International Journal of Agricultural Research and Review: ISSN-2360-7971,Vol. 6(2):pp 674-679, March, 2018.

Full Length Research

Extraction and Physico-Chemical Properties of Balanites Aegyptiaca (Heglig) Seed Oil Grown In Libya.

Mohamed A. Ahmed and Mohammed A. Alshareef*

Department of Food Science and Technology, Faculty of Engineering Sciences and Technology, Sebha University, Libya
*E-mail: moh.alshareef@sebhau.edu.ly

Accepted 20th March, 2018.

Oils are known to have important biological activities. The development in demand and different utilizations of oils foster the search for seed and vegetable oils that are of high quality to meet up with the developing rate of its demand worldwide. In this research, the extraction and physicochemical properties tests of the oil extracted from the seed of Balanites Aegyptiaca (Heglig tree) was carried out. The physical properties of the oil compares positively with those of the conventional vegetable and seed oils like groundnut oil, cotton seed oil and soybean oil among others. The results obtained showed 43% oil yield, light yellowcolour of the oil,agreeable odour,transparent liquid appearanceat room temperatures, 1.498 refractive index, 18.97 cp viscosity, 0.912 g/ml specific gravity, 1.51 mgKOH/g acid value, 1.21 meq/Kg peroxide value, 121.56 mg I_2/g iodine value and 223.98 mgKOH/g saponification value. The acid value of the oil is lower than the maximum permissible acid level of 4mgKOH/g fat or oil required for edible virgin fats and oils and therefore it is suitable for consumption. High saponification value guarantees the use of the oils in cosmetics and soap making industry. This study shows that, heglig seeds oil is a good source of edible oil.

Keyword: Balanites Aegyptiaca, hegligtree seeds oil, physico-chemical properties.

INTRODUCTION

Heglig (Balanitesaegyptiaca) tree is native to much of Africa and parts of the Middle East (Sands, 2001). It is found in many countries such as Saudi Arabia (Elfeel, 2010), India, Iran and Pakistan (Amalraj and Shankarnarayan, 1986). Von Maydell (1986) reported that Balanitesaegyptiaca had been used over thousands of years. The fleshy pulp of the heglig (laloub) fruit is eaten fresh or when dried. Laloub fruit (Figure **1**) contains 72% carbohydrates, plus crude protein, steroidal saponins, vitamin C, ethanol and other minerals (Abu Al-Futuh, 1989). Laloub seed contains moisture (3.10%) , oil (42.95%) ,protein (31.08%), fibre (12.64%), ash (3.19%) and carbohydrate (3.05%) on dry matter basis .Also the seeds contained different minerals e.g calcium (0.41mg), sodium (0.09mg), magnesium (0.13mg) phosphorus (0.30mg) and potassium (1.09mg) per 100g on dry matter (Fregon, 2005). All parts of the tree has a medicinal uses including fruits, seeds, barks and roots. The most important is a steroidal saponins, which yield diosgenin, a source of steroidal drugs, such as orticosteroids, contraceptives and sex hormones (Farid et al., 2002). Balanites seed is considered as an extremely useful edible product. It contains good quality oil and high protein content (Mohamed et al, 2002). The debittered seed is used as snacks (nuts like) by humans. The extracted oil is used for many uses, for example, in Western Sudan remaining cake is used as animal feed (Fregon, 2005). Both fruits and seed were widely used in many countries during the dry season and drought periods including Ethiopia,(Guinand and Lemess, 2001), Nigeria (Locket et al., 2000) and Sudan (Gullick, 2001). Nour et al. (1985) reported that the Balanitesaegyptiaca yellowish edible oil is released by extended boiling of the fruit seed.The need for vegetable oil is rising worldwide so it has to be to look for good sources for the production of high-quality oil can be exploited for manufacturing purposes (Ahmed and Okasha, 2016**)**. Therefore, the present study has taken up to analyse the

physico-chemical parameters of Balantiesaegyptiaca (laloub) seed oil because of its economical and nutritional importance.

Figure 1: Heglig (Balanitesaegyptiaca) fruit

MATERIALS AND METHODS

Materials

Balanites aegyptiaca fruitswhich collected from a tree grown in Brack, Libya werekindly provided, identified and authenticated by Department of Envermintal Scineces, Faculty of Engineering Scineces and Technology, Sebha University. Fruits were then crushed and seeds were then obtained. seeds was collected, cleaned with water to remove the impurities and were then ground using grinding machine. ground seeds were then stored in the laboratory for further analysis.

Methods

Proximate Composition of Balanites aegyptiaca seed

Proximate analyses of the samples i.e. moisture, crude protein, ash and crude fat, were carried out according to Association of Official Analytical Chemist (AOAC, 2008). Carbohydrate was calculated by difference.

Extraction of oil

Samples (1Kg) of dried groundheglig(laloub)seed were taken into the soxhlet apparatus. A piece of cotton is placed at the top and bottom of the apparatus to evenly distribute the solvent as it drops on the sample during extraction.

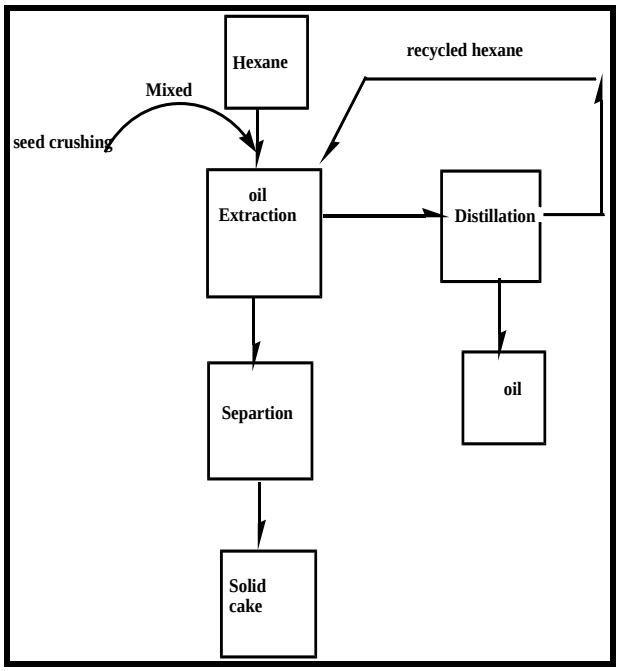

Figure 2: Oil extraction flow chart using hexane solvent

Extraction was carried out with *n*-Hexane for 6 hours without interruption by heating around 60^0C (Figure 2). After the extraction over, solvent was evaporated until no odour of solvent remains and finally oil was collected in a separate beaker. The oil was stored in the chemistry laboratory room for physico- chemical properties analysis.

Physico-chemical characteristics of oil

Physical properties: colour, Specific gravity and refractive index were analyzed according to standard methods (AOAC, 2008). The viscosity of the oil were recorded using Ostwald U-tube viscometer according to Cocks and Van Rede (1966). Chemical properties: acid value andsaponification number of oil were determined According to B.S.I (1984). The peroxide value (PV) of oils was determined according to Wail et al. (1995). The iodine value (I V) of the oils which quantifies their unsaturation level was determined according to the B.S.I (1985). Statistical analysis of the results was carried out and expressed as mean $\pm$ SE.

RESULTS AND DISCUSSION

Result of the proximate composition of Balanites aegyptiaca seed is shown in Table 1. The moisture content is 03.16 (±0.62) %, ash content 02.98 (±0.55) %, crude fibre 13.51 (±0.71)%, crude protein 32.97 (±2.62) %, fat content 42.98% and carbohydrate (by difference) 03.96 (±0.32) %. The observed low moisture content in Balanites aegyptiaca seed in this study serve as an indication that the activities of the micro-organisms would be reduced and thereby increases the shelf life of Balanites aegyptiaca sample. The observed moisture content value of 03.16% is similar with that value (03.10%) reported byBabeker (2013).The ash content is 02.98% which is lower than the value (03.19%) reported by Fregon (2005). Ash is an incombustible residue left when combustion of any substance is completed.The crude fibre content of 13.51% obtained in our sample was higher than 12.64% and 09.40% reported by Fregon (2005) and Babeker (2013) respectively, but lower than the 17.18% reported by Lohlumet al. (2012). Crude protein and oil content are 32.97% and 42.98% respectively. The crude protein content is lower than the 39.00% reported by Lohlumet al. (2012), while the observed oil content in this study is similar to that reported by Lohlumet al. (2012) and Fregon (2005), but it was lower than that reported byElfeel (2010), which was 50.00%. Carbohydrate content is 03.96% which is lower compared to the value 7.72% repoeted by Babeker(2013).

Table 1: Proximate Analysis of Balanitesaegyptiaca seed

Characteristics	Obtained Values*
Moisture	03.16 ±0.62
Ash	02.98 ±0.55
Crude fibre	13.51 ±0.71
Crude protein	32.97 ±2.62
Oil	42.98 ±3.12
Carbohydrate	03.96 ±0.32

*****Each data is mean of three replicates ± standard deviation (S.D)

The results for the physicochemical analysis of the extracted hegligseed oil were given in Table2. The percentage oil yield of the seed is 43%. The value is closely similar to that of the percentage oil yield of sweet orange seed oil (Abdulhamid et al., 2014), and higher than that of some conventional oil seed crops such as cotton (15.0-24.0%) and safflower (30-35%)and unconventional oilseeds such as canariumschwenfurthii fruits (36.1%)(Pritchard, 1991). Therefore, the heglig (laloub) seed can be considered as a potential source of vegetable oil for domestic and industrial purposes. And this high percentage oil yield in this study show that the industrial processing of the oil for soap making and edible purposes would be viable.The oil has an agreeable odour and the colour is light -yellow. The specific gravity of seed oil was 0.912 and this value is in agreement with the FAO/WHO international standard for edible oil (2009).The refractive index 1.498 was in agreement with the FAO/WHO international standard for edible oil (2009). The oil appearancewas a transparent liquid at room temperatures and the viscosity was recorded to be 18.97, which is lower than the 34 and 37cp. reported by Babagana et.al (2011) and Babeker (2013) respectively. As a result, the physical properties of the oil extracted from Heglig (Balanitesaegyptiaca) seed were in conformity withthe FAO/WHO standard (2009). On the other hand, the chemical properties of the oil are shown also in table 2. A saponification value (223.98 mgKOH/g) is higher than that of beeswax (93.0mgKOH/g) which is usually used in soap making (Mabrouk, 2005).Oil with low acid value will be stable over a long period of time and protect against rancidity and peroxidation (Aremu et al, 2015). The acid value of the oil is 1.51 mgKOH/g and this is lower than the maximum permissible acid level of 4mgKOH/g fat or oil required for edible virgin fats and oils and therefore it is suitable for consumption. This could be due to presence of natural antioxidants in the hegligseeds such as vitamins A and C as well as other possible phytochemicals such asflavonoids. Acid value is considered as an indicator of oil for use in cooking (edibility)and however for suitability of oil for use in the paint as well as soap industries. High acid value point to that the oil may not be suitable for use in cooking, but on the other hand, be useful for manufacture of liquid soap, shampoos and paints, (Aremu et al, 2006). The iodine value obtained is higher than 100 suggesting the presence of saturated fatty acids and this places the oil in the drying groups. Iodine value obtained 121.56 mg I_2/g is closely similar to 122.66mg I_2/g which reported byFrego (2005), but on the other hand higherto that reported by Manji et al. (2013), Babagana (2011) and Okia (2013)76.8, 56.4 and 98.28 mg I_2/g respectively. Peroxide value was 1.21 meq/Kg which is by far lower than the FAO/WHO standard (2009) and lower than that reported by Manji rt al. (2013) and Babeker (2013) 6.0 and 8.0 (meq/Kg) respectively. A low peroxide value as increases the suitability of the oil for a long storage due to low level of oxidative and lipolytic activities.

Table 2: Physical and chemical properties of Balanitesaegyptiaca seed oil

Physiochemical properties		Balanites aegyptiaca seed oil
Physical properties		
Organoleptic	Yield (%)	43
	Odour	Agreeble
	Colour	Light Yellow
Appearance at room temperature	Transparent liquid	
Specific gravity	0.912	
Refractive index	1.498	
Viscosity (cp)	18.97	
Chemical properties		
Acid value (mg/KOH/g)	1.51	
Iodine value I_2/g	121.56	
Saponification value (mg of KOH/g of oil)	223.98	
Peroxide value ($meqkg^{-1}$)	1.21	

CONCLUSIONS

Heglig (Balanites aegyptiaca) seed oil could be applied successfully as an edible oil. The physiochemical properties of the oil are similar to those of other edible oil utilized in food applications. The result also showed that the properties of oil could be employed for edible and cosmetics consumption. This oil exhibited good physiochemical parameters and could be useful for many industrial applications

REFERENCES

Abdulhamid A, Sani I, and andFekal I. M (2014). Physicochemical Analysis of Soxhlet Extracted Oils from Selected Northern Nigerian Seeds. International Journal of Biological,Biomolecular, Agricultural, Food and Biotechnological Engineering. 8(11): 1122 - 1124.

Abu-Al-Futuh (1989). Study on the processing of Balanitesaegyptiaca fruits for food, drug and feed industry. Chapman and Hall, London. pp. 272-278.

Ahmed, M, and Okasha, M. (2016). Olive Oil: Quality Indices. LAP Lambert Academic Publishing.

Amalraj V.A and Shankanarayan K.A., (1986). Ecological distribution of Balanitesroxburghii pi in arid Rajasthan. J Trop Forestry 2(3): 183-187.

AOAC. (2008). Official Methods of Analysis, Association of Official Analytical Chemists, Washington D.C. (15th ed).

Aremu M.O, Ibrahim H and Bamidele T.O (2015). Physicochemical Characteristics of the Oils Extracted from some Nigerian Plants Foods. (A Review). Chemical and Engineering Research. 32: 36 – 52.

Aremu M.O., Olaofe O. and Akintayo E.T. (2006). Chemical Composition and Physicochemical Characteristics of two Varieties of Bambara Groundnut (Vignasubterrenea) flours. J. Applied Sciences. 6 (9): 1900 - 1903.

BabaganaGutti, Shittu S. Bamidele and Idris M. Bugaje (2011). characterization and Composition of Balanitesaegyptiaca seed oil and its potential as biodiesel feed stock in Nigeria .Journal of TappliedPhytotechnology in environmental sanitation 1(1): 29-35.

BabaganaGutti, Shittu S. Bamidele and Idris M. Bugaje (2011).characterization and Composition of Balanitesaegyptiaca seed oil and its potential as biodiesel feed stock in Nigeria .Journal of TappliedPhytotechnology in environmental sanitation 1(1): 29-35.

Babeker , M.A .(2013) . Physicochemical Properties of Laloub Seed Oil. M .Sc .29-45 .Faculty of Agriculture, University of Khartoum.

British standard Institute Methods B.S.I (1984). Analysis of Oils and Fats. 684.

Cocks ,L.V and Van Rede ,C.(1966). Laboratory handbook for Oil and Fat Analysis . Academic Press Inc. Ltd ., London ,New York.

Elfeel A.A (2010). Variability in Balanitesaegyptiaca var. aegyptiaca seed kernel oil, protein and minerals contents between and within locations, Agriculture and Biology Journal of North America, 1(2): 170-174.

Farid, H, Haslinger E, Kunert O, Wegner C and Hamburger M., (2002). New steroidal glycosides from Balanitesaegyptiaca. Helvetica ChimicaActa. 85(4): 1019-1026.

Fregon, S. M. E. (2015). Physicochemical Properties of Balanites aegyptiaca (Laloub) Seed Oil (Doctoral dissertation, Sudan University of Science and Technology).

Guinand, Y., Lemessa, D. (2001). Wild food plants in Ethiopia. Reflections on the role of wild foods and famine foods at yime of drought. In kenyana C and hendessonA(2001). The potential pdf indigenous wild food. Workshop proceedings.USAID/OFDA. Mombassa, Kenya.

Gullick, C. (2001). Potential of indigenous food plants to support and strengthen livelihoods in southern Sudan. In Kenyatta C and Henderson A. (2001). The potential of indigenous wild foods. Workshop proceedings. USAID/OFDA, Mombassa, Kenya.

Locket C.T, Calvert C.C and Grivetti L.E., (2000). Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, northeastern Nigeria. I.n.t J Food Sci, 51(3): 195-208.

Lohlum S. A.1, Forcados E. G.1, Agida O. G.1, Ozele N.1 and Gotep J. G.1. (2012). Enhancing the Chemical Composition of Balanitesaegyptiaca Seeds through Ethanol Extraction for Use as a Protein Source in Feed Formulation, Sustainable Agriculture Research, 1(2): 251.

Mabrouk S. T (2005).Making Useable, Quality Opaque or Transparent Soap. Journal of Chemical Education. 82(10): 1534 - 1537.

Manji A. J., Sarah E. E. and Modibbo U. U (2013). Studies on the potentials of Balanitesaegyptiaca seed oil as raw material for the production of liquid cleansing agents. Department of Industrial Chemistry, ModibboAdama University of Technology, P. M. B. 2076,Yola, Adamawa State, Nigeria.

Mohamed, A.M., Wolf, W. and Spies, W. E. (2002). Physical, morphological and chemical characteristics, oil recovery and fatty acid composition of Balanitesaegyptiaca Del. Kernels. Plant Foods Human Nutrition 57(2): 179-189.

Nour, A. A. A., Ahmed, A. H. R., and Abdel- Gayoum, A. G. A. (1985). A chemical study of Balanites aegyptiaca L.(Lalob) fruits grown in Sudan. Journal of the Science of Food and Agriculture, 36 (12): 1254-1258.

Okia, C. A., Kwetegyeka, J., Okiror, P., Kimondo, J. M., Teklehaimanot, Z., and Obua, J. (2013). Physico-chemical characteristics and fatty acid profile of desert date kernel oil in Uganda. African Crop Science Journal, 21(1): 723-734.

Pritchard, J.L.R. (1991). Analysis of Oil Seeds, fats and fatty foods. Eds. Elsevier Applied Science. 80- 98. New York.

Sands, M.J. (2001). The desert date and its relatives: A revision of the genus Balanites. Kew Bulletin 56 (1):1-128.

Von MaydellHJ., (1986). Trees and shrubs of the Sahel: their characteristics and uses. Eschborn, GTZ, Germany.

Wail, S.; Sue, T.T. and Yew Ai, T. (1995). Palm Oil Research Institute of Malaysia. Ministry of Primary Industries. Malaysia. Published by Palm Oil Research Institute of Malaysia.