In situ epoxy-ring opening polymerization and sol-gel process synthesized hydrophobic TiO_2–SiO_2 composite aerogels for environmental remediation

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ABSTRACT

In situ epoxy-ring opening polymerization and sol-gel process was adopted to synthesize hydrophobic TiO_2–SiO_2 composite aerogels composed of an organic-inorganic molecular network. Epoxy-functionalized (3-glycidyloxypropyl)trimethoxysilane and amine-functionalized 3-aminopropyltriethoxysilane were used for ring opening polymerization and sol-gel reaction. This process was followed by hydrolysis and condensation of methyltrimethoxysilane (MTMS) and titanium butoxide (TBO) in the presence of oxalic acid as a catalyst. From the results, it is revealed that the TBO:MTMS molar ratio plays an important role to improve the crystallinity, porosity, and surface area of the prepared hybrid aerogels. The as-prepared supercritical dried aerogels show anatase phase of titania. The photocatalytic degradation of the aerogels was evaluated via a methylene blue textile dye degradation in presence of ultraviolet-light irradiation. The results demonstrated that the TiO_2–SiO_2 composite aerogel catalyst can yield 87% degradation with a high reaction constant ($k = 1.18 \times 10^{-1}$ min^{-1}). This approach provides a new method of synthesizing TiO_2–SiO_2 composite aerogel photocatalysts.

Keywords: TiO_2-SiO_2 composite aerogel; Anatase; Sol-gel process; Supercritical drying; Photocatalysis.

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