



Cold-plasma activated bubbles for the elimination of cyanobacteria in water treatment



Angelina

PhD Student | University of New South Wales
Sydney, Australia

Supervisors: Rita Henderson, Greg Leslie, Naras Rao, Stuart Prescott

Algae &
Organic
Matter
Laboratory

Water engineering
Separation processes
Characterisation
Monitoring
www.aom.unsw.edu.au

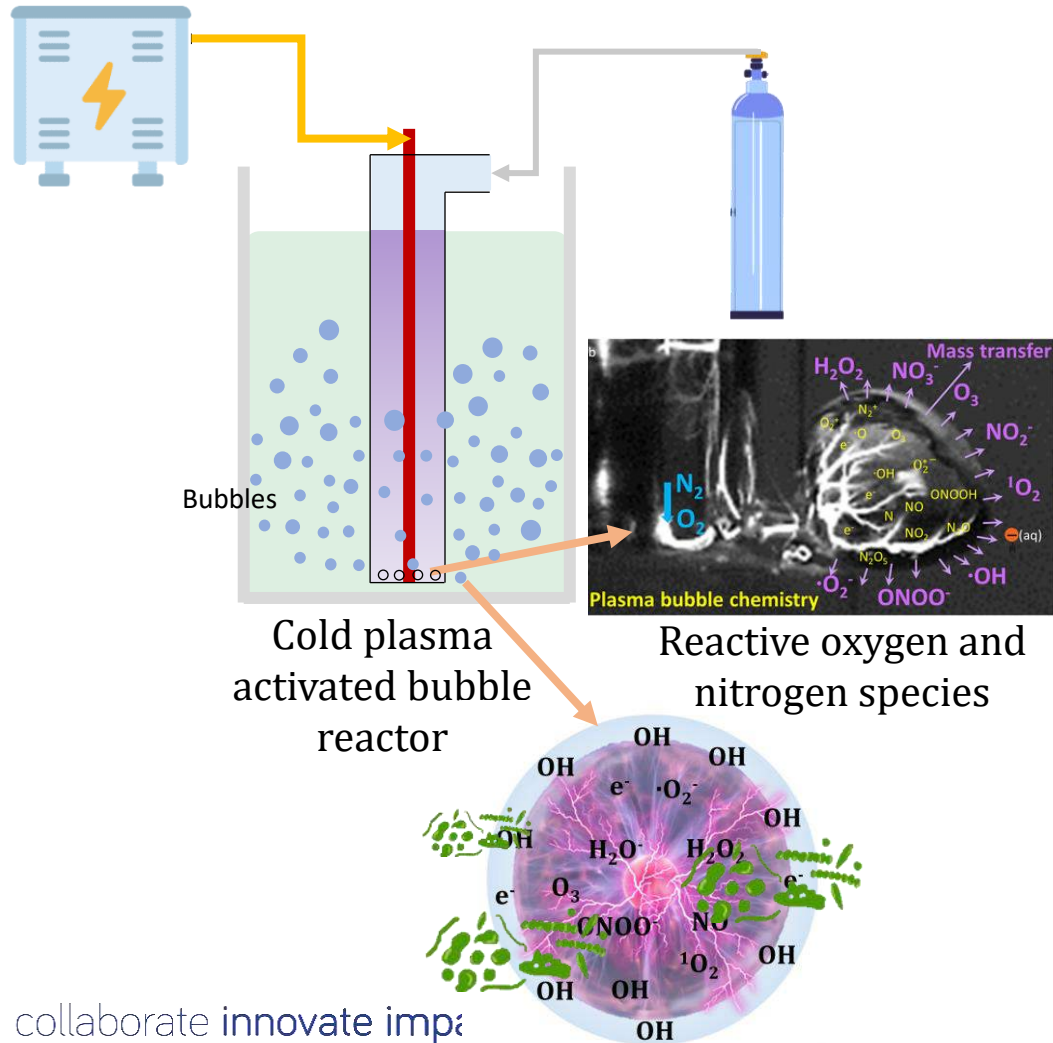


UNSW
THE UNIVERSITY OF NEW SOUTH WALES

Cyanobacteria Workshop '23

27-28th Sept 2023

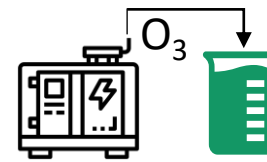
Cold plasma-activated bubbles



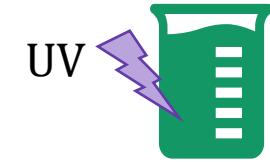
collaborate innovate impact

Common oxidation methods

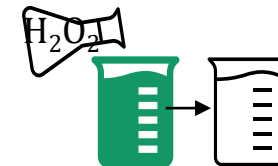
Ozonation



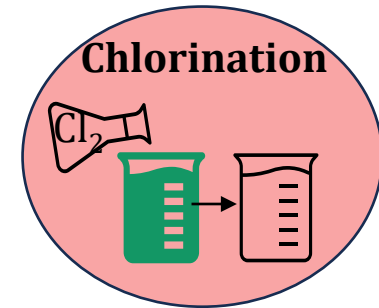
UV irradiation



Hydrogen peroxide



Chlorination

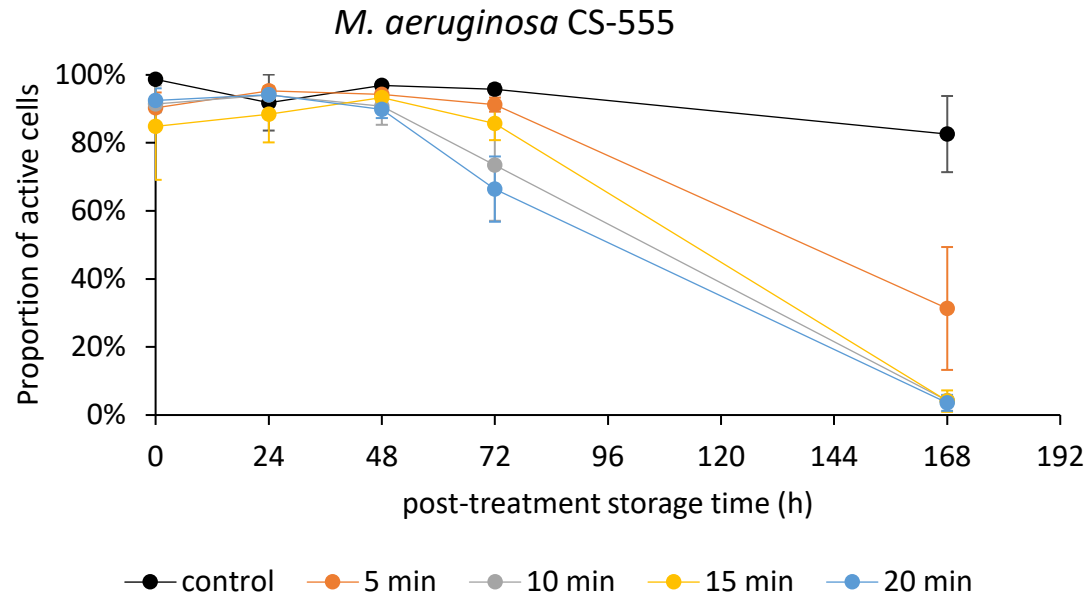


↓

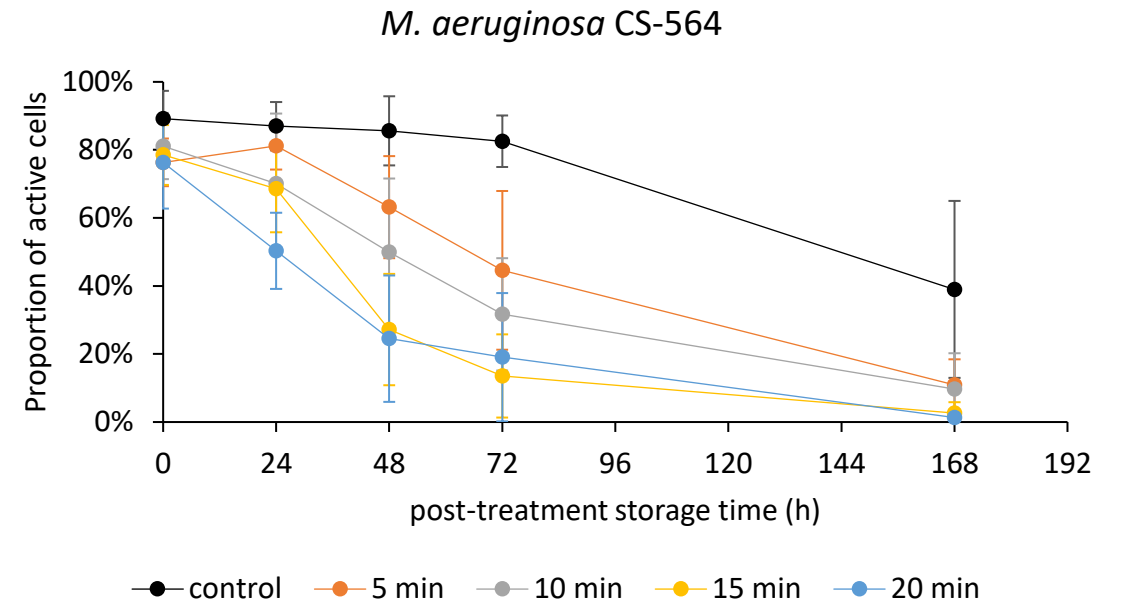
Unsustainable chemical
Disinfection by-product
formation

versus

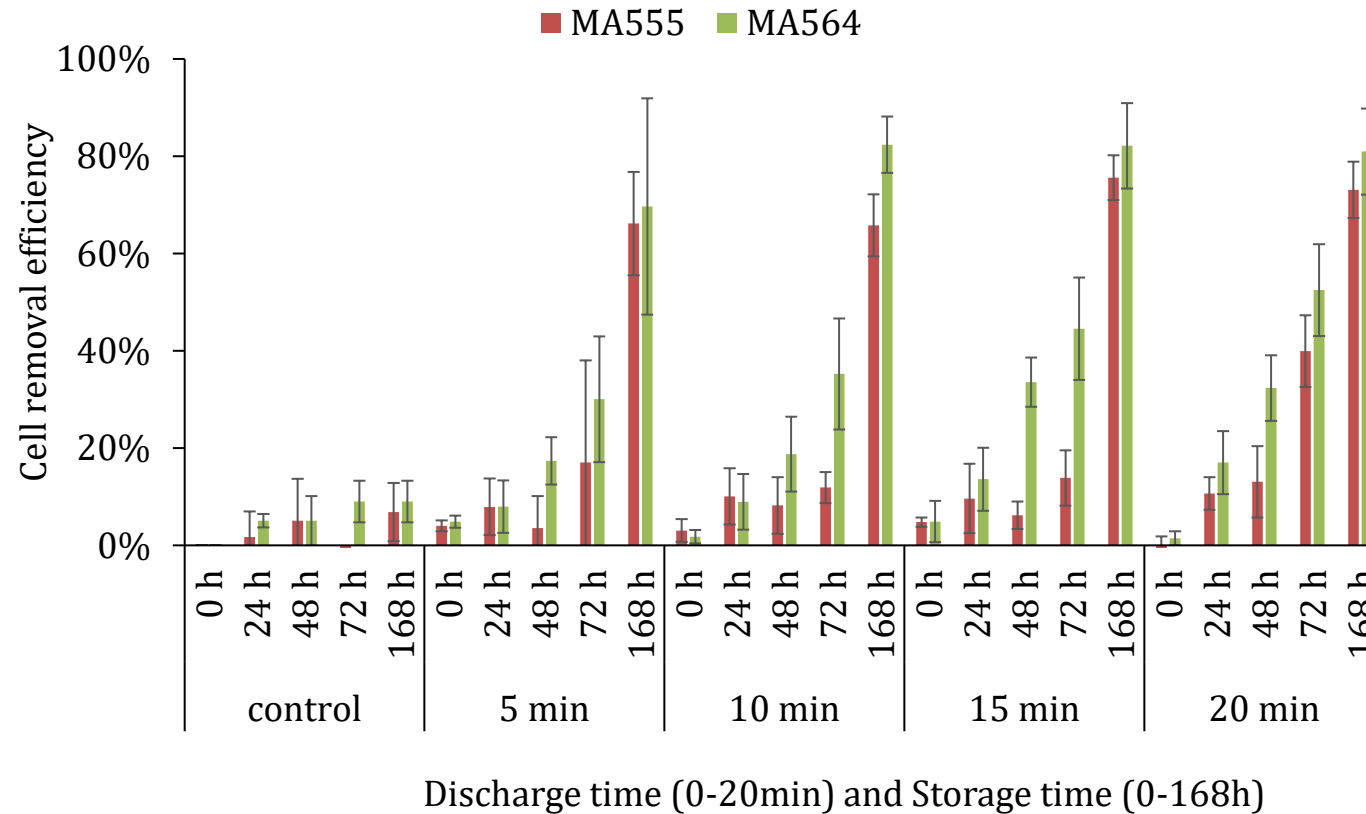
Cells are completely inactivated after a contact time of 168 hours



VS

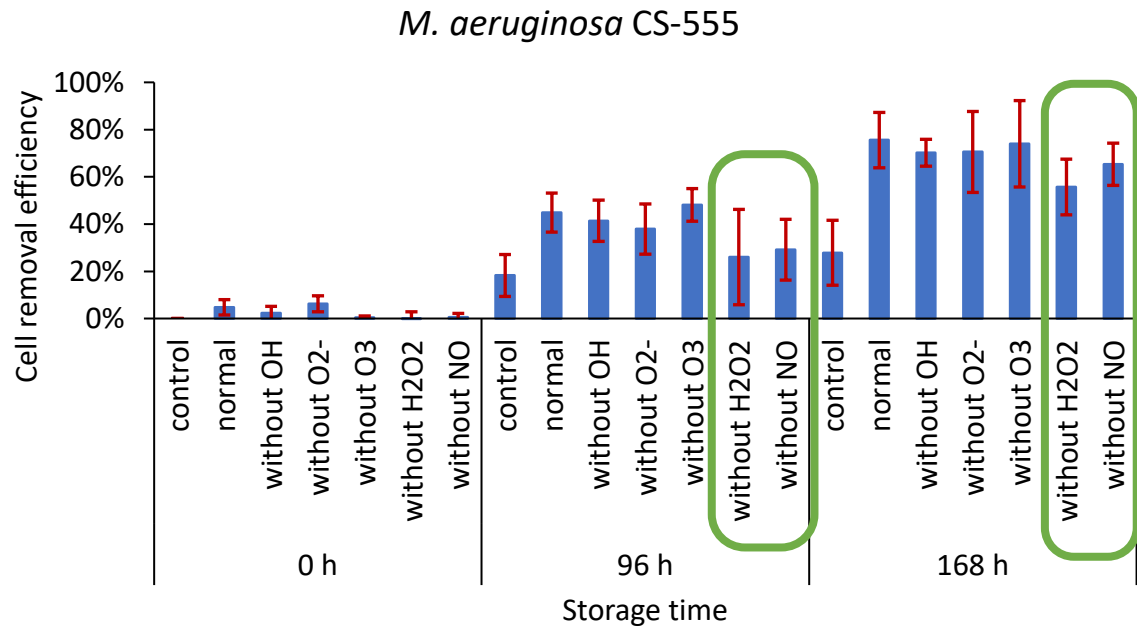


>60% cell removal after contact times of 168 hours

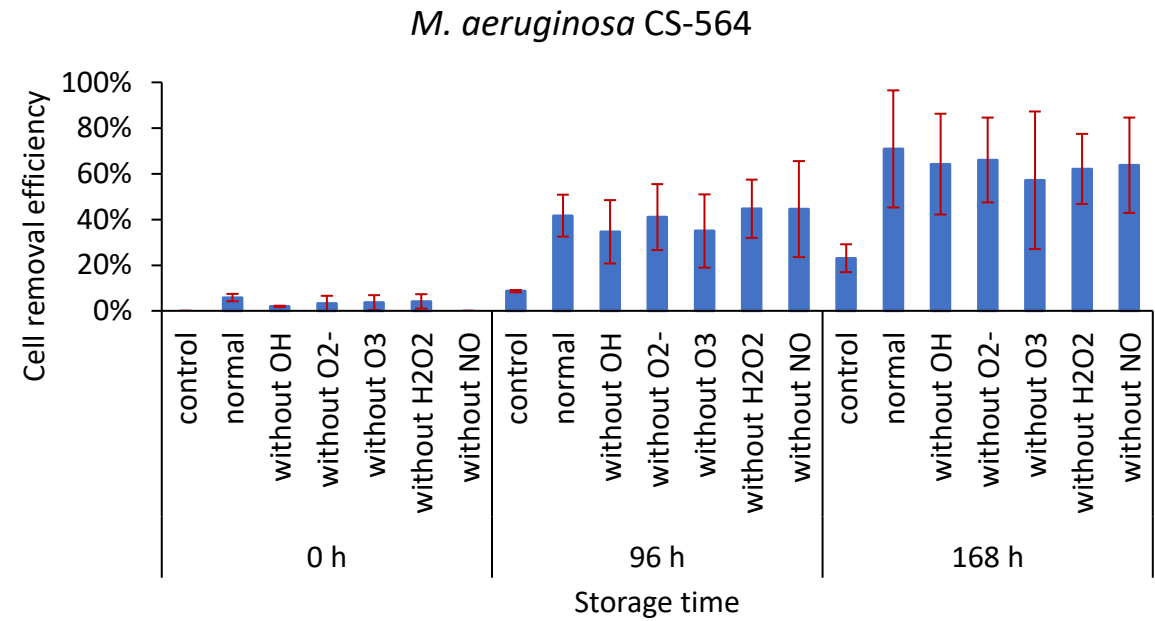


- Cyanobacteria cell removal efficiencies were more influenced by post-CPABs storage time than plasma bubble discharge time

Key reactive species involved in the oxidation process when using air-CPABs

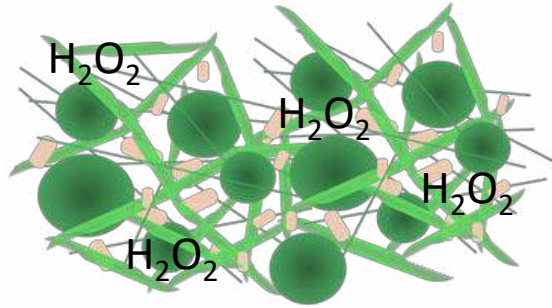


VS

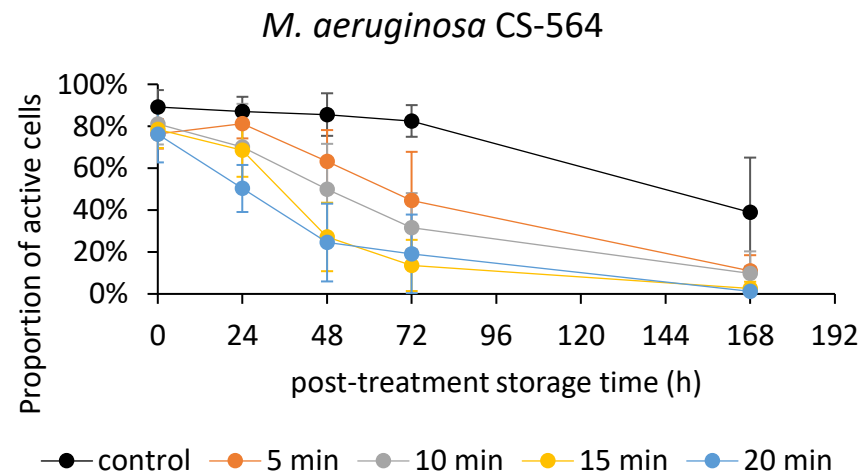
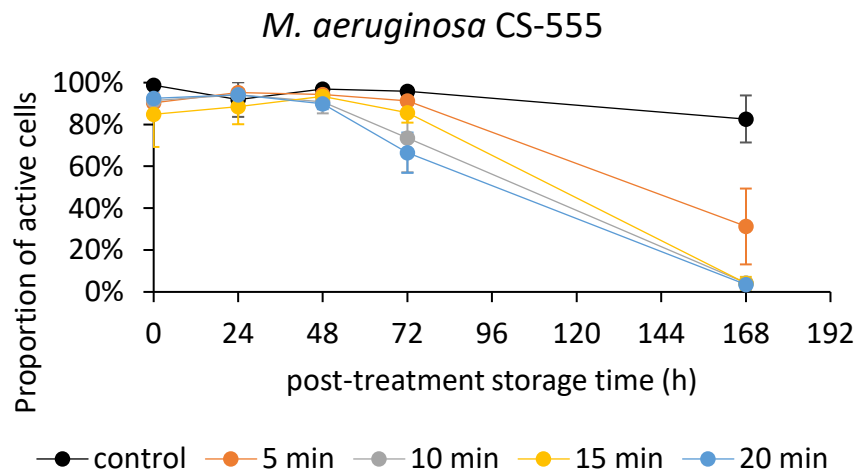


- H_2O_2 and $\bullet NO$ were the dominant species contributing to MA555 degradation

- Collective effort of all species (not just H_2O_2 and $\bullet NO$)



- MA564 has higher algal organic matter (AOM) concentration than MA555 especially the polysaccharides containing mucilage¹
- H₂O₂ is highly reactive with algal organic matter (AOM) especially the polysaccharides²



CPABs were still able to inactivate and degrade both types of cells due to the various reactive species available.

- Low CPABs discharge time (<10 min for $C_0 = 10^5$ cells/mL) is efficient for cyanobacteria degradation under sufficiently long post-treatment contact time (≥ 7 days).
- CPABs degradation efficiency is species-dependent, but the various reactive species available make CPABs still viable for different cyanobacteria species/strain degradation.
- Key reactive species to the oxidation process could vary depending on species and their organic matter characters; thus, process optimisation should be evaluated on a case-by-case basis.



Thank you

waterra.com.au

 WaterRA_updates

 WaterResearchAustralia

 WaterResearchAustralia

collaborate innovate impact