



Environmentally Friendly Dish Wash Liquids with Polymeric Surfactants from Natural Origin

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Abstract

Household cleansers are changing critically in last decades. Newer active materials of vegetable origin are replacing conventional active ingredients like acid slurry and alpha olefin sulphonates. In the present research work we have developed a novel polymeric surfactants based on liquid glucose, sorbitol and some organic acids. The idea is to replace fossil fuel based raw materials with renewable materials like liquid glucose and sorbitol. Mole ratios, reaction condition and order of addition have been standardized and a polymer suitable for dish wash liquid has been developed. In all the formulations reported in Table-2 we use 20% polymer successfully. The other ingredients are common ingredients. The physicochemical properties of dish wash liquid are reported in Table-3. Our samples are excellent in respect to foam height and surface tension reduction. The surface tension reduction is better than commercial products. Various household experiments were conducted to check our products as a dish wash liquid. Our products are on par with commercial samples. These samples were evaluated from some housewives and the details of results were reported in the table given below.

Keywords: Polymeric surfactants, Dish wash liquids, Liquid glucose, Sorbitol.

Introduction

Detergents¹ found in all cleansing preparations like dish wash, soaps, gels, shampoos, hand wash, toilet cleansers, etc. Detergents used in such preparations is to remove dirt and fat, make hair washing products to be foam up quickly. Till last 20 decades all of the detergent manufacturers used for preparation which are available in limited stocks. In search of alternatives producers move towards detergents made from sustainable resources. Now researchers from the whole world work out this problem and prepared surfactants² of natural origin.

Surfactant refers any substance whose presence in small quantity markedly alters the surface behavior of given system. There are certain solutes which when dissolved in very low concentration having starting property of reducing the surface energy of solvent in which they dissolve to an extreme degree. Because of presence of hydrophilic group, a surfactant is more or less readily soluble in water. However, hydrophobic group is repelled by water so that there is a tendency for that portion of molecules to leave aqueous space. These lead to higher concentration, the surface or boundary than in the main body of solution. Surfactant solution exhibits combinations of cleaning, foaming, wetting, emulsifying, solubilizing and dispersing properties.

Detergents refer to a combination of surfactant and other substances, inorganic or organic, formulated to enhance

functional performance, specially cleaning, over that of surfactant alone. The biological surfactants show different structure from synthetic once. As well as they are biodegradable. Hence it is less toxic to the environment.

Now-a-days in number of Industries they use edible feed stocks instead of fossil fuels as a starting material. In this way, Industry introduces second generation feedstock sources. These are the substitute of fossil fuels. These are prepared from natural resources such as parts of trees, raw material or some derived products. These are designed in such a way that they cannot affect nature in any manner. Researchers designed some products which are not even good but comparable with the crude petroleum oil. So, such products are environment friendly.

In India the use of liquid detergent is mostly in the form of dish washer. The basic material used for their preparation is soft acid slurry with some solubilizing agents. There are some liquid detergents³ which are recommended for special purpose prepared by adding enhancers and are used to wash woolen, silk cloths etc.

In the present research work a polymer is synthesized using liquid glucose, sorbitol and glycerol as a starting material having natural origin. This polymer is used to replace petroleum based products like acid slurry, alpha olefin sulphonate. There are number of cleansing products available in the market which are unsuitable for environment. In the present work 75-80% of

petroleum based products are replaced by eco friendly products⁴.

Methodology

From the natural feedstock containing corn starch after steeping liquid glucose⁵ is prepared. This liquid glucose together with sorbitol and some organic acids like citric, oxalic, maleic heated in a reactor at suitable temperature to form polymeric surfactants⁶. Various trials of different compositions of starting material were carried out. All these samples were tested for good viscosity, surface tension and some other physicochemical parameters⁷. According to these testing best samples were selected for various industrial preparations.

Surface tension of water coming down from basin is much lower; this thing was useful for the use of Dish wash liquid. Dish wash liquid⁸ was prepared from selected polymer samples.

The composition of polymer which are used to prepared dish wash liquid is given in Table-1. The other ingredients used for synthesizing dish washers are conventional ingredients. Little quantity of Sodium carbonate, Na₂CO₃, is used in the dishwasher product to make the solution alkaline. It is the salt of a strong alkali (sodium hydroxide) and a weak acid (carbonic acid) and is therefore alkaline. It dissociates in solution to form carbonate ions, CO₃²⁻, which help to maintain the pH of the washing water. The composition of dish wash liquids is given in Table-2.

Table-3 gives the physicochemical analysis of dish washers in comparison with standard dish wash available in market. It shows that dish wash made from liquid glucose based polymers (i.e. from natural resource) are comparable with commercial sample. Dish Wash Sample-4 was tested in society and feedback was taken. Some of the details of feedback were mentioned in Table-4.

Table-1
Composition of Polymer Containing liquid Glucose

Ingredient % by weight Batch No.	Liquid Glucose 70 % solids	Glycerol	Sorbitol	Maleic Anhydride	Citric Acid	Oxalic Acid	Sodium Meta Bisulphite
B12	19.04	-	57.14	9.52	4.76	4.76	4.76
B14	23.81	-	52.39	9.52	4.76	4.76	4.76
B16	28.57	47.61	-	-	4.76	4.76	4.76
B18	9.52	66.68	-	9.52	4.76	4.76	4.76
B24	50	-	30	-	10	-	10

Table-2
Composition of Dish Wash Liquids

Sample	% of Polymer	% of Acid Slurry	% of SLS (30%)	% of SLES	% of Sodium Carbonate	% of Sodium Sulphate	% of PVA	% of Water
Dish Wash 1	B 12 = 20	5	1	15	2	2	2	53
Dish Wash 2	B 14 = 20	5	1	15	2	2	2	53
Dish Wash 3	B 16 = 20	5	1	15	2	2	2	53
Dish Wash 4	B 18 = 20	5	1	15	2	2	2	53
Dish Wash 5	B 24 = 20	5	1	15	2	2	2	53

Table-3
Physico Chemical Properties of Dish Wash Liquids

Properties Dish Wash Liquid No.	Foam Height (in CC) (by Cylindrical method) (0.5 % Solution)	Foam Height (in CC) (by Cylindrical method) (1% Solution)	Density (1% solution) (gm/lit)	Surface Tension (in dyne/cm) (by Stalagnometer Method)	pH Value (1% solution) By Digital pH Meter
Dish Wash 1	850	1000	1.0016	27.51	7.1
Dish Wash 2	900	1000	1.0048	28.71	7.5
Dish Wash 3	800	1000	0.9972	33.75	7.5
Dish Wash 4	900	1000	1.0039	29.60	7.4
Dish Wash 5	850	1000	1.0120	31.45	7.6
Standard DW	860	1000	1.0027	42.9	7.6

Table-4
Feedback Analysis Report

	Color	Foam	Removal of grease	Feel to Hand	Appearance after cleaning
House Wife 1	Slight Dark	High	Good	Smooth	Shining
House Wife 2	Good	High	Good	Soft	Nice
House Wife 3	Average	Good	Nice	Soft	Shining
House Wife 4	Good	High	Excellent	Soft	Shine

Results and Discussion

In the present Research project we have synthesis polymers based on Liquid Glucose and Sorbitol. These carbohydrates have been reacted with Maleic anhydride, citric acid and oxalic acid to get useful polymeric surfactants. A small quantity of sodium meta bisulphite has also been used which will catalyze esterification and also react with -OH groups to give useful surfactants properties to the polymer.

Table-1 gives an idea about the composition of different batches. Liquid glucose and sorbitol or glycerol along with some organic acids is used. During preparation of these batches first all ingredients were mixed and then cooked in Heating furnace at 110-130⁰C for 3 hours. After the completion of heating, product is cooled at room temperature. On next day it was stored in air tied bottle. The mixing and cooking schedule was same for all batches. The main purpose to use dish washers is to remove grease. Focusing towards this purpose the polymer containing citric acid is used.

Table-2 shows composition of dish wash liquids. As compared to commercial sample these samples use minimum of petroleum based acid slurry i.e. 25% and remaining was synthesized

polymer as an active ingredients. The other components of dish wash liquids are used in fixed proportions.

The comparative study of physicochemical properties of dish wash liquids prepared from polymer samples with commercial one is given in Table-3. This shows that the samples made from natural feed stocks were comparable with commercial samples having petroleum origin. Some selected samples were given to house wives and they gave excellent performance report.

Conclusion

The physicochemical analysis shows the suitability of these polymers for preparation of various industrial products. These samples use minimum quantities of petroleum based surfactants therefore green to use. In this research work polymer based on liquid glucose and sorbitol was used as a polymeric surfactant for dish wash preparations. The polymer samples have natural origin and so most Eco-friendly.

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