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Degradation of phenacetin by the UV/chlorine advanced oxidation process: kinetics, pathways, and toxicity evaluation

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Abstract: The degradation of phenacetin (PNT) by the combination of low-pressure mercury lamp and chlorine (UV/chlorine), an advanced oxidation process (AOP) of recent interest, was systematically investigated in terms of degradation kinetics, effects of chlorine dosage and water parameters, oxidation products as well as toxicity evaluation. The degradation of PNT followed pseudo first-order kinetics. The first-order rate constant (k_{obs}) in the UV/chlorine AOP was 4.3, 8.4, and 11.1 times that of dark chlorination, UV/H_2O_2, and UV/PS, respectively, with the same molar dosage of oxidant at pH 7.2. Radical quenching tests suggested that chlorination, ·OH and reactive chlorine species were responsible for the UV/chlorine oxidation of PNT with contributions of 26.33%, 14.6% and 59.07%, at pH 7.2. As chlorine dosage gradually increased from 100 to 500 μM, the corresponding k_{obs} monotonically increased from 0.0229 to 0.216 min^{-1}. k_{obs} was not apparently affected by the pH and coexisting chloride, but decreased by 56.5% and 75.4% in the presence of 10 mM HCO_3^- and 10