AN ASSESSMENT OF THE REMOVAL BEHAVIOUR OF BIOFILMS GROWN UNDER STATIC AND FLOW CONDITIONS

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ABSTRACT

The ability of microorganisms to colonise, and establish biofilms on, virtually any surface presents fouling issues for the food industry, along with other sectors including pharmaceuticals and wastewater treatment. There is particular scope for the implementation of Green Cleaning principles in the removal of biofouling, alleviating the inherent risks to human health and to the environment. The technique of fluid dynamic gauging (FDG) is ideally suited to the studying of biological deposits, given that it can be operated in situ in the liquid environment and does not require contact with the fouled surface. It is adept at estimating both the adhesive (between biofilm and substrate) and cohesive (between cells and extracellular polymeric substances) strengths of deposits, which can be used to develop cleaning protocols minimising the use of energy, water, and chemicals.

Biofilms of Escherichia coli and Burkholderia cepacia were grown under static conditions on (i) polyethylene, (ii) stainless steel 304, and (iii) glass in order to observe their development and removal behaviour via FDG. E. coli biofilms were also grown on stainless steel strips under flow conditions similar to those found in industrial pipelines and reactors using a duct flow system with a consistent nutrient supply. The results indicate peaks in adhesion and cohesion after 14 days, with evidence of weakened structures as the biofilms age further. The difficulty in removing the surface layer of biofilm, coupled with the shear stresses required for total removal indicate the need for chemical or enzyme additives for optimised cleaning.