KUDO LAB.

[Peptide Catalysts]
– New Class of Enzyme-mimicking Catalysts –

Department of Materials and Environmental Science

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Molecular Functional Materials Synthesis

Department of Chemistry and Biotechnology

Peptide Catalysts

New class of catalysts that are inspired by structure and function of enzymes

Enzymes catalyze various reactions under physiological conditions. They are highly active and selective. This means that enzymes are exemplar for catalyst design in the field of organic synthesis. However, enzymes catalyze only the reactions to make biogenic compounds, hence are not directly applicable to industrial production. Catalysts with strength of enzymes but can promote kinds of reactions are highly desirable.

We have been working on the development of peptide catalysts because the peptides consist of amino acids, just as enzymes do. As a result, it was found that several peptides with characteristic properties in their structures are good catalysts. This research can potentially provide a new synthetic process which might shorten the synthetic route of fine chemicals such as drugs, thus it is expected to contribute to waste reduction and energy saving in chemical industry. The peptide catalysts are also scientifically interesting as a new approach in the catalyst development.

Selective reactions unique to peptide catalysts were found
The reactions proceeded in aqueous solvents near room temperature
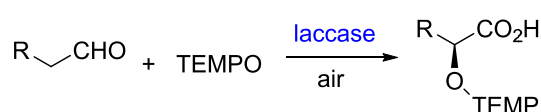Catalysts could be easily recovered from the reaction mixture and reused
Two-step reactions proceeded in the presence of other catalysts in one pot
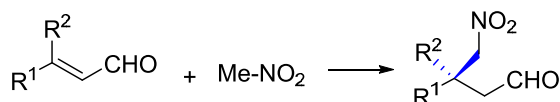Knowledge on the structure-activity relationship are accumulating

Amino acid sequence of peptide catalysts
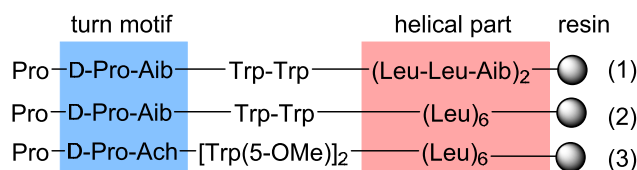
Pepitde/Enzyme cocatalysis [catalyst (1)]

Construction of quaternary asymmetric center [catalyst (2)]]

Regioselective asymmetric reduction [catalyst (3)]