

The effect of interactions of the silver nanoparticles with the thiol groups presented in the protein surface. Example of the EMAP II polypeptide

P-02-008

L. Kolomijets¹, P. Szczerba¹, I. Zhukov¹, W. Bal¹

¹Institute of Biochemistry and Biophysics, Polish Academy of Science, Warsaw, Poland

Metal nanoparticles (NPs) are promising agents for biomedical applications, specifically for diagnostic and therapeutic purposes. Silver NPs (AgNPs) are frequently used as active components of antibacterial coatings in wound dressings, medical devices, implants, cosmetics, textiles, and food packaging. Nevertheless, since Ag⁺ ions form potent bonds with thiol groups in proteins, applying AgNPs may harm human health.

Endothelial monocyte-activating polypeptide II (EMAP II) is a cleaved C-terminal peptide of the intracellular aminoacyl-tRNA synthetase complex protein AIMP1. EMAP II, expressed in endothelial cells, plays an important role in cancer, diabetes, atherosclerosis, chronic myocardial infarction, and lung injury. EMAP II contains five cysteine residues (Cys) exposed at its surface. Due to a high affinity of Ag⁺ ions to Cys thiol groups, the binding of some or all of these thiols to Ag⁺ ions present at the surface of AgNPs or released from it due to the oxidative metabolism of the cell could cause the inactivation of EMAP II.

Our studies aim to explore the relationship between EMAP II and AgNPs using UV-vis, fluorescence, and thermophoresis techniques. To further explore the structural and dynamic aspects of the EMAP II interaction with AgNPs, we also recorded NMR data for the ¹H, ¹⁵N, and ¹⁹F resonances. The obtained results demonstrated the existence of dimerization/oligomerization processes that block the EMAP II active site(s) due to significant alterations of the 3D structure upon saturation with the AgNPs.

Acknowledgment: This project was supported by EMBO Solidarity Grant SLG 5427-2023 (for L.K.), 2021/41/B/ST4/03807 National Centre for Science, Poland (for I.Z.), and 2021/43/O/ST4/02667 National Centre for Science, Poland (for P.S., W.B.)