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Controlling aerogel surface porosity to enhance functionality in foods

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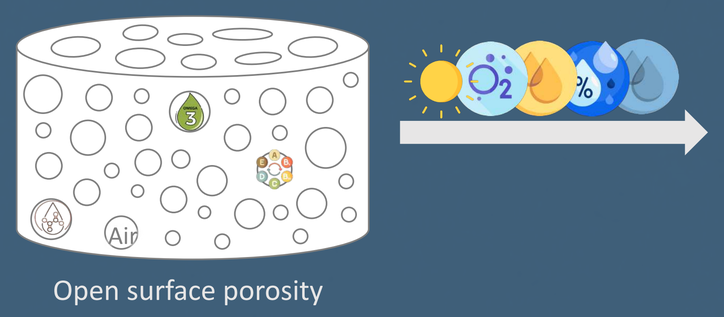
Introduction

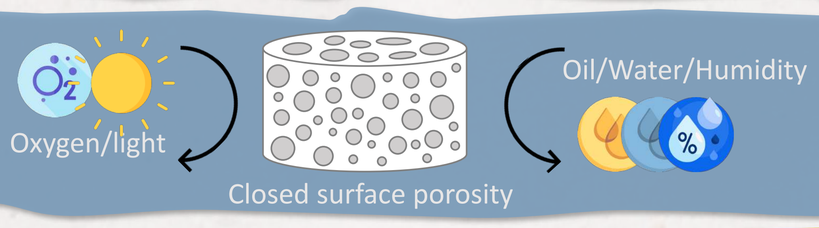
- Protein aerogels are innovative food-grade materials with distinctive physical properties (García-González *et al.*, 2019)
- Thanks to their peculiar structure, they are optimal candidates for the development of new food ingredients with unique functionalities
- The aerogel typical aerated structure can be exploited to deliver health-protecting bioactives or reduce food calories by increasing air content (Ubeyitogullari & Ciftci, 2019)
- Aerogels' porosity is easily lost upon contact with liquid food ingredients (water and oil)
- (Manzocco *et al.*, 2022)



Open surface porosity

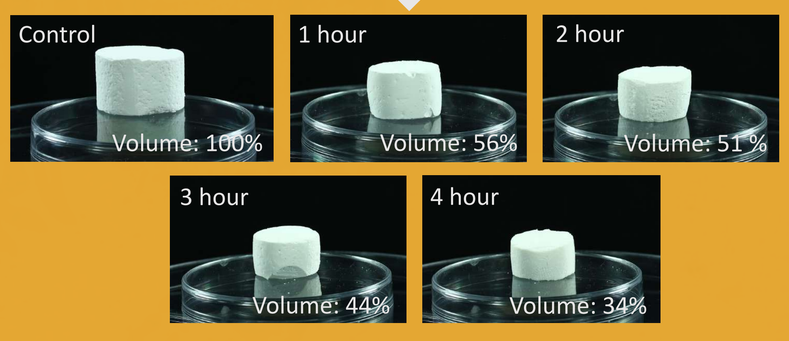
Aim

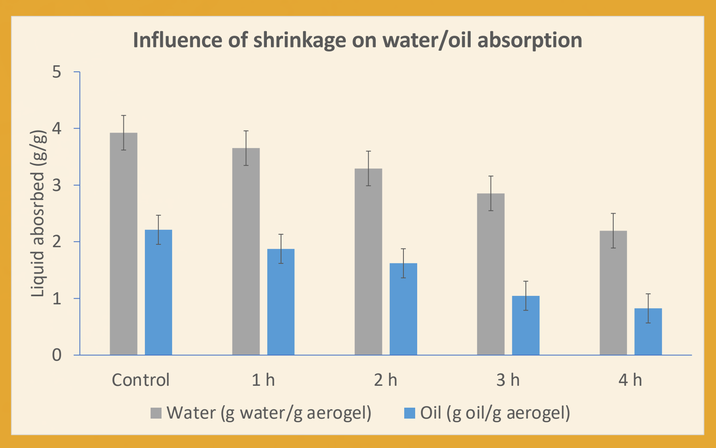
To explore processing and formulation strategies to increase the structural stability of whey protein aerogels in the presence of water and oil by controlling surface porosity



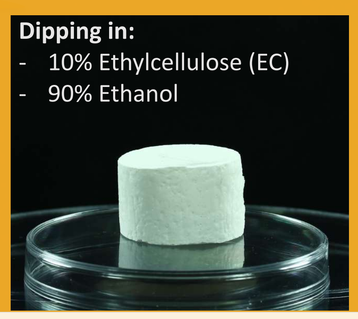
Strategies

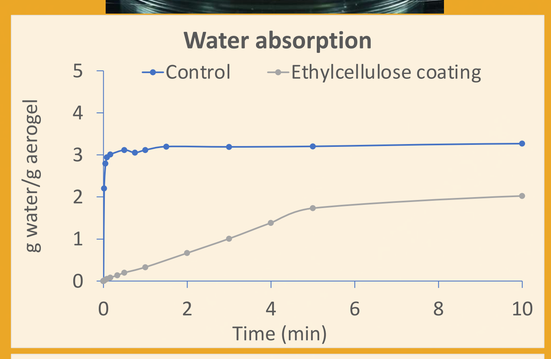
Results and discussions

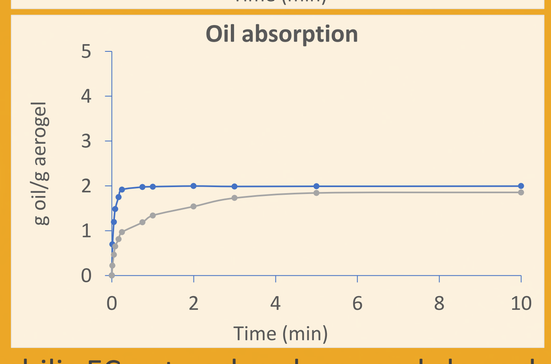




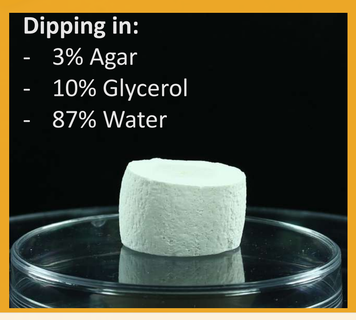
Control surface collapse:
- increases the shrinkage
- decreases water and oil absorption

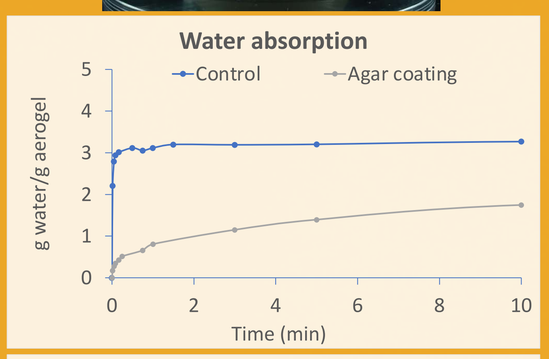


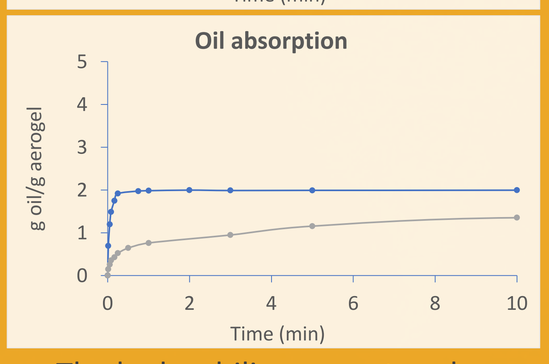




- The lipophilic EC network reduces and slows down water absorption, by occupying surface pores.
- Higher and faster absorption is instead observed for oil: EC is probably removed from the surface upon contact with oil, due to chemical affinity.







- The hydrophilic agar network reduces and slows the absorption of both water and oil.
- Surface pores are probably partially closed.

Conclusion

Controlled surface collapse does not allow to specifically control surface pores but reduces overall aerogel volume and porosity

Coating application allows to modulate surface porosity and can be thus exploited to protect loaded molecules from the food environment

Future perspectives

Investigate the possibility to control the surface porosity of aerogel particles

Explore multi-layer coating techniques to improve the barrier effect

Look at the human digestion behavior of both aerogel and loaded molecules as a function of surface porosity

References:
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EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY
Funded by the Horizon 2020 Framework Programme of the European Union
Co-funded by the European Union