

ORIGINAL PAPER

Degradation and toxicity changes in aqueous solutions of chloroacetic acids by Fenton-like treatment using zero-valent iron

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Three priority pollutants, i.e. mono-, di-, and trichloroacetic acids, were degraded by the conventional Fenton AOP system (Fe^{2+} and H_2O_2). The results obtained suggest that the degradation decreased in the order: monochloroacetic, dichloroacetic, and trichloroacetic acid. The best of advanced oxidation processes (AOPs) for the degradation of trichloroacetic acid was reductive dechlorination with the use of zero-valent iron (Fe^0). The results of *Escherichia coli* toxicity tests revealed that the reagents' toxicity after the Fenton treatment process was decreased.

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Introduction

Halogenated acetic acids (HAAs) are important chemical compounds which exhibit high phytotoxicity (Ballschmiter, 1992; Morris & Bost, 1991). This property is responsible for a significant part of forest dieback (Jensen, 1957; Frank et al., 1990).

Trichloroacetic acid (TCA) was used as a weed-killer in 1947, destroying, preferentially, monocotyledonous grasses (Martin, 1972). Its use is currently prohibited in most countries of the European Union. TCA is ubiquitous throughout the environment; it is particularly associated with conifers because it is accumulated in needles and is also found in the soils of coniferous forests (Frank et al., 1990). TCA, monochloroacetic (MCA), and dichloroacetic (DCA) acids are polar compounds of hydrophilic charac-

ter. The hydrosphere is the preferred environmental compartment in which their emissions accumulate (Ballschmiter, 1992; Morris & Bost, 1991). HAAs are biodegradable and are considered not to bioconcentrate in the food chain because of low octanol/water coefficients (Jensen, 1957; Haiber et al., 1996; Franke et al., 1994; Fulthorpe & Allen, 1995). Large uncertainties pertain in our knowledge of HAAs sources in the environment, although the formation of HAAs from volatile precursors was investigated and confirmed (Mroueh, 1994; Gribble, 1994; Itoh et al., 1994; Gürtel et al., 1994).

There is evidence that TCA is a minor product of the atmospheric degradation of 1,1,1-trichloroethane and tetrachloroethene in particular (McCulloch, 2002; Nelson et al., 1990). DCA and MCA may similarly be produced from 1,1,2-trichloroethene and

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