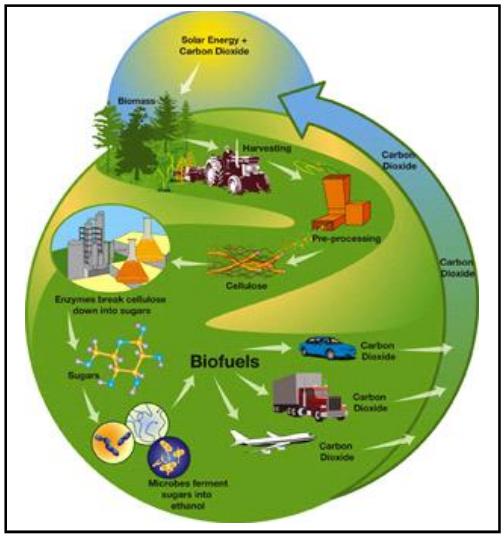
Biofuels – India's future source of energy

M.S. Shekhawat

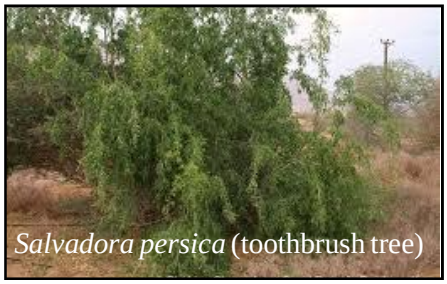
Department of Botany, K.M. Centre for Postgraduate Studies, Lawspet, PONDICHERRY (U.T.) INDIA
(E-mail: smahipal3@gmail.com)

India's 67% demand of petroleum products is completed by export only. Estimates indicate that this figure would rise to 95% by 2030. The price of petrol and diesel is increased many times in last one year. According to the Govt. of India, it is because of increasing price of petroleum products in International market. Petrol and diesel are the fuel for the automobile engines and found in the deep earth. There, in billions of years they formed by many types of reactions. The amount of these products is reduced day-by-day. In future only some parts of the world will have this valuable source of energy. USA covers the oil wells of Kuwait and other Gulf countries in few years also indicate that the mineral oils are limited. Self sufficiency in energy requirement is critical to the success of any growing economy. With increasing energy consumption, dependence on fossil fuels will necessarily have to be reduced. Now it is necessary to discover an alternative source of petroleum products. Biofuel is a type of fuel whose energy is derived from biological carbon fixation. Biofuels include fuels derived from biomass conversion, as well as solid biomass, liquid fuels and various biogases. Biofuels are gaining increased public and scientific attention, driven by factors such as oil price hikes and the need for increased energy security. However, according to the European Environment Agency, biofuels do not address global warming concerns.



Biodiesel/Biofuel : Scientists are successful to discover the alternative source of diesel. It is natural and prepared by the use of vegetable oils and fats. That's why the name of this product is biodiesel. Due to the green revolution and the white revolution, we are now self dependent in the production of food grains and milk. Now it is time to think about black revolution to attain the self dependence in the production of ethanol (biofuel) and mixed it at the level of 10% in petrol and secondly, production of biodiesel. In this context, year 2004 was celebrated as the year of Bio-trade.


Pongamia pinnata (Karanj)


Salvadora persica (toothbrush tree)

India has rich biomass resources which can be converted into renewable energy. The Planning Commission, Govt. of India, has launched an ambitious National Mission on Biodiesel to be implemented by a number of government agencies and coordinated by the Ministry of Rural Development. The Mission focuses on the cultivation of the *Jatropha curcas* (physic nut), a shrubby plant of the castor family. The seed contains 30-40% oil and can be mixed with diesel after trans-esterification. Initially Jatropha cultivation will be demonstrated on 0.4 m ha of wasteland area across the country. Indian climatic conditions are favorable to this plant. It needs minimal inputs or management. It has no insects, pests and not browsed by cattle or sheep. Plants can survive long periods of drought, propagation is easy and yield starts from the 3rd year onwards and continues for 25-30 years. This oil is used as biodiesel. In India the oil is tested so many times by operating railway engines and other types of


Madhuca indica (Mahua)

Table 1 : The comparative study of fuel properties of blend B20 and petroleum diesel

Sr. No.	Fuel Properties	Biodiesel	Petroleum Diesel
1.	Carbon monoxide	-12.6%	-43.2%
2.	Fuel standard	ASTM PS 121	ASTM D 975
3.	Fuel composition	C 12-C 22 FAME	C 10-C 21 HC
5.	Hydrogen wt. %	12	13
6.	Oxygen, by dif wt. %	11	0
7.	Carbon, wt. %	77	87
8.	Sulfur, wt. %	0.0024	0.05
9.	Lower heating value Btu/gal	117,093	131,295
10.	Flash point, degree C	100-170	60-80
11.	Cetane number	48-60	40-55

automobile engines.

The entire cost economics is dependent on the productivity, quality and performance of the raw material. The Government is also discussing a National Biofuel Policy. For further research and testing an MOU has been signed in between CSIR and the famous automobile company Diamler and Chrysler in 2003.

Biodiesel is the methyl ester of vegetable oil. The hydrocarbon chain is smaller than that in petroleum diesel. It is a naturally oxygenated fuel because it has 10% oxygen in it and can be mixed easily with petroleum diesel. Biodiesel can be blended at any level with petroleum diesel to create a biodiesel blend. It can be used without modification or with little modification. Biodiesel is simple to use, biodegradable, nontoxic and essentially free of sulfur and aromatic compounds. Since, biodiesel is a solvent, it can degrade natural rubber hoses and gaskets. But this problem can overcome by using B20 blends (20% biodiesel and 80% petroleum diesel).

The comparative study of fuel properties of blend B20 and petroleum diesel is given in Table 1.

There are two basic disadvantages in the use of biodiesel. Firstly, during cold weather biodiesel gets thickened so that it must be heated gently before use. Secondly, biodiesel has some solvent effect when we use biodiesel in our existing engine it may release deposits accumulated in the tank walls and pipes from pervious diesel fuel storage. These deposits may clog filters initially and precautions should be taken.

Indian efforts : Department of Biotechnology, Govt. of India has been entrusted through a micro-mission with the task of developing technologies that convert fiber, starch and sugar from woody plants and agricultural wastes into useful biofuel products. The thrust is on developing ethanol using lingo-cellulosic waste as raw material, identifying recombinant microbial stains for enhanced ethanol recovery, producing high quality raw material for biodiesel production and developing the enzymatic trans-esterfication process for more efficient conversion of oil to biodiesel. For the first time, a systematic scientific survey, characterization and collection of superior accessions of *J. curcas* from across the country has been taken up. More than 1500 accessions have been collected and characterized. Nurseries have been established at 12 locations for providing quality planting material to the National Mission. Nearly 0.8 million quality plantlets have been planted over an area of 300 ha. A special focus is being given to crop improvement and on genes involved in oil biosynthesis. India has tropical advantage with enormous waste lands and cheaper farm labor, hence, biofuel can be a success story in India. Other 'petro-crops' being investigated include *Pongamia pinnata* (Karanj), *Salvadora persica* (toothbrush tree) and *Madhuca indica* (Mahua).

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