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Quality Assessment of Soaps Produced from Palm Bunch Ash-Derived Alkali and Coconut Oil

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ABSTRACT: The making of soap using vegetable matter (palm bunch waste) was examined. All the factors that impact blackish on the soap products after saponification process were studied with a view to remedying them. The remedial process involved subjecting the dried palm bunch matter to total combustion, soaking, filtering and recrystallizing the ash-residue to obtain a colourless filtrate and pure extract of the alkali. Coconut oil was extracted from coconut seeds using hot –water extraction process. Soaps were produced using both the conventional and modified methods. Conventional saponification process was modified to improve on the quality of the soap produced with the extracted alkali hence, generating a neater soap which was milky in appearance. The following parameters were determined: free alkali content, total fatty matter, moisture content, lathering ability, cleansing power, matter insoluble in water, matter insoluble in ethanol. The free caustic alkali content of the black soap produced through the conventional method was found to be 0.09%, while 0.26% and 0.98% were recorded respectively for the improved and synthetic-alkali soaps. The total fatty matter content of the black soap was 55.45%, which was over two folds of 23.00% and 21.69% observed in the improved and synthetic –alkali soaps. Moisture content of modified soap was 29.05%, which was remarkably higher than 9.53% recorded for black soap and 6.65 for the synthetic-alkali soap. The lathering ability was found to be 5.00ml for black soap and 15.00ml and 10.00mL for the other soaps. The improved soap produced with purified palm bunch ash-derived alkali was comparatively of a better quality than its conventional black soap counterpart considering some physico-chemical properties such as matter insoluble in water, matter insoluble in ethanol, unsaponified neutral fat and lathering characteristics of the soaps © JASEM

The Making of soaps from ash- derived alkali has been an age –old craft in Nigeria and West African countries (Nwoko,1982). Ash- derived alkalis offer cheap alternatives to the imported ones. Irvine (1965) reported that agricultural wastes such as palm bunch chaff, cocoa pod, plantain peels, banana leaves, maize cob, wood, sugar beet wastes and many others contain a good percentage of potash. When these materials are burnt in air, the resulting ashes contain oxides of potassium and sodium which yield their corresponding hydroxides upon dissolution in water, which of course are of great importance to soap manufacturing industries. Previous research efforts had indicated the viability of vegetable matters especially the agricultural waste materials for alkali production (Edewor, 1984; Onifade, 1994 and Onyegbado, 1984). Presently, the Federal government policy on sourcing for local raw materials which are non-toxic and potentially suitable for alkali generation has given rise to an increase interest in research efforts gear towards exploiting locally available vegetable materials. Hence, the current research is focusing attention on the feasibility of deriving alkali from agricultural waste product such as palm bunch wastes and investigating the effectiveness of such alkali in generating soaps that are void of the blackish appearance often associated with conventional black soaps.

MATERIAL AND METHODS.

Palm bunch wastes were collected from Ministry of Agriculture Oil Palm Mill at Oka, Ondo West Local Government Area in Ondo State. All the reagents and chemicals used were of analytical grades and were not further purified.

Extraction of Alkali from Palm kernel Bunch Ashes.: The collected palm bunch wastes were sun dried and later oven-dried at a temperature of 105^0 C for two days to ensure adequate removal of moisture from the sample. The bunches were thus said to be "bone-dried". The bone-dried bunches were charred for 3h to ensure uniform combustion. The charred bunch was further burnt in a temperature controlled furnace set at a temperature above 550^0C for proper ashing which lasted for about 8h.

The ashed sample was homogenized by crushing between fingers and then sieved with analytical sieve

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of mesh size 126 x 10^{-4} micron to obtain uniform particles size. About 300g of the ash was placed in a 3 litre round bottom flask and 2 litre of distilled water was added. The flask was placed on an electric heating mantle and boiled continuously to about 100^0C for 4 h. After which the flask was allowed to stand for 48h and the content was filtered using poplin cloth and re-filtered with Whatman filter paper of 125cm to obtain clearer extract.

The filtrate was poured into a beaker, placed on an electric hot plate and concentrated by evaporating to almost dryness. The solid residue (alkali) obtained was dried and weighed. The extracted alkali was purified by subjecting it to series of recrystallization procedure until the melting point of the resulting white solid was sharp

The molarity of the pure alkali –extract was determined by titrating against 0.IM hydrochloric acid using phenolphthalein as indicator

Oil extraction and preparation: The coconut seed was extracted and bleached following the procedure described by Taiwo et al, 2001

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500g of the dried and blended coconut cake was cooked with 1000mL of water in a big stainless cooking pot continuously for four hours. After, the mixture was allowed to cool and decanted into a separating funnel where the oil formed the upper layer of the mixture. The separating funnel tap was opened to release the co-extracted water first and afterward obtained the extracted oil. The extracted oil was dried in an oven regulated at 100^0C to dry off the remaining water co- extracted with the oil.

100g of the extracted oil was bleached at 50^0C with constant stirring. 5mL of 0.15M sulphuric acid was added with the aid of a 5mL capacity syringe to break the long chains of the oil molecules. 4g of activated carbon was added to remove impurities and the mixture was stirred for 10min. The oil was heated to 95^0C for 30min and cooled to 80^0C; and then neutralized with 0.05g calcium carbonate. The oil was further cooled to 30^0C and filtered.

Production of black soap using conventional Method: The traditional method for producing black soap was adopted. 500g of the palm-kernel bunch ash was weighed on a piece of sack placed over a stainless steel pot. Enough quantity of water was carefully poured upon the ashes so as to leach the alkali through the sack that serves as a filter. The filterate was blackish in colour and evaporated to almost dryness by heating. Palm oil was gradually charged into the pot and stirred until the mixture became thickened. The heating continued for about 30min with continuous stirring. The pot with its content was removed from the fire and allowed to cool before removing the soap cake. .

*Production of soap using purified palm bunch ash derived- alkali (improved soap:)*The saponification process adopted was semi-boiled method as described by Schumark (2005). The procedure was modified with the exemption of NaOH. 150ml of the extracted coconut oil was poured into a 500mL beaker and heated to 60^0C . The purified alkali was added continuously with stirring until the mixture became thickened. 20ml of NaCl solutions was added for salting out and the soap was completely homogenized for 30 min. The soap formed a layer on the surface of the beaker while lye (a solution of glycerol and borne) was below. The lye was separated by means of separatory funnel. The soap was poured into a mould for cooling.

*Production of soap using synthetic Alkali (NaOH):*The saponification process adopted was as described above for the improved soap except that 1M NaOH was added drop wise with continuous stirring until the mixture thickened. Soaps were also produced with varying proportions of the synthetic - alkali and the purified- alkali in different ratios such as I:1, 2:1, 1:2 respectively.

. *Analysis:* The alkali content of the palm-bunch ash extract was determined. The physicochemical properties- total fatty matter, moisture content, matter insoluble in water, total free alkali content, bulk density, unsaponified neutral fat, titre and lathering ability of the soaps were determined. Quality assessment was also carried out

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RESULTS AND DISCUSSION.

Alkali content of the Palm kernel Bunch: The alkali content of the potash obtained from palm-kernel bunch ash was quantified using titrimetric method analysis. The analysis showed that the ash contains 0.15mol/dm^3 alkali.

Physico-chemical properties of the soaps.: Table 1. Shows the physico- chemical properties of the soaps: black soap, improved soap and the synthetic-alkali soap

Discussion: The moisture content of the improved-soap was found to be the highest compared with those of the black soap and synthetic-alkali soap that retained lesser moisture. Moisture content is a parameter that is used in assessing the shelf –life of a product. The moisture content of 29.05% recorded in the modified soap was higher than the recommended percentage (10-15%) Encylopedia of ind.Chemical analysis, (2007). Implication of high moisture content in soap is that the excess water could possibly react with any unsaponified neutral fat to give free fatty acid and glycerol in a process called hydrolysis of soap on storage. (Tewari, 2004)

Table 1: Physico-chemical properties of Black Soap**.**

PARAMETER	Black soap	Improved-soap	Synthetic-alkali soap
Moisture Content(%)	9.53	29.05	6.65
Matter insoluble in ethanol	14.80	9.70	4.31
Matter insoluble in water (%)	3.50	2.45	2.27.
Free caustic alkali(%)	0.09	0.26	0.98
Total fatty matter(%)	55.45	23.00	21.60
Unsaponified neutral fat	0.05	0.15	0.25
Bulk density(w/v)	1.56	1.20	1.13
Leathering ability	5.00	15.00	10.00

Table 2: Parameter showing the qualities of the soap

PARAMETER	**Black soap**	**improved-soap**	**Synthetic-alkali soap**
Lathering Ability	Average	Very Good	Very Good
Foam Size	Small	Large	Large
Lather Texture	Fairly Good	Very Good	Very Good
Colour	Black	Cream	Cream
Foam stability	Stable	Very Stable	Very Stable

Quality Assessment of the Soaps: The quality of the various soaps produced was assessed by determining the various parameters as shown on Table 2

The black soap recorded the highest level of insoluble material both in water and ethanol. The amount of matter insoluble indicated the level of purity of the soap. The higher the level of matter insoluble the lower the purity of the soap. Black soap contained 3.5 and 14.80% of insoluble matter both in water and ethanol respectively while the improved and synthetic –alkali soaps showed relatively lower percentages. This suggests that the black soap contained high level of impurities which may be attributed to the level of impurity of the alkali used for producing the soap

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Moreover, the slight difference in hardness between the black soap and the improved soaps which is milky in colour could be accounted for by the presence of impurities which had contributed to the bulkiness of the palm kernel oil used. Practically all the important unsaturated triglycerides e.g. triolein, trilinolin and trilinole are liquids at ordinary temperature. Hence, fats which contain them in considerable proportions are oils or if the proportion is smaller, they are soft solids (schuman and siekman , 2005). It can be deduced that palm oil contain smaller proportion of these triglycerides which makes it more saturated than coconut oil . As a result, coconut oil yielded a softer soap with the palm-bunch ash-derived alkali than the soap made using palm oil

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Free caustic alkali is one of the parameters that determine the abrasiveness of any given soap, Onyekwere (1996). This mostly results from improper or incomplete saponification. The recommended value is 0.25% for laundry soap and 0.2% for toilet soap (encyclopedia of industrial chemical analysis 2005). The Free alkali content of the soaps revealed that black soap has the lowest percentage; this is due to the palm kernel oil used which was highly saponified. The values recorded for the improved and synthetic-alkali soaps were comparatively higher than the recommended values. This may be attributed to the property of the coconut oil used which determines the rate at which the oil saponified

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The total fatty matter of soap is a measure of its suitability for bathing and washing of material. The recommended values are 20.0% and 50.0% for laundry and toilet soaps respectively. The values obtained for all the soaps indicated that the black soap would be most suitable for bathing rather than for laundry due to its high total fatty matter and this is evident in the level of the free caustic alkali content of the soap which was very low compared with the other soaps produced

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The unsaponified neutral fat (UNF) is expected to be low if at all present in any soap. However, soap which displays any presence of caustic alkali are expected to have no or lower UNF than free caustic alkali as observed in Table.1 For black soap with 0.09% free caustic alkali, 0.05% UNF was recorded while the improved soaps showed 0.15% UNF and synthetic alkal- soap 0.25% UNF, these values are relatively lower than their corresponding free caustic alkali. This confirmed that the percentage of unconverted organic material after saponification process was negligible, This observation is consistent with the report of Onyegbado et al, (2002)

Table 2. Shows the summary of all the physical tests carried out on the Soaps. All the quality parameters run on the soaps indicated the improh4 soap comparing favourably well with the synthetic soap, while the black soap was of lower qualities than them
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*Conclusion.:*Production of soap with purified alkali made from palm bunch ash is an improvement over the conventional method adopted for black soap. The qualities of soaps thus produced clearly indicated that exploitation of vegetable matter to generate alkali for soap production is worthwhile. Apart from the fact that our environment would be free of those agricultural wastes that often render them untidy, it will safe the environment from the potential harmful effects of pollution that commonly associate with these synthetic chemicals. In addition, the heavy-dependence on synthetic chemicals for soap production would drastically reduced if concerted effort is made on improving this source of raw material for soap making.

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