Volume : 2 | Issue : 4 | April 2013 • ISSN No 2277 - 8160

Research Paper | Biotechnology

Biodiesel as a Prospective Fuel in Karnataka, India

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ABSTRACT

India is the world's fourth largest petroleum consumer and the vehicular pollution is estimated to have increased eight times over the last two decades. To combat declining global oil productive capacity combined with a growing oil demand, the carbon footprint from burning fossil fuels and to attain energy security in India, an obvious need for renewable and also less polluting alternatives such as ethanol, biomass, butanol and biodiesel have been felt that can aid in achieving the Indian target of 20% biofuel blending by 2017.

In the year 2000, biodiesel became the only alternative fuel in the country to have successfully completed the EPA required Tier I and Tier II health effects testing under the Clean Air Act. It can be produced from vegetable oils, animal fats, and microbial oil. The most popular sources have been Jatropa and Pongamia seeds that can efficiently be grown on wastelands. Algae are emerging as a very promising source that helps contradict the biodiesel obtained from vegetable seeds through the "Food vs Fuel" conflict. The National Policy on biofuels approved on December 24, 2009 encompasses the National Bio-diesel Mission (NBM) identifying Jatrophacurcas as the most suitable tree-borne oilseed for bio-diesel production.

KEYWORDS: Biodiesel, Jatropha, Pongamia, algae

1. INTRODUCTION

An increase in worldwide interest in alternative sources of energy can be attributed to the inevitable depletion of the world's energy supply, with the increase in population and advancement in technology (Bajhaiya et al., 2010). Biofuels offer a number of environmental, social and economic advantages, including lower emissions of harmful pollutants; decreased greenhouse gas emissions; increased employment; increased energy security, especially in rural areas; decreased dependence on oil imports; production of oil at the backyards (indigenously) and good fuel properties for vehicles (Khan et al., 2009). Moreover, it is a non-toxic, renewable and biodegradable alternative fuel. Biodiesel is typically produced from vegetable oils, animal fats and microbial oil (algae, yeast, bacteria and fungi). In fact, the original diesel engine was designed by Dr Rudolph Diesel to run on vegetable oil. The shift to petroleum based fuels was made because they were cheaper than the vegetable oils. Due to depletion of fossil fuels, increased emission of pollutant gases and the increase in fuel prices, there is a renewed interest in biodiesel, with hope that it can supplement conventional ones (Annual Report 2007).

India is the fifth largest primary energy consumer (per international energy annual) and the fourth largest petroleum consumer in the world. Moreover, India ranks 5th in the list of countries producing high rates of emission and creating environmental and ecological imbalances after USA, China, Russia and Japan (Wright and Aaradhey, 2011). The biofuel industry is determined to make important contributions to meet India's energy needs by supplying clean, environmentalfriendly fuel.This caused the approval of the National Policy on Biofuels on December 24, 2009 by The Government of India (GOI).The GOI launched the National Bio-diesel Mission (NBM) identifying Jatrophacurcas as the most suitable tree-borne oilseed for bio-diesel production. This mission aims to attain 20% blending with conventional diesel (Sharma et al., 2010).

India produces over 100 varieties of oil seeds of which only 10-12 varieties have been tapped. Only a few million tonnes have been harvested to any noticeable extent due to lack of demand for industrial use in the country. Biodiesel is produced from the wild oilseed crops or plants which can easily be grown on wastelands (GAIN Report 2011).

In this paper we explore the extent to which the biodiesel has been produced and utilised in the country and determine the feasibility of alternative methods in Karnataka state.

2. MATERIALS AND METHODS

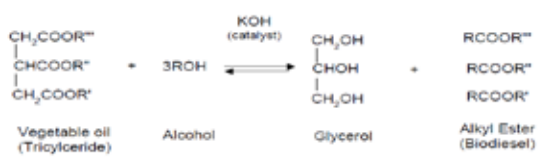

Fig.1. Synthesis of Biodiesel through transesterification

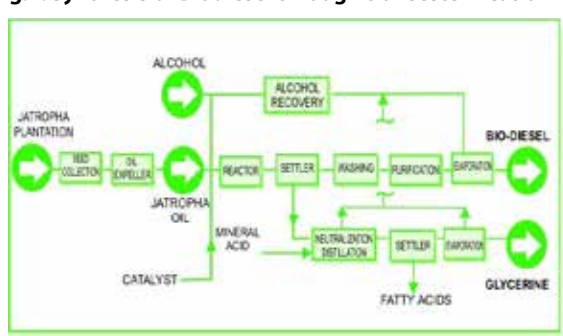

Fig.2. Production of biodiesel using Jatropha feedstock.

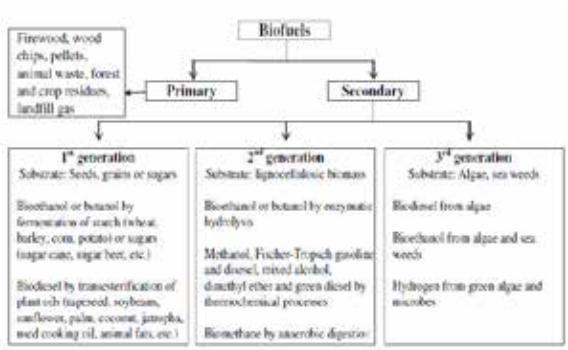

Fig.3. Classification of Biofuels into generations

3. RESULTS AND DISCUSSION

Table 1. Attributes of Biofuel yielding plants in Karnataka:

Plant	Pongamia	Simarouba	Neem	Mahua	Jathropa
Starts Yielding	5-6 years	5-6 years	5 years	10 years	3 years
Yield of seeds	15-40	10-25	10-25	10-40	1-2
Oil Content	30-35	40-50	28-35	30-35	30-35
Cost (Rs) (seeds/kg)	10-15	8-12	3-8	6-10	5-6

Source: Karnataka State Biofuel Development Board

The Government of Karnataka has initiated the awareness and production of the biodiesel using the above said plant seeds. The standard method of production of the oil after decortication of the seeds and the conversion of the oil into the biodiesel has been followed. The programme also aims at creating the awareness among the farmers of Karnataka to grow the oil yielding the plants in the waste lands and also supporting to grow these plants. Many of the farmers have been benefited from the grants to grow the Pongamia and other oil yielding plants. The production units have been sanctioned to each district and the collaboration was done with the responsible engineering colleges / Krishi Vijnana Kendra of the respective districts.

The conversion of the oil to the biodiesel involves the transesterification process. This process is carried out using chemical methods. The production of the biodiesel also yields the by products such as glycerine and seed cake. The glycerine can be used for the production of soaps and detergents. The seed cake will be used as the manure as well as cattle feed.

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