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Electron Spin Resonance Study of PMNT-PEG-PMNT Triblock Copolymer and Flower Type Micelles

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Extended Abstract

The paper presents the electron spin resonance (ESR) measurements of nitroxide radical-containing PMNT-PEG-PMNT triblock copolymer and flower type micelles in acidic and close to neutral pH.

Nanospheric particles drug carriers are the popular area of research in the biomedical field. Due to rapid recognition by the reticuloendothelial system (RES) and hepatic and/or kidney clearance of conventional drugs, new highly efficient and site-specific drug delivery systems are still in demand. A polymeric micelle is a macromolecular assembly that forms from synthetic block copolymers or graft copolymers. It has a spherical inner core and an outer shell. Most based on micelle drug carriers have been studied with AB- or ABA-type block copolymers. Such carrier consists of an outer corona formed by hydrophilic blocks extending into the aqueous solution and a core formed by the hydrophobic segments. Usually, PEG (poly(ethylene glycol)) is the hydrophilic block, because of its good biocompatibility and stability that minimize undesirable interactions with cellular components and serum proteins. Since reactive oxygen species (ROS) and oxidative stress play an important role in the development of chronic and degenerative diseases such as cancer, autoimmune, cardiovascular, neurodegenerative disorders or arthritis, the polymeric micelles utilizing ROS scavenging properties have gained researchers attention.

The EPR measurements were carried out using X-band (9, 4 GH) Bruker EPR/ENDOR EMX-10 spectrometer. The EPR spectra were recorded in the temperature range from 120K to 290K. One can observe three narrow lines coming from free radical TEMPO as a result of the interaction of an unpaired electron with the 14N nuclei (I=1). In some spectra only one line is visible what is the result of dipole-dipole and exchange interactions.

Temperature dependence of electron spin resonance spectra were measured for each probe and several spectroscopic parameters describing physical properties, such as g-spectroscopic splitting factor value, resonance field (H_r), peak-to-peak line width (ΔH_{pp}) and correlation time (τ) were calculated and discussed. For the determination of the parameters characterizing the dynamics of TEMPO radicals in complex spectra the computer resolution enhancement method (CREM) and EasySpin software for ESR spectra simulations were used.

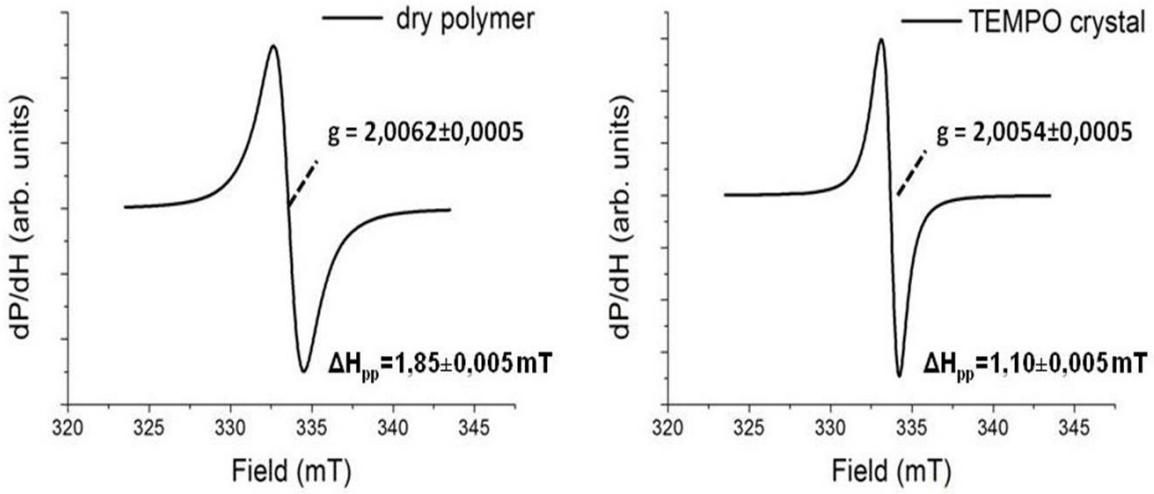

Fig. 1. ESR signals of dry polymer and TEMPO crystal at room temperature.

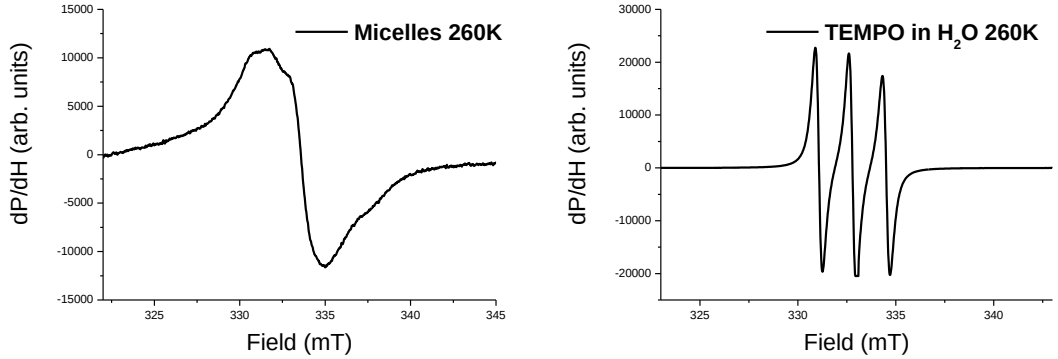

Fig. 2. ESR signals of micelles and TEMPO at 260K.

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