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Synergistic Behavior of Polymer Mixtures in Designing Hydrogels for Biomedical Applications

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Abstract : Investigation of polymer systems able to change inside of the body into networks represent an attractive approach, especially when there is a minimally invasive and patient friendly administration. Pharmaceutical formulations based on Pluronic F127 [poly (oxyethylene) (PEO) blocks (70%) and poly(oxypropylene) (PPO) blocks (30%)] present an excellent potential as drug delivery systems. The use of Pluronic F127 alone as gel-forming solution is limited by some characteristics, such as poor mechanical properties, short residence time, high permeability, etc. Investigation of the interactions between the natural and synthetic polymers and surfactants in solution is a subject of great interest from both scientific and practical point of view. As for example, formulations based on Pluronics and chitosan could be used to obtain dual phase transition hydrogels responsive to temperature and pH changes. In this study, different materials were prepared by using poly(vinyl alcohol), chitosan solutions mixed with aqueous solutions of Pluronic F127. The rheological properties of different formulations were investigated in temperature sweep experiments as well as at a constant temperature of 37oC for exploring in-situ gel formation in the human body conditions. In addition, some viscometric investigations were carried out in order to understand the interactions which determine the complex behaviour of these systems. Correlation between the thermodynamic and rheological parameters and phase separation phenomena observed for the investigated systems allowed the dissemination the constitutive response of polymeric materials at different external stimuli, such as temperature and pH. The rheological investigation demonstrated that the viscoelastic moduli of the hydrogels can be tuned depending on concentration of different components as well as pH and temperature conditions and cumulative contributions can be obtained.

Keywords : hydrogel, polymer mixture, stimuli responsive, biomedical applications
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