Powerful enzymes create ethanol from agricultural harvest waste

January 8 2013

The DISCO project coordinated by VTT Technical Research Centre of Finland has developed powerful enzymes, which accelerate plant biomass conversion into sugars and further into products such as bioethanol. The project's results include lignin-tolerant enzymes and enzyme cocktails for processing spruce, straw, corn cob and wheat bran. The commercialisation of these enzymes has now begun in the Netherlands.

The EU's DISCO project developed powerful enzymes and enzyme cocktails suitable for various raw materials, with the purpose of converting agricultural side streams into fermentable sugars and further into products such as bioethanol. Plant biomass was chosen as the raw material for the project, since it contains lignocellulosic biomass, which is an abundant raw material.

The commercialisation process of the second-generation bioethanol industry, which uses lignocellulosic biomass instead of starch, has reached critical momentum: there are a total of 15 plants being constructed in Europe, the Americas and Asia. Lignocellulosic biomass use will substantially expand the market for industrial enzymes. The total industrial enzyme market is currently worth approximately 2.7 million euros per annum.

The raw materials studied in the project were spruce, straw, corn cob and wheat bran used as animal feed. In Finland, the proportion of forest biomass, and conifer biomass in particular, is significant.

Lignocellulosic biomass consists of cellulose, hemicellulose and lignin. Agricultural harvest waste contains large amounts of lignocellulosic biomass, which can be converted industrially into fermentable sugars with the help of enzymes. Microbes can then be used to produce various chemicals, such as bioethanol, from the sugars. Lignocellulosic biomass contains substantial amounts of lignin, which interferes with enzyme activity.

The DISCO project produced new knowledge on the inactivating property of lignin, which helped scientists develop enzymes that tolerate lignin better. New information on enzymes and activities that break down hemicellulose, vital for the efficient exploitation of plant biomass, was also obtained during the project.

British scientists participating in the project determined the structural characteristics of various raw materials. This information can be used to select appropriate enzyme cocktails for raw materials when upgrading plant biomass.

The Dutch company Dyadic is currently commercialising the enzymes developed in the project.

Research Professor Kristiina Kruus of VTT coordinated the DISCO project, which had a total of 11 participants from seven countries. VTT's scientific role in the project related to discovering and developing enzymes from environmental samples as well as culture collections.

Provided by VTT Technical Research Centre of Finland