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### Project to produce bioethanol as alternative fuel

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The Centre for Biofuels (CBF), an establishment under the Council of Scientific and Industrial Research - National Institute for Interdisciplinary Science and Technology (NIIST) here, is gearing up for the key phase of a research project to develop technology for production of bioethanol as an alternative fuel for transportation.

A pilot plant, the first public sector initiative of its kind in India, has been installed on the NIIST campus to produce ethanol from biomass. Designed to run on agricultural wastes and forestry by-products, the plant will provide an opportunity to test and validate the technologies developed by the CBF over the last eight years. The project has been taken up to reduce the country's dependence on fuel imports.

Ashok Pandey, Head, CBF, has said the multi-feedstock plant is designed to use rice and wheat straw, sugarcane and cassava bagasse as well as bamboo and cotton waste to produce ethanol. Based on a survey covering several thousand farmers, agricultural markets and panchayats conducted in 2009, the NIIST had identified the surplus biomass resources available in different parts of the country.

The bioethanol research programme at the NIIST was initiated in 2006 with funding from the CSIR and the Technology Information, Forecasting and Assessment Council (TIFAC) under the Department of Science and Technology (DST).

#### Multi-stage process

There are three basic stages that biomass goes through in its conversion to ethanol: pre-treatment, enzymatic hydrolysis to produce free sugars, and fermentation of sugars to ethanol. Current research is focussed on developing enzymes and microorganisms to drive down the costs of converting biomass into sugars for ethanol production.

The conventional method of bioethanol production from fermentation of starch-rich crops such as corn, sugarcane and sugar beet is well established. However, the diversion of croplands for biofuel has sparked concerns over global food security and dictated the shift to cellulosic biomass as feedstock. Producing ethanol from biomass poses a challenge because the sugars necessary for fermentation are trapped inside a complex lignocellulose matrix that resists enzymes.

The CBF has tested different schemes using acid and alkali for pre-treatment of different biomass feedstock to break down the matrix. "We are continuously improving the process with hybrid methodologies. Simultaneously, efforts are on to develop new enzyme cocktails for better production of sugars," Dr. Pandey said. "We have achieved 70 per cent efficiency in the conversion of biomass to ethanol production but there is ample scope for improvement."

#### Biotechnology

The centre is currently working on the selection of the best organisms for fermentation and developing better technologies for alcohol recovery and dehydration.

One of the significant achievements of the programme is the development of a glucose-tolerant beta glucosidase, an enzyme that catalyses the chemical breakdown of the biomass into sugars. New microbes for enzyme production are being screened and existing ones improved for higher yield. The CBF has also developed a genetically engineered bacterium for the production of enzymes for hydrolysis. The bioethanol pilot plant will be inaugurated on April 23

by T. Ramasamy, Secretary, DST.