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A new score in waste management

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A novel yeast strain was used to ferment the glucose and make ethanol

Scientists from CSIR's National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram have been able to turn waste into wealth. They have produced ethanol from discarded cotton-stalks by using a combination of chemical and biological techniques. India has about 9.4 million hectares under cotton cultivation and every hectare generates 2 million tonnes of cotton stalk wastes. The results were published in *Bioresource Technology.*

The stalks were first treated with an acid, alkali and different enzymes to breakdown the complex organic polymers of the stalk. "The agro-residues are tough in nature and we need chemical pre-treatment to break down the complex structure of the stalk," explains Meera Christopher, research scholar at NIIST and first author of the paper.

The acid helps to remove hemicellulose, a polymer of the cell wall and the alkali extracts lignin, a binding matrix in the cell wall, made of complex phenolics. These treatments expose cellulose, the major component made of glucose to the action of enzymes.

The cellulose was further treated using enzymes to convert it into glucose.

Fermentation

To convert the glucose into ethanol, fermentation using a novel yeast strain was carried out. “We isolated the yeast-*Saccharomycescerevisiae*-RRP-03N, from a rotting wild fruit we found in the Silent Valley National Park in Palakkad, Kerala. In spite of several inhibitors of microbial growth produced during chemical treatment, the yeast performed better than distiller’s yeast strains in fermenting the cotton stalk hydrolysate,” says Dr. Rajeev K Sukumaran, Head of the Biofuels and Biorefineries Section, at NIIST and the corresponding author of the paper.

The yeast showed a glucose conversion efficiency of 76% and the entire glucose was utilised by the yeast in just 24 hours and converted into alcohol. This performance was superior to any other organism reported for fermentation of cotton stalk. The final alcohol obtained can be made to fuel grade bioethanol (>99% purity), after distillation and dehydration using molecular sieves, which is an existing technology practised in the distilleries.

Bioethanol

Bioethanol has a number of advantages over conventional fuels as it comes from a renewable resource. It is mandatory to blend 10% ethanol with petrol. Bioethanol presently in use is obtained by fermentation of sugar cane molasses which is a byproduct of sugar production, and has food value. Most of this first generation ethanol finds its way into consumer applications, primarily as liquor. Converting the agro-residues to ethanol reduces the food vs fuel competition,” explains Meera.

Further studies should be carried out for commercial viability and large-scale production.