TECHNOSCAPE 2023
International Conference on
Sustainable Technologies for Water and Wastewater Treatment
14th - 16th December'23

SophiA: Sustainable Off-Grid Technologies for Drinking and Deionised Water for Hospitals in Africa

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Abstract

The European Union's (EU) Horizon 2020 project 'SophiA – Sustainable Off-Grid Solutions for Pharmacies and Hospitals in Africa' aims to enable African people in rural and remote areas access to safe and clean drinking water, steam and cooling of food and medicine. It will be demonstrated at 4 health facilities - Burkina Faso, Cameroon, Uganda and Malawi such that different climate and geographical regions are covered. The concept of containerised water treatment system is based on 2-stages of low-pressure technologies – ultrafiltration (UF) to address microbial safety and membrane capacitive deionisation (MCDI) for water softening and deionisation. The laboratory pilot of the water treatment system developed at Karlsruhe University of Applied Sciences, Germany served as the groundwork to build SophiA's containerised solution that will be powered by off-grid carbon-neutral electricity with autonomous operation and monitoring.

Introduction

Rural areas in Africa lack access to health care, schools, clean water and infrastructure, which leads to higher number of illness and poverty compared to urbanized regions (Wilson et al., 2008). Sub-Saharan Africa has about 100,000 health facilities of which approximately 26 % have no access to electricity and only 28 % of health care facilities, on average, had reliable electricity among the 8 countries reporting data (Maina et al., 2019). So, the medical health care has to cope with the poor electricity and water supply in the remote and rural areas of Africa with no cooling facilities.

Material and Methods

SophiA systems developed by a team of 13 partners from Africa and Europe aim to provide solar cooling to remote rural medical stations along with safe and clean drinking water. It will be built in two 40-foot containers such that one container provides water treatment and steam generation while

the other container provides refrigeration for medicines. Both the containers will be solar powered with battery backup for seamless operation in case of power failure from the grid. The water treatment container employs chiefly two technologies – ultrafiltration (UF) and membrane capacitive deionisation (MCDI) (Figure 1). The first stage of treatment is the UF system comprising polyethersulfone (PES) based UF module manufactured by Martin Systems GmbH. All the suspended particulates and biological contaminants are rejected by the UF system to produce hygienically safe drinking water. The total dissolved solutes (TDS) are then removed by the novel MCDI technology.

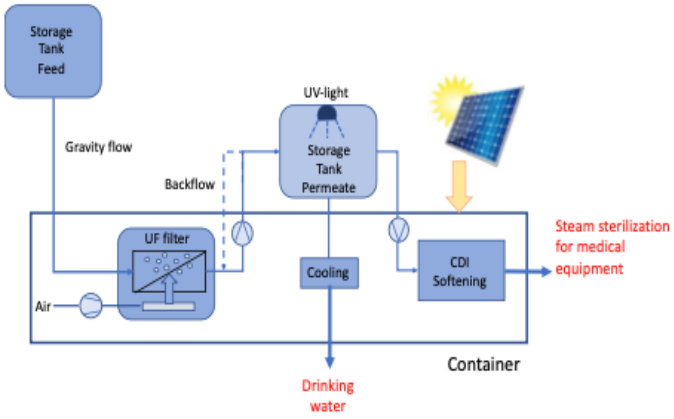

Figure 1. Safe water concept of SophiA container

Results and Discussion

A commercial electrode module (C12) was used to remove more than 90 % of the TDS such that the produced deionised water has electrical conductivity below 15 µS/cm. The deionised water will be used for steam production in the container and for sterilization purposes by the hospitals. About 5000 L of drinking water and 1000 L of deionised water will be stored in ultraviolet (UV) equipped tanks that are placed inside the container.

Conclusions

The water treatment technologies for SophiA containers were tested in the laboratory of Karlsruhe University of Applied Sciences, Germany followed by assembly of the containers in South Africa. These assembled containers will be shipped to the 4 chosen health care facilities for commissioning and further study.

References

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