GSJ: Volume 8, Issue 4, April 2020, Online: ISSN 2320-9186

www.globalscientificjournal.com

EXTRACTION AND CHARACTERIZATION OF OIL FROM BOTTLE GOURD SEED

Akuma Oji*[ϒ] and Chukueggu Providence Chinedu[+].
Department of Chemical Engineering,
University of Port Harcourt,
Port Harcourt, Nigeria,
[+]Department of Chemical Engineering,
Faculty of Engineering and Technology
Alex Ekwueme Federal University, Ndufu-Alike, Ikwo, Nigeria
akuma.oji@uniport.edu.ng[ϒ]

ABSTRACT

Oil from bottle gourd seeds were extracted and analyzed. Standard chemical methods by Association of official analytical chemists was used to analyze the physico-chemical properties of the oils extracted. The results obtained by the use of soxhlet apparatus showed percentage yield of 32.24% (w/w) and specific gravity of 0.84. Moisture content, peroxide value, saponification value, iodine value and acid value were 10.91%, 11Meq/Kg, 185MgKOH/g, 39.84gI_2/100g and 2.7mg/KOHg respectively. These values are within range of already known seed oils. Thus, oil from Bottle gourd seed can be a good substitute for already known fat and oil for both domestic and industrial purposes.

KEYWORD: Bottle gourd Seed, Extraction, Characterization, Fat and Oil, physico-chemical

INTRODUCTION

Oils from plant and animal sources are in high demand due to their dermatological and other therapeutic usage. Seed and vegetable oils can be broadly classified under essential oils and carrier oils (Oboh and Aluyor 2009; Oji and Vivian, 2020). While essential oils that can be applied directly, carrier oils are those ones that are used to dilute or in some cases as solvent for the extraction of oils from nuts and roots. Due to their wide application and usage, there is high global industrial requirement of fats and oil. The significance of oils from seeds makes them a major economic driver in some countries (Akubugwo *et al.*, 2008).

Fats and oil are non-water soluble and greasy liquid obtained from animal and plant origin which has found various application as fuels, production of soaps and cosmetics, coolants, lubricants etc. Oil seeds also find application in the health care industry in so many ways. In the food industry among other usefulness sectors. Fats and oils are essential sources fatty acids and soluble vitamins for humans (Sodeke, 2005).

Countries that produce seed oils are apprehensive of the trade demand. These countries are seeking for new techniques to increase the export value of seed oils by exploring new sources that will improve these countries primary net export, targeting needs of processing industries and countries. A research into the industries that utilize these oils and understanding of their specifications and application is on the increase. The quest for study and support in this area has opened focal point for farmers and industrialists, essentially in sub-Saharan Africa and other developing economies (Akubugwo *et al*., 2008).

Bottle gourd which is *Lagenaria siceraria* also known as new guinea bean, long melon or tasmaria. Cucurbitaceae is a family where Cucurbit belongs to, having about 825 species and 118

genera as recorded in taxonomy. Cucurbits are among the important plant associated with these family that supplies humans with numerous edible fruits, seeds and useful fibers. Cucurbits is from the Kingdom; plantae, the clade; tracheophytes, clade; Anglospetms, clade; eudiocote, clade: rosids; order; curcurbitales; family; cucurbitaceae; genus; lagenaria and species; *L. siceraria* (Achu et al, 2005).

There are several plants whose oil seed potentials are yet to be exploited in Nigeria. In some other areas there are inadequate research findings or studies in oil seed, nut oils and root oils (Akbar *et al*., 2009). The bottle gourd is believed to the under researched. This research focuses on the extraction and characterization of oil from Bottle gourd (lagenaria specie) seed to ascertain its physiochemical properties; this would aid in identifying areas where the seed oils can be better utilized.

MATERIALS AND METHOD

Collection and Preparation of Sample

The fruits of lagenaria sicceraria were collected within the residential area at Uburu, Ohaozara local government area of Ebonyi state Nigeria. The department of Plant science and biotechnology of University of Port Harcourt, Port Harcourt, Nigeria, identified the plant as lagenaria sicceraria (bottle gourd). The dried fruits were harvested, cut open and the seeds sunned to drier for 4 days. The dried seeds were wrapped on a paper and stored in a cellophane, a non-humid conditions to avoid rot.

The dried hulled seeds were crushed mechanically by manual grinder to particulate size of 2mm to increase the surface area for more efficient and effective extraction.

Extraction of Bottle Gourd Seed Oil

400ml of petroleum ether was poured into a 500ml flat bottom flask of the soxhlet apparatus. 150g of the grinned lagenaria sicceraria was wrapped in a pre-weighed filter paper and inserted into 500ml soxhlet extractor assembly. Heat was applied continuously to the boiling flask with the aid of a Bunsen burner. The solvent (n-hexane) boiled at about 80^{o}C.

At the end of the extraction, the filter paper containing the leachate was removed and the extractor dismantled.

Concentration Of Miscella

The bottle gourd oilseed extract was heated continously at a constant temperature 80^{O} using a liebig condenser until all the solvent is evaporated, leaving the concentrated bottle gourd seed oil in the beaker.

Solvent Recovery (%)

This is used to obtain the quantity of the solvent recovered after the extraction process in relationship to the total volume of solvent at the start of extraction.

Procedure

A simple distillation process was carried out after the soxhlet extraction. The solvent and the extract recovered were discharged into a 500ml flask of a Liebig condenser and heated at 80^{o}C till all the solvent was evaporated leaving behind concentrated bottle gourd oil. The oil recovered was weighed and poured into a measuring cylinder and the value was recorded.

The formula, equation 1 was used to calculate solvent recovery (%).

$$\text{Solvent recovery (SV \%)} = \frac{Vr\ x100}{Vt} \quad (1)$$

Where Vr = volume of solvent recovered

Vt = total volume of solvent used.

Physiochemical Properties Measurement

The physiochemical properties of the bottle gourd seed oil were measured using the methods described below.

Determination Of Yield Percentage

This is the quantity of oil extracted relative to the weight of the seed sample used.

Procedure

150g of the lagenaria siceraria seed sample was first weighed and soxhlet extracted. At the end of extraction, a quantity of oil was obtained in a beaker and concentrated. The beaker was first weighed and the value recorded. After concentrating the lagenaria siceraria seed oil, the weight of the oil obtained. The formular, equation 2 was used for determination of yield percentage is given as

$$\text{Yield\%} = \frac{weight\ of\ \ oil\ \ re\text{cov}ered\ \ x\,100}{weight\ \ of\ seed\ \ sample} \quad (2)$$

Determination of Specific Gravity

The specific gravity determination is carried out in order to ascertain the density of the lagenaria siceraria seed oil sample.

Procedure

A specific gravity bottle was washed, dried and weighed. The value obtained. The dry bottle was filled with lagenaria siceraria seed oil sample and weight measured. The same bottle was emptied, washed, cleaned, dried, filled with equal volume of water and re-weighed, the value recorded. The temperature of both the seed oil sample and distilled water were maintained at 29^{o}C in a constant temperature water bath. The formula, equation 3 was used for determination of specific gravity is gives as

$$S.G = \frac{(weight\ of\ density\ bottle + oil) - weight\ of\ density\ bottle}{(weight\ of\ water\ equivalent + density\ bottle) - weight\ of\ density\ bottle} \quad (3)$$

Determination of Moisture Content

Weighed amount of bottle gourd seed sample were dried in a hot air oven and weighed continously after cooling the sample in a dessicator till constant weight was obtained. Weight loss on drying to a final constant weight is recorded as moisture content of the material. The moisture content (wet basis) of bottle gourd seeds was calculated using equation 4.

$$\text{Moisture content (\%)} = \frac{(\text{int}ial\ weight\ of\ seeds - final\ weight\ of\ seeds)}{initial\ weight\ of\ seeds} \text{ x } 100 \quad (4)$$

Determination of Peroxide Value

The peroxide is the measure of those substances which oxidize potassium iodide in a sample under test conditions. Some of the oxygen that is absorbed by fats and oils form peroxide groups. The test was carried out in order to determine the extent or degree of oxidation of the bottle gourd seed oil.

Procedure

30ml acetic acid chloroform solution was measured into a flask containing 2g of the bottle gourd seed oil sample, followed closely by the addition of 30ml distilled water. The flask content was then titrated against 0.1M sodium thiosulphate until the yellow color almost disappeared. 0.5ml starch indicator was added and the titration continued until the blue color almost disappeared. This was the end point. A blank titration was also performed under the same condition. The formula in equation 5 was used for determination of peroxide value is given as

$$\text{Peroxide value (PV)} = \frac{(S - B)\,x\,N\,x1000}{W} \quad (5)$$

Where,

S = sample titre value

B = blank titre value

N = normality of acid used

W = Weight of oil sample used

Determination of acid Value

Acid value is the measure of rancidity of the oil. If the value is high, there will be high losses during de-acidification. It also gives the general indication of the quality of oil produced.

Acid value determines the general utility of the oil as a source of raw materials for Small scale industries. It affects the palatability of edible vegetable oil and also determines the nature of the seeds from which the oil was extracted.

Procedure

A solution of 25ml each of diethyl ether and absolute ethanol was prepared and 5g of the bottle gourd seed oil sample was dissolved in its. 0.5ml of phenolphthalein solution was added and the mixture ingested in a water bath for 10 minutes. It was titrated while hot with 0.1M potassium hydroxide (KOH) solution until the pink color lasted 20 minutes. A blank titration was also conducted under the same conditions. The formula, equation 6 is for determination of acid value.

$$\text{Acid value (AV)} = \frac{(S - B)\,x\,N\,x\,M}{W} \qquad (6)$$

Where,

S = Sample titre value

B = Blank titre value

N = Normality of acid used
M = Molecular weight of KOH used

W = Weight of oil sample used.

Determination of Free Fatty Acid Value (FFA %)

This is the percentage by weight of the number of a particular fatty acid found in the oil.

Procedure

3g of bottle gourd seed oil sample was weighed and dissolved in 50ml natural solvent (absolute ethanol). The solution was titrated with standard 0.1M sodium hydroxide solution using phenolphthalein as indicator. The end- point was reached when a permanent pink color appeared. The formula, equation 7 is for the determination of free fatty acid value (F.F.A %).

$$\text{Free fatty acid (FFA \%)} = \frac{V\,x\,N\,x\,M\,x100}{W} \qquad (7)$$

Where,

V= volume of NaOH

N = Molarity of acid used

M = Molecular weight of acid, W = Weight of oil sample used.

Determination of Saponification Value

The saponification value is a measure of the mean molecular weight of the fatty acids comprising oil. When the molecular weight is high, we can predict the high quality of saponification in the soap industry. It is also used in checking adulteration of oil.

Procedure

25ml of ethanoic potassium hydroxide solution was measured into a round bottom flask and 2g of the sample seed 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, equation 8 is for determination of saponification value.

$$\text{Saponification value (SV)} = \frac{(B-S)\ x\,N\,x\,M}{W} \qquad (8)$$

Where,

S = Sample titer 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 (Wij's Method)

This is expressed as the degree of unsaturation of oil. It is also expressed as the number of grams of iodine absorbed by 100g of oil under the test conditions used. It is used to test the extent of unsaturation of oils.

Procedure

1.5g of sample seed 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, equation 9 is for the determination of iodine value.

$$\text{Iodine value (IV)} = \frac{(B-S)\,x\,N\,x\,M}{W} \qquad (9)$$

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.

Results and Discussion

Results

The results obtained from the characterization of the extracted oil from bottle gourd seeds are represented in tables 1 and 2.

Table 1: Physical properties of oil extract from bottle gourd seed oil

PROPERTY	VALUE
Percentage oil yield	32.24
Percentage moisture content	10.91
Specific gravity	0.84
State at 29^{o}C	Liquid
Colour	Reddish brown
Odour	Agreeable

Table 2: Chemical properties of oil extract from bottle gourd seed oil

PROPERTY	VALUE
Acid value	2.7 MgKOH/g. oil
% free fatty acid	1.30 ± 0.01%

Peroxide value	11 Meq/kg
Iodine value	39.84 g I_2/ 100g.oil
Saponification value	185 MgKOH/g oil

Discussion

The physiochemical properties of the analysis of the bottle gourd seed oil obtained were in line with the result in other researches (Sodeke, 2005; Ejikeme et al., 2008; Okoye and Ibeto, 2010; Ibeto et al., 2012). The specific gravity of 0.84 and approximate yield percent of 32.24% was an indication that extraction of oil from bottle gourd can be commercially viable.

The extraction experiment using petroleum ether as solvent yielded pale colored oil that is liquid at room temperature with an agreeable odour. The phase is an indication of the presence of unsaturated fatty acids, linoleic and oleic acids in the seed oil.

The extracted seed oil had moisture content of 10.91%, an indication of storage stability of the oil depending on the post-harvest activity.

The peroxide value of 11Meq/kg explains that the oil will not go rancid easily during storage as the value is within the range that oils are stable without deteriorating (Audu *et al.*, 2013).

The saponification value of oils have an inverse relationship with the molecular weight of the oil. The 185mgKOH/g saponification value of the oil is an indication of oil high potential for usage in the laundry industry for soap making, degreasing and shampoo (Amoo et.al, 2004).

The Iodine value in the sample was 39.84gI_2/100g which is a measure of the unsaturated acid, fats and oil present in the seed oil. This explains the liquid nature of the oil at room temperature.

The Acid value of the oil obtained to be 2.7mg KOH/g indicates that the oil will not be corrosive, can be used as biodiesel, paint oil and is also edible because the acid value is less than 10 (Audu *et al*., 2013).

The FFA (Free fatty acid) of the bottle gourd oil which is 1.30 ± 0.01% is an evidence of the oleic acid indicating that the oil is edible and can be applied for industrial purposes.

Conclusion

This research has shown the bottle gourd, *lagenaria sicceraria* oil seed extract has an advantageous physico-chemical properties with the oil obtained have favorably industrial, nutritional, cosmetic qualities and can also improve the health status of consumers. The yield also reveal that the extraction process is commercially viable.

REFERENCES

Achu, B.M., E. Fokou, C. Tchiegang, M. Fotso and F.M Tchouanguep, 2005. Nutritive value of some cucurbitaceae oilseeds from different regions in Cameroun. AFR.J. Biotechnol., 4:1329-1334.

Akbar E, Yaakub Z, Kamarudin SK, Ismail M, and Salimon J., (2009): Characteristics and composition of Jatropha curcas oil seed from Malaysia and its potential as biodiesel Feedstock. European J. Scientific Res., 29(3): 396-403.

Akubugwo, E.I., G.C. Chinyere and A.E. Ugbogu, 2008. Physicochemical studies of extracts from plant seeds in Nigeria. Pak. J. Nutri. 7:570-573.

Audu, T. O. K., Aluyor, E.O., Egualeona, S., and Momoh, S. S.,(2012) Extraction and Characterization of Chrysophyllum albidum and Luffa cylindrica Seed Oils, Petroleum Technology Development Journal: An International Journal, Vol.3 No.1

Amoo, I.A., A.F. Eleyinmin, N.A.O Ilelaboye and S.S Akoja, 2004. Characteristics of oil extracts from gourd (cucurbita maxima) seed food Agric. Environ; 2:38-39.

Ejikeme, P M., Egbonu, C. A. C., Anyaogu, I. D. and Eze, V. C., (2008): Fatty acid methy esters of melon seed oil: characterization for potential diesel fuel application, Chemical Society of Nigeria, Enugu Chapter, Coal City Chemistry Conference Proceedings, 37–41

Ibeto, C N., Okoye, C O B. and Ofoefule, A U., (2012): Comparative Study of the Physicochemical

Characterization of Some Oils as Potential Feedstock for Biodiesel Production ISRN Renewable Energy Volume 2012 (2012), Article ID 621518, 5 pages

Oboh I. O. and Aluyor E. O., (2009): Luffa cylindrica - an emerging cash crop Review African Journal of Agricultural Research Vol. 4 (8), pp. 684-688

Okoye C O B and Ibeto C N (2010): Analysis of different brands of fruit juice with emphasis on their sugar and trace metal content, Bioresearch 7, 493-4957

Sodeke V A (2005): Extraction of oil from water melon seed and analysis; Quarterly Res. Service, 25-30