BUSITEMA UNIVERSITY
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FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

DEGRADING OF TEXTILE EFFLUENT THROUGH COMBINED BIOLOGICAL AND ADVANCED OXIDATION PROCESS UTILIZING MANGANESE OXIDE AS A CATALYST

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A fourth-year final project report submitted to the department of Textile and Ginning leading to the award of Bachelor's degree in Textile Engineering

DECLARATION

I OGWEL DINAH reg no BU/UG/2015/2112 declare that this project research is my original work and all the information contained in this report is a result of my continuous hard work and it has not been presented to any institution of higher learning for any academic award.

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DEDICATION

My special gratitude to my father Mr. Oyuku Charles, my sister Jane, my brother Job and my niece Sharita for their continuous love, prayers and support. Not forgetting my lovely friends and relatives for always being there for me whenever I needed them.

APPROVAL

This is to certify that the project titled DEGRADING TEXTILE EFFLUENT THROUGH COMBINED BIOLOGICAL AND ADVANCED OXIDATION PROCESS UTILIZING MANGANESE CATALSYT has been executed under supervision by

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List of Acronyms

AOPs	Advanced Oxidation Processes
APHA	American Public Health Association
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
pH	Power of Hydrogen ion
NEMA	National Environment Management Authority
NTU	Nephelometric Turbidity units
TSS	Total suspended solids
TDS	Total dissolved solids
E.C	Electrical conductivity
ptCo	Platinum Cobalt scale
Mg/l	Milligrams per liter
MnO	Manganese (II) Oxide
H_2O_2	Hydrogen peroxide
Mg/l	Milligrams per liter

ABSTRACT

The discharge of textile effluents directly into water bodies or into the environment poses a serious threat since this waste water contains harmful compounds such as dyes, complex organic compounds and heavy metals which can cause health problems to humans as well as on the organisms living in the water bodies. This therefore requires efficient methods for the complete reduction of these toxic substances. The aim of this study was therefore to degrade the textile effluent through the combined biological method and advanced oxidation process utilizing manganese oxide as the catalyst for hydrogen peroxide instead of iron catalyst which has severe impractical limitations.

Results: characterization of the textile effluent showed that the concentration of impurities was too high as to the discharge standards set by NEMA 1999 with the highest concentration being 5600 ptCo for colour and the lowest was for Total suspended solids (TSS). Biological treatment using pure cultures of E-Coli after incubation of seven days showed good percentage removal of colour of about 82%. However, the combined treatment method showed good percentage reduction of most of the physio chemical parameters at acidic pH of 3, optimum amount of hydrogen peroxide used for the combined treatment was 4.5g/l and optimum amount of catalyst used was 300mg/l. the chemical treatment of the effluent alone required higher quantity of the catalyst and hydrogen peroxide for complete reduction of the physio chemical parameters, 700mg/l of the catalyst was used and 6.6g/l of hydrogen peroxide was used for efficient reduction of the physio chemical parameters.

Conclusion: the textile effluent was characterized for the impurities; colour, TDS, TSS, turbidity and the toxicity was determined using the BOD/COD ratio and it was found out to be 0.35. Treatment was carried out using the biological method, chemical method and the combined treatment method. The combination of biological and chemical method utilizing manganese catalyst yielded higher efficacy.

This study demonstrates the potential of biological isolates in enhancing the management of dye effluent in textile industries.

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CHAPTER ONE

1.0 Introduction

The Textile industry is one of the major source of water pollution, with the wet processing being the most water consuming section (Rasheed and Kavitha, 2014).Textile wet processing use large amounts of water and various chemicals during the processing of a textile product (Abraham Ponsingh *et al.*, 2018). About 7.62 million m3/ year of waste water is produced in Uganda and about half in Kampala (Masiga, 2013), ('Objec & ves : WW-RRR Products', 2016). Dyes are one of the toxic chemicals present in waste waters. Statistics has showed that there are more than 100000 commercially existing available dyes and more than 700000 tons per year are produced annually (Rasheed and Kavitha, 2014) and approximately 10-15% of dyes are lost in effluent during the dyeing process (Sánchez Pérez *et al.*, 2013).

This study therefore seeks to use manganese catalyst for activating hydrogen peroxide instead of iron salts which have shown severe practical limitations i.e. it's hard to regenerate the iron catalyst as iron ion are continuously lost into solution during the degradation process leading to a higher consumption of hydrogen peroxide.

1.1 Background

Effluent refers to liquid waste that is discharged into water bodies either from direct sources or from treatment plants while waste water is water which contains many pollutants therefore it cannot be used like pure water and hence should not be disposed in a manner which is dangerous to human life, aquatic life and the environment. Textile waste water is the kind of water coming from the various sections in a textile mill and it consists of dyes, complex chemicals such as organic acids, fixing agents, reducing agents, oxidizing agents (Wang, Ma and Xing, 2018). and some traces of metals such Cr, As, Cu, and Zn which are capable of harming the environment and human health.(Zhezhova, Risteski and Saska, 2014). Therefore, making it critical to develop treatment technologies for removal of these pollutants.(Huang *et al.*, 2017).

The common waste water treatment mechanisms are; physical, chemical, biological or a combination and there are four sequences of treating water which include; primary, secondary and tertiary. (Rasheed and Kavitha, 2014), Primary waste water treatment is the first step and it involves the removal of suspended solids, excessive quantities of oil, grease and gritty materials. Example of the methods used include; screening, sedimentation, homogenization, neutralization, mechanical flocculation, chemical coagulation. Secondary treatments are basically biological methods which use microorganisms under aerobic or anaerobic conditions to remove biodegradable organic matter (Abraham Ponsingh *et al.*, 2018) . The use of biological treatment is efficient in the degrading of pollutants present in waste water but however most of these compounds are not efficiently removed (Vincenzo Naddeo, 2013) hence limiting its use. Tertiary treatment is a supplementary to primary and secondary. The treatment processes are mainly physicochemical in nature and include membrane technologies, adsorption, oxidation technique, ion exchange among others. Despite the advantages of the conventional methods for the removal of pollutants, individual application of these methods is limited, (Azizi *et al.*, 2015). due to the many complex pollutants which are contained in the textile waste water hence production of waste water which doesn't meet the recommended treatment standards (Bokare and Choi, 2014). These individual methods are also expensive in terms of chemical cost and sludge disposal. (Zhezhova, Risteski and Saska, 2014)

Advanced oxidation process (AOPs) is a chemical technology that generates and utilizes strongly oxidizing hydroxyl radicals for complete removal of organic pollutants into nontoxic products like carbon dioxide, water and energy (Cesaro, Naddeo and Belgiorno, 2013) and it has been studied previously but of course there is need for development of the treatment process in order to obtain higher efficiencies,

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