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Improvement of photocatalysis using ZnO/zeolite nanocomposites for contaminant removal in aqueous media

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ABSTRACT

In order to take advantage of the adsorbent capacity of zeolites, in the present work, ZnO particles and ZnO/zeolite nanocomposites were synthesized, using a natural zeolite and a synthetic zeolite structure. Compounds of: ZnO, ZnO/CLI (CLI = clinoptilolite zeolite) and ZnO/NaA (NaA = sodium type A zeolite) were synthesized by the sol–gel method and physical milling. The structural, morphological, textural and optical properties of the materials were characterized by X-ray diffraction, scanning electron microscopy and transmission electron microscopy, N_2 physisorption and UV-Vis spectroscopy. Nanocomposites with crystallite sizes between 20–30 nm were obtained. The morphology presents grains distributed in the composites, while agglomerates are observed in pure ZnO. The ZnO surface area decreases slightly in the CLI composite but in the ZnO/NaA composites the decrease is notable. The band gap of the materials is between 3.18–3.21 eV. Photocatalytic activity was evaluated using aqueous solutions of organic dyes such as methylene blue and rhodamine B at initial concentrations of 10 and 20 mg·L^{-1}. The photocatalytic performance increased ~60%, which shows that the use of semiconductor oxides supported on zeolites is a viable and efficient process in the reduction of contaminants present in wastewater.

Keywords: Zinc oxide; Clinoptilolite; NaA; Semiconductors; Aluminosilicates

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