



Extraction, characterization and pharmaceutical screening of oil obtained from seeds of *Pentaclethra macrophylla* benth (african oil bean seed)

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Abstract The seed of *Pentaclethra macrophylla* benth are seen plentifully during the plants' seasonal fruiting. Though the nutritional value of this seeds had been analyzed, the seed oil had not been characterized to see if it should be of high industrial importance. In this work, the author tried to extract and characterize *P. macrophylla* seeds oil. Again the anti-microbial screening of the oil is investigated on six pathogenic micro-organisms to know if the natural oil is medicinal or not. The six micro-organisms are: *Bacillus cereus*, *Bacillus lichemiformis*, *Lactobacillus* specie, *Escherichia coli*, *Candida albican* and *Aspergillus niger*. The percentage yield of the oil is 35.08%. Characterization of the oil shows that the acid value is 1.23 mg/KOH g⁻¹, peroxide value is 16 meq, lodine value is 116 mg/100g and saponification value is 207.54 mg/100g. The antimicrobial screening carried out shows that the 0.1ml of *P. macrophylla* seed oil can inhibit the growth of five out of the six test micro-organisms. The five micro-organisms are: *B. cereus*, *B. lichemiformis*, *L. species*, *E. coli* and *C. albican*. At 0.1 ml volume, the oil cannot inhibit the growth of *A. niger*. The pharmaceutical screening of *P. macrophylla* benth seed oil confirmed the medicinal value of the oil.

Keywords Extraction, characterization, micro-organisms, pharmaceutical screening, zone of inhibition, *P. macrophylla*.

Introduction

Pentaclethra macrophylla commonly called African oil bean belongs to the family fabaceae. They are trees which can be found in tropical African countries especially Cameroon, Cote d'voire, Democratic Republic of Congo, Ghana, Nigeria and Togo. *P. macrophylla* was not known to modulate until recently [1]. The tree has a characteristic low branching habit and an open crown. The compound leaves are usually about 20-45cm long and covered with rusty hairs. Its flowers are commonly yellow or pinkish white and sweet smelling. Its fruits are available at most periods of the year because the large woody pods are persistent. Its fruits split open explosively and this is the edible product and source of the oil, hence the name "the oil bean tree" [2]. *P. macrophylla* modulates and fixes atmospheric nitrogen. The main flowering season in West Africa is March-April with small flushes in June and November. In Liberia, trees flower in February-April and fruit in September-December. The flowers are very rich in nectar and much visited by honeybees [3]. The use of *P. macrophylla* seed extract as antimicrobial substance is new and little or no work had been done in this area. The aim of this research is therefore to extract oil from the seed of *P. macrophylla*, characterize it and investigate its antimicrobial activity. Proximate analysis and microbiological assessment of fresh fermented seed of *P. macrophylla* had been studied [4]. The fermented seed was found to be nutritious. Some parts of the plant have medicinal values as shown below.



Uses	Parts of plant	Country
Infertility	Seed	Cameroon
Convulsion	Pod	Cameroon
Convulsion	Smoke of burnt leaf	Ghana
Abortion	Crushed seed	Ghana/Nigeria
Diarrhea	Leaf/stem bark	Ghana/Nigeria
Itch	Bark as ointment	Ghana/Nigeria
Lactogenicity	Back decoction	Ghana/Nigeria
Wound treatment	Back as lotion	Ghana/Nigeria

The ashes are used as salt and as mordant in dyeing industries. The anthelmintic bark is pounded and applied to leprosy sores. The tree yields forest products for making wooden household [5]. The seed when cooked processed and fermented is called "Ugba" (in Igbo language of Nigeria) and used for preparation of many delicacies like African salad, sausages, soups for eating with different staples [6]. The edible oil extracted can be used for candle making, cooking and soap [6]. The seed shells are decorative and often used to craft beads which are worn as necklaces, rosaries and sometime as a local dancing apparels [7]. The empty dry pods are used as fuel for cooking.

Experimental Work

Sample collection and preparation

The fresh fruit of *P. macrophylla* benth were collected or picked from their trees growing in Ukpok and Ihiala towns both in Anambra State of Nigeria. The shell was dehulled by cracking to obtained the seed or the cotyledons. The seeds were washed, cut into small pieces, dried under the sun for five weeks and ground into powder. It was stored in polyethylene bottle until needed for analysis. The oil was extracted using soxhlet apparatus and normal hexane as the solvent. The oil was oven dried to remove the solvent. Characterization of the oil was done using the standard analytical methods [8]. The antimicrobial activities of *P. macrophylla* benth seed oil was determined by agar well diffusing method [9]. The zone of inhibition was recorded to the nearest size in mm [10].

Results and Discussion

Table 1: Characterization of oil obtained from *P. macrophylla* seed

State at Room temperature	Colour	% yield	Acid value (mg/KOHg ⁻¹)	Peroxide Value (Meq)	Iodine Value (mg/100g)	Saponification Value (mg/100g)
Liquid	Light yellow	35.08	1.23	16	116	207.54

Table 2: Anti-microbial activity of *P. macrophylla* seed Oil

Test Organism	Zone of Inhibition	On (mm)		Vol. used (0.1ml)		Control Methanol
	Pure Seed oil	50% diluted oil	seed	100% diluted oil	seed	
<i>B. cereus</i>	0.8± 0.2	0.1		0.7		NA
<i>B. licheniformis</i>	0.5± 0.2	0.5		0.5		NA
<i>A. niger</i>	No inhibition	Nil		Nil		NA
<i>L. specie</i>	0.6± 0.2	0.7		0.5		NA
<i>E. coli</i>	0.4± 0.2	0.5		0.3		NA
<i>C. albican</i>	0.1± 0.2	0.1		0.1		NA

NB: NA = No action; mm = Milimetre

Discussion



The percentage yield of *P. macrophylla* seed oil is 35.08. It is higher than $12.00 \pm 0.28\%$ obtained by [11]. At room temperature, *P. macrophylla* seed oil is a light yellow liquid. The chemical properties of *P. macrophylla* seed oil is shown in Table 1. The acid value for the seed oil $1.23 \text{ mg/KOHg}^{-1}$. This value is very much lower compared with the value obtained in *C. albidum* seed oil ($94.92 \text{ mg/KOHg}^{-1}$). This shows that the acid content is very low and it should be very edible. Peroxide value of *P. macrophylla* seed oil indicates that the oil is fresher than *C. albidum* seed oil. The peroxide value is used as an indicator of deterioration of oils. Fresh oils have value less than 10meq. Values between 20 and 40 result to rancid taste [11]. The iodine value is also an index for assessing the ability of an oil to go rancid [12]. The iodine value obtained (116 mg/100g) is higher than the value obtained in *C. albidum* seed oil (50.76). These values indicate that the oils contains appreciable level of unsaturated bonds. Storage procedure used should ensure protection of oil, from oxidative deterioration. Saponification value is used in checking adulteration. The high value recorded for *P. macrophylla* seed oil (207.54 mg/100) is an indication that it has potential for use in the industry [12].

Table 2 portrays the result of antimicrobial activity of *P. macrophylla* seed oil on six pathogenic microorganisms. The table shows that at 0.1ml volume, the pure oil indicates some inhibitory effect on five out of the six test microorganisms. The six test micro-organisms are: *B. cereus*, *B. lichemiformis*, *L. species*, *E. coli*, *C. albican* and *A. niger*. The zone of inhibition on these six organism are as follows: $0.8 \pm 0.2 \text{ mm}$, 0.5 ± 0.2 , 0.6 ± 0.2 , 0.4 ± 0.2 , 0.1 ± 0.2 and NA respectively. Fifty percent (50%) and one hundred percent (100%) seed oils also show minimal inhibitory effect on all the six test micro-organisms with the exception of *A. niger*.

Conclusion

Characterization of *P. macrophylla* seed oil indicates that the oil can be employed industrially in the manufacture of other materials or products. It can also be used domestically due to its low acid value (1.23 mgKOH^{-1}) and peroxide value (16meq). The anti-microbial screening of the seed oil confirmed the medicinal value of *P. macrophylla* seed oil. In further research greater volumes of 0.1 ml – 0.6ml of *P. macrophylla* seed oil should be investigated on the six organisms to enable us obtain greater zone of inhibition.

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