Success in synthesizing biodegradable plastic materials using sunlight and CO2

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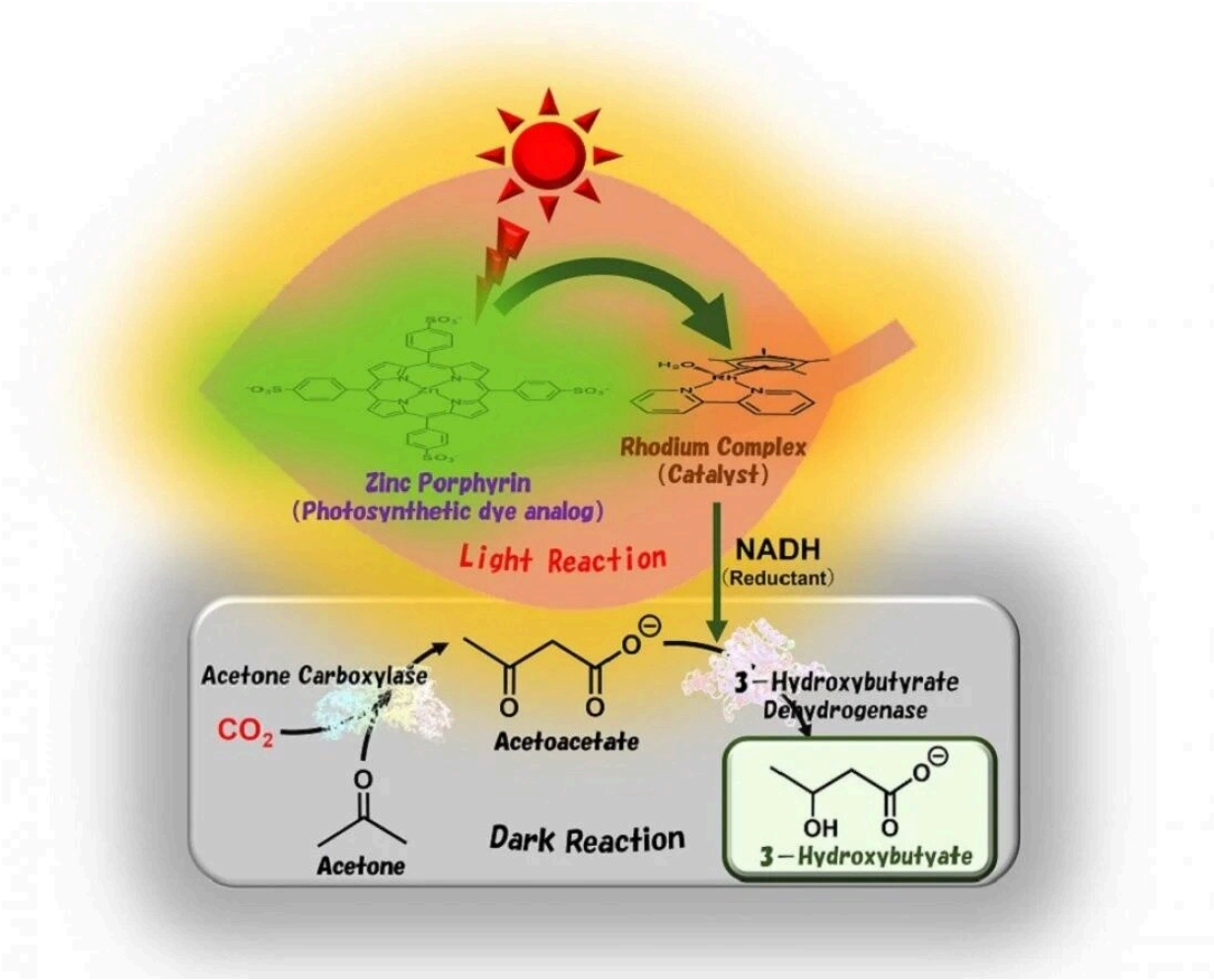

Visible light-driven 3-hydroxybutyrate production from acetone and CO2: Utilizing sunlight and biocatalysts, Osaka Metropolitan University scientists synthesized 3-hydroxybutyrate, a biodegradable plastic material, from acetone and CO2. Mimicking natural photosynthesis, the team artificially reproduced a

light reaction, which involves sunlight, and a dark reaction, which fixes CO2. Credit: Yutaka Amao, OMU

Much effort has been put into making plastics not only durable and convenient but also environmentally friendly materials for everyday products. Osaka Metropolitan University scientists made a significant advance in this journey with their innovative artificial photosynthesis technology that produces biodegradable plastics from acetone and CO_2, addressing the plastic waste crisis while moving toward the goal of carbon neutrality. Their findings were published in *Chemical Communications*.

The research team led by Professor Yutaka Amao from the Research Center for Artificial Photosynthesis at Osaka Metropolitan University has successfully synthesized 3-hydroxybutyrate, a raw material for poly-3-hydroxybutyrate (PHB)—a strong water-insoluble polyester used for packaging materials—from acetone and CO_2. With a visible light-driven catalytic system utilizing sunlight and two biocatalysts, the researchers achieved a yield of about 80%.

Mimicking natural photosynthesis, the team artificially reproduced a light reaction, which involves sunlight, and a dark reaction, which fixes CO_2, and synthesized 3-hydroxybutyrate.

This study is the latest in a series of the researchers' articles on using artificial photosynthesis to produce useful substances, generate renewable energy, and achieve a carbon neutral society. "This research result of synthesizing 3-hydroxybutyrate, a raw material for PHB, from CO_2 is a significant contribution to addressing both the plastic and CO_2 reduction issues," said Professor Amao. "In the future, we aim to produce 3-hydroxybutyrate through artificial photosynthesis using CO_2

contained in exhaust gas emitted from factories."

More information: Yu Kita et al, Visible-light driven 3-hydroxybutyrate synthesis from CO2 and acetone with the hybrid system of photocatalytic NADH regeneration and multi-biocatalysts, *Chemical Communications* (2022). DOI: 10.1039/D2CC03660F

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