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Ozonation of 3,3′-dichlorobenzidine in aqueous solution: degradation efficiency and kinetics

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ABSTRACT

The degradation efficiency and kinetics of 3,3′-dichlorobenzidine (DCB) in aqueous solution by ozonation was investigated in this study. In laboratory-scale experiments, the primary factors affecting the degradation of DCB were investigated. The results showed that pH strongly influenced the degradation process, with a maximum apparent rate of 0.235 min^{-1} obtained at pH 4. The reactivity of DCB decreased in the order $(C_{12}H_{10}Cl_2N_2)_2$ > $(C_{12}H_{10}Cl_2N_2)_2{\cdot}HCl$ > $(C_{12}H_{10}Cl_2N_2)_2{\cdot}2HCl$. The degradation rate of DCB increased with increasing ozone dosage and reaction temperature but decreased with increasing initial DCB concentration. We derived a reaction kinetics model of DCB degradation by ozonation in aqueous solution by interpreting the experimental data, and this model showed good stability. The efficiency of DCB degradation by ozonation was also evaluated. DCB could be removed efficiently by ozonation, with greater than 85% removal after 50 min at pH 4 and 16–30 °C with a DCB concentration of 1.2–6.5 mg/L and an ozone dosage of 3.7–5.1 mg/min. Most of the intermediate products could not be mineralised by direct oxidation by ozone. The addition of *tert*-butyl alcohol or Cl^- had little effect on the degradation rate of DCB, which indicated that degradation of DCB occurred via direct oxidation by ozone.

Keywords: 3,3′-Dichlorobenzidine; Ozonation; Influencing factors; Removal efficiency; Kinetics model

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