

**BUSITEMA  
UNIVERSITY**  
*Pursuing excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF WATER RESOURCES ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**DESIGN AND CONSTRUCTION OF A SOLAR POWERED  
SALT ELECTROCHLORINATION SYSTEM FOR WATER  
TREATMENT**

**BY**

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**BU/UP/2020/0359**

**CASE STUDY: NWSC-LUWEERO**

**This final project proposal report is submitted to the Faculty of Engineering in Partial  
Fulfilment of the Requirement for the award of the Degree of Bachelor of Sciences in Water  
Resources Engineering of Busitema University.**

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## **ABSTRACT**

Access to safe and potable water remains a major concern in Uganda. An important step in ensuring water safety and potable water is through disinfection. Chlorine case in point NWSC-Luweero, is used as a disinfectant to inactivate disease causing micro-organisms in the water. However, the Chlorine used is imported from countries like India, Kenya and US (Volza, 2023). This tends to be costly, in terms of purchase, transportation, storage and handling. National Water and Sewerage Corporation (NWSC) aims at minimizing the cost of production and profit maximization in water treatment thus a need. To address this challenge, this research focuses on design and construction of a solar powered salt electrochlorination system for water treatment. Involving onsite generation of sodium hypochlorite solution by electrolysis process from a brine solution for disinfection using Grade 2 titanium plates due to high corrosion resistance arranged in a bipolar parallel arrangement. Sodium Hypochlorite was generated successfully with an initial investment of Ugx.1,254,400 and annual savings of Ugx 5,266,000. Thus, a cost-effective alternative for water disinfection.

**KEY WORDS:** Brine solution, Electrolysis and Water treatment

## DECLARATION

### DECLARATION

I the undersigned, declare that this final year research report is my original work, except where due acknowledgement has been made. I declare that this work has never been submitted to this University or any other institution for funding/for partial fulfillment for any award.

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## **SUPERVISOR APPROVAL**

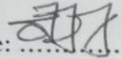
### **SUPERVISOR APPROVAL**

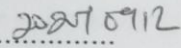
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## LIST OF ACRONYMS

|                      |                                    |
|----------------------|------------------------------------|
| Ca(OCl) <sub>2</sub> | Calcium Hypochlorite               |
| Cl                   | Chlorine                           |
| ClO <sup>-</sup>     | Hypochlorite                       |
| DPD                  | N-Diethyl-p-Phenylenediamine       |
| H <sub>2</sub>       | Hydrogen                           |
| HCl                  | Hydrochloric acid                  |
| HOCl                 | Hypochlorous acid                  |
| NaOCl                | Sodium Hypochlorite                |
| NWSC                 | National Water Sewage Corporation  |
| OSEC                 | On site Salt Electro chlorination. |
| SDGs                 | Sustainable Development Goals      |
| UGX                  | Ugandan Shilling                   |
| WHO                  | World Health Organization          |

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## **CHAPTER ONE: INTRODUCTION**

### **1.1 BACKGROUND.**

Water comes from a variety of sources, which can be contaminated with disease causing germs leading to the high spread of water borne diseases in the community, to prevent this contamination, it calls for addition of a disinfectant usually Chlorine that inactivates the disease-causing organisms in the water (Center for Disease Control and Prevention, 2023). Affordable water disinfection now becomes a key in reducing the water borne diseases experienced worldwide where resources are limited.

According Statista (Statista, 2023), the global market volume of chlorine was about 97.33 million metric tons in 2022, and is expected to grow to 128.95 million metric tons by 2030, meanwhile, 37.45 billion U.S. dollars in 2022 was the market value of chlorine. China, India, and the US are the leading countries in chlorine capacity additions. Also, in Norwegian, there have been higher expenditures on water treatment due to disinfection in the past years (Arnt & Sturla, 2023).

In Uganda, a project by The Gold Standard Foundation (The standard Gold Foundation, 2015) installed chlorine dispensers at water sources in rural regions of Uganda, serving over 2 million people as of July 2015 but the dispensers were and are dependent on supply of Chemical Chlorine. Currently they are non-operational due to limited supply of Chlorine chemical to the locals.

During COVID 19, National Water Sewerage Corporation (NWSC) faced a challenge of increasing costs due to reduced demand from non-residential users, the staff needed vital equipments like safety masks and disinfectants during water treatment and most of their consumers ( non-residential users) were schools, industries and businesses yet they had been put to halt. The total consumption reduced from 2.2 million cubic meters per day to 900000 cubic meters, nearly 41% decrease (Danilenko, 2020). Reduced demand and consumption mean less revenue collected by the corporation.

Currently, Luweero Area is located in the Central Region of Uganda approximately 75km by road north of Kampala (Lat: 0.8333; Long: 32.500). The population of Luweero according to the 2014 National Census is 456,158. Luweero Area consists of four branches namely: Bombo, Zirobwe, Luweero and Wobulenzi which deal in groundwater that is treated using chlorine compound my case study being NWSC-Luweero. The main branch is supplied by a composite of five boreholes

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## **APPENDICES**

Production drawings