THE EFFECT OF SURFACE PROPERTIES ON THE REMOVAL OF *BACILLUS CEREUS* AND *PSEUDOMONAS FLUORESCENS* SINGLE AND DUAL SPECIES BIOFILMS

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ABSTRACT

The aim of this work is to assess the effectiveness of the benzyldimethyldodecyl ammonium chloride (BDMDAC) on the removal of single and dual species biofilms of Bacillus cereus and Pseudomonas fluorescens formed on a bioreactor rotating system, using 316 stainless steel (SS) and poly (methyl methacrylate) (PMMA) as adhesion surfaces.

Predictions of the adhesion potential according to the thermodynamic theory showed more favorable adhesion for SS than for PMMA, for both species. Before the chemical treatment, the estimated adhesion for P. fluorescens seems to be more favourable than for B. cereus. After the BDMDAC treatment, B. cereus adhesion ability seems to be favoured, whereas P. fluorescens adhesion ability decreased, mainly on PMMA. Both bacteria had negative surface charge and the exposure to BDMDAC increased the charge. In vitro adhesion results were, for most cases, contradictory to those predicted from thermodynamic prediction.

Single and dual species biofilms were formed on the rotating bioreactor system for 7 days. Afterwards, the simultaneous action of BDMDAC, with increasing shear stress (τ_w) conditions, was tested. The results demonstrated that both species formed biofilms with distinct phenotypic characteristics, depending on the species association and on the adhesion surface used. The application of BDMDAC or the increasing series of τ_w (from 0.03-0.70 Pa for PMMA and 0.07-1.84 Pa for SS), when applied alone, were insufficient to remove the biofilms from the surfaces. The combined effects of BDMDAC with an increasing series of τ_w promoted additional removal of the biofilms. However, total removal was not achieved. Moreover, this effect was dependent on the surface used. For PMMA, the τ_w was more effective on the removal of BDMDAC-treated dual-species biofilms. For SS the synergy of chemical and hydrodynamic stresses removed more B. cereus biomass. The overall results demonstrate that even the combined action of BDMDAC and the exposure to a series of τ_w, the aim of obtaining biofilm-free surfaces, was not achieved during this study.

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