FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRUCTION OF A RECYCLABLE GREY WATER TREATMENT SYSTEM OF A SOLAR-POWERED WASHING MACHINE WITH SOAP DOSER

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JANUARY 2023

ABSTRACT

Grey water (sullage) is liquid wastewater generated from washrooms, laundries, kitchens which does not contain human or animal excreta. Due to an increase in the percentage of water discharged from laundries, there is a lot of greywaters discharged that needs to be recycled and reused. Regular water shortages in some parts of Uganda have led to poor sanitation in the people's homes of residence, hospitals and institutions due to lack of enough water for showering and cleaning around the shower room.

This project is about designing, constructing, building and testing of a recyclable grey water treatment system of a solar powered top-load type washing machine with a soap dozer that uses less water by utilizing the available greywater from laundries to supplement on the accessible surface and ground water source in the country, uses solar power to reduce energy consumption, and also doses soap during washing. In our design, greywater quality was determined by collecting samples and testing them using different water quality sensors like turbidity and electrical conductivity sensors, generated quantity of water was determined depending on the total water consumption per house holes.

Design of various components of the system was done using the given relevant formulas and equations. greywater generated in our system was 20 litres per wash load i.e. a 7kg drum can wash a double duvet or towels and sheets for small family with an efficiency of 90% and the discharged water exhibited poor physical and chemical characteristics and thus needs treatment before reuse. Distribution pipes, collection tank was sized then treatment units where Jain super flow Y filter was selected and clear tank, pump, storage tank was sized.

DECLARATION

We hereby declare that the work in this report is carried out in accordance with the Regulations of Busitema University. The work is original except where indicated by special reference in the text and no part of this work has been submitted to any other university for examination and degree award. Any views expressed in this report are those of the authors and in no way represent those of Busitema University.

Name.	Name
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APPROVAL

This final research report has been submitted to the Faculty of Engineering for examination with approval of our supervisor.

Mr. Maseruka Benedicto

Department of Water Resources Engineering.

Sign: ……..……

Date: ……

ACKNOWLEDGEMENT

We take this opportunity to concede the almighty God for He has granted us life, good health and the ability to research and gather the information that is incorporated in this report.

We tender our authentic thankfulness to our lovely parents for the work well done in nurturing us into responsible and hardworking people, we thank them for their assiduous patronage in the various aspects of our lives most especially the academic aspect. May God bless you copiously

We extend our sincere indebtedness to our dear supervisor **Mr. MASERUKA BENDICTO** for all the time, support, guidance, knowledge and advice that you readily provided us during the preparation of this final report, may the Almighty God bless you abundantly. More thanks go to the entire staff of the Water Resources and Minning Engineering department and the entire university at large.

Lastly, we are grateful to Faculty for enabling us access the laboratory and workshop for carrying out tests with ease and the construction of the prototype respectively, the entire staff for the permission granted to carry on the research work, to our fellow students and friends in and out of the university for their unseasonal support and May God bless all your endeavours.

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ACRONYMS

TSS- Totally suspended solids

TDS- Totally dissolved solids

UV- ultra violet

WHO - World health organization

EC – electrocoagulation.

NGO – Non –government organizations.

PVC - Polyvinyl Chloride.

PPE – personal preventive equipment.

SDG – sustainable development goals.

DC – Direct current

AC – Alternating current.

HEP - Hydro Electric Power.

PVC – Photovoltaic.

CHAPTER ONE:

1 INTRODUCTION.

This chapter includes the background of the study, statement of the problem, the purpose of the study, objectives of the study, scope of the study which includes the conceptual scope, geographical scope, time scope, and finally the justification of the study.

1.1 Background of the study

It is projected that approximately 2.3 billion people, or almost one-third of the world population, reveal that laundry washing in private houses uses vastly different quantities of energy and water in various regions of the world, both in absolute and relative terms to total household usage (Monoroma Hossain, 2017), based on the fact that about 75% of washing machines in Australia are vertical axis machines that consume more than 120liters of water every wash cycle and only 25% are horizontal axis machines that consume approximately 60liters per load, an average consumption of 106liters has been computed (Anand Prakash Singh, 2021).

There are over 840 million home washing machines in use globally (Stamminger, November 2010). With an average yearly direct power use of 110 kWh each, they account for around 2% of total residential electricity consumption and emit 62 million tons of greenhouse gas emissions globally. They utilize around 19 billion m3 of water each year, with an average yearly water consumption of 23 m3. By replacing washing machines with the most energy- and water-efficient models, 31.5 TWh of electricity, 2.2 billion m3 of water, and 20.8 million tons of CO2 may be saved by 2030 (Götz, 2013).

laundry Washing garments is a complicated process requiring the coordinated interplay of several physical and chemical factors. Washing may be described broadly as the removal of water-soluble residues by water or an aqueous detergent solution, as well as the breakdown of water-soluble substances (Monoroma Hossain, 2017). The earliest mechanical washing machines appeared in the mid-nineteenth century. A closed tube with wooden paddles (agitators later made of metal) allowed laundresses to operate in an upright posture without getting their hands too wet. Laundry was no longer the time-consuming and laborious process that it used to be (Terpstra, 20017). Before the invention of the washing machine in France in the 1850s, people used to spend hours doing their laundry by hand. Some people soaked their clothes in the stream and then beat them on rocks to get the dirt out, Over the years, this has been a very active and

CHAPTER FIVE:

5 CONCLUSSION AND RECOMMENDATION

5.1 Conclusions

- Specific objective one.

Several design equations were used in designing the parts of a recyclable grey water treatment system of a solar-powered washing machine with soap dozer and there was too much pressure realised in the system leading to too much leakages and system breakdown.

- Specific objective two.

The various components of the system were constructed with the help of materials such as Pvc pipes, woods through techniques like cutting, threading and welding.

- Specific objective three.

System components were tested and different test results was discussed and high level of turbidity and total dissolve solids was notified in our grey water.

- Specific objective four

An economic analysis of the project was carried out using the net present value method and the net profit was realised for using the system

5.2 Recommendations

- The soap dosing part should be automated.
- The water pressure in the system must be monitored and regulated.

6 References

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7 APPENDICES: PRODUCTION DRAWINGS

UV unit