

## Table of Contents

<b>List of Tables</b>	<b>X</b>
<b>List of Figures</b>	<b>XII</b>
<b>List of Photos</b>	<b>XIV</b>
<b>List of Abbreviations</b>	<b>XV</b>
<b>Chapter 1: Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Objectives	4
1.3 Methodology	5
1.4 Contents of the thesis report	6
<b>Chapter 2: Literature Review</b>	<b>7</b>
2.1 Impact of wastewater characteristics on the proposed anaerobic technology	7
2.1.1 UASB reactor	7
2.1.2 Suspended solids	10
2.1.3 Particle size distribution	12
2.1.4 Chemical composition	16
2.1.5 Settling	21
2.1.6 Biodegradability	23
2.2 Wastewater characteristics (physical, chemical and biological characteristics)	24
2.2.1 Physical characteristics	25
2.2.2 Chemical characteristics	26
2.2.3 Biological characteristics	27
2.3 Organic material in wastewater	27
2.4 Nutrients (Nitrogen and Phosphorus)	30
2.5 Wastewater components	31
2.6 Domestic wastewater and municipal wastewater	32
2.7 Sampling	33
2.7.1 Types of samples	33
2.7.2 Sample collection	34
2.7.3 Sample preservation	35
2.7.4 Summary of sampling	38

<b>Chapter 3: Materials and Methods</b>	<b>39</b>
3.1 General	39
3.2 Sampling	39
3.2.1 Sampling locations	40
3.3 Analysis	42
3.3.1 Chemical analysis	42
3.3.2 Physical analysis	44
<b>Chapter 4: Results and Discussions</b>	<b>45</b>
4.1 General	45
4.2 Fractionation (COD and Carbohydrate)	47
4.3 Measured parameters	49
4.3.1 COD	49
4.3.2 Carbohydrate	51
4.3.3 Volatile fatty acids	52
4.3.4 TKN	53
4.3.5 NH <sub>4</sub> <sup>+</sup>	53
4.3.6 Total phosphorus and ortho-phosphate	55
4.3.7 Sulfate	56
4.3.8 TSS	57
4.3.9 VSS	58
4.3.10 Settleable solids	59
4.3.11 pH	60
4.3.12 Wastewater and weather temperatures	61
4.3.13 Biodegradability	62
4.3.14 Color	63
4.4 Previous Studies	64
4.5 Calculation model for HRT from required SRT (Zeeman and Lettinga, 1999)	66
4.6 The application of anaerobic technology	68
<b>Chapter 5: Conclusions and Recommendations</b>	<b>70</b>
5.1 Conclusions	70
5.2 Recommendations	71

<b>References</b>	<b>List of Tables</b>	<b>74</b>
<b>Annexes</b>		<b>79</b>
Annex 1: Tables		79
A1.1: Measured Values		79
A1.2: Mean values, standard deviations and variations (weekly and daily) of measured parameters		82
Annex 2: Figures		94
A2: Mean values, standard deviations and variations (weekly and daily) of some measured parameters		94
Annex 3: Photos		99
Performance of recently implemented sewage treatment plants in terms of effluent quality and percentage values of each parameter (mg/l and percentage)		100
A3.1: COD and TSS ratios for samples no. 2 and 3		102
A3.2: Calculated protein values and their presence to total COD values and COD ratios		104
A3.3: Selected studies of wastewater quality (as mentioned in Blue Book)		104
A3.4: Comparison between measured values of COD, BOD <sub>5</sub> and TSS		106
A3.5: Wastewater characteristics of different cities and countries		108
A3.6: Examples of all the data obtained		110
A3.7: COD measured from sample no. 3		110
A3.8: Comparison between measured values of COD, BOD <sub>5</sub> and TSS		112
A3.9: COD measured from sample no. 2		112
A3.10: Comparison between measured values of COD, BOD <sub>5</sub> and TSS		114
A3.11: Description of the methods		116
A3.12: Nitrogen content of measured samples		118
A3.13: Nitrogen content of samples		120
A3.14: Nitrogen content of samples		122
A3.15: Mean weekly variations (mg/l)		123
A3.16: Mean weekly variations (mg/l)		123
A3.17: Mean weekly variations (mg/l)		124
A3.18: Mean weekly variations (mg/l)		125
Table A3.1: Mean NO <sub>x</sub> daily variations (mg/l)		126
Table A3.2: Total Phosphate values (mg/l)		127
Table A3.3: Ortho-Phosphate values (mg/l)		127