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Measurements of the Dynamics of Nanoparticles in Different Solvents by EPR Method

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Extended Abstract

Nanoparticles have many potential biomedical applications including drugs transport or magnetic resonance imaging contrast enhancement. One of the current problem to solve is to design nanosystem for delivery of therapeutic agents specifically to the site of inflammation in rheumatoid arthritis avoiding potential systemic and off-target unwanted effects.

The paper presents the results of electron paramagnetic resonance (EPR) of redox-active PMNT-PEG-PMNT polymer nanoparticles in different solvents (chloroform, DMF, water).

Nitroxide radical-containing antioxidant injectable hydrogel (RIG) system have been developed. Poly[4-(2,2,6,6-tetramethylpiperidine-N-oxyl)aminomethyl-styrene]-b-poly(ethylene glycol)-b-poly[4-(2,2,6,6-tetramethylpiperidine-N-oxyl)aminomethyl-styrene] (PMNT-PEG-PMNT) triblock copolymer possessing ROS scavenging TEMPO moieties as side chains of PMNT segment has been synthesized. Along with anionic poly(acrylic acid), it forms polyion complexes to become flower type micelle (ca. 79 nm), with nanoreservoir core for charged drugs. It can be further injected as mildly viscous solution, exhibiting in situ thermo-irreversible gelation under physiological condition, leading to long term retention of drug at local site.

The EPR measurements were carried out using X-band (9,4 GH) Bruker EPR/ENDOR EMX-10 spectrometer. The EPR spectra were recorded at 77K temperature and in the range from 120K to 290K. One can observe three narrow lines coming from TEMPO (Figure 1) 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. The typical spectroscopic parameters like g-factor, line width (Figure 2) and correlation time have been calculated. The results are shown in the graphs as a function of temperature.

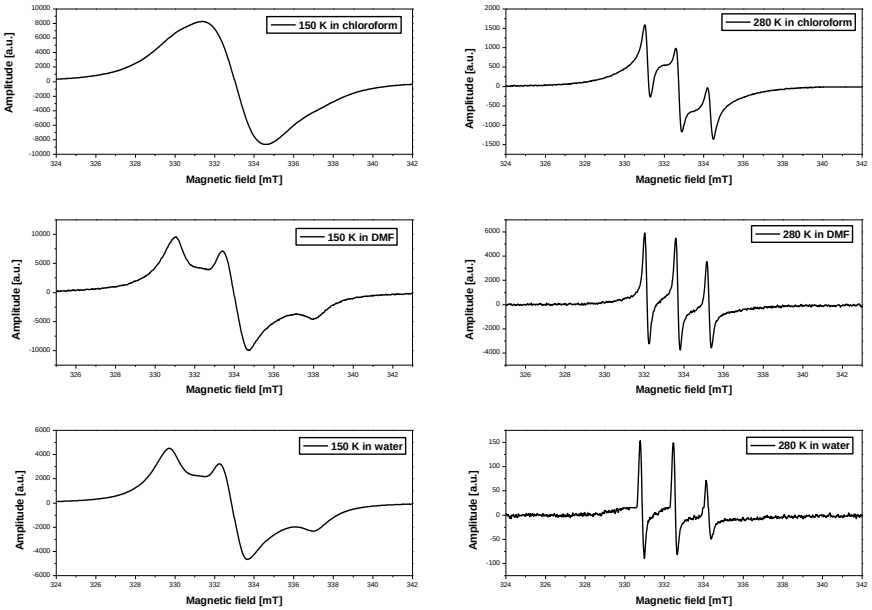

Fig. 1. EPR spectra of investigated nanoparticles diluted in different solvents and recorded at 150K and 280K temperature.

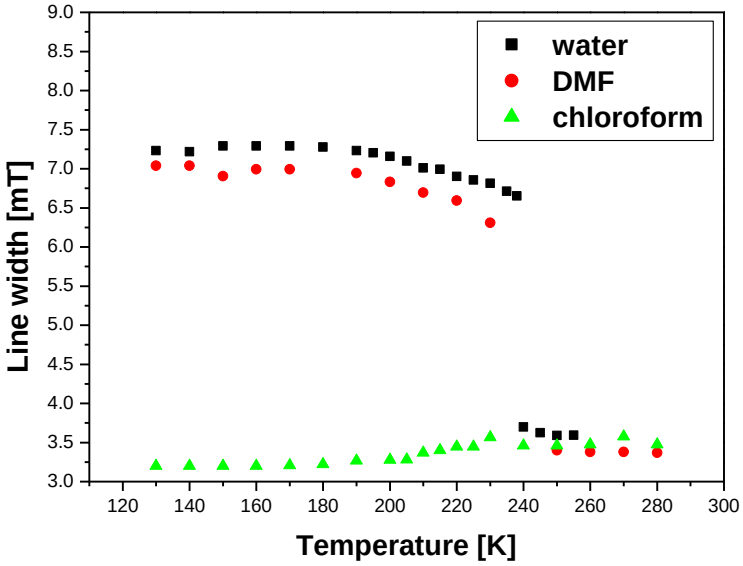

Fig. 2. Changes of line width versus temperature for investigated nanoparticles diluted in different solvents.