

# **KINETICS OF THE CHEMICAL AND BIOLOGICAL IRON (II) OXIDATION**

by

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## SUMMARY

The oxidation of pyrite in the presence of oxygen, water and acidophilic chemolithotrophic iron oxidising bacteria, of the species *Thiobacillus ferrooxidans* (*T. ferrooxidans*), leads to the formation of large volumes of Acid Mine Drainage (AMD). AMD is a major environmental pollution problem in coalmines and coalmine dumps in South Africa. Measures to control acid mine drainage include the treatment of acidic effluents by applying limestone neutralization. Prior to limestone neutralization of acid water, iron (II) concentration needs to be oxidized first to iron (III) to prevent downstream oxidation and the formation of acid.

The study presented here concentrated on the different parameters and conditions influencing the iron (II) oxidation rate, both chemically and biologically. The effect of temperature, pH, air concentration, support media, number of iterations, iron (II) concentration, support media concentration, surface area, nutrients, CO<sub>2</sub>, HRT and flow rate were investigated.

It was found that, the use of support media had no effect on the chemical iron (II) oxidation rate. When iron (II) was oxidised biologically under batch test, the highest oxidation rate was established when geotextile (GT) was used as the support medium and the initial concentration was 2 g/L. Operating under continuous feeding conditions resulted in the highest oxidation rate when the initial iron (II) concentration varied from 4.5 to 4.8 g/L, GT was used as the support medium and nutrients were added to the reactor. It was established that the removal rates were dependent on the HRT and the optimum HRT was achieved at 8 h.

The conclusion of this study was that the chemical iron (II) oxidation rate depends on the concentration of the sludge (CaCO<sub>3</sub>). It was also concluded that the biological iron (II) oxidation rate was dependent on the bacterial growth, and that the growth of the micro organisms was influenced by the different parameters.

## LIST OF ABBREVIATIONS

AMD	:	Acid Mine Drainage
GT	:	Geotextile
HRT	:	Hydraulic Retention Time
T. ferrooxidans:		<i>Thiobacillus ferrooxidans</i>
d	:	day
t	:	time
L	:	litre
mL	:	millilitre
conc.	:	concentration
h	:	hour
min	:	minute
A.F	:	Air flow