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Degradation of bentazon herbicide by heterogeneous catalytic ozonation with ZnO-scallop shell nanocomposite: kinetic, reaction pathways and mineralization

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ABSTRACT

In this study, the synthesized ZnO-scallop shell nanocomposite was applied as a catalyst in catalytic ozonation for removal of bentazon from aqueous solutions. Also, the impacts of key parameters (solution pH, catalyst dosage, initial bentazon concentration, oxygen and nitrogen gas, hydrogen peroxide, and organic compounds) on the removal efficiency were studied. It was found that under the optimum conditions: pH = 7, catalyst dose = 0.5 g/L, and initial bentazon concentration = 30 mg/L, the removal efficiency reached 76.86% after 60 min of ozonation; and, in the same conditions, in the presence of 50 mM hydrogen peroxide, the efficiency was 90.47%. Further, the kinetic results showed that the second-order model was more desirable for explaining bentazon degradation. Moreover, under the optimum conditions, the electrical energy per order (E_{EO}) was 102.595 kWh/m^3. In the case of actual drinking water, the removal efficiency of bentazon was 70%, and when synthetic water was tested, 55.56% of the herbicide was mineralized after 60 min. Besides, the reaction pathways of bentazon during ozonation were investigated.

Keywords: Operating parameters; Catalytic ozonation; ZnO-scallop shell; Mineralization; Reaction pathways

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