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Facile one-step fabrication of polymer microspheres with high magnetism and armored inorganic particles by Pickering emulsion polymerization

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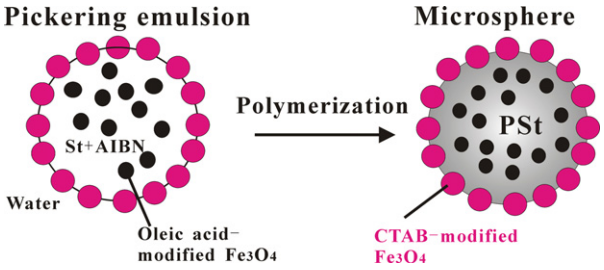
HIGHLIGHTS

- Microspheres with encapsulated and armored Fe_3O_4 were prepared by Pickering emulsion.
- Particles-formed film on Pickering droplet ensures high encapsulation to particles.
- Encapsulated Fe_3O_4 enables microspheres to be separated conveniently.
- Armored Fe_3O_4 endow microsphere with catalytic activity to Fenton reaction.

GRAPHICAL ABSTRACT



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ABSTRACT

Facile one-step Pickering emulsion polymerization was employed to prepare magnetic polymer microspheres with high magnetism and armored inorganic particles. Partially hydrophilic CTAB-modified Fe_3O_4 particles were employed as stabilizer of Pickering emulsion and were armored on the as-prepared microspheres, while totally hydrophobic oleic acid-modified Fe_3O_4 particles were encapsulated in the obtained microspheres. The microspheres were characterized by scanning electron microscopy (SEM), energy dispersive X-ray microanalyses (EDX) and magnetic measurements. Total Fe_3O_4, encapsulated Fe_3O_4 and armored Fe_3O_4 were detected and catalytic activity of microspheres for Fenton reaction was evaluated. The results showed that steady barrier formed by CTAB-modified Fe_3O_4 on droplet surface can prevent oleic acid-modified Fe_3O_4 from escaping away the polymerization vessel, which lead to an efficient encapsulation to oleic acid-modified Fe_3O_4. The encapsulated Fe_3O_4 enables the microspheres to be separated by external magnetic field and the armored Fe_3O_4 endows the composites with special catalytic property.

1. Introduction

Magnetic microspheres, since their introduction in the 1970s, have benefited from a variety of applications in pollutant removal [1], drug targeting [2], biosensor [3] and biomedicine [4]. The prominent merit of magnetic microspheres lies in the fast and cost-efficient separation by applying an external magnetic field. Traditionally, magnetic microspheres were fabricated conveniently by monomer polymerization in the presence of magnetic particles [5–7] and magnetic fillers are randomly dispersed in the polymer matrix.

Recently, interest was arisen on polymer microspheres with armored inorganic particles, because the armored nanoparticles can endow the composites with some special properties [8–12]. For example, microspheres with armored TiO_2 present excellent photovoltage properties [9] and photocatalytic performance [10,11]. Armored ZnS endows polymer microspheres with special optical property [12]. For particles-armored microspheres, post-surface reaction [10,13] and layer-by-layer self-assembly [8,14] have been

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