

Upon Poly(2-Hydroxyethyl Methacrylate-Co-3, 9-Divinyl-2, 4, 8, 10-Tetraoxaspiro (5.5) Undecane) as Polymer Matrix Ensuring Intramolecular Strategies for Further Coupling Applications

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Abstract : The interest for studying 'smart' materials is entirely justified and in this context were realized investigations on poly(2-hydroxyethylmethacrylate-co-3, 9-divinyl-2, 4, 8, 10-tetraoxaspiro (5.5) undecane), which is a macromolecular compound with sensibility at pH and temperature, gel formation capacity, binding properties, amphiphilicity, good oxidative and thermal stability. Physico-chemical characteristics in terms of the molecular weight, temperature-sensitive abilities and thermal stability, as well rheological, dielectric and spectroscopic properties were evaluated in correlation with further coupling capabilities. Differential scanning calorimetry investigation indicated T_g at 36.6 °C and a melting point at T_m=72.8°C, for the studied copolymer, and up to 200°C two exothermic processes (at 99.7°C and 148.8°C) were registered with losing weight of about 4 %, respective 19.27%, which indicate just processes of thermal decomposition (and not phenomena of thermal transition) owing to scission of the functional groups and breakage of the macromolecular chains. At the same time, the rheological studies (rotational tests) confirmed the non-Newtonian shear-thinning fluid behavior of the copolymer solution. The dielectric properties of the copolymer have been evaluated in order to investigate the relaxation processes and two relaxation processes under T_g value were registered and attributed to localized motions of polar groups from side chain macromolecules, or parts of them, without disturbing the main chains. According to literature and confirmed as well by our investigations, β-relaxation is assigned with the rotation of the ester side group and the γ-relaxation corresponds to the rotation of hydroxy-methyl side groups. The fluorescence spectroscopy confirmed the copolymer structure, the spiroacetal moiety getting an axial conformation, more stable, with lower energy, able for specific interactions with molecules from environment, phenomena underlined by different shapes of the emission spectra of the copolymer. Also, the copolymer was used as template for indomethacin incorporation as model drug, and the biocompatible character of the complex was confirmed. The release behavior of the bioactive compound was dependent by the copolymer matrix composition, the increasing of 3, 9-divinyl-2, 4, 8, 10-tetraoxaspiro (5.5) undecane comonomer amount attenuating the drug release. At the same time, the in vivo studies did not show significant differences of leucocyte formula elements, GOT, GPT and LDH levels, nor immune parameters (OC, PC, and BC) between control mice group and groups treated just with copolymer samples, with or without drug, data attesting the biocompatibility of the polymer samples. The investigation of the physico-chemical characteristics of poly(2-hydroxyethyl methacrylate-co-3, 9-divinyl-2, 4, 8, 10-tetraoxaspiro (5.5) undecane) in terms of temperature-sensitive abilities, rheological and dielectrical properties, are bringing useful information for further specific use of this polymeric compound.

Keywords : bioapplications, dielectric and spectroscopic properties, dual sensitivity at pH and temperature, smart materials

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