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Extraction, physicochemical characterization and phytochemical screening of *Jatropha curcas L.* seed oil

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ABSTRACT

To investigate the potential use of Jatropha curcas L. seed oil, dried Jatropha curcas L. seeds were crushed to release the kernels and oil was extracted using Soxhlet apparatus and the physicochemical characteristics of the oil determined using standard methods. The physico-chemical characteristics showed: oil yield 42.19%, specific gravity 0.93, saponification value 122.49mgKOH/g, iodine value 129.66gI_2/100g, acid value 1.38mgKOH/g, free fatty acid value 0.74mgKOH/g and peroxide value 1.55meq/Kg. The phytochemical screening of the oil showed the presence of saponins, alkaloids, steroids, terpenoids and cardiac glycosides, while tannins, flavonoids and phenols were absent. From the determined parameters, Jatropha curcas seed oil may be use as cooking oil and in cosmetics. In addition, the revealed phytochemcals suggested that the seeds oil has pharmacological potentialities.

Key words: *Jatropha curcas L.*, seed oil, physico-chemicals, phytochemicals.

INTRODUCTION

Jatropha curcas (Linnaeus) is a small tree belonging to the family of *Euphorbiaceae*. It is a native of tropical America, but now thrives in many parts of the tropics and sub tropics in Africa and Asia. It is a tropical plant that can be grown in low to high rainfall areas [1]. It is considered as a potential source of non-edible fuel along with its different medicinal properties [2].

In Nigeria it is known as “binidazugu/cinidazugu” and ‘lapa lapa” in Hausa and Yoruba languages respectively [3]. *J. curcas* is being explored for its oil yield potential throughout the world [4, 5].

Seeds have nutritive and calorific values, which make them necessary in diets. They are also good sources of edible oils and fats [6]. In Nigeria, the major sources of edible oils are peanut (Arachis hypogoea) and oil palm (*Eloesis guineensis*). These oils are used mainly as cooking oils, for the production of soap, margarine, and cosmetics [7]. However, with the increase in demand, which has led to increase in the importation of cooking oils, there is need to source for local oil-bearing-seeds which can be used in production of oils, both for consumption and industrial applications.

The present work is therefore aimed at extraction, physicochemical and phytochemical analysis of Northern Nigeria *Jatropha curcas L.* seed oil in order to justify its industrial and medicinal properties.

MATERIALS AND METHODS

Chemicals and Reagents

All chemicals and reagents used were of analytical grade.

Sample collection and identification

Indigenous *Jatropha Curcas* L. seeds were obtained from *Jatropha Curcas* plant in a test plot in Warra town Ngaski Local Government area of Kebbi State, Nigeria. The plant was identified and authenticated by a Botanist at the Biological Sciences Department, Bayero University, Kano (BUK) Nigeria. Confirmation of taxonomic identity of the plant was achieved by comparison with voucher specimen (voucher No. 110) kept at the Herbarium of the Department of Biological Sciences. The seeds were selected and damaged ones were discarded. The seeds were cleaned, de-shelled and well dried and ground using laboratory plastic pestle and Mortar prior to extraction.

Oil Extraction

The oil content of Jatropha curcas seeds were obtained by complete extraction using the Soxhlet extractor (Konte, USA). 49.7g of ground seed was placed in the thimble, which was inserted in the centre of the Soxhlet apparatus. 200cm^3 of the solvent (hexane) was poured into the flask. The set up was damped and heated on a heating mantle.

The extraction process was carried out in six hours and it was done in correspondence to the temperature of the solvent used (n-hexane at 60^{o}C). Solution obtained from the extract was regained through a reflux process for 15minutes and then the little content present in the oil was removed through evaporation by increasing the temperature to 70^{o}C for 30 minutes.

The oil obtained was weighed and the percentage oil content was calculated [8].

Physicochemical Analysis

The physicochemical analysis of this oil was carried out based on the AOAC official method of 1998 [9].

PHYTOCHEMICAL SCREENING

The phytochemical analysis was done according to the method reported by [10,11,12].

RESULTS AND DISCUSSION

Table 1.0: physical characteristics of *Jatropha curcas* seed oil

Characteristics	Result
% oil yield (wt/wt)	42.19±0.35%
Color	golden yellow
Odor	Pleasant
Specific gravity	0.93
Physical state at room temperature	Liquid

Table 2.0: chemical characteristics of *jatropha curcas* seed oil

Parameter	Value*
Peroxide value (meq/Kg)	1.55 ±1.02
Acid value (mg KOH/g)	1.38 ±0.18
Iodine value (g/100g)	129.66 ±1.98
Saponification value (mg KOH/g)	114.49 ± 0.51
Free fatty acid (%)	0.74 ±0.15

**The values are mean±standard deviation (n=3).*

Table 3.0: Phytochemical characteristics of *Jatropha curcas L* seed oil

Phytochemical analysis	Result
Tannins	-
Saponins	+
Flavonoid	-
Alkaloids	++
Steroids	+++
Terpenoids	+
Phenols	-
Cardiac glycoside	+

Note: +: Present in small concentration; ++: Present in a moderately high concentration; +++: Present in a very high concentration; -: not detected.

DISCUSSION

The oil yield of *Jatropha curcas* seed oil was found to be 42.19% (wt/wt) which is comaparable with oil content reported in *M. Peregrina (49.80%)* and *M. stenopetala* seeds (44.90%) oil reported from Saudi Arabia [13] and Kokwa Island [14] respectively. However, the oil content of *Jatropha curcas* seeds oil in the present analysis was found to exceed those of some conventional oil seed crops: cotton (15.0 – 24.0%), soybean (17.0 – 21.0%), safflower (25.0 – 40.0%) and mustard (24.0-40.0%) [15]. Such variation in oil content across species and locations might be attributed to the environmental and geological conditions of varied regions [16]. With this relative high percentage oil yield of 42.19% in the present study, the processing of the oil for industrial as well edible purposes would be of economic importance.

The chemical properties of the oil analyzed were presented on table 2. The saponification value was found to be 114.49mgKOH/g which is an indication that the oil has median weight fatty acid. Oil with a saponification value of 200mgKOH/g and above is regarded as high molecular weight fatty acid oil and is used in making of soaps [17]. According to Anchwagen *et al*. [18], saponification value is a measure of the equivalent weight of acid present and therefore it is an indication of purity. This type of oil with saponification value of 114.49mg KOH/g, is not a very good candidate in soap manufacturing industries. However, the oil can be subjected to refining processes in order to find place in soap making industries and to be used as emulsifiers [19].

The peroxide value for *Jatropha curcas* seed oil was found to be 1.55meq/Kg. This value is relatively low compared with the peroxide values of other oils of wild plants [20]. According to Epka and Epke [21], high peroxide value is associated with high rancidity rate. Thus, with this fact, the low peroxide value obtained from the oil is simply an indication the oil is less liable to rancidity at room temperature.

An Acid value of 1.38 ±0.177mgKOH/g was obtained which is lower than that of olive oil 17mgKOH/g but higher than 1.20 ± 0.065 reported for Jatropha seed oil [22] which signifies a maximum purity and made it suitable for soap production. Based on the acidity it can be edible since the value fall below maximum acceptable value of 4.0mgKOH/g of oil as recommended by Codex Alimentarus Commission for ground nut but only when it is detoxify [19].

The iodine value obtained was 129.66gI_2/100g, this is a measure of the average amount of unsaturation in fats and oils and is expressed in terms of the number of grams of iodine absorbed per 100 grams of oil sample. The oil shows a relatively high iodine value due to its high content of unsaturated fatty acids. Although, the iodine value obtained is relatively lower than that of the other common seed oils such as safflower and soyabean oil with iodine values of 145 gI_2/100g and 132 gI_2/100g [23] respectively, the oil may also be useful in oil paints manufacture and as a dietary supplement.

Free fatty acid value indicates the deteriorating condition and edibility of the oil [24]. The low value obtained for the free fatty acid indicates that the oil have low deteriorating rate and high edibility [18].

The phytochemical analysis conducted on the seed oil is presented on table 3. *Jatropha curcas* L. contains different secondary metabolites (phytochemicals) with biological activity that can be of medicinal values. The qualitative phytochemical analysis of the oil extracts indicates the presence of saponins, terpenoids and alkaloids in small concentration; the presence of alkaloids in moderately high concentration; the presence of steroids in very high

concentration; while tannins, flavonoids and phenols are absent. Saponins are known to produce inhibitory effect on inflammation. They also have the property of precipitating and coagulating red blood cells. Other characteristics of saponins include formation of foams in aqueous solutions, hemolytic activity, cholesterol binding properties and bitterness [25, 26].

Steroids have been reported to have antibacterial properties and they are very important compounds especially due to their relationship with compounds such as sex hormones [27]. Alkaloids have been associated with medicinal uses for centuries and one of their common biological properties is their cytotoxicity [28]. Thus, based on the detected phytochemicals, *Jatropha curcas* L. seed oil may has various medicinal values.

CONCLUSION

Jatropha curcas L. seed is a good source of oil due to its high percentage oil yield obtained in the present study. The oil has a good storage quality owing to its low peroxide, acid and free fatty acid values. In addition, the saponification value revealed that the oil may be used industrially for soap making. The phytochemical compounds present in the oil may qualify the oil to have therapeutic or medicinal potentials.

Recommendation
Further research is recommended on *Jatropha curcas* seed oil with regards to toxicity and detoxification process for its potential use. Also, government should put effort in encouraging the production of the plant and also provide sound laboratory technique in order to reveal more of its potentials.

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