PRODUCTION OF MEDICATED SOAP FROM THE BARK EXTRACT OF *Vitex doniana* TREE

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Abstract: Medicated soap (slightly yellow in colour) was produced using bark extract of *Vitex doniana* and a mixture of shear butter oil and palm oil. The saponification value for shear butter oil and palm oil were 185 and 244 while that of iodine value 4 and 13, respectively. The parameters determined to ascertain the quality of the soap were pH 8.6, moisture content 12%, total fatty matter 63.5%, acidity 0.02%, chloride content 0.6%, foam height 1.5 cm insoluble matter 1.5% and microbial effect. Insoluble matter were higher than expected value by NAFDAC, the effectiveness of the soap produced was analysed and it was found to be sensitive to *Staphylococcus aurues* with a zone of inhibition measured as 0.5 cm.

Keywords: Medicated soap, microbial sensitivity, phytochemical screening plants, *Vitex doniana*

Introduction

The high demand of soaps, especially antiseptic soap, that are obtained naturally from plants and animals and the high cost of available soap produced from costly synthesized raw materials has made this research work to exploit the use of extract from the bark of *Vitex doniana,* a very cheap and available plant especially in the northern Nigeria which is expected to be of medicinal importance. When this plant extract is incorporated into soap, it may produce soap of very good quality and mild enough for the skin.

Medicinal plants represent a rich source from which antimicrobial agent may be found. Plants are used medically in different countries as a source of many potent and powerful drugs (Nkafamiya *et al*., 2008). *Vitex doniana* plants are usually the tallest of plants and their height with single main-stem differentiate them from shorter shrubs. The bark tends to protect their inner body (Sirviastava *et al*., 1998). Free fatty acid occur naturally in small quantity in oils, however, the fatty acid are primarily esterified with glycerol to foam triglycerides.

The free fatty acid with few exceptions contain straight-chain compound with an even number of carbon atoms and they may be saturated or unsaturated. If all molecules of fatty acid are the same, a simple triglyceride is formed e.g. Triolein, but generally the acids are mixed glyceride type meaning that the fatty acid represented by R^1, R^2, and R^3 are different, example distearolein. When they appear as solid they are refer to as "fats" and when liquid they are called "oils", at room temperature it ranges its consistency from liquid to solid. Fats and oils are insoluble in water but have lower density than water. Also, soaps are cleansing agents that are usually made by reacting alkali (e.g., sodium hydroxide) with naturally occurring fat or fatty acids. The reaction produces sodium salts of these fatty acids, which improve the cleansing process by making water better able to lift away greasy stains from skin, hair, clothes, and any surface.

Oils and fats consist essentially of triglycerides of fatty acids and are used as raw materials in the manufacture of soap. When the oil or fat molecule is allowed to react with NaOH in the presence of water, soap and glycerol are formed (Kent, 1992). Selection of oil and fat blend for this reaction needs careful study so that a product of desired properties can be obtained**.** To make soap, the first step is to start with fats and oils (obtained from plants or animals) that are reduced to fatty acids and glycerine with a high pressure steam. The fatty acid then combine with either sodium or potassium salts (an alkali or base) to produce soap and water.

After this process, the soap possesses a hydrophilic end that is attracted to water and a hydrophobic end that is repelled by water, allowing the soap to break down materials that dissolve in both oil and water. Sodium soaps are harder and appear as bar soaps, while the potassium soaps are softer and are used in liquid hand soaps and shaving creams.

In general, since soaps are more natural products, they are used on a body since they are less harmful to the human skin and the environment. Soaps are biodegradable and do not create pollution in our rivers and streams.

This work was carried out to investigate the phytochemicals present in *Vitex doniana* bark extract and to evaluate its antibacterial activity when used to produce a medicated soap.

Materials and Methods

Sampling

The bark of *Vitex doniana* plant was obtained in Hong local government of Adamawa State; this was taken to Botany Department, Federal University of Technology Yola for identification and certification.

Sample preparation

The bark was powdered using pistil and mortar; this is to increase the surface area then aid the extraction process. The powdered bark (10 g) was soaked in 100 mL of ethanol for 24 h, at the end of the extraction process; the extract was filtered using Whatman filter paper. The filtrate was concentrated using a water bath.

The oils were used in the following composition; palm kernel oil 20 mL and Shear butter 20 mL

Phytochemical screening of Vitex doniana extract

Photochemical screening for major constituents present in the extract was undertaken using standard qualitative methods. The plant extract was screened for presence of saponins, phenols, tannins and volatile oil.

Test for saponins

The extract (5 mL) was measured into a test tube and 10 mL of distilled water was added, the mixture was shaken vigorously. Frothing persisted was taken as an evidence for the presence of saponins (Odebiyi *et al*., 1990).

Test for phenol

To 2 mL of the extract measured into a test tube, 2 mL of ferric chloride was added; a deep bluish-green solution was formed by the mixture, which gave an indication of the present of phenols (Odebiyi *et al*., 1990).

Test for tannins

The extract (2 mL) was taken and 4 mL of water was added, the mixture were introduced into a test tube and shaken. Four drops of ferric chloride were added to the mixture and immediately it changed into green colour precipitate indicating the presence of tannins (Sofowora, 1990).

Test for volatile oil

The extract (2 mL) was dissolved in 90 % ethanol in a test tube and 2 drops of ferric chloride were added and the colour changed green, which was an indication for the presence of volatile oil (Odebeyi *et al*., 1990).

Determination of soap value

Principle: The saponification value is the number of milligram of potassium hydroxide required to neutralize the fatty acids from 1 g of oil sample substance. The oil was saponified by heating with excess alcoholic potassium hydroxide, then the amount of alkaline consumed was back titrated with HCl. On refluxing with the alkali, glyceryl esters were hydrolysed to give glycerol and potassium salts of fatty acids (soap). The saponification value gives an indication of the nature of fatty acids in the fat since the longer the carbon the less acid is liberated per gram of the fat hydrolysed (Uppal *et al*., 2001).

Procedure: The Shea butter oil (2 g) was weighed into 250 mL round bottom flask, 25 mL of ethanolic potassium hydroxide solution was added and some boiling chips. The flask was connected to a reflux condenser. The solution was refluxed for 40 min then titrated while hot against 0.5M HCl solution using phenolphthalein as indicator until pink colour of the indicator turns colourless. A blank test was carried out (Uppal *et al*., 2001).

The same procedure was carried out for palm kernel oil.

Calculation

Saponification (mgKOH/g) $=\frac{(BT-ST)MX\ 56.1}{Weight\ of\ oil\ sample}$

Where: BT= Blank titre value, ST= Sample titre value, M= Molarity of HCl, 56.1= Molecular weight of KOH

Iodine value

Principle: Iodine value is a quantitative measure of the amount of unsaturation present in fat and can be defined as the number of grams of iodine required to completely saturate 100 g of fat. It is directly proportional to the degree of unsaturation and molecular weight (Uppal *et al*., 2001).

The bromine in Dams iodide reacts with KI to give iodine which subsequently reacts with the double bond of the fat and oil in the dark. The iodide is then titrated with sodium thiosulphate solution (Uppal *et al*., 2001).

Procedure: The iodine value was measured using 5 mL Dams iodide was added, corked and placed in a dark cupboard for 5 min, 5 Ml 10% potassium iodide was added followed by addition of 20 mL distilled water. This was mixed and titrated with 0.025 M sodium thiosulphate using 1 mL of starch as indicator until the blue colour turns to colourless and the titre value was recorded. This procedure was repeated with exactly 0.2 g of the oil sample, instead of using 5 mL chloroform and titre value recorded (Uppal *et al.*, 2001).

Calculation

Iodine value (mg/100g) = $(BT-ST)X\ 0.003175X40X100$

Where: BT= Blank titre value and ST= Sample titre value

Soap production

The boiling process was used during the soap production. The oil mixture was placed in 500 mL beaker and 20 mL of ethanol was added. 4 g of potassium hydroxide (KOH) in 20 mL of water and 20 mL of the extract were placed in the beaker. The mixture was heated for an hour on an oven, the temperature within the range of 80-90^{0}C was maintained with frequent stirring at a time intervals. Little distilled water was added occasionally to prevent the content of the flask from becoming solid due to evaporation of water and alcohol during heating. After one hour of heating. 100 mL of saturated solution of sodium chloride was added to the hot mixture then was allowed to cool. The addition of the salt solution threw the soap out of the solution "salting out" the soap produced floated on the surface of the solution, which was then filtered and placed in the mould to dry (Albert *et al.*, 1996).

Determination of some parameters of the soap

pH, Moisture content, Free alkalinity/acidity, Chloride content, Foam height, insoluble matter. Microbial effect this was done to draw a line of conclusion on the quality of the soap produced

pH

The pH meter was calibrated using buffer solution of pH between 4.0 and 7.0 thereafter, it was dipped directly into the sample while the reading was taken immediately (standard operation procedure, NAFDAC, 2005).

Determination of moisture content

The sample (10 g) was weighed before and reweighed after open heating for about 30 min. The difference in the weight was the moisture content which was expressed in percentage (standard operation procedure, NAFDAC, 2005).

Moisture content (%) $=\frac{lost\ weight}{weight\ of\ sample}x\ 100$

Determination of total fatty matter

The sample (5 g) was weighed into a beaker, 10 mL of distilled water was added and heated to dissolved it, 20 mL of 2M H_2SO_4 was also added to liberate the fatty matter. This was cooled in a beaker and decanted leaving behind the fatty matter (extract) in the beaker. The extract was washed with distilled water until it was neutral to litmus paper. Extract obtained was then dissolved in 70 mL hot neutral alcohol and titrated with 1M NaOH using phenolphthaline as indicator (standard operation procedure, NAFDAC, 2005).

Total fatty matter (%) = $\frac{FMV}{W}\ X\ 100$

Where: F is the factor of the oil blended, M is the morality of the base used (titre value) and W is the weight of the sample

Determination of free acid content

The soap (6 g) was dissolved in 70 mL hot neutral alcohol and titrated with 2 M H_2SO_4 using phenolphthalein as an indicator (standard operation procedure, NAFDAC, 2005).

The free alkali/acidity = $\frac{MV}{W}$

Where: M =morality of the base; V=titre value; W=weight of the sample

Determination of chloride content

The sample (5 g) was dissolved completely in distilled water; 10 mL of 20% calcium nitrate solution was added for complete precipitation. The mixture was quantitative transferred to 250 mL volumetric flasks and made to mark with distilled water. It was then filtered and 10 mL of 20% potassium chromate solution was added to 100 mL of the filtrate and titrated with 0.1 M silver nitrate solution to greenish yellow colour. (Standard Operation Procedure, NAFDAC, 2005).

A blank determination was carried out.

Chloride content: $\frac{(VR-VB)0.08865}{W}$

Where: VR=volume of real, VB=volume of blank and W=weight of sample

Foam height

The sample (2 g) was dissolved in 1 L volumetric flask then made up to mark with tap water; 50 mL of the solution was introduced into a measuring cylinder such that it followed the walls of the column to avoid foaming. The solution (200 mL) was taken into a conical flask then poured into a funnel, which was already clamped with the outlet closed. The measuring cylinder was then kept directly beneath the funnel while the level (height) of the foam generated was read from the cylinder immediately funnel was opened (standard operation procedure, NAFDAC, 2005).

Insoluble matter

Soap sample (5 g) was dissolved in 50 mL hot alcohol and quantitatively transferred into already weighed filter paper, the residue was dried in an oven at 105^0C for 30 min, it was cooled in a desiccator, the weight gained was taken (standard operation procedure, NAFDAC, 2005).

Microbial sensitivity analysis

The soap solution (20 ug/ mil) was prepared. Nutrient agar (20 mL) was poured into seven (7) different plates, one was used as control or standard, plates were sterilised for 30 min. The content in the plates was allowed to solidify. Six (6) different micro-organisms were added to the surface of the content in the plates (each to a plate). Hole was made using 1.5 diameter cork borer inside which the soap solution prepared was incubated for 24 h at 300^0C. The diameter of the inhibition zone was measured using cm ruler (standard operation procedure, NAFDAC, 2005).

The microorganisms used were *Basillus subtilis, Escherichia coli, pseudomonas aeruginosa, Staphylococcus aureus, Shegella and Salmonilla*.

Results and Discussion

The saponification value of shear butter (185 mgKOH/g) was higher than that (175.30±0.81 mgKOH/g) reported by Zaura *et al.* (2016). The iodine value obtained (64 mgKOH/g) was in the same range (65.99±1.27 mgKOH/g) with their findings (Table 1). For the palm oil, the saponification value (244 mgKOH/g) and iodine value (13 mgKOH/g) were higher (148.46±4.28 mgKOH/g) and lower (20.72±0.55 mgKOH/g) respectively than obtained by Davies & Peter (2017). The phytochemicals that were present in the leaves extract of *Virtex doniana* include saponin, tannin, volatile oil and phenol as seen in Table 2. The result is similar with that obtained by Suman Kumar *et al*. (2013) who also studied the phytochemical of some componds from plant leaf extract of *Holoptelea integrifolia* (Planch) and *Celestrus emarginata* (Grah). Phenol was also found to be present in some medicinal plants extract from Western Region of India as investigated by Vaghasiya *et al.* (2011).

Table 1: Saponification and iodine value of shear butter and palm oils

Oil	Saponification value (mgKOH/g)	Iodine value (mg/100g)
Shear butter	185	64
Palm	244	13

Table 2: Phytochemical screening of the plant extract

Saponnin	Tannins	Volatile oil	Phenol
+	+	+	+

+ = Present

Table 3: Physical properties of the soap produced

Tests	Results
Appearance	Soft and Creamy
Color	Yellow
Solubility	Soluble
Foam height	1.5 cm

The physical properties of the soap produced were investigated as recorded in Table 3. It was observed that the soap was creamy, slightly yellow in colour, soluble in water with foam height of 1.5 cm. The form height obtained was less than that obtained by Atiku *et al*. (2014) who produced a white soap using locally available alkaline extract from millet stalk.

The following results were obtained from the chemical properties investigation: moisture content (13 %), TFM (63.5%), free acidity content (0.02%), chloride content (0.6%) insoluble matter (1.5%) as shown in Table 4. This finding agrees with the findings of Ogunnowo *et al*. (2010) who investigated the chemical properties of medicated soap fortified with *Ocimum gratissimum* extract. The result also compares favourably with the findings by Mak-Mensah *et al.* (2011) who studied the chemical characteristics of toilet soap prepared from neem (*Azadirachta indica A Juss*) seed oil. Furthermore, the produced soap was sensitive to a micro-organism with the inhibition zone measuring 1.9 cm and ranges between the approved values by NAFDAC.

Table 4: Chemical properties of the soap produced

Property	Analytical Result (%)	NAFDAC Approved Value
Moisture content	13	15 max
Total fatty matter	63.5	76.5 max
Free acidity content	0.02	0.05 max
Antimicrobial test	0.5	Sensitive
Chloride content	0.6	0.75 max
Insoluble matter	1.5	1.0 max

Table 5: Sensitivity test of the soap produced

Micro organism	Result
Staphylococcus aureus	+
Bacillus subtillis	-
Escherichia coli	-
Pseudomonas aeruginosa	-
Shegella	-
Salmonilla	-

+ =Positive and - = Negative

The sensitiveness of the soap on a number of micro-organism was studied and recorded in Table 5. Among the micro-organisms the soap was only sensitive to *Staphylococcus aureus*. This study agrees with that performed by some researchers (Perera *et al*., 2016) on the microbial action of soap produced from pomegranate (*Punica granatum*) extract. In the analysis, the soap was found to be sensitive to *Staphylococcus aureus* and some other micro-orgamisms. The study therefore reveals that the soap may be used for skin rash treatment.

Conclusion

The findings of this study show that phytochemicals which are secondary metabolites that have antibacterial activity are present in the bark extract of *Vitex doniana* tree. The medicated soap produced using the extract had sensitivity towards *Staphylococcus aureus.* Other extraction methods should be investigated to enhance the extracts' performance on other micro-organisms.

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Conflict of Interest

The authors declare no conflict of interest.

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