**Structure formation in protein gels from mealworm (*Tenebrio molitor*)**

M. Klost1, R. Öztürk1, E. Köster1, M. I. Ramirez-Huerta1 and S. Drusch1

*1Technische Universität Berlin, Faculty III Process Sciences, Institute of Food Technology and Food Chemistry, Department of Food Technology and Food Material Science, Straße des 17. Juni 135, 10623 Berlin, Germany*

The farming of insects only requires a fraction of land and water compared to the production of other animal derived proteins. Additionally, insects such as mealworm can be reared on organic side streams [1] making them a very promising and sustainable source of alternative proteins for food and other applications. One key parameter for the utilisation of mealworm protein is its ability to form gels. However, when looking into gelation and gel properties it is important, to not only consider the protein itself, but also the influence of other constituents such as e.g. (divalent) cations, as these may have a relevant influence on gel structure and properties.

Despite the high potential for the utilisation of mealworm protein in various applications, research on its heat-induced gelation properties is scarce and so far, there is none that investigates the influence of (divalent) cations. Therefore, the presented study was designed to extent the existing knowledge in this field by investigating heat-induced mealworm protein gels with and without the addition of a divalent salt (ZnSO4). Our methodical approach focussed on

* applying rheological time sweeps to describe the gelation kinetics
* elucidating the involved types of interactions via gel solubility experiments
* approaching the microstructure of the gels from a microscopic, as well as rheological perspective
* using FT-IR measurements to consider changes in the structure of the protein

We could show, that all examined samples were able to form heat-induced gels and that the addition of salt influenced the structure of the protein, both before and after heating. Combining gel solubility experiments with the rheological investigation of the gelation kinetics via time sweeps we found hydrophobic interactions and hydrogen bonds to be dominant in all samples. From concentration dependent rheology the overall network structures of samples without added ZnSO4 were found to be in the transition regime where both inter- and intrafloc links contribute to the gel’s elasticity.

The addition of ZnSO4 led to additional electrostatic and/or covalent interactions. Moreover, the corresponding gels showed distinctly different rheological properties from the gels without ZnSO4 (i.e. higher storage modulus, shorter linear viscoelastic regime, an increasing contribution of intrafloc links and more pronounced intracycle strain stiffening at deformations outside the linear viscoelastic regime). This could be related to a less homogenous and more particulate gel structure as confirmed via scan electron microscopy.

The results from our study contribute to understanding the underlying mechanisms in heat-induced gelation of mealworm protein. They can act as basis for the development of strategies for the customisation of gel properties and gel composition, that may advance the potential for future utilisation of mealworm protein as a sustainable protein source in food and other applications.

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[1] Ramos-Elorduy J, et al. (2002). J. Econ. Entomol. 95 (1): 214–20.