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Physico-chemical and functional properties of watermelon (*Citrullus lanatus*) seed-oil

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Citrullus lanatus (water melon) is popular fruit and the seeds were rich in oil and protein, this oil could be exploited as edible oil. *Citrullus lanatus* contains about 6 per cent sugar and 92 per cent water by weight. As with many other fruits, it is a source of vitamin C. The seed being an excellent source of energy and the dried composition of watermelon per 100 g edible portion (50-70% of the mature fruit) include: water 91.5 g, energy 134 KJ (32 kcal), protein 0.6 g, fat 0.4 g, carbohydrates 7.20 g. The favorable functional properties makes the seed and the oil suitable for human consumption and therefore the result of this research work would provide further information on the domestic and industrial usage of the seed and seed-oil.

Key Words : Watermelon seed, Seed-oil characteristics, Functional properties, Physico-chemical, Quality

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INTRODUCTION

Watermelon is one of the drought tolerant crop which belongs to the Cucurbitaceae family of flowering plants. It is generally considered to be of the Citrullus species and has been referred to as *Citrullus vulgaris*. It can be placed as "simple multi grains pulp fruits" in the classification of edible fruits which are called "Pepo" fruits (Naseri Pouryazdi and Tehrani Far, 1995), grown in the warmer part of the world the juice or pulp from watermelon is used for human consumption while rind and seeds are major solid wastes. The rind is utilized for products such as pickles and preserves as well as for extraction of pectin (Hasan, 1993), whereas seeds are a potential source of protein (Teotia and Ramakrishna, 1984; Kamel *et al*., 1985 and Lazos, 1986) and lipids (El-Adawy and Taha, 2001). Melon seeds are used for oil production at the subsistence level, Cucurbit seeds are source of food particularly protein and oil (Hassan *et al*., 2008). Dehulled cucurbit seeds were reported to contain about 50 per cent fat and 35 per cent protein (Martins, 1998), and therefore there is need to source for good, cheap and novel source of oils that would be useful domestically and perhaps industrially. The aim of this research work is to determine some functional properties of the seed oil physicochemical properties of the oil extract with a view of harnessing it for consumption and possible industrial usage.

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METHODOLOGY

Collection and sample pre-treatment:

Matured watermelon fruits (fresh condition) were purchased from the market. The fruits were sliced using a clean stainless steel knife. The seeds were collected and washed severally with distilled water and sun-dried for a week, sorted to remove bad ones, shelled, grinded with a laboratory blender, packed in an air tight container and stored in a dessicator (containing silica gel) ready for further analysis.

Methods:

The A.O.A.C (2005) method is used for determine the proximate composition and carbohydrate was done by difference method. The oil content of the powdered seed was done using soxhlet type of direct solvent extraction of the sample with petroleum ether (b.pt. 60-80°C). At the end of the extraction, the solvent was evaporated and the flask dried in the oven at 60°C (Ojieh *et al.*, 2009), The physicochemical properties of the oil extract for specific gravity, iodine, peroxide, saponification and acid values were determined as described by A.O.A.C methods. The functional properties for foaming capacity and stability, oil and water absorption capacities and emulsion stability (after 12 hr) of the seed were determined according to the methods described by Arawande and Borokini (2010).

Physico-chemical properties:

The crude fat by the Soxhlet method (7.056) and the total nitrogen (Micro-Kjeldahl, 2.057) were determined according to the methods of the A.O.A.C (Helrich, 1990). The protein was calculated as N 95.3 (Helrich, 1990). The refractive index (RI, at 30°C), the acid value (AV, Cd 3a–63), the peroxide value (PV, Cd 8–53), the Saponification value (SV, Cd 3–25), the iodine value (IV, Cd 1–25) and the unsaponifiable matter (UM, Ca 6a–40) of the oil samples were determined according to the A.O.C.S.

OBSERVATIONS AND ASSESSMENT

According to Table 1, the moisture content of the seed was found to be 6.14 per cent. This value is higher compared to 5.70 per cent reported for it by FAO (1970) but similar to 6.46 per cent and 6.56 per cent reported for cotton seeds and sunflower seeds (FAO, 1982).

The protein content was 24.50 per cent which was similar to the 24.69 and 20 ± 0.12 per cent obtained for

Table 1 : Chemical composition of melon seed

Sr. No	Parameters	Mean %
1.	Moisture	6.14
2.	Fat	20.0
3.	Protein	24.5
4.	Carbohydrates	45.10
5.	Crude fibre	5.25
6.	Ash	2.0

* Means of duplicate analyses

Table 2 : Physico-chemical properties of watermelon seed oil

Sr. No.	Property	Mean ± S D
1.	Refractive index (30^{0}C)	1.4712 ± 0.001
2.	Saponification value (mg KOH/g oil)	218 ± 0.1
3.	Iodine value (g I/100 g oil)	112 ± 0.2
4.	Acid value (mg KOH/g oil)	4.4 ± 0.1
5.	Peroxide value (mequiv O_2/kg oil)	3.24 ± 0.1
6.	Unsaponifiable matter (% g/g oil)	0.50 ± 0.2
7.	Induction time (h) at 110 ^{0}C	5.41 ± 0.1
8.	Oil yield (g/100 g dry seed)	50 ± 0.2
9.	Protein yield (g/100 g oil-free seed)	47 ± 0.1

* Results are average of duplicate determinations ± S D

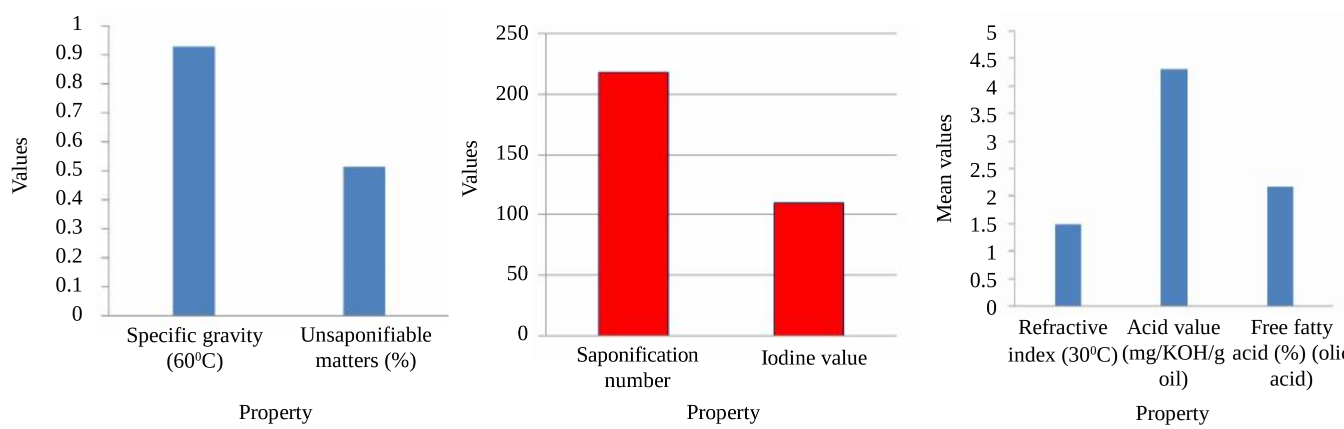

Fig. 1 : Graphical representation of seed oil property

unfermented groundnut and sesame seed by Ojokoh and Lawal (2008) and Nzikou *et al*. (2009), respectively, value obtained for crude fat was 20.0 per cent. The ash content of the seed flour was found to be 2.0 which was a lower comparable to 6.51 reported for jack bean by Arawande and Borokini (2010), the crude fibre for the seed was found to be 5.25 which is lower compared to 11.88 reported for fluted pumpkin by Adebisi and Olagunju (2011), the carbohydrate content obtained was 45.10 which was higher compared to 26.00 per cent reported for sunflower (FAO, 1982).

Some of the physico-chemical properties of watermelon seed oil presented in Table 2 and Fig. 1. The specific gravity values compared well with the 0.915 value reported by Kamel *et al*. (1985) and Badlfu (1991). The oils had relatively high iodine values, thus reflecting a high degree of unsaturation. Saponification numbers were relatively higher than those reported in the literature for cottonseed oil (189-198) but were relatively lower than those for coconut oil (248-265) (Codex, 1982).

The RI for watermelon seed oil and those of soybean and sunflower were similar. This similarity in RI suggests that these three sets of oils have similar degrees of unsaturation. The SV of watermelon seed oil (218 mg KOH/g oil) clearly suggests that watermelon seed oil consist mainly of medium-chain fatty acids (*i.e.*, C16 and C18). The IV for watermelon seed oil, 112 g I/100 g oil is higher than the range of IV for soybean and sunflower oils, 110–143 g I/100 g Oil, reported in (Lidefelt, 2007). However, the differences in the IV were small and this again corroborates the inference drawn from the RI value at 30^0C is 1.4712 regarding (Fig. 1).

The UM of watermelon seed oil is 0.50 g was more than soybean and sunflower seed oils. The UM of oil include tocopherols, sterols, triterpenic alcohols, hydrocarbons, aliphatic alcohols, and waxes. Generally, these results were in good with those reported by El-Adawy and Taha (2001) for watermelon seed oil except IV (112 g I/100 g oil) and UM (0.50% g/g oil) values were observed and indicate in Table 2.

Conclusion :

The research work is an indication that great potential exists for the use of watermelon seed instead of throwing them away as waste after consuming the pulp. The seed could be used in infant food formulation and the seed-oil could also be a useful source of oil for both domestic and industrial uses instead of depending solely on palm oil and peanut oil that are scarce and costly. Watermelon seeds could be utilized successfully as a source of edible oils for human consumption. Watermelon seed oil might be an acceptable substitute for highly unsaturated oils. Considering that the watermelon seed oil was highly unsaturated oil, the induction time of 5.41 h at 110^0C might indicate the presence of natural antioxidants in this oil.

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