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ENHANCEMENT OF PHENOL OXIDATION BY OZONE IN WASTEWATER. II: KINETIC MODELING

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Abstract

Four processes have been used to enhance the ozonation of phenol in water: ***I***-pH increasing (O_3-pH), ***II***- hydrogen peroxide addition (O_3- H_2O_2), ***III***- UV irradiation (O_3- UV), and in the presence of both H_2O_2 and UV; ***IV***-(O_3- UV- H_2O_2). In each of these processes the rate of phenol degradation has two components: direct and indirect. A general kinetic model is derived, valid for all processes, in which the apparent first- order rate constant has particular functional forms. $k_{ap} = f\left(pH, C_B^\circ, Y_{O_3}, T\right)$ in ***I***; $k_{ap}^{'} = f\left(pH, C_B^\circ, Y_{O_3}, T, C_{H_2O_2}^\circ\right)$ in ***II***; $k_{ap}^{''} = f\left(pH, C_B^\circ, Y_{O_3}, T, I_o\right)$ for ***III***; and $k_{ap}^{'''} = f\left(pH, C_B^\circ, Y_{O_3}, T, I_o, C_{H_2O_2}^\circ\right)$ for ***IV***. The rate constants have been identified by the integral method, using the kinetic model and the experimental data. They were of the same order of magnitude as those obtained through other advanced oxidation process: from 0.0881 min^{-1} for the process ***I***, to 0.1936 min^{-1} for the process ***IV***.

Key words: phenol degradation, kinetic curves, kinetic equation, model validation, rate constant

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