Application note
RHEOLASER®Master

Biopolymers: influence of salt concentration & type

Introduction

In the case of charged biopolymers, the gelling properties can depend on salt addition. Salt concentration and nature can significantly change the gelation temperature or even the gelation mechanism. Carrageenan is an interesting example as it shows a dependence on salt concentration and salt type. When κ-carrageenan is used, the gelation with Ca^{2+} salts show less syneresis than that with K^{+} salts. In the case of ι-carrageenan, the increase of $Ca2^{+}$ concentration can increase the gelation temperature significantly.

Materials & method

κ-carrageenan, ι-carrageenan, KCl and CaCl2 were purchased from Sigma-Aldrich and used as received. A 1 % (w/w) biopolymer dispersion was obtained by heating the sample under stirring to 90°C.
Note: 0.1% of polystyrene particles (1µm, Spherotech) were added to ensure multiple backscattering.

Effect of the salt concentration

Figure 1 shows the evolution of the elasticity index as a function of temperature during cooling of κ-carrageenan dispersions with different concentrations of $CaCl_2$. The higher this index is, the higher is the samples elasticity. At high temperature, the EI is low and does not change during cooling. The carrageenan polymers are dispersed as random coils and do not interact with each other. When the temperature lowers, the elasticity increases rapidly as the network is formed by double helices.

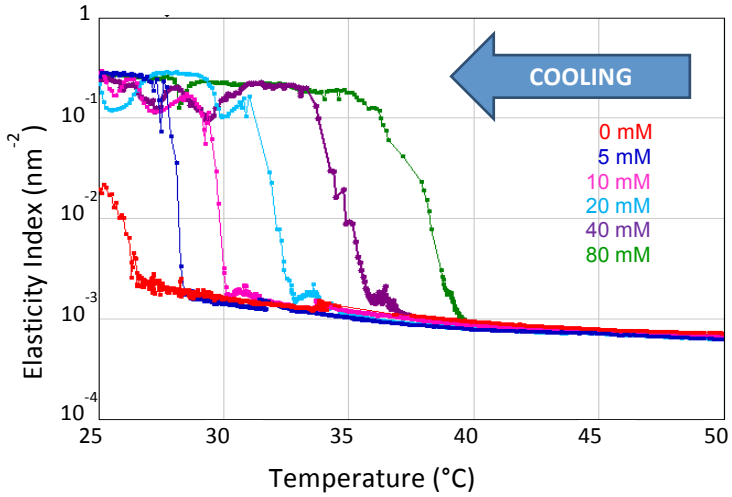

Figure 1. Elasticity Index as a function of the temperature (cooling), 1% κ-carrageenan dispersion with different concentration of CaCl2.

The Time-Cure Superposition data processing allows the accurate determination of the gel temperature for each salt concentration in 1-click. The higher the salt concentration, the higher is the gelation temperature

Salt concentration	Gelling temperature
0 mM	26.6 °C
5 mM	28.7 °C
10 mM	30.3 °C
20 mM	33.8 °C
40 mM	36.6 °C
80 mM	39.4 °C