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HU-ACE NEWS LETTER

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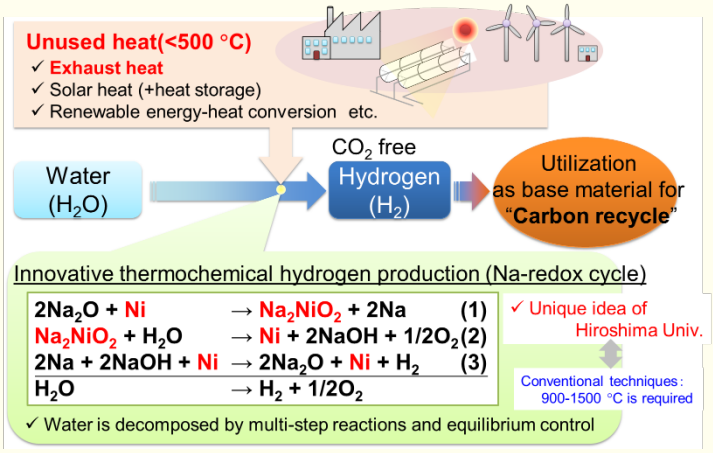
Activities of the Core

Apr. 18, 2023	The 3rd Ground thermal energy seminar was held.
Apr. 19, 2023	The 78th HU-ACE Steering Committee Meeting.
Apr. 21, 2023	The 131th Mechanical Systems Seminar (co-organized)
Apr. 24, 2023	The 106th Hiroshima University Biomass Evening Seminar (co-organized).

Research on "Thermochemical hydrogen production using low-temperature unused heats" in HIROSHIMA CARBON-CIRCULAR PROJECT funded by Hiroshima prefecture

At present, it is imperative that we find effective ways of utilizing unused heat generated by power plants and factories. Research on this is being funded by the "HIROSHIMA CARBON-CIRCULAR PROJECT", which started in October 2022. The sodium (Na)-redox cycle, a unique technique which uses reduction and oxidation of Na, and was proposed by a research group of Hiroshima University, is being investigated as a conversion technique of low-temperature unused heats from power plants and/or factories into hydrogen (H_2) in this project. Hydrogen is recognized as a key material that can be utilized as a carrier of renewable energy and as a base material in carbon recycling. While conventional thermochemical hydrogen production techniques require more than 900 ° C, the Na-redox cycle is a potential solution to the above mentioned issues, because the required temperature for the operation is much lower than that of conventional techniques. However, a requirement of around 500℃ for the reaction cycle and strong corrosion of the reactor at high temperatures were the main issues encountered so far. In this project, we proposed a Nickel (Ni) added Na-redox cycle and investigated the reaction properties. Our findings showed a decrease in the reaction temperature to 400 ℃ as well as the suppression of corrosion.



Related events

The 7th International Symposium on Fuels and Energy (ISFE 2023) will take place on July 3-4, 2023. Please visit the following ISFE 2023 website for more details. https://symposium2023.isfe.hiroshima-u.ac.jp

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Research Topics

No. 41

Development of Gas-to-Lipids bioprocess

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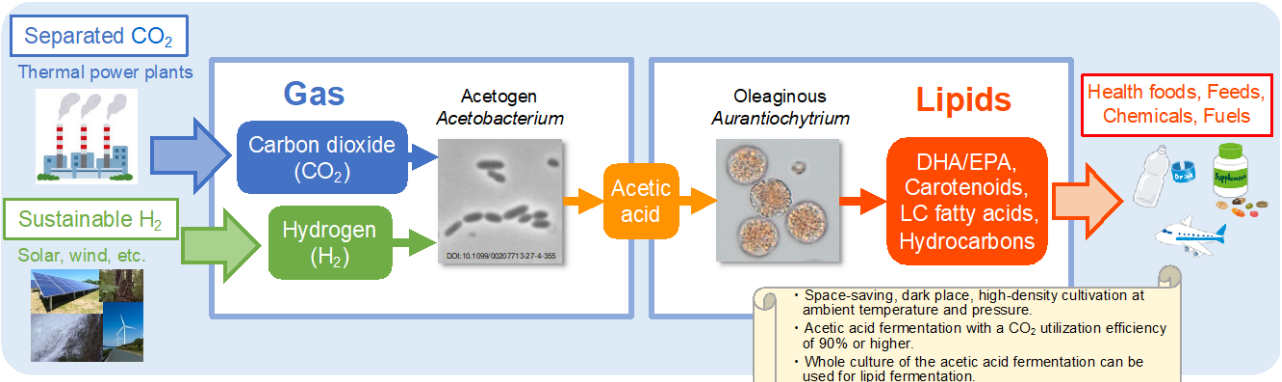
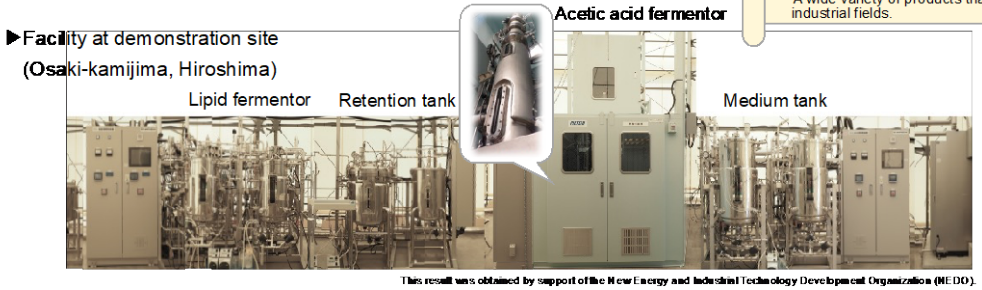
Research field: Molecular biotechnology, Applied microbiology
Keyword: Functional lipids, Microbial oils, Biofuel

Abstract

Background Microbial oil is expected to became an alternative source of functional food ingredients, cosmetics, sanitary goods, feeds, pharmaceuticals, chemical products and fuels. The marine microorganism, genus *Aurantiochytrium*, produces useful lipids such as fatty acids and hydrocarbons, including carotenoids, by assimilating sugars. Considering its problem of costs and competition with food, we are trying to develop a recycling technology for unused and waste materials through research to convert resources that cannot be directly used by *Aurantiochytrium* into raw materials through two-step fermentation in combination with other microorganisms.

Results Focusing on the property of *Aurantiochytrium* to actively assimilate organic acids such as acetic acid, the genus *Acetobacterium* that produces acetic acid using synthetic gas containing CO_2 as a substrate was combined. A biorefinery technology "Gas-to-Lipids bioprocess" in which CO_2 (Gas) separated and recovered from thermal power plants is converted into high-value-added lipids and chemical materials (Lipids), was conducted as a NEDO project (FY2020-23). There, we designed and built an integrated facility that enables high-speed and high-density culture in a dark place with excellent conversion efficiency. We are also aiming to improve the performance of both microorganisms through functional modification using genome editing technology.





This result was obtained by support of the New Energy and Industrial Technology Development Organization (NEDO).

References

1) Aki T., et al., Jpn patent No. 7048056.
2) Perez C.M.T. et al., *J. Oleo Sci.* 68, 541-549 (2019)