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Effect of Curing Temperature on the Textural and Rheological of Gelatine-SDS Hydrogels

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Abstract : Gelatine is a protein biopolymer obtained from the partial hydrolysis of animal tissues which contain collagen, the primary structural component in connective tissue. Gelatine hydrogels have attracted considerable research in recent years as an alternative to synthetic materials due to their outstanding gelling properties, biocompatibility and compostability. Surfactants, such as sodium dodecyl sulfate (SDS), are often used in hydrogels solutions as surface modifiers or solubility enhancers, and their incorporation can influence the hydrogel's viscoelastic properties and, in turn, its processing and applications. Literature usually focuses on studying the impact of formulation parameters (e.g., gelatine content, gelatine strength, additives incorporation) on gelatine hydrogels properties, but processing parameters, such as curing temperature, are commonly overlooked. For example, some authors have reported a decrease in gel strength at lower curing temperatures, but there is a lack of research on systematic viscoelastic characterisation of high strength gelatine and gelatine-SDS systems at a wide range of curing temperatures. This knowledge is essential to meet and adjust the technological requirements for different applications (e.g., viscosity, setting time, gel strength or melting/gelling temperature). This work investigated the effect of curing temperature (10, 15, 20, 23 and 25 and 30°C) on the elastic modulus (G') and melting temperature of high strength gelatine-SDS hydrogels, at 10 wt% and 20 wt% gelatine contents, by small-amplitude oscillatory shear rheology coupled with Fourier Transform Infrared Spectroscopy. It also correlates the gel strength obtained by rheological measurements with the gel strength measured by texture analysis. Gelatine and gelatine-SDS hydrogels' rheological behaviour strongly depended on the curing temperature, and its gel strength and melting temperature can be slightly modified to adjust it to given processing and applications needs. Lower curing temperatures led to gelatine and gelatine-SDS hydrogels with considerably higher storage modulus. However, their melting temperature was lower than those gels cured at higher temperatures and lower gel strength. This effect was more considerable at longer timescales. This behaviour is attributed to the development of thermal-resistant structures in the lower strength gels cured at higher temperatures.

Keywords : gelatine gelation kinetics, gelatine-SDS interactions, gelatine-surfactant hydrogels, melting and gelling temperature of gelatine gels, rheology of gelatine hydrogels
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