INFLUENCE OF WHEY PROTEIN DENATURATION ON ADHERENCE OF SOILING PARTICLES TO STAINLESS STEEL

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ABSTRACT

This work reports on the influence of β-lactoglobuline (β-LGB) and of its denaturation on the adherence of quartz particles, taken as a model of particulate soil, on stainless steel AISI 304 with mirror finish. The substrate was soiled with quartz suspensions in water or in β-LGB solutions as such or previously heated at 75°C, and dried at room temperature or in an oven at 75°C. Cleanability was evaluated after exposure to water in a radial flow chamber. Auxiliary characterizations were the surface tension and protein concentration of the solution, surface analysis of the substrate by X-ray photoelectron spectroscopy (XPS) and contact angle measurements.
The contact of stainless steel with β-LGB led to adsorption of the protein, which dominated the composition of the organic layer with respect to contaminants initially present, and was not markedly desorbed upon rinsing. The presence of β-LGB at the quartz particle/substrate interface slightly increased the adherence, which was further increased when the protein was denatured. On the other hand, denaturation of β-LGB enhanced its surfactant effect at the water/air interface. Comparison with systems investigated before suggests that the influence of protein via droplet spreading and soiling particles aggregation may be of minor importance compared to direct effects on the substrate/quartz interface. Stainless steel does not behave as a hydrophilic substrate owing to its surface contamination with organic compounds. It appears suitable to examine the influence of the initial surface state of stainless steel on its behavior regarding soiling and cleaning.