Changes In The Fatty Acid And Lipid Content Of Jatropha Curcas Induced By Fusarium Oxysporum And Macrophomina Phaseolina

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ABSTRACT

This research was carried out to study the deteriorative changes in oilseeds under the influence of *Fusarium oxysporum* and *Macrophomina phaseolina* on *Jatropha curcas* seed . There was a significant reduction of 5.0% and 3.3% in lipids and the fungi caused significant increase (P=0.05) in %free fatty acids 3.0% and 6.0% respectively of *Jatropha curcas* seeds inoculated at room temperature (28±2^{o}C) for 7days when compared to uninoculated controls. The increase in the formation of free fatty acid was found to be associated with a decrease in total oil. The high percentage of oil makes this *Jatropha curcas* seed a distinct potential for the oil industry.

1. INTRODUCTION

Gubitz *et al*.,1999 reported that analysis of *Jatropha curcas* seeds shows that it contains; moisture 6.62; protein 18.2; fat 38.0; carbohydrates 17.30; fibre 15.50; and ash 4.5% (Gubitz *et al*., 1999). The oil content is 35 to 40% in the seeds and 50 to 60% in the kernel (Gubitz *et al*., 1999). The oil contains 21% saturated fatty acids and 79% unsaturated fatty acids (Gubitz *et al*., 1999). It has also been found that there are some chemicals element in the seeds which possess poisonous and purgative properties and render the oil non edible for human consumption. It is also been stated that technologies are now available, whereby it could be possible to convert Jatropha oil into an edible oil which could prove to be a boon for developing countries (Gubitz *et al*., 1999). The oil is obtained from decorticates seeds by expression or solvent extraction and is known in trade as Jatropha. In general, the oil is reported to be mixed with groundnut oil for adulteration. This indicates the possibilities of obtaining edible oil from Jatropha oil base (Gubitz *et al*, 1999).

Jatropha oil is an environmentally safe, cost effective and renewable source of non-conventional energy as a promising substitute to Hydelpower, diesel, kerosene, LPG, coal and firewood etc. The fuel properties of the Jatropha oil closely resembles with the diesel oil. It was found that the specific gravity of Jatropha oil is 0.9180 (gr/ml) compared to diesel oil 0.8410 (gr/ml). Calorific value of the Jatropha oil is 41 MJ/kg and diesel oil is 45 MJ/kg (Rosenblum, 2000, Gubitz, 1999).

Similarly, it has been reported that the flash point of Jatropha oil and diesel is 2400 and 50^{o}C respectively. In addition to this, cetane number of Bio-oil and Diesel is 51 and 50 respectively. Likewise, the Sulphur weight (%) of Jatropha oil and Diesel is 0.13 and 1.2 respectively (Radich.2004, Gubitz. 1999)

One study, published in 1998 and cited by the National Biodiesel Board, found that one-half of samples of petroleum diesel sold in the United States did not meet the recommended minimum standard for lubricity. It was reported that Biodiesel has better lubricity than current low-sulfur petroleum diesel, which contains 500

parts per million (ppm) sulfur by weight. The petroleum diesel lubricity problem is expected to get worse when ultra-low-sulfur petroleum diesel (15 ppm

sulfur by weight) is introduced in 2006. A 1- or 2-percent volumetric blend of biodiesel in low sulfur petroleum diesel improves lubricity substantially. It should be noted, however, that the use of other lubricity additives may achieve the same effect at lower cost (Radich, 2004).

As a potential source of biodiesel production, the oil content and fatty acid (FA) composition of *J. curcas* seeds are of vital importance. The oil content of *J. curcas* seeds, together with the seed yield, remarkably influences its economic value, especially for large scale agricultural production.

2. MATERIALS AND METHOD

Collection of seeds

The Physic nut seeds were collected from the Federal College of Forestry Jos. Plateau State. The experiment was carried out in the Department of Plant Science and Biotechnology, University of Port Harcourt.

Determination Of Lipid By Soxhlet Extraction Method

One gram of sample each for both inoculated and uninoculated seeds was inserted into a filter paper and was placed into a soxhlet extractor. The extractor was placed into a pre-weighed dried distillation flask. Then the solvent acetone was introduced into the distilled flask via the condenser and attached to the solvent extractor. The set up was held in place with a stand clamp. Cold water jet was allowed to flow into the condenser and the heated solvent was refluxed as a result. The lipid in the soxhlet chamber was extracted in the process of continuous refluxing. When the lipid was observably extracted completely from the sample under test, the condenser and the extractor was disconnected and the solvent was evaporated to concentrate the lipid. The flask was then dried in the air oven to constant weight and re weighed to obtain the weight of the lipid.

$$\% \text{ Lipid} = \frac{\text{wt. of conical flask + lipid Ext.- wt. of flask}}{\text{Weight of sample}} \times \frac{100}{1}$$

Determination Of Free Fatty Acid Content

25ml of diethyl ether was mixed with 25ml alcohol and 1ml of phenolphthalein solution (1 per cent) and carefully neutralized with 0.1 M sodium hydroxide. One gram of the oil was dissolved in the neutral solvent and titrated with aqueous 0.1M sodium hydroxide by shaking constantly until a pink colour which persist for 15seconds is obtained.

$$\text{Acid value} = \frac{\text{titration(ml) x 5.61}}{\text{Wt of sample used}}$$

The FFA figure was calculated as oleic acid (1ml 0.1M sodium hydroxide =0.0282g oleic acid) in which case the acid value =2 x FFA

3. RESULTS

Changes In Lipid Content

The lipid content increased significantly(P=0.05) in all the samples inoculated with *Fusarium oxysporum* and *Macrophomina phaseolina* when compared with the control (Fig 1)

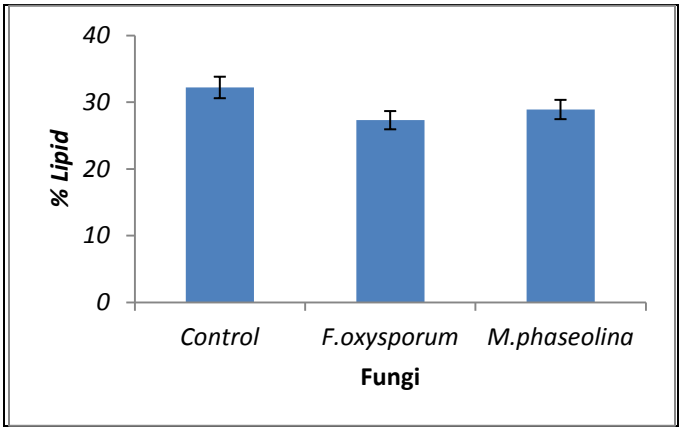

Fig 1: Lipid content of inoculated and uninoculated Jatropha curcas seeds

Changes In Free Fatty Acid Composition

The free fatty acids expressed as percent oleic acid for both inoculated increased from the uninoculated seeds (Fig 2)

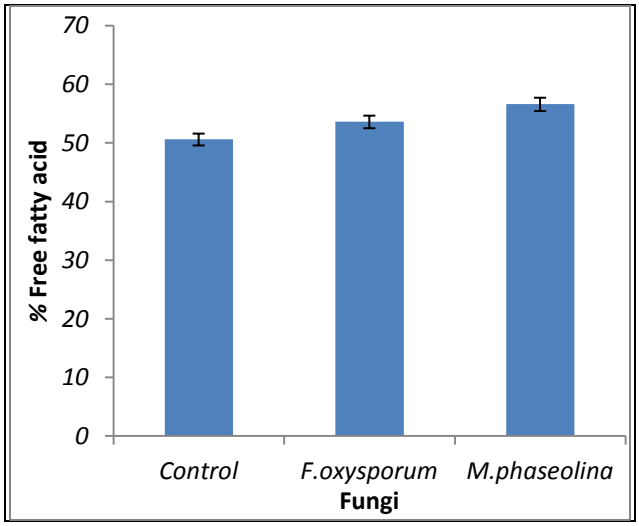

Fig 2: Free fatty acid content of inoculated and uninoculated Jatropha curcas seeds

4. DISCUSSION

The extracted lipid from the seeds inoculated with *Fusarium oxysporum* and *Macrophomina phaseolina* decreased from the uninoculated control (32.17%). *Fusarium oxysporum* (27.27%) and *Macrophomina*

phaseolina (28.97%) respectively. This is in agreement with the report of Ward and Diener (1961) who reported that fungi caused a decrease in total oil of groundnut. Also, Ogundero (1992) explained that the decrease in oil content could be due to the hydrolysis of oil to free fatty acid (FFA). This occurred at different rates for the individual micro-organisms.

The free fatty acid expressed as percent Oleic acid for both inoculated and uninoculated seeds increased. *Macrophomina phaseolina* induced the highest value of free fatty acid of (56.6%) while seeds inoculated with *Fusarium oxysporum* had the lowest free fatty acid value of (53.61%). The increase in free fatty acid seems to suggest that these fungi have high lipase activity. The increase in the formation of free fatty acid was found to be associated with a decrease in total oil. Ward and Diener, (1961) reported increase in free fatty acids of groundnut inoculated with *Aspergillus* sp. and noted that the fungus utilized the free fatty acid as carbon source. Fatty acid values which have been suggested as a quantitative indicator of deterioration may give unreliable results for two reasons. Production of fatty acid varies with the species and possible with the strain of the fungus and secondly, a fungus may be relatively productive but may itself subsequently consume portions of the fatty acids produced Christensen and Kaufman, (1969).

5. CONCLUSION

In conclusion the result showed that there was decrease in oil content due to the hydrolysis of oil to free fatty acid.

6. REFERENCES

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