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Qualitative Analysis of Soap Samples Prepared from Shea Butter

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Authors' contributions

This work was carried out in collaboration between all authors. Author AAW designed the study, wrote the protocol and wrote the first draft of the manuscript and did literature searches. Author JIK perform the laboratory analysis. Author HMI manage the interpretation of the results and authors LJB, OMA and TAS managed the review of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study was aim at extraction, saponification and quality determinations of shea nut fat samples obtained from different major sheanut producing areas of Kebbi state.
Study Design: The quality determination done with and without additives such as perfume, colour and silicate in terms of pH, foam stability and height from four major shea nut producing areas in Kebbi state, Nigeria.
Methodology: The dry powdered sample of ground shea kernel was extracted in soxhlet apparatus using n- hexane as the extracting solvent. Cold process saponification was used in preparing the soap. The soap pH was measured using pH metre. Foam ability of the soaps was also determined.

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Results: The highest foam height was observed on the shea soap from Tsamiya (60 cm^3), Kwanga (50 cm^3), Kwere (40 cm^3) with colour additive and the lowest on soap from Illo with perfume additive. For the foam stability test, shea soap from Tsamiya at 43 cm^3 was the highest followed by Kwanga at 38 cm^3 both with colour additive. Lowest foam stability was recorded on shea soap from Illo with perfume additive. The pH of the shea soap from Illo without additive (9.73) increased with addition of colour, silicate and perfume at 10.70, 10.98 and 11.63 respectively. It showed decrease on addition of perfume, silicate and colour from 11.72 to 10.45, 11.38 and 10.15 respectively from Kwanga.
Conclusion: Variation occurs in the foam stability and pH of the shea soap from the four locations and the addition of colour, perfume and silicate had effect on the foam stability and pH of the shea soaps.

Keywords: Shea nut; Shea kernel; Shea butter; saponification; quality control.

1. INTRODUCTION

Shea butter is probably the primary cooking fat for a large part of rural populations where the species occurs [1]. Shea-nut *(Butyrospermum paradoxum*) is an oil rich fruit obtained from tropical Shea-tree (*Vitellaria paradoxa*), which is indigenous to West African savannah zone [2]. The plant grows to an average of 15 m in height and produces edible fleshy fruits containing one or two nuts. Shea tree products have been an important source of food, medicine and source of income for the rural population for centuries, as the fruits and leaves are consumed by human and livestock and all parts of the plants as medicine [3]. The butter from shea tree nuts is rich in triterpenes, fatty acids such as palmitic, linoleic, oleic, and stearic acids, tocopherols, phytosterols and minerals such as calcium, aluminium and chlorine which contributes to its usefulness in the pharmaceutical and cosmetic industries [4-7]. The physico-chemical characteristics of the various fat extracts exploited in the research conducted [8,9] considerably favours utilization of shea butter for soap making and other cosmetic preparations. The aim of this research is to extract, analyze and saponify the shea nut fat samples obtained from different major sheanut producing areas of Kebbi state.

2. MATERIALS AND METHODS

2.1 Sample Preparation

Shea nut fruits were collected from Illo, Kwere, Tsamiya and Kwanga districts in Kebbi State, Nigeria, the fruits were collected with leaves of the shea nut tree for taxanomic identification which was authenticated by Dr. Dhramemdra Singh of the Botany unit Biological Sciences Department, Kebbi State University of Science and Technology, Aliero in comparison with voucher specimen No. 320 kept at Herbarium. The nuts were removed from the fruit and washed with distilled water and allowed to dry. The kernels were removed and and sun dried for two days, and was then ground using manual pestle and mortar. The dry powdered sample was then kept at room temperature in the laboratory for oil extraction.

2.2 Oil Extraction

The extraction of oil from the ground sample was carried out in a soxhlet apparatus using analytical grade hexane (n- hexane). At the completion of the extraction process the oil was recovered from the solvent by evaporating the residual solvent in an oven set at 50°C and stored in the bottle. The oil extraction was carried out in batches untill reasonable quantity of oil was obtained.

2.3 Saponification Procedure

Sodium hydroxide (200 g/dm^3) was dissolved in 1000 cm^3 of distilled water. The oil (2 ml) was heated gently and transferred into a beaker. The alkali solution (2 ml) was added to the oil and stirred continuously for 7 minutes using a stirring rod. For the mixture without additive, it was transferred into a mould and allowed to stand for 24 hours to solidify into soap bar. While for the mixture with additives, 1 ml of silicate, colourant and perfume was added to each mixture respectively, stirring for 3 minutes and transferred into moulds to solidify for 24hours [10].

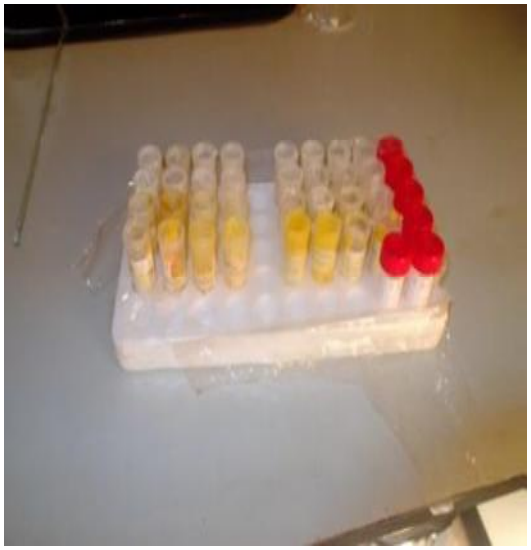
2.4 pH Determination of the Soap

The pH was determined using pH meter (827 PH Metronm Model). A 0.5 g of the soap shaving were weighed and dissolved with distilled water in a 100 ml volumetric flask. The electrode of the

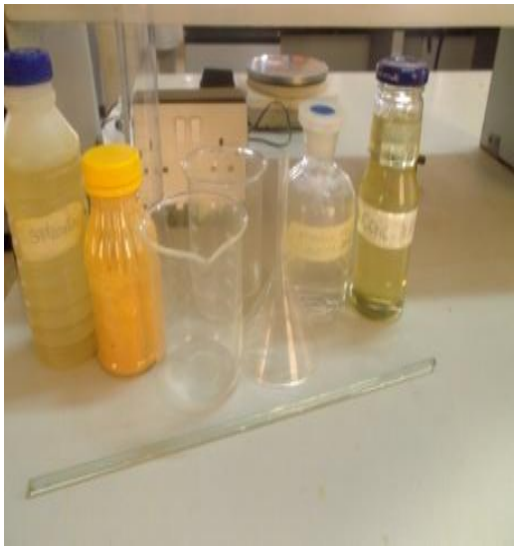
pH meter was inserted into the solution of the soap and the pH reading was recorded [11].

2.5 Foam Ability Test

The foaming ability of the soap was determined by weighing 0.5 g of the soap into a 100 cm^3 measuring cylinder containing 100 cm^3 of distilled water. The mixture was shaken vigorously so as to generate foams. After shaking for about 1 minute, the foam height was recorded and was allowed to stand for 3 minutes and the foam stability was recorded (Atolani et al., 2016).



(a)



(b)

(c)

(d)

Fig. (a) Dried coloured soap samples
(b) Perfume, colour and silicate as additives to soap
(c) Coloured soaps prepared for analysis
(d) Analysed soap samples

3. RESULTS OF ANALYSIS

Table 1. Foam ability of soaps produced from Shea butter obtained in selected districts in Kebbi State (Illo, Kwere, Tsamiya and Kwanga districts) with and without additives

Source	Without additives	With perfume	With silicate	With colours
Illo	Foam height – 25 cm^3	Foam height – 15 cm^3	Foam height – 25 cm^3	Foam height –30 cm^3
	Foam stability – 20 cm^3	Foam stability -8 cm^3	Foam stability – 19 cm^3	Foam stability –20 cm^3
Kwere	Foam height – 25 cm^3	Foam height – 30 cm^3	Foam height – 34 cm^3	Foam height –40 cm^3
	Foam stability – 21 cm^3	Foam ability - 23 cm^3	Foam ability - 25cm^3	Foam stability –30 cm^3
Tsamiya	Foam height – 28 cm^3	Foam height – 35 cm^3	Foam height – 30 cm^3	Foam height – 60 cm^3
	Foam stability – 22 cm^3	Foam ability - 25 cm^3	Foam ability - 25 cm^3	Foam ability - 43 cm^3
Kwanga	Foam height – 35 cm^3	Foam height – 35 cm^3	Foam height – 36 cm^3	Foam height – 50 cm^3
	Foam stability – 31 cm^3	Foam ability - 28 cm^3	Foam ability - 30 cm^3	Foam ability - 38 cm^3

Table 2. pH of soaps produced from shea butter obtained in selected districts in Kebbi State (Illo, Kwere, Tsamiya and Kwanga districts)

Source	Without additives	With perfume	With silicate	With colours
Illo	9.73	11.63	10.98	10.70
Kwere	10.02	10.63	11.27	10.37
Tsamiya	10.05	10.86	11.33	10.47
Kwanga	11.72	10.45	11.38	10.15

4. DISCUSSION

Cold-process alkali hydrolysis of the shea nut oil was adopted for the present studies as it was reported to be a simple adoptable technology in producing shea butter soap [12]. The brown colored shea soap produces from the shea nut extracted by soxhlet apparatus is in line with the report [13]. There was an increase in the foam height of all theshea soaps produced on addition of silicate, perfume and colours with that of colour additive producing the highest foam height and stability from Tsamiya, Kwanga, Kwere and Illo at 60 cm^3, 50 cm^3, 40 cm^3 and 30 cm^3 respectively. The result indicates, the foaming ability is attributed to the amount of lauric acid in the oil. Also, the colourant used may have contributed to an increase in the lauric acid composition of the shea soap. This is because lauric acid has been reported to produce high foam ability [14]. An increase in the foam height was observed to increase the foam stability of the shea soap in all the produce, with that of Illo been the lowest with foam height (15 cm^3) and stability (8 cm^3). The pH of the shea soap from Illo without additive (9.73) increased with addition of colour, silicate and perfume at 10.70, 10.98 and 11.63 respectively, whiles the pH of the shea soap from Kwanga decrease on addition of perfume, silicate and colour from 11.72 to 10.45, 11.38 and 10.15 respectively. Shea butter have been reported to increase the pH of black soap from 8.90 to 9.56 which was lower than black soap with honey (9.58) but higher than black soap with coconut oil with pH of 9.00 [15]. And from the result of this study, the use of silicate increased the pH of the shea soap from all the areas except Kwanga where all the addictives caused a decrease in the pH level. The addition of silicate may have increased the amount of unsaponifiable matter in the shea soap which have been reported to cause an increase in the pH of soaps [14]. Although, the pH of a normal healthy skin is between 5.4-5.9 and the use of soap with high pH can cause an increase in skin pH, which in turncauses damage to the skin, soaps in available in the generally have pH between 7-11 [16-19]. Therefore, the shea soap produced from the present study with colour additive and without additive from Illo, Kwere and Tsamiya falls within the soaps available in the global market.

5. CONCLUSION

Shea soap produced from the present study showed variation in the source of the Shea butter and type of additive used in terms of foam height, stability and pH.

6. RECOMMENDATION

Further research need to be carried out on shea nut oil in order to enlighten the populace on the potential of sheabutter and large scale production for commercialization for industrial growth.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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