

## TABLE OF CONTENTS

Executive Summary	iii
Acknowledgements	iv
Table of Contents	v
CHAPTER 1 – INTRODUCTION	1
CHAPTER 2 – THE SULPHIDE, IRON AND CARBONATE SYSTEMS – EQUILIBRIUM CHEMISTRY – A GRAPHICAL APPROACH	3
2.1 The sulphide/sulphate/sulphur system	3
2.1.1 Aqueous phase equilibrium	3
2.1.2 Aqueous-gas phase equilibrium	5
2.1.3 Aqueous-solid phase equilibrium	6
2.1.4 Chemistry of the iron system in relation to the oxidation of The reduced S species	9
2.2 The carbonate system and the role of $\text{CO}_2$ in the $\text{H}_2\text{S}$ stripping process	10
CHAPTER 3 – REMOVAL OF SULPHIDE AND ELEMENTAL SULPHUR RECOVERY	12
3.1 Discussion of industrial sulphide removal processes	12
3.2 Sulphide removal using silicone membrane	13
3.3 Experimental results	14
3.4 Sulphide stripping using $\text{CO}_2$	16
3.5 Results	16
3.6 Estimation of total surface area of the $\text{CO}_2$ bubbles	19
3.7 Determination of k-rate constant for $\text{H}_2\text{S}$ stripping	19
3.8 Conclusions	20
References to chapter 3	21
CHAPTER 4 – COAGULATION/FLOCCULATION OF METAL IONS IN THE CONTEXT OF THE RHODES PROCESS	22
4.1 Introduction	22
4.2 Basic chemistry of acid mine drainage waters	22
4.3 Results and discussion	25
4.4 Conclusions	30
CHAPTER 5 – IRON AND HEAVY METALS IN ACID MINE DRAINAGE WATERS – EQUILIBRIUM AND TREATMENT CONSIDERATIONS	31
5.1 Introduction	31
5.2 Metal hydroxides	31
5.3 Heavy metals – sulphide system	36
5.4 Practical considerations for iron and heavy metals removal from AMD waters in the Gauteng area	41

5.5	Metal oxides (the ferrite process) – an alternative approach to iron and heavy metals removal from AMD at ambient temperatures	42
	References to chapter 5	45
	CHAPTER 6 – CONCLUDING REMARKS	46