Description for the general public

The World Health Organization categorizes mercury as one of the top ten most dangerous chemicals threatening public health. The most common forms of mercury to which the society is exposed, are methylmercury (MetHg) and inorganic mercury (Hg II). The process of transformation of HgII into MetHg takes place in the aquatic environment, where its accumulation in the seafood occurs. Another organic compound of mercury is thiomersal, which is used as preservative in ophthalmic drugs, certain ointments, cosmetic products and vaccines. According to U.S. Food and Drug Administration, mercury compounds are easily absorbed through the skin and tend to accumulate in the body, can cause allergic reactions, skin irritation or neuro- and immunodegeneration symptoms.

Selenium, trace element essential in human body, plays an important role in antioxidant pathways. It is characterized by an effective binding of mercury compounds. Thus, it is widely used as a medical remedy in the mercury neutralization process in human body. Selenium nanoparticles (SeNPs), due to their lower toxicity and higher bioavailability compared to other forms of selenium, have a high bioapplicability potential as a new type of mercury antagonist. Most studies of SeNPS to date have focused on their chemopreventive properties. According to our best knowledge, there have been no papers describing the affinity and neutralization of mercury by SeNPs in biological systems.

The subject of our project is the biological synthesis of SeNPs, their characterization with the use of electron microscopy techniques and UV-Vis spectrophotometry, and their application in the process of effective detoxification of different forms of mercury in simulant fluids. In order to determine the safeness of SeNPs usage as a medical remedy, both cytotoxicity assay and simulation of the transport of SeNPs in the blood system using human serum albumin will be conducted. The undoubtedly novel element, apart from the applications of SeNPs as mercury antagonist in human body, will be the design and optimization of analytical procedures covering the effective separation of SeNP-Hg, SeNP-MetHg, SeNP-thiomersal, SeNP-albumin complexes, concurrently with determination of selenium and mercury concentrations by microwave-induced plasma optical emission spectrometry using a minispectrometer equipped with a CCD detector. In order to improve the sensitivity of the proposed method, the determination will be preceded by separation and preconcentration of the analytes by solid phase microextraction (SPME) and chemical or photochemical vapor generation. These analytical techniques do not require high-cost equipment, which definitely improves their competitiveness.

These experimental studies bring together the knowledge from four areas of science: nanotechnology, biology, chemistry and medicine that enhances the impact of the project. Also, it should give the answer on the safety of using SeNPs as a medical remedy for the population exposed to mercury poisoning. The prospect of using SeNPs as a potential mercury antagonists in the human body comes from its proven ability to absorb inorganic mercury in environmental samples. The proposed research project will answer the questions about the applicability of SeNPs in the process of mercury neutralization in biological systems.

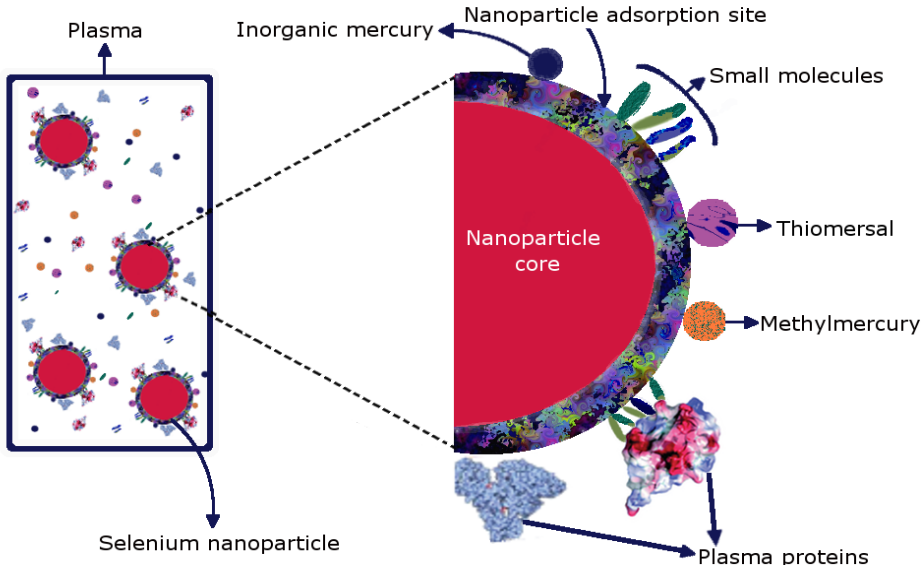

Fig. 1 The scheme of interactions SeNPs with plasma proteins and different chemical forms of mercury