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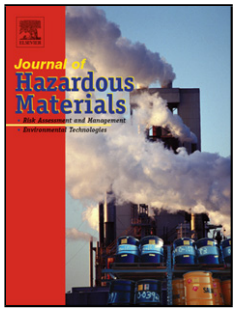

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PII: S0304-3894(14)00442-7
DOI: http://dx.doi.org/doi:10.1016/j.jhazmat.2014.05.087
Reference: HAZMAT 15994

To appear in: *Journal of Hazardous Materials*

Received date: 7-2-2014
Revised date: 2-5-2014
Accepted date: 29-5-2014

Please cite this article as: J.S. Romão, M.S. Hamdy, G. Mul, J. Baltrusaitis, Photocatalytic Decomposition of Cortisone Acetate in Aqueous Solution, *Journal of Hazardous Materials* (2014), http://dx.doi.org/10.1016/j.jhazmat.2014.05.087

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Photocatalytic Decomposition of Cortisone Acetate in Aqueous Solution

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Abstract

The photocatalytic decomposition of cortisone 21-acetate (CA), a model compound for the commonly used steroid, cortisone, was studied. CA was photocatalytically decomposed in a slurry reactor with the initial rates between 0.11 to 0.46 mg L^{-1} min^{-1} at 10 mg L^{-1} concentration, using the following heterogeneous photocatalysts in decreasing order of their catalytic activity: ZnO >Evonik TiO_2 P25> Hombikat TiO_2 > WO_3. Due to the lack of ZnO stability in aqueous solutions, TiO_2 P25 was chosen for further experiments. The decomposition reaction was found to be pseudo-first order and the rate constant decreased as a function of increasing initial CA concentration. Changing the initial pH of the CA solution did not affect the reaction rate significantly. The decomposition reaction in the presence of the oxidizing sacrificial agent sodium persulfate showed an observed decomposition rate constant of 0.004 min^{-1}, lower than that obtained for TiO_2 P25 (0.040 min^{-1}). The highest photocatalytic degradation rate constant was obtained combining both TiO_2 P25 and $S_2O_8^{2-}$ (0.071 min^{-1}) showing a synergistic effect. No reactive intermediates were detected using LC-MS showing a fast photocatalytic decomposition kinetics of CA.

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Keywords: Photocatalysis, Cortisone, metal oxides, kinetics.

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