

TABLE OF CONTENT

	Page
ABSTRACT	ii
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	vii
LIST OF FIGURES	xi
LIST OF TABLES	xiv
LIST OF ABBREVIATIONS	xvii
CHAPTER ONE : INTRODUCTION	1
1.1 Introduction	1
1.2 Generation of Rubber Effluent during the Processes	3
1.3 Regulatory Standards	6
1.4 Treatment of Effluent	7
1.5 Performance Studies on Rubber Glove Manufacturing Plants	11
1.6 Objectives of this Study	12
CHAPTER TWO : LITERATURE REVIEW	13
2.1 Rubber Product Manufacturing Industries	13
2.1.1 Background of Rubber Product Manufacturing Industries	13
2.1.2 Types of Rubber Products	14
2.2 Rubber Glove Manufacturing – Processes Involved	20
2.2.1 Definition of Latex	20
2.2.2 Manufacturing Process	22
2.3 Generation of Effluent and its Characteristics	24
2.3.1 Generation of Effluent	24

2.3.2	Characteristics of Effluent	26
2.4	Types of Effluent Treatment	29
2.4.1	Treatment Technology	29
2.4.2	Primary Treatment	30
2.4.2.1	Chemical Coagulation	30
2.4.2.2	Flocculation	32
2.4.2.3	Primary Sedimentation	35
2.4.2.4	Flotation	39
2.4.3	Secondary Treatment	47
2.4.3.1	General	47
2.4.3.2	Aerobic Processes	49
2.5	Treatment of Effluent from Rubber Glove Manufacturing Industries	62
2.5.1	Flocculation-Activated Sludge System	65
2.5.2	Flocculation, Anaerobic Digestion and Aerated Lagoon System	67
2.5.3	Flocculation-Aerated Lagoon System	69
2.5.4	Flocculation-DAF-Activated Sludge System	69
CHAPTER THREE : MATERIALS AND METHODS		71
3.1	Wastewater Samples	71
3.2	Chemical Analyses	74
3.2.1	Biochemical Oxygen Demand (BOD)	74
3.2.2	Chemical Oxygen Demand (COD)	75
3.2.3	Suspended Solids (SS)	77

CHAPTER FOUR :	RESULTS AND DISCUSSIONS	79
4.1	Characteristics of Rubber Gloves Manufacturing Industry Wastewater	79
4.2	Treatment of Effluent	84
4.2.1	General	84
4.2.2	Pre-treatment and Equalisation	85
4.2.3	Chemical Treatment	88
4.2.4	Primary Sedimentation	89
4.2.5	Biological Treatment	90
4.2.6	Secondary Sedimentation	90
4.2.7	Sludge Thickening and Disposal	92
4.3	Removal of BOD from Rubber Glove Manufacturing Industries Effluent	93
4.3.1	Removal of BOD from Factory A Effluent	94
4.3.2	Removal of BOD from Factory B Effluent	97
4.3.3	Removal of BOD from Factory C Effluent	99
4.4	Removal of COD from Rubber Glove Manufacturing Industries	102
4.4.1	Removal of COD from Factory A Effluent	103
4.4.2	Removal of COD from Factory B Effluent	106
4.4.3	Removal of COD from Factory C Effluent	108
4.5	Removal of SS from Rubber Glove Manufacturing Industries	109
4.5.1	Removal of SS from Factory A Effluent	111
4.5.2	Removal of SS from Factory B Effluent	114
4.5.3	Removal of SS from Factory C Effluent	115
4.6	Comparative Performance of WWTPs for Factory A, B and C	119

4.6.1	Removal Efficiency of BOD	121
4.6.2	Removal Efficiency of COD	123
4.6.3	Removal Efficiency of SS	126
CHAPTER FIVE :	SUMMARY AND CONCLUSION	129
REFERENCES		132
APPENDICES		141
Appendix I	Environmental Quality Regulations (Sewage and Industrial Effluents), 1979.	141
Appendix II	Photos of WWTP at different Stages of Treatment (Plate 1 to 6)	142