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PHYSICOCHEMICAL CHARACTERIZATION OF BREADNUT (*Artocarpus altilis*) SEED OIL

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ABSTRACT

Some physical and chemical properties of breadnut (Artocarpus altilis) seed oil were investigated. The oil was found to be pale-yellow in colour and thick, but not solid at room temperature. It sets at 11.3° C and melts at 42.3° C, has specific gravity of 0.82 and a refractive index of 1.46 at 40° C.

The total oil content of the seed was found to be 4.64%. The oil had an unsaponifiable matter content of 2.93% and a saponification value of 238.43. The iodine value was 46.83, while the acid and peroxide values were 1.15 and 14.6, respectively. The free fatty acid content of the oil was 1.89% . Although the oil has some advantageous physicochemical properties, this sample is not an oil seed because of its very low crude fat content.

KEY WORDS: Breadnut (Artocapus altilis) seed oil, specific gravity, physicochemical properties.

INTRODUCTION

The genus Artocarpus is a member of the family moraceae that occurs mainly in the tropics. The species Artocarpus altilis has two varieties, the seedless type (breadfruit) and the seeded form known as 'breadnut' (Purseglove 1974).

Much of the work reported in the literature are no the seedless variety (Purseglove 1974). There is no description in the literature of the physiochemical properties of Artocarpus altilis seed oil. The present communication reports the physico-chemical properties of Artocarpus altilis seed oil.

MATERIALS AND METHODS

Sample Collection and Preparation

The mature fruit of the plant were collected from Rumuji village in Rivers State,Nigeria. The seeds were then separated from the fruits, washed with plain tap water, dehulled and dried in an air circulating oven (Cosair Heating and Catering Ltd,) at 45° C to 50° for 20hours. The seeds were then ground into a fine powder using a manual grinder (CORONA, Landers and CIA S.A.). The prepared sample was packed in polythene bags and stored in screw capped bottles at 10°C until required for analyses. Oil used for percentage lipid content of sample was obtained by soxhlet extraction method using about 2g of the seed flour. Oil used for the other analyses was obtained by bulk extraction in which a large amount of the seed flour was soaked in petroleum either for two days and later filtered and the solvent evaporated off. The oil so extracted was preserved in screw capped bottles at 10°C until required.

Sample Analyses

The percentage lipid content of the sample was determined using Analar grade reagents and the AOAC (1975) method. The percentages of unsaponifiable matter and moisture in the sample were determined according to the procedures recommended by the AOCS (1973) method. The method of Folsch et al (1975) was used to extract and purify the lipid for analysis. The acid value of the lipid was determined by the method of the British Standards (BS 684, 1988) and the peroxide value by the method of Vogel (1974). The specific gravity of lipid was determined by the AOAC (1965) method while the saponification and iodine values were obtained using the respective methods recommended by AOCS (1973). Also determined were melting and setting points (AOCS, 1970) and the free fatty acids (Devine and Williams, 1961). The refractive index was determined at 40°C using Abbe Refractometer (Bellingham and Stanley Ltd, London).

RESULTS AND DISCUSSION

Results of the analyses are shown in Tables 1 and 2. The oil was pale-yellow in colour and constituted 4.64% of the seed components. This low

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Table 1: Physical properties of Breadnut seed Oil (Mean ± SD)*

Colour	Pale-yellow
Melting point	42.3° C ± 0.6° C
Setting point	11.3° C ± 1. 15° C
Specific gravity	0.82 ± 0.02
Refractive index, n_D^{40}	1.469 ± 0.001

* Mean of three independent determinations.

Table 2: Chemical properties of Breadnut seed Oil (Mean ± SD)*

Total Lipid (%)	4.64 ± 17
Unsaponifiable matter (%)	2.93 ± 0.10
Saponification value	238.43 ± 0.01
Iodine value	46.83 ± 0.23
Acid value	1.15 ± 0.03
Peroxide value	14.60 ± 0.30
% Free fatty acid as oleic acid	..89 ± 0.02

* Mean of three independent determinations.

total lipid content showed that breadnut is not an oil seed. Breadnut is, therefore, very good for those requiring oil-free diets. The specific gravity of 0.82 determined for breadnut oil is in agreement with the specific gravities of other oils (Hilditch and Riley, 1964), but lower than that of rubber seed oil (Eka, 1977). The refractive index of 1.469 obtained is in agreement with values obtained for some Nigerian fruits and seeds (Dosunmu and Ochu, 1995).

This refractive index is indicative of the fact that breadnut oil has constituent fatty acids with similar hydrocarbon chain length as the seeds and fruits studied by Dosunmu and Ochu (1995). The high melting point 42.3°C suggests that breadnut oil has a high proportion of saturated fatty acids. Melting point generally decreases with an increasing proportion of unsaturated fatty acid glycerides. This melting point of the sample oil is much higher than that of rubber seed oil (2.6° C - 2.7° C) (Eka, 1977). The melting point of a material is a definite physical property of a pure solid and this is used as a criterion of purity and for the characterization and recognition of pure compounds. This high melting point value of breadnut lipid is a disadvantage in cold cream preparation. The lower the melting point of a seed oil, the better the oil is for making oil creams (British Standard, 1958). The high melting point of the oil also makes it a valuable confectionery fat just like coconut oil (Peters, 1956). The setting point of breadnut oil is 11.3°C. This is lower than the setting point of 21.8°C - 23°C for coconut oil (Peter, 1956).

The saponification value of breadnut oil is 238.43 which is close to the value of 250 - 264 obtained by Peters (1956) for coconut oil. This high saponification value of the oil indicates the possibility of using it in soap making and in the manufacture of lather shaving cream (Hilditch, 1949 and Eka, 1986). Since the saponification value is inversely proportional to the weight of the fatty acids present in the oil, it can be deduced that breadnut lipid contains glycerides with lower molecular weight fatty acids than palm oil and groundnut oil (Oyenuga, 1968 and Eka, 1989). The iodine value of 46.83 obtained for breadnut oil is comparable to values for palm oil 52 (Eka, 1989) and palm kernel oil 37(Oyenuga, 1968). It is lower than the value for Hibiscus sabdariffa seed oil (Ahmed et al, 1979) and Hibiscus ficulneus seed oil (Sinha and Osman, 1982). This iodine value is indicative of the fact that breadnut oil contains a great number of saturated bonds as such cannot be classified as a drying oil. The oil cannot therefore be suitable for the paint industry. This high degree of saturation renders the oil very stable against oxidative rancidity and confers on the oil a longer shelf-life. The low acid value of breadnut oil of 1.15 makes it suitable for use in soap production (Divine and Williams, 1961). The low peroxide value of 14.6 of breadnut indicates that the oil is stable as oils with high peroxide values are known to be unstable (Ojeh, 1981). The low free fatty acid content of 1.89% for breadnut oil makes it suitable for edible purpose. The free fatty acid value falls below the maximum limit of 5% for free fatty acids in high grade palm-oil in Nigeria (NIFOR, 1989).

The low unsaponificable matter value for breadnut oil of 2.93% may be an indication of the low amount of hydrocarbons, higher alcohols as phytosterols. This makes breadnut oil suitable as an illuminant.

CONCLUSION

Concluding, therefore, the breaknut (Artocarpus altilis) is not an oil seed since its total crude fat content is only 4.64%. Breadnut oil is paleyellow in colour and thick, but not solid at room temperature (29° C). The oil is suitable as confectionery fat and a valuable raw material for soap and lather shave cream production based on its high melting point, low acid value, low free fatty acid content and high saponification value.

This is a preliminary investigation of the oil and work is in progress to identify the fatty acid composition of the oil and the level of toxicants and antinutritional factors present. This will help to elucidate the suitability of breadnut oil as a nutrient source.

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