

Biodiesel Production from *Jatropha curcus* : the Nigerian and Tanzanian Experiences and Implications for Africa

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JATROPHA CURCUS

Environmental and economic concerns have been driving the development of alternative green and renewable liquid fuels for transport for several years across the globe. Many African countries have joined this movement which saw the promotion of *Jatropha* for biodiesel production. The paper reviews these developments using Nigeria and Tanzania as case studies. It is clear that more than a decade of this policy campaign has yielded very limited success. It is evident that across the African landscape, *Jatropha* farmers hopes have been dashed, investments in *Jatropha* Biodiesel have failed and environmental degradation in some countries has occurred in the promotion of *Jatropha* plantations. It therefore becomes imperative to go back to the drawing board for a thorough techno-economic review. *Jatropha* clearly is unsuitable, both economically and environmentally, for biodiesel production and there is need to fund research to screen other indigenous African plants seeds for biodiesel production. There is also need to introduce Biofuels Production in higher education curricula in African countries. The COBRA consists of periodically spaced orifice baffles along the length of the tubular reactor that is superimposed with a reversing oscillatory component, giving both high fluid mixing and narrow residence time distributions. This has been designed and successfully tested in the University of Maiduguri, Nigeria as well as some European universities.

Energy is the prime mover of economic development. Africa's energy sector, especially the transportation and electricity generation sub-sectors, is heavily dependent on petroleum fuels. Finding sustainable alternatives and/or augmentation for these sub-sectors from new and renewable energy resources is necessary for sustainable economic development. Bio-fuels, among which biodiesel and bioethanol are the key components, are emerging as the major renewable and sustainable alternatives to the conventional petroleum based fuels. They are more environmentally friendly because they add fewer emissions to the atmosphere when compared to petroleum fuels and could use agricultural materials that currently have no significant economic use in their production. Unlike crude oil, which is a nonrenewable resource, biofuels are inexhaustible sources of fuel as long as the sun continues to shine.

Two African countries, Nigeria and Tanzania, have been zeroed down in this study because they made significant attempts in

taking a lead in biodiesel development in the last 14 years in the continent. In Nigeria, the most populous country in Africa, this was started in 2006 with the creation of the Renewable Energy Division (RED) in the Nigerian National Petroleum Corporation (NNPC) and signing of Joint Ventures on local Biofuel production (for blending). Sensitization workshops were carried out and plans rolled out to support out-growers of *Jatropha* across the country. The enthusiasm of local large and small holding farmers was very high and thousands of hectares were committed turning out thousands of tonnes of oil seeds. Unfortunately the value chain ended there as there were no up-takers, no Biorefineries to process the extracted oil to biodiesel and most farmers were disappointed and dejected.

In Tanzania, around the same time with Nigeria, government in 2006 launched promotion of *Jatropha* Biodiesel with foreign investors in the lead. However, in 2010 barely four years after, the Ecologist reported:

“Billed as wonder crop, the establishment of *Jatropha* plantations on the ground in Tanzania has been far from successful, or, in some cases, ethical Despite acres of scientific research, there's no evidence of it working on a large scale at all. It's driven by the industrialized countries and donors' need to find potential fuel to militate against environmental problems: it's sold as a plant that grows anywhere: on degraded land, as a hedgerow..... Any poor farmer can just put it in, and get rich. But *jatropha* doesn't grow on the commercial industrial scale needed to run biodiesel plants: the transaction costs of large scale don't add up. On a small scale, say 500 villages, you could produce the oil for this village to cook on, but not enough to run it at the size the investor's need.”

What went wrong? This is the pertinent question this paper is attempting to answer especially for Nigeria and Tanzania but surely can be applicable to the entire sub-Saharan Africa. Before we review these, it is important to understand the chemistry of Biodiesel Production using any seed oil raw material. The purpose of processing any vegetable oil in a bio-refinery is basically to reduce viscosity. This is necessary as modern diesel engines utilizing Automatic Gas Oil (AGO) are designed using low viscosity oils in mind but assuredly the first diesel engine developed in 1898 by the German Engineer, Rudolf Diesel, used direct peanut oil without any treatment

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