

# Bi FUELS

Research @ **DTU**



## **DELHI TECHNOLOGICAL UNIVERSITY**

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India being a developing country requires a tremendous amount of energy which is mostly provided by petroleum derived fuels. India imports around 82% of its crude petroleum requirement. Biofuels are renewable, indigenously produced and help in mitigating climate change. Biofuels are the promising & sustainable route to provide energy security, reforestation, social empowerment, employment generation and reducing petroleum import.



Delhi Technological University (Formerly Delhi College of Engineering), having a glorious history of more than 75 years of dedicated services to the nation, has emerged as a leading research institution for biofuels research not in India but at international level as well. Development of indigenous production technology, design and development of small to medium capacity processing units, establishing state of art quality assurance and exhaustive trials in stationary engines and vehicles are some key achievements. The university has also set up cultivation of high yielding Jatropha and Karanja along with other species of TBO. The Jatropha, Karanja & other oil seeds are collected from the plantation and extraction of oil is carried in an oil extraction unit. The university is first biofuel campus of India and can produce 10,000 Liters of biodiesel from its cultivation.

DTU also has a nursery of high yielding Jatropha saplings.



## Processing Units

The students and the faculty conceptualized the design of small capacity biodiesel processing units and developed 5, 10 and 100 litres unit during 2003-2005. These units revolutionized the small scale biodiesel production and large number of these design were replicated by Self Help Groups and farmers along with small entrepreneurs/academic institutions.



The university developed a 600 litres per day biodiesel production unit under Ministry of New & Renewable Energy (MNRE) Sponsored Project in 2006.

The institution expanded its horizon further by commissioning a high capacity biodiesel unit (5000 litres per day) as a part of Petroleum Conservation Research Association (PCRA) Sponsored Project in 2008. This is the biggest unit amongst any educational institution in India and has attracted many industries for transfer of technology.



## Biodiesel Training Programmes

The university has always been committed towards popularization of biofuels and the production technology to the rural community of our country. The biodiesel training programme for the farmers, rural entrepreneurs, self-help group of women and ex. defence personnel were organized during 2004-2005 for empowering them as well as provide them with an opportunity for better livelihood and employment. The Petroleum Conservation and Research Association (PCRA) was a key partner in these training programmes.



## Biodiesel Vehicles

Biodiesel Vehicle of DTU was flagged off by Smt. Sheila Dikshit, Former Chief Minister of Delhi on November 1, 2004.

A Maruti Zen diesel car was provided by Maruti Udyog Limited to Students of the institution in December 2004 for conducting field trials of 20,000 km. programmes.



## Participation in Exhibitions

The biofuel research group of the University regularly visit Exhibitions, Workshops, Fairs etc with biodiesel reactors, samples of biodiesel and other exhibits/educational material for interacting and disseminating information to farmers and small & rural entrepreneurs about the opportunities in this vital sector.



## Fences for Fuel

DTU had been a consultant in World Bank Funded Project “Fences for Fuel” which was carried at Virat Nagar Block of Jaipur. A cooking stove, which is a flexi-fuel stove, was developed during the project. Jatropa cultivation at the fences of the field of farmers was carried and Jatropa oil extraction and biodiesel production unit were commissioned in 2006.



## Development of Biodiesel Specific Engine

A Sponsored research project with Yanmar Co. Ltd., Osaka, Japan for carrying out exhaustive trials on a Yanmar diesel engine on neat Jatropa biodiesel (B100) was inaugurated on December 4, 2007. The project aimed towards the development of a biodiesel specific engine. A comprehensive 6,500 hours of trial run was accomplished in the project. The project was very unique and the Yanmar Co. Ltd. provided the engine and whole instrumentation for the exhaustive trial. The trial data were transferred to R&D Center of Yanmar Co. Ltd. at Osaka on line.



## Development of Super Critical Transesterification Reactor

Delhi Technological University has executed Indo-Spanish Collaborative Research Project "Application of supercritical technology for the synthesis of biodiesel from non-edible oils (*Jatropha curcas* and *Pongamia pinnata*) using heterogeneous catalysts" with the University of Murcia, Murcia, Spain. The faculty and the students from DTU and University of Murcia visited partnering institution and a super critical transesterification reactor was developed to accelerate the production process of biodiesel of non-edible origin.

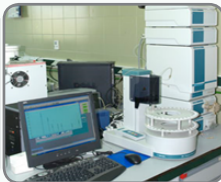


## Development of Ultra-Shear Reactor

Prof. Naveen Kumar was invited by Kreido Biofuels, Camarillo, California, USA to participate in a Workshop and also to work on STT Reactor. Students and faculty of the university are striving hard to develop indigenous ultra-shear biofuel production technology which would substantially reduce the reaction time.

## State of the Art Analytical Laboratory

The quality of the biofuel is an important consideration and off-specification biofuel shall result into severe damage to engines and vehicles. DTU has state of art analytical facilities to evaluate the physico-chemical properties of biofuels as per relevant ASTM standards.





## Engine Trial & Tribological Studies

The Center for Advanced Studies & Research in Automotive Engineering, which is carrying biofuels research at Delhi Technological University, has a variety of diesel engines, emission measuring and allied equipment for comprehensive engine trial of biofuels. The centre also has ultra-modern research facilities for carrying out tribological studies on a large variety of biofuels.



## Algal Biofuel

Research on Algal Biofuels is extensively carried out and a Photo-bioreactor has already been developed. The faculty and the students are carrying research to develop improved oil extraction technology from algae and also trying to produce  $H_2$  from algal biomass.

## Nanoparticle doped biofuels

Research is extensively carried out by the Biofuels Research Group of DTU to develop and use nanoparticles in biodiesel fuel for performance enhancement and emission reduction. The group head, Prof. Naveen Kumar visited Iran in May 2017 to attend an International workshop on nanotechnology and learnt new research trends.

## Ethanol & Higher Alcohols

The biofuels research group is carrying out exhaustive studies to use higher alcohols such as butanol, octanol etc in Spark Ignition and Compression Ignition engines in addition to ethanol. The work on binary and ternary fuel blends consisting of diesel, biodiesel and higher alcohols are actively pursued. The development and use of surfactants for making stable emulsions are also a key area of research.



## Heterogeneous and Nano Catalysts

Most of the biofuel production worldwide has been done using homogeneous catalysts which have some inherent limitations. The DTU is developing heterogeneous and nano catalysts for effective biofuel yield and accelerating the reaction.

## Green Diesel

The biodiesel produced from a variety of vegetable oils or animal fat has some deterrents and the DTU is now working on producing green diesel using hydrotreating of solid and liquid biomass, which shall have better properties than biodiesel. A biomass gasifier has also been commissioned in the institute for producing power from the biomass collected on the campus.

## Publications

Students and faculty members are involved in advanced level research of different facets of biofuels and publishing highly acclaimed research papers not only in Scopus Indexed Journals but also in SCI journals. 90+ peer-reviewed research publications are made by students and faculty (35 SCI, 55 Scopus Indexed) in last eight years.

## Linkages with other Research Organizations

The institution has close linkages with leading Indian and International Research Organizations, Universities and industries e.g. Petroleum Conservation Reservation Association (PCRA), National Research Development Corporation (NRDC), Defence Research Development Organisation (DRDO), Department of Science & Technology (DST) and Ministry of New and Renewable Energy in

India and University of Minnesota, University of South Florida, University of Murcia, Kongju National University, Korea Institute of Energy Research, Yonsei University, National Research Institute for Chemical Technology, Materials & Energy Research Center and Babol Noshirvani University of Technology in different countries.



**For suggestions and queries on Biofuels Research @ DTU; please contact**

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