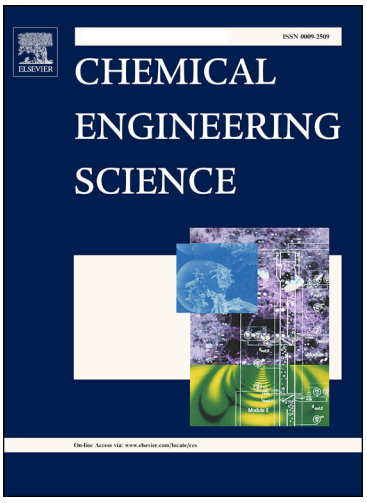

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Effect of calcium on the fouling of whey protein isolate on stainless steel using QCM-D.

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Abstract

Fouling is a ubiquitous problem in the food industry yet details are scarce on how such deposits grow with time to unsustainable levels; processes have to be stopped and equipment cleaned, both at a great cost. Proper understanding of fouling rates, through mechanistic models, would help developing strategies to minimize fouling. In this study, we consider the deposition over stainless steel similar to 316 of whey proteins as a model fouling material in the dairy industry. Fouling rates were determined using quartz crystal microbalance with dissipation monitoring (QCM-D) at 55-65ºC for >2 h. The key parameter studied is the effect of the calcium concentration, largely uncontrolled in the past but which recent studies suggest to be as important as temperature. The present QCM-D results confirm and detail the great enhancement effect of calcium in whey fouling, even at the low temperatures tested, increasing the fouling rates by more than hundred times at free calcium concentrations of 40-80 mg/L.

Keywords: QCM-D, whey proteins, fouling, deposition, denaturation, calcium.

1. Introduction

The continuous adsorption of proteins on heat exchanger surfaces can form fouling deposits that are thick enough to increase substantially the heat resistance and the pressure drop, as well as being a