

# A Unique Polymeric Surfactant for Hand Washes

Shubham D. Wagh<sup>1</sup>, Dr. V. Y. Karadbhajne<sup>2</sup>, Dr. B.B Gogte<sup>3</sup>

<sup>1</sup>M. Tech final year, Dept. of Oil Technology, LIT Nagpur, India

<sup>2</sup>Assistant Professor, Dept. of Oil Technology, LIT Nagpur, India

<sup>3</sup>Associate Professor, Dept. of Oil Technology, LIT Nagpur, India

\*\*\*

**Abstract** - A Polymeric Surfactant, based on Sugar, Polyethylene Glycol 400 and organic acids has been synthesized. The Polymers have been analyzed systematically and selected polymer has been used to the extent of 25 to 35% in Hand wash compositions. The Hand wash give excellent foaming, viscosity and surface tension reductions characteristics. The characteristics are comparable to commercial Hand wash in the market.

**Key Words** - Hand wash, Polymer, Surfactant.

## 1. INTRODUCTION

Awareness about hygiene cleanliness in developing countries is increasing at very fast pace in last decade. With increasing standard of living, better per capita income, role of T.V. media the hand wash now has become an essential commodity in every family.

In developing countries childhood mortality rates related to respiratory diarrhoeal diseases can be reduced by 50%, by proper use of soap and hand washes. In the present work we have synthesized polymers based mainly on sugar. As we know sugar and liquid glucose are natural preservatives which have been used for centuries in our Mango and Lemon based preparations. In our laboratories we have already synthesized polymers based on sorbitol<sup>1</sup>, starch<sup>2</sup>, liquid glucose<sup>3</sup> and Maleinized vegetable oils<sup>4</sup>. These polymers have been successfully utilized in various surfactant compositions. In our country large number of sugar factories are producing sugar. We export sugar and sometimes surplus is available. This work is to generate value added product from sugar for a non-food use like surfactant<sup>8</sup>. If we are able to generate value added product at reasonable rate, then this will also help the economics of sugar industry and sugar cane growers. The raw materials used are sugar, polyethylene glycol-400, organic acids and sodium bisulphate. These polymers have been analysed systematically and selected polymer has been used to prepare Hand wash compositions with following special features.

- 1) The product does not contain any large amount of acid slurry or petroleum based surfactant. Thus the product is likely to be eco-friendly.
- 2) Any phosphate has not been used in formulation so it will not create any pollution.

- 3) Use of sugar gives clean, transparent, free flowing homogeneous product which does not irritate the hand. A smooth feel is obtained.
- 4) The product does not use any alcohol. Let us try to understand what are the essential and desirable characteristics of a hand wash.

- It should completely & quickly remove dirt, oil, grease and other foreign material deposited on hand.
- It should have a moderate viscosity neither too high nor too low because higher viscosity sometimes make it difficult to remove from the bottle and very low viscosity is also not desirable.
- It should be clear, transparent with excellent stability at least for one year. It should not show any separation on standing.
- It should contain some glycerine or sorbitol so that after application it should not show any skin dryness or irritation.
- The special features of hand wash is its pH. It should be slightly acidic pH 5-6(1% solution) which should match with our skin.
- It should have excellent minimum negative effects like stripping skin of natural oils.
- It should give excellent foaming properties non-foaming compositions are not popular in India.
- It should not show any feeling of stickiness after application and removal.
- The hand should be clean of pathogeus including bacteria or viruses and chemicals which can cause personal harm or disease to the person using it. In our laboratory we have already prepare hand wash and commercial surfactant based on liquid glucose, starch, sorbitol and Maleinized oil. In the present research work special polymers based on sugar have be synthesised and used in formulation of hand wash. The use of sugar based polymer is expected to give stability and excellent technical properties.
- A mild perfume should be incorporated which will give decent and pleasant feeling after application.
- Some Herbal extracts like neem, aloe Vera or other plants should be incorporated this will make the product acceptable to Indian customers who have special taste for herbal products.

## 2. EXPERIMENTAL SET UP

The preparation of novel polymer based on sugar is shown in the picture. The experiment was carried out in a glass reactor of two litre capacity. Lower part of the reactor was a round bottom vessel of with very wide mouth. The upper part of the vessel reactor is its lid having four necks with standard joint. 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 third neck and fourth neck was used for dosing chemicals in the reactor. The reactor was heated by an electric heating mantle having special arrangement for smooth control of temperature ( $\pm 20^\circ\text{C}$ ) of the reactor. A regulator controlled the speed of the stirrer. The reaction vessel and its lid were tied together with the help of clamps.

**Polymer was prepared by batch process with following steps :-**

- 1) All the ingredients powder, liquid and water were first converted to a slurry and then added to the reactor.
- 2) The mass is heated slowly in a step wise manner first at  $80^\circ\text{C}$  (In about 15 minutes) and then takes to  $120-130^\circ\text{C}$  in about 30 minutes. The reaction continued at  $120-130^\circ\text{C}$  for about 2.5 to 3 hours. The acid value, viscosity and flow and homogeneity was monitored continuously.
- 3) Normally the reaction is stopped after 3 hours.

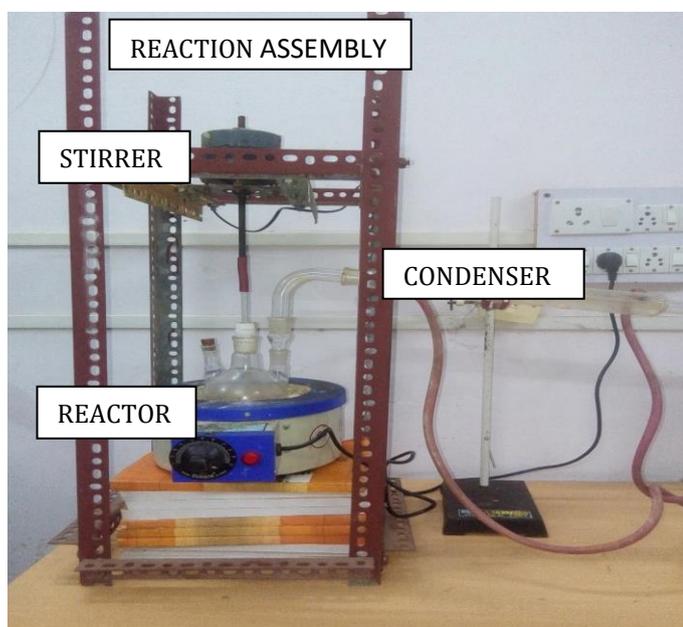


Fig: Photograph of Reactor

- 4) The mass is cooled to  $80^\circ\text{C}$  and filtered and collected in glass stoppered bottles.

- 5) The final sample is analysed for acid value, viscosity and other physicochemical characteristics and then used for hand wash compositions.

### Preparation of Hand Wash Composition :-

- First weigh accurately all ingredients used in Hand wash composition ( except Borax)
- Mix thoroughly all ingredients in a homogenizer.
- Take the temperature to  $80-90^\circ\text{C}$  and then add borax.
- Continue mixing in homogenizer for 15-20 minutes.
- Allow the sample to settle overnight.
- Next day filter the sample and collect clear sample in corked glass bottle.

Table No. 1: Composition of Sugar Polymer

Name	S1	S2	S3
Sugar	45	43	41
DW	22	22	22
PEG 400	10	10	10
Maleic Anhydride	10	10	10
Citric Acid	10	10	10
Sodium Bisulphate	3	5	7

DW: - Distilled water, PEG 400:- Polyethylene Glycol

Table No. 2: Analysis of Sugar Polymers

Batch Name	S1	S2	S3
Viscosity by ford cup no 4 at 30 c in sec	235	205	215
% Solid by wt.	77.06	78.8	82.2
Acid Value	127.3	130	132
HLB ratio, dynes/cm (based on sap value)	15	12.65	17.66
Cleaning Performance after Neutralization	Excellent	Good	Good

Table No. 3: Composition of Toilet Cleaners based on Sugar Polymer

Ingredients % by weight	HW1	HW2	HW3	HW4	HW5
Polymer	25	30	35	35	31
SLES 70%	30	20	10	20	20
Water	42	47	52	36	45
Sodium Hydroxide	02	02	02	02	02
Borax	01	01	01	02	02
Alfa olefin Sulphonate 30%	-	-	05	-	-

Table No. 4: Analysis of Toilet Cleaners and Comparison with Commercial Product

Sample	pH	Foam in c.c. (cylinder method)			Viscosity (by ford cup at 30°C) in sec	Surface Tension by Stalagm-ometer Method Dynes/cm
		1 %	0.5 %	0.25 %		
HW1	7.0	850	650	500	660	37.0
HW2	6.0	700	550	450	220	38.0
HW3	6.0	450	300	250	370	33.0
HW4	5.6	1000	650	500	840	31.0
HW5	6.0	850	700	600	660	37.0
Commercial	6.0	1000	800	700	600	32.0

### 3. RESULT AND DISCUSSION

Table no 1 give composition of different sugar based polymer, same amount of distilled water is used in all samples.

In progressive sets sodium bisulphate is increased from 3 to 7 %. Sodium bisulphate has a dual role. It catalyses esterification at the same time it can react with -OH groups to form sulphonates. Use of polyethylene glycol give superior surfactants as it contains ethoxy groups. All organic acids used are likely to react with -OH groups in carbohydrates skeleton of sugar. The analysis of sugar based polymer is given in table no 2. Standard methods of analysis have been used. Sample s1 gives excellent cleaning performance, high viscosity and desired HLB ratio. So it has been used for formulation of various Hand wash composition.

Composition of hand wash polymers based on s1 sugar polymer is given in table no 3. 25-35% polymer has been used in different compositions. 10-30% SLES (70%) has been used in different formulations. NaOH is used to neutralised the acid polymer. 1 % borax gives a homogeneous products and stable pH Hand wash. The analysis of Hand wash and its comparison with commercial Hand wash is given in table no 4. Sample HW2 and HW3 have lower viscosity and lower foaming compared to commercial Hand wash sample. Sample HW4 and HW5 have desired pH, viscosity, surface tension reduction when compared against commercial product. Sample HW1 is also good but it is utilizing very high percentage of SLES.

The samples after testing antibacterial activity can be recommended for commercial use as they meet most of all the requirement given at the beginning of article.

### 4. CONCLUSION

Sugar based polymers can be incorporated to the extent of 25 to 35% as they give good viscosity, smooth feel, transparency, foaming, and surface tension characteristics as desired in commercial products. The price of sugar polymer is reasonable and the formulation can be called eco-friendly as they do not contain acid slurry or any other petroleum based surfactants. This sugar based polymer is a value added product from sugar so it will be a good outlet for sugar producing industries.

### 5. ACKNOWLEDGMENT

Special appreciation goes to *Department of Oil, Fats and Surfactant Technology, Laxminarayan Institute of Technology, Nagpur* for accessing their laboratory and giving training for how to use equipment's. Also thanks to library staff for their contribution in using books and journals. Thanks for supporting us in every aspect.

### REFERENCES

- Garrett F. Bass, Mark S. Colt, Anton D. Chavez, "Synthetic design and investigation of novel polymeric surfactants", March 2015
- Jean-Louis Salagar, "surfactant Types and Uses", 2002
- Michael A. R. Meier, Jürgen O. Metzger and Ulrich S. Schubert, "Plant oil renewable resources as green alternatives in polymer science", July 2007, 1788-1802
- Qinghong Fu, "Polymeric Surfactants Based on Oleic Acid", 2001
- Y. Mylonas, G. Bokias, I. Iliopoulos, G. Staikos, "Interpolymer association between hydrophobically modified poly(sodium acrylate) and poly(N-isopropylacrylamide) in water: The role of hydrophobic interactions and polymer structure" *European Polymer Journal* 42, 849-857, 2006.
- Santipharp Panmai, Robert K. Prud'homme, Dennis G. Peiffer, Steffen Jockusch, and Nicholas J. Turro, "Interactions between Hydrophobically Modified Polymers and Surfactants: A Fluorescence Study", 18, 3860-3864, 2002.
- A S Shedje, "Hydrophobically Modified Watersoluble Polymers: Synthesis, Characterization & Rheology", 2012
- Hoi Y.H., "Baily's Industrial oil and fats products", 5, p. 78-80, Fifth edition, John Wiley and Son's, Inc, New York, 1996.
- Hugh D., Youngs Roger A., "Freedom Univariate Physics with modern physics Addison-Wisley Publication", P. 374, 2012.

10. Jayasekara R., Harding I., Bowater I., Lonergan G.; Journal of Polymer Environment, Vol 13, pp 203-205, 2005.
11. Tian Huayu, Tang Zhaohui Zhuang, Xiuli Chen, Xuesi Jing Xiabin; Progress in Polymer Science, Vol 37(2), pp 237-280, 2012.
12. Dhakite P. A, Deshpande A. D., Gogte B. B., Phate B. W.; International Journal of Research in Pharmacy of Chemistry, Vol 1(3), pp 432-437,2011.
13. Lichtenberg D., Ahyayauch H., Goni F. M., Bio-Physics Journal for Detergent, Vol 105(2), pp 289-299,2013.
14. Sindhu R., Suprabha G.N., Shashidhar S.; African Journal of Microbiology Research , Vol 3(9), pp 498-503, Sep 2009.
15. 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]