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Photocatalytic removal of Reactive Red 4 dye by immobilised layer-by-layer TiO_2/cross-linked chitosan derivatives system

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ABSTRACT

The synergistic photocatalysis–adsorption processes of immobilised TiO_2/chitosan (TiO_2/CS/glass) layer-by-layer systems have been improved by the cross-linking of the chitosan (CS) sub-layer with different cross-linkers, namely epichlorohydrin (ECH) and glutaraldehyde (GLA). The immobilised layer-by-layer system was applied for the removal of an anionic Reactive Red 4 (RR4) dye solution in the presence of air and light irradiation under a 45-W compact fluorescent lamp. Based on the results, the pseudo-first-order rate constant of the TiO_2/CS-ECH/glass was more than two times faster compared to the TiO_2/CS-GLA/glass. But as the pH decreases, the TiO_2/CS-GLA system showed higher photocatalytic performance due to its better mechanical and optical properties compared to the TiO_2/CS-ECH system. In addition, the TiO_2/CS-GLA system showed excellent reusability with complete removal of the RR4 dye from the first to at least four cycles of extended usage.

Keywords: Photocatalysis; Adsorption; Titanium dioxide; Cross-linked chitosan; Layer-by-layer

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