To boost ethanol production, Centre moots dedicated enzyme manufacturing

The first such manufacturing plant may come up in Haryana's Manesar, and will likely be a supplier to proposed 2G bio-ethanol plants in U.P., Punjab, and an existing plant in Haryana

Published - August 31, 2024 07:24 pm IST - NEW DELHI

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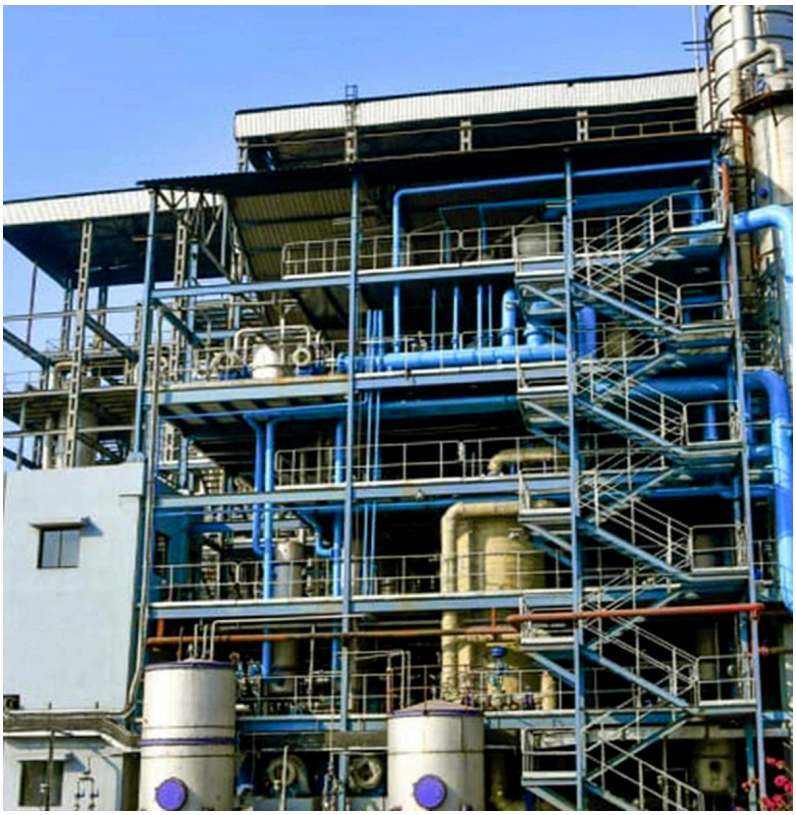

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Days after the Centre unveiled its BioE3 policy to boost bio-technology-centric manufacturing in India, the Department of Biotechnology – as part of first steps – is contemplating setting up enzyme-manufacturing facilities to bolster ethanol production., according to scientists and officials with the Department of Biotechnology.

The first such plant may come up in Manesar, Haryana and will likely be a supplier to proposed 2G bio-ethanol plants in Mathura (Uttar Pradesh), Bhatinda (Punjab) and an existing plant in Panipat. Among other things, the BioE3 (Biotechnology for Economy, Environment and Employment) policy cleared by the Union Cabinet last week aims to set up 'bio-foundries' that will produce biotechnology-developed feedstock and catalysts.

The NITI Ayog estimates that India will need about 13.5 billion litres of ethanol annually by 2025–26. Of this, about 10.16 billion litres will go towards meeting the fuel-blending mandate of E20. '2G' or second generation bioethanol is ethanol that is produced from rice-straw as opposed to the conventional method of sourcing it from molasses (sugarcane).

In 2022, the Indian Oil Corporation Ltd. set up a first-of-its-kind 2G ethanol plant in Panipat that uses rice stubble – whose burning spikes pollution in north India – as a feedstock. The plant, theoretically capable of producing 1,00,000 litres of ethanol a day runs at 30% capacity and needs 1,50,000 – 2,00,000 tonnes of rice straw per year, which is generated at the end of the sowing period in September-October.

However a critical ingredient to convert stubble into ethanol are a cocktail of enzymes and an appropriate treatment process. As of today, these enzymes are imported and constitute a significant component of the cost of the 2G-ethanol production process, said Dr. Ramesh Sonthi, Director, International Centre for Genetic Engineering and Biotechnology (ICGEB). "We have developed enzymes that are as good, if not better, than the ones currently used for the production of ethanol at Panipat. We have been able to show its efficacy in producing up to 15,000 litres of ethanol and are looking at scaling up," Mr. Sonthi said.

Maharashtra-based Praj Industries, a leading industrial biotechnology company is the technology licensor (of enzymes from Danish Biotechnology company, Novozymes). That, alongside Praj's "proprietary technology" (treatment) powers the ethanol refining plant at Panipat, according to a press release from 2022.

"We are now currently working with Praj and they have tested our enzyme and said it as good as the ones they use. They are going to work with us on techno-economic analysis as well as the building of plants," Dr. Shams Yazdani, senior scientist at the ICGEB, whose research group has developed the enzymes, said. While still early days, a first step is to be

able to produce at least 20,000 litres of ethanol at Panipat using the ICGEB-Praj processes.

The enyzmes in question are derived from tweaking a fungus that belongs to a broader family of fungii called Penicillium funoculosum.

However, it is only through several steps of genetic engineering that the fungus can be tweaked to produce the necessary enzymes in sufficient quantity that can then act as an efficient hydrolyser of organic refuse such as rice stubble.

EDITORIAL: **Biotech enigma: On the BioE3 proposal and beyond**

The fungus, which is found in soil and a part of the solid waste, in this case rice stubble, itself can be used to grow the fungi and secrete enzymes.

“It is a cell-free system with enzymes available now to digest the biomass. So eventually what you have after digestion is a free sugar, which can be fermented not only for ethanol but to make cosmetics, active pharmaceutical ingredients (APIs, or the base components of drugs),” said Yazdani.

He estimates that if India’s future ethanol needs – government policy currently mandates all petrol to be blended 20% with ethanol by 2025 – were to rely on locally developed enzymes it could mean a roughly 2/3rd reduction cost in procuring the enzymes.

OPINION: **India’s ethanol conundrum**

A report by the NITI Ayog on India’s ethanol blending programme estimates that a litre of ethanol requires 2.3 kg of rice, 2.6 kg of maize or 50 kg of sugarcane. Because these are key food crops, relying on them for fuel means using land for food for fuel. Secondly these crops are extremely water-guzzling. The recommendation thus is to rely on agriculture biomass, and further municipal solid waste, to serve as the feedstock for ethanol. Additionally, use agriculture residue as fuel sources, also translates to an alternate use of stubble that is otherwise burned by farmers to clear the land for cropping. This year Punjab alone is estimated to produce 20 million tonnes of rice stubble. A plant, even like the one at Panipat, can process at its maximum 2,00,000 tonnes.

Producing ethanol is one part of the larger BioE3 programme, which was approved by the Cabinet – though sans a budgetary outlay – last week. While the fossil fuel industry is the main source of a variety of consumer products at present and resulting in pollution and plastic pollution, BioE3 aims to leverage India's capabilities and put it at the forefront of a global movement, already underway, away from fossil fuel and towards using biological organisms and biotechnology as the new sources of energy and consumer products, said Rajesh Gokhale, Secretary, Department of Biotechnology.