



Reactive barrier system for nitrate removal from mine effluents in northern Sweden: Laboratory experiments

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Laboratory column experiments have been conducted to determine nitrate removal rates from mine effluents by denitrification, with the purpose of providing initial data for the construction of a pilot scale reactive barrier system at the Malmberget iron mine, Sweden. Experiments were conducted at several different flow rates at 5C, 10C and room temperature; annual mean temperatures at the Malmberget site lie close to 0C. Columns were filled with an organic substrate consisting of sawdust mixed with sewage sludge, the source of denitrifying bacteria, supported by oven-dried clay pellets. Apparent denitrification rates, calculated from inflow and outflow nitrate concentrations and column hydraulic residence time, ranged from 5 to 13 mg N/L/d, with the lowest rates corresponding to the 5C experiments. These rates are, however, limited to a certain degree by the low flow rate and the supply of electrons acceptors (i.e. nitrate) to denitrifying bacteria.

Results from the column experiment have been used to construct a barrier system in Malmberget, Sweden. Trial runs with the pilot-scale barrier will be conducted during 2010, with the purpose of determining the performance of the barrier as mean air temperatures increase from below to above 0C and saturated flow commences in the barrier. The barrier system is constructed as a rectangular container with steel sheet walls (9m length in flow direction, 1.5m deep), and the flow rate will be adjusted to a hydraulic residence time of 1 day. The pilot-scale barrier system currently lies above ground, but a permanent barrier system would be installed below the ground surface so that the system can be maintained at positive temperatures throughout the year.