

Poster 7

Synergistic bactericidal combinations: far-UV-C, mechanical cleaning and chlorine against Gram-negative and -positive bacteria

Mariana Sousa^{1,2}, **Isabel M. Oliveira**^{1,2}, **Liliana Correia**³, **Inês B. Gomes**^{1,2}, **Cátia A. Sousa**^{1,2}, **Daniel F. O. Braga**³ and **Manuel Simões**^{1,2,*}

¹ LEPABE—Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, Department of Chemical Engineering, University of Porto, 4200-465 Porto, Portugal

² ALiCE—Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, 4200-465 Porto, Portugal

³ SpinnerDynamics, Lda., Rua da Junta de Freguesia 194, 4540-322 Escariz, Arouca, Portugal

* Correspondence: mvs@fe.up.pt

Abstract

Background: The issue of indoor contamination stands as a global health challenge, contributing to the spread of infectious diseases [1,2]. Consequently, there is an urgent need to explore new disinfection strategies that rely on reduced concentrations of conventional cleaning chemicals [3,4]. **Objective:** This study aimed to explore innovative disinfection approaches utilizing far-UV-C (222 nm) radiation along with chlorine and mechanical cleaning, offering a promising solution with minimal application doses. **Methods:** The study assessed the bactericidal efficacy of far-UV-C (222 nm) at various intensities (78.4 $\mu\text{W}/\text{cm}^2$ to 597.7 $\mu\text{W}/\text{cm}^2$ for 1 minute) against *Escherichia coli* and *Staphylococcus epidermidis* cells adhered to polystyrene microtiter plates by cellular culturability. Furthermore, combinations with mechanical cleaning (ultrasounds for 1 minute) and free chlorine (0.1, 0.5, and 1 mg/L for 5 minutes) were tested. The triple combination of mechanical cleaning + free chlorine (0.5 mg/L) + far-UV-C (54 mJ/cm²) was also evaluated against bacteria adhered to materials commonly found in hospital settings and other public spaces: polyvinyl chloride (PVC), stainless steel (SS), and polyetheretherketone (PEEK). **Results:** Disinfection with far-UV-C (54 mJ/cm²) and free chlorine at 0.5 mg/L for 5 minutes achieved a complete reduction of culturable *E. coli* cells and a logarithmic reduction of 2.98 ± 0.03 CFU/cm² for *S. epidermidis*. The triple combination resulted in a total reduction of culturable cells for both adhered bacteria. Bacterial adhesion to PVC, SS, and PEEK varied, influencing the bactericidal activity of the triple combination, with logarithmic reductions of up to 3 CFU/cm². **Conclusions:** The study underscores the efficiency of far-UV-C (54 mJ/cm²) combined with chlorine (0.5 mg/L; 5 minutes) and mechanical cleaning (1 minute) as an effective disinfection strategy under mild conditions. Utilizing a combination of mechanical and chemical disinfection strategies is recommended to detect regrowth events and enhance the effectiveness of microbial growth control.

Keywords: bacterial contamination; bactericidal activity; public places disinfection; surface disinfection; UV-C irradiation

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