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CHARACTERIZATION AND FORMULATION OF LIQUID SOAP USING LEMONGRASS ESSENTIAL OIL AS FRAGRANCE

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Abstract
The aim of this research is to formulate liquid soap using lemongrass (cymbopogon citratus) essential oil as fragrance and to determine its physicochemical properties. Extraction of the essential oil was done using hydro distillation. After extraction, some physicochemical properties of the extract were determined and the following results were obtained. The specific gravity, acid value, moisture content, iodine value, refractive index and percentage yield values were 0.825, 4.975 mg KOH/g, 18.05%, 107 (100g of I_2 / g oil) 1.421 at 25°C and 10% respectively. The results were in agreement with prescribed standards, and deviations are attributed to the difference in the geographical location where the lemongrass was grown. And, the lemongrass oil is relatively of good quality, and is suitable for applications in cosmetics, food industry, agriculture, beverages and medicine.

Keywords: lemongrass, fragrance, extraction, liquid soap, essential oil, formulation,

1. NTRODUCTION
The term soap is associated to any cleaning agent [1]. Soap is made of sodium or potassium hydroxide and natural fats. Soap is created when a fat interacts with an alkali, resulting in a fatty acid salt with cleansing properties soap removes dirt, stain, grease, inactivates viruses and microbes by disrupting the lipid membrane and intracellular lipids several studies indicates that soap as a more effective method of hand hygiene than hand rub. Hand washing with soap has the added benefit of physically washing away debris and pathogens with running water [2]. There are 2 classification of soap, depend on a kind of alkali use, which are soap bar or sodium soap and liquid soap called potassium soap. Many advantages of liquid soap, such as easy to use, lower contamination and several of formulation all these reasons lead liquid soap, product to commonly use in every better appearance [3]. Natural liquid soap with lemongrass oil is an alternative cleanser to replace synthetic chemicals used as fragrance in soap.
Lemongrass *Cymbopogon Citratus* is a member of poaceae family. Lemongrass is tropical perennial plants which yield aromatic oil. The name Lemongrass is derived from the typical lemon-like odour of the essential oil present in the shoot. The herb originated in Asia and Australia. It is a medicinal plant with compounds capable of controlling pathogens and increasing herbal resistance to pathogenic disease. This aromatic plant is used for perfume production and is grown to produce essential oils for business purpose [3]. Due to its good aroma, it is used for preparation of the colognes deodorants and soap in different pharmaceutical industry. Its major component are citral monoterpense (an isomeric mixture of the geranial and neral) and myrcene both of which

have anti-bacterial and medicinal importance. The citral momoterpenes show anti-fungal and anti-microbal action [4]. Many studies have confirmed that lemongrass oil has potent anti-fungal and anti-microbal activities [5,6]. However, it does not present a high risk of skin irritancy and sensitizing activities on the skin. Thus, the aim of this study is to formulate liquid soap using lemongrass essential oil as fragrance and to determine its physicochemical properties.

2. MATERIALS AND METHODS

2.1 Sample Collection and Pretreatment

Fresh sample of lemongrass leaves were collected from a garden in Ogwashi-Uku, Delta State of Nigeria in the month of August, 2022. Fresh samples of lemongrass leaves were cut and sliced into pieces, then washed and dried in an oven, afterward was grinded into fine particles for extraction.

2.2 Procedures for the extraction of Lemongrass Essential oil

Extraction of the essential oil was done using hydro distillation. This was carried out with a Clevenger type apparatus according to the Hungarian Pharmacopeia vii (1996). Sample quantity of 40g was used; it was distilled with 500ml of n-hexane for 8 hours. The resulting essential oil was dried over anhydrous sodium sulphate and stored at 4^{o}C. 0.1ml of dichloromethane and 100vol of sample injected into the column.

2.3 Formulation of Liquid Soap

20g of caustic soda was dissolved with 2 litres of water and left for 30 minutes. Similarly, soda ash was dissolved in 2 litres of water and allow to stay for 30min. Sulphonic acid was poured inside an empty bowl and lemongrass essential oil was then added as perfume to the texapon. 10 litres of water was added and then stirred very well for about 5-10 minutes. Sodium Laurate Sulphate (SLS) and Sodium Tripoyphosphate (STPP) were both dissolved in 5 tin milk cup of water. Nitrosol was also made available.

Preparation

- Get the nitrosol that has been dissolved in water.
- Add the dissolve sulphonic acid, texapon and lemon oil together and stir very well
- Add already dissolved caustic soda and stir very well.
- Add the already dissolved soda ash and stir properly.
- Add formalin to the content and stir properly.
- Add the dissolved S.T.P.P and S.L.S to the content stir
- Dissolve your colorant in water and ensure that the colorant is completely dissolved, then add it to the solution and stir thoroughly.
- Add some quantity of water to the mixture, depending on the thickness of mixture leave the mixture for some hours or preferably till the following day and then package for use.

2.4 Determination of the Physiochemical Properties of Lemongrass oil

Acid valve

Procedures:

i. Mix 25m diethyl ether with 25ml alcohol and 1ml pheonolpthalein (1%) and carefully neutralize with 0.1m NaOH
ii. Dissolve 1-10g of the oil or melted fat in the mixed neutral solvent and titrate with aqueous 0.1m NaOH shaking constantly until pink colour which persists for 15 seconds is obtained.

Calculations: Acid value $= \frac{titre\ (ml)\ x\ 5.61}{weight\ of\ sample\ used}$

The FFA figure is usually calculated as oleic acid (1ml 0.1m NaOH = 0.0200g)

Iodine Value

Determination of iodine value:

i. Pour the oil into a small beaker, add a small rod and weigh out a suitable quantity of the sample into a dry glass stoppered bottle of about 250ml capacity. The approximate weight of the oil taken can be calculated by dividing 20 by the highest expected iodine value.
ii. Add 10ml of carbon tetrachloride to the oil or melted fat and dissolve.
iii. Add 20ml of wijis` solution, insert the stopper (previously moistened with potassium iodine solution) and allow it to stand in the dark for 30 minutes.
iv. Add 15ml of potassium iodine solution (10%) and 100ml water, mix and titrate with 0.1 thiosulphate solution using starch as indicator just before the end-point (titration = aml)
v. Carry out a blank at same time commencing with 10ml of carbon tetrachloride (titration = bml)

$$\text{Iodine value} = \frac{(b-a) \times 1.269}{weight\ (g) of\ sample}$$

NOTE: If $(b - a)$ is greater than $b/2$ the test must be repeated using a smaller amount of the sample. It should be noted also that the less unsaturated fat with low iodine value are solid a room temperature, or conversely, oils that are more highly unsaturated are liquid (showing there is a relationship between melting point and the value).

Preparation of wijis` solution

i. Dissolve 8g iodine trichloride in 200ml glacial acetic acid.
ii. Dissolve 9g iodine in 300ml carbon tetrachloride.
iii. Mix the two solution and dilute to 100ml with glacial acetic acid.

Specific Gravity

i. Thoroughly wash a 50ml pyrometer bottle with detergent, water and petroleum ether dry and weigh.
ii. Fill the bottle with water and weigh.
iii. After drying the bottle, fill it with the oil sample and weigh.

Calculation: $$\text{Specific gravity} = \frac{weight\ of\ x\ ml\ oil}{weight\ of\ x\ ml\ water}$$

Refraction Index

i. Reset the Abbe refractometer with a light compensator.
ii. Sear the oil sample con the lower prism of the instrument and close
iii. Pass a light by means of the bangled mirror, the reflected light appears in form of a dark background.
iv. Using the fine adjustment move the telescope tube unit the lack shadow appears central in the cross wire indicator.
v. Read off the refractive index.

Moisture Content

This was performed using ***AOAC, 2005*** method.

Procedures:

- A petri-dish was washed and dried in the oven.
- Approximately 2g of the same was weighed into a petri-dish
- The weight and the petri-dish and sample were noted before drying.
- The petri-dish and sample were put in the oven and heated 105^{o}C for 2 hrs the result noted and heated another 1hr until a steady result is obtained and the weigh was noted.
- The drying procedure was continued until a constant weight was obtained.

$$\% \text{ moisture content} = \frac{w_1 - w_2 \times 100}{weight\ of\ sample}$$

Where: w_1 is Weight of petri-dish and sample before drying and w_2 is Weight of petri-dish and sample after drying

Percentage Yield

The amount of essential oil obtained by hydro distillation was 4.992g of essential oil per 100g of dry lemongrass sample. This gave about 4.992% yield of essential oil per 100g of dry lemongrass. The temperature used was 4^{o}C, i.e boiling point of ethanol. The volume of oil was measured at every 8 hrs interval to determine the oil yield at varying time. As the time increase the ethanol solvent reduces thereby leaving the essential oil in the mixture.

Weight of sample used = 358.78g

Weight of oil = 38.28

$$\% \text{ yield} = \frac{38.28 \times 100}{358.78}$$

= 10.669%

3. RESULTS AND DISCUSSION

3.1 Results

Table 1 below shows the values of the physicochemical parameters of the essential oil obtained from lemongrass.

Table 1. Physicochemical parameters of Lemongrass essential oil

Parameters	Values
Specific gravity at 25^{o}C	0.825
Moisture content (%)	18.05
Acid Value (mg KOH/g oil)	4.975
Iodine value (100g of I_2 / g oil)	107
Refraction index 25^{o}C	1.421
% yield	10

3.2 Discussion

The specific gravity of the lemongrass oil extract obtained is 0.825. Specific gravity is a ratio of densities which varies with temperature and pressure, therefore, reference and sample must be compared at the same temperature and pressure. Specific gravity is a parameter used to identify, measure concentration and confirm purity of substances. The value obtained 0.8960 is less than 1, indicating that the oil is less dense than water.

The result shows that moisture content of lemongrass leaves was 25.04% and yield of the essential oil obtained was 10.00%. Alhassan et.al., (2018) reported that the essential oil extracted from lemongrass leaves was 4.5% through solvent extraction method and 3.8% for soxhilet extraction method. These variations could be attributed to a change in environmental factors, geographical location, methods used for extraction.

The reason for the difference in values between two findings was maybe because of the difference in the

sample location climatic condition and agroecological difference including soil type.

As it has been also described in table 1, the acid value of the extracted lemongrass oil is 4.975mg KOH/g. There is also a result for lemongrass oil obtained from soxhilet extraction method done by Abbas, (2018) which was an acid value of 4.09mg KOH/g. The higher the acid value of oil, the lower storage quality and vice-versa, this ensures that the extracted lemongrasses oil has an excellent storage quality.

The iodine value gives a measure of the average degree of unsaturation of a lipid: the higher the iodine value, the greater the number of C=C double bonds. By definition the iodine value is expressed as the grams of iodine absorbed per 100g of lipid. Iodine value is directly proportional to the degree of unsaturation (number of double bonds) and inversely proportional to the melting point of lipid. This value could be used to quantify the amount of double bonds present in the oil, which signifies the susceptibility of oil to oxidation. The value obtained was also within the range of established standard (104-120) (Codex standard, 2001).
The Refractive value obtained in this study was 1.421 which was within Codex standard, 2001. Refractive index is used mainly to measure the change in unsaturation as the oil is hydrogenated. The refractive index of oils depends on their molecular weight, fatty acids chain length, degree of unsaturation and degree of conjugation. It is a measure of how fast light travels through a substance and it is used to identify, confirm purity and measure concentration of the substance (Olayemi, Jawonisi & Samuel (2018).

4. Conclusion and Recommendation

The use of liquid soap in Nigeria has increased recently due to its low cost. Liquid soap is highly preferred for washing of clothes and kitchen utensils because it requires less energy. This research work shows that lemongrass essential oil could be used as natural fragrance for producing antibacterial liquid soap.
Base on the study, it is recommended that care must be taken during extraction time and selection of extraction techniques since essential oils are sensitive to high temperature to be decomposed in to smaller fractions and there may be also hydrolysis of ester components of essential oils as a result the original molecule cannot be found within the extract. Besides to this, further study must be carried out to isolate and identify essential oil constituents.

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