

SUMMARY

In South Africa, the need for water treatment is increasing, especially in the mining sector. As active water treatment technologies are expensive, the mining sector has an increasing need for passive water treatment technology, with low maintenance and operating costs, yet efficient water treatment ability. Literature on passive water treatment suggests that these systems only offer a narrow range of treatment capabilities. Therefore, hybrid water treatment systems could be a solution to low-cost water treatment in South Africa. The Degrading Packed Bed Reactor (DPBR) is one of the units comprising the hybrid treatment group. The DPBR's main action is to convert sulfates into sulfides and alkalinity. In practice, the main drawback of the DPBR is clogging. Clogging lessens the amount of Acid Mine Drainage (AMD) that comes into contact with Sulfur Reducing Bacteria (SRB) in the DPBR, thereby reducing the efficiency of the bioreactor.

In this study, six small-scale DPBRs were constructed. Each was classified according to its unique organic source (manure, straw, vegetable food processing waste, wood shavings, chicken litter and a combined sample with layers of all the carbon sources). Synthetic AMD was fed through the six bioreactors for a period of three months. From the small-scale DPBRs, the permeability, sulfate, iron and pH of the exit samples were measured.

On average, the carbon sources removed 50 % of the sulfates and 98 % of the iron from the fed AMD. The different carbon sources showed no significant difference between each other in terms their sulfate and iron removal. The range between the best performing carbon source and the poorest performing carbon source, in terms of sulfate removal, was 17%. For iron removal, the range between the best and poorest performing carbon sources was only 2%. It was found that the permeability of the carbon sources played a larger role in the efficiency of the DPBR than the type of carbon source used.

Manure is highly effective in terms of pH improvement, sulfate and iron removal. However, this is at the expense of permeability, as its packing clogs very rapidly. Compost and straw have excellent permeabilities which do not change significantly over long timeframes. This is, however, at the expense of the remedial ability of the packing materials. The combined reactor, in every instance, offers a good compromise between these different behaviours.