

TABLE OF CONTENTS

Chapter No.	Description	Page No.
	CERTIFICATE	I
	DECLARATION BY THE CANDIDATE	II
	COPYRIGHT TRANSFER CERTIFICATE	III
	DEDICATION	IV
	ACKNOWLEDGEMENTS	V-VII
	TABLE OF CONTENTS	VIII-X
	LIST OF FIGURES	XI-XIV
	LIST OF TABLES	XV
	LIST OF ABBREVIATIONS	XVI-XVII
	PREFACE	XVIII-XIX
1.	INTRODUCTION AND LITERATURE REVIEW	01 - 26
1.1	General	01
1.2	Problem Statement	02
	1.2.1 Production process of jarosite waste	03
1.3	Literature Review	04
	1.3.1 Disposal practice of jarosite waste and its management	04
	1.3.2 Application/ Utilization of jarosite	06
	1.3.2.1 <i>Jarosite used in brick manufacturing</i>	06
	1.3.2.2 <i>Jarosite used in construction work/industry</i>	08
	1.3.2.3 <i>Jarosite used as a sub-grade and geotechnical material</i>	11
	1.3.2.4 <i>Jarosite used as a liner in landfill</i>	13
	1.3.2.5 <i>Jarosite used as a substitute of gypsum in cement production</i>	14
	1.3.2.6 <i>Jarosite used as a substitute of fine aggregate in concrete mix</i>	14
	1.3.2.7 <i>Jarosite used as a cement replacement in concrete production</i>	15
	1.3.2.8 <i>Jarosite used as a proxy in remote sensing</i>	16

1.3.2.9	<i>Jarosite used in metals recovery</i>	17
1.3.2.10	<i>Jarosite as a soil fertilizer</i>	18
1.3.2.11	<i>Jarosite used in ceramic and glass products</i>	19
1.4	Scope and Objectives	24
2.	MATERIALS AND METHODOLOGY	27-50
2.1	Materials	27
2.1.1	Jarosite	27
2.1.2	Ground granulated blast furnace slag (GGBS)	29
2.1.3	Hydrated lime	30
2.2	Testing Methodology	31
2.3	Detailed Description of Testing Methodology Adopted	32
2.3.1	Specific gravity	34
2.3.2	Grain size distribution	35
2.3.2.1	<i>Sieve analysis</i>	35
2.3.2.2	<i>Hydrometer analysis</i>	36
2.3.3	Consistency Limits	36
2.3.3.1	<i>Liquid limit</i>	37
2.3.3.2	<i>Plastic limit</i>	38
2.3.4	Mini compaction	38
2.3.5	Hydraulic conductivity	39
2.3.6	Differential free swell index	40
2.3.7	Strength study	40
2.3.7.1	<i>Unconfined compressive strength</i>	41
2.3.7.2	<i>Split tensile strength</i>	41
2.3.7.3	<i>Sample preparation for the strength test</i>	43
2.3.8	Durability study	45
2.3.8.1	<i>Freezing-thawing</i>	45
2.3.9	Mineralogical and Morphological analysis	46
2.3.9.1	<i>X-Ray diffraction</i>	47
2.3.9.2	<i>Morphological analysis (SEM-EDX)</i>	48
2.3.10	Toxicity Leachate Characteristics Procedure	49
3.	RESULTS AND DISCUSSION	51-96
3.1	Compaction Study	51

3.1.1	Effect of GGBS on compaction parameters	51
3.1.2	Effect of lime and GGBS on compaction parameters	53
3.2	Strength Study	59
3.2.1	Effect of the GGBS on Jarosite-GGBS mixture	59
3.2.2	Effect of Lime on Jarosite-GGBS-lime mixture	61
3.2.3	Relationship between unconfined compressive strength (q_u) and split tensile strength (q_t)	67
3.2.3.1	Use of the equation developed	75
3.3	Durability Study (Freezing and Thawing test)	76
3.3.1	Strength study	77
3.3.2	Weight loss study	80
3.4	Mineralogical and Morphological Study	82
3.4.1	Mineralogical study (X-Ray Diffraction)	83
3.4.2	Morphological study (SEM-EDX)	86
3.5	Toxicity Leachate Characteristics Procedure (TCLP) Study	93
4.	APPLICATIONS IN CIVIL ENGINEERING AND ECONOMIC VIABILITY	97-104
4.1	Applications in Civil Engineering	98
4.1.1	Jarosite as a construction material in pavement design	98
4.1.2	Development of solidified, durable and immobilized unfired bricks	100
4.2	Economic Viability	102
4.2.1	Example 1: Cost of construction of an embankment of one m^3	102
4.2.2	Example 2: Cost of a standard size brick	103
4.3	Construction Sequence and QA/QC Procedure	103
5.	CONCLUSIONS AND FUTURE SCOPE	105-108
5.1	Conclusions	105
5.2	Limitation of Present Study and Scope for Future Work	107
	REFERENCES	109-121
	LIST OF PUBLICATIONS	122-123