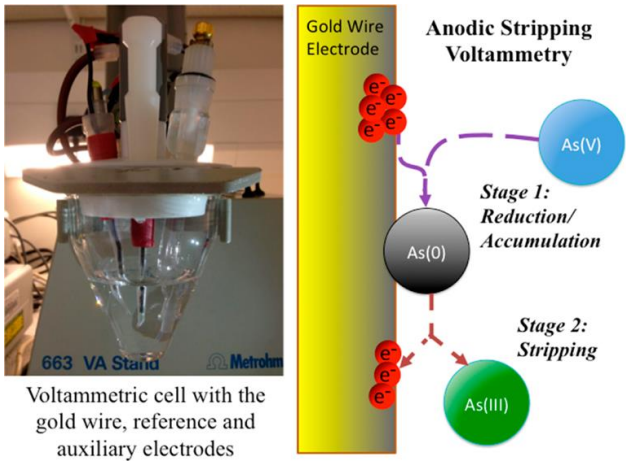
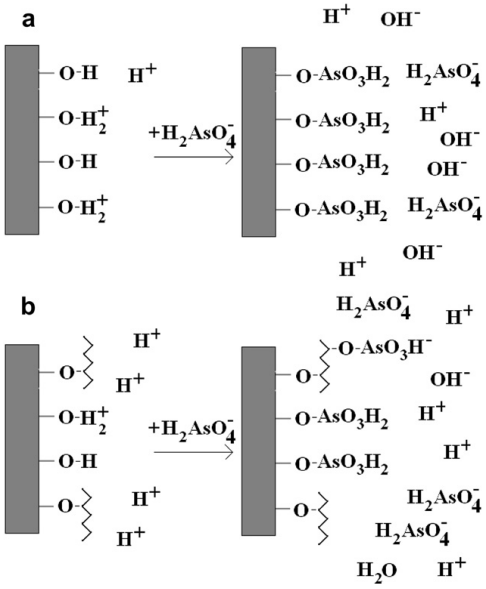
Arsenic Contamination of Drinking Water



Voltammetric cell with the gold wire, reference and auxiliary electrodes

Schematic of the electrochemical technique used to determine the arsenic species in the groundwater



A proposed model how Na+ bridges lead to increased arsenic adsorption in saline waters

Approximately 170 million people in over 70 countries are threatened by arsenic polluted drinking water. Our work addresses two distinct challenges, one more technological oriented, one more environmental oriented.

The focus is on addressing the widely observed failure of iron oxides, the state of the art removal technology, to remove arsenic concentrations to the safe levels when dealing with groundwater removed from anoxic depths. This is because the reduced form of arsenic adsorbs poorly to iron and aluminium oxides. To this end, we are developing treatment devices for municipal scale plants using FeIII oxide and TiIV dioxide combined in a bi-functional composite material as it integrates the adsorption performance of the iron phase and the titanium phase photo-catalytically oxidizes AsIII. To optimise the cartridge design, we are at present studying in detail the photo oxidation and the adsorption mechanism and developing surface compilation models to predict the amount of arsenic adsorbed under different groundwater. Future work aims on to enable photo oxidation in the visible light range.

The second area focuses on the effect of climate change on arsenic mobility in aquifers in coastal areas. It is predicted that sea level rise will increase the salinity of groundwater aquifers and on great unknowns is how this change in aqueous chemistry will affect the performance of treatment plants and of the arsenic chemistry in soils

Contact:

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Literature:

1. Cheng, A., Tyne, R., Kwok, Y.T., Rees, L., Craig, L., Lapinee, C., D'Arcy, M., Weiss, D.J. and Salaün, P. (2016) Investigating Arsenic Contents in Surface and Drinking Water by Voltammetry and the Method of Standard Additions. Journal of Chemical Education 93, 1945-1950.

2. Moffat, C.D., Weiss, D.J., Shivalingam, A., White, A.J.P., Salaun, P. and Vilar, R. (2014) Molecular recognition and scavenging of arsenate from aqueous solution using dimetallic receptors. Chemistry - A European Journal 20, 17168-17177.
3. Zafar, R., Watson, J.S., Weiss, D.J. and Sephton, M.A. (2017) Organic compound-mineral interactions: Using flash pyrolysis to monitor the adsorption of fatty acids on calcite. Journal of Analytical and Applied Pyrolysis 123, 184-193.