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KINETICS AND ADSORPTION COMPARATIVE STUDY ON PHOTOCATALYTIC DEGRADATION OF o-, m- AND p-CRESOL

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Photocatalytic degradations with TiO_2 at different concentrations (10-125ppm) of o-, m-, and p- cresol have been studied. The initial degradation rates between described concentration range of these compounds are nearly the same for each substance (maxima differences being $0.37 \cdot 10^{-7}$ M•s^{-1} for m-cresol, $0.41 \cdot 10^{-7}$ M•s^{-1} for o-cresol, $0.17 \cdot 10^{-7}$ M•s^{-1} for p-cresol). We can observe a clear maximum of initial degradation rate for m-cresol y o-cresol at 50 ppm. In contrast, p-cresol presents little variations along described concentration range without any clear maximum.

Adsorption and rate constants have been obtained by Langmuir-Hinselwood equation from initial concentration (C_o) and velocity values (r_o):

$$r_o = \frac{k \cdot K \cdot C_o}{1 + K \cdot C_o}$$

For this model, the rate of reaction is proportional to the fraction of surface covered by the substrate. At first, this model was developed in order to describe solid-gas reactions. Nevertheless this model has been recently applied to solid-liquid systems.

Degradation for diluted solutions of cresol follows pseudo-first-order kinetics. Initial rates are so obtained from next product,

$$r_o = k \cdot K \cdot C = k^o \cdot C_o$$

where k^o are first-order pseudo-constants for each concentration.

FTIR studies show cresol isomers interaction with catalyst surface. The region between 1550-1300 cm^{-1} was selected to emphasize νC=C and δOH vibration changes after interactions. O-cresol and m-cresol are adsorbed on catalyst surface by hydrogen bridges. p-cresol interaction is a mixture between cresolate formation and H-bond, as we have observed for phenol.

Even little proportion of cresol isomers in solution suffers adsorption on catalyst surface, interaction fits well Freundlich and Langmuir models for a given concentration range. p-cresol presents clear different behaviour from the other two studied isomers. As we have described, FTIR studies agree with obtained adsorption Langmuir constants.

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