Title:

ADVANCED RHEO-ACOUSTICS TECHNIQUES FOR FOOD STRUCTURE INVESTIGATION

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Abstract:

Introduction :

Rheological properties of food are of first interest because elastic moduli and viscosity are strongly linked to microstructure : chemical composition, moisture content... The determination of these rheological properties on a large frequency bandwidth is full of information because it gives an analysis at many scales. It could be called a rheological spectroscopy. Generally such a task is achieved with rheometers, viscosimeters...which can give shear moduli, viscosity on quite small bandwidth operating at room temperature. If large bandwidths have to be covered one can heat or cool the sample and use the time temperature superposition principle. Such a procedure is not applicable on every sort of food because it can modify its properties. The main goal of this communication is to show how such a difficulty can be overcome using high frequency ultrasonic longitudinal or shear waves.

Methods :

In our team we are designing and adapting ultrasonic sensors or vibrating systems to samples in order to evaluate their rheological properties. These devices are used on viscoelastic materials and so they are well adapted to food investigation. All these devices with the associated signal processing, working from a few dozens of kHz to many dozens of MHz, will be presented and described on a theoretical and practical point of view.

Results and discussion

Examples showing the link between ultrasonic parameters measured , the rheological behaviour deduced and the food microstructure will be presented. In particular our attention will be focused on : sugar water solutions (link between ultrasonic velocity and sugar content), mango juice (link between composition, ultrasonic velocity, ultrasonic attenuation and viscosity), mango fruit (link between firmness and ultrasonic impedance), and honey (link between moisture content and ultrasonic shear parameters) . The extension to other types of foods or beverages will be discussed.

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