Recyclable Solid-supported Photocatalysts for Antibacterial and Polymerization Applications

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Photocatalysis is used for a wide variety of applications including chemical synthesis, polymerizations, and antibacterial applications. Light is a low cost, sustainable energy source able to activate the photocatalysts at ambient temperatures and pressures. Many homogeneous photocatalysts suffer from limited recyclability as a result of expensive recovery processes. Heterogeneous supports, however, can be easily recovered, further increasing sustainability and reducing costs. Here, we investigate methods of supporting photocatalysts on silica glass beads and cellulose to design inexpensive, safe, and recyclable materials. Fluorescein o-acrylate is copolymerized into polymer brushes for a photocatalyzed cyclic condensation reaction, and the photocatalysts retain efficacy with recycling. In an alternate approach, photocatalysts are bound to cellulose directly through esterification, and polymer brushes grown on silica are crosslinked using the porphyrin tetrakis(4-carboxyphenyl)porphyrin. The materials are tested for singlet oxygen production and antibacterial activity against *E. coli*. The photocatalysts showed singlet oxygen production in solution and on supports, providing promising opportunities for further development as non-specific anti-bacterial materials.