Interconnection between structure and viscoelastic and transport properties of reactive polyelectrolyte hydrogels

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The main aim of this contribution is focused on deep study on finding of mutual interconnection between structure of reactive hydrogels and their viscoelastic and transport properties. Generally hydrogels, as a typical example of non-Newtonian liquids, represent important material either from scientific point of view, as well as from the view of possible applications. Hydrogels based on thermoreversible biopolymer agarose were selected in this work as a representative material for further research. The biggest advantages of the application of agarose hydrogel can be found in its simple and reproducible preparation procedure, which is well-known and described elsewhere [1,2]. Moreover during the preparation of agarose hydrogels different additional solutes/polyelectrolytes can be simply widespread in the sample. This allows easy and fast way how to modify the final properties of studied hydrogels. In experimental part of present work different polyelectrolytes (sodium alginate, hyaluronic acid, kappa-carrageenan, sodium polystyrene sulphate, dextran, chitosan, L-lysine etc.) were selected as proper modifier of agarose hydrogel. The experimental works of present contribution can be separated on the study of two basic phenomena. Firstly, the influence of incorporation of polyelectrolytes on the structure and viscoelastic properties of hydrogels was investigated. For these purposes either the basic methods of hydrogel characterisation (mainly ash content of hydrogels, inner pH etc.) as well as viscoelastic properties measurement (macro and microrheology) were used. The second part of the work was dealing with the deep research on the transport properties of selected solute (Rhodamin 6G) in individual hydrogel samples. Here both methods of diffusion from solution into hydrogel samples (with UV-VIS detection) as well as fluorescence correlation spectroscopy were used [3]. The results of the work are indicating that the polyelectrolytes added into hydrogels at studied concentrations are not significantly influencing the final structure and rheological properties of agarose hydrogels. On the other side the transport and barrier properties of individual agarose hydrogels are significantly affected by polyelectrolyte charge and its charge density. The results of present work in connection with deep meta-analysis of literature can significantly contribute to further applied research and development in the area hydrogels and carrier materials based on different biopolymers and polyelectrolytes complexes.

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