OPEN ACCESS

Scientific Letters

III 1H-TOXRUN
International Congress 2024
02-03 May, 2024 | Porto, Portugal

Oral Communication 18

Bacterial coaggregation's role in water disinfection resistance

Ana C. Afonso [1,2,3,4,*], Inês B. Gomes [1,2], Maria J. Saavedra [3], Lúcia C. Simões [4] and Manuel Simões[1,2]

[1] LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal
[2] ALiCE - Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal
[3] CITAB, Department of Veterinary Sciences, University of Trás-os-Montes e Alto Douro, 5000-801, Vila Real, Portugal
[4] CEB-LABBELS, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal

* Correspondence: up202010573@edu.fe.up.pt

Abstract

Background: In the realm of water treatment and public health, the interplay between microorganisms and disinfection processes represents a constant and dynamic challenge [1]. As society strives to ensure the availability of safe and clean water, understanding the factors contributing to bacterial resistance to water disinfection emerges as a critical area of research [1]. Among these factors, the phenomenon of bacterial coaggregation has gained increasing attention for its pivotal role in shaping microbial communities and influencing the effectiveness of disinfection strategies [2]. **Objective:** This work aims to elucidate the intricate relationship between bacterial coaggregation and resistance to water disinfection. **Methods:** Biofilms of the emerging drinking water (DW) pathogen *Stenotrophomonas maltophilia* [3,4] were formed on polyvinyl chloride (PVC) coupons for 7 days and studied for their resistance to sodium hypochlorite disinfection when co-cultured with two strains from the DW context: one exhibiting coaggregation behavior (*Delftia acidovorans* 005P) and another without coaggregation tendencies (*D. acidovorans* 009P). **Results:** It was observed that high doses of free chlorine (> 10x MBC) were not able to completely kill biofilm bacteria within 30 minutes of disinfection. However, biofilms that combined *S. maltophilia* with *D. acidovorans* 005P (coaggregating strain) showed greater resistance to disinfection. In addition, the biofilms that contained the coaggregating strain were also those that presented a greater content of extracellular polymeric substances (EPS), namely proteins and polysaccharides, and a greater thickness. **Conclusions:** It is known that coaggregation is mediated by protein-saccharide interactions and that in this case, they may be contributing to the biofilm's tolerance to disinfection [1,5]. Thus, understanding the role of bacterial coaggregation in disinfection resistance is pivotal for developing innovative strategies that can effectively combat the persistence of pathogenic microorganisms and safeguard public health in an increasingly complex and interconnected world.

Keywords: biofilm characterization; drinking water disinfection; drinking water safety; sodium hypochlorite; waterborne pathogen

Acknowledgments

This work was financially supported by: LEPABE, UIDB/00511/2020 (DOI: 10.54499/UIDB/00511/2020) and UIDP/00511/2020 (DOI: 10.54499/UIDP/00511/2020), and ALiCE, LA/P/0045/2020 (DOI: 10.54499/LA/P/0045/2020), funded by national funds through FCT/MCTES (PIDDAC); UIDB/04469/2020 (CEB) and by LABBELS – Associate Laboratory in Biotechnology, Bioengineering and Microelectromechanical Systems, LA/P/0029/2020; UIDB/04033/2020 (CITAB); the FCT contract attributed to Inês B. Gomes (2022.06488.CEECIND) and the FCT PhD grant attributed to Ana Afonso (2020.04773.BD).

References

1. Simões, L.; Simões, M.; Vieira, M. Influence of the diversity of bacterial isolates from drinking water on resistance of biofilms to disinfection, *Appl. Environ. Microbiol.* 2010, *76*, 6673–6679.

2. Afonso, A.C.; Gomes, I.B.; Saavedra, M.J.; Giaouris, E.; Simões, L.C.; Simões, M. Bacterial coaggregation in aquatic systems, *Water Res*. 2021, 196.
3. Gomes, I.B.; Lemos, M.; Mathieu, L.; Simões, M.; Simões, L.C. The action of chemical and mechanical stresses on single and dual species biofilm removal of drinking water bacteria, *Sci. Total Environ.* 2018, *631–632*, 987–993.
4. Brooke, J.S. *Stenotrophomonas maltophilia*: an emerging global opportunistic pathogen, *Clin. Microbiol. Rev.* 2012, *25*, 2–41.
5. Afonso, A.C.; Gomes, I.B.; Saavedra, M.J.; Simões, L.; Simões, M. Drinking-water isolated *Delftia acidovorans* selectively coaggregates with partner bacteria and facilitates multispecies biofilm development, *Sci. Total Environ.* 2023, *162646*.