

Physical and Phytochemical Characteristics of seed Oils from Selected Cultivars Grown in Northern Nigeria.

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ABSTRACT

Oil extracts from the seed of some selected indigenous cultivars were exploited for physical and phytochemical characteristics and they revealed the following; Oil yields *Adansonia digitata* seed oil (27.37%), *Jatropha curcas* L seed oil (42.19%), *Lagenaria siceraria* (calabash gourd) seed oil (44.83 %), *Luffa cylindrical* seed oil (29.03%), *Ricinus communis* L.(Bean) oil (42.30%), *Ricinus communis* L.(Wild) seed oil (46.20%), *Sesamum indicum* L. (Brown) seed oil (41.67%) . Their colours were Greenish yellow, Lighter green, Light yellow, Greenish light brown, Light brown, Pale amber and Brownish yellow respectively. The following phytoconstituents were found in varying limits; Tannins. Saponins Flavonoids, Alkaloids, Steroids and Terpenoids. The properties exhibited by the seed oils justify their applications in food, soaps, detergents and perfume industries.

INTRODUCTION

Various phytochemicals of nutritional, medicinal and cosmetic importance can be derived from seed oils. Apart from the use of extracted seed oils for cooking, seed oils are also used for soaps, detergents, perfumes and related products. Their yields, different compositions and by extension their physical and chemical properties determine their usefulness in various applications aside edible uses ^[1]. Seed oils are important sources of nutritional oils, industrial and pharmaceutical importance^[2]. Various techniques such as mechanical extraction, solvent extraction, traditional extraction and super critical fluid extraction are used to obtain the oil from the seeds. The solvent extraction has become the most popular method of extraction of oil because of its high percentage of oil recovery from seeds. Solvent extraction bridges the gap between mechanical extraction which produces oil with high turbidity metal and water content and supercritical fluid extraction which is very expensive to build and maintain its facilities. Hexane is often used as solvent for oil extraction due to its lower boiling point for easy separation after extraction, its non-polar nature which makes it suitable for extracting vegetable oils which are generally non-polar and its comparatively low toxicity when compared to other solvents^[3]. This research work was aimed at exploiting the physical and phytochemical characteristics of seed oils from selected indigenous cultivars and justify their potential in food, soaps, detergents and perfume industries.

MATERIALS AND METHOD

Seeds materials

Indigenous *Ricinus communis* L.(Bean) and *Jatropha curcas* L. seeds were plucked directly from plant during three consecutive years (2007 – 2009) harvesting seasons. The plants were identified and authenticated by a Botanist at the Biological Sciences Department, Bayero University, Kano (BUK) Nigeria. Confirmation of taxonomic identity of the plants was achieved by comparison with voucher specimens (voucher No. 225 and No. 110) respectively kept at the Herbarium of the Department of Biological Sciences, Biological Sciences Department, Bayero University, Kano (BUK) and use of documented literature [4,5]. Wild variety, which ripens from late October until late December, was obtained from a test plot in Warra town of Ngaski Local Government Area of Kebbi State, Nigeria. Good seeds were carefully selected cleaned, de-shelled and well dried. Seeds were grounded using laboratory plastic pestle and mortar prior to extraction. The other parts of the plants collected were the leaves, the fruits and the flowers for the purpose of identification. The other plant species were identified using documented literatures[6].

Oil extraction

The routine extraction of 35g of the grounded seeds of the selected cultivars was conducted in a soxhlet extractor using n-hexane (boiling between 40–60 °C) for six hours. The oil was obtained after the solvent was removed under reduced temperature and pressure and refluxing at 70 °C to remove excess solvent used in the oil. Extracted seed oil was stored in freezer at –2 °C for subsequent physicochemical analysis. The extraction was carried out in the Biochemistry Laboratory, Department of Biochemistry, Kebbi State University of Science & Technology, Aliero, Nigeria.

Oil Yield

The oil which was recovered by complete distilling of most of the solvent on a heating mantle was then transferred to measuring cylinder. The measuring cylinder is then placed over water bath for complete evaporation of solvent for about 2–3 hours in accordance with the method reported[7] and weight of the oil was recorded and expressed as oil content(%) as follow

$$\text{Oil content (\%)} = \frac{\text{Oil weight}}{\text{Sample weight}} \times 100$$

Qualitative Phytochemical Analysis

The method reported in literature[8] was used.

Test for tannins

Few drops of 1% lead acetate were added to 5ml of the oil extract in a test tube. A yellow precipitate was formed which indicated the presence of tannins.

Test for saponins

The oil extract was diluted with 2 ml of distilled water and it was agitated in a test tube for about 15 minutes. The formation of 0.1cm layer of foam showed the presence of saponins.

Test for flavonoids

Few drops of dilute sodium hydroxide were added to 1ml of the oil extract in a test tube. An intense yellow color was formed which turned colorless on addition of few drops of dilute acid indicating the presence of flavonoids.

Test for alkaloids

The oil extract (2ml) was added to 2ml of HCl. To the acidic medium, 1 ml of Dragendroff's reagent was added. An orange or red precipitate was immediately formed which indicated the presence of alkaloids.

Test for steroids

To 1ml of the oil extract in a test tube, 10 ml of chloroform was added. Equal volume of concentrated sulphuric acid was added by the sides of the test tube. The upper layer turned red, whereas the sulphuric acid layer turned yellow with green fluorescence. This indicated the presence of steroids.

Test for terpenoids

Two ml of the oil extract was mixed in 2 ml of chloroform, and concentrated H₂SO₄ (1 ml) was carefully added to form a layer. A reddish brown coloration was formed at the interface to show positive results for the presence of terpenoids.

Test for cyanogenic glycosides

Small quantity of the oil extract was put in a test tube. 1.5mL of distilled water and 6 drops of chloroform were added and the mixture stirred with a rod. The test tube was stoppered with a cork containing a strip of picrate-impregnated paper hanging down from the stopper, and incubated at ambient temperature for 2 hours. A color change of the paper, from yellow to brown-red, indicated the release of HCN by the plant. If there was no release of HCN within 2 hours, indicating a negative test, the tube was left at ambient temperature for 24 and 48 hours, so that it could be re-examined. A brown-red coloration within 2 h indicated the presence of cyanogenic glycoside and the respective hydrolytic enzyme, and the plants were considered cyanogenic in the field. A brown-red color appearing within 48 hours indicated that the cyanogenic glycoside spontaneously released HCN without the action of enzyme. No color change after 48 hours indicated that the test was negative for cyanogenic glycoside.

RESULTS

Table 1. Oil content and physical Characteristics of selected indigenous seed cultivars.

Sample	Oil Yield (%)	Physical State at Room Temperature	Colour	Odour
A	27.37	liquid	Greenish yellow	Agreeable
B	42.19	liquid	Lighter green	Agreeable
C	44.83	liquid	Light yellow	Agreeable
D	29.03	liquid	Greenish light brown	Strong
E	42.30	liquid	Light brown	Agreeable
F	46.20	liquid	Pale amber	Agreeable
G	41.67	liquid	Brownish yellow	Agreeable

Table 2. Phytochemical screening of oil extracts of selected indigenous seed cultivars.

Sample	Tannins	Saponins	Flavanoids	Alkaloids	Steroids	Terpenoids	Cyanogenic glycosides
A	-	+	++	+	-	+++	-
B	++	++	-	++	++	+	NC
C	+	+	-	++	++	+	NC
D	+	++	-	+++	+	-	NC
E	+	+	+	+	++	++	NC
F	-	+	-	-	+	+	NC
G	-	-	+	+	+	+++	-

Key: + = slightly present; ++ = averagely present; +++ largely present; - = completely absent; NC = Not carried out

A = *Adansonia digitata* seed oil, B = *Jatropha curcas* L seed oil C= *Lagenaria siceraria*(calabash gourd) seed oil, D= *Luffa cylindrical* seed oil, E= *Ricinus communis* L.(Bean) oil, F= *Ricinus communis* L.(Wild) seed oil, G= *Sesamum indicum* L. (Brown) seed oil

DISCUSSION

The percentage yield was between 27.37% to 46.20% which were higher than 11.92 % and 24.53 % reported for *Corchorus olitorius* and *Hibiscus sabdariffa* seed oils with a number of nutritional, cosmetic and dietetic properties^[9].

Tannins were present in most of the oil extracts with exception of *Adansonia digitata*, *Ricinus communis* L.(Wild) and *Sesamum indicum* L. (Brown) seed oils. Tannins have different functions in that they serve as chelating agents for metals ion, antioxidants in biological systems, and as protein precipitating agents.

Saponins were present in almost all the seed oil samples only absent in *Sesamum indicum* L. (Brown) seed oil. Because of their surfactant nature, they are used industrially in mining and ore separation, in preparation of emulsions for photographic films, and, extensively, in cosmetics, such as cleansing formulae. In addition to their emollient effects, the antifungal and antibacterial properties of saponins are important in cosmetic applications^[10]. Flavanoids were only present in *Adansonia digitata*, *Ricinus communis* and *Sesamum indicum* L. (Brown) L.(Bean) seed oils. Flavanoids are now recognized as possessing an array of bioactivities with several mechanisms relevant to potential reductions in the pathogenesis of chronic diseases (e.g., anti-inflammatory and antioxidant actions as well as alteration of redox-sensitive signal transduction pathways and gene expression)^[11]. With exception of *Lagenaria siceraria*(calabash gourd) and *Ricinus communis* L.(Wild) seed oils, alkaloids were found present in most of the seed oil samples which signifies their functionality in repellence, deterrence, toxicity and growth inhibition by herbivores/ predators and in growth inhibition and toxicity by microbes/ viruses and as secondary metabolites for UV- Protection and Nitrogen storage.

Steroids were only absent in *Adansonia digitata* seed oil, but present in all the other seed oil samples. Because of the profound biological activities encountered, many natural steroids and a considerable number of synthetic and semi-synthetic steroidal compounds are routinely employed in medicine^[12]. Terpenoids were only absent in *Luffa cylindrical* seed oil. The presence of terpenoids in all the other seed oil extracts justifies why decoction of dried kernel can be used for the treatment of diabetes mellitus as reported for Cashew nut oil^[8].

CONCLUSION

Significant percentage yield recorded from the selected oil seeds and presence of a number of phytoconstituents in them is indeed an indication of their potentiality in food, soaps, detergents and perfume industries.

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