UFZ - UMWELTFORSCHUNGSZENTRUM LEIPZIG-HALLE GMBH

In situ Bioremediation of Acidic Mining Lakes by Addition of Organic Substrate and Lime

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Problem

As a result of pyrite oxidation in surrounding dumps >100 acid mining lakes have formed in former lignite mines in Eastern Germany. With pH values of 2.3-2.9 they represent a major environmental problem. The lakes are also characterised by high concentrations of iron and sulfate. There is currently no proven method for the remediation of such acidic mining lakes available.

Strategy

Lake sediments have an intrinsic capacity to produce alkalinity by microbial sulfate and iron reduction which results in iron sulfide formation accompanied by the consumption of protons. The remediation strategy presented here aims at the specific stimulation of these microbial processes in the lake by controlled supply of carbon and nutrients. In an up scaling approach, Carbokalk® (a by-product from the sugar industries containing organic carbon and lime) and straw amendments are being investigated in Laboratory experiments and 24 m³ to 5,000 m³ enclosure systems within the model mining lake 111 in Lusatia/SE-Germany.

Scaling Up

bottles

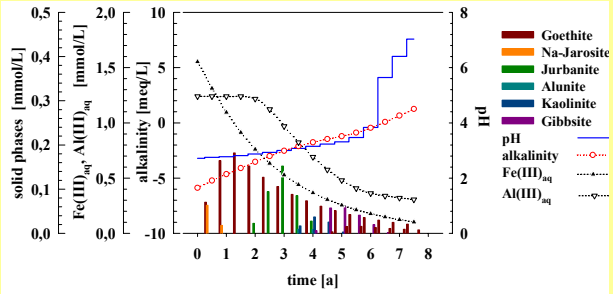
laboratory columns

enclosures

2m 10m 30m diameter

Results

With a combination of Carbokalk and Straw neutralisation is possible



Modelling of the neutralisation in a 2 m enclosure using PHREEQC. It will take several years until the pH reaches values above pH 3 although alkalinity decreases continuously. During the course of neutralisation different iron-minerals will precipitate or dissolve. The inflow of acidity from the surrounding dumps by erosion and groundwater is not considered. The rate of neutralisation is extrapolated from the TRIS formation in the first two years of an enclosure experiment. Calculations were done by R.Frömmichen.

This poster

► Fe(III) reduction in the sediment is the initial process of microbial alkalinity generation.

► The presence of bonding partners is crucial for neutralisation because Fe(III) reduction exceeds sulfate reduction.

► Reoxidation can be very rapid and has to be prevented by physical and chemical measures (inhibition of mixing, excess carbon source).

► As a consequence, the addition of straw can not be omitted.

Work in progress

in cooperation with

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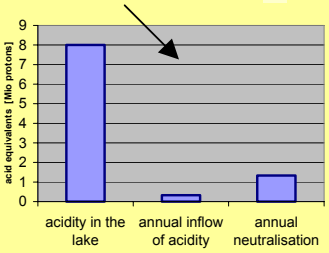
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