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Wetlands for removal of sulphate and metals from mine tailings water

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Objectives

The biogeochemistry of wetlands is conducive to the retention of sulphate and other contaminants, as the (the reduction is chemical BUT biologically mediated) reducing substrate environment provides for the reduction of sulphate to sulphides, which in turn either precipitate with metals or volatilise as hydrogen sulphide. In addition, the formation of insoluble metal sulphides can remove excess metals from the water. We have been investigating the use of constructed wetlands for the removal of sulphate and metals from mine tailings water atTara Mines, Co. Meath, Ireland since 1997.

Materials and Methods

Two experimental systems were constructed on-site at the tailings facility of Tara Mines[1] (Figure 1).

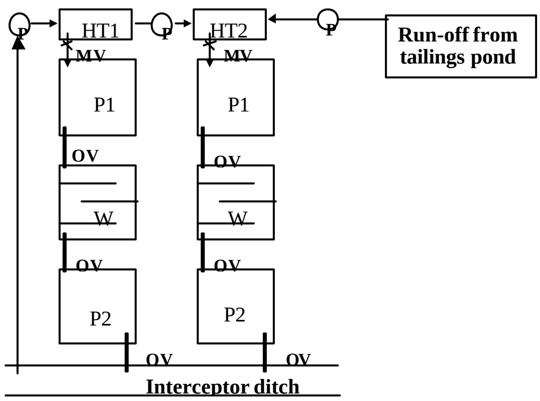

Figure 1. Design of the experimental treatment systems. The systems consist of a settlement pond, a wetland compartment and a second detention pond. The three compartments measure 4 m x 4 m x 2 m (l x w x d). HT = header tank, MV = manual valve, P1 = ponds receiving untreated tailings water, W = wetland compartments, P2 = ponds receiving treated water, OV = overflow. One system receives water pumped from an interceptor ditch, while the other system usually receives run-off from a vegetated tailings pond. During periods of low supply of run-off both systems receive interceptor ditch water. The substrates in the wetland compartments consist of spent mushroom compost and fine gravel and were originally planted with *Typha latifolia* and *Phragmites australis*[2].

The systems are monitored for concentrations of sulphate, phosphate, and metals, for pH, redox potential and conductivity, and for biotic factors such as plant species (planted and invading), plant growth, and invertebrate- colonisation .

Outcome and conclusions

The performance of the systems has been very promising, comparing favourably with other studies. Removal rates for sulphate reached 69 % (or 29 g m^{-2} day^{-2}), bringing the concentrations from originally at 1500 mg SO_4^{2-} L^{-1} to below the maximum acceptable level for discharge into surface waters on occasion. Due to the alkaline nature of the wastewaters and due to the efficient metal recovery process at Tara Mines, concentrations of zinc (0.2-27 µmol L^{-1}) and lead (0.1-1.6 µmol L^{-1}) in the tailings water are already very low prior to reaching the treatment wetlands. Yet the wetland still retained up to a further 99% of zinc and 64% of lead[3], confirming the potential of constructed wetlands for the retention of metals[1].

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