

BIODIESEL – A renewable energy source

Vijay Kale

Deputy Director, Lipid Science and Technology Division
Indian Institute of Chemical Technology (CSIR) Hyderabad
Email: vijaykale@iict.res.in

Fossil fuel supply is dwindling fast and it also contributes to about 70% of the atmospheric pollution. Hence, there exists a need for an alternative, renewable and eco-friendly energy source. Vegetable oils, animal fats and their derivatives can meet such requirements. Vegetable oils have higher molecular weight, higher viscosities, poorer cold flow properties and poorer combustion and these are the main impediments to using vegetable oil directly as a fuel. Hence, vegetable oil derivatives mainly methyl esters have become popular as biodiesel. Biodiesel is defined as mono alkyl esters, mainly methyl esters of long chain fatty acids derived from renewable feed stock such as vegetable oils or animal fats. Cleaner combustion is obtained with biodiesel due to its lower molecular weight, low viscosity comparable to that of petrodiesel and the presence of about 10% oxygen in the molecule. Biodiesel is non-toxic, completely biodegradable natural energy source alternate to petrodiesel. Biodiesel is prepared from various vegetable oils such as soybean oil in USA, rape seed oil in Europe, Palm oil in Malaysia, Indonesia. India cannot afford to use edible oils for biodiesel as it imports above 40% of its edible oil requirement. Hence, the focus is on non-edible oils such as Jatropha and Karanja oil. These trees can be grown on the 55 million ha of waste land as they need little water. These oils from different regions are classified as having either <1% or >1% free fatty acids (FFA). Low FFA oils can be directly transesterified to biodiesel. In high FFA oils, the fatty acids are first esterified and the oil is then transesterified to get the methyl esters which on refining yields biodiesel.

At the Indian Institute of Chemical Technology (CSIR) Hyderabad an autocatalytic process for biodiesel is developed on bench scale and is patented and a batch technology for converting both high and low FFA non-edible oils like Jatropha and Karanja is available for commercial exploitation. In addition development of a continuous process is being pursued.

Vijay Kale
Deputy Director
Lipid Science and Technology Division
Indian Institute of Chemical Technology (CSIR) Hyderabad
Email: vijaykale@iict.res.in

Dr. Vijay Kale obtained his B. Tech, M. Tech and Ph.D in Chemical Engineering from Osmania University, Hyderabad, India and has over 30 yrs of experience in lipid science and technology area. He is engaged in process development on bench and pilot scale in various fields such as castor oil derivatives, rice bran oil refining using enzymatic degumming, biodiesel, high performance lubricants, and membrane technology in vegetable oil industries

He has **industry collaboration** in the following areas:

- 1.) Castor oil derivatives:
 - a.) Designed, commissioned and commercialized a 50 tpd castor derivatives plant
 - b.) A 6 tpd continuous plant for castor oil methyl esters and 2 tpd undecenoic acid.

The processes was demonstrated at the following industries

- M/s. DRIPE, China
- M/s. Gujarat State Fertilizer Corporation, India
- M/s. Sunrise Oil Industries, India

- 2.) Rice bran oil:

The process in enzymatic degumming of rice bran oil was developed on 10 ton/batch commercial scale and the technology was successfully demonstrated to 20 rice bran oil refining industries throughout India. Indian and PCT patents are applied.
- 3.) Processes were developed for Jatropha and Karanja oils and high performance lubricants
- 4.) Membrane processes for the waste water treatment in vegetable oil industries were developed.

Selected List of Achievements

- 1.) Technology prize for enzymatic degumming of rice bran oil from CSIR in the year 2005
- 2.) Undecenoic acid manufacture at Gujarat Oleochem Ltd was implemented with the technology developed by his team. This was released by the Ministry of Human resources Development, Science, Technology and Ocean Development in the year 2002
- 3.) Dr, Hussain Zaheer Award from the Oil Technologists Association of India for the work on castor oil derivatives in the year 1999
- 4.) Best performance award for “Technology development for 10-undecenoic acid for castor oil” from CSIR foundation for the year 1999-2000

He is also the President of the Oil Technologists Association of India and has published in both Indian and International journals and has three patents.