



## Hybrid materials in the remediation of arsenic contaminated waters: a physico-chemical study

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### ABSTRACT

Hybrid materials are obtained by the organic modification of sericite using the organic cations viz. tetramethylammonium chloride (TMA or T) and dimethyldioctadecylammonium chloride as (DDDMA or D) by a simple wet cation exchange process. Surface morphology of these solids is discussed with the Scanning Electron Microscopic images. Moreover, the materials are characterized by the X-ray diffraction and Fourier Transform-Infrared analytical techniques. Removal behavior of these organo-modified sericite samples is assessed for arsenite and arsenate from aqueous solutions under the batch and column reactor operations. The batch reactor experiments show that increasing the sorptive concentration (1–20 mg/L) and pH (2–10) is caused to decrease the percent uptake of arsenite and arsenate significantly. Increasing the background electrolyte concentrations from 0.0001 to 0.1 mol/L NaNO<sub>3</sub> causes a significant decrease in percent removal of As(III) which infers that As(III) is sorbed onto the solid surface, primarily, by weak electrostatic or by van der Waals forces hence, forming an outer-sphere complexes at the solid surface. On the other hand As(V) uptake is insignificantly affected in presence of background electrolyte concentrations. This indicates that As(V) is sorbed by a strong chemical force and forming an inner sphere complexes onto the solid surface. The equilibrium state modeling shows that the data is fitted well to the Freundlich and Langmuir adsorption isotherms. The sorption capacities of these solids are calculated under these equilibrium conditions which indicate that organo-modified-sericite samples possess significantly higher removal capacity comparing to the virgin sericite. The leaching of the organic molecules (T or D) are also conducted in the sorption process of As(III) or As(V) and shows that almost negligible amount of T or D leaches in the bulk solutions since the Total Organic Carbon value of the bulk solution is not increased. Further, the breakthrough curves are obtained for these oxyanions under the column experimentations and the data is fitted well to the Thomas equation hence, the maximum loading capacity for arsenic is estimated under the dynamic conditions.

*Keywords:* Hybrid materials; Arsenite; Arsenate; Batch operation; Fixed-bed column; Sorption

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