



HAL
open science

Starch aerogels, cryogels and xerogels for biomedical applications

Hiba Bouras, Fangxin Zou, Yannick Tillier, Sytze Buwalda, Tatiana Budtova

► **To cite this version:**

Hiba Bouras, Fangxin Zou, Yannick Tillier, Sytze Buwalda, Tatiana Budtova. Starch aerogels, cryogels and xerogels for biomedical applications. *Advanced Functional Polymers for Medicine* 2024, Jun 2024, Utrecht, Netherlands. . hal-04659189

HAL Id: hal-04659189

<https://hal.science/hal-04659189v1>

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Starch aerogels, cryogels and xerogels for biomedical applications

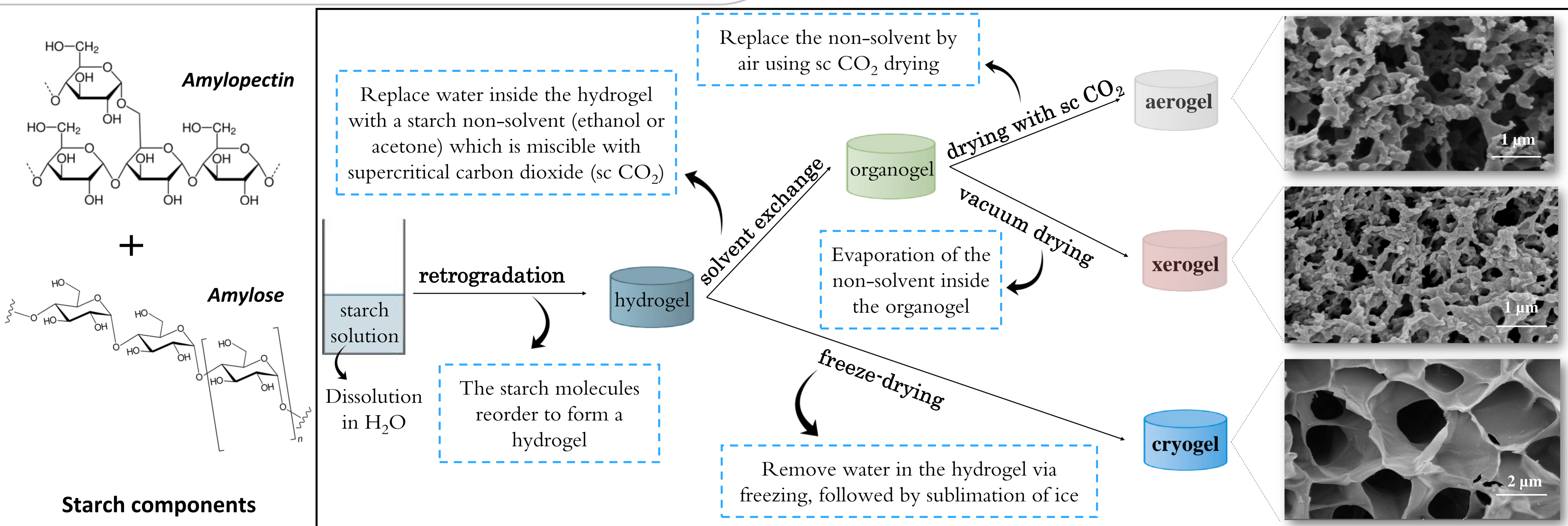
Hiba Bouras, Fangxin Zou, Yannick Tillier, Sytze Buwalda, Tatiana Budtova

MINES Paris, PSL University, Center for Materials Forming (CEMEF), UMR CNRS 7635, CS 10207, 06904 Sophia Antipolis, France

Context

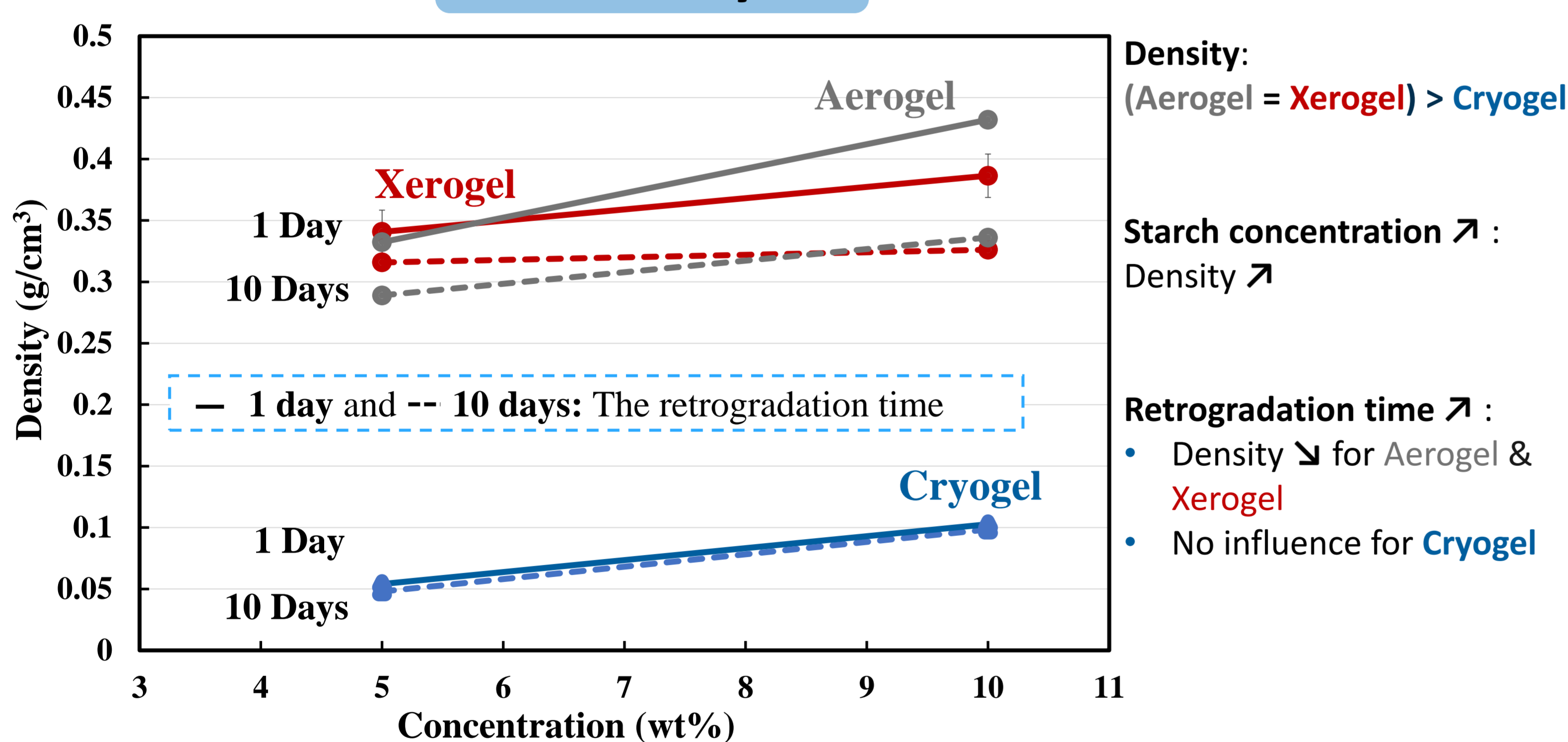
- Lightweight and porous materials are essential for progress in different fields. Starch-based porous materials have great potential for various biomedical applications, from scaffolds to drug carriers.¹
- Each application requires specific structural and physico-chemical properties. It is thus important to understand e.g. morphology development during processing and to correlate it with final material properties.
- We investigated the influence of preparation conditions on the properties of porous starch materials.

Preparation of porous starch materials

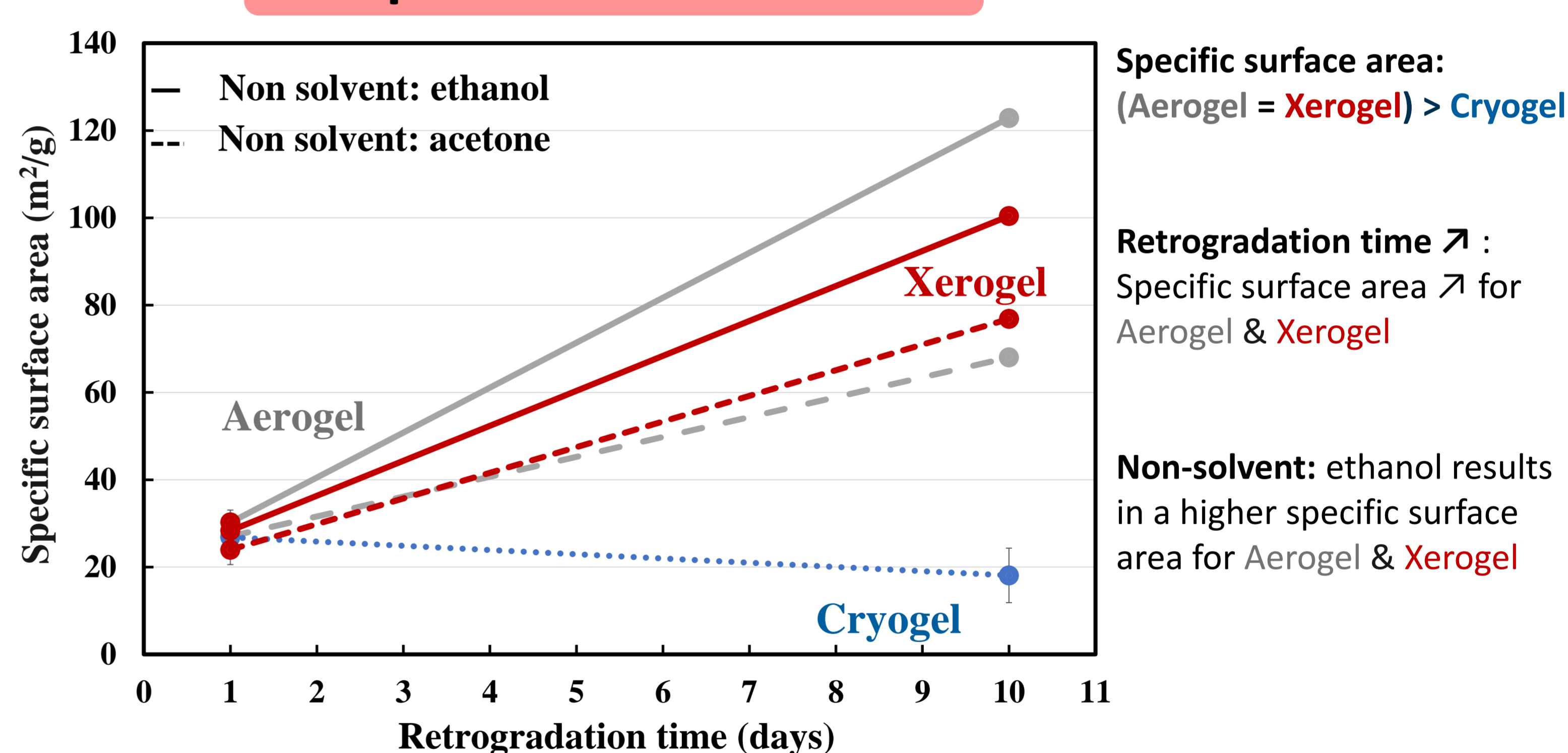


Results

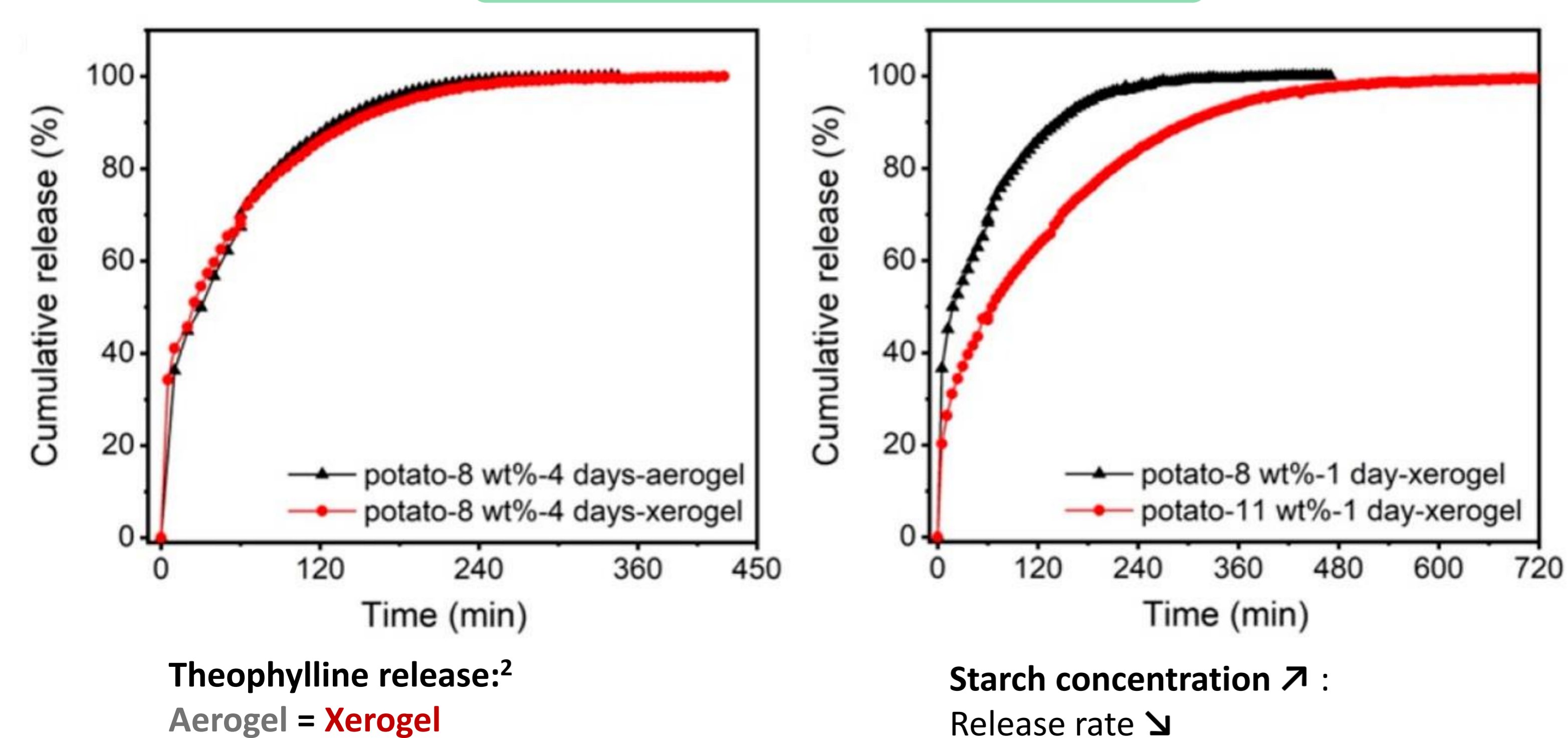
Density



Specific surface area



Theophylline release



Conclusions

Porous starch materials have:

- Density:** from 0.05 g/cm³ for Cryogels to 0.4 g/cm³ for Aerogels and Xerogels
- Specific surface area:** from 20 m²/g for Cryogels to 120 m²/g for Aerogels and Xerogels
- Young's modulus:** up to 20 MPa
- Mesopores and macropores**

Aerogels and Xerogels have:

- Higher density and specific surface area than Cryogels
- Similar properties → Vacuum drying (Xerogels) is a cost-effective alternative to the expensive sc CO₂ drying method (Aerogels)

Acknowledgements

P. Ilbizián and Dr. J. Jaxel (PERSEE, MINES Paris) are thanked for help with sc CO₂ drying. Carnot M.I.N.E.S. (CARINGS project) and Roquette are thanked for funding, the latter also for providing starch.

References: 1. M. Garcia, C.F. Garcia, A.A.G. Faraco, Pharmaceutical and Biomedical Applications of Native and Modified Starch: A Review, *Starch-Stärke* 2020, 72, 1900270.
2. F. Zou, T. Budtova, Starch Alcogels, Aerogels, and Aerogel-like Xerogels: Adsorption and Release of Theophylline, *ACS Sustainable Chemistry & Engineering* 2023, 11, 5617–5625.