2. Sensitized degradation of chlorophenols on iron oxides induced by visible light Comparison with titanium oxide

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Abstract

The sensitized photocatalytic degradation of mono-, di- and trichlorophenols on iron oxides aqueous suspensions of α-Fe_2O_3 and α-FeOOH is reported in detail. The degradation of these compounds followed pseudo-first-order kinetics when α-Fe_2O_3 was used as photocatalyst. α-FeOOH was found to be inactive for chlorophenols degradation with the exception of 2,4-dichlorophenol (2,4-DCP) where a modest effect was observed. The formation of a surface complex by the chlorophenols with the iron oxide and the solubility of the particular chlorophenol in aqueous solution were observed to be the controlling parameters during the photodegradation. The results obtained with the most active catalyst α-Fe_2O_3 are compared with TiO_2. Total mineralization of chlorophenols was observed on TiO_2 while on α-Fe_2O_3 only partial mineralization was observed. In either case, the intermediates produced in solution during the photodegradation were found to be significantly more biodegradable than the initial compound. For mono-, di- and trichlorophenols the overall photocatalytic degradation was observed to increase in the order: 2,4,6-trichlorophenol (2,4,6-TCP) $<$ 2,3-dichlorophenol (2,3-DCP) $<$ 2-chlorophenol (2-CP) $<$ 2,4-DCP. The former sequence shows that the recalcitrant 2,4-DCP degrades more rapidly than other chlorophenols tested during this study. The photodegradation of chlorophenols on α-Fe_2O_3 and TiO_2 proceeds mechanistically through *para*-hydroxylation of the initial compound as suggested by the intermediates found by high-pressure liquid chromatography HPLC during the course of the degradation.

Keywords: Chlorophenols; Photocatalysis; FTIR DRIFT spectroscopy; COD
