Use of a surfactant to control biofilms formed under different flow regimes

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Abstract

The aim of this work was to investigate the sanitation action of a surfactant Cetyltrimethylammonium bromide (CTAB) on *Pseudomonas fluorescens* biofilms grown in either laminar or turbulent flow. The tests were performed using a range of concentrations and an exposure time of 30 min. The toxic effect of CTAB was first investigated with planktonic cells by measuring the ATP released and the respiratory activity, and the effect of BSA as an interfering substance. Concerning the biofilm situation, the action of CTAB was assessed by means of the respiratory activity and the loss of biofilm mass. The damage caused by CTAB application was inspected using SEM. The physical stability of the biofilm was evaluated through the variation of the mass of the biofilm after submission to a series of different rotation velocities.

The results showed that CTAB promotes a total bacteria inactivation for the higher concentrations tested. However, the antibacterial effect of CTAB was significantly reduced when BSA was used in the planktonic tests. CTAB also promotes the release of the intracellular ATP, possibly related with the outer membrane damage. Comparing with biofilm situation, suspended bacteria were more easily inactivated. CTAB acts differently in biofilms formed under different flow regimes: biofilms formed under laminar flow were more susceptible to CTAB than those formed under turbulent flow, but total inactivation was not achieved in all situations studied. CTAB appears to cause little effect on the removal of biofilms from the surface. After CTAB application, the bacteria entrapped in the biofilm seems to loose, in same extent, their typical morphological structure, which reinforces the ATP results. The physical stability tests showed that the synergistic action of an increase of the surfactant concentration and shear stress enhances biofilm detachment.