4th International Conference on Engineering Future Food (Florence, Italy)

Number of authors : 4

Title of the paper: Tuning plant protein gelling properties by covalent modification with phenolic compounds for plant-based meat and dairy alternatives of the future.

Topic (select 1):

☒ Delivering functionality in food: from structure design to food product engineering
☐ Food safety by design: novel approaches for risk assessment and mitigation
☐ Gentle and smart food processing: innovative process engineering approaches for improving the sustainability of food products
☐ Digital transition in the food and beverage industry: "computer aided" food engineering, modelling and computational approaches

Preferred format of presentation: Lecture ~~/Poster~~/~~No choice~~
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Background:

To facilitate the protein transition, plant-based alternatives to meat and cheese are introduced on the market. However, plant protein isolates have shown inferior structuring properties as compared to their counterparts which limits the product quality. Recently, the conjugation of phenolic compounds to proteins under controlled conditions was found to enhance the techno-functionality of milk and some plant-proteins (Keppler et al., 2020). The outcome was highly dependent on the phenolic compound type, the reaction conditions as well as the protein source. Gel structure formation is most relevant for meat and cheese alternatives. However, knowledge about how phenolic compound addition affects gelling capacity of plant proteins is lacking. We hypothesize that the functionality of plant proteins can be altered in various ways depending on the phenolic compound selected and the quantity added.

Methods: Conjugation of phenolic compounds with plant proteins was induced via autooxidation. A selection of phenolic compounds was made based on similar structural units, increasing molecular weight and hydroxyl groups, and thus their capacity to facilitate cross-links between proteins. Conjugates were prepared at various protein to phenol molecular ratios to study the dependency of the quantity of attached phenolic components (degree of modification) to the gelling properties. Rheology was used to study gelling properties. Subsequent underlying gel interactions were quantified. Changes in physicochemical properties were determined with SDS-PAGE, TNBS, Ellman's assay and the water holding capacity.

Results & discussion: Covalent attachment of phenolic compounds altered the protein molecular weight composition as seen with SDS-PAGE. Free amino groups and thiol groups decreased upon increasing number of attached phenolic compounds and are related to the degree of protein modification. Confirming our hypothesis, outcomes revealed that the gelling properties of plant proteins can be altered in different ways based on the degree of modification and the type of phenolic compound used.

Overall, our findings contribute towards tuning the functionality of plant proteins with natural plant-inherent compounds for the development of future alternatives for meat and dairy.

References:

Keppler, J. K., Schwarz, K., & van der Goot, A. J. (2020). Covalent modification of food proteins by plant-based ingredients (polyphenols and organosulphur compounds): A commonplace reaction with novel utilization potential. *Trends in Food Science & Technology*, *101*, 38–49. https://doi.org/10.1016/J.TIFS.2020.04.023