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The physico-chemical properties of the seed and seed oil of *Jatropha gossipifolia*

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Abstract. The physico-chemical properties of the seed and seed oil of *Jatropha gossipifolia* were assessed by standard methods. The seed contains 35.8% crude oil of iodine value 107.25, 13.40% protein, 9.25% fibre, 30.32% carbohydrate and 6.0 g/kg saponins. The fatty acid composition of the seed oil was determined by GC-MS. Caprylic, myristic, palmitoleic, palmitic, oleic, stearic, linoleic, vernolic, arachidic, behenic and lignoceric acids were found.

Introduction

Vegetable seeds and seed oils constitute an essential part of human diet. The demand for dietary oils in the world has been increasing (FAO, 1978; Akinbo, 1987). They also constitute an essential part of industrial input.

Large amounts of oil-bearing vegetable seeds which have not been investigated for dietary purposes abound in many parts of Nigeria (Dalziel, 1955; Ogbobe, 1988). One such vegetable seed is the seed of *Jatropha gossipifolia* which grows in coastal areas of west tropical Africa. It was planted for ornamental purposes in the past. In some parts of Nigeria, the plant is an object of superstition as it is often a village hedge, a defence against burning and, by some people, is believed to ward off lightening. The sap is said to be poisonous.

Although the plant bears a large amount of seeds yearly, the seeds are usually left to waste at the foot of each tree. The aim of this study was to characterise the seed and seed oil of *Jatropha gossipifolia* and thus ascertain its potential in the food and polymer industries.

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Materials and methods

Extraction and analysis of seed oil

Jatropha gossipifolia seed oil was extracted by soxhlet from the ground seed using a low boiling petroleum ether (40–60 °C) and analyzed immediately for iodine value using Wij's method (Wij's, 1929). Saponification value and peroxide value were also immediately determined using the Official and Tentative Methods of the American Oil Chemists Society (AOCS, 1973). Crude oil content of the seed was determined as a mean value of six determinations.

Analysis of fatty acid distribution

Methyl esters of extracted oil were prepared according to the Official Methods of the American Oil Chemists Society. The fatty acid distribution was obtained on a Hewlett-Packard 5988 GC-MS with the following experimental conditions. The column was a silica fused capillary column 15 cm long, with an internal diameter of 0.32 mm, SE-52 stationary bonded phase with 0.1–2 microns thick. The GC oven programme was at 100 °C for 2 min, then 8 °C/min until up to 280 °C. Helium was used as carrier gas at a pressure of 0.5 atm at the injector. The vacuum was about 2.0×10^{-4} while the injection pot was held at 200 °C. 0.2 microliters of sample were injected with a split ratio of 1/50. The capillary column was directly inserted in the ion source in electron impact conditions with a scan of 1 sec. Identification was by comparison with standard samples (palmitic, stearic and oleic) and molecular mass correspondence.

Analysis of defatted seed

Moisture, nitrogen and ash contents of the defatted seed were determined by the usual standard methods recommended by AOAC (Officials Methods of Analysis of the Association of Officials Analytical Chemists, 1975). The percentage protein was calculated by multiplying the total nitrogen by a factor of 6.25. Saponin content of the defatted seed was assessed by the method described by Hudson and El-Difrawi (Hudson and El-Difrawi, 1979).

Results and discussion

Table 1 shows the physico-chemical composition of the seed oil and defatted

Table 1. Physico-chemical composition of seed and seed oil of *Jatropha gossipifolia*

Crude oil content (%)	35.44 ± 0.18*
Refractive index	1.35
Specific gravity	0.883
Melting point (°C)	2–4
Solidification point (°C)	−8 - (−10)
Peroxide value (m eq. kg^{-1})	4.57
Acid value	2.81
Saponification value	179.55
Iodine value	107.25
Carbohydrate	41.32
Protein	13.41
Ash (%)	7.28
Saponins content (s/kg)	6.0

* Mean ± SD of six determinations.

seed of *Jatropha gossipifolia*. The seed shows a moderate amount of protein, high fibre content, low saponins or alkaloid content. The iodine value suggests that the oil is a semi-drying oil indicating that the oil is poly-unsaturated. This is significant as it is an essential requirement for food oils. The oil also contains 2.62% of vernolic acid (an epoxy acid compound) known to be substantially used by industry to manufacture plastic formulations, protective coatings and other products (Perdue et al., 1986).

Fractionation of the fatty acids (as methyl esters) in the seed oil of *Jatropha gossipifolia* by GC–MS showed eleven component fatty acids with fragment ions M^+ of m/e 158, 242, 268, 270, 296, 298, 294, 310, 326, 354 and 382.

The distribution and relative concentrations of the fatty acids are given in Table 2. It can be seen that it contains two of the normal fatty acid

Table 2. Fatty acid distribution in the seed oil of *Jatropha gossipifolis*

Fatty acid	R.T	R.A (%)
Caprylic	6.85	10.45
Myristic	11.17	2.62
Palmitoleic	13.77	3.26
Palmitic	14.25	20.90
Oleic	16.68	31.35
Stearic	17.10	15.68
Linoleic	19.00	5.25
Vernolic	19.28	2.62
Arachidic	19.52	4.54
Behenic	21.95	1.63
Lignoceric	25.23	0.99

components (oleic and linoleic) of food fats (Howstmueller, 1975) in significant amounts.

The saponin content in the seed was approximately 6.0 g/kg compared to about 19 g/kg in soybean. The saponins content is lower than the saponins contents of soybean, oil bean and Mucuna Uriens (Achinewhu, 1983). The alkaloid content is also comparable to that in mucuna and lupin seeds. *Jatropha gossipifolia* seed is, therefore, a potential source of plant food for human and animal consumption as well as a potential additive for plastic formulations.

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