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Study of Physical Parameter of Novel Synthesis Eco-Friendly Detergent Powder

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ABSTRACT

High efficiency and Study of physical parameter.Various household cleaning products have been developed to help remove dust and dirt, for surface maintenance, and for disinfection. Products are available in powder, liquid or spray form. The basic ingredients determine the type of cleaning tasks for which they are suitable.

Keywords: Eco Friendly; High efficiency; Study of physical parameter.

INTRODUCTION

From ancient times, chemical additives were used to facilitate the mechanical washing of textile fibers with water [1]. The earliest recorded evidence of the production of soap-like materials dates back to around 2800 BC in ancient Babylon. German chemical companies developed an alkyl sulfate surfactant in 1917, in response to shortages of soap ingredients during the Allied Blockade of Germany during World War I In the 1930s, commercially viable routes to fatty alcohols were developed, and these new materials were converted to their sulfate esters, key ingredients in the commercially important German brand FEWA, produced by BASF, and Dreft, the U.S. brand produced by Procter & Gamble. Such detergents were mainly used in industry until after World War II. By then, new developments and the later conversion of aviation fuel plants to produce tetra propylene, used in household detergents, caused a fast growth of domestic use in the late 1940s.

Various household cleaning products have been developed to help remove dust and dirt, for surface maintenance, and for disinfection [2]. Products are available in powder, liquid or spray form. The basic ingredients determine the type of cleaning tasks for which they are suitable. Some are marketed as general-purpose cleaning materials, while others are targeted at specific cleaning tasks such as drain clearing, oven cleaning, lime scale removal and polishing furniture. Household cleaning products provide aesthetic and hygiene benefits, but may cause health risks [3]. The US Department of Health and Human Services offers the public access to the Household Products Database, with consumer information on over 4,000 products based on information provided by the manufacturer through the material safety data sheet [4].

An example of this is the mixing of ammonia-based cleaners (or acid-based cleaners) and bleach [5].This causes the production of chloramines that volatilize (become gaseous), causing acute inflammation of the lungs (toxic pneumonia), long-term respiratory damage, and potential death [6]. The use of nontoxic household chemicals is growing as consumers become more informed about the health effects of many household chemicals, and municipalities are having to deal with the expensive disposal of household hazardous waste (HHW) [7,8].

From the above literature study, we must develop ecofriendly surfactants which can partly or totally replace active materials of hazardous and expensive ingredients without affecting their cleaning activity. In this article we have successfully developed less chemical based detergent powder.

EXPRIMENTAL

Materials and Method

Soap nut

Soap nuts, or Indian soap berries, have become increasingly popular in recent years for a variety of reasons. They are an amazing natural detergent due to a natural cleaning essence that is contained in their shell. The great thing about saponin is that it is a 100% organic substitute to chemically made laundry and cleaning products [9].

Alpha Olefin Sulfonate (AOS)

Alpha olefin sulfonate is of National Chemicals of density 0.960-0.965 g/ml. It is used 100% based on its actual% solids (40%). AOS provides good wetting and foaming properties in hard water [10].

Sorbitol (70%)

Sorbitol is generally used in liquid detergents. Sorbitol has been induced to avoid dusty feel and behavior of detergent. Sorbitol also reduces the irritating feel due to the high proportion of sodium carbonate [11].

Sodium Carbonate (NaCO3)

Sodium carbonate is added as a builder of detergent. It provides high alkalinity; soften water by precipitation of calcium and magnesium hardness, provided the pH of the solution is greater than 9.

Sodium Tripolyphosphate (STPP)

Sodium tripolyphosphate also do the same work of water softening as done by sodium carbonate. It is a builder of the detergent. Builders enhance the action of surfactant, it softens the water, to help disperse soils and prevent their redeposit ion out of solution and to provide alkalinity, which assists the dissolving of oil-based soils.

Ethylene diamine tetra acetic acid (EDTA)

It also softens the water. It forms the complex with Ca+2 and Mg+2 and precipitates (falls out) the solution.

Carboxymethyl Cellulose (CMC)

CMC is works as anti-redeposit ion agent prevents soils that have been dislodged from fabric being redeposited. Anti–redeposit ion agents increase the negative charge on the fabric surface, so that the surface repels soil particles because they are also negative charged.

Urea

Co-solvents, such as urea, can entail drastic changes in the micellization behavior of detergents.

Glauber's salt

A water softener, a chelating agent and an additional detergent builder

Neem leaf powder

Kills bacteria and other microorganisms

Tulsi leaf powder

Kills bacteria and another micro-organism

Perfume (0.1%)

The name of perfume used is Deter clean D03. Perfumes do more than give laundry a pleasant smell. They neutralize the inherent odour of the detergent chemicals and also of the soils in the laundry wash. They can also enhance mood and help to create pleasant association with ‘doing the laundry’.

Water

Water was added to mix up all the above ingredients in detergent powder.

Preparation of detergent powders

Detergent powders P1, P2, P3 and P4 were prepared by mixing the components given in the Table 1

Analysis of detergent powders

The prepared detergent powders P1, P2, P3 and P4 were analyzed for various properties

Determination of moisture %

The moisture % of detergent [12,13] powders P1, P2, P3 and P4 were measured by keeping the known weight of powder in a petri dish in an oven at 110 ºC for 1 hr.
Moisture %= W1−W2 / W1 ×100
Where, W1= Weight of sample

W2 = Weight of sample after kept in an oven for 1 hr.

Determination of pH of powder solutions

The pH of the detergent powder solutions (0.1%, 0.25%, 0.5% and 1.0%) were measured on ELICO LI 120 pH meter.

Determination of foam volume by Bubble Cylinder Method

A 1000 ml cylinder provided with a stopper was taken, 50 ml solution of particular concentrations was added whose foam characteristics was to be measured. It was given 30 up-down rotations within a time period of 30 seconds, then that cylinder was kept on table and the foam above liquid level was observed and the reading was noted in minutes. The readings were taken after 5 min., 10 min. and 15 min. respectively. Same procedure was carried out for the solution of different concentrations (0.1%, 0.25%, 0.5% and 1.0%).

Determination of surface tension

The surface tension of the detergent powder P1, P2, P3 and P4 solutions of varying concentrations (0.1%, 0.25%, 0.5% and 1.0%) were measured by Drop Weight Method.

The drop weight method requires a stalagmometer to measure the surface tension of the liquid. A clean and dry stalagmometer was mounted vertical on stand. The weight of empty weighing bottle was already measured. The bottom end of the stalagmometer was dipped in the beaker which was full of distilled water. The balloon of a stalagmometer was filled with distilled water (from the beaker) up to the mark with the help of tubing. The balloon was removed and 20 drops of water collected in the weighing bottle. The weight of 20 drops was measured by weighing the bottle.

The weighing bottle and the stalagmometer made empty and dry for the next measurement. The above procedure was repeated for every detergent solution. By noting the temperature in the lab, the surface tension of water was noted from the literature. The surface tension of the powder liquids was determined from the equation

$\sigma = \sigma H2O \times m / mH2O$

Where,
σ = surface tension of unknown liquid
$\sigma H2O$ = surface tension of water at 25 ºC (0.07197)
m = mass of 20 drops of unknown liquid
mH2O = mass of 20 drops of water

Determination of % Detergency

For the determination of % detergency the stained cloths of cotton and polyester samples were washed in solutions (0.1%, 0.25%, 0.5% and 1.0%) of P1, P2, P3, P4 and commercial detergents. The cloth samples then after dried and ironed which were used to find out detergency [14, 15].

The tea and coffee stains were prepared simply by boiling 1 teaspoon of tea and coffee in 100 ml water.

The % detergency was found out using Lamberts and Senders formula

$\% \text{ Detergency} = Rw - Rs / Ro - Rs \times 100$

Where, Rw =Reflectance measured on washed cloth
Rs = Reflectance measured on stained cloth
Ro = Reflectance measured on original cloth
The reflectance of different cloth samples was measured using the reflectance meter

RESULTS AND DISCUSSIONS

Table 1: Composition of detergent powders based on Soap Nut

S.No.	Ingredients	Samples (% by weight)			
		P1	**P2**	**P3**	**P4**
1.	Soap nut	-	10	20	30
2.	AOS	30	20	10	-
3.	Sorbitol	7	7	7	7
4.	Na2CO3	40	45	45	45
5.	STPP	4	4	4	4

6.	EDTA	0.5	0.5	0.5	0.5
7.	CMC	1	1	1	1
8.	Urea	1	1	1	1
9.	Glauber's salt	2	2	2	2
10.	Neem leaf powder	2	2	2	2
11.	Tulsileaf powder	2	2	2	2
12.	0.1% Perfume	0.8	0.8	0.8	0.8
13.	Water	11.7	11.7	11.7	11.7

Table 2: Analysis of prepared detergent powders

Powder Detergent	Moisture (%)	Concentration (%)	Foam value				pH	Surface tension (dynes/cm)
			0 min	5 min	10 min	15 min		
P1	20.98	0.1	250	200	175	150	9.50	35.92
		0.25	325	275	225	225	9.80	34.96
		0.5	400	325	300	300	9.90	33.30
		1.0	425	350	325	325	10.0	32.50
P2	19.41	0.1	130	120	115	100	9.40	38.11
		0.25	140	135	110	95	9.50	37.45
		0.5	125	115	100	90	9.50	36.95
		1.0	120	105	90	80	9.45	36.03
P3	16.37	0.1	130	120	105	95	9.30	33.18
		0.25	175	170	160	150	9.40	31.45
		0.5	400	335	325	250	9.55	31.20
		1.0	390	350	325	300	9.60	30.26
P4	14.23	0.1	175	150	240	230	9.25	29.48
		0.25	350	300	250	240	9.21	28.12
		0.5	435	350	300	250	9.23	26.57
		1.0	375	360	340	325	9.23	24.28

Table 3: Detergency of detergent powders on Cotton and Polyester clothes

Cloth	Stain	% concentration	P1	P2	P3	P4	Commercial powder
Polyester	Tea	0.1	80.55	82.68	84.77	90.64	79.54
		0.25	83.79	84.41	85.40	91.52	82.32
		0.5	85.83	87.71	87.91	92.69	85.49
		1	89.23	91.10	94.19	97.13	88.33
	Coffee	0.1	91.53	91.88	92.10	92.93	91.49

		0.25	90.45	91.59	92.50	94.14	89.55
		0.5	91.11	92.18	93.18	95.68	90.01
		1	91.97	93.78	94.88	96.69	91.87
Cotton	Tea	0.1	82.31	83.51	84.51	91.51	82.41
		0.25	87.01	88.21	90.21	93.09	86.90
		0.5	89.11	90.11	93.22	94.79	90.01
		1	91.45	93.45	94.05	96.05	91.40
	Coffee	0.1	83.00	83.20	84.21	84.96	84.11
		0.25	84.58	85.88	86.72	87.91	85.85
		0.5	86.98	87.91	88.15	89.91	86.91
		1	87.33	88.38	90.33	91.05	87.26

CONCLUSION

Detergent powders P4 appears to be best, which is containing soap nuts instead of AOS. Very small amount of STPP was used and therefore, the problem of pollution reduced considerably. The soap nut shows higher detergency than the commercial one. The incorporation of soap nuts in detergent powder helps to reduce the pollution load of the environment.

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