3. NANOBIOLOGY

3.2. Biophysics

2.3.2.1. Structural and magnetic properties of ailver oleic acid multifunctional nanohybrids. /S. Khutsishvili, P. Toidze, M. Donadze, M. Gabrichidze, T. Agladze, N. Makhaldiani/. Annals of Agrarian Science. – 2019. – vol. 17. – #2. – pp. 242-250. – eng.; abs.: eng.

Sols of core-shell silver NPs are synthesized by an electrochemical method. The method provides for the ability to adjust the particle size by changing both the concentration of oleic acid and the residence time W_0 in the organic phase. We synthesized silver nanoparticles with oleic acid concentration of 0.25% (Ag&0.25%OA) and 0.75% (Ag&0.75%OA). The silver nanoparticles have been studied using modern physical–chemical methods: Transmission Electron Microscopy (TEM); Fourier Transform Infrared Spectroscopy (FT-IR); Dynamic Light Scattering (DLS); Thermogravimetric and Differential Thermal Analysis (TGA and DTA); Electron Paramagnetic Resonance (EPR). DTA curves indicate the chemical nature of bond ligand in the secondary shell. This conclusion is supported by quantum chemical simulation using the quantum-chemical software HyperChem-8 and semi-empirical calculation method ZINDO. In the EPR spectra of silver-containing sols Ag&0.25%OA and Ag&0.75%OA a complex wide asymmetric signal with several resonant lines is recorded, which is consistent with a wide-size distribution of nanoparticles. It is important to note that a change in the oleic acid layers of the nanoparticles seems to affect the dimension of the nanocrystallites that are being formed. The presence of the FMR resonance line in Ag&0.75%OA may indicate the presence of Ag-cubic cells in nanoparticles with internal magnetic fields significantly larger than the Zeeman field, the available EPR in the X-band range. Fig. 5, Tab. 2, Ref. 30.

Keywords: Core-shell, nanoparticles, oleic acid, ligand, charge, activation energy

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3.3. Biochemistry

2.3.3.1. Revealing a Nonergodic Mechanistic Pattern for Electron Exchange between Azurin and Electrodes Coated by Nanofilms under the Glassy Environmental Conditions. /T. Dolidze, R. van Eldik, D. Khoshtariya/. Bulletin of the Georgian National Academy of Sciences. – 2019. – vol. 13. – #4. – pp. 97-103. – eng.; abs.: eng., geo.

Fast-scan protein-film voltammetry was applied to explore interfacial biomimetic electron exchange under the environmental glass forming conditions. Gold electrodes were coated with 1-pentanethiol SAM–azurin (Az, blue cupredoxin) assemblies and placed in contact with a water-doped and buffered protic ionic melts of choline dihydrogen phosphate ([ch][dhp]), served as electrolyte media, allowing for a necessary cell conductivity under the virtually solid, semi-solid and liquid electrolyte conditions over 273–353 K, within which the electron exchange rate was studied as a function of the water amount and temperature. Exposure of the Az films to the semi-solid electrolyte greatly affected the protein's conformational dynamics, hence the ET rate, via the mechanism occurring in the extra complicated dynamically-controlled regime. Results are compared to the earlier studies on the reference system with a conventional electrolyte, allowing for the disclosure of mutually-entangled mechanistic motifs. Under the "standard" condition (with no [ch][dhp] added), the Az biomolecule may reside in an apparently ergodic state, whereas upon adding of [ch][dhp] to allow water content ranging between 6 to 15 waters per [ch][dhp], system displays anomalous temperature dependences, suggesting that the reactive system crosses a broad, well-manifested nonergodic zone which arises from the continuous interplay (freezing/unfreezing) of ET-coupled highly cooperative conformational modes of the Az protein, inherently linked to the electrolyte's slowest collective relaxation(s). Above this [ch][dhp] concentration, allowing the water content between 1.65 to 3.7 waters per ion pair, the system returns to a series of new, quasi-ergodic states, with each displaying virtually linear Arrhenius patterns yet with distinct parameters. Fig. 2, Tab. 3, Ref. 22.

Keywords: redox protein, electron exchange, interphase, self-assembly, nonergodicity

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2.3.3.2. A new generation of biocompatible nanoparticles made of resorbable poly(ester amide)s. /T. Kantaria, T. Kantaria, G. Titvinidze, S. Kobauri, M. Ksovreli, T. Kachlishvili, N. Kulikova, D. Tugushi and R. Katsarava/. Annals of Agrarian Science. – 2019. – vol. 17. – #1. – pp. 49-58. – eng.; abs.: eng.

A new generation of resorbable nanoparticles (NPs) were prepared on the basis of amino acid-based biodegradable (AABB) poly (ester amide)s (PEAs) for drug delivery application. The NPs were fabricated by cost-effective polymer deposition/solvent displacement (nanoprecipitation) method on the basis of three different AABB PEAs recently developed by our group: (i) PEA composed of amino acid leucine as a basic component, (ii) cationic PEA composed of amino acid arginine for imparting positive charge, and (iii)

functional PEA composed of amino acid leucine and lateral poly(ethylene glycol) groups acting as surfactant as well as PEGylating agent. The mean particle diameter (MPD), polydispersity index (PDI) and zeta-potential (ZP) were determined by Dynamic Light Scattering (DLS). Moreover, the stability (resuspendability) of the NPs over time at low temperature was investigated. The NPs were studied for *in vitro* cell compatibility using four different stable cell lines: A549 (human), U937 (human), RAW264.7 (murine), Hepa 1-6 (murine). The produced nanoparticles exhibit high stability and cell compatibility and have potential for the application as drug delivery devices. Fig. 2, Ref. 37.

Keywords: Biodegradable polymers; nanoprecipitation; nanoparticles; biodegradable surfactant; PEGylation; *in vitro* cell compatibility

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