ANALYSIS OF SEED OIL OF *JATROPHA CURCAS*: A MIRACLE PLANT

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Jatropha curcas, commonly known as physic nut, is a drought resistant plant and grows in the places where most of plants would die. It is a multipurpose plant because all the parts of the plant are used either as medicine or for other purposes since ancient times. The plant produces many useful products, specially the seeds from which oil can be extracted. The present study shows the linkage of ancient knowledge of ***Jatropha curcas*** with the modern knowledge by giving the detailed chemical analysis of the seed oil. The oil is rich in unsaturated fatty acids. This oil can be used as biodiesel and other industrial applications as indicated in the literature.

Keywords: *Jatropha curcas*, seed oil, gas liquid chromatography, fatty acids.

Introduction

India is the land of *Ayurveda*, the ancient science of traditional medicines. The herbal wealth of India and the knowledge of their medicinal properties have a long tradition, as referred in Rigveda and other ancient literature (Chandra, *et al*., 2007). A wide range of medicinal plants is grown in India. In ancient times, these plants were used to treat many diseases. In this paper, author has focused on a plant *Jatropha curcas*, which is used in *Ayurvedic* literature such as *Charaka-Samhita*. Portuguese sailors when came to South America, learned about the medicinal properties of *Jatropha*. The botanist Carl Von Linné was the first who classified the plant in 1753. He gave it the botanical name *Jatropha curcas* from the Greek word "Jatros" meaning a "doctor" and "trophe" meaning "nutrition" which implies medicinal uses and today it is cultivated in many countries. Olmeca people, who lived 3500–5000 years ago, reinforce that *J. curcas* has Mexican origin. Due to its exceptional medicinal properties, it is reasonable to presume that *Jatropha curcas* has been a plant species known to humanity since antiquity (Dias *et al*., 2012). According to World Health Organisation (WHO), about 25 per cent of the prescribed human medicines are derived from plants and 80 per cent people still depend on the traditional system of medicines.

Jatropha curcas plant belongs to family *Euphorbiaceae* which is native to Central America and Mexico. The plant originates in Central America and has been spread around tropical and sub-tropical countries (Heller, 1996). It is mainly grown in Africa and Asia. It grows almost anywhere-even on sandy and saline soils. It is called by different names in different countries; in general, it is called physic nut (Linnaeus, 1753) and *Ratanjot* or *Jangli Arandi* in Hindi.

Jatropha can grow to a height of about 3 to 5 metres and if the conditions are favourable

they can grow even to a height of 8–10 metres. In this plant, male and female flowers blossom separately female flowers are little larger than male flowers. During winter, shrubs are leafless, giving way to produce fruits. After three months of flowering, seeds are matured. The matured *Jatropha* seeds are 2.5 cm long. *Jatropha* seed once planted, starts fruiting after 2 years and continues up to 30–40 years. It is a drought-resistant species which is widely cultivated in the tropics as a fence crop from centuries.

Fig. 1. *Jatropha Curcas* plant

In ancient times, the extract of its leaves and seeds was used as a traditional medicine and for veterinary purposes. A chemical *curcin* (an alkaloid) is present in its shoots and leaves, which is effective as antiseptic, but if taken in large quantity, can be anti-nutritional. The root extract of *Jatropha curcas* shows anti-diarrhoeal activity (Mujumdar, 2004).The oil is used for skin diseases and to relieve the pain caused by rheumatism. The decoction of leaves is used for cough and as an antiseptic after birth. Its branches are used as chewing sticks (Isawumi, 1978). The latex of this plant has antimicrobial properties (Thomos, 1989).

Jatropha curcas root bark has been reported to inhibit the growth of *Staphylococcus aureus and Escherichia coli* (Naqvi *et.al.*, 1991; Sundari *et al*., 2011). The bark contains, resin, tanin, wax, etc., which makes it useful for industrial purposes. In earlier times, its oil was used for making soaps and candles. The seed oil is also used for illumination and can be the best alternative for diesel and kerosene. The valuable medicinal information in the ancient times used to be passed from generation to generation by traditional practices. In this modern world, it is important to recognise the importance of these medicines and to analyse how these medicines work.

Literature shows that during ancient times, each and every part of the plant was useful in some ways or the other. A lot of systemic research work is yet to be done to investigate the medicinal significance of this plant. Since seed chemistry is an interesting subject for scientific study, this work involves a detailed chemical analysis of seed oil of *Jatropha curcas*.

Materials and Methods

The seeds of *Jatropha curcas* were collected and dried. 300 gm of seeds were crushed and taken in a soxhlet extractor. Extraction was done with petroleum ether (40–60°C) for 10–12 hours on a steam bath. Petroleum ether was removed on a rotary evaporator under reduced pressure. The oil yield obtained was 24–25 per cent. The oil was stored in a refrigerator under nitrogen atmosphere until use. The physico-chemical characteristics of the oils were determined using standard methods (AOAC, 1973). The results obtained are tabulated in Results and Discussion.

Fig. 2. *Jatropha curcas* seeds

Preparation of Fatty Acids

The oil (5 mL) was saponified for 12 h with 1M solution of alcoholic KOH in 95 per cent ethanol (50 mL) on a steam bath. The solution was cooled and distilled water (100 mL) was added to it. The solution was extracted with ether. The ether extract was washed several times with distilled water and dried over an anhydrous sodium sulphate. The non-saponifiable matter was removed on removal of solvent on a rotator evaporator under reduced pressure. Water washings were added to the aqueous layer which was acidified with hydrochloric acid and extracted with ether. Free fatty acids were obtained on removing the solvent and stored at 4°C under nitrogen atmosphere.

Preparation of Fatty Acid Esters

The methyl esters of mixed fatty acids (0.05 g) were taken in methanol (5 mL) in a round bottomed flask and 0.5 mL of H_2SO_4 was added to it. The material was refluxed over a steam bath for 4 h. Esters formed were extracted with ether. Ethereal layer was once washed with 10 per cent potassium carbonate and thrice with distilled water. After drying it over anhydrous sodium sulphate, the solvent was removed on a rotator evaporator under reduced pressure. Methyl esters were stored at 4°C under nitrogen atmosphere.

Analysis of Fatty Acids by Gas Liquid Chromatography (GLC)

The methyl esters of mixed fatty acids prepared were taken in cyclohexane and subjected to GLC using the following parameters:

Detector	FID/Isothermal mode
Column	DEGS 15°, 80/100
	Chromosorb WAW DMCS 6HX1/8°SS.
Column Temperature	195°C
Carrier Gas	Nitrogen
Flow Rate	20 mL/min.
Sample Volume	1°L

The peaks were identified by comparison with the retention times of reference compounds.

Results and Discussion

The physico-chemical characteristics of *Jatropha curcas* oil is shown in Table 1.

Table 1: Yield and Physico-chemical Characteristics of Oil of *Jatropha Curcas*

Per cent Oil Yield	24–25
Acid Value	48.62
Saponification Value	215.05
Iodine Value	104.74
Specific Gravity (32°C)	0.911
Refractive Index (32°C)	0.301

Table 2: Fatty Acid Composition (per cent)

Caprylic Acid ($C_{8:0}$)	1.38
Capric Acid ($C_{10:0}$)	0.43
Lauric Acid ($C_{12:0}$)	0.35
Palmitic Acid ($C_{16:0}$)	18.70
Stearic Acid ($C_{18:0}$)	8.02
Lauroleic Acid ($C_{12:1}$)	0.57
Oleic Acid ($C_{18:1}$)	53.94
Linoleic Acid ($C_{18:2}$)	13.49

Results show that *Jatropha curcas* contains saturated fatty acid mainly palmitic acid (16:0) 18.70 per cent, stearic acid (18:0) 8.02 per cent and unsaturated fatty acids mainly oleic acid (18:1) 53.94 per cent and linoleic acid (18:2) 13.49 per cent. Literature also shows presence of these fatty acids in *Jatropha Curcas* (Azhari *et al*., 2008; Sachdeva, *et al*., 2011). The oil extracts exhibited good physico-chemical properties and could be useful as biodiesel and for other industrial applications.

Conclusion and Future Prospects

Most of the ancient systems of medicines have therapeutic values and India been always in forefront in utilising the indigenous plants for medicines, but are deficient in edible and non-edible oils. A large amount of these are imported leading to the drainage of the valuable foreign exchange. The seeds of *Jatropha curcas* contain 24–25 per cent oil that can be processed to produce biodiesel, and oil cake can be used as manure. Studies have shown that oils from unconventional native source will not only fulfil the gap between demand and supply, it could also be the source of earning foreign exchange. Presently, *Jatropha curcas* has received much attention because of its immense role as eco-friendly fuel in comparison to petro-diesel.

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