

IWRA's XVII WORLD WATER CONGRESS

제 17차 IWRA 세계물총회

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The Control of Pathogens in Stored Rainwater using Direct Electrochemical Activation

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Background



- Almost 2 billion people world wide do not have access to safely managed drinking water services¹
- In 2019, 0.8 million people died as a result of diarrhoeal diseases, contracted from the consumption of biologically contaminated water²
- Rainwater harvesting systems enable off-grid, or remote, communities to store freshwater throughout dry periods



¹ WHO & UNICEF. Progress on drinking water, sanitation and hygiene in households 2000-2020: Five years into the SDGs. (2021);

² World Health Organization. Water, sanitation, hygiene and Health A Primer For Health Professionals. (2019)

Electrochemical Activation [ECA]



Water + ions + energy = ECA

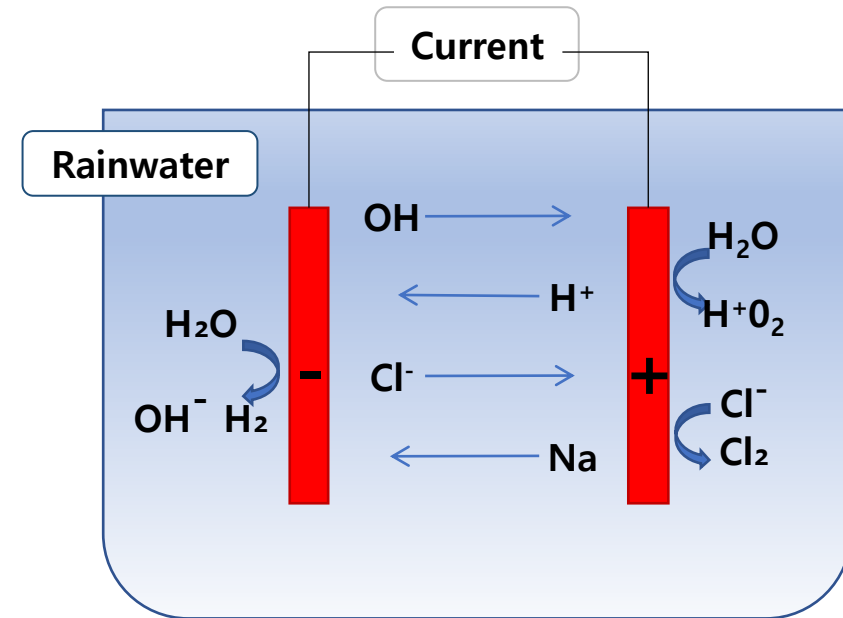
ECA damages and ruptures bacterial membranes through oxidation reactions

Rapid antimicrobial kinetics:

- 2 – 10 seconds

Applications in:

- Food processing
- Healthcare settings
- Drinking water disinfection

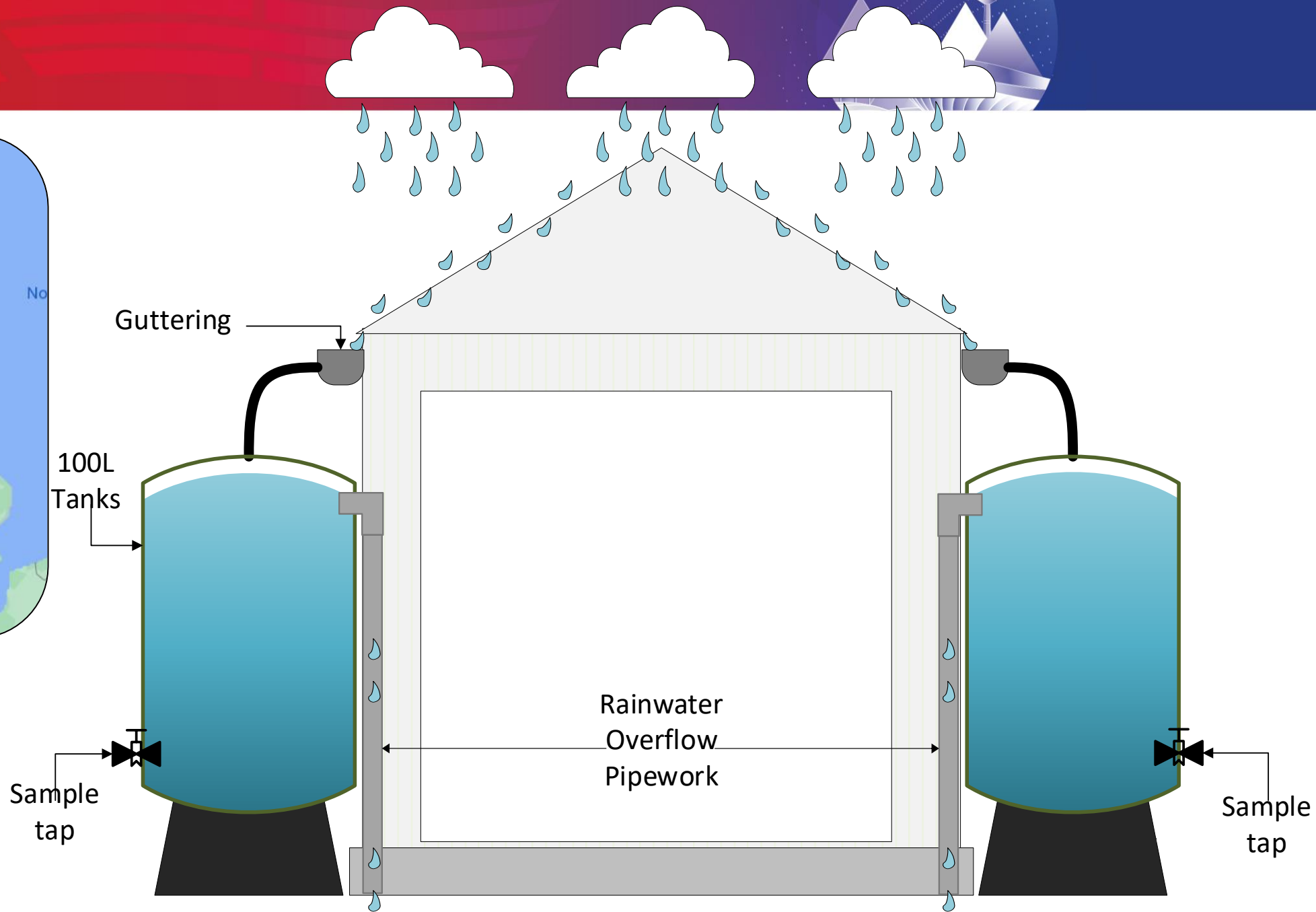


Study Aim: To control potential waterborne pathogens using small-scale direct electrochemical activation.

Methods



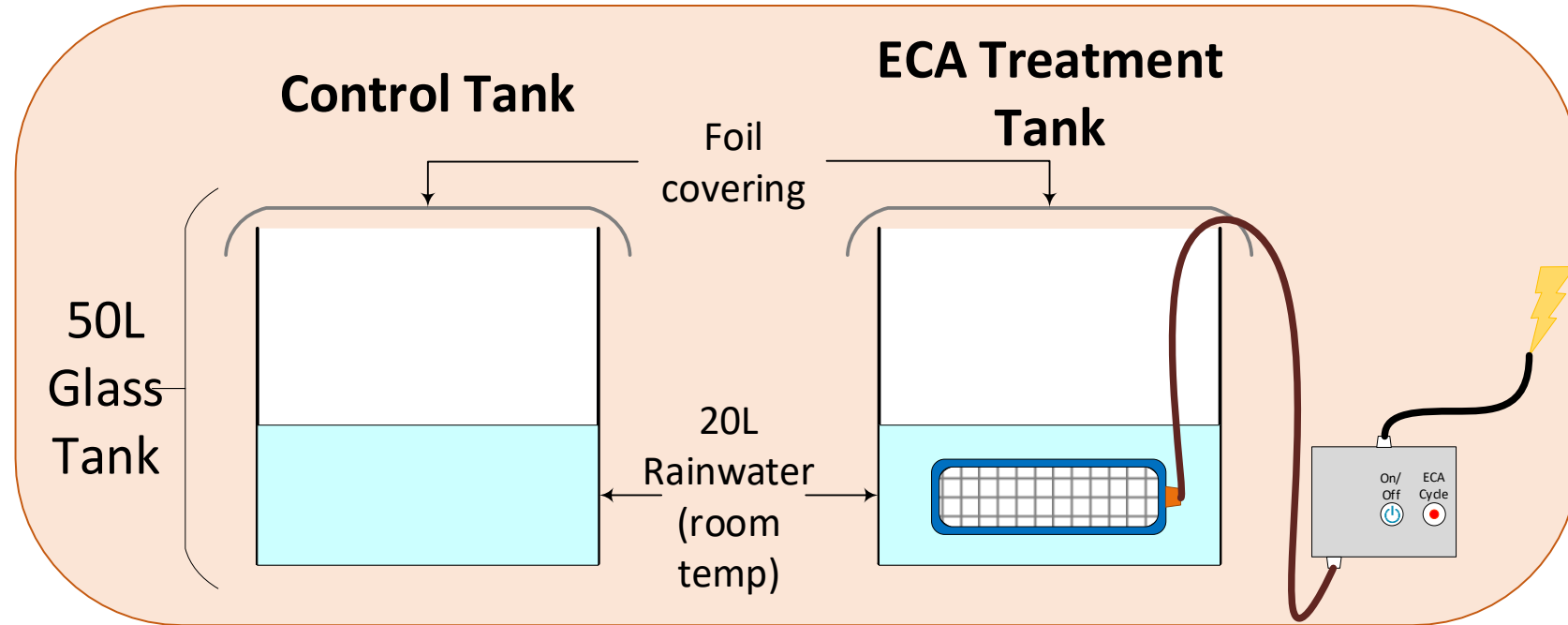
UWE, Bristol



Methods

Total electrochemical activation [ECA] time: 4 hours

- Tanks were then left covered with no activation for a further 20 and 44 hours (48 hours total).



Physicochemical parameters monitored every 30 minutes

- Conductivity and oxidation reduction potential [ORP]

Biological parameters monitored every 30 minutes

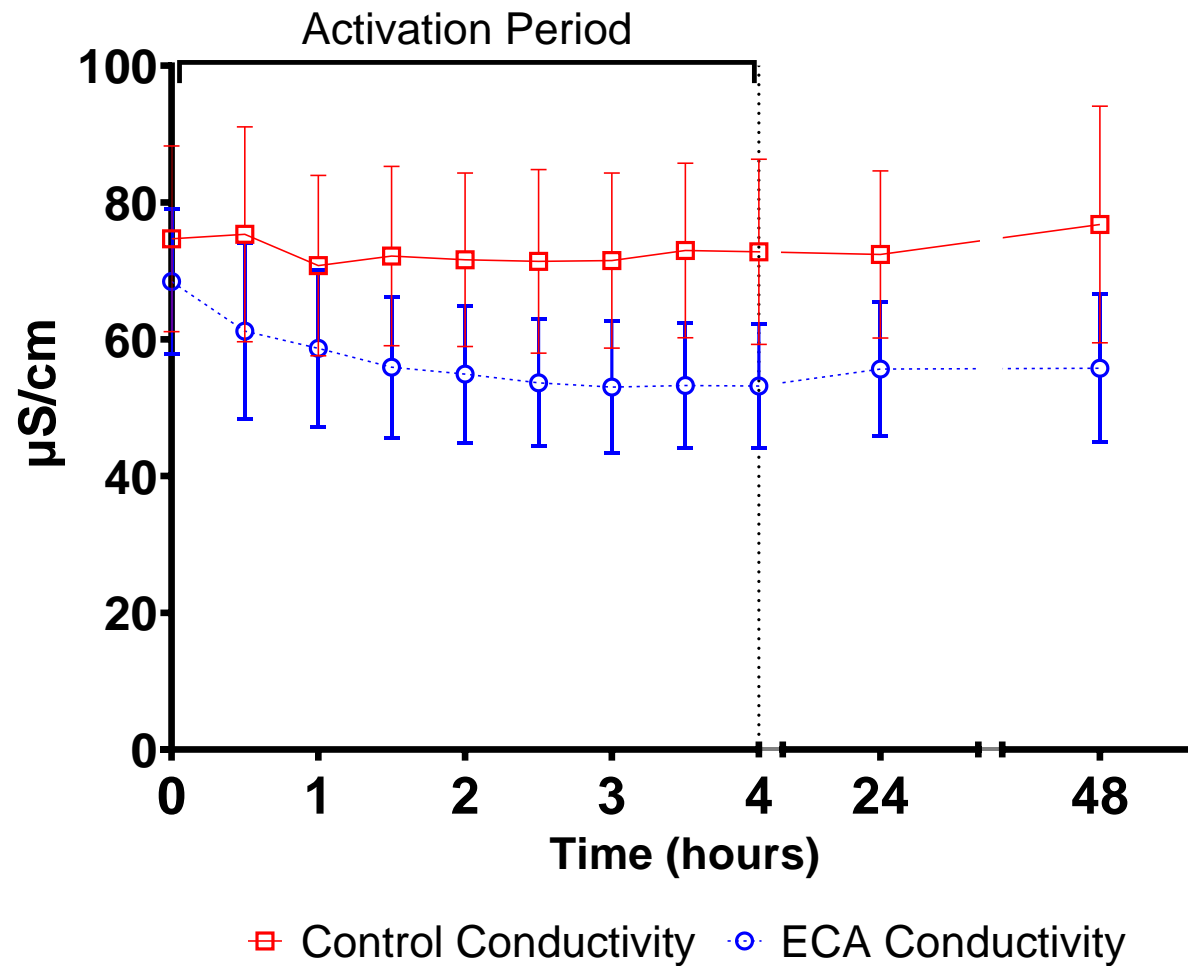
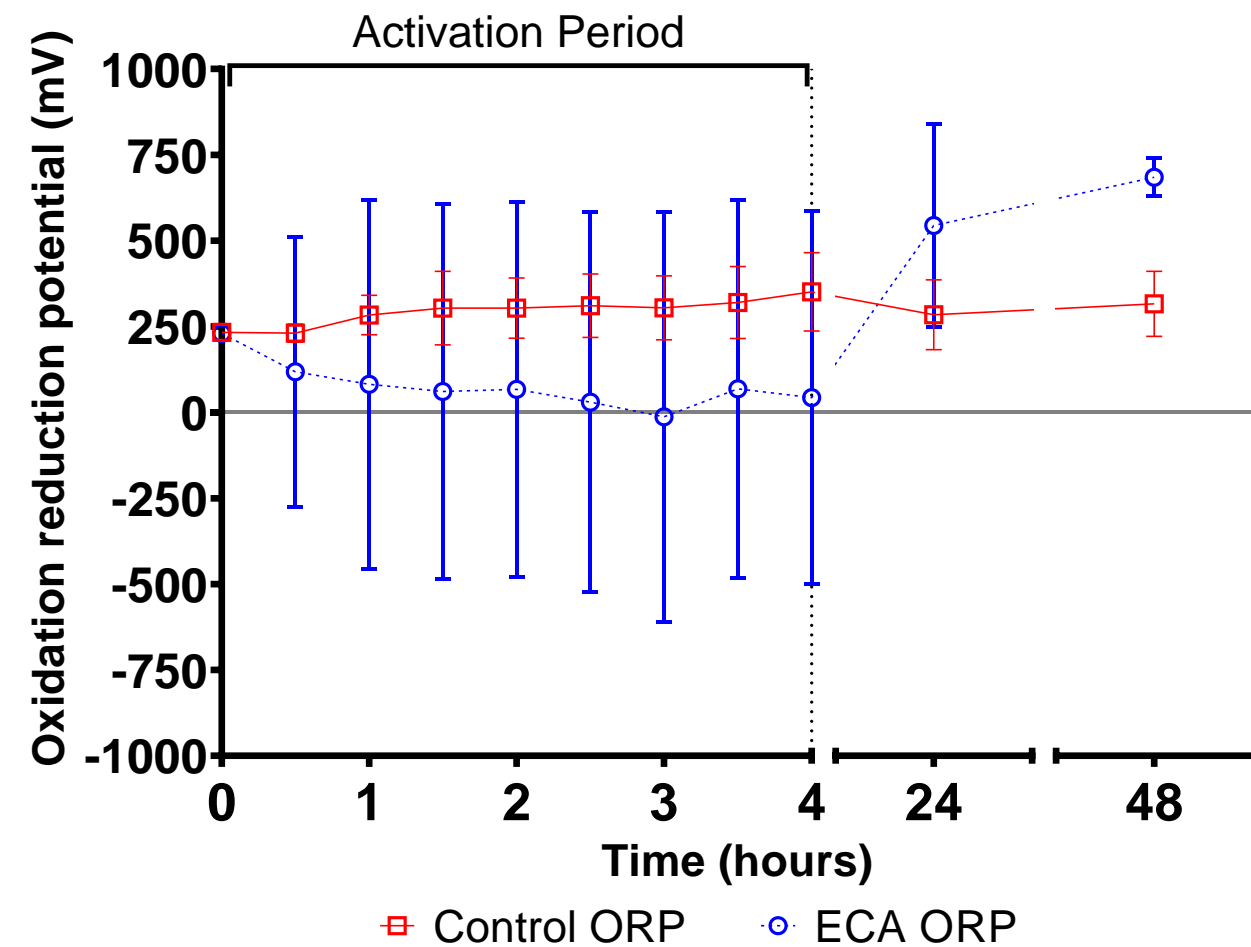
- Heterotrophic bacteria (HPC) and total coliforms

Physicochemical parameter results



Oxidation Reduction Potential

Conductivity

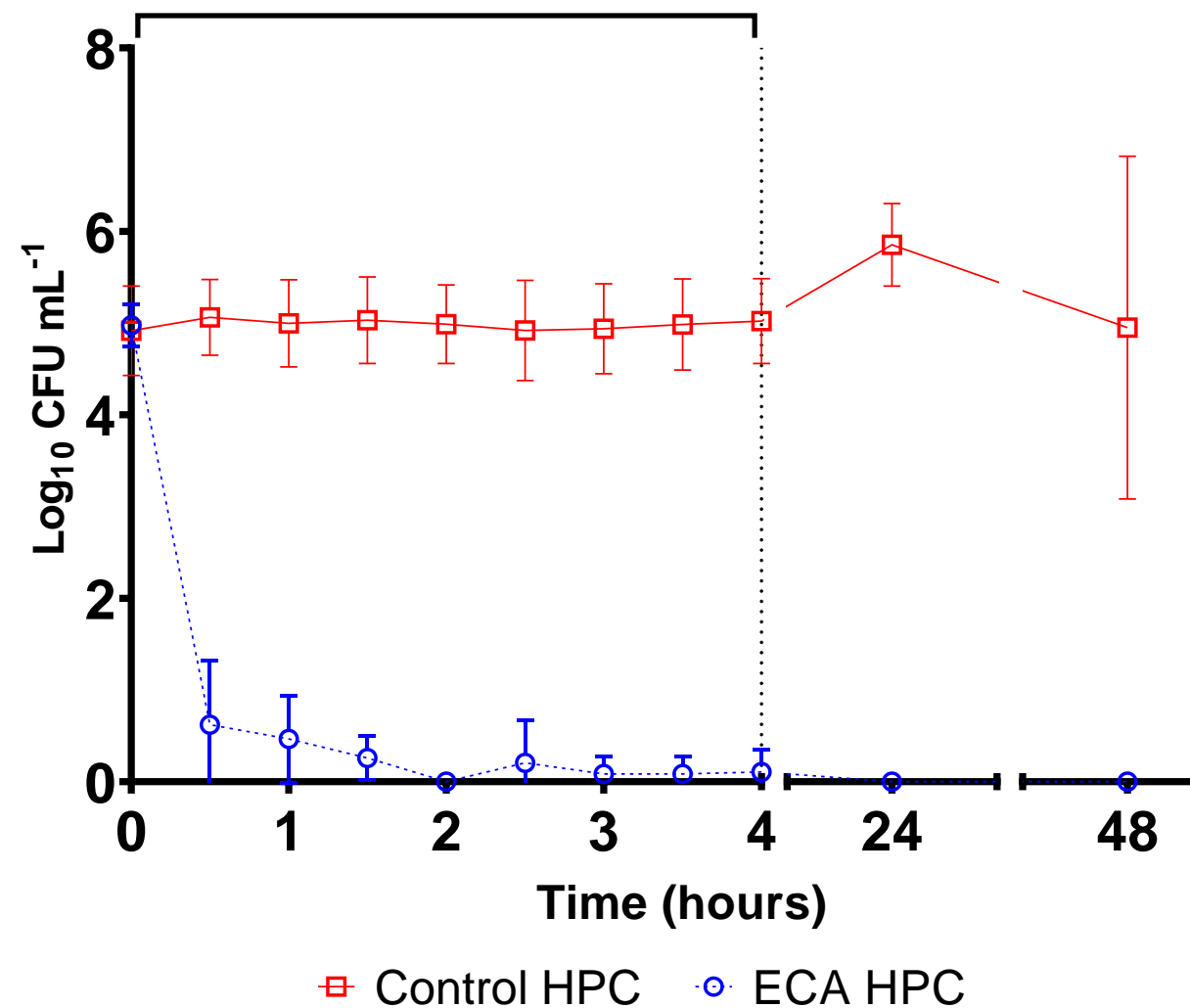


Biological results



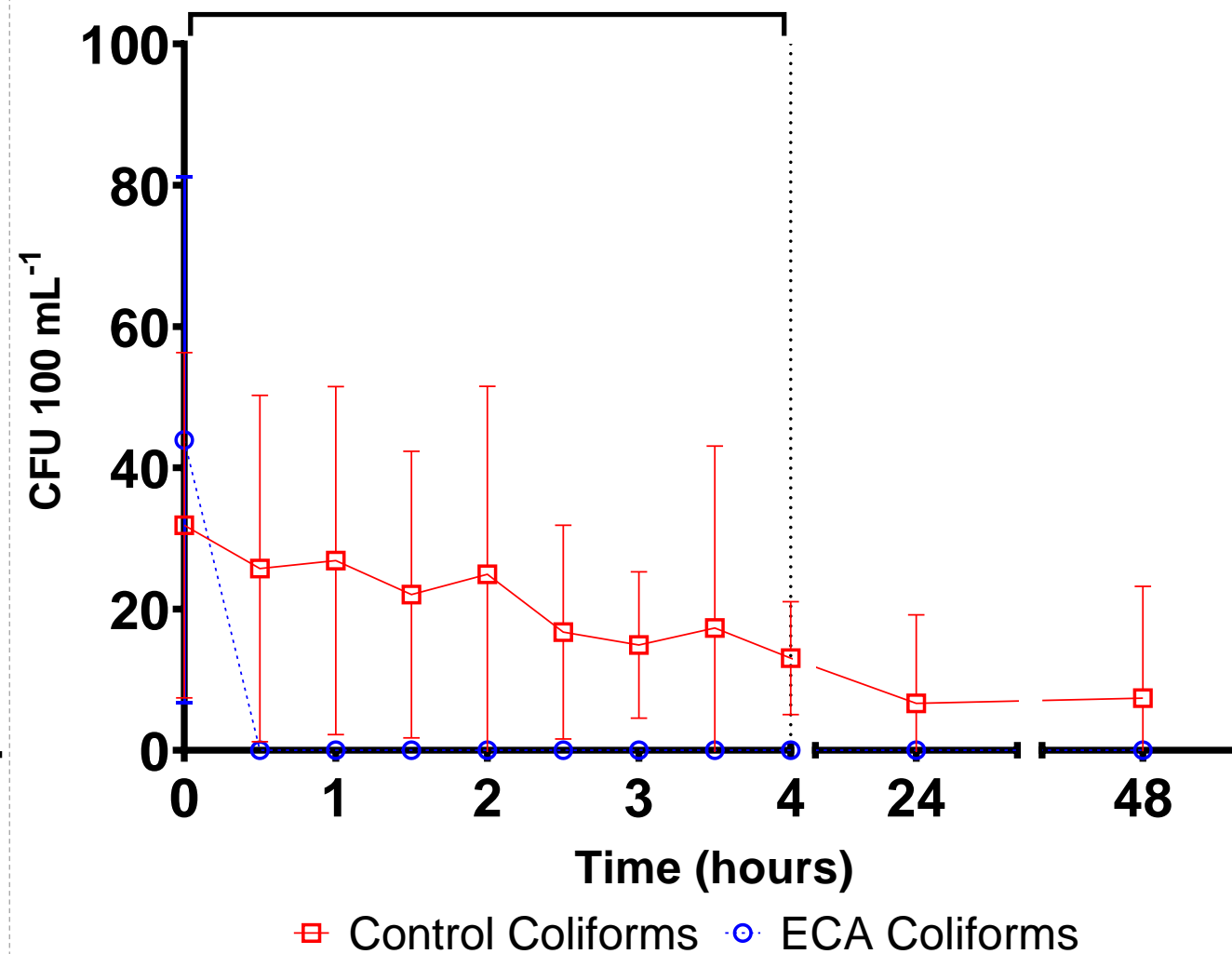
Heterotrophic Bacteria (HPCs)

Activation Period



Total Coliforms

Activation Period



Conclusions



- Stored rainwater can have a relative high biological loading
- The bacteria present in the **control tank** remained stable through the 48 hour trials
- After 30 mins, there were no recoverable coliforms in the **ECA rainwater tank**, and there was a significant reduction in HPCs ($p < 0.0001$)
- ORP did not have an effect on the antimicrobial efficacy of direct **ECA** of rainwater.
- Biologically safe water was maintained throughout the 44-hour period of non-**ECA**

Acknowledgements

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(10.30 – 11.45) **Session GS5-2**



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Sadabe



Sadabe, Madagascar

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