

Treatment of groundwater contaminated by arsenic using iron oxides/hydroxides

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In natural waters inorganic arsenic appears commonly in the oxidation states III and V, respectively as arsenides (As III) or as arsenates (As V). Both forms are toxic and carcinogenic. In contaminated regions, the range of As concentrations found in natural waters is wide, ranging from a few $\mu\text{g/L}$ to more than $5000 \mu\text{g/L}$. European Union has recently lowered the permissible maximum concentration for drinking water from 0.05 mg/L to 0.01 mg/L , in accordance with the Council Directive 98/83/CE [1].

Available technologies for arsenic removal are co-precipitation, adsorption to solid surfaces, ion exchange, membrane processes and electro-coagulation. Jiang [2] reported that the commonly used technologies in developing countries are oxidation, coagulation-precipitation, and adsorption by activated carbon, activated alumina, and iron oxide coated materials. Membrane technologies have shown to be effective but the cost is not always affordable.

The main goal of this research is the study of the operation conditions for the arsenic removal, both as As (III) and As (V), using a granular iron oxide as sorbent; so far we have been using ARM 300 from BASF.

Column experiments were performed in order to study the effect of the specific flow rate and of the oxidation state of arsenic. When it increases it leads to a decrease in the breakthrough time corresponding to a column saturation of 50%.

A loading sorbent capacity around $9500 \mu\text{g/g}$ was obtained for an inlet concentration around $1050 \mu\text{g/L}$; tests also suggest that As (III) is easier adsorbed than As (V).

The results obtained demonstrate the feasibility of applying this material to treat natural underground waters either at surface, in adsorption columns, or in-situ, as a reactive medium for permeable reactive barriers.

References:

[1] Council Directive 98/83/EC on the quality of water intended for human consumption, Official Journal of the European Community of 3 November 1998, L 330, pp. 32.

[2] Jiang, J. Q. (2001), *Removing arsenic from groundwater for the developing world – a review*, Water Sci. Technol. 44, 89-98.