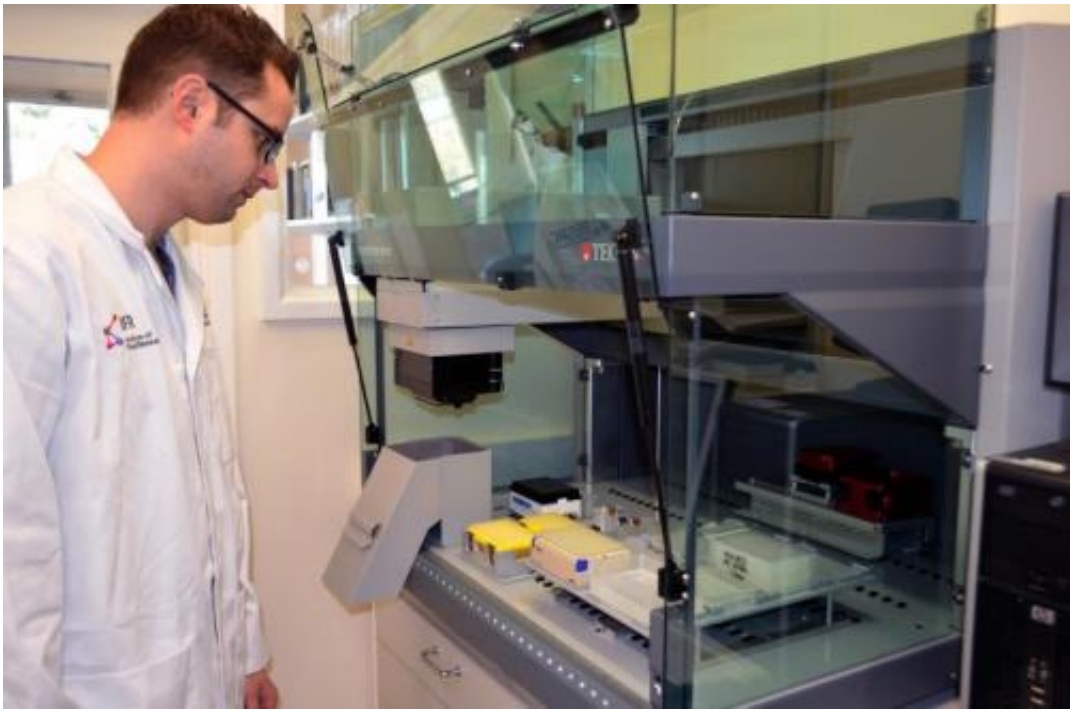
Step change for screening could boost biofuels

March 3 2015



Dr Adam Elliston with the yeast high throughput screening robot. Credit: Institute of Food Research

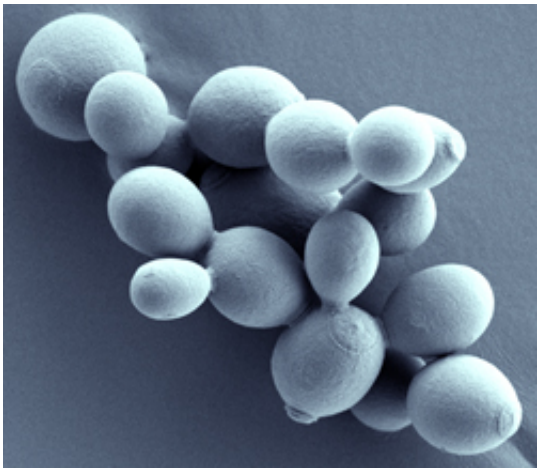
Researchers at the Institute of Food Research have developed a new way of rapidly screening yeasts that could help produce more sustainable biofuels.

The new technique could also be a boon in the search for new ways of deriving valuable renewable chemicals from plant-based wastes,

reducing our reliance on petrochemicals.

Yeasts are a key step in producing biofuels, fermenting sugars into ethanol. First generation biofuels used sugars, starch and oils derived from plants grown for that purpose. These, however, may compete with food crops for land and resources, so there has been a lot of interest in producing biofuels from non-food sources, such as agricultural wastes like straw. But a problem with these "second-generation" biofuels is that the sugars are less accessible to the yeasts.

Pretreatments are used to break open the cellular structure of the biomass, and enzymes convert the treated biomass into sugars for yeasts to ferment. But this saccharification process, along with the pretreatments, can reduce the economic viability of producing biofuels in this way. Pretreatments can also generate compounds that stop yeasts from fermenting as efficiently.



Saccharomyces cerevisiae

To try and boost the efficiency of generating second generation biofuels,

The Biorefinery Centre at IFR has joined forces with the National Collection of Yeast Cultures (NCYC), a BBSRC-supported National capability, also within IFR. NCYC has over 4,000 different yeast strains in its collection. Screening this collection could find yeasts that are naturally better at producing biofuels, especially if they are able to cope better with the compounds that reduce fermentation efficiency of conventional yeast strains. Simultaneous Saccharification and Fermentation (SSF) is seen as a big step forward for biorefining, as it simplifies the overall process, reducing costs.

Screening thousands of yeasts under different conditions and on different starting materials needs a high-throughput system to cope with large numbers of samples quickly and reproducibly. But there were no ways of doing this with solid 'real-world' sources of biomass, such as bales of wheat straw. Experiments on these sorts of substrates are typically done in flasks, but the researchers needed to develop a way of reducing the volumes they were working by a factor of a hundred, using 96 well plates that are the mainstay of high throughput processing.

They developed a technique that allowed them to accurately and reproducibly measure tiny quantities of pretreated biomass. Extensive trials showed that bioethanol yields were the same as using conventional, larger scale flasks.

"This work represents a step change in our ability to search for and exploit a wider range of industrially-relevant yeast species and genes" said Dr Ian Roberts, Curator of NCYC.

The new technique will also make it easier to screen for yeasts and other microorganisms that could be harnessed to produce other biobased chemicals or pharmaceuticals.

"We are now in a position to use this technology to screen different

biomass sources, different microbial fermenting organisms, and different conditions rapidly in order to evaluate different combinations" said Professor Keith Waldron, Director of the Biorefinery Centre.

Provided by Norwich BioScience Institutes