# Fouling of Food-Contact Surfaces; Scale-up Parameters

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The fouling of food-contact surfaces has negative impact on several aspects of food manufacturing operations. The most direct impacts are reduced efficiency of heat exchangers, and lower product production rates. These factors emphasize the need for an improved understanding of the fundamental mechanisms of fouling. The potential for use of nanoscale sensing of fouling as provided by quartz crystal microbalance with dissipation (QCM-D) is very appealing, but the scale-up of outcome parameters must be established. The objective of this research was to demonstrate the ability to use outcomes from nanoscale experiments to predict outcomes from pilot-scale operations for milk protein beverages.

A series of experiments have been conducted to evaluate the magnitude and composition of foulants from samples containing milk proteins when heated to temperatures between 65 and 132 C. The experiments were conducted with a High-Pressure-High Temperature (HPHT) QCM-D, and with a pilot scale UHT system containing strategically located temperature and pressure sensors. The results demonstrated a distinct relationship between the magnitude and composition of foulants on nanoscale sensors as compared to fouling on surfaces in a pilot-scale system. The topography of foulants at both scales indicated that surface finish is important when evaluating scale-up results from HTHP-QCM-D to pilot scale experiments. The influence of temperature on rate of fouling was similar for experiments conducted at both scales. Overall, these results support the use of HPHT QCM-D for the study of fouling for scale-up to pilot- and industrial-scales.