

Viscoelastic Behaviour of Hyaluronic Acid Copolymers

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Abstract : The paper is devoted to the behavior of gels based on poly(itaconic anhydride-co-3, 9-divinyl-2, 4, 8, 10-tetraoxaspiro (5.5) undecane) copolymers, with different ratio between the comonomers, and hyaluronic acid (HA). The gel formation was investigated by small-amplitude oscillatory shear measurements following the viscoelastic behavior as a function of gel composition, temperature and shear conditions. Hyaluronic acid was investigated in the same conditions and its rheological behavior is typical to viscous fluids. In the case of the copolymers, the ratio between the two comonomers influences the viscoelastic behavior, a higher content of itaconic anhydride favoring the gel formation. Also, the sol-gel transition was evaluated according to Winter-Chambon criterion that identifies the gelation point when the viscoelastic moduli (G' and G'') behave similarly as a function of oscillation frequency. From rheological measurements, an optimum composition was evidenced for which the system presents a typical gel-like behavior at 37 °C: the elastic modulus is higher than the viscous modulus and they are not dependent on the oscillation frequency. The formation of the 3D macroporous network was also evidenced by FTIR spectra, SEM microscopy and chemical imaging. These hydrogels present a high potential as drug delivery systems.

Keywords : copolymer, viscoelasticity, gelation, 3D network

Conference Title : ICMSEM 2016 : International Conference on Materials Science, Engineering and Manufacturing

Conference Location : Paris, France

Conference Dates : April 25-26, 2016