PRODUCTION OF DETERGENT FROM BLEACHED PALM OIL

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Abstract

The research was carried out with the objective of utilizing palm oil in the production of synthetic detergent The research revealed some properties of palm oil in terms of values obtained by the determination of saponification value of 105.138mg KOH/g of oil as opposed to the standard saponification of value of 183.728mg KOH/g of oil and the iodine value (IV) of 40J08 maximum. Other parameters used to determine the quality of palm oil include formability and pH tests. The present work concludes that palm oil may not be a very good solvent for the production of detergent due to the very low values obtained. The researcher recommends the use of other oils outside palm oil.

The washing industry, usually known as soap industry, has roots over 2000 years, a soap factory having been found in the Pompeii excavation. However, among the many chemical process industries, none has experienced such a fundamental change in a raw material as have the washing industry. Soap itself was never actually "discovered", but instead gradually evolved from crude mixture of alkaline and fatty acid (George, 1984).

Scientifically, the term detergent covers both soap and synthetic detergent, or "syndets" but it is widely used to indicate synthetic cleaning compounds as distinguished from soap. Detergent differs from soap in their action in hard water. Although soaps are excellent cleaners, they do have disadvantages. As salts of weak acids, they are converted by mineral acids in free fatty acids. These fatty acids are less soluble than the sodium or potassium salts and form precipitate or soap scum. Because of these, soaps are ineffective in acidic water. Also soaps form insoluble salts in hard water such as water containing magnesium, calcium or iron. The insoluble salts from bath rub rings, leave film that reduce hair luster, and gray/roughen textiles after repeated washings. Synthetic detergents, however, may be soluble in both acid and alkaline solutions and do not form insoluble precipitate in hard water (^www.chemistry.about.com/library/weeklv/aa081301a.htm).

Many of the activities of man, starting from the primitive fanning techniques to today's high technological industrial activities have in small or large ways impacted on man and his environment while the various products developed are highly desirable for *the* enhancement of the citizenry's well being and sustenance of the nations' economy. The impacts precipitated may be catastrophic if allowed to build up and uncontrolled.

Industrial revolution and evolution have been targeted principally at satisfying immediate changing demands rather than tailored towards a structured, wholesome and guided global program that will satisfy not only temporary human needs but are environmentally safe. The result of this is an increasing ecological degradation that has severely polluted water, land and air, (Odigure, 1998).

The detergent and soap making industries are no exceptions to the above trends for while they provide us with cleansing agents, their processing and by-products are also a cause of public concern. For instance, detergents, unlike soaps, have proved very effective cleansing agents in hard and cool water whereas soap is often ineffective under such conditions. It was observed, however that many of these detergents were neither soluble nor biodegradable, that is they were so stable that when they flow into the soil in laundry sewage water, they remain unchanged resisting conversion into less complex and more soluble substances. They thus, create suds and foams in fresh tap water, naturally occurring ground and surface waters.

To correct these odds require that environment issues be considered at the initial stages of conceptualization and development of synthetic detergents and other products as well This will not only reduce pollution to the barest minimum but also save costs of treating these products, A deep knowledge and good manipulation of the process chemistry with a view to eliminating wastes is the most viable means of achieving this objective.

Above 75 percent of detergents used in the early 1960s were for the most part made with alkyl benzene, made from propylene tetramer coupled to benzene, Tetra propylene is a very highly branched alkyl molecule. Research into the bacteria decomposition of alkyl based detergents showed that branched molecules are indigestible to the bacteria that must decompose the detergents when they reach the ground. To be biodegradable, a detergent should be based on straight chain alkyl molecule, examples of straight chain alkyl are the linear alkyl benzene sulphonates (LABS) and ricinoleic acid obtained from the castor bean. (Encarta online search).

This research work is aimed at studying the replacement made to the biodegradable detergents. Production of environmentally friendly synthetic detergents (soft detergents) from palm oil has the dual advantages of using locally sourced raw materials that can be grown and generating wastes that are appetizing to micro organisms (bacteria).

Experimental

Materials

Apparatus; The apparatus used for the study are; stirrer, flask, weighing balance, hot plate.

Reagents

Palm oil, NaOH, hydrogen peroxide, sulphric acid, potassium hydroxide, ethanoic acid. Phenolphthalein, HC1, cyclohexane, sodium thiosulphate, starch solution, Wijs reagents and fragrance.

Saponification Value *Procedure*

2g of the oil was placed in a conical flask to which 25ml of ehtanoic potassium hydroxide (0..1M) was added and the mixture allowed to boil gently for about 60 mins. with shaking at regular intervals of 5mins.

Few drops of phenolphthalein indicator, as specified by International Standards Organization (ISO 3657, 1988) was added to the warm solution and then titrated with 0.5M HC1. The end point was reached when the pink colour of the indicator just disappeared. The same procedure was followed for the blank.

The saponification value (sv) is given by: Sv

$$= 5\text{-}6N.(V_o\text{-}V_1/m$$

Where: V_o = volume of HC1 solution used for the blank test, V_i = volume of HC1 solution for the determination, N = actual molarity of HC1 used, and m = mass of sample.

Iodine Value

In the determination of IV, about 0.2g of oil sample, in a 20ml mixture of cyclohexane and glacial acetic acid was reacted with 25ml of Wijs reagent followed by addition of 20ml of $lOOgL^{-1}$ potassium iodide and distilled water after storage in the dark for 1h. The liberated iodine was titrated with 0,1M sodium thiosulfate until the yellowish iodine colour disappeared. A small amount of starch solution was then added to the solution as an indicator and the titration continued until the blue colour has also disappeared. The IV is calculated by the following equation:

$$IV(g/100g) = \frac{12.69C(V_1-V_2)}{m}$$

C is the concentration of sodium thiosulfate solution (mole I/), Vi is the volume (ml) of sodium thiosulfate solution used for the blank test, V_2 is the volume (ml) of sodium thiosulate solution used for the sample; and m is the mass (g) of the sample.

Production of Detergent

0.1M sodium hydroxide solution was prepared by weighing 4g of NaOH pellets into a volumetric flask containing some water and shaking vigorously and made up to the mark. The electric hot plate was switched on; 30ml of palm oil in a stainless steel plate was placed on it and heated at 35°C for about 2mins. Caustic soda (0.1M) was added and the mixture stirred with a glass rod. 18M sulphuric acid was then added with constant stirring and the reaction allowed to complete after which hydrogen peroxide (Bleaching agent) was introduced into the reaction mixture. When the foaming had subsided, the heating was continued to allow for more vaporization before putting off the heating system. Finally, perfume was added and the system was allowed to cool. The powdered detergent formed was then subjected to formability test to ensure the effectiveness of the process.

The results are as shown in Table 1-3.

Results and Discussion

Table 1: Determination of Saponification Value

Burette Reading	**Titration**		
	1st	*2nd*	3rd
Final reading in (cm^3)	7.0	28.0	36.0
Initial reading in (cm^3)	0.00	20.5	21.0
Volume of acid used	7.0	7.5	8.0

Average volume of acid used $= \frac{7.0 + 7.5 + 8.0}{3}$ = 7.5m/

$$Sv = \frac{56.1JV. (Vo\text{-}Vi)}{m}$$

V_0 = vol. of HCl solution used for the blank test. 28.0ml *Vi* = vol. of HCl solution for determination. 20,5ml

N = actual molarity of HCl used, m = mass of sample 2g.

N = 0.5M HCl

$$Sv - \frac{56.1x0.5(28\text{-}20.5)}{2} = 105.138\text{mg KOH/g of oil.}$$

Determination of 1odine Value

Table 2: Burette Reading

Burette Reading	**Titration**		
	1st	2nd	3rd
Final reading in (cm^3)	6.4	12.8	19.2
Initial reading in (cm^3)	0.0	6.4	12.8
Volume of litre used	6.4	6.4	6.4

Average volume of thiosulfate used $= \frac{6.4 + 6.4 + 6.4}{3} = 6.4ml$

$$IV(g/100g) - \frac{12.69C(V_1 - V_2)}{m}$$

C = Concentration of sodium thiosulfate solution ($molL-^1$) = 0.1M

V1 = Volume of sodium thiosulfate solution used for the blank test (ml). 12.8ml

V_2 = Vohime (ml) of sodium thiosulate solution used for the sample. 6,4ml

m = mass (g) of the sample = 0.2g

$$IV = \frac{12.69X0.1x6.4}{0.2} = 40.508\ max$$

Table 3: Foamability Test

Detergent base material palm oil	**Height of foam in water (cm)**
1	0,85
2	0.82
3	0.86

The results obtained from the saponification value, iodine value and foamability test of palm oil are presented in Tables 1-3, The quality of oil was not very desirable as demonstrated by the saponification value of 105,138mgkOH/g of oil which does not in any way compare to the standard saponfication value of ISO.OOmgKOH/g of oil) of conventional oils.

Moreover, the sulphonation and neutralization reactions did not really give powdered detergent of high enough efficiency as seen from the result of the foamability tests. Ordinarily, the efficiency of a washing detergent is assessed by the amount of foam it is capable of producing.

The average foam height of 0,85cm persisted for some minutes and it is not enough height as compared to that of conventional oil. When the palmitin ester was treated with concentrated H_2SO4, it gave a complex mixture in which the H_2SO_4 was added to the double bond. Esterification and addition do not occur together in the same molecule of palmitin.

The product which was obtained however, had average wetting properties. Neutralization of the product with NaOH gave a detergent plus water. The reaction proceeded at temperatures between 30-40°C. The water was vaporized by further heating and a solid (Powdered) detergent was the result The bleaching agent (H_2O_2) added did not really help to further bleach the color of the oil. pH test showed that the detergent exhibited basic property. The detergent can thus be described as amphoteric. The sulphonation reaction occurred at the carbonyl group while the esterification reaction occurred at the ester linkages and thus can be used to produce both soluble and insoluble soap. Hence, the detergent produced was the esterification of palmitin esters.

Conclusion

The research work has been undertaken to bleach palm oil and determine whether or not bleached palm oil has high enough quality to be utilized in the production of detergent. Other operations such as bleaching and drying were done to improve the texture of the detergent Although many other additives such as optical brighteners, etc were not added, even when the active ingredient (surfactant) was used, the detergent efficiency was not high enough.

Recommendation

The production of synthetic detergent from bleached palm oil was quite frankly done successively, but whether or not the detergent produced from palm oil has the qualities of a good detergent is the issue. The many undesirable qualities of palm oil makes it not very useful in the detergent industry, thus palm oil solvent may not serve as a good substitute to petroleum products.

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