CHAPTER 1

INTRODUCTION

The production of effluents containing high amounts of sulphate, heavy metals and a low pH is a world-wide problem, of increasing concern. These effluents are known as acid mine drainage (AMD) and the primary source is coal mining. The metabolism of sulphur –and iron-oxidising bacteria when pyrite is exposed to atmospheric oxygen and the combination of autoxidation and microbial sulphur and iron oxidation leads to the production of large quantities of sulphuric acid (Atlas and Bartha, 1993). AMD leads to various environmental problems, killing aquatic life as well as economic problems due to the fact that it is highly corrosive.

By neutralising the effluent and removing the sulphate, AMD may be remediated. Currently, a variety of sulphate removal technologies are available. These include:

- Desalination processes, such as reverse osmosis and ion exchange (Dill *et al.*, 1994).
- Chemical methods, using barium ions such as barium hydroxide or barium chloride (Maree and Strydom, 1985).
- Biological removal of sulphate, using sulphate reducing bacteria (SRB) (Dill *et al.*, 1994).

Chemical and physical methods, however, require a high degree of maintenance and supervision. Thus, there is an increasing demand for inexpensive, environmental friendly technologies to remediate AMD. The use of SRB in the biological removal of sulphates is such an alternative. SRB can oxidise organic compounds like lactate or acetate, if a suitable electron donor is available (Dill *et al.*, 1994). During this process, sulphate is used as electron acceptor and reduced to sulphide.

Various experiments using different bioreactor setups and different carbon sources have been studied for potential use in the biological removal of sulphate by SRB (Tuttle *et al.*, 1969; Maree and Strydom, 1985; Du Preez *et al.*, 1991; Van Houten *et al.*, 1994).

Another method which involves SRB, is the passive treatment of AMD (Batchelor, 1993). Passive treatment processes refer to those systems which utilise natural resources and processes to drive the overall treatment process of polluted or contaminated water. However, due to the absence of methods to evaluate the potential use of different undefined carbon sources, there is a lack of experience with passive treatment systems designed for the treatment of AMD.

The aims of this study were therefore:

- to develop a standard procedure for the evaluation of carbon sources for sulphate reduction in AMD;
- to evaluate different defined carbon sources for the reduction of sulphate of AMD.
- to propose a conceptual model for the passive treatment of AMD.

References

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