

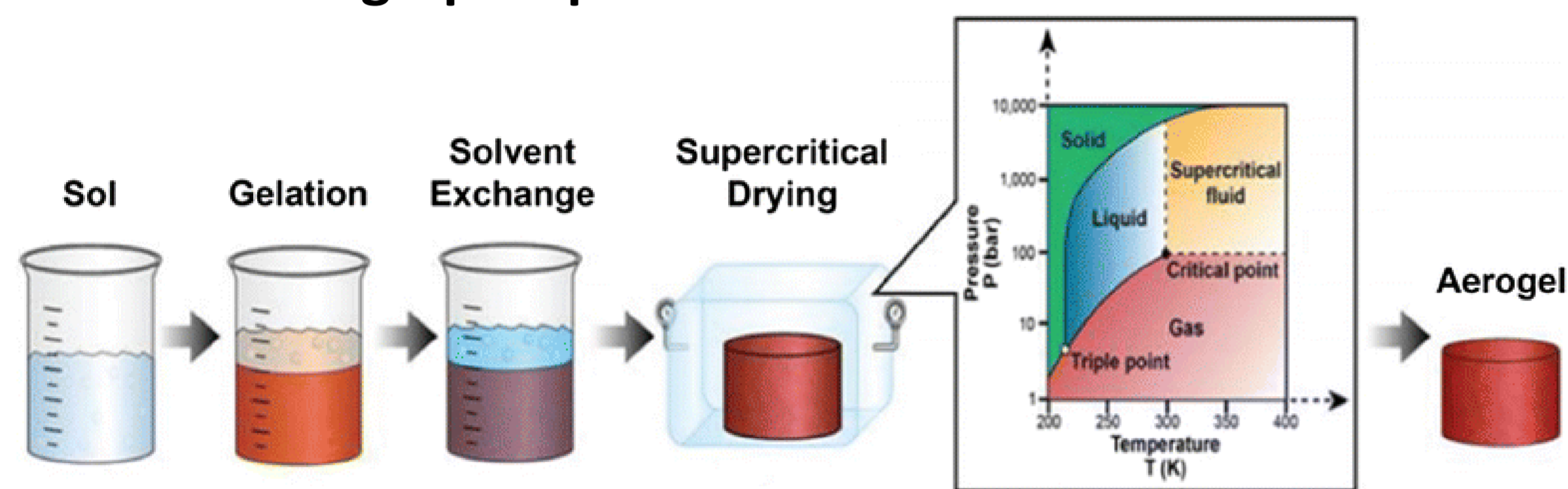


## Introduction

- Increasing importance of natural-based polymers due to their renewability, abundance, biodegradability and other unique properties.
- Development of food-compatible carriers for sensitive compounds on biopolymer and protein-based aerogel.
- The **aim** of this work is to determine the interactions between active compounds and biopolymer-aerogels with supercritical fluid chromatography (SFC).

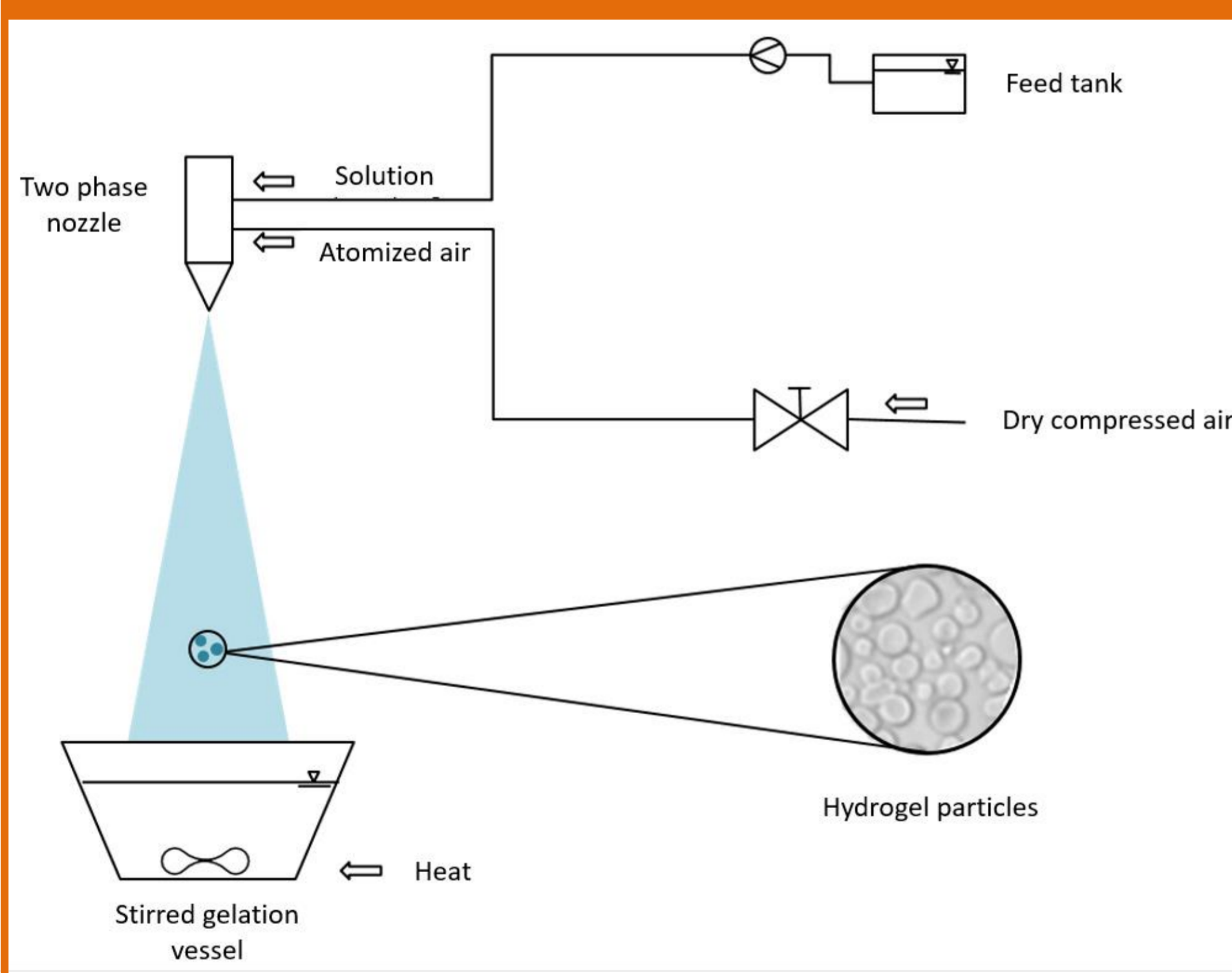
## Particle Production

### Production of biopolymer aerogels to be used as stationary phase for chromatographic processes



- Why protein isolate (WPI), potato protein isolate (PPI), cellulose and alginate used as precursors.
- Formation of hydrogels by thermal induced or ionic cross-linked gelation processes.
- Following steps: Solvent exchange and supercritical drying of biopolymer aerogels.

## Shaping



### Two-substance nozzle set up

- Particle size 1-50  $\mu\text{m}$
- Spherical particles, monodisperse
- Parameters nozzle:  $\varnothing$  200 - 1200  $\mu\text{m}$

## Properties of aerogel particles

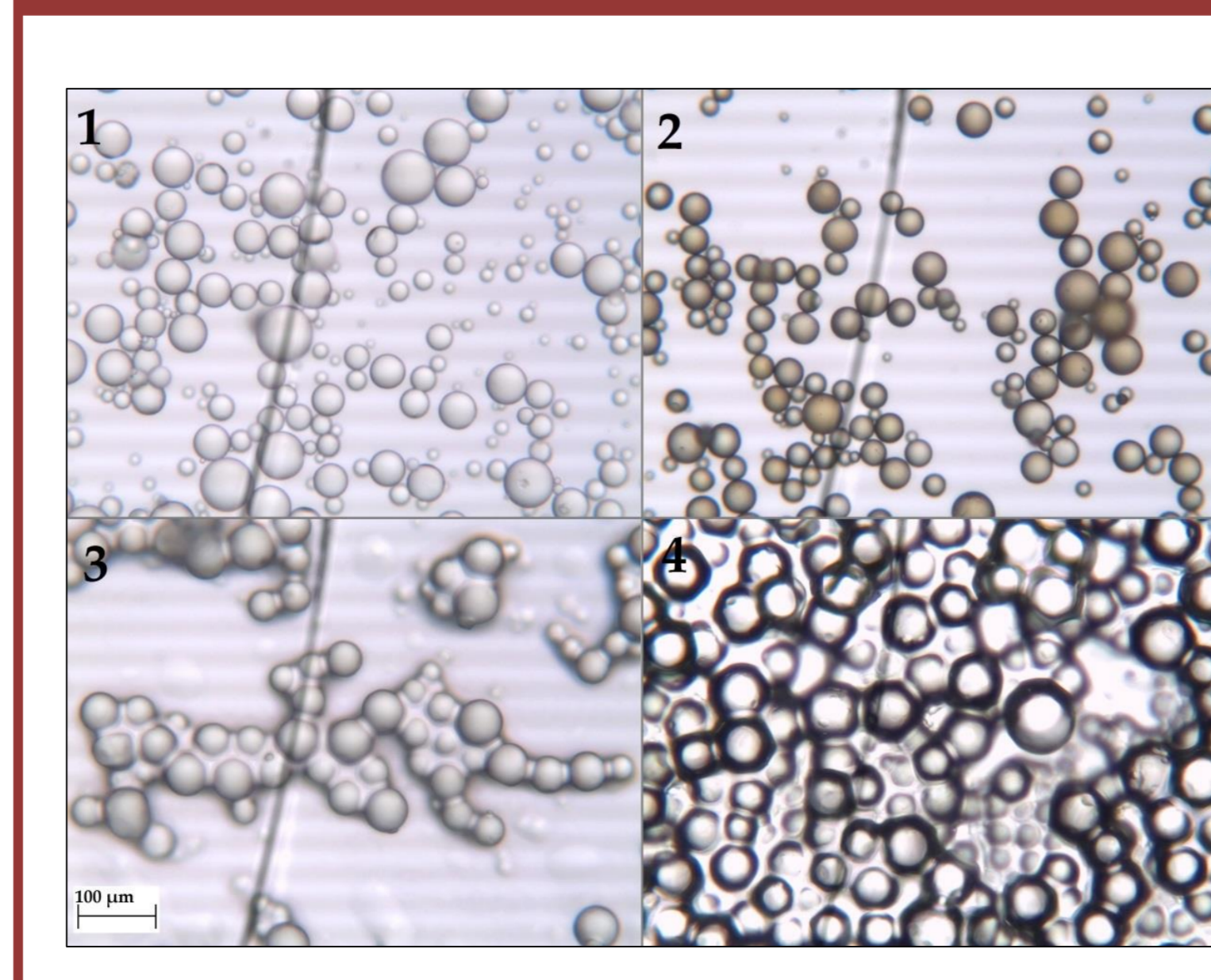
### Process parameters

- pH-value, gelation temperature, salt concentration, nozzle parameters.

### Aerogel properties

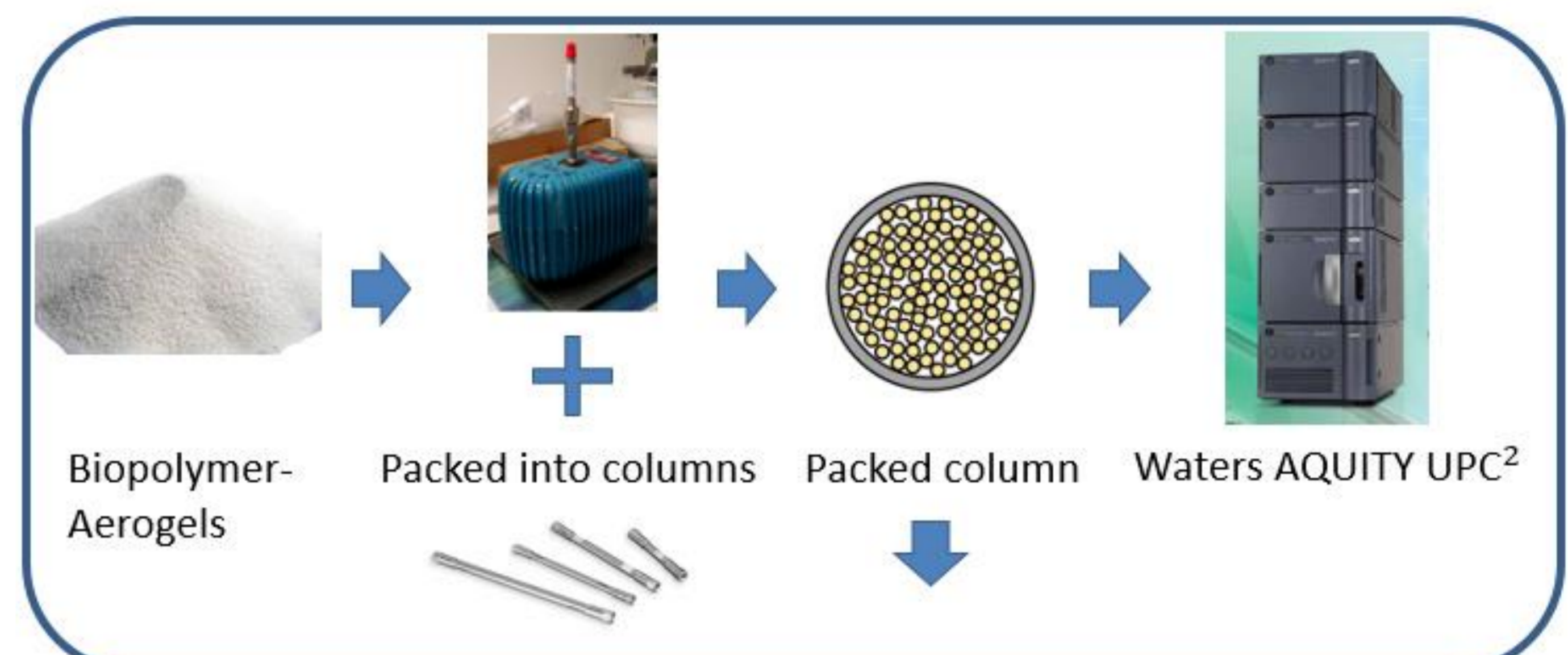
- specific pore volume and surface area, shrinkage, skeleton density, breaking force, etc.

## Characterization

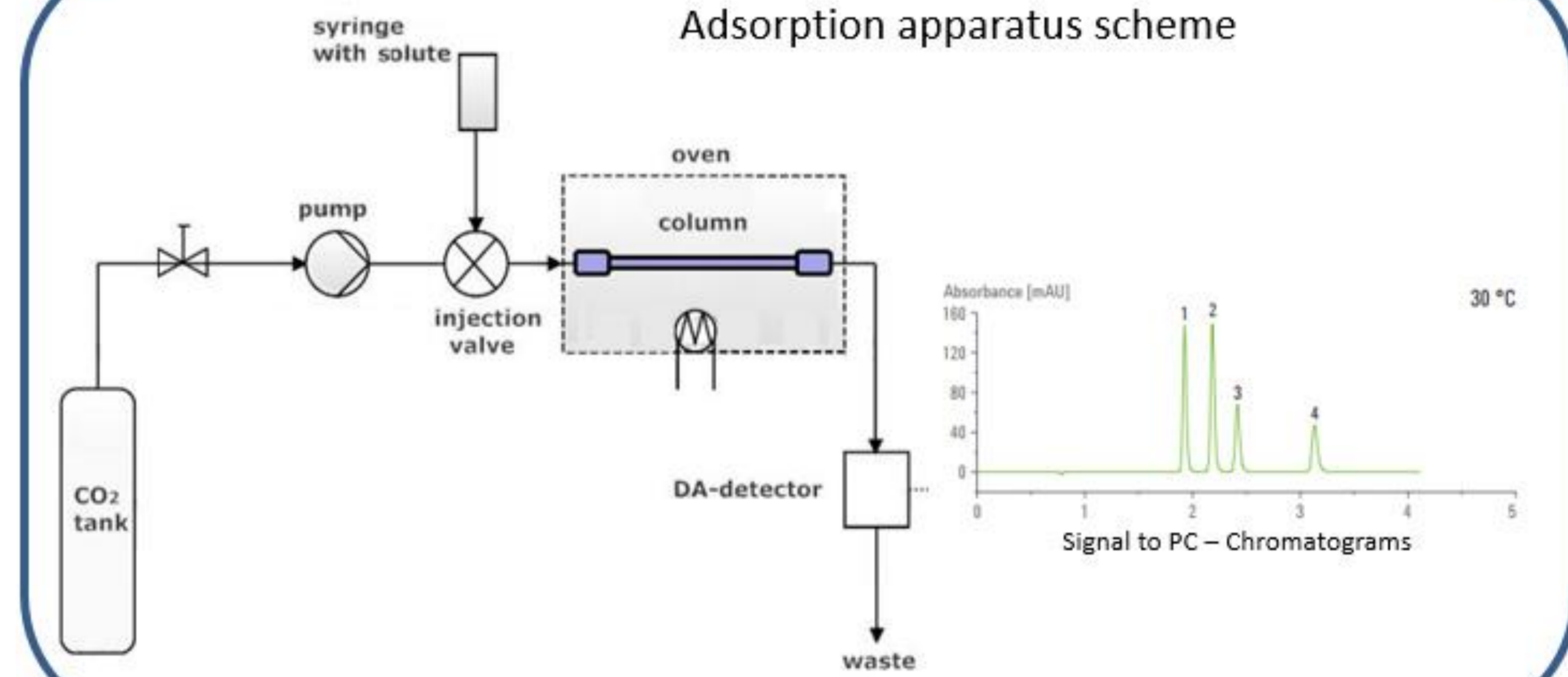


## Supercritical Fluid Chromatography

- Establishment of SFC methods using a biopolymer-aerogel system.
- Interactions of different organic/polar solutes with the biopolymer-aerogel as well as the components of the mobile phase (scCO<sub>2</sub>).
- Determination of thermodynamic parameters by quantitative models (retention time, entropy, enthalpy...).



### Adsorption apparatus scheme



## Impregnation

- Impregnation of adsorption of different CO<sub>2</sub>-soluble components (caffeine, vitamin C, fish oil, various aromas, ketoprofene, L-menthol etc).
- Screening of aerogels as carrier material for various branches (food-, pharma-, and environmental industry) in SFC.
- Selected materials loaded in supercritical impregnation reactor.



## Further Work and Outlook

- Optimization of aerogel production of smallest particles and their gelation processes.
- Modelling SFC interactions with cellular automata: numerical and analytical solutions for diffusion processes.
- Implementation of adsorption experiments with SFC and promising food-compatible solutes.

### Literature:

- [1] Gurikov, P.; Kolnoochenko, A.; Golubchikov, M.; Menshutina, N.; Smirnova, I.; Comp.&Chem.Eng. 2016  
 [2] Sun, M.; Ruiz Barbero, S.; Johannsen, M.; Smirnova, I.; Gurikov, P.; Chrom. A. J. 2019  
 [3] S. Cumana; P. Gurikov; A. Belugin; M. Johannsen; N. Menshutina; I. Smirnova; St. Petersburg University. 2013