Dehalogenation of trihalomethanes by a micro-alloyed aluminium composite under flow conditions

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Abstract

A new method for dehalogenation of trihalomethanes (THMs) by a low-cost and highly effective micro-alloyed aluminium composite (MAlC) in a semi-flow system (SFS) was studied. Addition of micro-alloyed elements significantly accelerated the rate of Al corrosion and enhanced reduction activity by destabilising the oxide film. THM dehalogenation by the MAlC followed pseudo first-order kinetics with respect to degradation of substrate. Batch experiments showed that complete dehalogenation of $CHCl_3$, $CHBrCl_2$ and $CHBr_3$ could be achieved within 120, 75 and 30 min, respectively, which periods are 5 to 10 times shorter than those of the bimetallic complexes and zero-valent iron. Additional advantages of the MAlC, related to other zero-valent metals, are capability of CH_2Cl_2 degradation and working under high pH conditions. Dehalogenation kinetics is mass-transport limited since it could be accelerated by using the SFS and by increasing the composite surface area. Presence of NaCl in solution increased the dehalogenation rate up to the concentration corresponding to seawater. The MAlC could be a promising reactive reagent for the remediation of the THM-contaminated ground- and seawater.

Keywords: micro-alloyed aluminium composite, chloroform, bromodichloromethane, bromoform, dehalogenation, reduction, semi-flow system, groundwater, seawater