Light-Driven Pickering Interfacial Catalysis Using Polydopamine-Based Particles

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Pickering emulsions constitute a sustainable alternative to conventional surfactant-based systems, offering enhanced stability while reducing environmental impact. In this work, bio-inspired polydopamine (PDA) particles were synthesized via the spontaneous auto-oxidation of dopamine under alkaline conditions, allowing straightforward control over particle size through polymerization time. Owing to their catechol- and amine-rich surface chemistry, PDA particles exhibit strong interfacial adhesion properties.

PDA particles and their metal-functionalized counterparts were employed as stabilizers for oil-in-water emulsions with different oil phases, yielding stable systems. Beyond emulsion stabilization, these particles were investigated as platforms for Pickering interfacial catalysis under visible light irradiation, taking advantage of the inherent photoactive character of polydopamine and the plasmonic properties of metal nanoparticles.

This study highlights the potential of polydopamine-based materials as multifunctional and sustainable Pickering systems, bridging interfacial stabilization and light-driven catalysis.

Keywords:

Pickering interfacial catalysis, polydopamine, light-assisted catalysis, Pickering emulsion