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Abstract Formulary

Presentation type: **Oral** ✔ **Poster** ☐

Title: From solution to aerogel: study of chitosan coagulation kinetics

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ABSTRACT (Space limited to 2200 characters)

Chitosan aerogels are promising materials for biomedical applications as they combine chitosan antibacterial and antifungal properties as well as the high porosity and high surface area of aerogels. aerogels are prepared by dissolving the polymer in an acid medium, coagulation in sodium hydroxide solution followed by replacement of water by a fluid miscible with CO_2 and finally drying in supercritical conditions. Coagulation is an important step in the preparation of chitosan hydrogels as upon the addition of NaOH a non-solvent induced phase separation occurs leading to the formation of a chitosan network. It is supposed that the morphology of this network is preserved during solvent exchange and drying with supercritical CO_2. While non-solvent induced phase transition and its kinetics are well studied for synthetic polymer gels, it is a “white” area for polysaccharides. For example, the kinetics of solvent/non-solvent diffusion during coagulation of cellulose have been reported, but to the best of our knowledge, nothing is known about the kinetics of chitosan coagulation and the evolution of the mechanical properties of coagulating chitosan.

In this work, kinetics of chitosan coagulation when NaOH is added were studied by two methods: i) using macroscopic observation with a video camera recording the evolution of the coagulating front and ii) using dynamic mechanical thermal analysis (DMTA) recording the evolution of the elastic modulus. The influence of chitosan concentration was investigated. Optical observations showed that coagulation may be divided into 3 steps: initiation, steady growth of the coagulated layer and acceleration. DMTA analysis confirmed the first two steps. Comparison of the two methods showed that DMTA is more sensitive in the detection of the first two coagulation steps. An increase in the chitosan concentration increased the coagulation rate estimated with both methods.

We assume that our study may help selecting 3D printing parameters for systems in which processing and coagulation occur at the same time. For example, it may help to avoid crushing of the bottom layer by a new one during printing of a solution in a coagulation bath.