



A review of the reducing and alkalinity-producing passive treatment system for remediating coal mining influenced water

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Abstract

Polluted mine water is treated using active and passive treatment systems. Active systems require electrically powered equipment, chemicals, and regular maintenance to treat polluted mine water. Whereas passive systems depend on naturally occurring biological, geochemical, and physical processes to treat polluted mine water. Passive systems are preferred over active systems because of their cost-effectiveness. These systems typically use natural construction materials (soil and rocks), and natural treatment materials (wood chips, limestone, compost). Furthermore, they rely on gravity for water flow, and aesthetically, they can be integrated into the natural landscape, and they usually have a longer lifespan. The use of passive treatment techniques to treat mining influenced water is well documented all over the world. One such technique is the reducing and alkalinity-producing system (RAPS), which combines bio-geo-chemical and physical processes to treat mining influenced water through neutralisation and bacterial sulfate reduction. The setup of the system is a combination of the anoxic limestone drain (ALD) and anaerobic wetland systems. In this system, acidic water is ponded from 1–3 m over a 0.2–0.3 m layer of organic compost substrate which is underlain by a 0.5–1 m layer of limestone aggregates. The compost is a source of sulfate-reducing bacteria (SRB) providing anaerobic conditions and is responsible for sulfate reduction and precipitation of metals. The limestone layer is responsible for generating alkalinity and metal removal by raising the pH of the system. The system typically operates as a downward flow reactor in which water flows from the top of the system to the bottom. Treatment occurs as the water percolates downwards through the treatment material (compost and limestone) and is eventually discharged through pipes. In this review, RAPS will be discussed in detail with an aim to propose ways in which its efficiency, performance and longevity for polluted mine water remediation can be improved or optimized in South Africa. Furthermore, the processes involved in the treatment, limitations and advantages will be explored.

Keywords: Passive treatment, mining influenced water, RAPS, downward flow, performance