

Extraction and evaluation of oil from water melon (*Citrullus lanatus*) seed

Abstract

The water melon fruit (*Citrullus lanatus*) seeds were obtained from discards of fruits and prepared for use by decoating, sun drying and grinding. Light yellow coloured oil was obtained by solvent extraction using petroleum ether and the following characteristics were obtained using petroleum ether: pH, refractive index, density, solvent miscibility, congealing temperature, flame nature, specific gravity, flash point and heat of combustion. Fire point and % yield. The saponification, iodine, peroxide value and unsaponification matter were determined according to the standard method of analysis oil yield of 40% was obtained. The solvent miscibility of the oil was determined by physical observation of the uniform blending of oil sample in alkali (NaOH), acid, (HCl), ether, water, sodium hydrogen carbonate solution and carbonate solutions at room temperature, 40°C, 60°C, 80°C and 100°C. The results show refractive index (1.50 at 27°C) high level of acid value 85% (0.85), with the presence of oleic acid, stearic and palmitic acid and traces of linoleic acid and absence of arachidic, myristic and linolenic acids. With very low level of unsaturation, marked level of oiliness, and presence of high level of reasonable amount of free fatty acids. The low value of the congealing temperature of the oil gave an indication that the oil can be handled in other regions irrespective of the difference in temperature. The trace level of linoleic acid of the oil gives an indication of high degree of stability.

Keywords: water melon, extraction, physicochemical properties, fatty acid composition, *Citrullus lanatus*

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Adedeji TO

Department of Food Science and Technology, Osun State Polytechnic, Nigeria

Correspondence: Adedeji TO, Department of Food Science and Technology, Osun State Polytechnic, P.M.B. 301, Ire, Nigeria, Tel +234 8066514332, Email temileyeadejideji@yahoo.com, temileyeadejideji2@gmail.com

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Introduction

The water melon (*Citrullus lanatus*) fruit belongs to the family of cucurbitaceae. The plant produces a special type of fruit known by botanists as a berry which has a thick rind (exocarp) and fleshy center (mesocarp and endocarp).¹ Water melon fruit has a smooth exterior rind, green, juicy, sweet interior flesh (dark red). The inner rind being white or light green. This fruit contains about 6% sugar and 90% water by weight and a lot of nutrients like carbohydrate, fat, protein, minerals like calcium, iron, magnesium, phosphorus, potassium, and Zinc and Vitamins like vitamin B, C and notably Vitamin A through its concentration of beta- carotene.² It is also packed with some important natural and powerful antioxidants which travel through the body neutralizing free radicals which cause damage to human body Wolford et al.³ Water melon plays an important role in African as it is used to quench thirst when there is shortage of water.⁴ The seed of water melon (*Citrullus lanatus*) can be bruised and rubbed up with water to form an emulsion which can be used to cure catarrh infections, in disorder of the bowels, urinary passage and fever. It is also being used as worm expeller.⁵

The extraction and characteristics of oil from fruit seed have been carried out but little has been done on the physiochemical properties and fatty acid composition of the oil from water melon seed. The chemical composition of the oil extract gives a qualitative identification of oils which reveals guide in its commercialization and utility i.e iodine value gives an index of the drying and polymerizing properties of oil while flash points indicates a substantial removal of solvent from a solvent extracted oil.⁶ The characterization based on different fatty acids group gives an insight into the distribution of acids in the unsaturated fraction among oleic, linoleic and linolenic acids. The aim of this research work is to extract oil from water melon seed, find use for the seed and assess the quality of the oil so as to find application for its use.

Materials and methods

The fruit seeds were obtained from local fruit vendors, prepared for use by decoating, sundrying and grinding. A 5litres capacity soxhlet extractor was used for the extraction of oil from the seed at a temperature of 40°C with petroleum ether solvent. Extraction was done continuously for 18hours⁷ after which the solvent was covered by simple distillation and the residual oil was oven-dried at 60°C for one hour. The oil was allowed to cool in a desiccators before being weighed. The extracted oil was well sealed in dark brown colored glass bottle and kept for analysis. Solvent miscibility of the oil was determined by physical observation of the uniform blending of oil samples in acid (HCl), alkali (NaOH), Sodium hydrogen carbonate solution, ether and water at room temperature, 4°C, 60°C, 80°C and 100°C

The nature of the flame of burning oil sample was determined by heating the oil in a stainless saucer and at the start of smoke, placing a clean white ceramic plate 25cm above the oil sample and the ceramic plate is removed after a period of about 20mins and observed for the presence of soot. The congealing temperature was determined crudely by putting 20mls of the dried oil sample in a 100ml beaker and inserting a simple laboratory thermometer into the oil and putting it in a freezer. The pH of the oil was determined according to the official method of analysis of the society of Leather Trades chemist⁸ Density was determined using a density bottle at 25°C and this is the ratio of the mass of the oil to its volume. The refractive index, specific gravity, heat of combustion smoke point, flash point and fire point were determined using standing methods.⁹ The oil sample was then taken for determination of acid value, free fatty acid, saponification value, iodine value, peroxide value and unsaponifiable matter according to the standard method of analysis.¹⁰

Results and discussion

Table 1 shows the physico-chemical properties of watermelon seed oil. The yield of the seed oil was found to be 40%. The pH value of 3.89 suggests that the oil is acidic, which is indicative of the presence of free fatty acids in the extracted oil. The oil was found to be miscible with ether which shows that the oil contains unsaturated free fatty acids that confers on its industrial utility. The oil was found to have a congealing temperature of -15°C to 20°C. The refractive index of the oil was 1.46 at 25°C while the Rf values was determined to be 1.7cm which falls within values reported for similar seed oils 1.48 for *Teleferia occidentalis* seed oil and 1.47 for corn oil.⁵ The specific gravity obtained was found to be 0.9g/ml at 15°C. This is very close to the values 0.89–0.92g/l reported for edible oil.¹¹

Table 1 Physico-chemical properties of water melon seed

Parameters	Physicochemical values
pH	3.89
Refractive index	1.46 at 25°C
Specific gravity	0.90ml at 15°C
Retention factor (Rf value)	1.7cm
Congeeing	
Temperature	- 15 to 20°C
Smoke point	150°C
Flash point	153°C
Fire point	175°C
Heat of combustion	9.717kcal/g
Flame nature	Non sooty
Solvent	Soluble in ether
Miscibility	
Product% yield	40%
Acid value	85%
Saponification Value	116.54mg/k (Hg.sup-1)
Iodine Value	60.43g /100g
Peroxide value	19
Unsaponifiable matter	0.9

The acid value of the oil was found to be 85 percent while the oil had the saponification value of 116. The unsaponifiable matter content of the oil was found to be 0.9. The iodine value and peroxide value of the water melon seed oil were determined to be 60.43g/100g and 19.00 respectively. The value of the product yield makes the industrial practice of the oil recovery a profitable venture, and will reduce the level of waste that is obtained from the juice making industry. Thereby, encouraging sustenance of the cultivation of seedy species of water melon fruit. The low pH level is indicative of the presence of a reasonable amount of fatty acids in the oil which is a good indicator of the advantageous utilization of the oil as a result of the presence of free fatty acids.

Table 2 shows the result of the fatty acid composition of the oil. The preferential solubility in the ether shows that the oil has high level of unsaturated free fatty acids bearing in mind that oil rich in unsaturated fractions are readily soluble in ether while those rich in saturated fractions are insoluble in ether. The presence of a high amount of unsaturated free fatty acids in the oils identifies the oil as one that can undergo polymerization and this imparts on the oil a level of industrial utility.⁷

Table 2 Fatty acid composition of watermelon seed oil

Analysis	Result
Free fatty acids	
Saturated	
Palmitic acid	6.00%
Stearic acid	5.00%
Myristic acid	Nil
Arachidic acid	Nil
Unsaturated	
Oleic acid	60%
Linoleic acid	Traces
Linoleic acid	Nil

The refractive index of 1.47 and the retention factor/Rf value of the chromatogram show the degree of purity of the oil. Though the result may change with different methods of extraction, the level of purity desired can easily be obtained by little process modifications, like filter pressing or centrifugation. The low values of congealing temperature of the oil gives an indication that oil can be handled in very many geographical regions, irrespective of temperature changes. The smoke, fire and flash points of the oil have a linear relationship with the context of free fatty acids presents.⁷ Also, the higher the amount of free fatty acid present in an oil sample, the higher the nutritional value, consequently, the water melon seed oil with a smoke point of 150°C deductively has a good degree of free fatty acid.

The presence of more than one free fatty acid in the oil gives it the status of a mixed triglyceride or compound glyceride the presence of oleic (Octadeca-9-enoic) and linoleic (octadeca 9, 12-dienoic) acids in the oil, classifies the water melon seed oil as belonging to the oledec-linoleic group of fatty acids.¹² The Saponification number value projects the oil in a good light in such areas as soap making and in the detection of adulteration of the oil. The Saponification value of 190 indicates that the oil has a saponification equivalent of 292.21.¹³ The iodine value of (110) places the oil in a position in-between the non-drying and semi-drying oils. This implies that the oil can be used in the production of paints vanish and lubricant. The stability of the oil was because of the absence of traces of linoleic and other polyethanoid acid in the oil which can causes oxidative rancidity therefore, making it good for edible purposes.¹⁴ The golden-yellow colour gives an indication of the presence of carotene which can be converted to Vitamin A, therefore giving the oil a medicinal value.

Conclusion and recommendation

In view of the above findings, the industrial extraction and commercialization of this water melon seed oil will reasonably

enhance the profit status of most fruit juice, beverages, pharmaceutical resins, paint and soap making and livestock feed industries and as well encourage the sustenance of the cultivation of the seedy species of water melon fruit.

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None.

Conflict of interest

Author declares no conflict of interest.

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