# Antimony Removal by Zero-valent Iron: Implications for Insitu Groundwater Remediation

Tomáš Klimko [a)], Bronislava Lalinská [a)], Peter Šottník [b)]

*Comenius University, Faculty of Natural Sciences, Mlynská dolina, Bratislava 84215, Slovakia*
*[a)] Department of Mineralogy and Petrology e-mail: klimko@fns.uniba.sk*
*[b)] Department of Economic Geology e-mail: sottnik@fns.uniba.sk*

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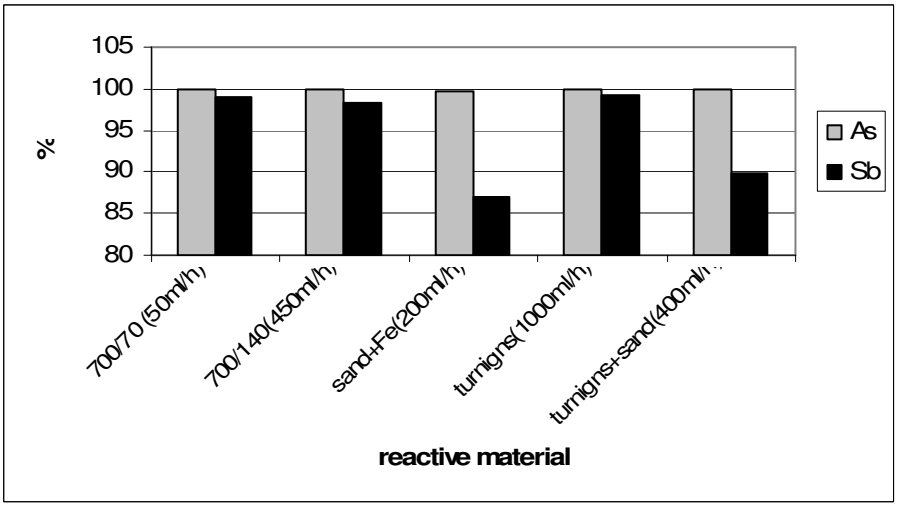
Antimony mineralization has been intensively exploited at numerous deposits in Slovakia. Weathering and dissolution processes are taking part in the environment of old mines and tailings, mobilizing elevated levels of toxic elements such as antimony, which represent dangerous contaminants for the surrounding ecosystem. The problem of contaminated groundwater has to be solved and one of the possible remediation method is the Permeable Reactive Barrier system (PRB). The choice of $Fe^0$ as a filling in reactive material for a PRB, was based of publications, whichdealt with the suitability of this filling material for arsenic adsorption. While arsenic and antimony are very common elements we decided to test this filling material also for antimony removal.
We have performed 3 batch and 4 column tests to study the usefulness of zero-valent iron for arsenic removal from contaminated water.
In the first phase, batch tests were run with three different types of iron: iron powder (Lambda), Fe chip (Merck) and steel manufacturing by-products in form of turnings. All pilot experiments were successful, with the best results observed in case of laboratory Fe chips (100% removed in 4 hours), but the removal efficiency of iron turnings was also suitable (100% of antimony removed in 8 hours) and its advantage of low price is incomparable.
In the second phase we have focused on effectiveness of these materials in column experiments. We used various mixtures of filling material such as: iron powder mixed with sand in ratio 700g of sand/70g of iron powder; 700g of sand/140g of iron powder; pure iron powder in combination with pure sand; steel manufacturing by-products (in the form of turnings) and, finally, turnings mixed with sand.
In these experiments we were trying to find out how thick the barrier needs to be to be able decontaminate the water, based on the known water velocity. The best results were observed by using iron turnings as the reactive material.

***Figure 1*** *Effectiveness of As and Sb removal by particular materials*




The thickness of reactive material in column was 50 cm, and the contaminated water flowed through the column 6 times. That means that the contaminated water passed the trajectory of 3 metres, while the water discharge speed was 1000 l/h (24 l/day). The water discharge rate in the place where the

barrier is planned is 8 litres per day and the concentration of contaminants is under 1mg/l. So the three metre-thick PRB will surely be adequate for the remediation proposes.
The time after which the reactive filling has to be replaced has been tested in laboratory conditions, but the effectiveness of such system decreases slowly, so the result will be known probably after a very long period of time.

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