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Development of a sustainable automatic disinfection system for rainwater treatment

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ABSTRACT

In many remote areas, where mains water is unavailable, roof harvested rainwater (HRW) is one of the principal sources of drinking water. On many occasions, the occupants store rainwater to ensure a continuous supply of drinking water. Researchers worldwide found many harmful chemicals and microbiological contaminants at high concentrations in the HRW. Most rural people do not use any regular/established disinfection methods for making HRW safe to meet the national drinking water guidelines. Pool chlorine is very popular for disinfecting water in treatment plants and residential swimming pools. It is relatively cheap and may provide residual effects up to certain period and keep water drinkable and safe if used to treat the HRW. However, most residents do not use it for disinfecting HRW before drinking.

This masters research project aims to develop an automatic disinfection system using a filter and pool chlorine to treat the HRW at household scale. Therefore, the project scope is to design and construct a product that can automatically disinfect the filtered HRW and benchmark the water quality with Australian drinking water guidelines. The aim is to provide clean water for six occupants with a high reliability. Multiple chlorine decay tests on the filtered HRW sample will determine the chlorine dose rate. Several instruments, such as a programmable logic controllers (PLC), six solenoid valves, and seven non-contact capacitive level switches will be used to configure the intended automated system. This automatic disinfection system will enable rural people to have safe drinking water at household scale.

An experimental rainwater harvesting system has been constructed at Western Sydney University (WSU) (Werrington South, Penrith Campus) as a part of this study. The proposed disinfection system is being built in the Environmental Engineering Laboratory at Penrith Campus of WSU. The completion target of this project is August 2022. A review paper has been submitted based on this research, which is under review. Another two journal articles will be prepared based on this research. It is expected that the outcomes of this study will be useful to rural communities across the globe in obtaining clean drinking water where rainwater is available, and where there is no other viable clean water supply. This research will assist in achieving water related sustainable development goals by many developing countries.