Applied Biochemistry and Biotechnology

Effect of the Addition of Zero Valent Iron (Fe0) on the Batch Biological Sulphate Reduction Using Grass Cellulose as Carbon Source

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Abstract

Mineral mining generates acidic, saline, metal-rich mine waters, often referred to as acid mine drainage (AMD). Treatment of AMD and recovering saleable products during the treatment process are a necessity since water is, especially in South Africa, a scarce commodity. The aim of the study presented here was to investigate the effect of zero valent iron (Fe0) on the biological removal of sulphate from AMD in batch reactors. The performance of the reactors was assessed by means of sulphate reduction, chemical oxygen demand (COD), volatile fatty acid (VFA) utilisation and volatile suspended solids (VSS) concentration. To this end, three batch reactors, A, B and C (volume 2.5 L), were operated similarly with the exception of the addition of grass cuttings and iron filings. Reactors A and B received twice as much grass (100 g) as C (50 g). Reactor A received no iron filings to act as a control, while reactors B and C received 50-g iron filings for the experimental duration. The results showed that Fe0 appears to provide sustained sulphate removal when sufficient grass substrate is available. In reactors A and C, sulphate removal efficiency was higher when the COD concentration was lower due to utilisation. In reactor B, sulphate removal efficiency was accompanied by an accumulation of COD as hydrogen (H2) provided by the Fe0 was utilised for sulphate reduction. Furthermore, these results showed the potential of Fe0 to enhance the participation of microorganisms in sulphate reduction.