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DEVELOPMENT OF A LAUNDRY SOAP USING PALM KERNEL OIL AND CAUSTIC SODA

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Abstract
Laundry soap is one of the most important household commodity used by average Nigerians today. With the recent call for production and promotion of indigenous household commodities, this paper presents the procedure for the production of a laundry soap. The procedure begins with pouring of Palm Kernel(PK) oil into plastic container and then adding soap dye. Caustic soda already dissolved in water was then added to the PK oil and the mixture then stirred. Soda ash fermented into the liquid was then added to the mixture. This followed by addition of colour dye and perfume to the mixture. Sodium sulphate and hardener were finally added. Stirring rod was then used to mix the contents thoroughly. Thereafter, the mixture was brought to boil until it was thick. The process took about two hours. The final mixture was poured into the constructed mould and left to cool and set. When it became hard, the block of the soap was cut into slabs and finally into small bars. The soap produced is pink, solid and foaming very well. When used to wash cloth, it leaves lasting pleasant smell. Therefore, the paper recommends the use of the produced soap in every Nigerian household.

Keywords: Laundry Soap, Palm Kernel, Caustic Soda, Soap dye, Hardener, Abia State College of Education (Tech) Arochukwu

Introduction

Soap is very important commodity in that it is used for removing dirt from human body and clothes. It is also used for removing dirt from utensils and other materials. Some soaps cure skin diseases. In this way soap become an indispensible commodity that should be available in any household. Soap is simply a salt (or mixture of salts) of the non-volatile fatty acids. Soap is formed by mixing correct proportions of vegetable oil or animal fat with aqueous base. Vegetable oil or animal fat comprise of triglycerides. When triglycerides are mixed with an aqueous base such as sodium hydroxide (NaOH) or Potassium Hydroxide (KOH), a soap and glycerol are formed. Perfumes, fillers, colourants, medical agents and preservatives are added after the mixture reached 'trace' to improve the quality of the soap. (Burleson, Butcher, Goodwin, Sharp & Ruder, 2017).

The quality of the soap produced depends on a number of factors. Such factors include the types of the ingredients (such as oil and base) used in the production of the soap. The amount of caustic solution reacting with corresponding amount of fat or oil and the combination as well as the proportion of oils used in soap production determines the quality of the soap produced. The execs oil used, fragrances, fillers, colorants and medical agents also affects the quality of the soap produced (Gaboya, 2012).High grade ingredients such as sodium hydroxide and potassium hydroxide used for soap production are not available in local communities for purchase. Where they are available, their prices do not economically justify their used for local production of soap.

The obvious solution to the above observed problem is the used of locally sourced soap ingredients. Wood ashes were found to be good sources of caustic solution. Such wood ashes can be obtained by burning dried palm branches, dried out banana peels, cocoa pods, kapok tree wood, oak wood, apple tree wood, agricultural waste products or any fire wood (Norman, 2011).This discovery lead to the increase in research on the area of use of wood ashes and waste agricultural products for making soap. In other words, research on the use of agricultural waste products or wood ashes as a source of caustic solution has received great attention in recent times. For instance, Umeh-Idika and Maduakor (2013) conducted a study on the use of Cassava peel ash and Plantain peel ash as active ingredients for making soap. The findings of the study showed that the ashes were good alternative, ingredient for soap making. Other studies conducted using

wood ashes sourced locally to produce soap also pointed the efficacy of wood ashes in soap production (Atiku, Fakai, Wara, Birnin-Yauri & Musa, 2014; Aiwize & Achebo,2012).

It is well known that the caustic solutions made from either sodium hydroxide or potassium hydroxide yield soap when combined with common oils or fats. Unfortunately, caustic solutions from wood ashes do not turn all the oils or farts that the caustic solution from sodium hydroxide or potassium hydroxide does into soap. On strategy of overcoming this problem is the use of blended oil. Evidently, Norman (2011) reported that Coconut oil has been used successfully with wood ash lye, but often needs a lot of beef tallow grease with it. This implies that successful use of wood ashes requires blended oil with solution of wood ash to produce quality soap. There a number of studies that successfully obtained soap by combining blended oil with caustic solution from wood ash. For example, Zauro, Abdullahi1,Aliyu, Muhammad, Abubakar and Sani (2016) carried out a study on the production of soap using locally available raw materials . The soap was prepared using shea butter oil (SBO), palm kernel oil (PKO) and plantain peels. In this study three, types of soaps were produced; one from the combination of SBO and plantain peel, the other from PKO and plantain peels and the third one from blends of SBO and PKO. The three soaps were then analysed. The results of the analysis indicated that the soap produced by SBO:PKO (50:50) showed a very good properties, hence regarded better compared to the soaps produced by SBO and PKO separately. These results indeed support the idea of blending two or more oils whenever one is to use wood ash to produce soap.

Palm oil is one of the ingredients often used in conjunction with caustic solution from wood ash in soap production. Palm oil comes from the fruit pulp of different kind of palm tree. When palm oil is used as the only oil in soap production, it produces crumbly soap. However, its best performance is when used in combination with other oils. It is inexpensive and has good shelf life of 12 months plus. It produces a low to medium lather, but is slow to lather. It traces quickly and serves as substitute for animal tallow. It is mild cleaner and rich in antioxidants vitamin A and E. It protects skin. Cocoanut oil is another good oil that can be combined with caustic solution to produce soap. Cocoanut is good soap ingredient produced from the dried flesh of cocoanuts and therefore can be easily sourced. It is low cost oil and has good fluffy lather even in cold water. It is quick to lather, has good cleansing ability and adds hardness to the bar. It has very long shelf life of 2 to 4 years if stored properly. It is highly stable oil and trace quickly. Soaps from cocoanut oil do not go rancid quickly. It is used in combination with highly emollient oils to compensate for its drying effect. It has strong odour but odour does not follow through into the end soap. It provides moistening but becomes drying in high doses (Rain,1993).

Development of new soap using soap ingredients such as caustic solution from wood ash and oils is multifaceted activity that does not only involve production of soap itself but also testing its quality and efficacy. In this sense, various quality parameters are used in testing the quality of soap produced. Such parameters include % yield, Total Fatty matter (TFM) value, total alkali content, free caustic alkali content, pH and antimicrobial activity (Sarasan & Rangwala,2014). Other quality parameters include saponification value iodine value, acid value, ash content , colour, texture (Atiku, Fakai, Wara, Birnin-Yauri & Musa,2014) .This study set out to produce laundry soap using palm tree branch wood ash and blends of palm and cocoanut oils and to analyse the physical and chemical properties of the soap produced.

Problem Statement

Soap is very essential household commodities in Nigeria as well as other countries of the world. In Nigeria, laundry soap is used in most of the laundry activities. But unfortunately, most of the soaps used in Nigerian household today are imported ones. This situation does not only render many of our youth unemployed, but also affect the economy of the country. Therefore, the researcher, proposed the production of soap using locally available materials.

Objectives of the Study

The main objective of this study is to develop a laundry soap using palm kernel and caustic soda.
Specifically, the study sought to:

1 produce laundry soap using palm kernel oil and caustic soda.
2 Identify the physical properties of the soap produced

3 Analyse the chemical properties of the soap produced.

Literature Review

This section reviewed some empirical studies concerning the development of soaps using locally sourced materials. The review provided the data that will help in the development the soap proposed in this study.

Atiku,Fakai, Wara, Birnin-Yauri and Musa (2014) carried out a study on the production of soap using locally available Alkaline extract from Millet stalk. Millet stalks where used to extract alkaline using traditional method. The alkaline extract was used in the preparation of soap using traditional method. The resulting soap was subjected to physicochemical test. Saponification value (171 mg/KOH/g), iodine value (41.2g/100g), acid value (1.46mg/KOH), ash content (9.2%), colour (white), texture (hard and rough). This implies that the white colour of soap is as a result of bleaching of the oil sample and also the soap is hard due to the presence of high concentration of k+ ions in the prepared soap, emulsification test (observed), foam test (form lightly with moderate persistence), foam height (1.8cm). Reactions with metals NaCl, KCl and NH4Cl (form white ppt) but soluble in water, Ca2+, fe2+, mg2+ form (white gelatineous ppt) and form insoluble complex with water. Reaction of soap with 1 drop of phenolphtalein gave (pink colour) and the reaction of the soap with 3M HCl gave (colourless solution) to ascertain the quality of soap produced. These properties tested showed that the soap prepared using traditional method gave a better quality soap which could be compared with any other soap**.**

In another related study, Warra, Hassan, Gunu and Jega, (2010) carried out a study to find out how different fats and oils produce soaps of different characteristics. The study describes cold-process saponification using different fats and oils. Shea nut oil (SAP value:183.9mgKOH/g), groundnut oil (SAP value:187.7mgKOH/g) and Tallow (SAP value: 140.3mgKOH/g) were used. Colour, texture, lathering and cleansing power of the prepared soaps were analyzed. shea butter soap had the best lathering capacity. The groundnut oil soap had the most effective cleaning power .The soaps were also recommended for household use .This activity was also provided to share a delight in chemistry with senior school students and to actively engage them in hands-on-active learning.

Aiwize and Achebo (2012) produced liquid detergent using locally sourced palm fruit bunch (Elaeis Guineesis) waste saponifier. An optimum blend ratio of rubber seed oil to palm kernel oil RSO:PKO 20:80 being constituent elements used for the production of the soap; was obtained using the Duncan Multiple Range Test. The black pigmentation in the oil was removed by bleaching and passing compressed air through it using laboratory grade activated carbon. Saponification values of 130.5 and 126.3 were obtained for the local KOH and laboratory grade respectively. From expert test results, good quality soap was produced using local KOH comparable to laboratory grade KOH.

Umeh-Idika and Maduakor (2013) developed soap using Cassava peel ash and Plantain peel ash as an active ingredient. These peels are agricultural waste materials that litter the whole environment. The study used the peels as alternative source to the much needed lye, in soap making. The usage of these peels will reduce the cost of soap making and also reduce waste materials in our environment and these will reduce diseases caused by these waste. The plantain peels and cassava peels were burnt into ashes and the ashes were turned into solution with water and filtered. The filtrate was boiled with palm kernel oil, until good lathering soaps were obtained, sensory evaluation was conducted using 15 home Economic respondents. The data were analyzed using frequency distribution and percentage. The qualities of the soap evaluated were the colour, odour, lathering ability and texture. The findings showed that the ashes were good alternative, ingredient for soap making. Recommendations were made based on the findings: that the use of the raw materials should be encouraged for soap making to save the country's foreign exchange. There is need to create awareness on the use of the ashes. Home economics graduates should exploit the self employment opportunity in the area of local soap production using these ashes for self-reliance.

Arasaretnam and Venujah (2019) conducted research on production of soap. The molecule of soap consists of two dissimilar ends, a hydrophilic end (polar head) which binds with water and another end which is hydrophobic end (non-polar hydrocarbon tail) that binds with oil. The soap is made by the saponification process, which reacts with the oil that contains triglycerides and lye (NaOH). Oils with different properties

make them distinct from each other as the composition of fatty acids is incompatible. In the present study in the process of preparation of soaps, dissimilar oils of 5 types i.e., coconut oil, palm oil, castor oil, olive oil and gee oil were utilized. In order to prepare various soap samples, the oils were blended in different ratios which are then checked to analyze the soap's quality. In this study amount of volatile matter and moisture content, total fatty mater content, alkali content and pH were determined. The obtained results were compared with some of commercially available soaps such as baby soap (BS-1), elder soap 1 (ES-1), elder soap 2 (ES-2), elder soap 3 (ES-3) and elder soap 4 (ES-4). With the observed studies, the soap made using olive oil was found to have better properties that the others. It has the good alkaline content, TFM value and pH values.

Zauro, Abdullahi1,Aliyu, Muhammad, Abubakar and Sani (2016) carried out an experiment on the production of soap using locally available raw materials . The soap was prepared using sheabutter oil (SBO), palm kernel oil (PKO) and plantain peels. The physicochemical parameters of the oils were analysed. The saponification values of the oils 175.30±0.81mgKOH/g (SBO) and 249.18±1.40mgKOH/g (PKO), and the iodine values 65.99±1.27 I2/100g (SBO) and 18.58±0.86 I2/100g (PKO) agreed with those found in literature. The free fatty acid (FFA), acid value and Relative density were found to be 1.719±0.009, 3.60±0.06mgKOH/g and 0.90±0.02 for PKO and for SBO the corresponding values were 5.499±0.113, 11.78±0.56mgKOH/g and 0.91±0.07 respectively. The alkali was extracted from the plantain peels ash and used to saponify the oils for the production of soap. The soap produced was analysed by testing its hardness, moisture and foaming stability. The results indicated that the soap produced by SBO:PKO (50:50) showed a very good properties, hence regarded better compared to the soaps produced by SBO and PKO separately

Sarasan and Rangwala (2014) prepared soap by mixing various non-edible oils such as Jatropha oil, Castor oil and Mahua oil by mixing with warm lye. In order to improve quality and market value, controlled quantity of fillers, permissible colors and fragrances were added in these samples. Soaps prepared from non-edible oils were compared with popular soaps in terms of several parameters such as % yield, TFM value, total alkali content, free caustic alkali content, pH and antimicrobial activity. It was found that TFM value of non-edible oil soap is more than 65%. According to BIS norms, such soap can be categorized as Grade II soap and it can be used for general bathing purpose. Also, total alkali content, free caustic alkali content, pH value etc. were found within prescribed value of BIS. S. aureus was chosen for study of antimicrobial activity. It was observed that soap from non-edible oil has more potential of inhibiting bacterial growth as compared to commercial antiseptic soap, which shows that production of soap from non-edible oil could be of great importance in agriculture as well as pharmaceutical sector.

Procedure for Making Bar Soap

The following presents the procedure for making bar Soap
of the soap.

- Determination of the amount of soap to be produced
- Determination of ration of oil to base
- Preparation of mould to be lined with polythene, freezer paper, parchant paper or plastic wrap
- Wearing safety materials
- Preparation of oils to be blended and calculations of amounts and their percentages
- Preparation of Alkali (base) and calculation of the amount to be used
- Melting oils
- Heating solution of base
- Mixing solution of Alkali and blended oils
- Adding additives
- Pouring the mixture into mould
- Allowing the soap to settle (24 hours)
- Removal of the soap from the mould
- Cutting the soap into pieces
- Stamping the pieces of soaps
- Identifying the physical properties of the soap produced **(eg.** hardness ,. colour , Odour , lathering)

- Analysing the chemical properties of the soap produced
- Making some adjustment and start the process again until a satisfactory result is achieved.

Materials and Method

Chemicals used in the Production of the Soap

1) PKO-3 litres
2) Water-6 litres
3) Caustic Soda-500gms
4) Sada ash-500gms
5) Sodium silicate-250gms
6) Soap hardener-250gms
7) Perfume-2 table spoon full
8) Soap dye-1 tablespoon full
9) Foaming agent-1/2 litre
10) Mould

Procedure

1. PK oil is poured into rubber container
2. Caustic soda was dissolved in water and then stirred thoroughly and left for 48 hours
3. Soap dye was added to the PK oil and stirred thoroughly
4. Caustic soda was added to the oil and stirred very well
5. The soda ash was fermented into the liquid and add it and mixed it very well
6. Sodium tripolyphosphate (STTP) was added into the mixture
7. Colour dye was then added into the mixture
8. This followed by the addition of perfume (or fragment)
9. Sodium sulphate and the hardener were then added
10. Stirring rod was then used to stir or mix it thoroughly. Thereafter, the mixture was brought to boil until it was thick. This took about two hours
11. The mixture was poured into the mould and left to cool and set.When it became hard, the block of soap was cut into slabs and finally into small bars.

Conclusion

Nigerian economy will do well if the governments at local, state and federal levels supports and promotes indegenious production of many household commodities such laundry soap. In other words, local production of laundry soap will not only provide employment opportunities to teeming Nigerians, but also improve Nigerian economy. In light of this, the paper first reviewed the available literature in laudry soap making and then presents the chemicals used for the production of the soap.The paper then presents the procedure used for the production of the soap.. The soap produced is pink, solid and foaming very well. When used to wash cloth, it leaves lasting pleasant smell.

Recommendations

As stated earlier, the soap produced is pink, solid and foaming very well. Futhermore, when used to wash cloth, it leaves lasting pleasant smell. Therefore, the paper recommends the use of the produced soap in every Nigerian household.The paper also recommends periodic training of Nigerian youth on local production of the laundry soap.

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