

Aminopropylorganosilane: A Green, Smart and Facile Solution for Arsenic Pollution

SANTANU MUKHERJEE

Shoolini University of Biotechnology and Management Sciences,
Solan, Himachal, India

Presenting Author: santanu@shooliniuniversity.com

The occurrence and hydrogeochemistry of geogenic (arsenic, fluoride, uranium, nitrate, iron, and manganese, etc.) contaminants may induce an environmental and public health concern due to their non-biodegradability and bioaccumulation over a longer period. In the present study, the aminopropyltrimethoxysilane agents (TT1-3-(Aminopropyl) trimethoxysilane and TT2-N-(2-Aminoethyl)-3-aminopropyltrimethoxysilane) was impregnated on a silica surface/material (sand), considering sand as a natural filter material commonly used for pretreatment of metal-contaminated water. 1 g of STS (1% and 5 % of each TT1-STS and TT2-STS) was added to the working solution (100 mL of As) and kept on a magnetic stirrer (250 rpm) (REMI-2 MLH, Mumbai India) at $298 \text{ K} \pm 1$ for 3 h period. The primary aim of the study was to : (i) prepare organosilane treated sand (STS) particles and perform pre-and post- sorption characterization of the silane sorbent ; (ii) study the removal capacity of STS for the targeted metalloids solutions (As) under various experimental conditions; and (iii) develop an understanding of the sorption process.

Spectroscopic characterization of organic functionalized silica materials indicated the presence of an organic moiety (-O-CH₂-CH₃ groups) and a propyl chain terminated with an amino group that drives the homogeneous diffusion of silica particles. TT1 and TT2 results in an array of parallel hexagonal channels (depending on the chain length of initial alkoxysilating agents) that provide ~1.8-2.0 mmol g⁻¹ of charged amido alkyl groups. The EDS images (Fig.1) revealed the successful impregnation of 1% TT1 and TT2 agents onto sand and co-occurrences of Mn, Ti, Mg, Fe on its smooth surfaces consisting of intra- and intergroup cross-linking. Batch sorption studies were performed with the optimized experimental parameters, where an increased removal (>20% for TT2-1% and >60 % for TT1-1%) of As was observed with sorbate concentration (50 $\mu\text{g L}^{-1}$), temp. ($25 \pm 2 \text{ }^\circ\text{C}$) and sorbent dosages (of 10 g L⁻¹) at 120 min contact time. Among the different adsorbent dosages, 10 g L⁻¹ of both TT1 and TT2 was selected as an optimum dosage (maximum adsorption capacity $\approx 2.91 \mu\text{g g}^{-1}$) (Fig. 2). The sorption model parameters suggested the possibility of chemisorption, physisorption, charge/ion-dipole interaction for the removal of arsenate.

Fig. 1

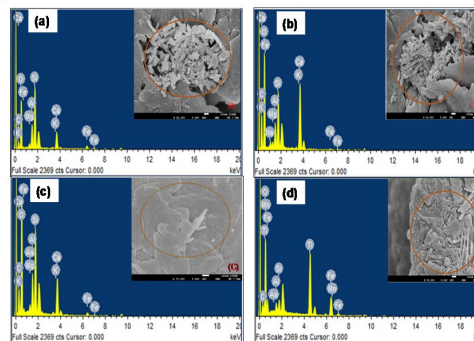


Fig. 2

