Mechanical properties of nanofibrils made from faba bean and mung bean protein

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Plant proteins can be a good alternative to animal based proteins for generating sustainable foodstuff. With a growing need to produce more sustainable protein rich food comes an imperative for better understanding of how we can efficiently extract these plant proteins and tailor them to generate desirable food with an appealing texture. The challenge lies in the structural differences between animal and plant protein yielding, resulting in different textures for produced foodstuffs. We address this problem by generating nanofibers from plant proteins and use these to create threads, films and gels with controlled structure that we hypothesize will exert control over the foodstuff texture.

In this study we aim to understand the mechanical properties of nanofibrils formed by faba bean and mung bean protein and how these affect the stiffness and elasticity of films and gels. The formation of nanofibers was investigated at different protein concentrations and incubation time periods. The nanofibrils were evaluated by AFM, ThioflavinT (Th-T) assay and far-UV-CD. The mung bean fibrils were investigated during the fibrillation process at three different concentration 5, 10, 20 mg/ml and at several incubation time periods 0, 3, 6, 9, 24, 48h. The results from the Th-T assay and far-UV-CD indicate that the optimal conditions for mung bean fibrillation is a protein concentration of 10mg/ml at 24h heat incubation. Solubility, aggregation and stability under different treatments were analyzed on a microstructural level with the help of light microscopy and confocal microscopy.

Films were generated with a combination of glycerol plasticizer, faba bean or mung bean protein, and faba bean or mung bean protein nanofibrils with an increasing concentration ratio. The mechanical properties (stress and strain) of the films were investigated with help of a tensile tester. Preliminary results indicate that the tensile properties of films made with mung bean protein were improved when nanofibrils were incorporated. We hypothesize that the results will be similar for films made with faba bean fibrils.

Initial gelation studies on faba bean protein have been made at two different pH, we will further investigate the gelation properties by adding nanofibrils to the gels and with help of rheological measurements investigate the fibrils effect on the elasticity (G´).