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Extraction and physico- chemical investigation of oil from the seeds of *Ceiva Pentandra* Linn grown in Katsina, Nigeria

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ABSTRACT

The physicochemical parameters of oil extracted from the seeds of Ceiva pentandra Linn were determined and compared with those recommended by the international codex standards for edible oils. The seeds were soxhlet extracted using n – hexane to render 24% light yellow crude oil, whose density was 0.91 g/cm^3. The physico-chemical analysis carried out on the crude lipid showed that the oil has the following properties: iodine value (125.6 gI_2/100g), Saponification value (229 mgKOH/g), peroxide value (14 meqKOH/g), acid value (0.56 mgKOH/g) and free fatty acids (8.5mgKOH/g). The high oil content of the seeds obtained in this work strongly indicates its prospects for commercial extraction.

Keywords: *Ceiva pentandra Linn*, Katsina, Nigeria, Oil, Seeds.

INTRODUCTION

Ceiva pentandra belong to the family Bombacaceae (Dutta, 1954). The plant is widespread in the tropics especially in Africa and is very large, 30 – 40m high with thick trunks and sometime with water storage tissue. The leaves of the plant are simple or palmate with deciduous stipules while flowers are bisexual, often large and usually regular. The five calyx lobes are fused and the valvate often with epicalyx. The five free petals are convoluted and asymmetrical. There are five to many anthers, which may be free or united into a tube. There are 2 – 5 fused carpels in the superior ovary which is multilocular. It has two to many erect anatropous ovales in each loculus. The fruit is capsule; often with the seeds embedded in hairs arising from the wall. There is little or no endosperm, and cotyledons are flat, contorted or plicate (George, 1966).

The silky fibres from the pods of a kapok tree (*Ceiva pentandra*) is widely used for different domestic purposes; such as stuffing pillows, locally made mattresses, life preservers and also against cold and sound, equipping automobile trucks for refrigeration. The fibre is resilient, buoyant, water resistant and highly moisture proof. The seeds are source of an oil used for illumination and for manufacturing soap. The wood is easily worked, used for packing boxes and matches, also used as a fire wood (Uphof, 1968).

EXPERIMENTAL SECTION

Sampling and Sample Treatment

The samples of *Ceiva pentandra Linn* seeds were collected from Malumfashi Local Government area of Katsina State, Nigeria. The seeds were oven dried at 70^{o}C for 24 hours (Nordeide *et al.*, 1996). The oven dry seeds were

pounded using a mortar and pestle and sieved with 2mm sieve. The powdered sample was stored in polythene bags for analysis.

Procedure

The crude oil was extracted by the use of a soxhlet extractor with n – hexane at 40^{o}C for 24 hours (Das *et al.,* 2002). Specific gravity of the oil was determined at 30^{o}C according to the method of Chopra and Kanwar (1991). Analyses for iodine value, saponification value, peroxide value and acid value were carried out using the methods of AOAC (1990). The mean molecular mass was estimated from the saponification value as 56.1/SV x 100, while the free fatty acid (FFA) was calculated from the relationship: 1 unit of acid value = 0.503% FFA (as oleic acid) (Ajiwe *et al.,* 1997).

RESULTS AND DISCUSSION

Table of results shows that the values of physico-chemical analyses carried out on the crude oil extract of *C. pentandra* Linn seeds. The results indicate that the seeds contain 24% light yellow crude oil characterized with pleasant smell. The quantity of the crude is comparable to 25% reported when cotton seeds grown in Katsina, Nigeria were analyzed (Abayeh *et al.*, 1997). The comparable oil content of *C. pentandra* to cotton seed could be due to the much similarities in the characteristics of the plant and their seeds. The high oil content of the seeds of *C. pentandra* Linn will apparently make it viable for commercial extraction.

The oil was showed to have a specific gravity of 0.91g/cm^3, which is comparable to the values reported in seeds of *Balanites aegyptiaca,* 0.90, *Laphira lanceolata,* 0.89 and *Sclereoclarya birrea,* 0.90 (Eromosele and Paschal, 2003). The oil density is however less denser than groundnut oil (0.918g/cm^3), albizia lebbeck seed oil(0.87g/cm^3) and neem seed oil (0.939 g/cm^3) (Akpan, 1999; Hassan et. al., 2005).

The iodine value of the crude oil was 125.6 gI_2/100g, which is high, indicating that it is semi dry oil (Fekarurhobo *et al.,* 2009, Fernando and Akujobi, 1982). Thus, the oil will not attract high interest in the paint and coatings industry unless it undergoes dehydration before use (Abayeh *et al.,* 1998). The value is comparable to iodine value of melon seed, 124.5 gI_2/100g (Das *et al*., 2000) and 121.03 for African pear, *Caryodes edulus* (Ajiwe *et al.,* 1997). On the other hand, the value obtained is higher than 53.4 to 106.5 reported as iodine value for some selected vegetable oils (groundnut, cotton seed, melon seed and shea) marked in former Sokoto State of Nigeria (Fernando and Akujobi, 1987) and other wild seeds oil grown in Bauchi, Nigeria (Abayeh *et al.,* 1998), but lower than 178.8 reported in palm oil (Oshinowo, 1987).

The saponification value of the seed oil was found to be 229mgKOH/g. According to Entanan (1982), a saponification value of 200 mgKOH/g indicates high proportion of fatty acids of low molecular weight as confirmed from its calculated molecular mass (241.22). This show that the oil has a potential for use in soap making, shampoo, alkyl resins and for the thermal stabilization of polyvinyl chloride (PVC), as has been reported for *Spondias mombiri* seed oil (Eromosele and Paschal, 2003). The value obtained is comparable to 188 mgKOH/g, 213 mgKOH/g, 120mgKOH/g (Oyedeji et al., 2011) and 253.2 mgKOH/g reported in rubber seed oil (Abalaka *et al.,* 1988), neem seed oil (Akpan, 1999) and coconut oil (Oshinowo, 1987) respectively. The value is also within the range of 67.3 to 327.3 mgKOH/g reported in some Nigerian oil seeds (Abayeh *et al.,* 1998).

Peroxide value is an index of rancidity, thus the low peroxide value of the oil (14 mEqKOH/g) indicates a good resistance of the oil to peroxidation during storage. This value is comparable with the maximum acceptable value of 10 set by the Codex Alimenterius Commission for groundnuts (Abayeh *et al.,* 1998). In comparison with some oil seeds, the value is also lower than 30 mEq/KOH/g reported in chloroform - methanol extract of *Jartropha curcas* seed oil (Abayeh *et al.,* 1998). However, subjecting the oil to alkaline treatment, bleaching, or improving method of storage by adding antioxidants can reduce the magnitude drastically.

The acid value (0.56 mgKOH/g) which is an index of free fatty acid content due to enzymatic activity in the seeds, was found to be low, below the maximum acceptable value of 4 mg/KOH/g recommended by the Codex Alimenterius Commission for groundnuts (Abayeh *et al.,* 1998), it is also lower than that of palm oil, 16.4 (Oshinowo, 1987), 13.40 for horse beans (Ajiwe *et al.,* 1997) and 35.46 found in African star apple (Ajiwe *et al.,* 1997). This value shows that the oil is good for human consumption and advantageous in paint and liquid soap making (Owoyale *et al*., 1987; Ajiwe *et al.,* 1997).

Table : The physico-chemical properties of *Ceiva pentandra* Linn seed oil*

Parameter	Result
Oil yield	24%
Specific gravity	0.91g/cm^3
Colour of oil extract	Light yellow
Odour	Pleasant
Iodine value	125.6gI_2/100g
Sapofinication value	229 mg/KOH/g
Peroxide value[a]	14 mEq KOH/g
Molecular mass	241.22
Free fatty acid	8.5mg/KOH/g

** The values are mean of three replicate measurements.*
[a] peroxide value after 2 months storage

CONCLUSION

The results of the physico-chemical investigation of the oil extracted from the seeds of *Ceiva pentandra* Linn compared well with those reported by other investigators(Abaye et. al., 1998; Ajiwe et. al., 1997; Akpan, et. al., 1999; Entana, 1982; Ezeagu, et. al., 1998; Fernando and Akujobe, 1987; Hassan, et. al., 2005). Also, the high oil content of the seeds of Ceiva pentadra Linn will make it viable for commercial extraction. The oil was found to be cyanide free and hence suitable for human consumption.

The extracted oil sample can be sulphated and the sulphated oil sample would have a wide range of industrial applications such as in Tanneries for fat – liqourting and finishing of leather, etc.

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