

Unraveling the role of chitosan in enhancing the photodegradation of ciprofloxacin by using chitosan titanate composites

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A hybrid composite (inorganic-organic) based on chitosan-functionalized hydrogen titanate nanotubes (TiCH) was synthesized by the hydrothermal method assisted by microwave. In-silico analysis determined the possible chitosan chemical adsorption models after calculating the Gibbs energies of their HOMO-LUMO orbitals. The TGA analysis confirmed the stability and helped to obtain the real functionalization degrees for the 3TiCH (2.22 %) and 5TiCH (4.33 %) samples, respectively. SEM images revealed that the 3TiCH and 5TiCH composites present tubular morphology that seemed covered with chitosan. The XRD patterns of 3TiCH and 5TiCH presented chitosan peaks, confirming their functionalization with chitosan anchored on the titanate surface. The photocatalytic degradation of ciprofloxacin antibiotic reached 93 % using the 3TiCH sample under 365-UV irradiation for 240 min. The photocatalytic performance of 3TiCH was 14.71 % more efficient than that of unfunctionalized TiNS after four reuses. The incorporation of the chitosan into the titanate improved the photocatalytic performance of the titanate, because it reduced its bandgap value, increasing the surface area, and boosting the adsorption capacity. A biopolymer such as chitosan in low concentrations can tailor the photoactivity of the inorganic nanomaterial to eliminate emerging contaminants contained in water bodies.

Keywords: Titanate, chitosan, functionalization

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