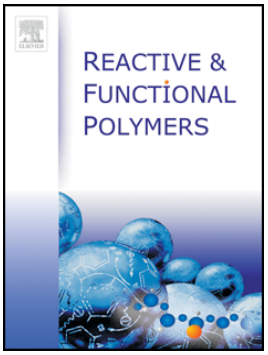

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Self-assembled spin-labeled nanoparticles based on poly(amino acids)

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Abstract

The development of detectable nanoparticles for controlled drug delivery systems has tremendous practical importance regarding the monitoring of drug pathway in organism. Self-assembly amphiphilic block-copolymer poly(*L*-glutamic acid)-*b*-poly(L-phenylalanine) (pGlu-*b*-pPhe) was chosen for the preparation of discussed nanoparticles. The synthesis of blocks was carried out using ring-opening polymerization (ROP) of *N*-carboxyanhydrides of mentioned amino acids. To introduce the spin label at C-terminal position of hydrophilic block, (4-amino-2,2,6,6-tetramethylpiperidin-1-yl)oxyl (4-amino-TEMPO) was applied as ROP initiator and the polymerization of hydrophobic block was carried out with previously synthesized macroinitiator. The results obtained by transmission electron microscopy clearly showed that TEMPO-pGlu-*b*-pPhe polymer was really capable to self-assembling in aqueous solutions followed by polymersomes formation. The mean size of nanoparticles was increased in a range TEMPO-pGlu$_{\mathbf{43}}$-*b*-pPhe$_{\mathbf{12}}$ < TEMPO-pGlu$_{\mathbf{43}}$-*b*-pPhe$_{\mathbf{29}}$ < TEMPO-pGlu$_{43}$-*b*-pPhe$_{\mathbf{49}}$ as 60 < 200 < 280 nm, respectively. EPR spectroscopy of the solutions of spin-labeled homopolymer TEMPO-p-γ-Glu(Bzl), block copolymers TEMPO-p-γ-Glu(Bzl)-*b*-pPhe and suspension of polymersomes formed from TEMPO-p-Glu-*b*-pPhe was performed and the results were compared. It was proved that in the case of nanoparticles EPR detectable spin labels are located on polymersome surface. The experiments in cell culture demonstrated the absence of cytotoxity of labeled nanoparticles. Additionally, it was shown that TEMPO-label can be detected inside the cell by EPR method.

Keywords: poly(amino acids); spin label; polymersomes; ring-opening polymerization of N-carboxyanhydrides.