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Structuration and Rheological Properties of Gels made from Gluten Proteins

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Thursday 10:00 Clubraum

BF17

Rheological properties of Costa Rican guava (*Psidium friedrichsthalianum* (O. Berg) Niedenzu) pulpDaniel A. Mendez*¹, Lina M. García¹, Alfredo A. Ayala², José A. Muñoz¹, Henry A. Váquiro¹, José F. Solanilla¹

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Costa Rican guava is a tropical fruit more aromatic and sour than the common guava, native from the seasonally flooded forest from south Mexico to northern South America. The interest for better understanding of processing and properties of this and other exotic fruits has been increasing due to their nutraceutical benefits [1]. An important tool for unit operations design and process optimization is the rheological characterization, which has not been studied yet for this exotic fruit. In the present work the dynamic shear rheological properties of Costa Rican guava (*Psidium friedrichsthalianum* (O. Berg) Niedenzu) pulp has been evaluated. Pulp samples were reconstituted with distilled water to 10 °Brix, from lyophilized and milled pulp. Flow behavior of the samples was measured at temperatures between 0-80 °C and evaluated using the Casson (C), Herschel-Bulkley's (HB), Mizrahi-Berk (MB), Bingham (B) and power law (P) models. The yield stress was calculated by extrapolation from experimental data for the C, HB and MB models. The models best described the flow behavior were the P and the HB models ($R^2 > 0.95$). The consistency coefficient (CC) and flow behavior index (F) of these models were described as function of temperature by Arrhenius ($R^2 > 0.95$) and linear ($R^2 > 0.89$) equations respectively. The results showed that CC decreased when temperature increased, with a significant change between 40 and 60 °C (16.99-7.96 Pa sn). The F was in the range of 0.27-0.32 and 0.31-0.41 for P and HB models, respectively. The temperature effect on yield stress was not significant for both models. The parameters of HB and P models of guava pulp were influenced by temperature; however yield stress of pulp could be affected by milling process. The obtained data are useful for future studies on food properties.

[1] Flores, G.; Dastmalchi, K.; Wu, S.-B.; Whalen, K.; Dabo, A. J.; Reynertson, K. A.; Foronjy, R. F.; D'Armiento, J. M.; Kennelly, E. J. *Food Chem.* 2013, 141, 889-895.

Thursday 10:20 Clubraum

BF18

Structuration and Rheological Properties of Gels made from Gluten ProteinsMohsen Dahesh¹, Amélie Banc*¹, Agnès Duri², Marie-Hélène Morel², Laurence Ramos¹

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Wheat gluten proteins are among the most complex protein networks in nature, due in particular to their poor solubility in water and to their viscoelastic behavior. Gluten networks are often considered as transient networks comprising extensible biopolymer segments of flexible or semiflexible chains between junction points. However, the exact structure of the network, the nature of the junction points, its mechanical properties and the way it gets structured under shear remain to be clarified.

Here we report the visco-elastic behavior of model systems composed of gluten proteins near gelation. We build model systems by dispersing in ethanol-water mixtures two major protein groups, gliadins and glutenins that we have purified from gluten. Rheological properties show a slow evolution over time scales of the order of days of the linear frequency dependence complex modulus of the samples, with a concentration-dependent liquid to solid transition. Interestingly, we find that all data acquired at different protein concentrations and different times after sample preparation (different sample ages) can be scaled onto a master curve, showing a cross-over from a soft solid behavior at low frequency to a visco-elastic fluid at higher frequency, and revealing the self-similarity of the gels. Rheological data are completed by scattering experiments in order to elucidate the complex structure of the materials. For gel samples, the scattering profiles display at small length scales features typical of semi-dilute polymer solutions. At larger length scale a fractal structure is measured, that we interpret as being due to the highly disordered spatial organization of the junction points, at the origin of the solid behavior.