Comparative Study on Extraction of Essential Oil from Scent Leaf (*Ocimumgratissimum*) and Fluted Pumpkin Leaf (*Telfairiaoccidentalis*)

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***Abstract*:- Comparative study on extraction of essential oils from Scent leaf (*ocimumgratissimum*) and Fluted Pumpkin leaf (*telfairiaoccidentalis*) using solvent extraction method have been investigated. The solvent used was ethanol. The yields for both leaves were 2.28% for Ocimumgratissimum and 2.14% for Telfairia Occidentalis respectively. The optimum temperature and time of extraction was 78^{o}C and 180 minutes for both leaves. Ocimum Gratissimum gave a higher yield than Telfairia Occidentalis. Physical and chemical properties were assessed to evaluate quality characteristics of the oils. The results obtained for ocimumgratissimum and telfairiaoccidentalis are as follows: Saponification value, 154.3% and 112.2%, %FFA: 0.374% and 2.057%, Acid value: 0.187mg/g and 1.029mg/g, Peroxide value: 154.3% and 112.2%, Iodine value: 126g and 54.9g respectively. The result from the analysis of these essential oils have shown that they can be applied in vast industrial processes such as soap making due to their high saponification values.**

Keywords: **Ocimumgratissimum, Telfairia Occidentalis, Essential oil, Characterization, physicochemical**

I. INTRODUCTION

Essential oils are plant-based volatile oils with strong aromatic components that are made up of different chemical compounds, for example, alcohols, hydrocarbons, phenols, aldehydes, esters and ketones are some of the major components of essential oil [1]. Oils from hundreds of plant species are available commercially[2]. Numerous studies have demonstrated the efficiency of Essential Oils in low doses in the fight against bacterial pathogens [3] even against multi-resistant bacteria [4][5]. The effectiveness of these procedures has been attributed mainly to the presence of active phytochemicals or bioactive compounds in plants.

Scent leaf which has the Latin name “Ocimumgratissimum” share the same family with Perilla Shiso. These herbaceous, perennial shrubs are of the family Lamiaceae. Scent leaf is added to soups, pottage, to bring clean citrus flavour and a distinctive scent. Scent leaf as it is called in Nigeria and other names in various dialects, for example: the Yorubas of the South West call it Efirin, the Igbos of the South East called it Ncho-anwu, the Edos, of the South ‘west/central know it as Aramogbo, the Ibibio of South-South call it Ntong and the Hausa of Northern Nigeria, call it Daidoya. This plant is found in the tropics, with Africa and Asia having various species. These leaves have a curvy peak with serrated/wavy edges, the leaf itself is not smooth, both back and front [6].

The chemical substance which produces a definite physiological action on the human body is where the medicinal values of this plants lie[7]. The most important of these bioactive constituents of plants are flavonoid, saponins, alkanoids, tannins and phenolic compounds [7]. Extraction is an important step for the separation, identification, and use of valuable compounds from different plants [8]. The choice of an acceptable technique to obtain maximum yield and highest purity varies according to the nature of the target compound. Numerous chemical and mechanical processes like solvent extraction and steam distillation are used for the extraction of compounds from plants [9].

Essential oils have been used as perfumes, flavors for foods and beverages, or to heal both body and mind for thousands of years[10][11][12]. A number of countries produce different kinds of essential oils. India ranks second in the world trade of essential oils[13]. Essential oils are derived from various sections of plants. An essential oil is usually separated from the aqueous phase by a physical method that does not lead to significant change in its chemical composition. The essential oils could be then subjected to an appropriate further treatment. Essential oils are oily aromatic liquids extracted from aromatic plant materials. They could be biosynthesized in different plant organs as secondary metabolites[14].Most local industries in Nigeria depend on imported essential oil which serve as raw materials for perfumery, beverages and pharmaceuticals etc.This will help local industries in its production of perfumes, medicine, soaps etc, using the essential oils from these plants.

Essential oil used in the perfume industry and other industries can cause severe damages to vital human organs due to poor formulation, The knowledge of extraction of essential oil will be useful in Nigeria for various industries, this will also provide jobs for both farmers and the unemployed youths, because more industries which use this oil for perfumery, soap making, pharmaceuticals, etc., thereby reducing the high level of unemployment in Nigeria. This paper seeks to examine the physiochemical characteristics of the essential oil extracted from scent leave and fluted pumpkin leave

II. MATERIALS AND METHODS

Collection of Plant Materials

Fresh samples of scent leaves and fluted pumpkin leaves plant materials were collected from a farm in Omokiri, Aluu, Port Harcourt, Nigeria. The samples were harvested in the early hours of the morning (6:30-8:00am) and taken to the laboratory. The leaves were separated from the stem and stalk and were weighed to be 256.3g of scent leave and 494.6g of fluted pumpkin leaves.

Treatment of the Plant Materials

The fresh plant samples was put into the tray drier in the laboratory and was left to dry for 4 hours. On completion of the drying process, the plant samples were reweighed, the scent leaves had a weight of 224.5g and the fluted pumpkin leaves had a weight of 420.6g. The leaves were crushed into fine particle size and weighed to determine the loss of moisture due to the drying effect. The objective for reducing the size of the plant material is to rupture its organ, tissue and cell structure so that its medicinal ingredients are exposed to the extraction solvent. Furthermore, size reduction maximizes the surface area, which in turn enhances the mass transfer of active principle from plant material to solvent

Solvent Extraction

100g of scent leaves and fluted pumpkin leaves were both weighed from the dried sample and put into the extraction chamber of the Soxhlet extractor. 300ml of ethanol was put in the round bottom flask and heated to a temperature of78^0 C. the vapor goes into the condenser, the condensed solvent drips into the thimble containing the dried leaves and extract it by contact. When the level of ethanol in the chamber rises to the top of the siphon tube, the liquid contents of chamber siphon into the flask. The extraction was carried out at different times (2hours and 3hours) to get the optimum time of extraction. At the end of the extraction, the heater was turned off and the plant material was removed from the chamber. The content of the flask was distilled to remove the excess ethanol in the mixture. The temperature was adjusted to 78^0C which is the boiling point for ethanol.

Physio-Chemical Properties

Determination of pH:

The pH of the essential oil was determined using a pH paper. The pH paper was inserted into a beaker containing the essential oil and the reading was recorded.

Determination of Specific Gravity:

The specific gravity determination is carried out in order to ascertain the density of each oil sample (ocimum oil and telfairia oil). The specific gravity of the essential oil was determined using a Pycnometer. The weight of the empty Pycnometer was recorded; 2ml of water was poured into the Pycnometer and the weight was recorded too. The specific gravity was calculated using the formula;

$$S.G = \frac{weight\ of\ empty\ pycnometer - weight\ of\ pycnometer + essential\ oil}{weight\ of\ empty\ pycnomter - weight\ of\ pycnometer + distilled\ water}$$

Determination of Density:

The density of the essential oil was calculated using the formula below:

Density = specific gravity × 1000kg/m^3

Determination of Free Fatty Acid:

The free fatty acid of the essential oils was determined using titrimetric method using ethanol and phenolphthalein.

Determination of Free Fatty Acid Value (% FFA)

3g of each oil sample (ocimum oil and telfairia oil) was weighed and dissolved in 50ml natural solvent (absolute ethanol). The solution was titrated with standard 0.1M sodium hydroxide solution using phenolphthalein as an indicator. The end- point was reached when a permanent pink color appeared. The formula for determination of free fatty acid value (F.F.A %) is given as

Free fatty acid (FFA %) = $\frac{(V-S)\times N\times M}{W}$

Where,

V= volume blank titre

N = Molarity of acid used

M = Molecular weight of acid

W = Weight of oil sample used.

S= Sampletitre value

Determination of Saponification

25ml of ethanoic potassium hydroxide solution was measured into a round bottom flask and 2g of oil sample (ocimum oil and telfairia oil) was dissolved in it. A reflux condenser was attached to the flask and heated in a water bath for an hour. 7ml phenolphthalein solution was added and titrated against 0.5M hydrochloric acid solution to a point where the pink color disappeared. A blank titration was conducted under the same conditions. The formula for determination of saponification value is given as

Saponification value (SV) =$\frac{(B-S)\times M}{W}$

Where,

S= Sampletitre value

B = Blank titre value

N = Normality of acid used

M = Molecular weight of KOH used

W = Weight of oil sample used.

Determination of Iodine Value

1.5g of each oil sample (ocimum oil and telfairia oil) was weighed and dissolved in a 500ml flask with 20ml of carbon tetrachloride (CCl_4). The mixture was transferred into a clean, dried amber bottle. The bottle was corked and shaken thoroughly to make sure the oil dissolves. 25ml of Wij's reagent was added to the mixture from a pipette. The stopper, moistened with potassium iodide solution was used to cork the bottle and then stored in the dark for 30 minutes. A blank test was carried out simultaneously under the same conditions. After removal from the dark, 20ml of potassium iodide solution was added. This was followed by addition of 100ml distilled water. The mixture was poured into a conical flask and titrated with 0.1M sodium thiosulphate solution using starch solution as an indicator. The titration continued until the blue color disappeared. The formula for determination of iodine value is given by

$$\text{Iodine value (IV)} \frac{=(B-S)\,x\,N\,x\,M}{W}$$

Where,

S = Sample titre value

B = Blank titre value

N = Molarity of acid used

M = Molecular weight of KOH used

W = Weight of oil sample used.

Determination of Moisture Content:

The moisture content of the essential oil was determined using the formula below:

$$moisture\ content(\%) = \frac{weight\ of\ wet\ leaves - weight\ of\ dried\ leaves}{weight\ of\ wet\ leaves} \times 100$$

III. RESULTS AND DISCUSSION

Table 1: Characterization of Scent Leaf

Sample Parameters	Value
Weight of material (g)	100g
Mass of essential oil (g)	2.28g
Yield (%)	2.28
Moisture content (%)	12
Appearance of oil	Greenish yellow
Specific gravity	0.6809
Density	680.9kg/m^3
pH	8
Free fatty acid	0.3740 (% oleic acid)
Odor	Characteristic smell of the leaves
Acid value	0.187
Saponification value	154.27(mg.KOH/g)
Iodine value	126.9(g/100g of sample)
Peroxide value (%)	6.0(meq.peroxide/kg)

Table 2: Characterization of fluted pumpkin leaf

Sample parameter	Value
Weight of material (g)	100g
Mass of essential oil (g)	2.14g
Yield (%)	2.14
Moisture content (%)	15
Specific gravity	0.6533
Appearance of oil	Dark Green
pH	7.5
Free fatty acid	2.057(% oleic acid)
Odor	Characteristic odor of leaves
Density	653.3kg/m^3
Saponification value	112.2 (mg.KOH/g)
Acid value	1.029mg/g
Iodine value	54.99g (g/100g of sample)
Peroxide value (%)	2.6 (meq.peroxide/kg)

The extracted essential oils are liquid at room temperature are greenish yellow and dark green in color for ocimum and telfairia oils respectively with the characteristic odor of the leaves. The liquid state of the oils at room temperature however is an indication of the presence of oleic acid and linoleic acid and other unsaturated fatty acids. The specific gravities of 0.68 and 0.65 for ocimum and telfairia oils indicate that each of the oils could be used on commercial scale.

Peroxide value is used as an indicator of deterioration of oils. A general rule is that peroxide value should not be above 10-20 meq/kg fat to avoid rancidity flavor. The values of 6.0% and 2.6% for ocimum and telfairia oils indicates that these oils can be stored for a long period of time without going rancid.

Saponification value is used in checking adulteration of oil. The saponification values of ocimum and telfairia oils obtained are 154.3% and 112.2%respectively. The relatively high saponification value of the oil indicates that the oil could be used for vast industrial applications such as soap making [15].

The Iodine value is the measure of the proportion of unsaturated acid or fat and oil present. The test measures the amount of iodine absorbed per gram of sample. An iodine value of 126.9g I_2/100g ocimum oil and54.99g I_2/100g telfairia oil obtained from each essential oil is an indicative of

high level of unsaturated fatty acids and can explain its liquid state on storage at room temperature.

Acid value is used to quantify the acidity of a substance. The lower the acid value, the higher the storage quality and vice versa. It is used as an indicator for edibility of oil and suitability for use in the paint industry [16]. An acid value of 0.18mg/g and 1.02mg/g was obtained forocimum and telfairia oils respectively. Ocimum and telfairia oils were seen to have a high acid respectively. These high values show that the oils may not be acceptable as edible oil.

Free fatty acids (oleic acid) help to determine the suitability of the oil for edible or industrial uses. The free fatty acid value obtained for indicates that the oil is not for consumption. The percentage free fatty acid values were obtained as 0.37% and 2.05% for ocimum and telfairia oils respectively.

IV. CONCLUSION

The characterization of scent and fluted pumpkin leaves essential oil have shown distinctive characteristics of these oils. The color and odor of each essential oil was agreeable and can be used on a commercial scale as indicated by their specific gravities. The are very rich in D-Limomene. The peroxide values show that each of the oils possess a high storage quality and can be stored for a long time without going rancid. The iodine value presented high level of unsaturated fatty acids resulting in their liquid state on storage at room temperature. The scent and fluted pumpkin leaves has great potential for essential oil that can compete favourably with the conventional agricultural oil seeds

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