AN INDUSTRIAL PROCESS CONTROL CONCEPT FOR MICROSTRUCTURE-RHEOLOGY RELATED FOOD PRODUCT CHARACTERISTICS BASED ON IN-LINE ULTRASOUND-DOPPLER AND ULTRASOUND ATTENUATION MEASUREMENTS

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ABSTRACT

The main quality characteristics of multiphase liquid food systems and various non-food industrial products depend on microstructure and rheological properties which mirror the dynamic properties of microstructure. If the development of rheology and microstructure during different stages of production processes can be monitored, acess will be given to tailormake products with well defined quality characteristics by rheology-microstructure based control of processing parameters. As In-line rheometers do not exist for non-transparent concentrated suspensions, conventionally off-line rheometers, which do not always represent the process flow conditions, are often used to determine the rheological properties. In a similar often also non-representative way microstructure is measured off-line.

Consequently, it has been proposed to (i) develop a Compact In-line Rheometer based on pulsed Ultrasound Velocity Profile (UVP) and Pressure Difference (PD) measurement, which can monitor or control the rheology/microstructure related quality parameters at multiple locations in a process under transient and steady-state conditions, to (ii) investigate the In-line rheology of model and real suspension based food systems in an industrial process using the Compact UVP-PD in-line Rheometer, and (iii) apply in addition coupled ultrasound in-line attenuation measurements to get information on the system microstructure (e.g. particle size distribution) for the investigated suspension systems.

The process control concept, the UVP-PD in-line rheometer, the Ultrasound spectroscopy principle and results from laboratory and industrial measurements are presented and discussed.