Weight	F1	F2	F3	F4	F5
1	S1 polymer	15	-	-	04	02
2	S2 polymer	-	15	-	-	-
3	S3 polymer	-	-	15	-	-
4	Sodium lauryl ether sulphate 30%	15	15	15	-	-
5	Sodium lauryl sulphate	02	02	02	-	-
6	Sodium bicarbonate	02	02	02	02	02
7	Sodium hypo chloride 5% solution	10	10	10	-	-
8	Acid slurry	-	-	-	02	03
9	Alphaolefine sulphonate 30%	-	-	-	02	-
10	Isopropyl alcohol	-	-	-	02	02
11	Polyethylene Glycol 400	-	-	-	-	01
12	Distilled water	55	55	55	88.6	89.7
13	Perfume	01	01	01	0.3	0.3

Table 4: Analysis of floor cleaners and comparison with commercial sample

Property	F1	F2	F3	F4	F5	COMMERCIAL
pH of1% Soln	8.1	8.2	8.0	8.5	9.0	8.5
% Solids	27.18	27.76	27.80	5.0	6.8	9.48

Viscosity by fordcup no 4 at 30^{0}C (In seconds)	20	17	20	20	20	20
Foam (cylinder method in C.C.) 1% soln	570	610	600	140	140	120
Surface tension (In dynes/cm)	26.78	26.52	27.10	19.0	20.9	21.34
Cleaning performance of Tile	EX	EX	EX	EX	EXS	EXS

Ex: Excellent
EXS: Excellent with shine

2. RESULTS AND DISCUSSION

Synthesis of sugar polymer: -

All the compositions (S1-S3) use fixed properties of water and sugar (25 and 42). Only organic acids have been changed. In S1 composition we use 20% citric acid. In S2 we use a combination of maleic and phthalic anhydride while S3 composition we use a combination of maleic and oxalic acid. PEG 400 has been used to have better surfactant characteristics (as it contains ethoxy group) and sodium bisulphate has a dual role of catalyst of esterification reaction and it can react with OH groups of carbohydrate skeleton to formsulphonate group which will give better cleaning and surfactant properties. The following chemical reaction are possible.

1. Sugar molecule breaks to glucose and fructose by hydrolysis.
2. Esterification of OH groups of carbohydrates skeleton and acidic groups in organic acids.
3. Sodium bisulphate can react with OH groups to form OSO3Na groups.

All these reactions give excellent surfactant characteristics to the polymer.

Physicochemical analysis of polymers is given in table 2. The acid value range between 120 to 140. The % solids are in the range of 72 to 76. The viscosity and flow characteristics are satisfactory. Surface tension is also recorded. S1 and S3 composition show good reduction in surface tension of water at 1% concentration.

H.L.B ratio of all the polymers suggest their use in cleaning composition. All samples have good to excellent cleaning of tiles. S1 sample show some shine on tiles after cleaning.

The formulation of floor cleaners based on sugar polymer is given in table No 3. In samples F1, F2 and F3. We used high properties of polymers (15%) while in F4 and F5 we used 2 to 4% of S1 polymer. In our experimentation we have used very high and low % of polymer to check which concentration is more suitable for cleaning. The other ingredients are conventional surfactants, P.E.G. 400 and perfume. Isopropyl alcohol has been used in F4 and F5 as it will give better dispersion of surfactants and help quick and complete cleaning P.E.G. 400 will help in removing stains. Use of sodium hypo chloride will give antibacterial properties. Formulation F4 and F5 are free from hypo chloride. As sugar based polymer and isopropyl alcohol may give antibacterial properties.

Table 5 show composition analysis of floor cleaners. Most of the characteristics match with commercial samples. Formulations F1, F2 and F3 use higher % solids and give foam which is not much expected in floor cleaners. Formulations F4 and F5 are quit close in performance to commercial samples therefore they are recommended for Pilot Plant studies.

After complete testing of microbial activity, they can be recommended for commercial use. Formulation F4 and F5 have special feature. The % solids is very low (5-8%) yet they are effective equally to commercial sample in cleaning. Sample containing PEG 400 (1%) will also show good stain removing properties. Sample F5 can be adjudged as the best.

3. CONCLUSIONS

(1) Sugar based polymers can be used in formulation of floor cleaners. They can be used from 2 to 15% in various formulations.
(2) Formulations F4 and F5 are adjudged as the best combination as they give shine, excellent cleaning and stain removing properties.
(3) They are Techno economically sound composition and comparable to commercial products. Pilot scale studies are essential for commercialization.

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