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REDUCING MILK PROTEIN ADHESION RATES: A TRANSIENT SURFACE TREATMENT OF STAINLESS STEEL

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ABSTRACT

The primary factor in developing a surface that diminishes fouling of surfaces during food processing, is reducing the rate of formation of the initial foulant layer, in view of the fact that once a fouling layer has formed, the fouling phenomenon shifts from a plant/process fluid interaction to a "fouling layer"/process fluid interaction.

Modifying the properties of plant processing surfaces, which are typically 316L or 304L stainless steel, is one way of achieving a reduction in initial fouling rate. Here we have developed a treatment that modifies the surface properties of the metal oxide surface, thereby reducing the interaction potential between the stainless steel processing surface and foulants associated with milk processing. The transient nature of the treatment is that it is removed at high pH which is an environment that exists during the CIP cycle. The effectiveness of this surface treatment on reducing fouling on stainless steel has been demonstrated using whey protein isolates (WPI), containing > 40% β-lactoglobin (the principle protein component associated with milk fouling) and monitored by Atomic Force Microscopy (AFM) which enables the measurement of the initial 100 nanometres of foulant formation. Using this technique both the initial fouling rate, and the strength of foulant adhesion, can be determined.

The transient surface treatment was utilised in fouling trials, conducted in a pilot plant milk pasteurizer, which has been developed as a model system to emulate some of the conditions associated with milk fouling in industrial plant Evaluation of the results show significant reductions in fouling rates compared to the normal controls, as indicated by the pressure drop across the plate heat exchanger and the observed reduction in the fouling of the heat exchanger plate.
The mechanism of the fouling reduction will be discussed in terms of the nanostructure of the surface and its influence on phosphate anion binding.