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PHYSICOCHEMICAL CHARACTERISATION OF BUTTERNUT *JUGULANS CINEREA)* OIL

EKA B. ESSEIN AND CHIDI E. AMADI

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ABSTRACT

Some physical and chemical properties of butternut (*jugulans cinerea)* oil were investigated. The oil was found to be deep amber in color and slightly thick. The oil melts at 26^0c, has specific gravity of 0.99 and a refractive index of 1.44 at 40^0c. The chemical characteristics showed the total oil content to be 46.15%. Unsaponifiable matter was 0.69%, saponification value was 248.02mg/KOH/g oil. The iodine value was 40.45 while the acid and peroxide values were 3.96mg/KOH/g oil and 7.2Meq/100g oil respectively. The free fatty acid content of the oil was 3.16%. The oil was thus observed to have some advantageous physicochemical properties and could be regarded as seed oil due its high fat content.

KEY WORDS: Butternut *(Jugulans cinerea*) oil, specific gravity, and physicochemical properties.

INTRODUCTION

The butternut (*jugulans cinerea)* also called white walnut or oil nut is of the walnut family belonging to the family Jugulans. The walnut fruit is widely known throughout the world for the nuts and timber it produces. Presently all butternuts are used locally for their highly flavored oily kernels.

There is no report in the literature on the physicochemical properties of *Jugulans cinerea* oil in Nigeria. Therefore the present work is to evaluate the physicochemical properties of the nut oil to ascertain its suitability for domestic or industrial use.

MATERIALS AND METHODS

Sample Collection and Preparation

The walnuts were bought from the Oyigbo market in River State, Nigeria. The shells were removed and the nuts were washed with plain tap water and dried in an air-circulating oven (Corsair Heating and Catering Ltd. Model5) at 45^0c to 50^0c for 24hrs. The nuts were then ground to powder using a manual grinder (Wiley mill, model 4 Philadelphia, PA). The prepared samples were packed in polythene bags and stored in screw-capped bottles at 10^0c until required for analysis.

Sample Analysis

The percentage lipid content of the sample was determined using Analar grade reagents and the AOAC (1984) 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 British Standards (BSI 684, 1958) method; peroxide value by the Vogel (1974) method and the specific gravity by the AOAC 1965 method. The saponification and iodine values were determined using specific methods recommended by AOCS (1973). The method of AOCS (1973) and Devine and Williams (1961) was used to determine the melting point and free fatty acid values, respectively, while the refractive index of the oil was determined at 400c using Abbe Refractometer (Bellingham and Stanley Ltd, London).

RESULTS AND DISCUSSION

Tables 1 and 2 show the results of the analyses. The oil was deep amber in color and constituted 46.15% of seed components.

TABLE 1: PHYSICAL PROPERTIES OF BUTTERNUT OIL (Mean + SD*)

Color	Deep amber
Melting point (^{0}C)	26^0 C ± 0.5^0C
Specific gravity	0.90 ± 0.05
Refractive index, R_D^{40}	1.44 ± 0.01

*Mean of three independent determinations

Eka B. Essien, Department of Biochemistry, Nutrition and Toxicological Unit, University of Port Harcourt, Port - Harcourt, Nigeria
Chidi E. Amadi, Department of Biochemistry, Nutrition and Toxicological Unit, University of Port Harcourt, Port-Harcourt, Nigeria

TABLE 2: CHEMICAL PROPERTIES OF BUTTERNUT OIL (Mean +SD*)

Total lipid (%)	46.15 ± 0.17
Unsaponifiable matter (%)	0.690± 1.00
Saponification value (mg/KOH/g oil)	248.02 ± 0.05
Iodine value	40.54 ± 0.13
Acid value (mg/KOH/g oil)	3.96 ± 0.02
Peroxide value (Meq/100g oil)	7.28 ± 0.10
% Free fatty acid as oleic acid	3.18 ± 1.20

*Mean of three independent determinations

The total lipid content showed that butternut is an oilseed. Seeds having more than 20% total lipids are regarded as oil seeds (Oyenuga, 1968). The melting point of the butternut oil is lower than that reported for coconut at 27^0c (Eka, 1977).

The melting point of lipids decrease with increasing proportion of unsaturated fatty acid glycerides and to a lesser degree will increase with increasing proportion of long chain fatty acid glycerides (British Standards 1958). The low melting point of the extracted butternut lipid seems to indicate the presence of unsaturated fatty acid glycerides. The British Standards (1958) states that the lower the melting point of an oilseed, the better the oil is for making oil creams. Thus the butternut oil may be suitable for cold cream preparations because of its low melting point.

The specific gravity of 0.90 obtained for butternut oil is in agreement with the specific gravities of other oils (Hilditch and Riley; 1964). The refractive index of 1.44 determined for butternut oil agrees with values obtained by Dosunmu and Ochu (1995) and Nwinuka *et al,* 2000 for some Nigerian fruits and seeds. This value is indicative of the presence of fatty acids with similar hydrocarbon chain length as those obtained by Dosunmu and Ochu (1995) and Nwinuka *et al* (2000).

The saponification value of butternut oil is 248.02mg/KOH/g oil. This value is quite comparable to that obtained for other oils (Peters, 1956; Oyenuga, 1968; Eka, 1989). The high saponification value indicate the possibility of using the oil in soap making and manufacture of leather shaving creams (Eka, 1989). Since the saponification value is inversely proportional to the weight of the fatty acids present in the oil, it can be deduced that butternut lipid contain glycerides with lower molecular weight than groundnut oil (Eka, 1989).

Butternut oil had an iodine value of 40.54. This value compare well with values obtained for breadnut seed oil (Nwinuka *et al* 2000). The value is however lower than that obtained for *Hibiscus ficulenus* seed oil (Sinha and Osman, 1982). This value for the butternut oil shows that it contains a great number of saturated bonds and as such cannot be classified as a drying oil. The oil may therefore not be suitable for paint industry. Nutritionally, this high degree of saturation makes the oil very stable against oxidative rancidity and confers on oil a longer shelf life (Oyenuga, 1968).

The acid and peroxide values of the butternut oil were quite low. The low acid values 3.96mg/KOH/g oil makes it suitable for soap production while the low peroxide value further confirms the stability of the oil. Oils with high peroxide values are known to be unstable (Ojeh, 1981). Because of its low free fatty acid content (3.16%), butternut oil is suitable for edible purposes. The free fatty acid value falls below the maximum limit of 5% for free fatty acids in high grade palm oil on Nigeria (NIFOR, 1989). The unsaponifiable matter obtained for butternut oil was 0.89%. This indicates that there is low hydrocarbon, higher alcohol and phytosterols. Thus the oil could be suitably used as illuminant.

CONCLUSION

The butternut oil is an oilseed due to its total lipid content of 46.15%. The oil is deep amber in color and liquid at room temperature. The oil may be suitable as confectionery fat and as a raw material for soap making, for production of lather shaving creams and as an illuminant, as indicated by its low melting point, Acid value, free fatty acid content and high saponification value. Analysis of the fatty acid composition of the butternut oil is in progress. This work serves as a preliminary study.

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