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Modulating the rheological properties of plant-based proteins by enzymes

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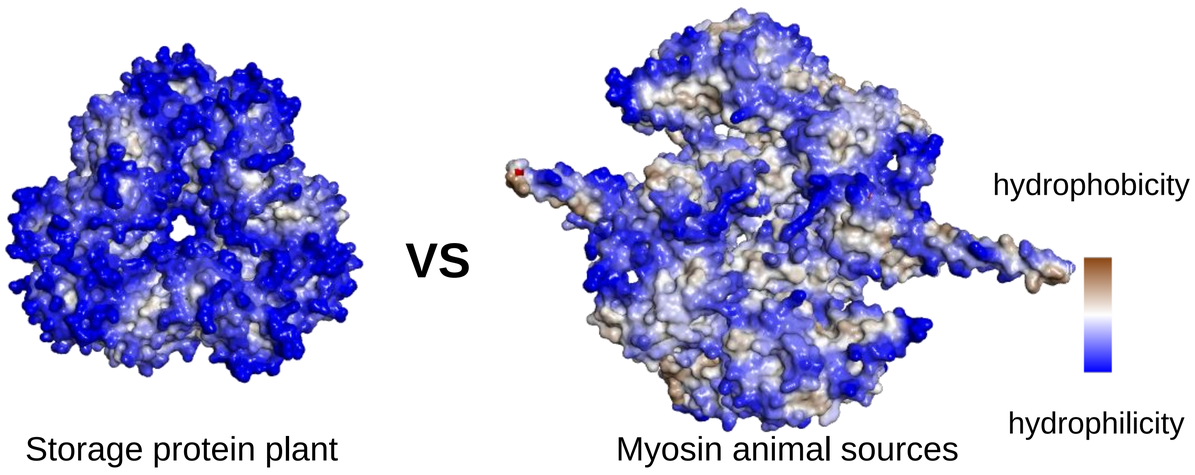
1 Motivation & Method

Enzymes are GRAS tools to modify protein structure and networks at molecular level. Enzymatic reactions can be easily incorporated to manufacturing, to diversify texture and quality of protein-based products. Current study aims at screening for enzymes as effective biocatalysts to modify selected plant proteins recovered from side-streams and the rheological properties of these protein dispersions

Driving plant proteins towards myofibril proteins

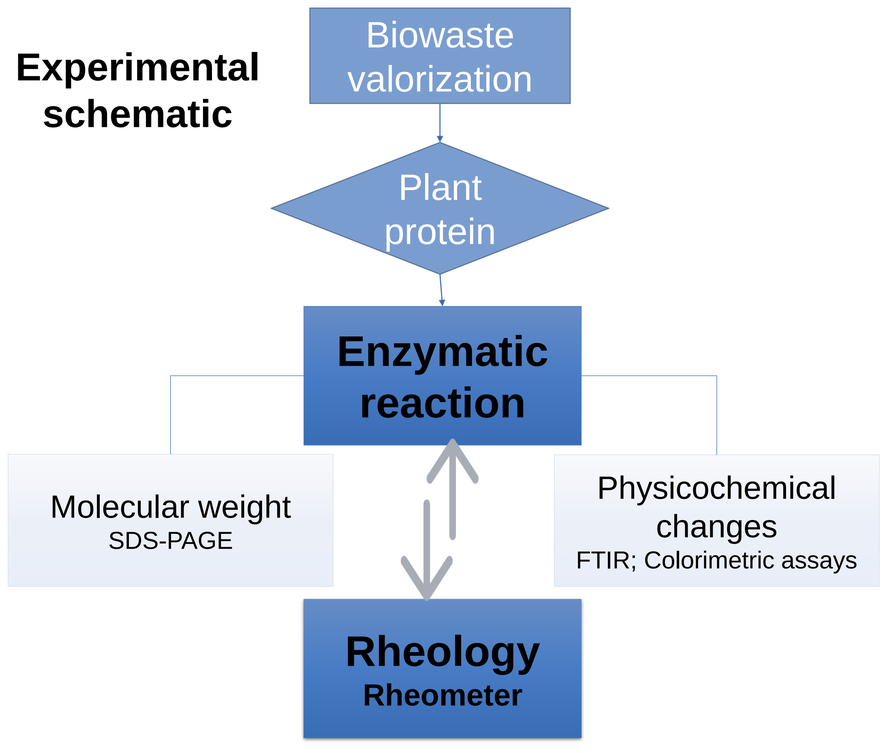


Storage protein plant sources

Myosin animal sources

Structure and surface | Solubility | Water holding | Flexibility | Aggregation | Oil binding

Experimental schematic



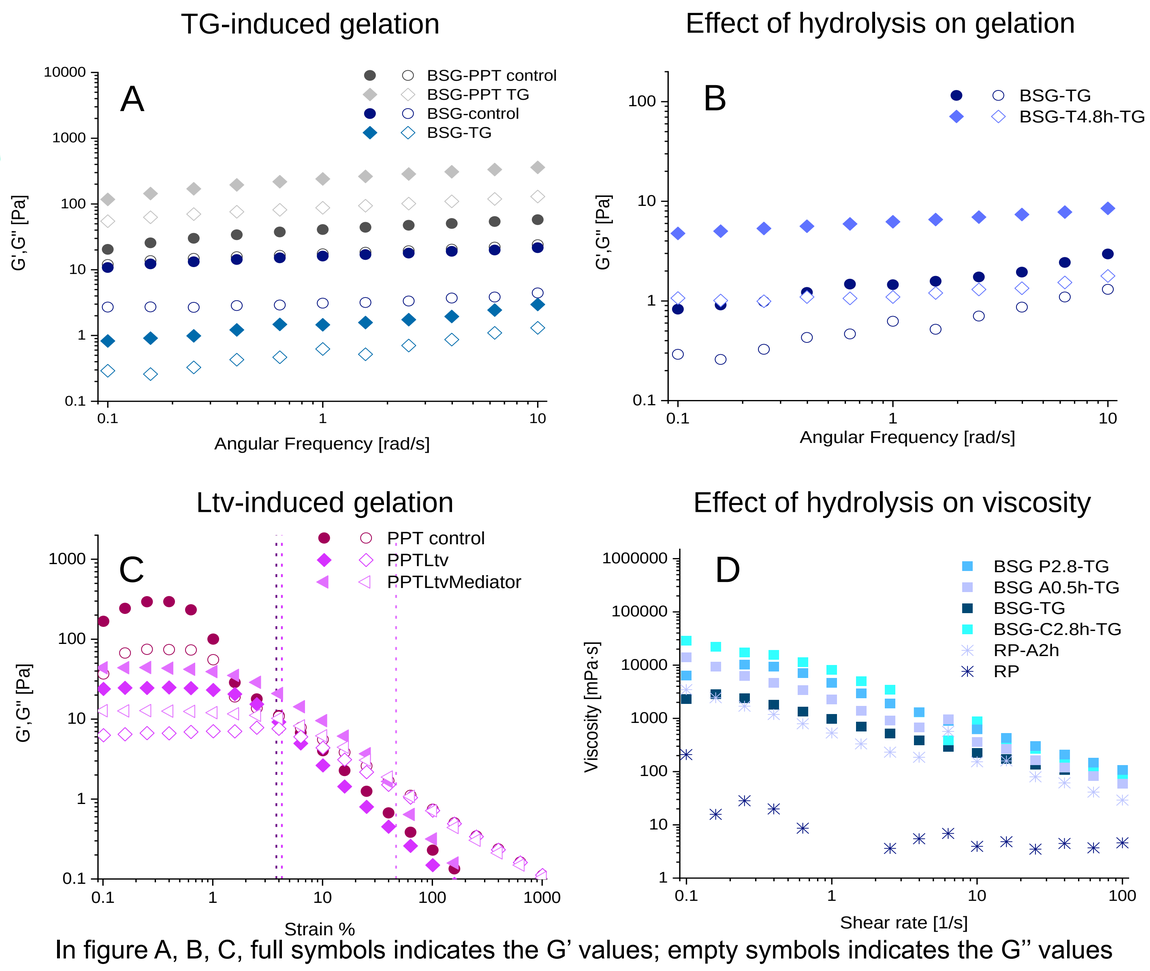
2 Results

Plant-based protein substrate reactivity

Substrate proteins	Pepsin (P)	Trypsin (T)	Chymotrypsin (C)	Alcalase (A)	Transglutaminase (TG)	Laccase (Ltv)
Barley protein (BSG)	**	**	**	***	***	-
Potato protein (PPT)	TBD	TBD	TBD	TBD	*	**
Rice protein[a] (RP)	*	*	*	***	N/A	N/A
Zein from corn	***	*	*	****	N/A	N/A

-; no evidence of cross-linking was shown; *, **, *** and **** are the qualitative parameters assigned based on changing on molecular weights and hydrolysis extent (hydrolysis) or FTIR spectra (cross-linking); TBD, to be determined; N/A, not applicable due to poor water solubility; a. commercial product

Protein dispersion rheology



In figure A, B, C, full symbols indicates the G' values; empty symbols indicates the G'' values

A list of enzymes and their ability in modifying four types of side-stream protein extracts were summarized in the table.

TG cross-linking weakened the network of barley protein (Fig. A). Barley protein co-cross-linking with potato protein or its hydrolysis was possible to strengthen the TG-induced network (Fig. A & B). In terms of laccase cross-linking reactions, the potato protein network exhibited better resistance towards deformation upon cross-linking, as indicated by the yield stress (Fig. C). In addition, a general trend in increased viscosity of the protein dispersion upon enzymatic hydrolysis was observed (Fig. D).

3 Contribution to Sustainable Food Systems

The efficient exploitation of plant proteins from side-streams requires careful tuning on their structure and functionalities. This study will expand the enzyme toolbox in protein modification, for improved application potential of emerging protein ingredients. In the long term, this help ensure plant-based food trend and environmental sustainability

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