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Mixed silver–zinc encapsulated zeolite-Y powders toward the photodegradation of aqueous fenoxycarb solutions

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ABSTRACT

Mixed silver–zinc doped in zeolite Y was prepared via cation exchange process. Two samples with various silver and zinc contents were prepared as well as two samples modified with microwave treatment before the calcination process. The prepared samples behave as good adsorbents towards fenoxicarb where up to 30% of the pesticide was removed from solutions upon mixing for one minute. In addition, all of the modified materials tend to enhance the photo-degradation of fenoxicarb when irradiated at 254 nm UV light. The study indicates that Ag-ZnY1 (10.7% Ag and 10.32% Zn) provides the best catalytic activity towards the degradation of fenoxycarb where the rate constant was 0.041 min^{-1} compared to the observed rate constant of 0.0162 min^{-1} for the similar test without a catalyst. In addition, both microwave samples provide an enhancement in the photo-degradation by 1.6–1.7 times compared to the zeolite-free samples. The data showed that silver played the major role in the observed catalytic activity. For example, the rate constant of the Ag-ZnY1M sample (1.8% Ag and 0.20% Zn) was 0.0283 min^{-1} while the reaction proceeds with a rate constant of 0.0270 min^{-1} when Ag-ZnY2M (0.90% Ag and 0.30% Zn) catalyst was used. GC-MS analysis of the irradiated solution of fenoxycarb for 60 min showed the formation of 4-(2-aminoethoxy)phenol ethane as the major product.

Keywords: Zeolite; Fenoxycarb; Silver; Zinc; Pesticide; Luminescence; Photo-catalysts

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