

Development of a Bioprocess That Uses Electrical Energy to Fix Atmospheric CO₂

Presenter : Prof. HORI Katsutoshi
(Nagoya University, Tokai National Higher Education and Research System)

PM : Dr. KATO Souichiro, National Institute of Advanced Industrial Science and Technology (AIST)

Implementing organizations : National Institute of Advanced Industrial Science and Technology (AIST),
Tokyo Institute of Technology, Nagoya University

Construction of Microbial Gas-phase Reactors

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(Nagoya University, Tokai National Higher Education and Research System)

PI: Prof. HORI Katsutoshi, Dept. Biomolecular Engineering, Grad. Sch. Engineering,
Nagoya University, Tokai National Higher Education and Research System

Implementing organizations: Prof. Shuji Nakanishi
Research Center for Solar Energy Chemistry, Osaka University

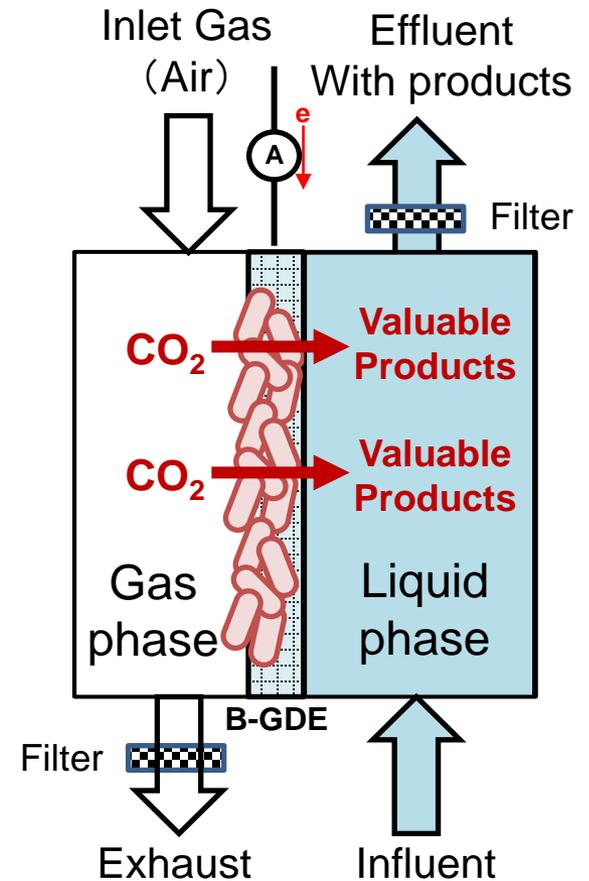
Construction of Microbial Gas-phase Reactors (NU/OU teams)

■ The goal of this project :

Demonstration that the rate of CO_2 fixation can be enhanced using gas-phase bioreactors integrated with a gas-diffusion bioelectrode.

■ Research and Development :

- * Design and Construction of a novel bioreactor that enables to conducting reactions involving gas, liquid and solid phases simultaneously.
- * Development of a gas diffusion bioelectrode (B-GDE) that can simultaneously supply gaseous CO_2 , hydrogen ions, and electrons to microorganisms (biocatalysts) on the electrode.

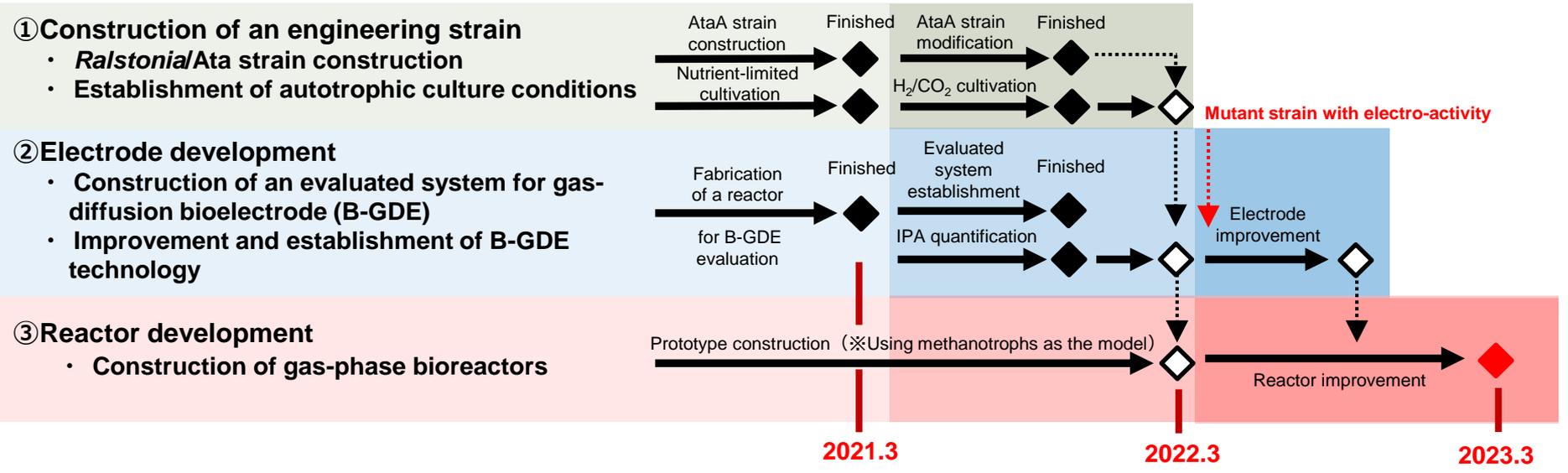
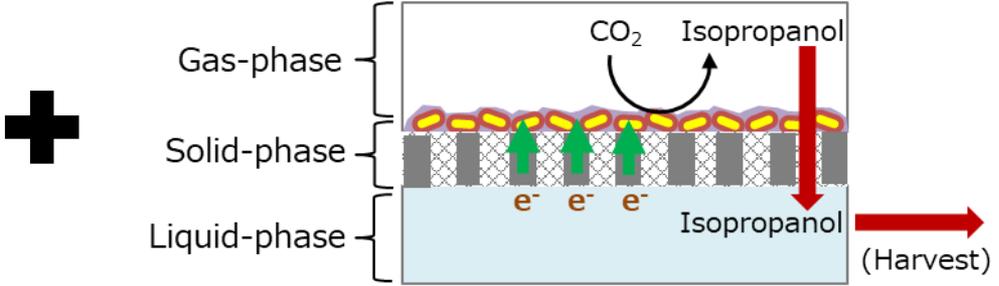
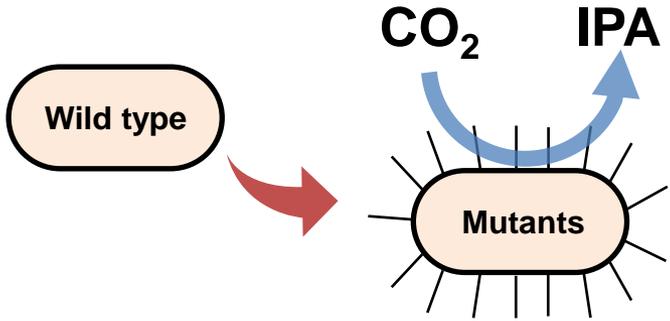


Construction of Microbial Gas-phase Reactors (NU/OU teams)

■ The goal of this project :

Construction of gas-phase bioreactors for enhancing the rate of CO₂ fixation using *Ralstonia*

- ① Construction of an engineering strain
- ② Electrode development
- ③ Reactor development



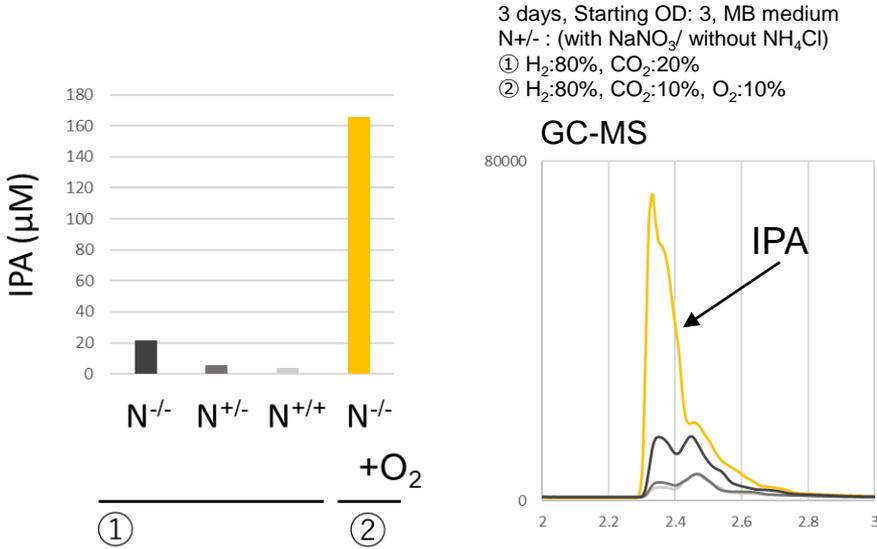
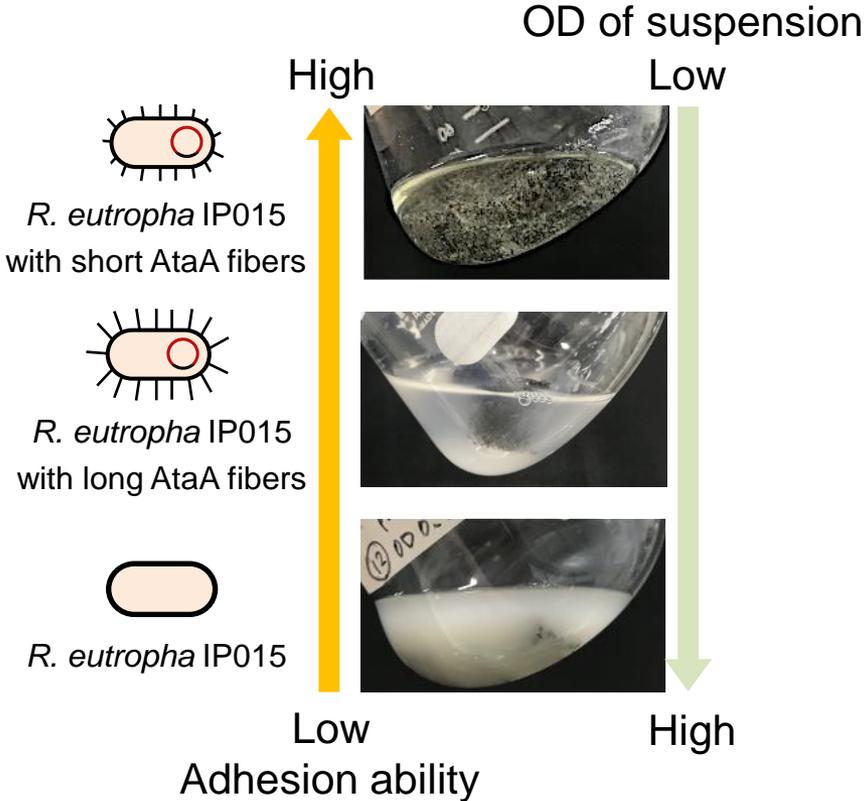
Construction of Microbial Gas-phase Reactors (NU/OU teams)

Current results

① Construction of an engineering strain

Result 1 :
***Ralstonia*·Ata strain construction**

Result 2 :
Establishment of autotrophic culture conditions



IPA production from H₂/CO₂ using *R. eutropha* IP015

Conditions for IPA production → {

- aerobic
- N-source limited

Next stage : CO₂-IPA bioconversion using *Ralstonia*/AtaA strain

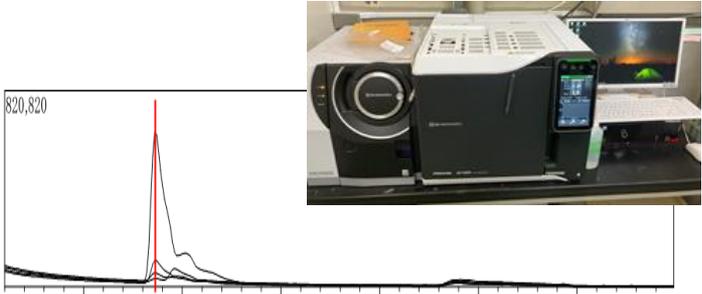
Construction of Microbial Gas-phase Reactors (NU/OU teams)

■ Current results

② Electrode development

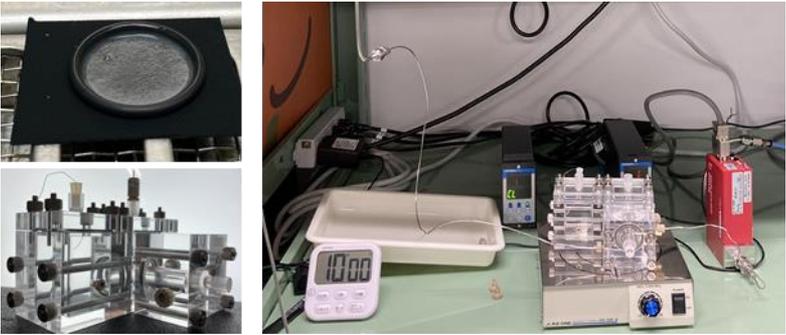
Result :

- Establishment of IPA quantified technique
- Fabrication of a B-GDE evaluated system



Establishment of IPA quantified technique by GC-MS

Gas-diffusion bioelectrode (B-GDE)



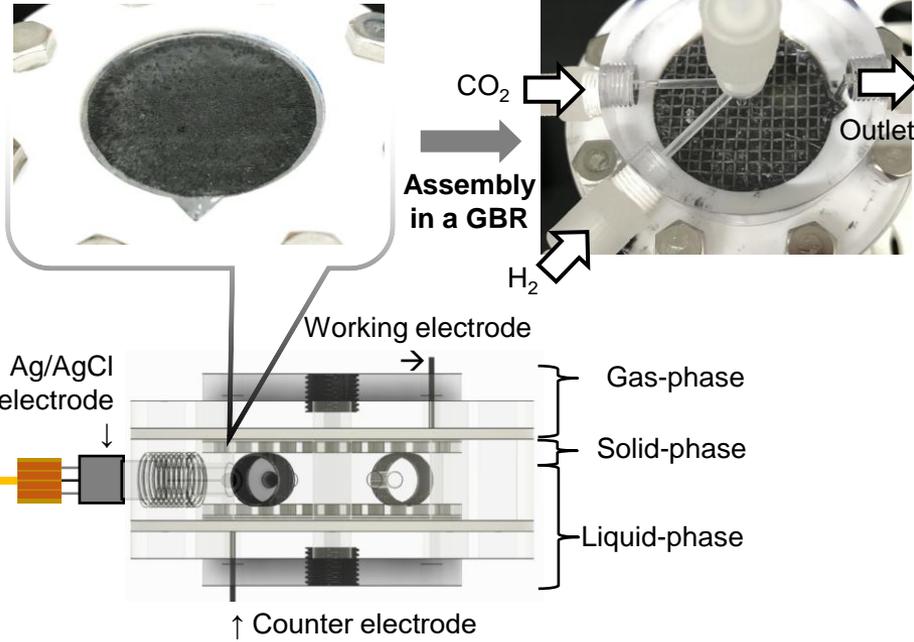
B-GDE evaluated device B-GDE evaluated system for CO₂/IPA bioconversion

③ Reactor development

Result :

- Cell immobilization on gas-diffusion electrode
- Design of a gas-phase bioreactor (GPR) using carbon paper as an electrode.

R. eutropha IP015 pBBad-IFD059 on carbon paper



Next stage : Verification of CO₂/IPA bioconversion on B-GDE

Next stage : Demonstration of *Ralstonia/AtaA* strain in GPR

