First wood-digesting enzyme found in bacteria could boost biofuel production

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(PhysOrg.com) -- University of Warwick researchers funded by the Biotechnology and Biological Sciences Research Council (BBSRC)-led Integrated Biorefining Research and Technology (IBTI) Club have identified an enzyme in bacteria which could be used to make biofuel production more efficient. The research is published in the 14 June Issue of the American Chemical Society journal *Biochemistry*.

This research, carried out by teams at the Universities of Warwick and British Columbia, could make sustainable sources of biofuels, such as woody plants and the inedible parts of crops, more economically viable.

The researchers, who were also supported by the Engineering and Physical Sciences Research Council, have discovered an enzyme which is important in breaking down lignin, one of the components of the woody parts of plants. Lignin is important in making plants sturdy and rigid but, because it is difficult to break down, it makes extracting the energy-rich sugars used to produce bioethanol more difficult. Fast-growing woody plants and the inedible by-products of crops could both be valuable sources of biofuels but it is difficult to extract enough sugar from them for the process to be economically viable. Using an enzyme to break down lignin would allow more fuel to be produced from the same amount of plant mass.

The researchers identified the gene for breaking down lignin in a soil-living bacterium called Rhodococcus jostii. Although such enzymes have been found before in fungi, this is the first time that they have been

identified in bacteria. The bacterium's genome has already been sequenced which means that it could be modified more easily to produce large amounts of the required enzyme. In addition, bacteria are quick and easy to grow, so this research raises the prospect of producing enzymes which can break down lignin on an industrial scale.

Professor Timothy Bugg, from the University of Warwick, who led the team, said: "For biofuels to be a sustainable alternative to fossil fuels we need to extract the maximum possible energy available from plants. By raising the exciting possibility of being able to produce lignin-degrading enzymes from bacteria on an industrial scale this research could help unlock currently unattainable sources of biofuels.

"By making woody plants and the inedible by-products of crops economically viable the eventual hope is to be able to produce biofuels that don't compete with food production."

The team at Warwick have been collaborating with colleagues in Canada at the University of British Columbia who have been working to unravel the structure of the enzyme. They hope next to find similar enzymes in bacteria which live in very hot environments such as near volcanic vents. Enzymes in these bacteria have evolved to work best at high temperatures meaning they are ideally suited to be used in industrial processes.

Duncan Eggar, BBSRC Sustainable Bioenergy Champion, said: "Burning wood has long been a significant source of energy. Using modern bioscience we can use woody plants in more sophisticated ways to fuel our vehicles and to produce materials and industrial chemicals. This must all be done both ethically and sustainably. Work like this which develops conversion processes and improves efficiencies is vital."

More information: This paper is available online here:

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