● FY2014 Jun Takada （Professor, Okayama University）

Toward Creating Innovative Applications to Harness the Novel Functions of Nano-scaled Iron Oxides of Microbial Origin

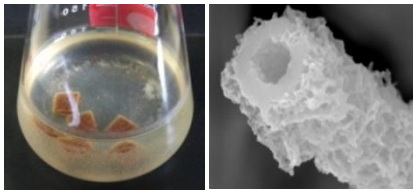
Research Project Outline (From Oct. 2012 to Mar. 2017)

Structural and functional analyses of unique iron oxides of bacterial origin , BIOX, and their mimic iron oxides artificially synthesized

◎ Iron oxides produced by bacterial culture: Creation of novel nano-scaled iron oxides by artificial culture of an isolated Fe-oxidizing bacterium (strain OUMS1) under altered culture conditions

◎ Synthetic iron oxides: Creation of novel nano-scaled low-cyrstalline iron oxides by adjusted preparation of chemicals in reference to chemical characters of the bacterial product

→Toward creation of novel eco-friendly innovative functional materials [e.g., great potential as electrode of Li ion rechargeable battery, high affinity to human cells available for 3D culture, efficient catalytic potential, high grade pigment (glaze), plant protectant, etc.]



Iron oxides produced by bacterial culture

Research Results (FY2014)

Manipulation of crystallinity of iron oxide complex containing varied Si contents

- ✓ Characters of natural *L*-BIOX (inorganic composition, nano-structure, crystallinity, etc.) as well as functions are nearly unchanged irrespective of its harvesting sites.
- ✓ We succeeded to create novel iron oxide complexes containing desired amounts of Si with abandon by culturing OUMS1 in medium containing varied contents of Si. The Si ratio in the complexes was found to largely influence the crystallinity of the complex: γ-FeOOH at lower rate and low crystalline 2-line ferrihydrite at higher rate.

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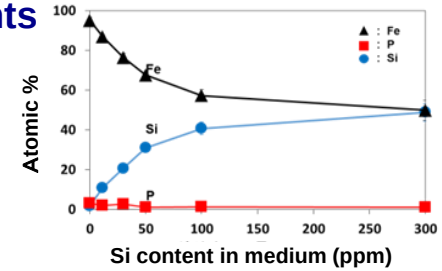
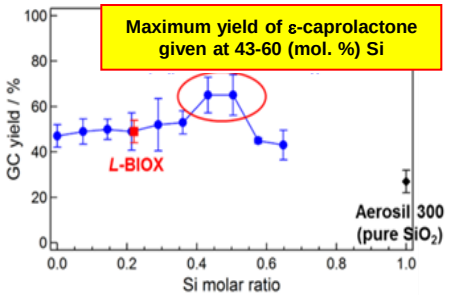


BIOX containing varied Si contents

High catalytic activity of *L*-BIOX and Si-containing synthetic iron oxides

- ✓ *L*-BIOX produced by bacteria showed higher catalytic activity than typical iron compounds in Baeyer-Villiger oxidation using molecular oxygen as an oxidant.
- ✓ Further investigation using Si-containing synthetic iron oxides, which are artificial mimics of *L*-BIOX, revealed that Si content (molar ratio) strongly affected the catalytic activity. The synthetic iron oxides with Si molar ratio around 0.4-0.5 showed maximal catalytic activities.
- ✓ The higher catalytic activity of *L*-BIOX might arise from some cooperative effect of the iron and silicon components.

（Manuscript submitted)



Catalytic activity of Si-containing synthetic iron oxides