

CHALLENGES IN CLEANING MICROSTRUCTURED DEVICES

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ABSTRACT

Continuous crystallization of lipid nanoparticles, carrying bioactive compounds, is employed as model system for food products to demonstrate benefits, application possibilities and challenges of microscale process engineering. It could be shown, that high and well-defined cooling rates (up to 10^4 times higher compared to the standard batch process) can be achieved by using a micro heat exchanger device for the continuous melt crystallization of lipid nanoparticles distributed in an emulsion, resulting in well-defined product qualities. During the crystallization of various lipid nanoparticle formulations, several formulations lead to fouling and blocking of small passages in the micro heat exchanger. Fouling, blocking and associated challenging cleaning issues often are drawbacks for the usage of micro devices for particulate flows in industry applications. Furthermore, no standardized design methods for cleaning strategies exist for microstructured devices.

This contribution addresses the design of cleaning strategies for microstructured devices, shown for the model process of the continuous crystallization of lipid nanoparticles in a micro heat exchanger. The design of the cleaning strategies in micro scale is realized with standardized macroscopic methods, like fluid dynamic gauging and a simple flow channel.