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Proximate Composition and Selected Physicochemical Properties of the Seeds of African Oil Bean (*Pentaclethra marcrophylla*)

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Abstract: Flour produced from the seeds of African oil bean (*Pentaclethra marcrophylla*) was evaluated for proximate chemical composition, some mineral constituents and physicochemical properties of the ether extract. The results showed that the seed contained 5.3% moisture, 47.4% fat/oil, 36.2% protein, 1.5% ash and 9.6% carbohydrate. The mineral content of the defatted seed flour was found to be Na (236.2), K (181.3), Ca (104.5), P (101.6) and Fe (34.8) ppm. The proximate and mineral compositions suggest that the seed, as a cheap source of protein, oil and macro minerals, may find a good use as human food or be incorporated into animal feed. The oil was found to have a saponification value of 189.85, iodine value 161.95, acid value 7.01, unsaponifiable matter 36, specific gravity 0.890 and a refractive index of 1.465. The high degree of unsaturation makes it suitable for cooking purposes and for use as a drying oil for cosmetics, paints and varnishes.

Key words: *Pentaclethra macrophylla*, chemical composition, degree of unsaturation

Introduction

Seeds have nutritive and calorific values, which make them necessary in diets. They are good sources of edible oils and fats. The amount of energy provided by 1g of fat/oil when fully digested is more than twice as many joules as do carbohydrates and proteins. Fats make a meal more satisfying, enrich its flavour and delay the onset of hunger. For normal functioning, the human body requires sufficient amount of protein. Unfortunately, protein foods are in short supply and, therefore, not within the reach of low-income households in Nigeria. The country relies on importation for the greater part of her protein foods and cooking oil despite the availability of potential raw materials that could provide these things.

Pentaclethra macrophylla, after being processed in the local way is cherished by many people, especially in the rural areas of the southern part of Nigeria. It is prepared and eaten as oil bean "salad" or used as a condiment in soup. The fatty acid composition and the essential amino acid content have been reported (Achinewhu, 1982). However, the nutritive value of the whole seed and its contribution to the nutrition of man has not been thoroughly investigated. The mineral composition of the seed and chemical parameters of the oil have not been reported. A more detailed study of the proximate and mineral compositions of the seed as well as chemical and physical parameters of the oil was considered necessary to determine the nutritional value of the seed and possible industrial or commercial uses of the oil. The usefulness of *Pentaclethra macrophylla* as a source of protein, fats, and essential macro minerals necessary for the growth of man and animals is being investigated. In this communication, proximate and mineral compositions of the seed are reported as well as physico-chemical parameters of the oil.

Table 1: Proximate Composition of African Oil Bean Seed

Components	Percentage'
Moisture	5.3 ±0.06
Fat	47.4 ±0.03
Protein	36.2 ±0.04
Ash	1.5 ±0.02
Carbohydrate	9.6 ±0.05

*Mean of triplicate determinations ± standard error

Table 2: Mineral Composition of African oil bean seed

Element	Concentration (ppm)*
K	181.3±1.6
Na	236.2±2.4
Ca	104.5±1.4
P	101.6±1.2
Fe	34. 8±1.3

*Mean of triplicate determinations ± standard error

Materials and Methods

Preparation of sample for analysis: All the African oil bean (*Pentaclethra macrophylla*) seeds used for this work were bought from local markets in and around Owerri, Nigeria. The seeds, which belong to the family of leguminosae, are flat in shape, brown in colour and have a tough seed coat. They were shelled manually and dried in an air oven at 60^{o}C for 24 hours. The sample was powdered with a mechanical grinder, packaged and stored in a refrigerator at 4^{o}C until required for use.

Table 3: Physicochemical Parameters of the Extracted Oil Compared with Other Edible Oils

Parameter	Value		
	OB	SB*	AH*
Saponification value (mgKOH/g)	189.85	189-195	187-196
Iodine Value (Wijs)	161.95	120-143	80-106
Acid Value (mgKOH/g)	7.01	0.6	4
Free fatty acid (mgKOH/g)	3.53	-	-
Unsaponifiable matter (g/kg)	36	15	10
Specific gravity	0.890	0.919-0.925	0.914-0.917
Refractive index at 26°C	1.4650	1.466-1.470	1.460-1.465
Smoke point (°C)	162.5	-	-

OB, Oil bean; SB, Soya bean; AH, *Arachis hypogaea*. *See Pearson (1976), P: 504

Proximate composition: Moisture and ash contents were determined as described by AOAC (1990). Crude fat was extracted by the Soxhlet method with petroleum ether (40-60°C) for 8hr. The total nitrogen was determined using the microjeldahl method and converted to crude protein by multiplying by 6.25 while the carbohydrate was determined by difference. Determinations were done in triplicates and results were expressed as averages on dry weight basis.

Mineral composition: The seed flour was wet oxidized and Corning flame photometer (Model 400) was used to estimate the amount of Na, K, and Ca. Phosphorus was determined as the phosphate by the vanadomolybdate colorimetric method (Pearson, 1976). Iron was determined spectrophotometrically by reading the absorbance at 535 nm after pigmentation with thioglycollic acid.

Physicochemical parameters of the oil: The acid value, saponification value, Wijs iodine value and unsaponifiable matter were determined as described by Pearson (1976). The refractive index at 26°C was determined using Abbe refractometer. The specific gravity was determined using a universal hydrometer.

Results and Discussion

The proximate composition is given in Table 1. The values obtained showed that the seed contained high levels of fat and protein at 47.4 and 36.2% respectively. The carbohydrate content was 9.6%. Some of the mineral constituents of the defatted seed flour are given in Table 2 while Table 3 shows of the physicochemical parameters of the seed oil. The sodium, potassium and phosphorus contents were high at 236.2, 181.3, and 101.6 ppm respectively. Calcium was 104.5 ppm, while iron was low at 34.8 ppm.

Results from the present investigation show that the seed is of high nutritional value. The protein and fat contents at 36.2 and 47.4%, respectively agree with the values (34.1 and 46.3%) reported by Achinewhu (1982). Compared with the values of 30.1g $100g^{-1}$ and 28.70% reported for fluted pumpkin by Asiegbu (1987), and Fagbemi and Oshodi (1991), respectively African oil bean seed is richer in protein. An adult male of about 70kg body weight requires 35g of protein daily, therefore only 97g of African oil bean seed with 36.2% protein would be required to provide the minimum daily protein need. However, 121g should be consumed to meet the requirement, if an allowance of 25% is made to take care of digestibility and the limiting sulphur amino acid (Fagbemi and Oshodi, 1991).

The oil content (47.4%) is comparable with values reported for *Telfairia occidentalis*, (Asiegbu, 1987, Fagbemi and Oshodi 1991) and *Arachis hypogaea* (Irwin and Hegsted, 1971), which are, also oil seed crops consumed in Nigeria. The saponification value compares well with values (188-196) for most oil of plant origin but less than that for coconut oil (245-265) and palm kernel oil (245-255) (Pearson, 1976). The high iodine value indicates that the oil has a high content of unsaturated fatty acids. About 75% of the total oil in African oil bean seed is made up of unsaturated fatty acids, predominantly oleic and linoleic (Achinewhu, 1982). The high degree of unsaturation suggests that the oil may be used as a drying oil for the manufacture of cosmetics, oil paints and varnishes. It may also be used as edible oil for cooking or manufacture of margarine. The mineral composition shows that the seed is a potential source of some of the essential macro minerals needed by man.

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