Mold unlocks new route to biofuels

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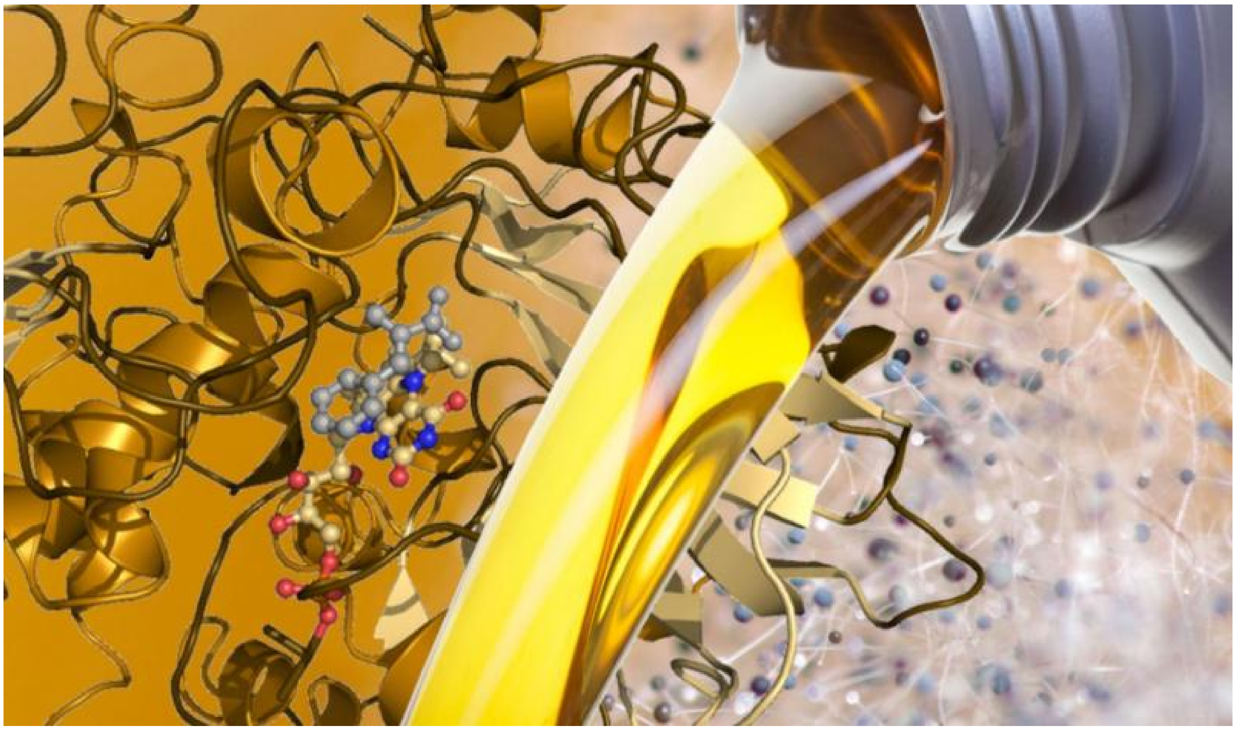

The structure of two key enzymes isolated from yeast molds can be used to produce hydrocarbons. Credit: Manchester Institute of Biotechnology

Scientists at The University of Manchester have made an important discovery that forms the basis for the development of new applications in biofuels and the sustainable manufacturing of chemicals.

Based at the Manchester Institute of Biotechnology (MIB), researchers have identified the exact mechanism and structure of two key enzymes isolated from yeast moulds that together provide a new, cleaner route to the production of hydrocarbons.

Published in *Nature*, the research offers the possibility of replacing the need for oil in current industrial processes with a greener and more sustainable natural process.

Lead investigator Professor David Leys, explains the importance of his work: "One of the main challenges our society faces is the dwindling level of oil reserves that we not only depend upon for transport fuels, but also plastics, lubricants, and a wide range of petrochemicals. Solutions that seek to reduce our dependency on fossil oil are urgently needed."

He adds: "Whilst the direct production of fuel compounds by living organisms is an attractive process, it is currently not one that is well understood, and although the potential for large-scale biological hydrocarbon production exists, in its current form it would not support industrial application, let alone provide a valid alternative to fossil fuels."

Professor Leys and his team investigated in detail the mechanism whereby common yeast mould can produce kerosene-like odours when grown on food containing the preservative sorbic acid. They found that these organisms use a previously unknown modified form of vitamin B2 (flavin) to support the production of volatile hydrocarbons that caused the kerosene smell. Their findings also revealed the same process is used to support synthesis of vitamin Q10 (ubiquinone).

Using the Diamond synchrotron source at Harwell, they were able to provide atomic level insights into this bio catalytic process, and reveal it shares similarities with procedures commonly used in chemical synthesis but previously thought not to occur in nature.

Professor David Leys says: "Now that we understand how yeast and other microbes can produce very modest amounts of fuel-like compounds through this modified vitamin B2-dependent process, we are in a much better position to try to improve the yield and nature of the compounds produced."

In this particular study, published in the journal *Nature*, researchers focussed on the production of alpha-olefins; a high value, industrially crucial intermediate class of hydrocarbons that are key chemical intermediates in a variety of applications, such as flexible and rigid packaging and pipes, synthetic lubricants used in heavy duty motor and gear oils, surfactants, detergents and lubricant additives.

Professor Leys concludes: "This fundamental research builds on the MIB's expertise in enzyme systems and provides the basis for the development of new applications in biofuel and commodity chemical production. The insights from this research offer the possibility of circumventing current industrial processes which are reliant on scarce natural resources."

More information: Paper 1: White, M. D. et al. "UbiX is a flavin prenyltransferase required for bacterial ubiquinone biosynthesis" will be published in *Nature* on Wednesday 17 June 2015. Advance Online Publication (AOP) doi: dx.doi.org/10.1038/nature14559

Paper 2: Payne, K.A.P. et al. "New cofactor supports alfa-beta-unsaturated acid decarboxylation via 1,3-dipolar cycloaddition" will be published in *Nature* on Wednesday 17 June 2015. Advance Online Publication (AOP) doi: www.dx.doi.org/10/.1038/nature14560

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