More efficient processing of straw and wood into chemicals

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Alternatives for replacing fossil raw materials with renewable ones for the production of chemicals, materials and energy are being sought worldwide. One of these alternatives is plant biomass. In her doctoral dissertation, Anne Kallioinen, MSc (Tech.), Research Scientist at VTT Technical Research Centre of Finland, developed methods for a more efficient use of the side streams of agriculture and forestry in the manufacture of sugars and sugar-based chemicals.

Kallioinen's doctoral dissertation involved development of a new pretreatment method for lignocellulose, suitable for the processing of both wood and straw material. Raw material flexibility is important since biorefineries depend on a sufficient supply of raw material.

The material obtained through this method can be broken down into sugars even if the enzyme levels are very low – potentially 60 per cent lower than in traditional pretreatment methods. Alternatively, it is possible to shorten the time used for enzymatic treatment. The tailored enzyme cocktails developed in this research will also increase the efficiency of enzymatic treatment and enable a reduction in enzyme levels. Lower enzyme levels will in turn save operating costs in biorefineries.

This study explored two raw materials that are possible in Nordic conditions: reed canary grass and barley straw. These are well suited as raw material because of their high carbohydrate levels. Kallioinen's study shows that the time of harvest is nevertheless significant: spring-

harvested reed canary grass is better suited for processing than that harvested in autumn.

Lignocellulose derived from the side streams of agriculture and forestry, such as straw and wood, may constitute a significant future raw material for biofuels, biochemicals and plastic-like products, among others. The use of enzymes to convert lignocellulose into sugars, and for further conversion, for example into ethanol, requires that the strong structure of lignocellulose is first broken down through pretreatment. Such technology is already in use, but industry needs new raw materials and more efficient pretreatment methods. The research results obtained in Anne Kallioinen's dissertation can be used to develop more efficient biorefineries.

More information: The thesis is available online at www.vtt.fi/inf/pdf/science/2014/S56.pdf

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