Removal and Recovery of Metals from Mining and Metallurgy Waste Waters

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Waste waters from mining and metallurgy both contain dissolved heavy metals. However, geochemical characteristics reveal large variations. Adsorption- and (co-)precitipitation reactions are one of the key factors for the mobility of heavy metals in the environment.

In our experiments, we are using fluidized bed reactors with granules of different inventory materials to fix the heavy metal load from the water. Due to abrasion, a constantly reactive surface area of the reactant is provided and clogging effects are prevented which are the main advantages compared to other treatment techniques.

The utilization of zero valent iron (ZVI) to remove heavy metals from waste waters is proven to be very effective; however, the treatment of AMD with ZVI is not suitable due to low pH and heavy loads of dissolved iron. Instead of ZVI, different granuled (carbonate-) rocks are being tested to treat AMD. The idea of using granuled (carbonate-) rocks is to:

a) Neutralize the pH and
b) Induce precipitation of Fe-(oxy-)hydroxide as well as co-precipitates with other dissolved heavy metals.

Precipitation of Fe-(oxy-)hydroxides (and co-precipitates) not only removes Fe and other heavy metals from solution, but also provides adsorption sites for other contaminants which are still dissolved in the waste water.

Our experiments, revealed a removal rate up to 90% of Ni, Zn, up to 98% of V and up to 99% of In, Cu, Mo, W and Cr from metallurgy waste waters by using ZVI in the reactors. Our goal is to obtain similar removal rates for highly acidic, Fe bearing AMD by using granuled (carbonate-) rocks in the fluidized bed reactors.

After treatment, resulting sludges are separated and further processed. Different techniques are currently tested to enable heavy metal recycling from the sludges by applying thermal treatment, ionic liquids, microbes etc.