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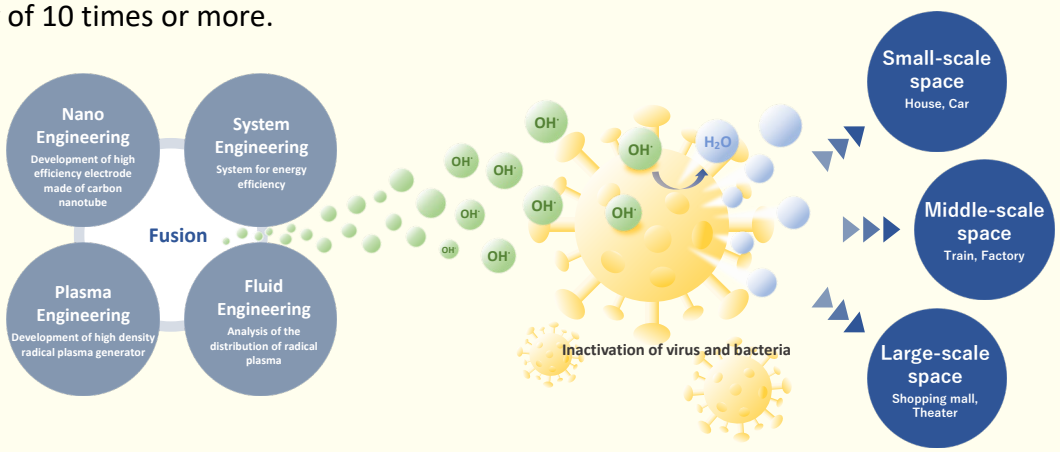
Activities of the Core

Mar. 2, 2022	The 5th Hiroshima University Biomass Premium Evening Seminar (co-organized).
Mar. 4, 2022	We invited 15 students and 2 faculty members from Yanshan University and Hajime Engineering University in China to the International Youth Science Exchange Program (Sakura Science Program) and conducted "Advanced Technology Exchange of Environmental Systems" online.
Mar. 8, 2022	The 70th HU-ACE Steering Committee Meeting.
Mar. 28, 2022	The 25th Biomass Project Research Center Symposium(co-organized)

Development of Virus Disinfection System using Ultra-Efficient Radical Plasma

We, currently, proceed the project of JST A-STEP “Support for research and development projects that are expected to contribute to social change in the with/post corona virus. Vaccination is effective, but requires time and money for development, and cannot respond immediately to mutations or unknown viruses, so a method that can eliminate them indiscriminately is effective. Radical plasma is highly reactive, and if it can be generated optimally and efficiently, sterilization is possible without ventilation, regardless of the shape and size of the space. In addition, the energy loss for heating and cooling associated with ventilation cannot be ignored, and under the current situation where CO2 reduction is strongly demanded, viruses pose a threat not only to mankind but also to the environment. In this proposal, carbon nanotube paper with many thin tips is used as an electrode to significantly reduce the discharge voltage and achieve a plasma generation energy efficiency of 10 times or more.



Sterilization system by radical plasma and fusion of fields to realize it

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Research Topics

No. 30

Bioconversion of Volatile Fatty Acids into Biodiesel Fuel by Marine Bacterium — afterward

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Research fields: Engineering／Biotechnology／Genomic engineering

Keywords: Marine Biotechnology, Biomineralization, Metagenome

Abstract

Background

This is the third time that the HU-ACE Newsletter has featured *Nitratireductor* sp. strain OM-1, a BDF producing marine bacterium (Fig. 1). This strain synthesizes butenoic acid (crotonic acid) and pentenoic acid during assimilation of organic acids, and also highly accumulates their polymerized esters. In the previous issue (Vol. 24), I described the complete consumption of remaining organic acids in methane fermentation effluent, reduction of excess sludge, and ester accumulation capacity and its combustion energy using this strain. Currently, we are investigating the ester synthesis pathway and the conversion of waste biomass to diesel oil.

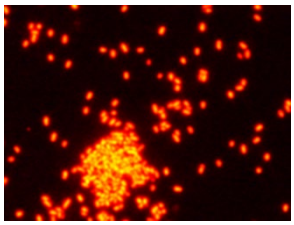

Fig. 1 *Nitratireductor* sp. strain OM-1 stained by Nile-red.

Methods

1) The oil synthesis system was predicted base on whole genome sequence and comparative expression analysis of strain OM-1.
2) The ability to reconvert waste glycerol from green oil production into biodiesel oil was evaluated.

Results

1) Whole genome sequence was determined, and together with the results of comparative expression analysis, the biosynthetic pathway was predicted (Fig. 2). We tried to introduce the thioesterase gene into *E. coli*, but the growth was inhibited and mass production by heterologous expression was abandoned. In the future, we aim to establish a high production strain of OM-1 and have developed a recombinantion system for OM-1. Furthermore, polyhydroxybutyrate (PHB) synthesis pathway was also suggested. We confirmed the PHB production and the amount of PHB was 27.5% of the cell weight.

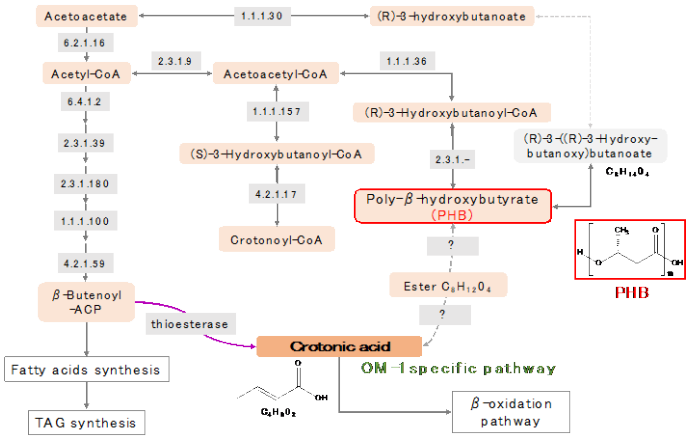

Fig. 2 Predicted oil synthesis and PHB synthesis pathways

2) Green oil is produced through solvent extraction and methyl esterification of triacylglycerol (TAG). Resulting waste glycerol from the process was directly used for the OM-1, although the glycerol contained organic solvent. As a result, OM-1 completely consumed 0.2 g/L (20 times dilution concentration) of glycerol and produced 0.18 g/L of total fat, the main component of which was long-chain fatty acids. Thus, it revealed that OM-1 showed the high efficiency of oil production when used glycerol as a carbon source.

References

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3) Okamura *et al*. Biotechnology Reports, 24, e00366 (2019)