A comparative study on oxidative degradation of 2,4-dichlorophenol and 2,4-dichlorophenoxyacetic acid by ammonium persulfate

Krzysztof Kuśmierek[a], Lidia Dąbek[b,*], Andrzej Świątkowski[a]

[a]Institute of Chemistry, Military University of Technology, Warsaw, Poland, emails: kkusmierek@wat.edu.pl (K. Kuśmierek), a.swiatkowski@wp.pl (A. Świątkowski)
[b]Faculty of Environmental Engineering, Geomatics and Power Engineering, Kielce University of Technology, Kielce, Poland, email: ldabek@tu.kielce.pl

ABSTRACT

The degradation of 2,4-dichlorophenol (2,4-DCP) and 2,4-dichlorophenoxyacetic acid (2,4-D) by ammonium persulfate under various activation conditions was investigated. The effect of the initial oxidant concentration, pH, temperature, and Fe^{2+} concentrations were studied. The rate of 2,4-DCP and 2,4-D oxidation was proportional to the concentration of persulfate. The optimal pH for 2,4-DCP degradation was 9.0, while for the 2,4-D, it was 3.0. The effect of temperature on the kinetics of 2,4-DCP and 2,4-D oxidation was examined, and it was demonstrated that increasing the temperature from 25 to 50°C accelerated the oxidation rate of both contaminants. The effects of Fe^{2+} concentrations and the optimal ratio of persulfate to Fe^{2+} were studied. Synergistic activation of persulfate by heat and Fe^{2+} was also investigated to enhance the oxidation of 2,4-DCP and 2,4-D. Under optimal experimental conditions, when the persulfate to Fe^{2+} molar ratio was 1:2 at 50°C, the complete oxidation of 2,4-DCP and 2,4-D was achieved after about 45 and 60 min. In any case, the 2,4-DCP was oxidized faster and more efficiently than 2,4-D.

Keywords: 2,4-DCP; 2,4-D; Oxidation; Persulfate