Using Creep and Recovery Experiments to Evaluate the Effect of High Pressure Homogenization (HPH) on Tomato Juice Microstructure

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Abstract:
High pressure homogenization (HPH) is a non-thermal technology that has been widely studied as a partial or total substitute of food thermal processing. However, there is just a few works in literature regarding its influence on fruit products rheology and structure. The present work evaluated the effect of HPH on tomato juice creep and recovery behaviour. Samples were processed by HPH up to 150 MPa, being quickly cooled just after homogenization. The rheological evaluation was carried out using a controlled stress rheometer and a vane geometry at 25°C. Samples were placed in the rheometer and kept at rest for 10 min before the experiment. The creep procedure was conducted at 0.1 Pa (linear range) during 5 min, being its strain recorded. The stress was then instantly removed, and strain was recorded during 5 min (recovery procedure). Samples behaviour were evaluated using mechanical models, and its particle size distribution (PSD) was measured by light scattering. The mechanical Burger model well explained the juice creep compliance (R²>0.98). Its parameters (Newtonian dashpots and Hookean springs) were evaluated as function of the homogenization pressure (PH) and compared with sample PSD. The HPH processing improved tomato juice elastic and viscous behaviour, whose changes could be attributed to the suspended particles disruption during processing. Moreover, each Burger model constituent could be related to the product internal structure (isolated particles, aggregates and serum). The obtained results highlighted the possible applications of the HPH process as a valuable tool to promote physical properties changes in food products.

Keywords: creep, compliance, food properties, high pressure homogenization, recovery, rheology.

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