Grass cellulose as cost-effective energy source for biological sulphate removal

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Abstract

Acid mine drainage (AMD) needs to be treated before it is discharged to water courses. The biological sulphate removal technology can be applied for the removal of salinity (sulphate), acidity and metals, the main pollutants in AMD. The aim of this study was to demonstrate that sulphate removal can be achieved using the fermentation products of grass-cellulose as cost- effective carbon and energy sources. Two studies were conducted. In the first study (an experimental period of 32 d) two stirred anaerobic batch reactors with a volume of 2.5 ℓ each were operated at 37 to 39 ˚C and at a pH of 6.7 to 6.9. Both reactors contained grass cuttings, sulphate-reducing bacteria and rumen fluid. The test reactor contained sulphate-rich water and the control reactor tap water. The results from this study indicated that grass cellulose could serve as an energy source for biological sulphate removal. In the second experiment a 20 ℓ continuously fed one-stage reactor containing grass cuttings, rumen fluid and immobilised sulphate-reducing bacteria, was fed synthetic sulphate-rich feed water. The results showed that sustained sulphate removal could be achieved when operating this reactor. The butyric and propionic acids formed were mainly utilised as the electron donors for the sulphate reduction, which resulted in increased levels of acetic acid. A clear relationship existed between the rate of sulphate reduction and the COD/VFA concentration in the reactors. It was concluded that sustained sulphate removal was achieved operating the continuously fed reactor using grass-cellulose as the carbon and energy sources.

Keywords: cellulose, fermentation, grass cuttings, rumen microbes, sulphate, VFA