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PHOTOCATALYTIC DEGRADATION OF ATRAZINE USING ZINC OXIDE TEXTURALLY MODIFIED WITH STICKY RICE STARCH TEMPLATE AND DOPED WITH TRANSITION METALS

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Abstract

Atrazine is a herbicide used widely with a large quantity in Thailand and can contaminate in surface and groundwater. This work investigated atrazine removal from an aqueous solution by catalytic photodegradation using oxides of metal-cerium-zinc (M-Ce-ZnO, M = Ag, Fe, and Cu). ZnO is texturally modified with sticky rice starch template, doped with cerium (Ce) and either Ag, Fe, or Cu with the M:Ce:Zn molar ratio of 0.005:0.005:1. The catalysts were characterized by XRD, UV-Vis-DRS and N_2 adsorption-desorption analysis; and tested in a batch reactor under visible light. 0.005Ag-0.005Ce-ZnO exhibited a higher atrazine removal than 0.005Fe-0.005Ce-ZnO and 0.005Cu-0.005Ce-ZnO. Thus, a further investigation was carried out on 0.005Ag-0.005Ce-ZnO with various atrazine concentrations. The photocatalysis was explained by Langmuir-Hinshelwood-Hougen and Watson (LHHW) kinetics. The reaction rate constant was higher than the adsorption equilibrium constant indicating that the photocatalytic reaction was a key role in the atrazine removal. In the presence of humic acid, a representative of natural organic matter, a competition with atrazine was observed. To determine the degradation pathway, several intermediates were detected by liquid chromatography-mass spectrometry including 2-isopropylamino-1,3,5-triazine which was not previously reported. The efficiency of 0.005Ag-0.005Ce-ZnO suggests a possibility for the application under the sunlight.

Key words: atrazine, metal doped ZnO, photocatalysis, sticky rice starch, textural modification

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