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ENGINEERING**

WAR 4201: ENGINEERING PROJECT II

FINAL PROJECT REPORT

OPTIMIZATION OF SOLAR WATER

DISINFECTION TECHNOLOGY FOR EFFICIENT PATHOGEN REMOVAL

CASE STUDY: KIKONI, KAMPALA

BY

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*Submitted in Partial Fulfillment of the Requirements for the Award of a Degree
of Bachelor of Science in Water Resources Engineering*

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DECLARATION

I SANYA FILEX, hereby declare to the best of my knowledge that this report is my original work. It was done through my own efforts and practical experience during the course of my study. All literature and material that was consulted in the preparation of this report is fully acknowledged and referenced herein.

This report has never been submitted to any university or institution for any academic awards.

Signature:

Date:/...../.....

APPROVAL

This research project was conducted under my supervision and has been submitted with my approval for examination and award of B.Sc. Water Resources Engineering at Busitema University.

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LIST OF ACRONYMES

DNA.....	Deoxyribo Nucleic Acid
DO	Dissolved Oxygen
EC	Electrical Conductivity
<i>E. coli</i>	Escherichia coli
INRESA	Integrated Rural Energy Systems Association
MWLE	Ministry of Water Lands and Environment
NTU	Nephelometric Turbidity Unit
PET.....	Polyethylene Terephthalate
pH	Potential Hydrogen
SANDEC	Sanitation in Developing Countries
SODIS	Solar Water Disinfection
TDS	Total Dissolved Solids
TSS	Total suspended solids
TTCs.....	Thermo tolerant Coliforms
TVS	Total Volatile Solids
UN	United Nations
UV	Ultraviolet
UV-A	Ultraviolet light in with wavelength in the range of 320 to 400 nm
UV-B.....	Ultraviolet light in with wavelength in the range of 290 to 320 nm
UV-C	Ultraviolet light in with wavelength in the range of 190 to 290 nm

ABSTRACT

SODIS technology has been used for many years as a Household Water Treatment System (HWTS). However, due to the high density of houses in slums, a slight movement of the sun results in to the houses casting a shadow on to the bottles. This implies that the contact time required for disinfection of the pathogens in the water while using the SODIS technology may not be attained in slums.

This study sought to optimize the Solar water technology by reducing the contact time for pathogen disinfection by black wrapping PET bottles using polythene bags of gauge 30 microns. Black wrapping increases thermal inactivation of the pathogens in the water thereby reducing the contact time required for deactivation. This study investigated the effect of black wrapping on the solar disinfection rate of pathogens in drinking water from springs in slums. Results of raw water samples from the study area have showed the need for treatment of water before it is used for drinking as 80% of the springs had their water contaminated with faecal matter.

The rate of disinfection in the first run for black wrapped was obtained as 1.833 per hour and 1.363 per hour for the unwrapped bottles and the rate of disinfection in the second run for black wrapped was obtained as 2.657 per hour and 1.689 per hour for the unwrapped bottles

100% disinfection of pathogens was attained by the fifth and fourth hour of exposure for the black wrapped bottles and by the eight and sixth hour for the unwrapped bottles for the first and second run respectively. This shows that the black wrapping makes the disinfection faster and thus this solves the problem of envisaged inadequate contact time for disinfection encountered in slums due to the casting of the shadows from the closely spaced houses.

CHAPTER ONE:

1.0 INTRODUCTION

1.1 Background

Water is the most widely distributed substance on the planet and plays a vital role in both the environment and human life (Shiklomanov, 1998). The various water sources in the world include lakes, rivers, seas, oceans, streams, springs, swamps among others. The quality of water is threatened by both point and non-point source pollution from agriculture and runoff (Herman, 2000). Access to water is recognized as a precondition of the fulfillment of universal human rights and indispensable for leading a life with dignity (de Albuquerque, 2009).

Most of the water sources are becoming highly contaminated due to the poor disposal of municipal and untreated industrial waste discharge in water bodies (Ritter et al., 2002; Hossain, 2009). This is due to the development of the various cities and industries in the world that discharge untreated water into the water bodies. Public water supplies in developing countries often fail to produce and distribute safe water for consumption (Meierhofer, et al., 2009). 663 million people worldwide still rely on unimproved drinking water sources, including unprotected wells and springs and surface water (United Nations, 2015). The lack of access to safe drinking water makes water borne diseases one of the major public health problems in developing countries. It is estimated that 1.5 million people die each year worldwide because of the consumption of untreated or contaminated water (Kalt et al., 2014). In Uganda, there are many slums with poor solid waste and faecal sludge management practices. Access to improved sanitation in urban poor areas of developing countries is low. Slums are heavily populated areas, characterized by substandard and unplanned infrastructure, poverty, and lack of basic services like water and sanitation (UN-HABITAT, 2009). Poor waste management leads to deterioration in water quality for various water sources, which pose risks to the human health. Slum dwellers resort to using the low-quality water available from the water sources such as springs, swamps, wells among others (Meierhofer & Wegelin 2007). This leads to the increased prevalence of the water borne diseases like diarrhea, cholera, and dysentery, which claim the lives of many people (Borts, 1949).

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