

CONTENTS

| | Page |
|--|------|
| Chapter I Introduction and Literature Review | 1 |
| 1.1 Introduction | |
| 1.2 Literature Review | 6 |
| 1.2.1 Treatment by plant and its mechanism | 14 |
| 1.2.2 Treatment by clay, evaluated optimum conditions | |
| Chapter II Material and Methods | 24 |
| 2.1 Sampling and Preservation | 24 |
| 2.1.1 Water Samples | 24 |
| 2.1.1.1 Chemical station of CLEQM | 27 |
| 2.2 Chemicals | 28 |
| 2.3 Laboratory Analysis | 28 |
| 2.3.1 Determination of pH | 28 |
| 2.3.2 Determination of EC and TDS | 29 |
| 2.3.3 Determination of TOC | 29 |
| 2.3.4 Determination of trace metals | 30 |
| 2.4 Treatment | 30 |
| 2.4.1 Plant treatments | 30 |
| 2.4.1.1 Experimental for plant treatments | 30 |
| 2.4.2 Clay treatment | 30 |
| 2.4.2.1 Experimental for clay treatment | 31 |
| 2.4.3 Removal of iron by clay | 31 |
| 2.4.3.1 Effect of Time | 31 |
| 2.4.3.2 Effect of pH | 31 |
| 2.4.3.3 Effect of initial concentration of iron | 32 |
| 2.4.4 Removal of copper and zinc by Clay | 32 |
| 2.4.5 Treatment of CLEQM | |
| Chapter III Results and Discussion | 33 |
| 3.1 The aim of study | 34 |
| 3.2 Treatment by natural wastes (by-products) | 34 |
| 3.3.1 Treatment by rice Straw | 35 |
| 3.2.1.1 pH | 35 |
| 3.2.1.2 Electric conductivity (EC) | 36 |
| 3.2.1.3 Total dissolved solid (TDS) | 37 |
| 3.2.1.4 Total organic carbon (TOC) | 38 |
| 3.2.1.5 Trace metals | 41 |
| 3.2.2 Treatment by guava seeds | 41 |
| 3.2.2.1 pH | 42 |
| 3.2.2.2 Electric conductivity (EC) | 42 |
| 3.2.2.3 Total dissolved solid (TDS) | |

CONTENTS

| | | Page |
|--------------------|---|------|
| Chapter I | Introduction and Literature Review | |
| 1.1 | Introduction | 1 |
| 1.2 | Literature Review | |
| 1.2.1 | Treatment by plant and its mechanism | 6 |
| 1.2.2 | Treatment by clay, evaluated optimum conditions | 14 |
| Chapter II | Material and Methods | |
| 2.1 | Sampling and Preservation | 24 |
| 2.1.1 | Water Samples | 24 |
| 2.1.1.1 | Chemical station of CLEQM | 24 |
| 2.2 | Chemicals | 27 |
| 2.3 | Laboratory Analysis | 28 |
| 2.3.1 | Determination of pH | 28 |
| 2.3.2 | Determination of EC and TDS | 28 |
| 2.3.3 | Determination of TOC | 29 |
| 2.3.4 | Determination of trace metals | 29 |
| 2.4 | Treatment | 30 |
| 2.4.1 | Plant treatments | 30 |
| 2.4.1.1 | Experimental for plant treatments | 30 |
| 2.4.2 | Clay treatment | 30 |
| 2.4.2.1 | Experimental for clay treatment | 30 |
| 2.4.3 | Removal of iron by clay | 31 |
| 2.4.3.1 | Effect of Time | 31 |
| 2.4.3.2 | Effect of pH | 31 |
| 2.4.3.3 | Effect of initial concentration of iron | 31 |
| 2.4.4 | Removal of copper and zinc by Clay | 32 |
| 2.4.5 | Treatment of CLEQM | 32 |
| Chapter III | Results and Discussion | |
| 3.1 | The aim of study | 33 |
| 3.2 | Treatment by natural wastes (by-products) | 34 |
| 3.3.1 | Treatment by rice Straw | 34 |
| 3.2.1.1 | pH | 35 |
| 3.2.1.2 | Electric conductivity (EC) | 35 |
| 3.2.1.3 | Total dissolved solid (TDS) | 36 |
| 3.2.1.4 | Total organic carbon (TOC) | 37 |
| 3.2.1.5 | Trace metals | 38 |
| 3.2.2 | Treatment by guava seeds | 41 |
| 3.2.2.1 | pH | 41 |
| 3.2.2.2 | Electric conductivity (EC) | 42 |
| 3.2.2.3 | Total dissolved solid (TDS) | 42 |

| | | |
|-----------|--|----|
| 3.2.2.4 | Total organic carbon (TOC) | 43 |
| 3.2.2.5 | Trace metals | 43 |
| 3.2.3 | Treatment by willow bark | 46 |
| 3.2.3.1 | pH | 46 |
| 3.2.3.2 | Electric conductivity (EC) | 47 |
| 3.2.3.3 | Total dissolved solid (TDS) | 47 |
| 3.2.3.4 | Total organic carbon (TOC) | 48 |
| 3.2.3.5 | Trace metals | 48 |
| 3.2.4 | Treatment by Eichhornia Crassipes | 51 |
| 3.2.4.1 | pH | 51 |
| 3.2.4.2 | Electric conductivity (EC) | 53 |
| 3.2.4.3 | Total dissolved solid (TDS) | 54 |
| 3.2.4.4 | Total organic carbon (TOC) | 55 |
| 3.2.4.5 | Trace metals | 56 |
| 3.2.5 | Treatment by Phragmites Australis | 61 |
| 3.2.5.1 | pH | 62 |
| 3.2.5.2 | Electric conductivity (EC) | 63 |
| 3.2.5.3 | Total dissolved solid (TDS) | 64 |
| 3.2.5.4 | Total organic carbon (TOC) | 65 |
| 3.2.5.5 | Trace metals | 65 |
| 3.3 | Treatment by natural clay | 70 |
| 3.3.1 | Treatment by hebba | 70 |
| 3.3.1.1 | pH | 70 |
| 3.3.1.2 | Electric conductivity (EC) | 71 |
| 3.3.1.3 | Total dissolved solid (TDS) | 71 |
| 3.3.1.4 | Total organic carbon (TOC) | 72 |
| 3.3.1.5 | Trace metals | 72 |
| 3.3.2 | Removal of iron, copper, zinc by clay | 75 |
| 3.3.2.1 | Removal of iron by clay | 76 |
| 3.3.2.1.1 | Effect of pH | 76 |
| 3.3.2.1.2 | Effect of time | 77 |
| 3.3.2.1.3 | Effect of initial concentration | 77 |
| 3.3.2.2 | Removal of copper by clay | 80 |
| 3.3.2.2.1 | Effect of pH | 81 |
| 3.3.2.2.2 | Effect of time | 81 |
| 3.3.2.2.3 | Effect of initial concentration | 82 |
| 3.3.2.3 | Removal of zinc by clay | 85 |
| 3.3.2.3.1 | Effect of pH | 86 |
| 3.3.2.3.2 | Effect of time | 86 |
| 3.3.2.3.3 | Effect of initial concentration | 87 |
| 3.4 | Differential between iron, copper, zinc in the values of removal | 90 |
| 3.5 | Differential between material used in treatment | 91 |