

Solving Mine Water Problems with Peat-based Sorption Media

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Mine water often contains elevated levels of trace metals that must be removed prior to discharge. Conventional technologies exist but generally are labor intensive and expensive. Peat-based sorption material can be a less expensive alternative and is easily deployed in either “semi-active” or passive treatment designs. APTsorbTM, a hardened granular material produced by American Peat Technologies from natural reed sedge peat, is a uniform material with a hydraulic conductivity of around 1 cm/sec, and metal removal capacity ranging from 1 -15% on a dry weight basis. It has been used successfully to remove suspended and dissolved copper from the Soudan iron mine in Minnesota and suspended and dissolved Pb, Zn and Cd from a lead mine in North America.

Since 2009, water discharging from the Soudan mine has been treated with a commercial ion exchange resin system that includes flow equalization tanks, bag and cartridge filters, a break tank, a carbon tank and several ion exchange tanks. Although effective, the system’s high cost, inefficient removal of suspended material and substantial maintenance have been ongoing and troublesome issues.

In November 2012, a pilot test was initiated using a single tank of APTsorbTM. Mine water was pumped through the media without any pretreatment. Copper input typically ranges from 30 – 60 ug/l but concentrations increased to a maximum value of around 300 ug/l in the summer of 2013. Since startup, over 16.5 million gallons (> 32,000 bed volumes) have been treated with an average removal of around 75% for suspended copper and 60% for dissolved copper. Backwash is required at about 4000 bed volumes, but with a combination of air sparging and high flow backwash, the suspended material is effectively removed from the bed.

The APTsorb media produced equivalent copper removal to the existing treatment system components of the bag and cartridge filters, the break tank, the carbon tank and the first commercial ion exchange tank. By reducing the size and complexity of the system, the capital and operation and maintenance costs are substantially reduced. Based on the existing data, using a single APTsorb tank will reduce annual operating costs by about a factor of 6; from around \$130,000 to \$21,000.

A pilot test was initiated at a lead mine in North America in October 2013. The pilot was designed to model both a “semi-active” (pressurized tank) and passive (biocell) treatment system approach. The original plan was to treat the discharge from the clarification basin, but if the mine discharge could be treated directly, the basin could be eliminated. To accommodate this approach, a pressurized sand filter was installed before both systems.

Input mine water had a pH greater than 7 and contained about 1500 ug/l total lead, with about 90% in the suspended form. Total metals concentration varied with the amount of total suspended solids in the discharge. The sand filter essentially removed all suspended metals, but removal did decrease as the pressure drop over the filter increased. Lead removal in both pilot systems was generally greater than

99%. Excessive solids in the mine discharge contaminated the pressurized tank and affected treatment at 6400 bed volumes. This reduced dissolved metal removal efficiency in the media from 99% to about 85% and caused the discharge to exceed the permit limit of 11 ug/l lead. The biocell was not affected and discharge limits are still being met after 12000 bed volumes.