PYRO- AND POLYPHOSHATE IN COOKED SAUSAGE BATTERS- OSCILLATORY EXPERIMENTS.

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Background

Pyro- and polyphosphates are added to cooked sausage batters during the chopping process in order to reduce water losses during cooking. This ability of phosphates was studied intensively in the past. My intention was not to repeat such experiments. Phosphate batters are more liquid and more glossy than batters without phosphate. In addition to that, when examining triphosphate-batters by hand they show a certain corpus, a volume, which does not exist in pyrophosphate-batters. If phosphate batters are stored, they solidify. From experiments with concentric cylinder rheometers is known, that cooked sausage batters are viscoelastic and thixotrop.

Objective

In order to characterise cooked sausage batters better than is possible with concentric cylinder viscometers, this work was undertaken.

Methods

To cooked sausage batters (54% pork, 26% backfat, 26% ice, 1.65% nitrite curing salt, 0.05% Na-ascorbate) from 0 to 0.5 %, calculated as P_2O_5, of Trisodiumhydrogendiphosphate (= Diphosphate) or Pentasodiumtriphosphate (= Triphosphate) was added. Diphosphate had a pH of 7.3 and a P_2O_5-content of 58.0%. Triphosphate had a pH of 9.5 and a P_2O_5-content of 57.5.%. All the materials were added together to a chopper and chopped within 5 to 5.5 min to 12°C. The oscillatory experiments were made with a parallel plate viskosimeter (TA Instruments CSL^{2}500). A combination of a hatched geometry with a diameter of 4 cm and a hatched plate was used. The gap between geometry and plate was 500µm. The experiments were done either directly after the batter was comminuted or after storing the batters for 24 h at 2°C. The measuring temperature was always 12°C. The measurements were conducted as frequency sweeps with 0.1 to 40 Hz and a couple of 100 µNm. In prexperiments it was found, that a couple of 100 µNm was well within the linear viscoelastic region of the batters. For TPAs (texture profile analyses) of cooked batters (70°C core temperature) the Instron 1140 was taken.

Results and discussion

1. In all experiments G' (storage module) and G" (loss module) increased, η* (dynamic viscosity) decreased with increasing frequency of oscillation, as was found before by ERDMANN (1). Tan δ (G"/G') had never a value of 1 - a "gel-point" did not exist.
2. Immediately after comminution: Already 0.05% and higher amounts of the phosphates influenced the moduli of the batters. With increasing amounts of phosphates between 0.05 and 0.5% the modulus G' did not always decrease, but was always smaller that G' of the control without phosphates (fig. 1). So the phosphates decreased the elasticity of batters, even if only 0.05% of phosphates were added. The moduli G" differed for controls, di- and triphosphate-batters (fig 1). With the controls it was relatively constant between 0.1 and 0.4 Hz, and G" increased delayed with further increasing frequencies of oscillation between 0.4 and 40 Hz. After addition of diphosphate G" increased accelerated with frequency and was between 0.1 and 1 Hz smaller than G" of the controls. After

addition of more than 0.25% of triphosphate the module G" showed a wave-form and did not increase substantially with increasing frequency. The more dissociated actine and myosine are, the lower are the rheological values (2). Apparently high amounts of triphosphate of more than 0.25% disturbed a dissociation of actomyosine or myosine-strands.

3. 24 h after comminution: After using 0.05 or 0.10% of phosphates especially G', but G" too, had increased considerably in comparison to the measurements immediately after comminution. The slope of the graph of G' or G" and the magnitude of G' and G" of the these batters were after 24 h comparable with G' and G" of the controls. G' and G" of the controls increased slightly during the storage-period. On using 0.15% or higher amounts of diphosphate measurements after 24 h showed, that G' and G" of the diphosphate batters were lower than these moduli of the controls (fig 2). G' of batters with 0.40% and higher amounts of triphosphate decreased during storage, and their G" showed a shape which was comparable to that of diphosphate batters.

Conclusions

By the results of oscillatory experiments viscous and elastic elements of cooked sausage batters can be described. Batters without added phosphates show a different shape in G' and G" than batters with added phosphates. On storing batters with triphosphate a shape of G' and G" develops, which is similar to that of batters with diphosphate.

References

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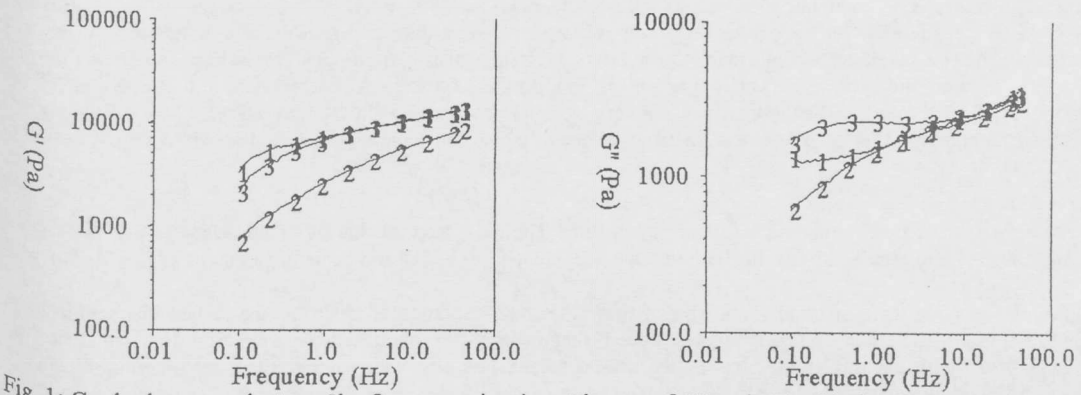

Fig. 1: Cooked sausage batters 0h after comminution. Change of G' and G" with the frequency of oscillation. 1: Control without phosphates, 2: 0.5% diphosphate, 3: 0.5% triphosphate.

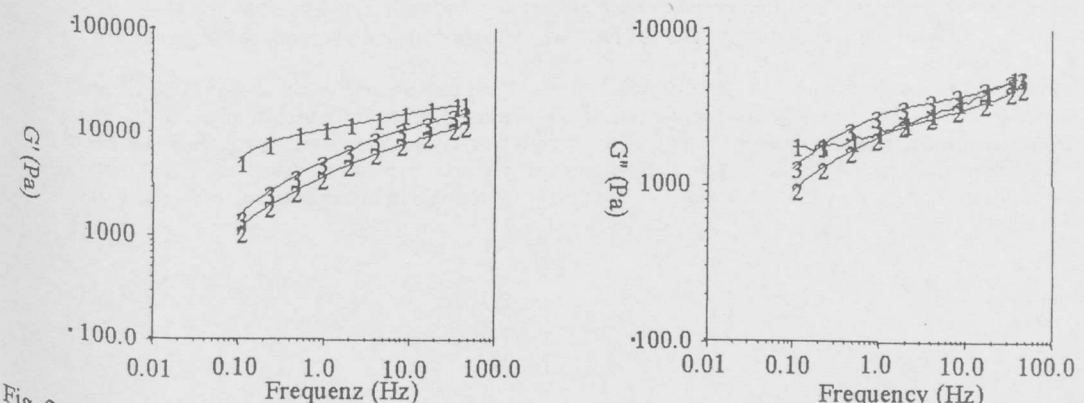

Fig. 2: Cooked sausage batters 24h after comminution. Change of G' and G" with the frequency of oscillation. 1: Control without phosphates, 2: 0.5% diphosphate, 3: 0.5% triphosphate.