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University of Udine

Department of Agricultural, Food, Environmental and Animal Sciences, Udine, Italy

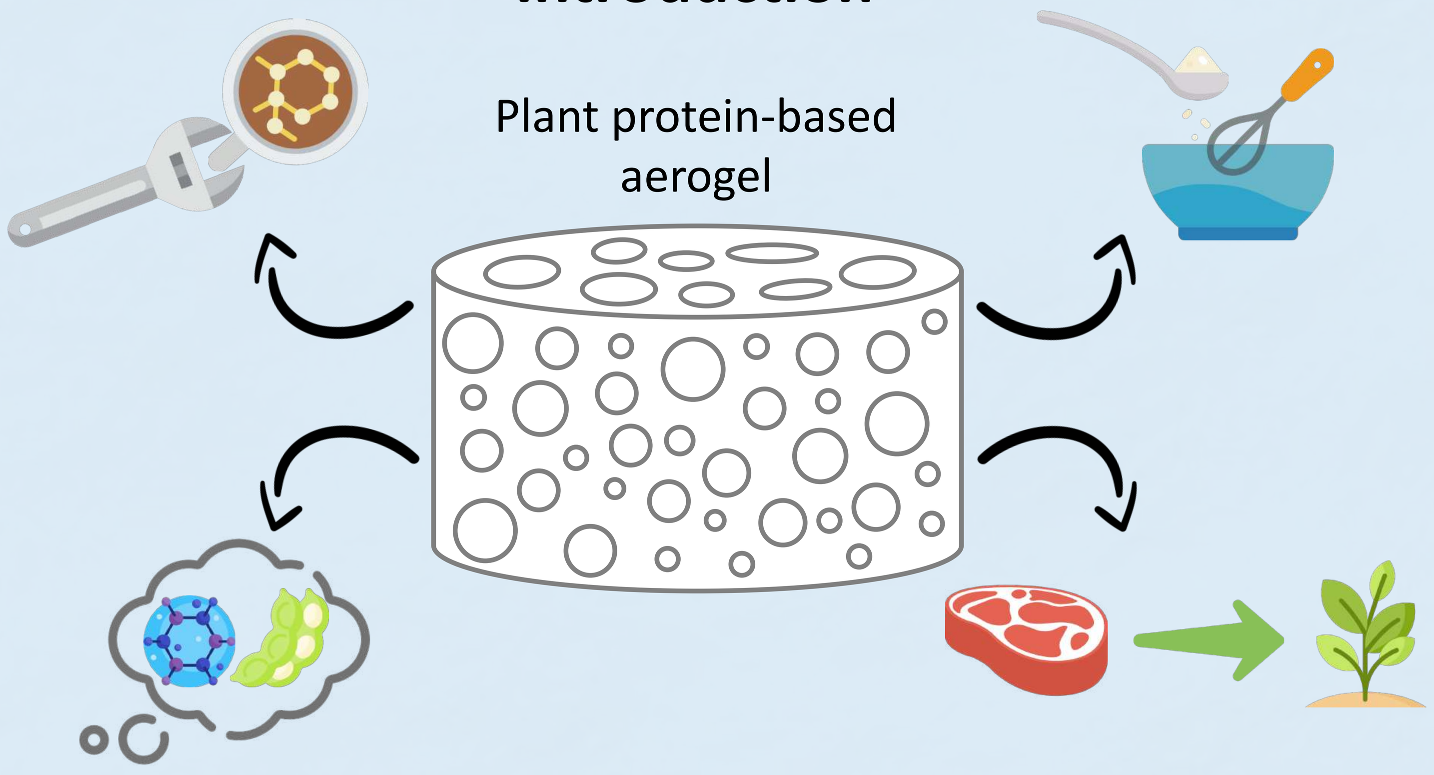
Potentialities of plant protein aerogels as innovative food ingredients

*Lorenzo De Berardinis, Stella Plazzotta, **Sonia Calligaris***, Lara Manzocco*
**e-mail: sonia.calligaris@uniud.it*

Introduction

Protein aerogels show appealing characteristics as innovative food ingredients since presenting unique structural and functional properties, and potentially large consumer acceptance (1).

Potential applications of protein aerogels as advanced food ingredients include the development of bioactive delivery systems, and templates for fat-replacer production (2,3).



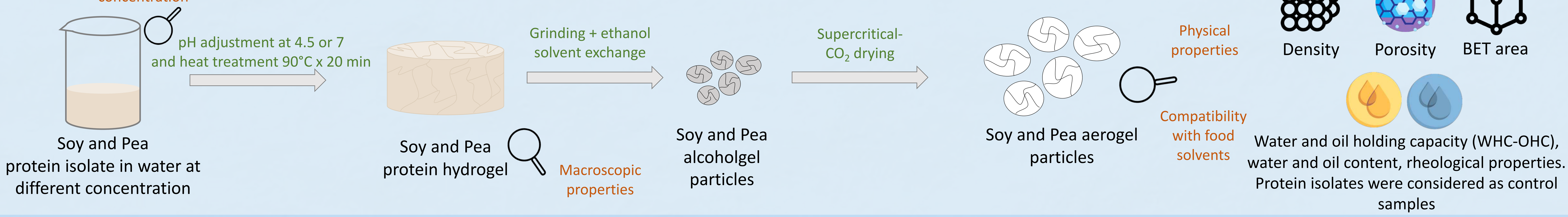
To date, the potentialities of protein aerogels as innovative food ingredients have been only demonstrated for animal protein-based systems, due to the lower gelling ability of plant proteins (4,5).

The higher sustainability of plant proteins and the current "plant-protein transition" encourage the development of plant-protein aerogels, such as those from pulses, which could represent an important opportunity to favor the inlet of aerogels in the food sector (6).

Aim

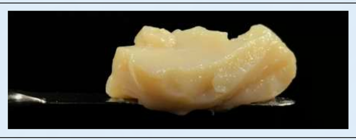
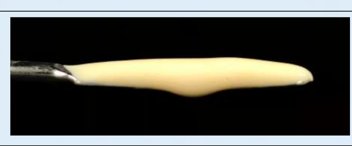
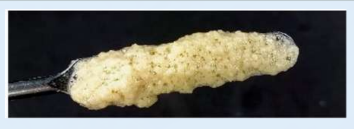
To study the possibility of producing food-grade aerogels based on plant proteins (Soy and Pea) and to collect preliminary data on their compatibility with food systems.

Materials and Methods



Results and discussions

Hydrogel characterization

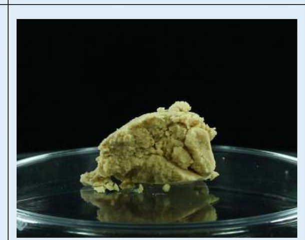
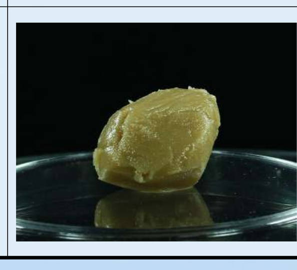
Protein type	Maximum dispersible concentration (%)	pH	Images	Gel characteristics	
SOY	14	7		Self-standing strong gel	✔
		4.5		Microgels formation Phase separation	✔
PEA	19	7		No gel formation	✖
		4.5		Microgels formation Phase separation	✔

Physical properties of aerogels

Soy and Pea protein aerogels present high porosity (>70%), high surface area (60-140 m^2/g), and low density (0,20-0,30 g/cm^3). These values are accentuated in aerogels obtained from microgels formed near the isoelectric point of both proteins (pH 4.5).

Compatibility of the aerogels with food solvents

SOY	Aerogels after water absorption				Aerogels after oil absorption			
Sample	Image	Content (%)	WHC ($g_{water}/g_{aerogel}$)	G' x 10^3 (Pa)	Image	Content (%)	OHC ($g_{oil}/g_{aerogel}$)	G' x 10^3 (Pa)
Control		80	4,03 ± 0,30	5,0		37	0,58 ± 0,03	Granular structure
Aerogel pH 7		77	3,43 ± 0,34	17,0		69	2,23 ± 0,14	34,1
Aerogel pH 4.5		68	2,29 ± 0,03	22,7		72	2,52 ± 0,04	467,4

PEA	Aerogels after water absorption				Aerogels after oil absorption			
Sample	Image	Content (%)	WHC ($g_{water}/g_{aerogel}$)	G' x 10^3 (Pa)	Image	Content (%)	OHC ($g_{oil}/g_{aerogel}$)	G' x 10^3 (Pa)
Control		77	3,38 ± 0,09	5,7		31	0,45 ± 0,04	Granular structure
Aerogel pH 4.5		70	2,33 ± 0,01	61,2		63	1,68 ± 0,04	866,4

Aerogelation does not improve the ability of the protein isolates to structure water.

Aerogelation significantly improves OHC, probably due to process-induced exposure of protein hydrophobic groups.

Conclusions

- By selecting proper concentration and pH, it is possible to prepare food-grade aerogels based on Soy and Pea proteins
- Soy and Pea proteins aerogels might be interesting ingredients with high oi-structuring ability

References

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