HYBRID HYDROGEL'S NETWORK FORMED BY PHOTOGELATION OF THERMOSENSITIVE MACROMONOMER IN AQUEOUS ENVIRONMENT

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In the presented work, we have studied different parameters affecting hydrogel's hybrid network formation of temperature-sensitive biodegradable PLGA-PEG-PLGA triblock copolymer, generally used as injectable drug delivery system, modified by itaconic acid. Resulting α,ω-itaconyl-PLGA–PEG–PLGA macromonomer having end-caped reactive double bonds can be crosslinked both physically at physiological temperature due to hydrophobic interactions between hydrophobic PLGA ends, and chemically through reactive double bonds. "Flower-like" micelles, formed in aqueous solution at 37 °C, associate double bonds in their middle, which is essential for later chemical crosslinking.

Here, aqueous solutions of α,ω-itaconyl-PLGA–PEG–PLGA macromonomer have been chemically crosslinked by photopolymerization in aqueous environment by visible light at 37 °C in the presence of very efficient water soluble photoinitiator lithium phenyl-2,4,6-trimethylbenzoylphosphinate (LiTPO). Photorheology as a powerful tool for the direct monitoring of the network formation was used to investigate mechanical properties during the irradiation.

It was discovered that the addition of LiTPO increases the pH of aqueous solutions resulting in higher amount of deprotonated carboxylic groups. Repulsive force between negative charges leads to the micelle destruction, when the certain concentration of LiTPO is exceeded. Nevertheless, at higher temperatures micelle structure can be again recovered due to hydrophobic interactions. It was found, that LiTPO shifts the region of gel stability to higher temperatures. Therefore, at 25 °C the best mechanical properties were achieved with the addition 0.1 wt. % of LiTPO while 3 wt. % concentration did not lead to any chemical crosslinking. However, 0.5 wt. % and 1 wt. % of LiTPO lead to good mechanical properties at 37 °C.

Novel hybrid network hydrogels might be used in medicine as injectable carriers or wound healing coverings with long-term controlled release of hydrophobic drugs.

This research was supported financially by the Ministry of Education, Youth and Sports of the Czech Republic under the CEITEC 2020 project (NPUII LQ1601) and by the Austrian Research Promotion Agengy (FFG, project „Hydroceram", number 849787).