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ECOFRIENDLY STAIN REMOVER BASED ON SUGAR BASED POLYMERIC SURFACTANTS

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Abstract - *Sugar based polymers containing citric acid, Maleic and phthalic anhydride have been synthesized with special intension of developing stain removing surfactants. The polymers were analyzed for Physico chemical characteristics like acid value, viscosity, surface tension and HLB value. Selected polymers have been used in formulation of stain removing compositions. Sugar based polymers successfully remove stain of Katha, soil, ink and turmeric. The result was compared with multinational brand stain remover. Our sample were excellent and on bar with commercial products. Our stain remover does not harm the surface of white or colored cloths.*

***Key Words*: *Polymers*, *Stain Remover*, *Sugar Polymers*, *Surfactant* etc…**

1.INTRODUCTION

Stain removing is always a challenging problem of working housewife's. The careless family members always stain their cloths with variety of stains like haldi, ink, tea, coffee, soil and what not? As the advertisements of multinationals suggest it is never as easy as shown in advertising films. Let us try to understand the basics and remedies of various stains.

Stain removal is the process of removing mark or spot left by one substance on a specific surface like fabrics. A solvent or detergent is generally used to conduct stain removal and many of these are available in the market. Most stains are removed by dissolving them with a solvent. The solvent to use is dependent on two factors the agent that causing the stain and the material that has been stained. Different solvents will dissolve different stains and the application of some solvents is limited by the fact that they not only dissolve the stain but also dissolve the material that is stained as well. Another factor in stain removal is the fact that stains can sometimes have two separate staining agents which require different routes of removal.

1.1 Classification of Stains

Table no. 1 classification of stain types

Enzymatic	Blood	Egg	Grass
Oxidisable	Tea	Coffee	Red Wine
Greasy	Olive oil, Ground nut oil, ruff & collar stains (On shirts)	Motor oil	Butter, Ghee etc
Particulate	Clay	Mud	Dirt
Pigment and Dye stains	Paints	Inks	Dyes

- Enzymatic stains are removed with the help of enzymes.
- Oxidisable stains are removed with an oxidising agent, bleach and are called bleachable stains.
- Greasy stains are removed by the use of surfactants.
- Particulate stains are removed by builders like Sodium carbonate & Bicarbonate. Pigments, Paints & Inks are removed by stronger solvents.
- In the present work we are using polymeric surfactant as a base for stain remover. Polymeric surfactant is a based on carbohydrate skeleton & acid. This medium should be an excellent medium for removing most of the stains. A special sugar based polymer has been synthesised which has best possible stain removing ability. This sugar polymer along with coherent surfactant like acid slurry and organic solvent like Isopropyl alcohol has been used in combination with Polyethylene Glycol 400 Which is excellent solvent for many stains.

2. EXPERIMENTAL SET UP

2.1 SYNTHESIS OF SUGAR BASED POLYMER

The synthesis of novel polymer was carried out in a glass reactor of 2 litre capacity. Lower part of the reactor is a 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 is inserted in the reactor through the central neck, while another is used for temperature measurement. A condenser is fitted through the

third neck and fourth neck is used for dosing the chemicals in the reactor. The reactor is heated by an electrical heating mantel having special arrangement for smooth control of temperature +-3^{0}C. A regulator controlled the speed of stirrer. The reaction vessel and its lid are tied together with the help of clamp. See figure 1. The synthesis is carried out in following steps.

STEP1: Sugar and other ingredients weighed accurately are first converted into a homogenous dispersion or slurry by using electrically controlled homogenizer. The homogenizer dispersion should have flow and mobility. This dispersion is introduced into the reactor.
STEP2: The mass is steadily heated to 80^0 C in about 15 minutes. The reactor temperature is then raised to 115-120^0 C in about half an hour. The reactor charge is monitored for flow, mobility, homogeneity and pH of 1% solution.
STEP3: In about three hours the desired physico-chemical characteristics of polymer are achieved. The heating is stopped and the charged is cooled to 80^0 C.
STEP4: The batch is withdrawn and filtered through a strainer and stored in tightly closed transparent bottles.

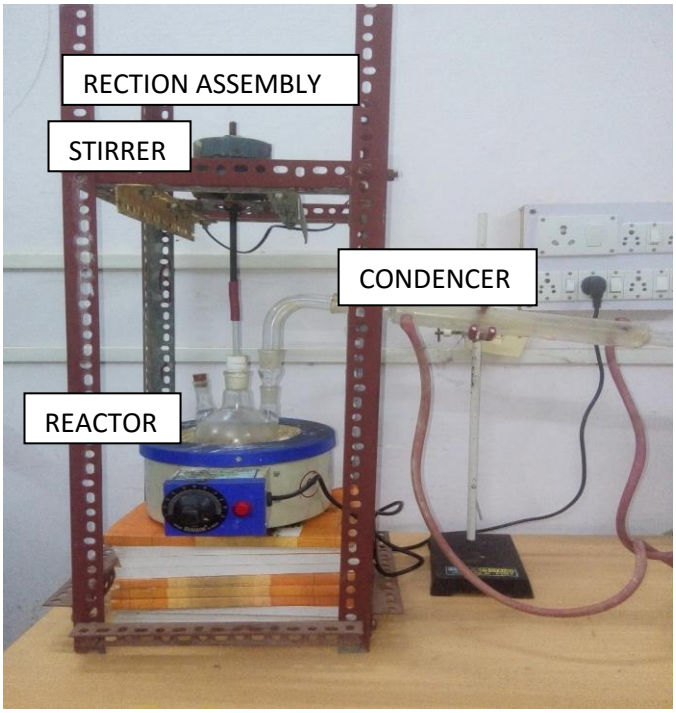

Fig: Photograph of Reactor

The two polymer prepared were analyzed for characteristics like Acid value, % solids, foam, surface tension and stain cleaning properties.

The following chemical reaction are possible in the reactor.

(1) The reaction of –COOH group from acids and –OH group from carbohydrate skeleton to form ether groups.
(2) The –OH groups in sugar can react to form ether groups.
(3) Sodium bisulphate catalyse esterification reactor as well as it can react with –OH groups to form sulphonate groups.
All these reactions give an excellent surfactant.

Table No 2: Synthesis of Sugar based Polymer.

Ingredients % by weight	Polymer P1 (B31)	Polymer P2 (B35)
Sugar	42	42
PEG 400	10	10
Citric acid	20	-
Phthalic anhydride	-	10
Maleic anhydride	-	10
Sodium bisulphate(NaHSO4)	03	03
Distilled water	25	25

Table No 3: Physico chemical analysis of polymer

Characteristics	P1	P2
Acid Value	111.2	148.49
% Solids by weight	76.7	76.98
Density (gms/cm^3)	1.0052	1.1005
Viscosity by Ford Cup No 4at 30^0 C (In Seconds)	215	225
Surface Tension by Stalegmometer (dynes/cm)	58.66	65.05
HLB Ratio (by sap value method)	16.1	17.1
Stain Removing (Rating after Neutralizing)	Excellent (Quick and Complete removal of stain)	Good (Stain not removal takes time)

Table No 4: Composition of stain remover

Content	Stain remover A1	Stain Remover A2
Polymer P1	02	06
Alfaolefine sulphonate (30%)	02	-
Acid slurry	02	03
Water	96	88
PEG400	-	01
Isopropyl Alcohol	-	02
3o% NaOH	Add drop by drop till you get alkaline Ph	

Table No 5: Analysis of prepared stain remover and comparison with commercial

Sr No	Characterstics	S1	S2	COMMERCIAL
1	Ph (1% soln)	9	8.5	8
2	% Solids	04	5.82	04
3	Viscocity(by Ford cup No 4 at 30^0 C) in seconds	20	20	20
4	Foam (by cylinder method) of 1% soln in c.c.	110	140	30
5	Surface tension (by Stalagmometer Method) dynes/cm	20.83	21.93	24.06

NOTE: -

Removal of stains of turmeric, kattha, oil and ink are given by photographs and the performance has been compared with commercial stain remover of multinational brand.

The analysis and testing of polymer and stain remover has been done by standard analytical techniques (6-10)

3. RESULT & DISCUSSION

The composition and analysis of sugar based polymer made to the requirements of stain remover are given in table No 1 & 2. The proportion of sugar and PEG-400 has been maintained constant. In P1 composition the only organic acid used is citric acid. (well known for its cleaning performance). The other formulation is using a combination of maleic & phthalic anhydride. The combination of PEG and citric acid is an excellent combination for stain removing. The viscosity, surface tension, & H.L.B. ratio indicate that S1 is a better combination for inclusion in final stain remover formulation. Stain removing after neutralization is excellent, quick and complete in case of polymer P1. So polymer P1 has selected for inclusion in final stain removing compositions. The composition of stain removers is given in table 4. Combination of polymer and conventional surfactants like AOS and Acid slurry has been used (1%). This helps to remove stains like INK, KATTHA, & HALDI. All composites were neutralized by 30% NaOH to get an alkaline Ph.

The analysis of prepared stain remover is shown in table 5. Simultaneously a commercial multinational brand stain remover was also analysed. The prepared samples are quite close to commercial sample interference to pH, Viscosity and surface tension characteristics. Our samples show slightly higher foam than commercial preparation. The pictures show the stain removing properties for turmeric, kattha, soil & ink.

Our sample with % solids of 5.82 appears to be excellent and comparable to commercial sample so sample S2 should be tried on pilot plant scale.

4. CONCLUSIONS

(1) Sugar polymer have been synthesized using 10-20% of citric acid, Maleic anhydride and phthalic anhydride. Sample with citric acid give better results of in removing.
(2) Polymer based on citric acid have been used 2 to 6% along with conventional surfactants like Acid slurry, AOS in formulations of stain remover.
(3) The analysis of stain remover in comparison to commercial multinational brand of stain remover show that our samples give excellent results for removing of stains of Soil, Kattha, Turmeric & Ink.
(4) Our samples are using low % solids and yet giving excellent results.
(5) Sugar based polymers should be manufactured on pilot scale and should be used freely for stain removing as they are harmless and eco-friendly.
(6) Use of PEG-400 give good results of stain remover.
(7) Stain remover does not affect adversely the surface of white or coloured cloth.

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6. REFERENCES

1. Dhakite P.A., Phate B.W., and Gogte B.B., "Research Journal of Science and Technology", 2011, 3(4), 184-188.
2. Kharkate S.K., Karadbhajne V.Y., And Gogte B.B., "Journal of scientific and Industrial Research", 2005, 64, 752755.
3. Deshmukh, MrsA.G., Gogte B.B. and Yenki M.K.N., "Dr Pharma Chemica 2014,6(16), 143-148
4. Mrs. Gawande P.D., Ph.D. Thesis Synthesis, characteristic and Utilization of Polymerbased on liquid Glucose and sorbitol 2015(RTM Nagpur University)
5. Bhagwat A.M., and Gogte B.B., "Soaps, Detergent and toiletries review sept. 2004, 35(8), 20-25
6. Haries, "Detergent Evaluation & Testing" 1954, P 92-103, (Wiley Interscience Publisher)

7. "Hand Book on Soaps, Detergent & Acid Slurry", 2006(Second Edition), P. 391. (National Institute of Industrial Research)
8. Urizoller,"Handbook of Detergent Part (E)", Applicate CRC-Press, P. 39-65, ISBN978
9. BIS 4955-2000 Methods for test of detergent for household detergents
10. A.S.T.M. Standard Method, 1981, 6. 01, D, 1952-67 Publish by American society for testing of materials.
11. Garrett H.E., "Surface Active Chemicals Programmer Press New York (1972)
12. Jayasekara R., Harding I., Bowater I., Lonergan G.; Journal of Polymer Environment, Vol 13, 2005, pp 203205.
13. 13. Tian Huayu, Tang Zhaohui Zhuang, Xiuli Chen, Xuesi Jing Xiabin; Progress in Polymer Science, Vol 37(2), 2012, pp 237-280.
14. 15. Lichtenberg D., Ahyayauch H., Goni F. M., Bio-Physics Journal for Detergent, Vol 105(2), 2013, pp 289-299.
15. 16. Sindhu R., Suprabha G.N., Shashidhar S.; African Journal of Microbiology Research Sep 2009, Vol 3(9), pp 498503.
16. 17. IS 3025-44 (1993): Methods of Sampling and Test (physical and chemical) for Water and Wastewater, Part 44: Biochemical Oxygen Demand (BOD) [CHD 32: Environmental Protection and Waste Management]