Introduction

The versatility and biophysical similarity of hydrogels to soft tissues make them important materials for tissue engineering, synthetic extracellular matrices, implantable devices, biosensors, etc. 3D-(bio)printing of hydrogels has brought new challenges, as the liquidlike printable material needs to solidify rapidly after printing with or without cells through gelation, coagulation or crosslinking reactions and provide suitable stability and mechanical properties while being biocompatible and biodegradable.

Non-destructive and contactless mechanical testing of gelation kinetics using ElastoSens™ Bio² enables rapid testing of soft hydrogels to ensure the raw material quality and to adjust the formulations, gelation conditions and mechanical properties for desired applications. The instrument also allows monitoring the mechanical changes upon enzymatic or hydrolytic degradation. Examples of both gelation and degradation tests are given below.

Experimental Conditions, Results

A series of solutions was prepared from 1% solution of food-grade agar (pH 7.4). Solutions (40 °C) were injected in the sample cup and gelation was monitored at 25 °C using ElastoSens™ Bio². For degradation tests, acidic 2% solution of chitosan was mixed with TPP gelling agent and injected in the sample cup at 37 °C. The gelation was monitored using ElastoSens™ Bio². After 70 min, an aliquot of either water or papain solution was added, let react for 10 min and removed, after which mechanical monitoring was continued.

On ElastoSens™ Bio²

ElastoSens™ Bio² is a benchtop instrument that measures without contact, non-destructively and in real time the viscoelastic properties of soft gels as function of time or temperature. The patented technology behind the instrument is based on gentle mechanical vibration of sample confined in a sample cup and laser detection of the response. The response is converted into viscoelastic parameters (shear storage and loss moduli).

Advantages of ElastoSens™ Bio²:

• non-destructive and contactless measurements
• removable sample cups: clean, retesting of the same sample possible at any time
• simultaneous testing of 3 samples optional
• fast and easy to use
• affordable

![Fig. 1. Concentration dependence of the gelation of agar solutions at 25 °C upon cooling from 40 °C.](image1)

![Fig. 2. Gelation and enzymatic degradation of 2% chitosan solution at 37 °C.](image2)