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M. Schweitzer
JGU, Chemistry

Supramolecular Self-Assembly and Hydrogelation of Multidomain Polymer-Peptide Conjugates

Synthetic hydrogels have sparked high interest in recent years as matrix materials for biotechnological applications. In supramolecular hydrogels the three-dimensional gel network is formed by non-covalent interactions between small molecules. These can be influenced and selectively switched on and off by external stimuli. Telechelic polymer-peptide conjugates using the basic amino acid histidine in a hydrophobic phenylalanine (F)-histidine (H) pentapeptide sequence FHFHF have previously been reported to promote pH-switchable self-assembly into one-dimensional nanorods by β-sheet formation. When encoding for assembly into parallel β-sheets these structures have also shown interstrand cross-linking, leading to the formation of hydrogels. Furthermore, ROS-responsiveness can be achieved by altering the peptide sequence to incorporate methionine. The use of polymer-peptide conjugates combines the advantages of synthetic polymers like the easy scalability with the defined amino acid sequence and the resulting high structural definition of peptides.
In this work we report the synthesis of telechelic poly(ethylene glycol)-peptide conjugates and their ability to form multistimuli-responsive hydrogels. The terminal peptide blocks contain the hydrophobic pentapeptide sequence FHFHF to promote pH-switchable β-sheet formation and self-assembly into nanorods as well as interstrand cross-linking for hydrogelation. The conjugates were characterized by NMR and GPC and the pH-switchable self-assembly and formation of nanorods was confirmed via CD-sp[illegible] and transmission electron microscopy. Rheological measure[illegible] hydrogels at physiologically relevant conditions showed respons[illegible] pH-value and temperature.

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