A Novel Instrument for Viscoelastic Characterization of Fats

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The rheological properties of crystal networks formed by fat crystals are important in food products containing significant amount of fats and oils. Many sensory characteristics such as appearance, texture, spreadability, and hardness depend on rheological properties of the fat crystals. Furthermore, fat crystal networks usually demonstrate a viscoelastic behavior and posses yield stress. Type, size and number of fat crystals, forming the crystal network, are the main factors determining the rheological properties. However, measuring rheological properties of fat crystal networks often affected by the temperature fluctuations because of the relatively thicker sample requirement of the conventional rheometers. Moreover, the viscoelastic measurements with the conventional rheometers usually take long time and temperature control
becomes a difficult task to overcome.

In this presentation, a new instrumental setup to characterize viscoelastic properties of fat systems will be presented. The proposed instrument uses the principles of oscillatory squeezing flow and can be used to determine viscous and elastic moduli values of the fat samples. During measurements very thin layer of sample (50mm) is placed between two plates, the bottom plate is stationary and its temperature is controlled using a peltier system. The top plate is connected to a piezo electric actuator and can freely oscillate in vertical direction. The measurement system also includes a signal analyzer and an impedance head. When certain voltage is applied to the piezo actuator, it oscillates at frequencies between 10 to 100000 rad/sec and resonance frequencies of the fat samples are measured. From this frequency response function, viscoelastic properties of fat samples are calculated.

This presentation will describe the working principles of the proposed instrument. Applications of the instrument will be shown using wide range of fat samples, which were prepared in our laboratory through hydrogenation and blending. The relations between the measured resonance frequencies of fat samples with SFC values (solid fat content) and fractal dimensions will be presented.