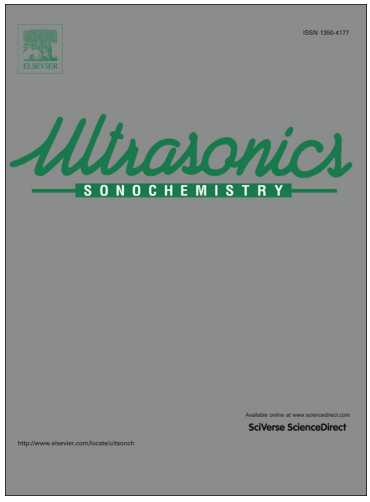

Acoustic cavitation induced synthesis of zirconium impregnated activated carbon for effective fluoride scavenging from water by adsorption

Aditi Mullick, Sudarsan Neogi

PII: S1350-4177(18)30355-9
DOI: https://doi.org/10.1016/j.ultsonch.2018.03.002
Reference: ULTSON 4114

To appear in: *Ultrasonics Sonochemistry*

Received Date: 13 October 2017
Revised Date: 19 January 2018
Accepted Date: 3 March 2018

Please cite this article as: A. Mullick, S. Neogi, Acoustic cavitation induced synthesis of zirconium impregnated activated carbon for effective fluoride scavenging from water by adsorption, *Ultrasonics Sonochemistry* (2018), doi: https://doi.org/10.1016/j.ultsonch.2018.03.002

Acoustic cavitation induced synthesis of zirconium impregnated activated carbon for effective fluoride scavenging from water by adsorption

Aditi Mullick, Sudarsan Neogi*

Department of Chemical Engineering, Indian Institute of Technology Kharagpur

Kharagpur-721302, West Bengal, India

aditi.mullick@iitkgp.ac.in, sneogi@che.iitkgp.ernet.in

Abstract

Environmental concern associated with the side effects of high fluoride content in ground water and surface water has prompted the researchers to look for an efficient, convenient and easy method. Considering the potential of a good adsorbent, present study reports the synthesis of a composite by impregnating zirconium on powdered activated carbon (AC) using ultrasound as the tool for synthesis and applying it for fluoride adsorption from water. The nature of the composite was determined through characterization by scanning electron microscopy (SEM), energy dispersive Xray (EDX), Xray diffraction (XRD), N_2 adsorption analysis (BET) and Fourier Transform Infrared Spectroscopy (FTIR) analysis. The pH_{pzc} (point of zero charge) of the adsorbent was found to be 5.03; with the optimum pH obtained at 4 for adsorption of strong electronegative fluoride ions. The initial fluoride concentration was varied from 2.5 upto 20 $mg.L^{-1}$ and the maximum adsorption capacity of 5 $mg.g^{-1}$ was obtained. A maximum fluoride removal of 94.4% was obtained for an initial concentration of 2.5 $mg.L^{-1}$ within an equilibrium time of 180 min. The adsorption isotherm followed the Langmuir isotherm model indicating a monolayer adsorption process and the adsorption kinetics followed pseudo second order model. The effects of various coexisting ions (HCO_3^-, NO_3^-, SO_4^{2-}, Cl^-) commonly present in the water were found to have negligible impact on the process performance. Conducting the adsorption-desorption studies for five consecutive cycles for an initial fluoride concentration of 10 $mg.L^{-1}$, the removal efficiency reduced from 86.2 to 32.6%. The ultrasonic method provided an easy