IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 11, Issue 3 Ver. I (May.- Jun.2016), PP 83-88
www.iosrjournals.org

Effect of Solvents Extraction on the Yield and Physicochemical Properties of Dehulled *Hunteria Umbellata* Seed Oil

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Abstract: *In this study, the characterization and physicochemical properties of dehulled Hunteria umbellate (DHUS) were critically examined to ascertain the functional groups and components of the extracted oils. Oils were extracted from DHUS using; methanol, aqueous and ethyl acetate in soxhlet extractor. The low acid and peroxide values (5.61-23.00mgKOH/g) and (4.00-7.20Meq/kg) respectively confirm the presence of antioxidants, flavonoids and free fatty acid. DHUS oil can be used industrially for the preservation of food, production of cosmetics and medicinally to cure cancer and viruses. The FTIR results revealed the O-H of phenol at absorption band between 3270-3388cm^{-1} and some other important groups.*
Keywords*: Dehulled hunteria umbellate seed (DHUS), Hunteria umbellate (HU), Soxhlet extraction, Saponification value, Iodine value, Acid value*

I. Introduction

Hunteria umbellata is a good source of carbohydrate, protein and minerals which are nutritional requirements of both humans and livestock. The fruit is about 5–25cm and consist of two separate globose mericaps 3– 6 cm long, yellow, smooth, 8 – 25 seeded embedded in a gelatinous pulp. The seeds of this plant can be used as feed supplement and as medicine to improve health and growth performance in humans and livestock. *Hunteria umbellata* seeds extract contains secondary metabolite like tannins, cardia glycosides, flavonoids, saponins, alkaloids, anthraquinones, polyphenols and terpenoids [1]. The extract reduces the blood glucose levels, reduces cholesterol level, and triglycerides. *Hunteria umbellata* (HU) significantly elevates Red Blood Cell, Packed cell volume, and Hemoglobin levels, which strongly suggest that HU could be useful in the management of anemia [1]. Claimed that the fruit pulp extract of *Hunteria umbellata* can be used in traditional medicine for the treatment of inflammatory conditions. The aqueous fruit pulp extract of *H. umbellata* has shown to be very effective against acute inflammation in a dose related manner. We shall, therefore, undertake the present study in order to evaluate the physicochemical properties of dehulled *Hunteria umbellata* seed oil.

II. Materials And Method

Hunteria umbellata seed was bought at Oja Oba, Isale Osun Osogbo, Osun State, Nigeria. The seed was dried for 14days and was dehulled to remove the outer cover of the seed and grinded using a mechanical grinder. *Hunteria umbellata* seed oil was extracted from the already grinded seed using three different oil extraction solvents (boiling point of 60-100^{o}C). These included methanol, ethylacetate, and distilled water. The extraction involved the use of Soxhlet extraction method [2] and physicochemical properties using the method reported by [3]. Detection of the characteristic peak values and their functional groups was performed on a Perkin Elmer spectrophotometer system. About 40g of DHUS was weighed into a thimble in the Soxhlet extractor fitted to conical flask. *Hunteria umbellata* seed oil was extracted with 250 ml methanol, 250ml ethyl acetate and 250ml distilled water from different samples. The solvents were boiled under reflux for about 4hrs, 5hrs, and 8hrs respectively. The oils were recovered by evaporating off the solvents using rotary evaporator. *Hunteria umbellata* seed oil yield was calculated for each extraction solvent.

$$\%Yield = \frac{mass\ of\ oil}{mass\ of\ DHUS}\ x\ 100$$

III. Results And Discussion

Table 1: PERCENTAGE OIL OF DIFFERENT EXTRACT OF DHUS

Samples	Percentage oil yield (%)
Methanol extract of DHUS	88
Distilled H_2O extract of DHUS	18
Ethyl acetate extract of DHUS	35

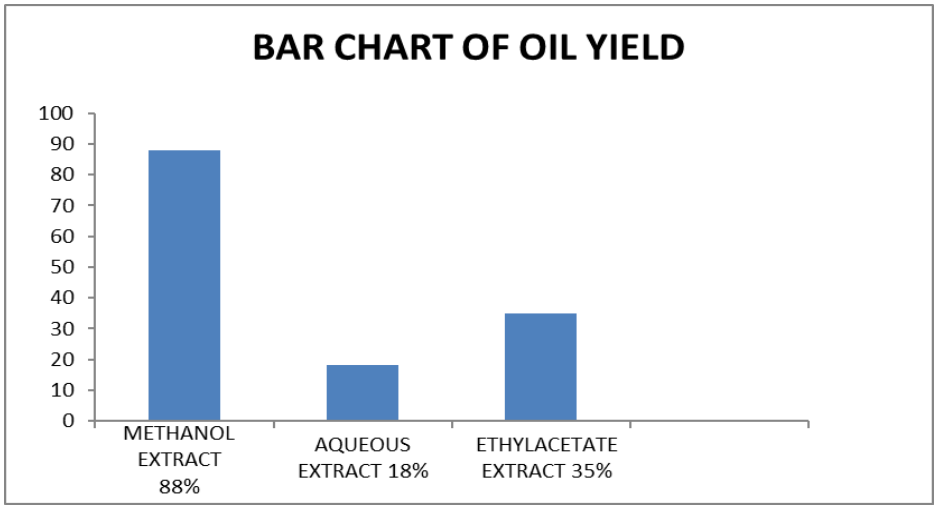

Fig. 1: Bar chart of oil yield

Soxhlet extractor was used to extract oil from DHUS by using a different solvent such as methanol, ethylacetate, and Aqueous. Out of these solvents, methanol gives the highest oil yield which shows that methanol is the best solvents for the extraction of dehulled *Hunteria umbellata.* While Ethylacetate and water are seen as poor solvent in the extraction of DHUSO not only because of their poor yield but also the length of time taken for the extraction. Methanol, ethanol, and acetone have been suggested for the extraction of edible oil, therefore, oil extracted with methanol from DHUS may be edible.

Table 2: RESULT OF PHYSICOCHEMICAL PROPERTIES OF DHUS OIL OF EXTRACT OF DIFFERENT SOLVENTS

Oil samples of DHUS	Saponification values (mgKOH/g)	Acid values (mgKOH/g)	Iodine values (gI2/100g)	Peroxide values (Meq/kg)	Specific gravity
Methanol extract	84.15	5.61	2.15	4.00	0.82
Ethylacetate extract	140.25	11.78	1.52	7.20	0.93
Aqueous extract	134.64	23.00	3.36	6.60	0.26

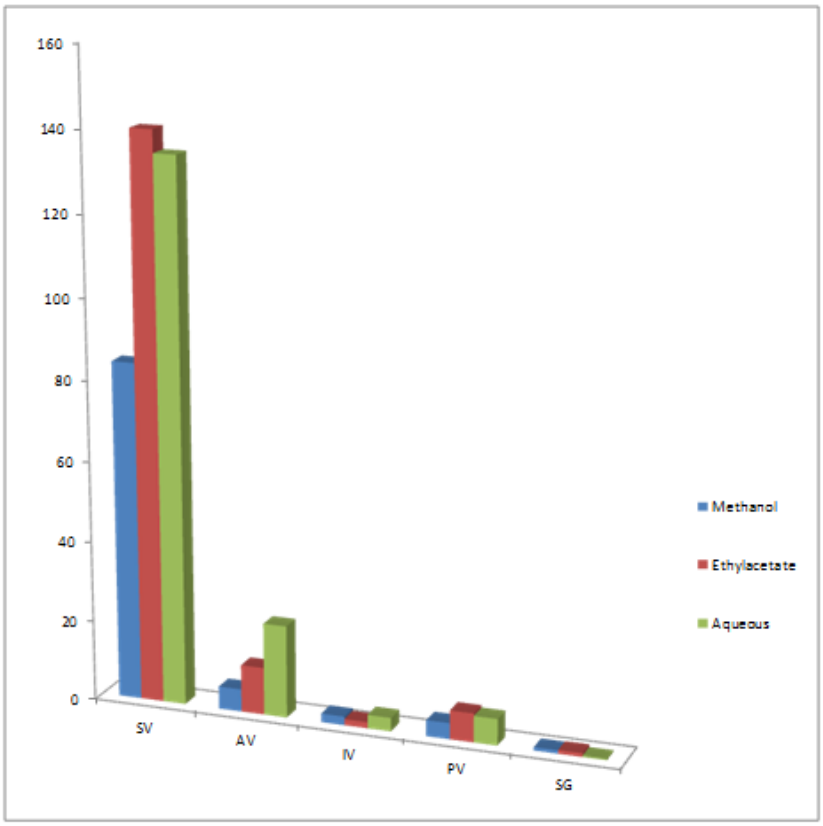

Fig. 2: Ilustration of Physicochemical Properties of DHUS Oil Extraction of Different Solvent

The Saponification value obtained for the oil samples showed 84.15, 140.25 and 134.64mgKOH/g for methanol, ethylacetate and aqueous extract of DHUSO. These values are very close to 108.27, 140.25, and 137.00mgKOH/g recorded for African pear seed oil, Bambara groundnut seed oil [4] and cashew nut seed oil; and higher than 9.4, 5.58 and 43.85mgKOH/g reported for almond seed oil [5], castor seed oil [6] and Pterygota seed oil [7]. These values are however low compared to 189.00, 227.49, 208.10mgKOH/g obtained for sesame seed oil [8], groundnut seed oil, and melon seed oil. The lower value of saponification values suggests that the mean molecular weight of fatty acids is low. This might imply that the fat molecules did not interact with each other [9]. The low saponification value is an indication that these oils may not be suitable for soap making, oil-based ice-cream and shampoos unless refined.

The iodine value could be used to quantify the amount of double bond present in the oil which reflects the susceptibility of the oil to oxidation. The iodine values for these three oils are 2.16, 1.52 and 3.36 iv/wijs. These values are very close to 2.65, 3.45, and 4.02 reported for almond seed oil, melon seed oil [5] and calabash seed oil [10] but very low compared to 101.00 and 115.1 reported pumpkin seed oil [11] and cashew seed oil [12] respectively. Oils with iodine value less than 100 gI2/100g of oil are non-drying oils; correspondingly, [4] reported that the lower the iodine value, the lesser the number of unsaturated bonds; thus the lower the susceptibility of such oil to oxidative rancidity. Therefore, DHUS oil from these three solvents is not suitable for ink and paint production due to their non-drying characteristics. Notwithstanding the non-drying characteristics, DHUS oil has a lower susceptibility to oxidation rancidity.

Acid values accounted for the presence of free fatty acids in the oils as an indicator of the presence and extent of hydrolysis by lipolytic enzymes and oxidation. However, the acid values for these three extract of DHUS oil are 5.61, 11.78, and 23.00mgKOH/g. These values agree with 5.61, 11.50 and 22.72mgKOH/g obtained for African pear seed oil [13], cotton seed oil [14] and cashew seed oil [12]. But higher than 1.79, 0.87, and 2.63 mg KOH/g recorded for groundnut seed oil [15], castor seed oil [16] and sesame seed oil [17]. These values are very low compared to 36.14 and 62.60 reported for groundnut seed oil [6] and pumpkin seed oil [18] respectively. The low acid value indicates that the oil will be stable over a long period of time and protect against rancidity and peroxidation. This could be attributed to the presence of natural antioxidants in the seeds such as vitamins A and C as well as other possible phytochemical like flavonoids.

Peroxide value is used as a measure of the extent to which rancidity reactions have occurred during storage, it could be used as an indication of the quality and stability of fats and oils [19].The peroxide value of these oils (DHUSO) are 4.0, 6.6, and 7.2Meq/kg. These values are very close to 4.36, 6.62. and 7.45 Meq/kg

reported for palm kernel seed oil, bottle gourd [10], and sesame seed oil [8] and higher than 0.93 obtained for almond seed oil [18] but lower than 10.40, 22.06 and 77.50 Meq/kg recorded for melon seed oil, groundnut seed oil, and African pear seed oil [20]. However, peroxide values of fresh oil are always less than 10ml/kg. When peroxide value is between 30-40ml/kg a rancid taste is noticeable. Low peroxide value is a pointer to the presence of anti-oxidant in DHUS oil.

The specific gravity showed that these oils are less dense than water because their values are lesser than one. The obtained values for DHUS oil are 0.82, 0.93, and 0.26. These values are in agreement with 0.83 and 0.93 reported for pumpkin seed oil [21] and bottle gourd [10] respectively. The specific gravity of aqueous extract is very low which indicate that water extract of DHUS is less dense than water. Therefore, DHUSO will be useful in cream production due to its low specific gravity because It will allow the oils to flow and spread easily on the skin [22].

Table 3: Result of FTIR of DHUSO of Different Solvents

Samples	**FTIR Bands**
Pure DHUS	3388.00, 2926.45, 1650.52, 1412.61, 1023.00, 855.94
Methanol extract of DHUS	3396.00, 2932.39, 1645.55, 1413.00, 1063.63, 920.27
Distilled water extract of DHUS	3270.00 - 1639.00, 1401.39, 1082.51
Ethyl acetate extract of DHUS	3332.26, 2925.36, 1608.56, 1457.22, 1090.66

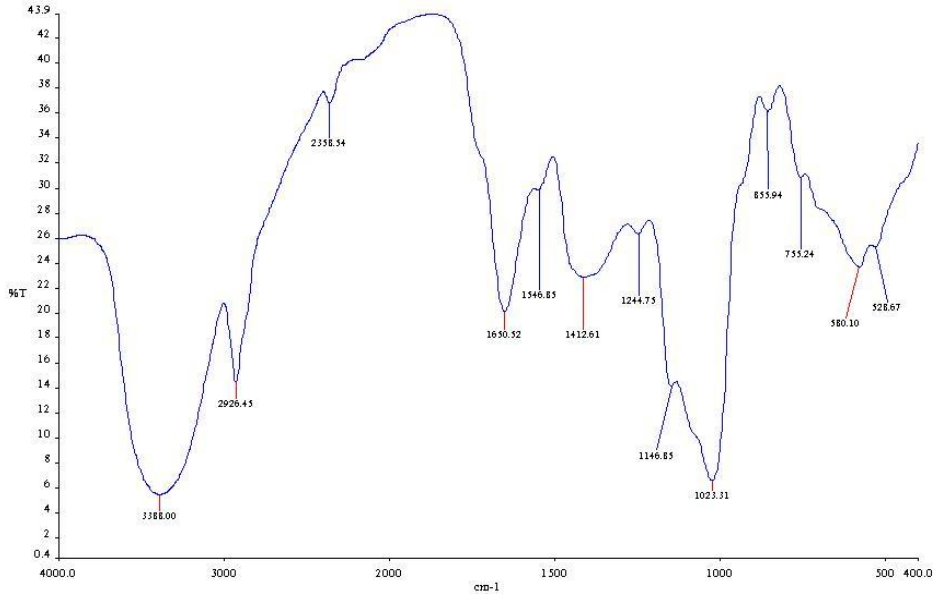

FIG 3: FT-IR of Pure Dehulled *Hunteria umbellate*

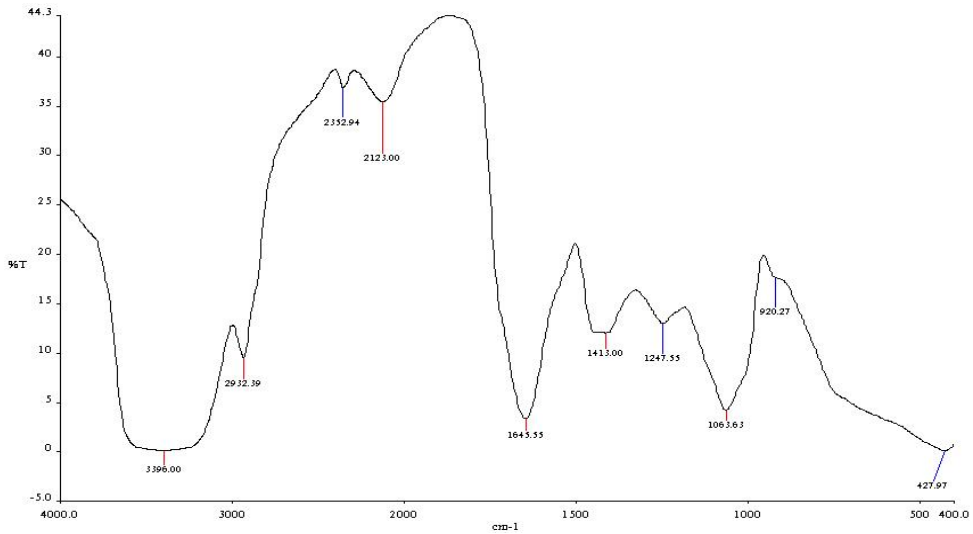

FIG 4: FT-IR of Methanol Extract of Dehulled *Hunteria umbellata*

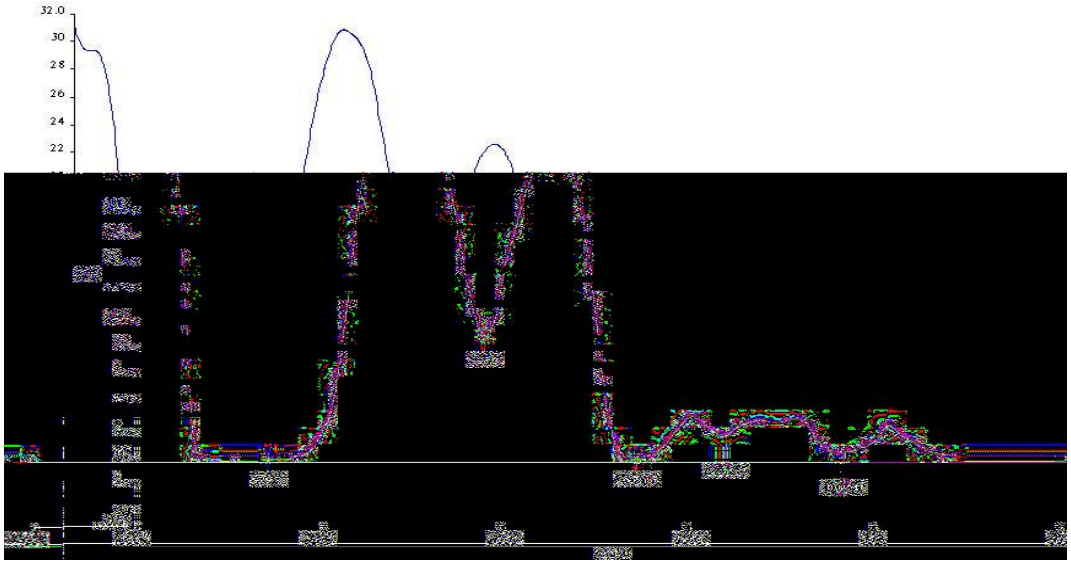

FIG 5: FT-IR of Aqueous Extract of Dehulled *Hunteria umbellata*

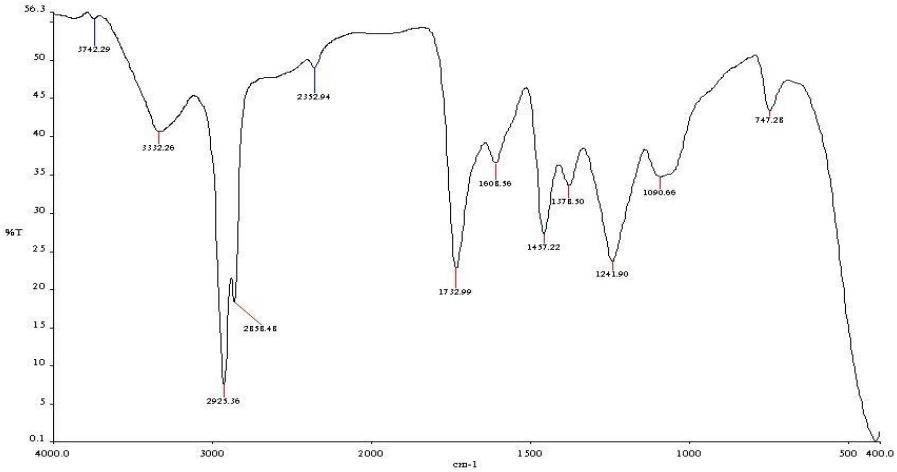

Fig 6: FT-IR OF Ethyl acetate Extract of Dehulled *Hunteria umbellate*

The FTIR spectra of pure DHUS and oil extract of different solvent showed the presence O-H stretch between 3388-3270cm^{-1} which is within the range of absorption of the phenolic compound. However, the phenolic compound was reported by [23] to consist of flavonoids and natural antioxidant. In alkane, C-H stretching aliphatic absorption bands always occur below 3000cm^{-1} except in a strained ring compound [24]. The spectra also showed the absorption bands of alkanes between 2932.39-2925.36cm^{-1}. There were absorptions of moderate intensity at the region between 1650.52-1608.56cm^{-1} which is due to N-H bending vibration of primary amines. The FTIR spectra also confirmed the presence of aromatic compounds, aliphatic amines, and some other important groups DHUSO.

IV. Conclusion

The result of this research suggests that dehulled *Hunteria umbellata* seed oils is nutritional potent and a good source of oil judging from its high yield. The FTIR analyses also show the presence of a phenolic compound which indicate that the oils contain flavonoids and natural antioxidant and some other important groups like alkanes, primary amine, etc. Due to its low acid values and peroxide value which is the pointer to the presence of an antioxidant, flavonoids, and low free fatty acid, DHUS oil can be used industrially for the preservation of food, production of cosmetics and to prevent the degradation of rubber and gasoline. It is worthy to conclude that methanol is the best choice of solvent for the extraction of DHUS not only because of its high oil yield but that it also show similar absorption peaks with that of pure DHUS.

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