

Bio-Catalytic Approach to Mesoscopic Particle Synthesis

Innovative method using hydrolytic action of enzymes

Overview

Mesoscopic particles, ranging from several tens to several hundred nm in size, have attracted attention in a wide range of fields as interesting materials where quantum size effects and bulk effects interact or synergize. Regarding manufacturing methods, top-down approaches such as physical grinding and bottom-up approaches such as chemical synthesis have been proposed. However, these methods face challenges related to yield, dispersibility, and cost, necessitating new solutions.

In this study, the inventor has developed a novel manufacturing method to address these issues: the "Biocatalytic Nanoparticle Shaping method" (BNS method), which utilizes enzymes. The BNS method can be applied to fabricate various mesoscopic particles by combining enzyme-degradable materials with organic/inorganic materials. For example, semiconducting quantum dots (QDs), porphyrin molecules, bipyridine molecules, and nanographene were used as core units, resulting in nearly monodispersed mesoscopic particles with uniform sizes, obtained as stable aqueous dispersions.

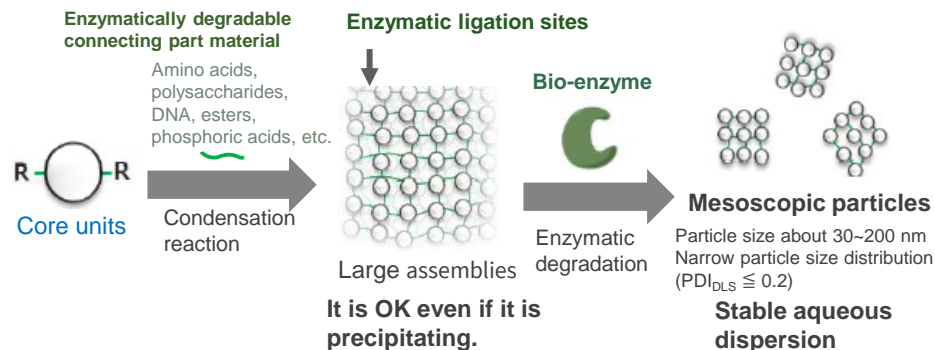
Product Application

- Nanopharmaceutical
- High performance electronic device element
- Drug delivery system
- Next-generation solar cell materials

IP Data

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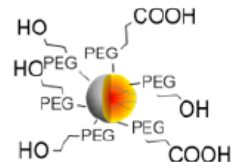
Highly-water dispersible mesoscopic particles with uniform size can be produced [1]



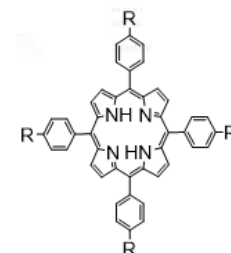
Examples of functional core units

(Widely applicable from organic molecules to inorganic materials)

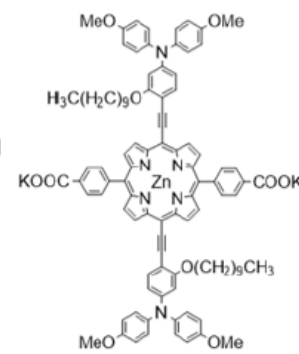
- : Catalysts and Photocatalysts
- : Luminescent material
- : Nanopharmaceutical
- : Metal nanoparticle
- : Magnetic nanoparticle



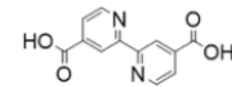
Semiconductor quantum dots



Photofunctional organic molecules



Large organic molecules



Small organic molecules

Related Works

[1] Bio-catalytic nanoparticle shaping for preparing mesoscopic assemblies of semiconductor quantum dots and organic molecules
 Nanoscale Horiz., 2024, 9, 1128–1136.

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