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Passive treatment technologies for the treatment of AMD from abandoned coal mines, Emalahleni, South Africa: Column experiments

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Acid mine drainage (AMD) production from abandoned and ownerless coal mines is a huge environmental problem worldwide. Characteristics of AMD includes low pH (<4), high sulfate (SO_4) concentrations, high acidity levels and potentially hazardous metals such as Al, Fe and Mn. Passive treatment technologies for AMD remediation can function in remote areas with low costs of operation, monitoring and maintenance and therefore are practical for setting up on abandoned mine sites. Even though such systems have been used to treat acid mine water efficiently, limitations such as coating and clogging as a result of Al^{3+} and Fe^{3+} oxyhydroxide precipitates have been reported. For solving the clogging problems associated with most of the passive treatments, dispersed alkaline substrate (DAS) was introduced in Spain by Rotting, et al., 2008. A DAS is a system composed of coarse matrix (e.g., wood shavings: Provide and maintain high permeability) mixed with a fine grained alkaline material (e.g., limestone: Provides a bulk reactive surface area, where it will dissolve and react with AMD before it is coated). The main aim of the study was to investigate the effectiveness of the DAS system in treating AMD from an abandoned coal mine and compare it with the traditional reducing and alkalinity producing system (RAPS). The column experiments remediated acid water successfully for 21 weeks after which the DAS system clogged while RAPS was continuing to treat AMD successfully. For assessment of the treatment systems water parameters such as pH, EC, Redox, Total Dissolved Solids (TDS), concentrations of metals and metalloids were analyzed weekly. Both treatment systems were able to raise the pH from an average of 3 to 8. Contaminants such as Fe, Al, and Zn were completely removed. Mn concentrations were reduced but were still above the standards. Minimal SO_4 reduction was also noted in both the systems.

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