

Photocatalytic degradation of 2,4-dichlorophenol in irradiated aqueous ZnO suspension.

ABSTRACT

This paper focuses on the destruction of aqueous 2,4-dichlorophenol in ZnO suspension irradiated by low wattage UV light at 299 K. The operating variables studied include initial 2,4-dichlorophenol concentration, photocatalyst doses and pH. At 1.5 g l⁻¹ feed concentration of ZnO and 50 mg l⁻¹ initial 2,4-dichlorophenol level, a complete degradation was achieved in 180 min. The decomposition kinetics with respect to 2,4-dichlorophenol approximates pseudo zero-order with rate constant peaking at 0.38 mg l⁻¹ min⁻¹. High performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) detected benzoquinone, 2-chlorohydroquinone, 4-chlorophenol, 3,5-dichlorocatechol, hydroquinone, 4-hydroxybenzaldehyde and phenol during the ZnO-assisted photodegradation of 2,4-dichlorophenol among which some pathway products are disclosed for the first time. The reaction mechanism accounting for the degradation pathway intermediates is proposed. Inorganic anion additives such as S₂O₈²⁻, SO₄²⁻, and HPO₄²⁻ manifested inhibition against 2,4-dichlorophenol removal.

Keyword: 2,4-dichlorophenol; Intermediate; Photocatalysis; Anion; ZnO.