Performance of a C-containing Cu-based photocatalyst for the degradation of tartrazine: Comparison of performance in a slurry and CPC photoreactor under artificial and natural solar light

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Abstract

A carbon-containing Cu-based material (Cu@C) was used as photocatalyst for the degradation of a commonly food-industry azo-dye (tartrazine, also called Y5), under solar light at laboratory and pilot scale photoreactors. Important performance parameters such as dark adsorption capacity, catalysts loading and initial concentration of the dye were first optimized in a slurry photoreactor at laboratory scale under artificial solar light following the kinetics of degradation of the dye. Afterwards, the photocatalytic activity was investigated at pilot scale in a compound parabolic collector (CPC) photoreactor operating for 10 h of irradiation. The degradation of tartrazine is among the highest values reported for alternative metal oxide semiconductors, in both photoreactor configurations. Catalytic data revealed a 3 times faster degradation kinetics of tartrazine in the CPC photoreactor under natural solar light than in the slurry reactor under artificial solar light. This behavior indicates that a moderate photon flux in the CPC is more adequate to operate with the prepared photocatalyst, as it minimizes the recombination of charge carriers in the catalyst. This is important, since most of the photocatalytic tests designed to evaluate the activity of novel materials are frequently carried out under simulated solar light and disregard the impact of photon flux in outdoor conditions. © 2022 Elsevier Inc.

Author keywords

Carbon; CPC photoreactor; Cu-based catalyst; Solar-driven photocatalysis; Tartrazine