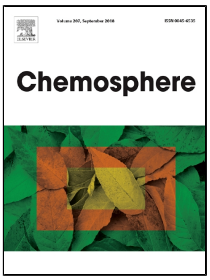
Accepted Manuscript



Investigating the suitability of Fe^0 packed-beds for water defluoridation

Svenja Heimann, Arnaud Igor Ndé-Tchoupé, Rui Hu, Tobias Licha, Chicgoua Noubactep

PII:	S0045-6535(18)31163-9
DOI:	10.1016/j.chemosphere.2018.06.088
Reference:	CHEM 21620
To appear in:	*Chemosphere*
Received Date:	16 April 2018
Accepted Date:	11 June 2018

Please cite this article as: Svenja Heimann, Arnaud Igor Ndé-Tchoupé, Rui Hu, Tobias Licha, Chicgoua Noubactep, Investigating the suitability of Fe^0 packed-beds for water defluoridation, *Chemosphere* (2018), doi: 10.1016/j.chemosphere.2018.06.088

Investigating the suitability of Fe^0 packed-beds for water defluoridation

Svenja Heimann[(a)], Arnaud Igor Ndé-Tchoupé[(b)], Rui Hu[(c)], Tobias Licha[(a)] Chicgoua Noubactep[(a,*)]

[(a)] Angewandte Geologie, Universität Göttingen, Goldschmidtstraße 3, D-37077, Göttingen, Germany.

[(b)] University of Douala, Faculty of Sciences, Department of Chemistry, B.P. 24157 Douala, Cameroon;

[(c)] School of Earth Science and Engineering, Hohai University, Fo Cheng Xi Road 8, 211100 Nanjing, P.R. China;

*Corresponding author: E-mail: cnoubac@gwdg.de; Tel.: +49-551-393-3191.

Abstract

A commercial granular metallic iron (Fe^0) specimen was used to evaluate the suitability of Fe^0 materials for removing aqueous fluoride (F^-) (water defluoridation). Experiments were performed to characterize the defluoridation potential of the tested Fe^0 as influenced by the presence of chloride (Cl^-) and bicarbonate (HCO_3^-) ions using tap water (H_2O) as operational reference system. Duplicate column studies were conducted for 120 days (4 months) using an initial F^- concentration of 22.5 mg L^{-1}, columns flow rates were about 17 mL h^{-1}. Each column contained a reactive layer (11 cm) made up of 100 g of Fe^0 in a 1:1 volumetric Fe^0:sand mixture. The reactive layer was sandwiched between two layers of the same sand. A pure sand column was used as control system. After the F^- removal experiments, the columns were flushed by methylene blue (MB) and Orange II for 21 days. Removal studies revealed (i) no F^- removal in the control system, (ii) no F^- significant removal on the Cl^- system, (iii) limited F^- removal in the HCO_3^- system, and (iv) the best F^- removal efficiency in tap water (H_2O). Dye flushing studies confirmed the ion-selective nature of the Fe^0/H_2O system and demonstrated the relatively low efficiency of the same for F^- removal. The overall results challenge the prevailing perception that water defluoridation using granular Fe^0 is not possible and suggest that effective water defluoridation in Fe^0 packed-beds is pure a site-specific design issue.

Keywords: Frugal innovation, Fluoride determination, packed-bed adsorption, Water defluoridation, Zero-valent iron.