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EFFECTS OF DRYING METHODS ON PROPERTIES OF WATER MELON (*Citrullus lanatus*) SEED OIL

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ABSTRACT

An experiment to investigate the effect that different drying methods would have on the quality and quantity of oil from water melon (*Citrilus lanatus*) seeds was conducted. The water melon seeds were removed from the pod and washed. The sample was weighed and divided into two equal parts; one part was subjected to sun drying while the other part was subjected to oven drying (at a temperature of $30^{o}C$). Drying by sun as expected was gradual as compared to the oven drying method which was faster and more rapid. The dried seeds (sun-dried or oven-dried) were de-husked, dry-milled into fine crumbs using hand milling machine. The powdered product from the mill was then subjected to oil extraction using hexane as solvent.

Results show that there was no significant difference in the quantity of oil obtained from either of the samples. The sun-dried sample yielded 56% of oil/100g of seeds, compared to the oven-dried samples which yielded 57% of oil/100g of seeds. However, it was observed that Free Fatty Acid (FFA) and Acid values were higher in oven-dried sample relative to the sun-dried sample; whereas other chemical properties were not affected. Free Fatty Acid value for the oven-dried sample was 6.4% and 2.4% for the sun-dried sample. This is an important variable in considering the quality of oil because the lower the FFA, the better the quality of the oil.

Analysis also revealed that the properties of oil extracted from both samples fall within that of non-drying oil. Crude protein in the seed was 26 % which compared favourably with high protein seeds and nuts like cowpea (22.7%) soybeans (35%). This implies that the oil samples are edible to humans. The high protein content of the seed coupled with a fairly high concentration distribution of the Amino acids makes the seed suitable for fortification of foods while the oils can serve as a good supplement in animal feed formulation. Oil from the sun-dried sample will however be preferable because of its low acid value though the extracted oil from the two samples still needs to be refined. Meanwhile, the oil samples may not be used as alkyl resin for manufacturing of paints or bar soap due to their low saponification values. Large quantity of potassium hydroxide will certainly be required to prepare soap from these oils.

KEY WORDS: Sun-dried, Oven-dried, Watermelon, Seeds

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INTRODUCTION

The edible fruit of watermelon *(Citrullus lanatus)* belongs to the family *cubitaceae*. The fruit contains many obovate, smooth compressed seeds thickened at the margin and of a black or yellowish white colour [1]. Watermelon plays a very important role in Africa as it is used to quench thirst when there is shortage of water [2]. The seed of watermelon (*Citrullus lanatus*) can be bruised and rubbed up with water to form an emulsion, which can be used to cure catarrhal infections, disorders of the bowels, urinary passage and fever. It is also being used as worm expeller; in recent years it has been used to expel tape worm [1]. Watermelon seed oil is light, penetrating and rich in essential fatty acids [3]. This research was designed to observe the effect of two drying methods on the physico-chemical properties of the seed oil and determine its edibility, suitability for paints, alkyl resin and soap making.

MATERIALS AND METHOD

The watermelon fruits were obtained from Panseke, a local market in Abeokuta, Ogun State, in the South Western part of Nigeria. The flesh was removed and the seeds collected were washed and dried for easy removal of the epicarp. The Melon seeds were then divided into two, one portion of which was subjected to sun-drying while the second was oven-dried. Each sample of 100gm was dry-milled and the oil content was extracted by Soxhlet extraction method before being subjected to physico-chemical analyses.

Proximate analysis, refractive index, iodine value, saponification value, free fatty acid, peroxide and acid values were determined by methods already described in the AOAC [4]. Ester value was obtained by finding the difference between the saponification value and the acid value. The viscosity of the oil value was determined by pouring the sample into the viscosity apparatus. Time in seconds required for the flow was recorded and multiplied by the constant 1.073. The specific gravity was taken at $20^{o}C$ using density bottle. In order to determine the amino acids, the seed protein was hydrolysed for 3 hours with 6N HCl. The amino acid was derivatized and analyzed with an HPLC [5].

RESULTS

The summary of the proximate composition of watermelon (*Citrullus lanatus*) seed is shown in figure 1 and Table 1.

The moisture content of the seed is quite low (4.91%) and falls within the range of moisture contents of similar seeds. The ash content (3.88%) obtained during proximate analysis is higher than the established value for animal feed [6]. Figure 1 presents the composition of sundried watermelon seed from the result of the proximate analysis. The figure also shows clearly that fat, crude protein and nitrogen free extract are highest.

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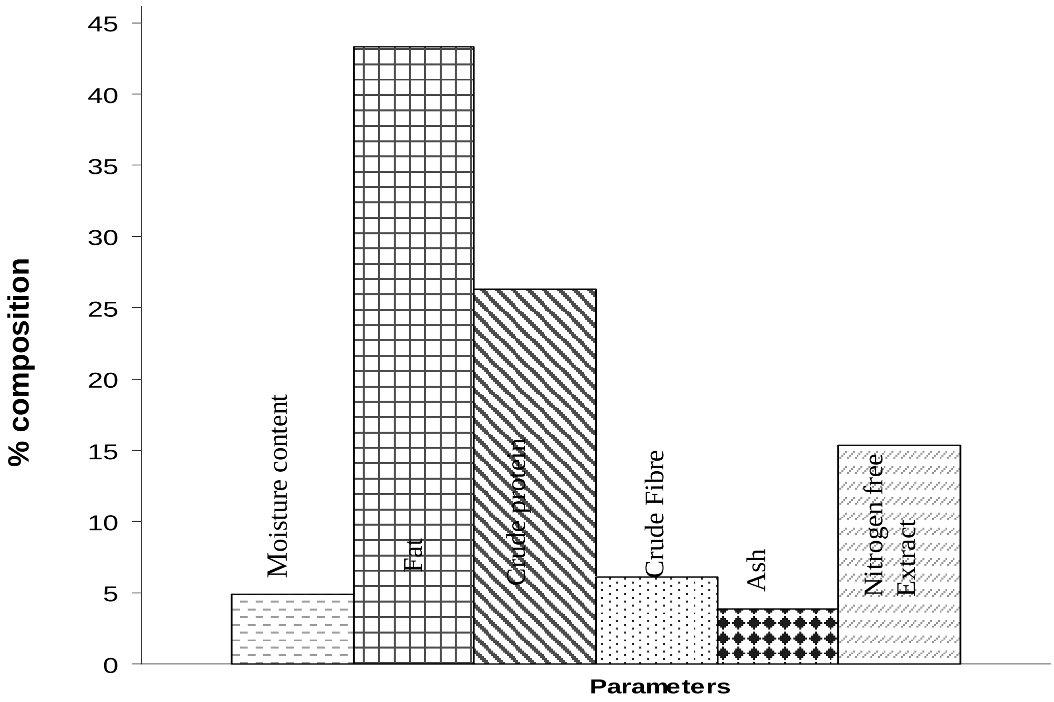

Fig. 1: Proximate Composition of sundried *Citrillus lanatus* seed oil

Figure 2 compared sundried watermelon seed oil with other edible seed oil. The figure shows that soybean has highest content of protein (35%) followed by watermelon

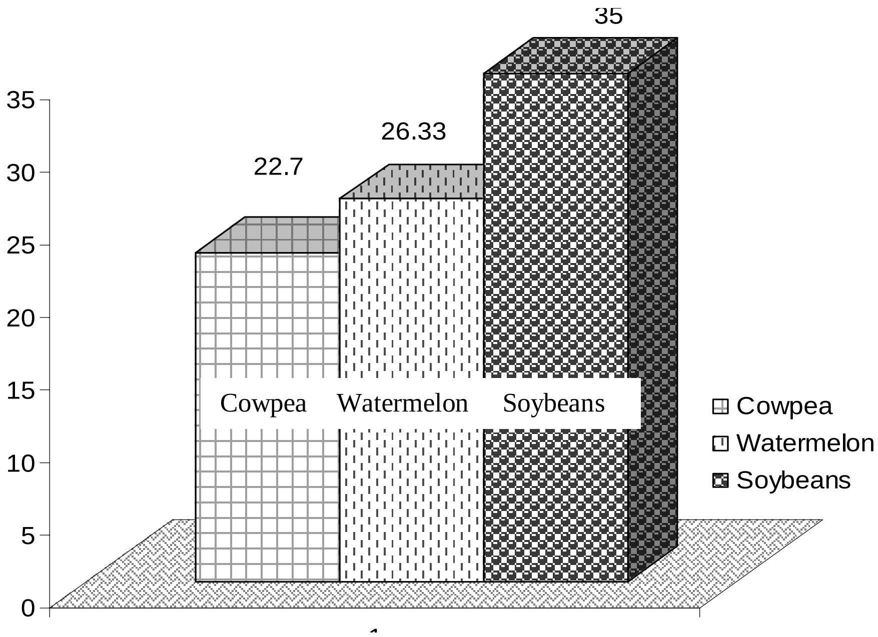

Fig. 2: % crude protein of watermelon seed oil relative to other edible seed oil

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(26.33%) while cowpea has the least value (22.7%) [7].

In table 2, sixteen amino acids detected in the protein concentrate were as presented: Tyrosine showed the highest concentration (10.9g/100g) ahead of glutamic acid with a value of 6.01g/100g and arginine with 4.29g/100g of seed.

Figure 3 summarizes amino acid composition in watermelon seed.

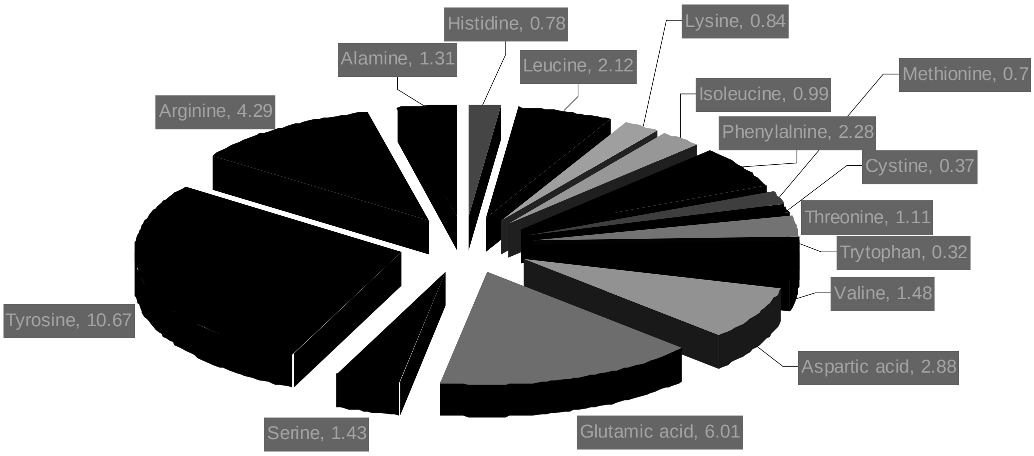

Fig. 3: Summary of amino acid composition of *Citrillus lanatus* seed oil

Table 3 presents the physico-chemical properties of oil from watermelon seeds. Soxhlet extraction of the oil with Hexane (at 60^{o}C) gave light yellow colour oil with a yield of (43.32%) from the oven-dried samples and a yield of 40.28% from the sun-dried samples. Free Fatty Acid (FFA) value for the oven-dried sample was 6.4% and 2.4% for the sun-dried sample.
The peroxide, refractive index, pH and specific gravity values were same for both drying methods. The oil from oven dried seeds was almost similar to that from sun dried seeds in refractive index; this fact is buttressed in the slight differences in colour (yellow and yellowish brown, respectively). Saponification value, ester, and iodine content values were all slightly higher in the oil extracted from the oven-dried seed sample compared to the one from the sun-dried samples

The specific gravity obtained for both was 0.86g/ml; this is very close to the values 0.89 – 0.92g/ml reported for edible oil [9]. The refractive index falls within values reported for similar seed oils, 1.48 for *Teleferia occidental* seed oil, 1.47 for soybean and 1.47 for corn [1]. Figures 4 and 5 clearly depict these comparisons.

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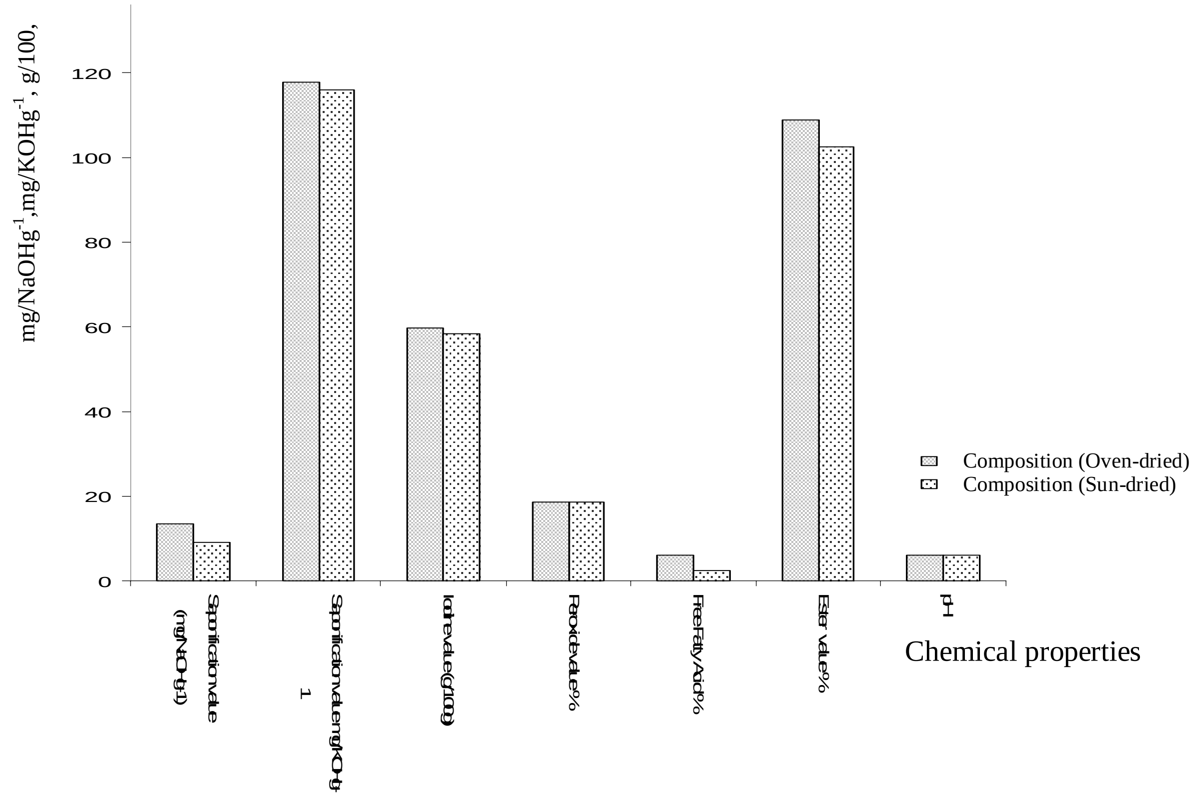

Fig. 4: comparison of the chemical composition of the two samples

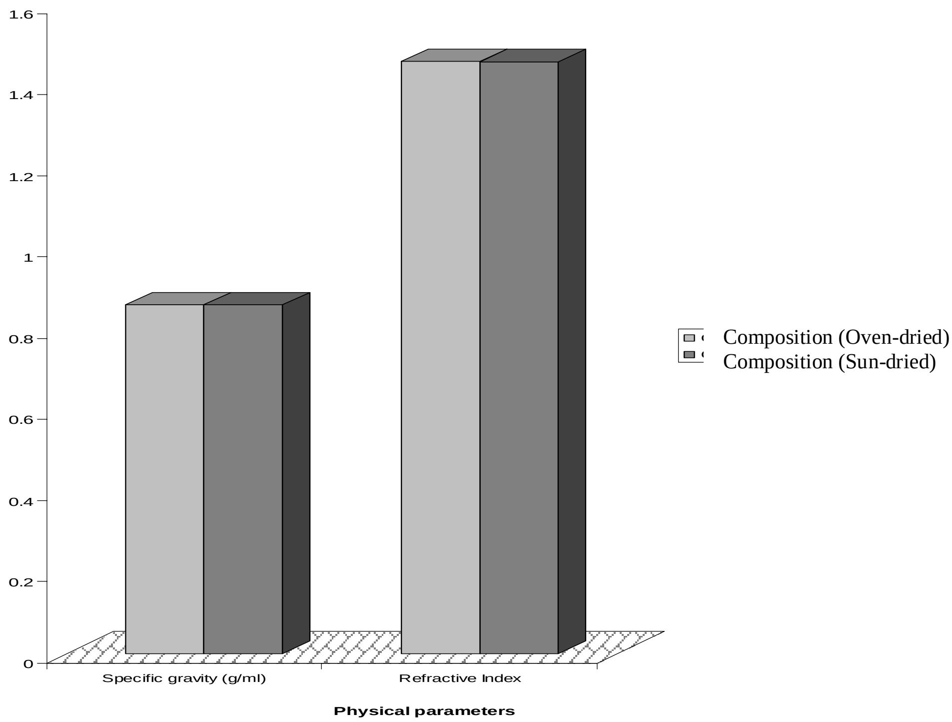

Fig 5: comparison of the physical parameters of the two samples

DISCUSSION

The low moisture content of watermelon seed is advantageous in terms of shelf life of the seed, with less moisture content seeds able to be preserved for a longer period. From literature, ash content for nuts, seeds and tubers should fall within acceptable limits for edible oils (1.5-2.5%) in order to be suitable for animal feed. High ash content in seeds makes it unsuitable for compounding feed. The high quantity of oil content is an indication that watermelon seed is another ready source of oil like the peanut and soybean seeds. The high protein content of the oil has a good implication in a society with high protein deficiency. The fairly high concentration of the amino acids makes the seed suitable for fortification of foods; watermelon oil will therefore be good for frying snacks and in soup preparation.

Free Fatty Acid value of oil from the oven-dried sample was 6.4% while 2.4% was recorded for the sun-dried sample. FFA value is an important variable in considering the quality of oil because the lower the free fatty acid, the better the quality of the oil. By inference it therefore implies that oil extracted from the sun-dried sample is of better quality because of its low free fatty acid (2.4%) and acid value (8.98mg/NaOHg^{-1}) which fall within acceptable limits for edible oils $\leq$10mg/NaOHg^{-1} [8].

Oil extracted from both samples (sun-dried or oven-dried) did not change after being stored for more than two months. This is an indication that the oil regardless of how the seeds were processed can be preserved for long periods even at room temperature. Large quantities of the oil can be kept for domestic purpose without fear of it going bad.

It is clear from the results that the drying method has no effect on the peroxide value, and specific gravity. It however does have effect on a number of other physical parameters that may in the long run determine the level of acceptability in the market. For instance colour and odour can affect acceptability.

CONCLUSION

The high protein content of the watermelon seed coupled with a fairly high concentration of the amino acids make the seed suitable for fortification of foods. The sun dried sample is preferred because of its low acid value though oil extracted from the two samples needs to be refined. These oils can serve as supplement in the formulation of animal feed.

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Table 1: Proximate composition of *Citrullus lanatus* seed oil

Parameters	Composition %
Moisture	4.91 ± 0.03
Fat	43.32 ± 0.07
Crude Protein	26.33 ± 0.01
Crude Fibre	6.10 ± 0.02
Ash	3.88 ± 0.06
Nitrogen Free Extract	15.37 ± 0.12

Mean ± standard deviation of three replicate analysis.

Table 2: Amino Acid composition of *Citrullus lanatus* seed oil (g/100g)

Parameters	Composition
Histidine	0.78
Leucine	2.12
Lysine	0.84
Isoleucine	0.99
Phenylalnine	2.28
Methionine	0.70
Cystine	0.37
Threonine	1.11
Trytophan	0.32
Valine	1.48
Aspartic acid	2.88
Glutamic acid	6.01
Serine	1.43
Tyrosine	10.67
Arginine	4.29
Alamine	1.31

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Table 3: Physico-chemical properties of Citrullus lanatus seed oil

Parameters	Composition (Oven-dried 30°C)	Composition (Sun-dried)
Colour	Yellow	Yellowish brown
Specific gravity	0.86g/ml	0.86g/ml
Refractive Index	1.459	1.458
Acid value %	13.40 ± 0.5mg/NaOHg^{-1}	8.98mg/NaOHg^{-1}
Saponification value	117.81mg/KOHg^{-1}	115.94mg/KOHg^{-1}
Iodine value (g/100g)	59.69	58.42
Peroxide value %	18.75	18.75
Free fatty acid %	6.24	2.40
Ester value	108.84	102.48
pH	6.16	6.11
Viscosity	11.80mm^2/sec	10.73mm^2/sec

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