Dutch researchers make breakthrough in bioethanol production from agricultural waste

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With the introduction of a single bacterial gene into yeast, researchers from Delft University of Technology in the Netherlands achieved three improvements in bioethanol production from agricultural waste material: 'More ethanol, less acetate and elimination of the major by-product glycerol' This week the invention was published in the scientific journal *Applied and Environmental Microbiology*.

Bioethanol is made by the yeast Saccharomyces cerevisiae from sugars obtained from plant biomass. This microorganism also converts such sugars into ethanol (alcohol) in beer and wine. The production of bioethanol is rapidly increasing due to the growing use of bioethanol as a car fuel. With an annual world production of 65 billion liters, bioethanol is aready the largest product of the fermentation industry

Bioethanol should of course preferably be produced from resources that do not compete with food production. For this reason, efforts are made to produce second-generation bioethanol, using agricultural residues such as wheat straw and corn stover. However, when the sugars from these raw materials are released, significant quantities of acetate are formed. Acetate can slow down or even halt bioethanol production by yeast.

Another challenge of the current bioethanol production process is that about 4% of the sugar is lost to formation of the byproduct glycerol.

Glycerol formation was long considered to be an inevitable consequence of the production conditions during bioethanol production.

TU Delft researchers have now solved these issues. Yeast can, at least in theory, also convert the harmful acetate to ethanol. As it turns out, just one single gene is missing in the yeast. By introducing a single gene from the bacterium Escherichia coli, researchers of the Netherlands-based Delft University of Technology and the Kluyver Centre for Genomics of Industrial Fermentation enabled this conversion of acetate to ethanol by yeast. This replaced the normal role of glycerol so efficiently that key genes in glycerol production could be removed, thus completely abolishing glycerol production.

The invention is enthusiastically summarized by the principal researcher Jack Pronk: 'In the laboratory, this simple genetic modification kills three birds with one stone: no glycerol formation, higher ethanol yields and consumption of toxic acetate'.

For the potential billion liter ethanol gain to be realized, follow-up research on the transfer of this concept to industrial yeast strains and real-life process conditions is required. The Delft yeast researchers, who applied for a patent on their invention, hope to intensively collaborate with industrial partners to accelerate its industrial implementation.

Source: Delft University of Technology (news : web)