

AN EXPERIMENTAL COMPARISON OF FILM FLOW PARAMETERS AND CLEANING BEHAVIOUR OF FALLING LIQUID FILMS FOR DIFFERENT TILT ANGLES

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ABSTRACT

Efficient cleaning is crucial in the food industry due to increasing safety needs, decreasing production batches and increasing cost pressure. In Cleaning in Place (CIP) systems different flow types provide the cleaning effect by interaction. The gravity driven falling liquid film is one important flow regime, which can be essentially influenced by the surface inclination to the horizontal line. In publications recommended tilt angles vary between 67° and 90°. The different values suggest that there is no general optimal inclination. As a consequence, the acting cleaning mechanism should also be taken into account to give reliable guidance for the design of equipment. Nowadays, only high volumetric wetting rates for all types of soil are recommended. In a previous publication could be shown that for resource efficient cleaning a low wetting rate is suitable. Furthermore, the results pointed out that mean wall shear stress and mean flow velocity have an influence on the cleaning progress for a low tilt angle of 30°. In this paper the investigation are extended to give a profound evaluation of surface inclination in regard to film flow characteristics on stainless steel samples. The results show that the tilt angle has a major impact on the film thickness, wall shear stress and on the main cleaning rate. By applying the ideal tilt angle on machine surfaces and aligned flow parameters an enhanced fluid mechanical cleaning efficiency can be achieved. On the other hand, it is possible to make better predictions for difficult-to-clean areas. In addition cleaning results for three different stainless steel surfaces show that a low surface roughness does not necessarily lead to a better cleaning result.