DESIGN PARAMETERS OF PULSED FLOW FOR ENHANCED CIP PROCESSES

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ABSTRACT

The cleaning of machinery and equipment in food and pharmaceutical industries is a crucial process step to maintain the product quality. In parallel, the rising demands on the environmental protection and the process efficiency results in a discrepancy between consumer safety and minimal resource usage. In this work, the application of pulsed flow to improve cleaning in place (CIP) processes is examined in detail. Experiments showed the contribution of the different pulsation parameters (frequency, stroke volume, waviness) of a new hygienic pulse generator in the removal of cohesive layers in pipe geometries with different sudden expansions. To measure the local cleaning time in complex geometries, the Local Phosphorescence Detection method (LPD) was used in order to determine the local cleaning effects of pulsed flows. The used model food soil consisted of a modified waxy maize starch matrix containing phosphorescent zinc sulfide crystals, which served as optical tracer. Cleaning tests were carried out with variation of the pulsation frequency f (range 1.0 – 2.7 Hz), the stroke volume (range 80–212 ml) and the expansion ratio Φ of the sudden expansions of the pipes (range 1.46–3.80). The obtained results show that intense pulsed flow leads to enhanced cleaning efficiency up to 75% especially in hard to clean areas downstream of the sudden pipe expansion. Furthermore, the pulsation frequency has more influence on the cleaning result compared to the stroke volume. However, with increasing the expansion ratio the intensity of the pulsed flow has to be increased to achieve a significant reduction of cleaning time in hard to clean locations behind the step.