

Lignin coating of Alginate aerogel particles

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Motivation

- The main drawback of biopolymer aerogels is their hydrophilic surface and the open pore structure which permits the penetration of moisture into the inner structure and may cause damage of the pores.
- Coating of aerogels with an external layer provides protection of the inner part and can contribute positively to mechanical stability as well.
- The aim of this study is to apply external, nanometer-sized lignin layers to alginate aerogel particles via self assembly during solvent exchange and gelation.



Experimental Approach

Lignin coating was applied at two different stages:

(A) During gelation by mixing lignin microparticles with the alginate solution.

(B) During the solvent exchange.

Focus parameters : Polymers concentration (C_{Lig} , C_{Alg}) , gelation temperature.

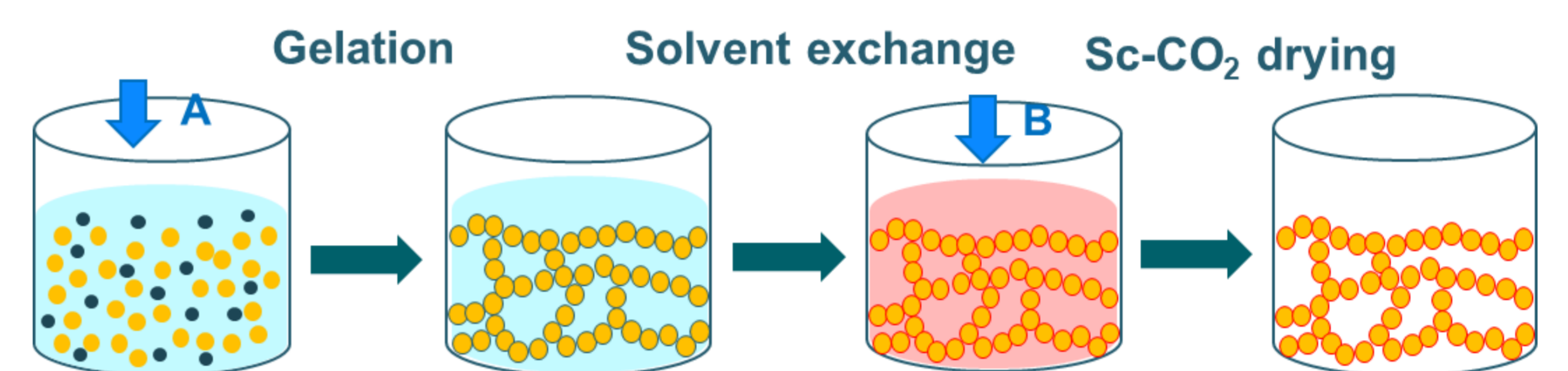


Fig.1 Experimental approach followed for the synthesis and lignin coating of alginate aerogels.

Results

Microstructure and Layer formation

Lignin-alginate matrix aerogel particles (A)

Lignin-alginate aerogel particles with different lignin concentrations (C_{Lig}/C_{Alg}): 25%, 50%, 66,67%.

Nanoscale-lignin outer shell was formed with using lignin as additive in the alginate polymer solution.

Lignin Alginate core-shell particles (B)

Layer of lignin particles is formed on the surface of the alginate hydrogel particles by electrostatic adsorption.

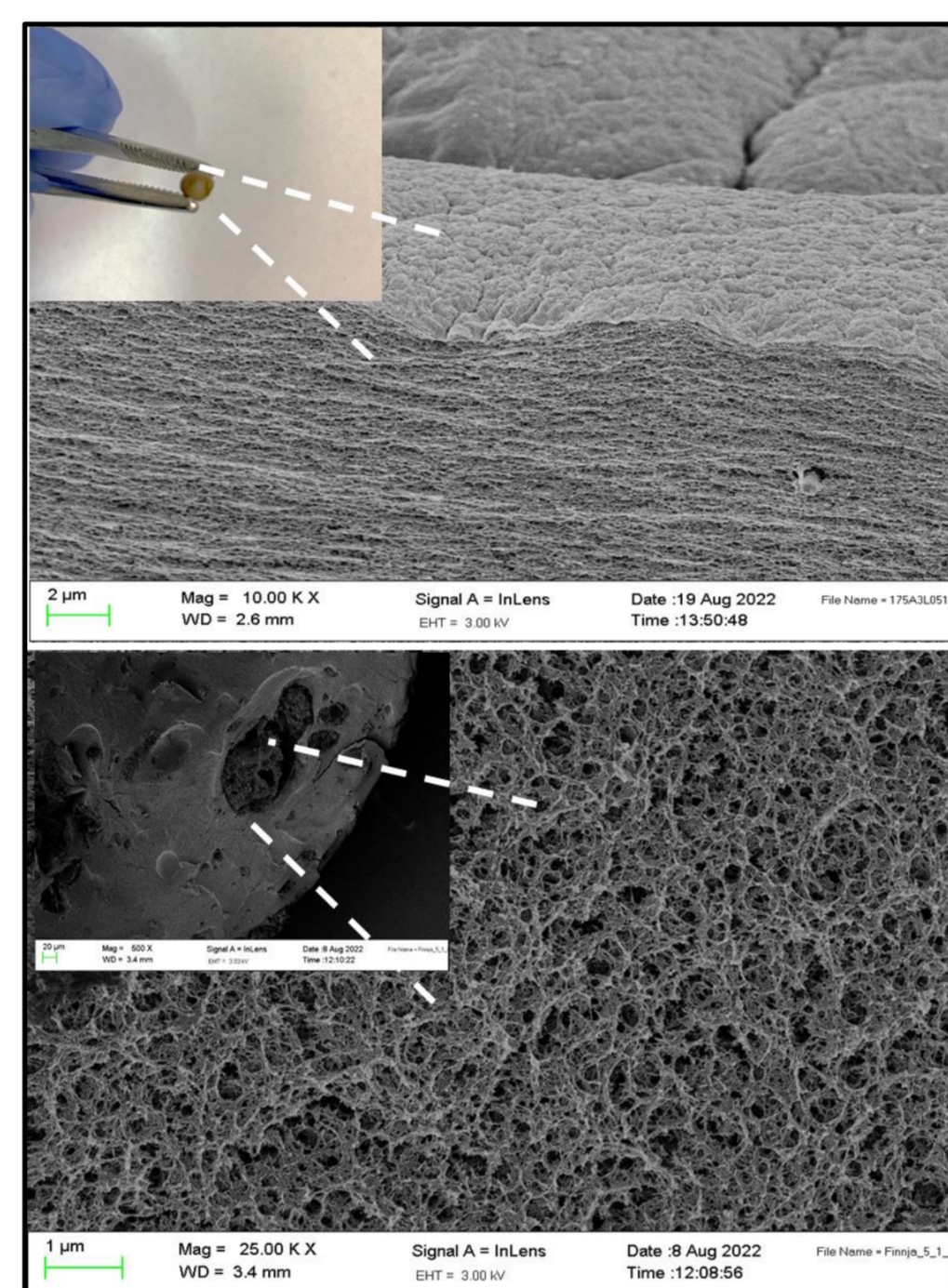


Fig.2 SEM image of External lignin shell and inner pore structure (top),porous lignin microparticle in aerogels structure (bottom).



Fig.4 SEM image of the Lignin coated alginate shell-core aerogel particle.

Specific surface area

- Linear relation between C_{Lig} and S_v .
- Results suggest, that coating procedure has no negative influence on inner pore structure.

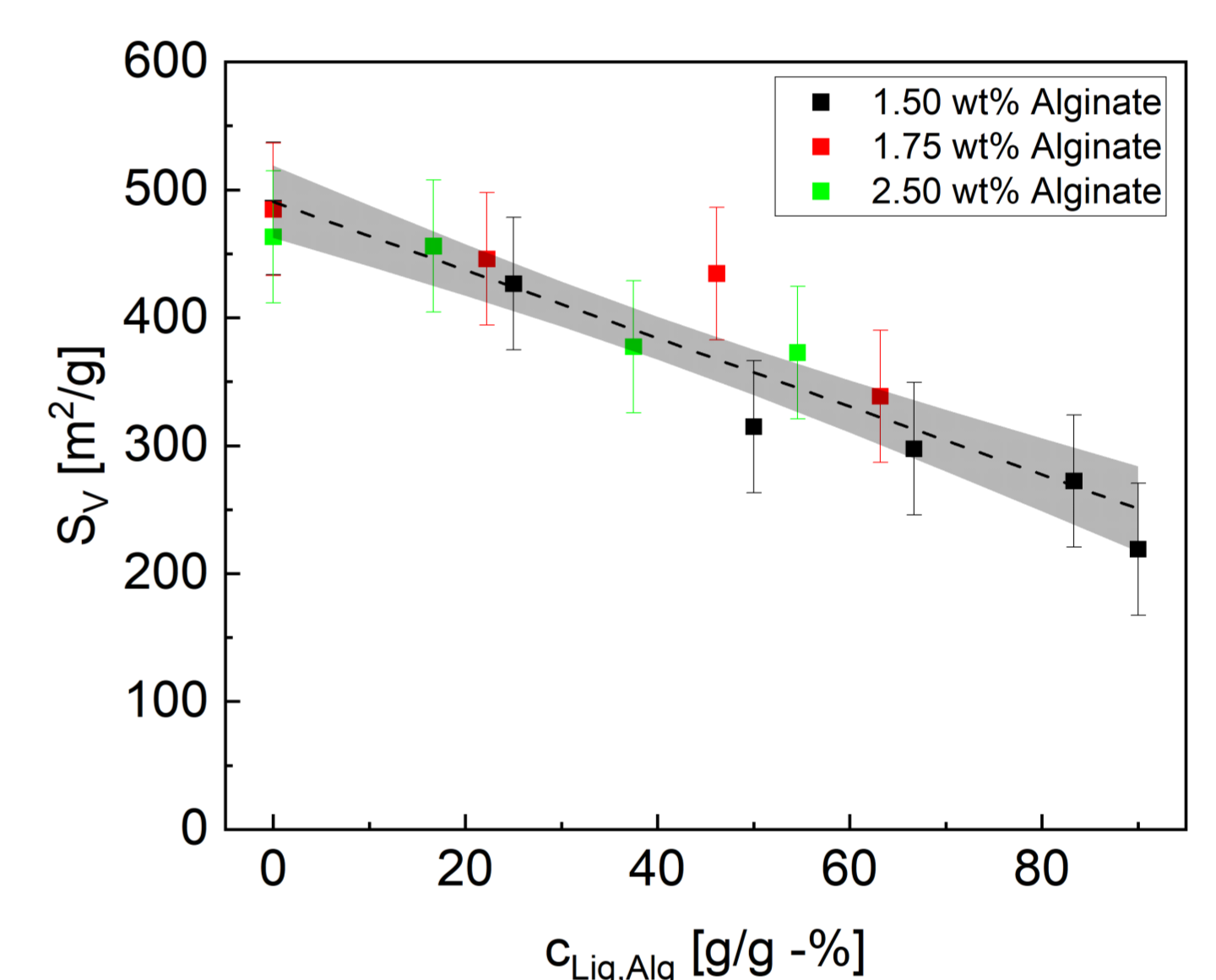


Fig.5 Influence of Lignin ratio on specific surface area.

Mechanical properties

The lignin enforcement increased the mechanical stability of lignin alginate aerogel particles and provided protection against volumetric shrinkage during synthesis.

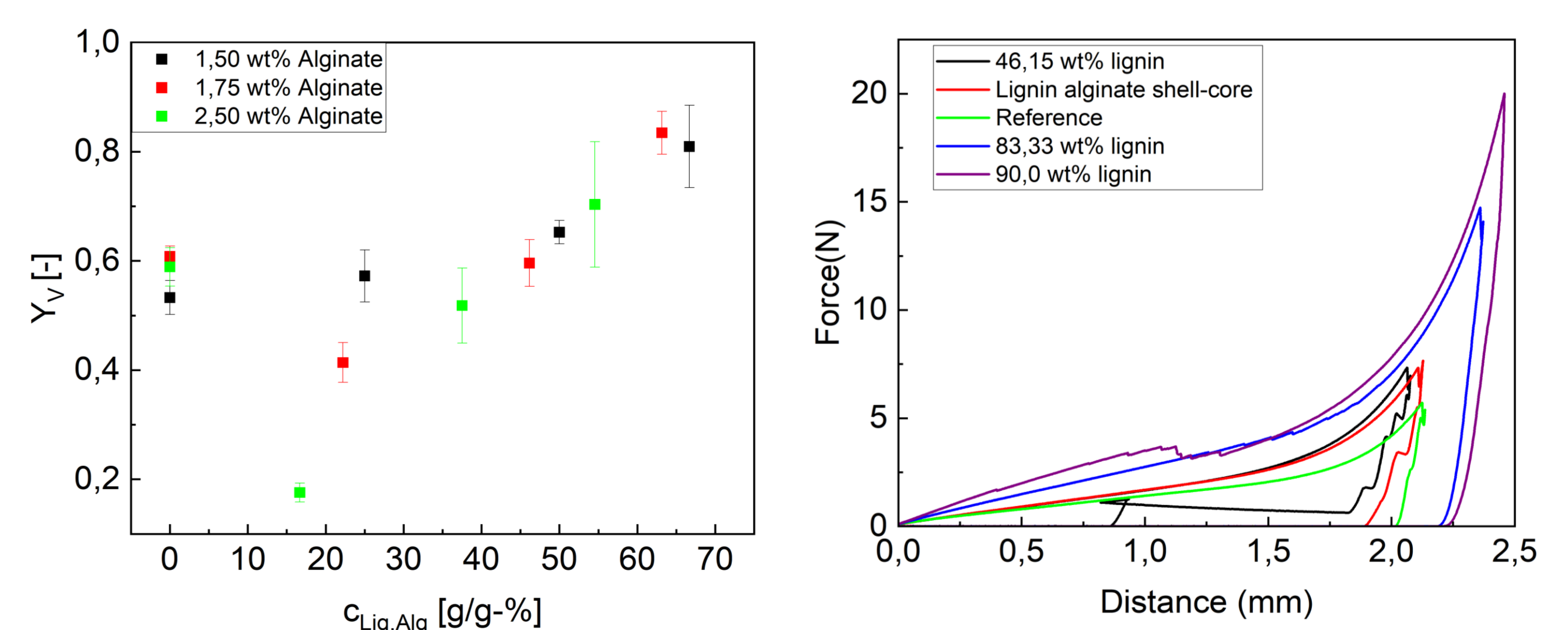


Fig.6 Shrinkage and compressive force of lignin-alginate aerogel particles.

Outlook

- Optimization of lignin coating layer in terms of thickness and homogeneity as well as coating layers-build up.
- Correlating the coating parameters to the change in surface chemistry e.g. surface energy and hydrophobicity.
- Application of lignin coating to different biopolymer aerogels.

