Researchers improve production of chemicals from wood waste

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Researchers from Delft University of Technology in the Netherlands have succeeded in making a significant leap forward in the production of biochemicals and biofuels from waste wood. They discovered that the bacterium *Cupriavidus basilensis* breaks down harmful by-products which are produced when sugars are released from wood. They also managed to incorporate the degradation process in bacteria which are in common industrial use.

This breakthrough does away with the need to resort to costly and environmentally unfriendly methods for removing by-products, thereby boosting the appeal of waste wood as a sustainable resource. The research results were published on 2 March in the US journal Proceedings of the National Academy of Sciences, USA (*PNAS*).

The use of wood or plant waste in the production of chemicals and biofuels such as bioethanol has the advantage that such raw materials do not compete with food production. However, the use of these so-called "second generation raw materials" is not yet ideal. Sugars found in wood in the form of lignocelluloses are not naturally well digested by the micro-organisms which convert biomass into usable raw materials. First these complex sugars have to be released and broken down into digestible units. This process gives rise to harmful by-products, including furans, which can have a strong inhibiting effect on the fermentation process.

Researchers Frank Koopman and Nick Wierckx discovered that the

bacterium *Cupriavidus basilensis* is capable of breaking furans down into harmless waste products, while leaving the wood sugars untouched. Together with their supervisors, Koopman and Wierckx unlocked the secrets of the entire degradation process in the bacterium, identifying the genes and enzymes involved. In addition, they succeeded in introducing this entire degradation process into the bacterium Pseudomonas putida, an organism frequently used in industrial biotechnology, and which is not naturally capable of breaking down furans.

Supervisor Han de Winde, Professor of Industrial Microbiology at TU Delft's Biotechnology Department takes up the story: "The fact that we now have a process for breaking down furans, not to mention one that can be successfully incorporated into other organisms, paves the way for removing these kinds of compounds during the production of second-generation chemicals and fuels from waste wood. This enables us to avoid the costly and environmentally unfriendly methods which are currently used to remove furans. That makes using wood waste as a sustainable raw material a much more attractive proposition."

The research by Koopman, Wierckx, Ruijssenaars and De Winde forms part of the B-BASIC consortium. B-BASIC (which stands for Bio-based Sustainable Industrial Chemistry) is an NWO-ACTS research consortium in which Dutch universities and research institutes collaborate with industrial partners. The programme is geared towards developing new concepts for the sustainable production of energy and chemicals. The technologies generated by B-BASIC offer major benefits to society, such as cleaner production, waste recycling and a more competitive market position. On this project, the consortium collaborated with research institute TNO's working group on bioconversion.

Provided by Delft University of Technology