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Abstract Formulary

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Title: Is the structure of biopolymer aerogels uniform?

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ABSTRACT (Space limited to 2200 characters)

Biopolymer aerogels are biodegradable and suitable for human consumption, which opens up opportunities for life science applications such as food, pharmacy or biomedical engineering. They can be produced in a standard three-step procedure: gelation, solvent exchange and supercritical drying.

Over the course of the solvent exchange and supercritical drying, mainly as a result of different polymer-solvent interactions, mass transport-induced changes in the gel porous structure take place that result in the reduction of gel volume. Such changes in the gel structure affect the final properties of biopolymer aerogels, which needs to be accounted for when considering the commercial applications of biopolymer aerogels. Therefore, it is necessary to describe the mass transport together with the changes in the gel matrix during the processing in order to be able to minimize the shrinkage and control the final structure of the aerogel.

In order to help this aim, we developed a new method to study the uniformity of shrinkage of different biopolymer aerogels based on imaging metal tracer particles using X-ray microtomography (µCT) in hydrogels, alcogels and aerogels. The key steps of the method were established: gelation with tracer particles, µCT imaging, image processing and analysis to obtain radial particle and closest neighbor distributions of the tracer within the gels. The information on the local interparticle distances was then correlated to determine the local changes in the polymer density. This method enables the description of the shrinkage uniformity and local matrix properties for various biopolymer gel systems. This information can be then used for the description of gel shrinkage coupled with mass transport processes, helping to optimize the processing costs and final material properties.