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Removal of mono-chlorophenols by slow sand filtration and UV irradiation

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ABSTRACT

We attempted to remove mono-chlorophenols (MCPs) with a slow sand filter and UV irradiation, and compared the removability and the structure. The phenols examined are 2-chlorophenol (2-CP), 3-chlorophenol (3-CP) and 4-chlorophenol (4-CP). MCPs were also examined for removal under ultraviolet (UV) lamp irradiation and the relationship between degradability and molecular orbital properties of the phenols was estimated. The order of removability with a slow sand filter of the examined phenols was 4-CP > 3-CP ≥ 2-CP. Only 4-CP was removed without acclimation. After 5 min of UV irradiation, the initial concentration of MCPs of 20 mg L^{-1} was decreased to approximately 0 mg L^{-1}, and the stoichiometric amount of chloride ions was released. A decrease in the concentration of dissolved organic carbon (DOC) suggested mineralization of MCPs. The degradability of 2-CP and 3-CP was slightly lower than 4-CP. Molecular orbital calculation suggests that the electrophilic frontier density and HOMO energy may be related to the degradability of MCPs under UV irradiation.

Keywords: 2-chlorophenol; 3-chlorophenol; 4-chlorophenol; Slow sand filtration; UV irradiation

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