Application note
RHEOLASER®Master

Biopolymers: viscosifiers & gelling agents

Introduction

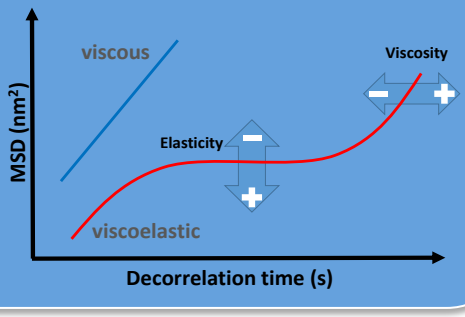
Biopolymers have received much attention in recent years due to their unique rheological properties, their bioavailability, biocompatibility and biodegradability. They can be divided in three main groups.

I. Polysaccharides | II. Proteins | III. Others

For almost every kind of application, a suitable biopolymer can be found. They can be used alone and can show important sensitivity to temperature, pH or salt addition. Some biopolymers show synergistic effects with other biopolymers. They have thickening, viscosifying and gelling effects.
Some do not form gels, whereas others form gels as a function of concentration, temperature, salt or change in pH.
In some cases, the frontier between viscosifying and gelling systems is not so clear, but may be important for the application. This series of application notes show how the Rheolaser MASTER can respond to various challenges in biopolymer characterization.

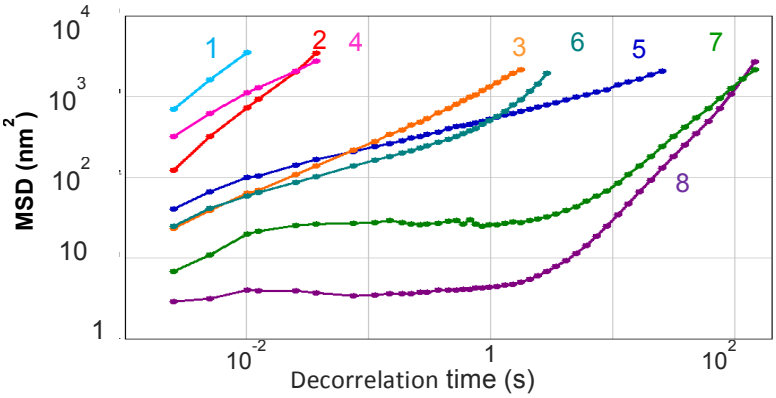
Reminder on the technique

Rheolaser uses multispeckle diffusive wave spectroscopy (MS-DWS).
Laser light is backscattered several times by particles present in the sample. A patented algorithm analyzes the interferences of the backscattered light, in order to get the particles Mean Square Displacement (MSD). Two main signatures of MSD are observed. Purely viscous samples show a linear behaviour, whereas viscoelastic samples show a plateau. The height of the plateau can be linked to the samples elasticity, whereas the macroscopic viscosity depends on the linear increase at longer decorrelation times.



Viscoelastic properties characterization

Figure below shows typical signatures of the MSD curve for different biopolymers.



1 - Xanthan 0.005%
2 - HPMC 2% cold
3 - HEC 0.5%
4 - Xanthan 0.1%
5 - Xanthan 0.5%
6 - HPMC 2% hot
7 - Carrageenan 0.5%
8 - Agar 0.5 %

Figure 1. Typical MSD curves for different biopolymers

Dispersions of 0.005% xanthan, 2% hydroxypropyl methylcellulose and 0.5% hydroxyl ethylcellulose are purely viscous as indicated by the straight lines. However, HEC is the most viscous one. The xanthan 0.1% dispersion is slightly viscoelastic as its bent curve indicates. But its viscosity is much lower as that of the HEC dispersion. The warm 2% HPMC and the 0.5% xanthan dispersion show almost similar elasticity, but the xanthan dispersion is more viscous. 0.5% carrageenan and 0.5% agar solution are way more elastic and viscous that the other samples.