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Chemical Properties of Different Treated Seed and Kernel of *Jatropha Curcas* Samples

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Abstract: The *Jatropha curcas* seed and kernel from different treated samples was conducted to investigate the chemical properties of the different *Jatropha curcas* seed and kernels oil treated like control (T_1), chemical fertilizer (T_2) and organic manure (T_3). The effect of the *Jatropha curcas* seed and kernels individual chemical properties indicate that the acid value, viscosity, flash point, refractive index, pour point, ash content, density, specific gravity, saponification value and iodine value are tested and compare to the different treatment values. The results reveal that there are significant chemical properties to *Jatropha curcas* and it's also sufficient to purify seed oils for biodiesel production.
Key words: *Jatropha curcas*; Seed oil; Chemical properties; Biodiesel.

1. Introduction

Plants have been an important source of medicines for thousands of years. The World Health Organization estimates that up to 80 percent of people still rely mainly on traditional remedies such as herbs for their medicines[1]. There are thousands of species of medicinal plants used globally for the cure of different infections and they are recommended for treating various diseases[2,3].

Jatropha curcas is a shrub belonging to the Euphorbiaceae family. It is cultivated in central and South America, South East Asia, India and Africa[4,5]. Jatropha comes from the Greek words jatrós meaning medical and trophé meaning food[6]. It is a poisonous, semievergreen shrub or small tree, reaching a height of 6 m, 20 ft[7]. It is an ornamental plant which is also employed to cure various infections in traditional medicine[3]. The knowledge of physical and chemical properties of agricultural products is very essential for the design of suitable machines and equipment for the production, handling, processing and storage of these products[8]. For biodiesel, physico chemical properties are a set of property specifications measured by specific American Society for Testing and Material (ASTM). Jatropha curcas is one of the non-edible oil expanded widely in many countries such as South East Asia (Indonesia, Malaysia and Thailand), India, Pakistan and Africa. Among the various non edible feedstock's, jatropha curcas has been found more suitable for biodiesel production and it a substitute for petrol diesel besides edible oil (palm oil and soyabean oil). The objective of this study is to determine the design related chemical properties of *Jatropha curcas* found. These parameters will be useful in designing equipment for production, handling, processing and storage of the *Jatropha curcas*.

2. Materials and Methods

2.1. Collection and preparation of Jatropha curcas seed samples

The seeds of *Jatropha curcas* were collected from Department of Agronomy, Faculty of Agriculture, Annamalai University, TamilNadu. Three different treated samples Control (T_1), Chemical fertilizer (T_2), Organic manure (T_3) seed and kernel were separated (Fig.1.). This work was carried out in the Department of Mechanical Engineering Laboratory, Annamalai University.

Seeds were ground prior to oil extraction, soxhlet apparatus was used for the extraction and n-hexane as solvent at (40-70) °C. After 8 hrs the extraction mixture was cooled and filtered to get rid of the solid from the solvent. The filtrate was concentrated under vacuum in a rotary evaporator apparatus at 400 °C. Extracted seed oil was stored in freezer at -20 °C for subsequent physico chemical analysis[9].

Extracted seed oil were then analysed for various Chemical parameters such as acid value, viscosity, flash point, refractive index, pour point, ash content, density, specific gravity, saponification value and iodine value. The above tests were analysed in Soil Science and Agricultural Chemistry, TNAU, Coimbatore, India.

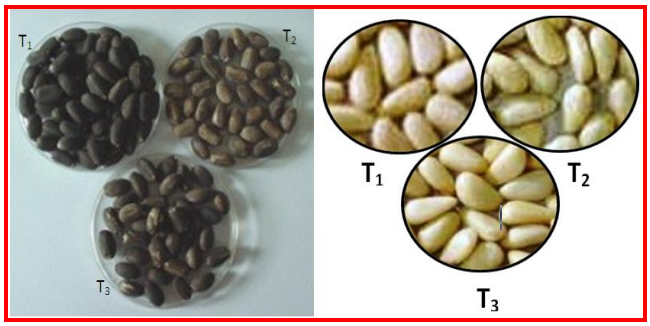

Fig.1. Different treatment samples of *Jatropha curcus* seeds and kernels.

3. Results and Discussions

3.1. Chemical analysis of *Jatropha curcas* seed oil samples

The present investigation aims to assess the status of *Jatropha curcas* seed oil samples. The chemical properties of different treated Control (T_1), Chemical fertilizer (T_2) and Organic manure (T_3) *Jatropha curcas* seed oil had been investigated by various methods were studied such as acid value, viscosity, flash point, refractive index, pour point, ash cont, density, specific gravity, saponification value and iodine values were estimated respectively and also determined and compared with treated *Jatropha curcas* oil of the parameters describes the chemical values obtained from the analysis of the values and various results of treatments are presented in Table 1 and Fig.2.

3.1.1. Acid value

The acid values shown range from 2.82 to 4.26 mgKOH/g. Among them (T_3) treated samples showed higher value of 4.26 mgKOH/g and (T_1) sample showed lower acid value of 2.82 mgKOH/g. but chemical fertilizer (T_2) treated samples had moderate acid value of 3.82 mgKOH/g. Acid value of oil suitable for edible purposes should not exceed 4 mg/g[5,10]. The results thus indicated the inedibility of *Jatropha curcas* oil[11].

Table-1: Chemical properties of *J.Curcas* seed oil

Parameter	Treatments			Reference Value
	T_1	T_2	T_3	
Acid value (mgKOH/g)	2.82	3.82	4.26	5.31
Viscosity (mm^2/s)	51.14	48.82	45.14	52
Flash Point (°C)	210	225	235	258
Refractive Index (μ)	1.46	1.47	1.48	1.496
Pour Point (°C)	-3	-4	-5	-15 to 16

Ash Cont (%) (w/w)	7.97	5.46	3.14	4.56
Density (kg/m^3)	910	924	935	910
Specific Gravity (°C)	0.896	0.914	0.930	0.94
Saponificationvalue (mgKOH/g)	172	182	196	210
Iodine value (g /100g)	98	101	108	106

3.1.2. Viscosity value

Viscosity value of all the three treated samples had range from 45.14-51.14 mm^2/s. Among them (T_1) treated samples showed higher value of Viscosity 51.14 mm^2/s and (T_3) sample showed lower Viscosity value of 45.14 mm^2/s. but chemical fertilizer (T_2) treated samples had moderate Viscosity value of 48.82 mm^2/s. Which is an essential property of fuel, is very high in castor and jatropha oils. Kinematic viscosity of crude castor oil is almost ten times higher than those of jatropha and palm[12,13].

3.1.3. Flash Point value

Flash Point value was around 210 to 235 °C in all three treated samples. Among them (T_3) treated sample showed higher value of the Flash Point in 235 °C and (T_1) showed lower value of Flash Point 210 °C, (T_2) showed a moderate value of Flash Point 225 °C. The flash point increases as the percentage of Jatropha biodiesel increases in the blends. Generally, fuel with the flash point more than 66 °C is considered as a safe fuel[14].

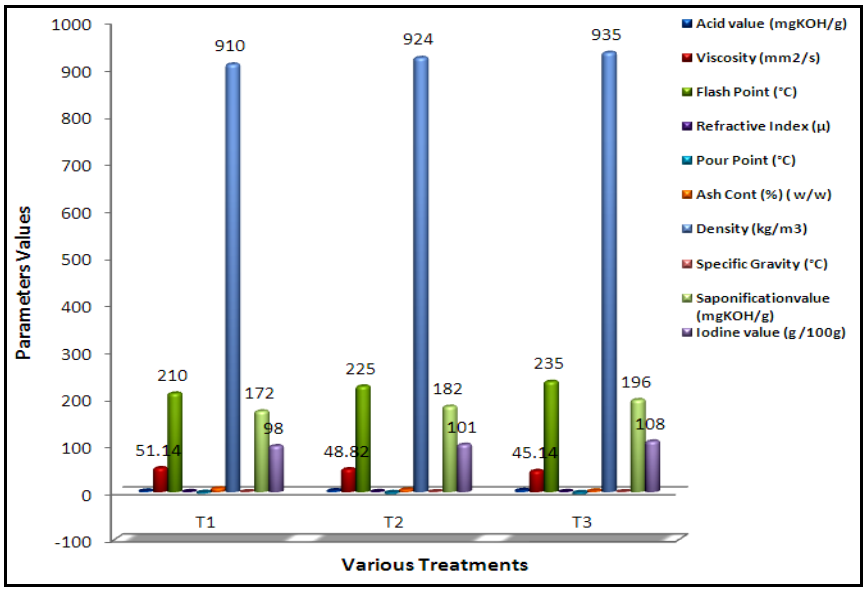

Fig. 2. Variation of chemical parameters at different treatment.

3.1.4. Refractive Index and pour point values

Refractive Index was around 1.46 to 1.48 µ in all three treated samples. Among them (T_3) treated sample showed higher value of the Refractive Index in 1.48µ and (T_1) showed lower value of Refractive Index 1.46µ, (T_2) showed a moderate value of Refractive Index 1.47µ[11,15].

Pour Point was around -3 to -5 (°C) in all the three treated samples. Among them (T_3) treated samples showed higher values of Pour Point in -5 (°C) and (T_1) treated samples showed lower value of Pour Point -3 (°C) chemical fertilizer (T_2) showed the moderate value of Pour Point in -4 (°C).

3.1.5. Ash content value

Ash content was around 3.14 to 7.97 % w/w in all the three treated samples. Among them (T_1) treated samples showed higher values of Ash content in 7.97 % w/w and (T_3) treated samples showed lower value of Ash content 3.14 % w/w chemical fertilizer (T_2) showed the moderate value of Ash content 5.46 % w/w[5].

3.1.6. Density and Specific gravity values

Density was around 910 to 935 kg/m^3 in all three treated samples. Among them (T_3) treated sample showed higher value of the Density in 935 kg/m^3 and (T_1) showed lower value of Density 910 kg/m^3, (T_2) showed a moderate value of Density 924 kg/m^3. Density is another important property of biodiesel. The density of fuel has some effect on the break-up of the fuel injected into the cylinder. In addition, more fuel is injected by mass as the fuel density increases[14,16].

Specific Gravity was around 0.896 to 0.930 (°C) in all the three treated samples[16,14]. Among them (T_3) treated samples showed higher values of Specific Gravity in 0.930 (°C) and (T_1) treated samples showed lower value of Specific Gravity 0.896 (°C) chemical fertilizer (T_2) showed the moderate value of Specific Gravity in 0.914 (°C).

3.1.7. Saponification and Iodine values

Saponification value of all the three treated samples had 172 to 196 mgKOH/g. Among them (T_3) treated samples showed higher value of Saponification value 196 mg KOH/g and (T_1) sample showed lower Saponification value of 172 mg KOH/g. but chemical fertilizer (T_2) treated samples had moderate Saponification value of 182 mg KOH/g[5].

Iodine values were in the region of 98 to 108 g/100g in all the three treated samples[11]. Among them (T_3) treated samples showed higher values of organic manure treated iodine value 108 g/100g and (T_1) control treated samples showed lower value of iodine 98 g/100g chemical fertilizer (T_2) showed the moderate value of iodine101 g/100g. The oil shows a high iodine value due to its high content of unsaturated fatty acids. Jatropha collected from rural area of Dehradun has nearer 104.46 iodine value then that was reported as 105.20 in Nigerian and 135.85 in Malaysian[5,17]**.**

Moreover, a comparison with the obtained results from several literatures had been done and found that most of the parameters of ASTM specification. These results based on it proved that *jatropha curcas* could be utilized as a feedstock for biodiesel. Many researches were conducted on *jatropha curcas* biodiesel production, properties and engine performance/emission characteristic. Therefore, *jatropha curcas* biodiesel had been scientifically proved and could be used to replace petrol diesel in the future studies.

4. Conclusion

The chemical properties of *Jatropha curcas* seed and kernel such as acid value, saponification value, viscosity, refractive index, flash point, pour point, ash content and density values were estimated. The chemical properties and superior acid composition when compared to three treated samples were investigated. The investigation of Jatropha *curcas* different treated oil samples, the high yield is in (T_3) treated sample. The oil studied exhibited good fuel properties except palm oil. This study shows that most of the properties evaluated for the biodiesel conform to the ASTM values. All the studied seed and kernel exhibited good physicochemical properties and could be useful as biodiesel feedstock. It is sufficient to purify *jatropha* oil for biodiesel production.

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