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Extraction and Physicochemical Characterization of Sunflower Seed Oil

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***Abstract*—** Edible oil is most often plant based oil, edible oil may be liquid at room temperature. It is suitable for food and cooking use. Sunflower seed are used to make oil, meal and confectionary products. Sunflower is one of the four major sources of edible oil worldwide and in Nigeria. Its oil quality is relatively flexible and has been adapted for many specific uses, but extended use of sunflower oil for industrial applications are difficult or impossible to obtain because vegetable oils are less stable chemically. One limiting factor in industrial uses of vegetable oils is that all such oils are susceptible to becoming rancid. The commercial success of such industrial application depends on their physical and chemical parameters. The oil sample used for this work was extracted from the oil-type sunflower seeds by mechanical pressing method. The percentage yield of the oil was 41%. This Work examines some of its physicochemical parameters. The values obtained were 1.464 as refractive index (at 40°C), 324.00 ± 1.00°C as its flash point, 0.9157 ± 0.0002 of specific gravity, 0.36 ± 0.058mgKOH/g as acid value, 190.65 ± 1.41mgKOH/g as saponification value and 103.21 ± 1.47g/100g as iodine value. These parameters were analyzed using the standard procedure as described by Onwuka (2005). The result obtained indicates that the sunflower seed oil is better consumed as food rather than its uses as industrial product.

***Keywords*—** Physicochemical; Parameters; Sunflower; Seeds; Oils

I. INTRODUCTION

Sunflower (*Helianthus annuus*) is a member of the compositae (or Asteracea) family and the genus Helianthus. It originates from North America, where it was traditionally cultivated by the Native Americans [1]. It was in the late 1800s when the flower was introduced in the Russian Federation that the sunflower became a food crop. By 1860, Russian farmers made significant improvement in the way that the sunflower was cultivated; they became the world's largest producers of sunflower seed. There are two types of sunflowers, the oil seed and non-oil seed, which are nevertheless of the same species. The oil type sunflower seed has 38-50% oil content and about 20% protein. Sunflower seeds are four-sided and flat, and are generally 0.6cm long and 0.3cm wide. They have a black seed coat with dark or grey stripes [2]. Sunflower plant grows well within a temperature range of 20-25°C, temperature above 25°C reduce its yield and oil content of the seed. Sunflower adapts to wide variety of soil but performs best on a good soil suitable for maize or wheat production. During the growing season, the individual flowers are each pollinated. Seed development then begins moving from the outer rim of the flower towards center. It generally takes 30 days after the last flower is pollinated for the plant to mature. Sunflower, a temperate crop which has been found to fit well into Nigeria farming system was introduced to Nigeria as an alternative oil crop to the existing oil crops [3]. Fats and oils are recognized as essential nutrients in both human and animal diets. Edible oils and fats are important parts of our diet and more than 90% of the world production is from vegetable oil and animal [4]. Sunflower seed is now used among the Indian tribes in making traditional soup and medicine. Oil extracted from the seed provides many tribes with cooking oil. It is equally used in making plantain chips, bread, other confectionary products and hair treatment [5]. The interest in many vegetable oil as diesel fuel substitutes is increasing and various oil containing crops are grown for this purpose. Vegetable oils are often modified into biofuels, making the oil into biodiesel involves some toxic and hazardous chemical transformations [6]. The commercial success of such industrial application depends on their physical and chemical parameters [7], hence the reason for this present study. The current study is designed to extract and characterize some of the physicochemical properties of sunflower seeds oil which are but not limited to Flash Point, Refractive Index, Specific Gravity, Acid Value, Iodine Value and Saponification Value.

II. RELATED WORK

The reports on some physicochemical properties of sunflower seed oil made by researchers:

Researchers have reported Specific Gravity of sunflower seeds oil as 0.934, Refractive Index as 1.470, Saponification Value as 177.78mgKOH/g oil, Iodine Value as 109.86g/100g oil and Acid Value as 0.55mgKOH/g oil [8]. Others have also reported Refractive Index as 1.468, Saponification Value as 194mgkOH/g oil, Iodine Value as 130g/100g oil and Acid Value as 0.17mgkOH/g oil [9].

III. METHODOLOGY

Sample Collection and Identification: Sunflower seed used for this work was purchased from Zaria, Kaduna State, Nigeria and was authenticated by a Botanist.

Study Design: Sunflower seed obtained was cleaned and stored properly at room temperature prior to the time of actual experimentation.

Study Location and Duration: This research work was carried out at the Federal Polytechnic Idah, Kogi State, in the Department of Science and Laboratory Technology from December 2015 to December 2016.

Procedure Methodology: The sample was stored for a short period of time, as long storage time will reduce its yield and oil quality. The seed was manually hulled, winnowed and milled. The pressing machine was made ready and continuously fed with pressure as the oil is squeezed out through the slot in the barrel into a clean and dry container. This oil extraction was done aseptically, devoid of any form of impurities. The most obvious by-product of the oil process is the oil seed cake.

Figure 1: Showing freshly extracted sunflower oil, seeds and flower.

Figure 2: Showing ZY24 (202-3) pressing machine.

Statistical Analysis: Refractive index was analyzed by the use of the handheld refraction meter with a light compensator, Flash Point by the use of Open-Cup Method, Specific Gravity using Density Bottle, and using the Official Method of Analysis to determine Acid, Iodine and Saponification Value as described by Onwuka (2005).

IV. RESULTS AND DISCUSSION

Results: The oil extracted from the sunflower seed was yellowish in color.

Table 1: Percentage of oil yield

Sample	% of Oil Yield
Sunflower seed	41

Table 2: Physicochemical properties of sunflower seed oil

S/No	Parameters	Sunflower Oil
1.	Specific gravity	0.9157 ± 0.0002
2.	Flash point	342.00 ± 1.00
3.	Refractive index	1.464
4.	Acid value (mgKOH/g oil)	0.36 ± 0.058
5.	Saponification value (mgKOH/g oil)	190.65 ± 1.41
6.	Iodine value (g/100g oil)	103.21 ± 1.47

- Values are mean ± SD of 3 replication

Discussion: The sunflower oil was extracted by mechanical pressing method and the oil yield was 41%. The percentage yield of oil ranging from 38-50% is normally considered to be reasonable. The yield of 41% with mechanical pressing method is in agreement with the value of Food and Agriculture Organization of the United Nations (FAO).

The physicochemical properties of the oil sample as presented in table 2 above shows 324.00 ± 1.00°C as the flash point of the sunflower oil. This was the temperature at which the volatiles evolving from the heated oil began to flash as soon as fire was passed over it. Regulatory authorities use flash point determination made from small scale test apparatus in classifying flammable and combustible liquid. The high flash point value of the sunflower seed oil indicates that it is combustible oil rather than flammable oil.

Specific gravity (S.G) of the sunflower oil obtained is 0.9157 ± 0.0002. This value was the ratio of the density of the sunflower oil to the density of equal volume of water at the same temperature. The value obtained indicates that the oil is less dense than water at equal temperature. S.G is used in wide variety of industries it is particularly useful because it allows access to molecular information in a noninvasive way.

As observed from the result in the table 2, the value obtained as its refractive index is 1.464. This characteristic presents a simple, yet accurate way for rapid determination of the concentration of the oil. The refractive index of the oil is sensitive to its composition. It increases with increasing chain length of fatty acid in triglycerides or with increasing unsaturation. This makes it an excellent spot test for uniformity of compositions of oil.

Acid value (A.V) obtained is 0.36 ± 0.047mgKOH/g oil the value is greater than 0.17 presented by Ngassapa and

Othman (2001). The low acid value shows that the oil is good for human consumption as it has very low level of free fatty acid which could cause rancidity or pose health problem upon consumption.

Saponification value (S.V) which is the number of milligram of potassium hydroxide (KOH) required to saponify 1g of oil obtained is 190.65 ± 1.41mgKOH/g oil. The low saponification value of the oil is an indication that the oil will not be quite suitable for soap making. Unlike coconut (S.V 255), palm kernel oil (S.V 247) and butter fat (S.V 225) which contain a high proportion of the lower fatty acid.

As also seen in the table 2 above, the result of the iodine value 103.21 ± 1.47g/100g oil of sunflower oil is below the value (109.86g/100g oil) presented by Mohammed et al (2015). Thus, this level of iodine in the sunflower oil indicates that sunflower oil is more of unsaturated fatty acid. This further confirms the reason why sunflower oil is more of liquid than solid. Hence, it cannot easily congeal at ordinary temperature. However, oils with lower gelling points tend to be less saturated (leading to a higher iodine number) and polymerize more easily in the presence of atmospheric oxygen.

V. CONCLUSION AND FUTURE SCOPE

The results of the analysis carried out on sunflower seed oil suggest that high iodine value portrays it richness in unsaturated fatty acid which implies that, it will have short oxidative storage stability. The low acid value is an indication that the oil can be refined to edible vegetable oil. The slightly low saponification value of the oil could be attributed to the low free fatty acid (FFA) content which indicates that the oil may not be suitable for soap making and oil-based shampoos. The specific gravity shows that the oil is less dense than water. The Refractive index revealed the composition of its increasing chain length of fatty acid and unsaturation of the sunflower oil. The flash point of the oil indicates that sunflower oil is a combustible liquid. It is therefore certain that sunflower oil is more suitable for consumption rather than industrial application of soap making or biofuels production.

However, the use of sunflower oil with lower gelling points tend to be less saturated is currently being investigated as a means of improving cold-weather starting engines. Production of sunflower oils for use as fuels is theoretically limited only by the agricultural capacity of a given economy. Further studies should be under taken to elucidate its potential values as fuel in diesel motors and its industrial application in paint production.

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REFERENCES

[1] A. Abitogun, A. Osmosheyin, D. Oloye, O. Alademelen, "Extraction and Characterization of Sunflower Crude Oil", *The Internet Journal of Nutrition and Wellness*, Vol**.8,** Issue**.2,** pp**.1-5, 2008.**

[2] P. Inna, "Agribusiness Handbook: Sunflower Crude and Refined Oils", *VialedelleTeme di Caracalla*, **Rome,** pp**.19-23, 2010.**

[3] B.A. Lawal, G.O. Obigbessan, W.B. Akanbi, G.O. Kolawole, "Effect of Planting Time on Sunflower (*Helianthus annuus)* Productivity in Ibadan, Nigeria". *African Journal of Agricultural Research*, Vol**.6,** Issue**.13,** pp**.3049-3054, 2011.**

[4] P. Singh, "Fatty Acid Compositional Analysis of Different Edible Oils and Fats in the Kairwara, Alwar (Rajasthan)", *International Journal of Scientific Research in Chemical Sciences*, Vol**.5,** Issue**.4,** pp**.08-12, 2018.**

[5] D.O. Torimiro, O.J. Yusuf, S.K. Subair, B.J. Amujoyegbe, N. Tselasele, J.O. Ayinde, "Utilization of Sunflower Crop Among Small Holder in Sub-Saharan Africa: Evidence from Nigeria and Botswana", *Journal of Agricultural Extension and Rural Development*, Vol**.6,** Issue**.9,** pp**.298-304, 2014.**

[6] R.S. Altin, A. Cetinkaya, H.S. Yucesu. "The Potential of Using Vegetable Oil Fuels as Fuel for Diesel Engines", *Journal of Energy Conversion and Management*, Vol**.42,** No**.5,** pp**.529-538, 2001.**

[7] A. Mushatq, A. Shoaib, U.H. Fayyaz, A. Muhammed, A. K. Mir, Z. Muhammad, S. Shazia, "Base Catalyzed Transesterification of Sunflower Oil Biodiesel, *African Journal of Biotechnology*, Vol**.9,** Issue**.50,** pp**.8630-8735, 2010.**

[8] I. Mohammed, A.M. Hassan, T.B. Ali, "Physicochemical Characteristics of Some Imported Edible Vegetable Oils in Iraq", *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, Vol**.6,** Issue**.5,** pp**.488- 494, 2015.**

[9] F.N. Ngassapa, O.C. Othman, "Phvsicochemical Characteristics of Some Local Manufactured Edible Vegetable Oils Marketed in Dar'es Salaan Tanzanian", *Journal of Science*, Vol**.27,** pp**.49-57, 2001.**

[10] P.A Odiba, S. Adetola, "ABC of Biochemistry", *Adura Printing and Publishing Press*, **Nigeria,** pp**.17-18, 2016.**

[11] G.I. Onwuka, "Food Analysis and Instrumentation Theory and Practice", *Naphthali Prints*. **Nigeria,** pp**.33-37, 2005.**

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