Lignocellulose bio-refinery developed for value-added chemical overproduction in yeast

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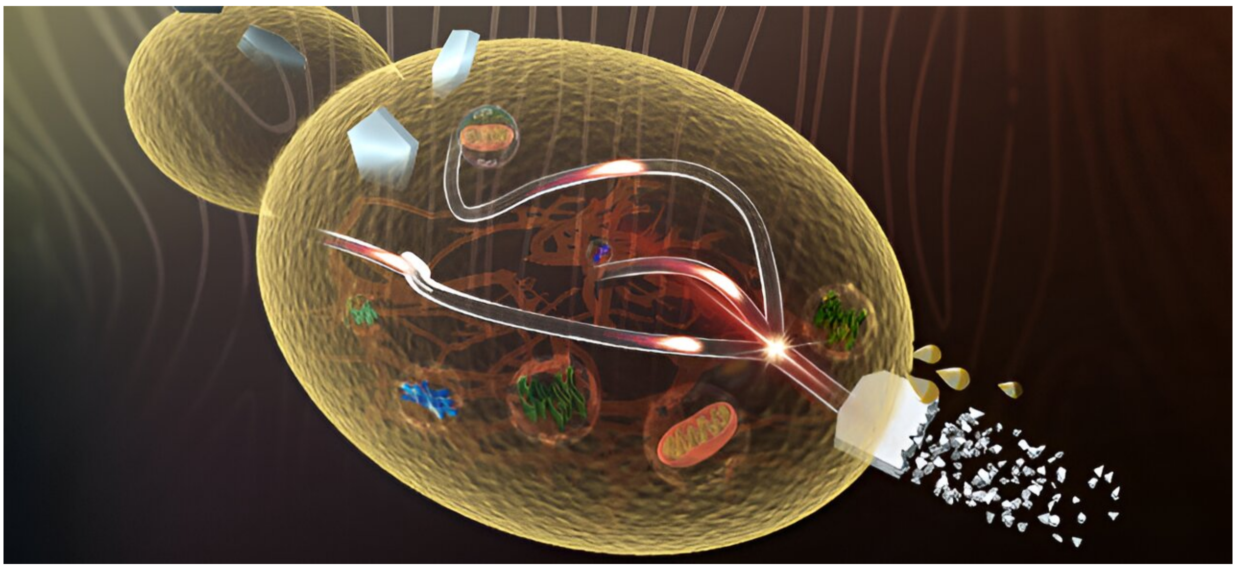

Fatty acids and 3-hydroxypropionic acid were efficiently produced by engineering co-utilization of glucose and xylose in Ogataea polymorpha for lignocellulose biorefinery. Credit: DICP

Lignocellulosic biomass is a renewable feedstock for 2nd-generation biomanufacturing. In particular, efficient co-fermentation of mixed glucose and xylose in lignocellulosic hydrolysates is a key issue in reducing product costs.

However, co-utilization of xylose and glucose in microbes is challenging due to limited xylose assimilation and the glucose repression effect.

Recently, a research group led by Prof. Zhou Yongjin from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has proposed a microbial platform for lignocellulose bio-refinery. It can efficiently synthesize acetyl-CoA derivatives, such as fatty acids (FFA) and 3-hydroxypropionic acid (3-HP), owing to the enhanced supply of precursor acetyl-CoA and cofactor NADPH by rewiring the cellular metabolism of Ogataea (Hansenula) polymorpha.

This study was published in *Nature Chemical Biology* on Aug. 24.

The researchers realized co-utilization of glucose and xylose by introducing a hexose transporter mutant and xylose isomerase, and overexpressing the native xylulokinase to enhance xylose catabolism and import.

The engineered strain produced 7.0 g/L FFA from real lignocellulosic hydrolysates in shake flasks and 38.2 g/L FFA from simulated lignocellulose in a bioreactor. Furthermore, this superior cell factory was expanded for 3-HP production by a metabolic transforming strategy, obtaining the highest 3-HP titer of 79.6 g/L from simulated lignocellulose.

"Our work realized co-utilization of xylose and glucose without compromising native glucose metabolism and demonstrated the potential of O. polymorpha as a cell factory to produce versatile value-added chemicals from lignocellulose," said Prof. Zhou.

More information: Engineering co-utilization of glucose and xylose for chemical overproduction from lignocellulose, *Nature Chemical Biology* (2023). DOI: 10.1038/s41589-023-01402-6

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