

NEUTRALIZATION OF ACID ROCK DRAINAGE USING A FLUIDIZED LIMESTONE REACTOR ¹

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Abstract. A cost effective treatment system for acid rock drainage using a cone shaped Fluidised Limestone Reactor (FLR) has been extensively investigated by both field and laboratory tests. A pilot scale system (with a flow rate of 100 Lpm and treatment of 130 mg/L CaCO₃ acidity) has been used in a mine lake system, successfully achieving suitable water quality for an aquaculture facility. This system was designed based on investigations into fluidisation dynamics, armouring, particle sizes and chemistry.

The reactor comprises a cone shaped container of limestone in which water is pumped through the limestone from the base of the cone. The water pressure causes the limestone to fluidize, thereby maximizing the contact between the limestone particles and the acid water and avoiding channeling effects that occur in static limestone treatment systems. One of the attractive features of the fluidized limestone reactor is its ability to minimize armourisation of limestone particles during the dissolution process. This is primarily achieved through the abrasion action induced by the agitation caused by the water flow. Armouring is avoided in the FLR by virtue of the container design, and also by controlling the pH in the effluent water so it does not exceed pH 6.0.

Control of pH remediation in the FLR is achieved by ensuring that the shape of the container is specifically designed for: 1) the desired input flow rate; 2) the limestone proposed for use in the reactor; and 3) the pH of the influent water. Design parameters for the purpose-built cone reactor are derived by conducting tests at the proposed installation site using the influent water and the limestone proposed for use in the full scale treatment system.

The fluidized limestone reactor will be most cost effective if it is incorporated into a passive treatment system with the reactor taking the pH from pH 3 to pH 4-5 linked to either wetlands or a carbon reactor that takes the pH from pH 4-5 to pH 6 and removes metal contaminants. After both treatments the water is suitable for agriculture/horticulture/aquaculture uses or for simply releasing into the receiving environment.

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