Scientists find way to cut nanoparticle toxicity levels

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Bioengineers and biophysicists from the National Research Nuclear University MEPhI, the Sechenov First Moscow State Medical University, the Universite de Reims Champagne-Ardenne in France, and the University of Tubingen in Germany have discovered that the toxicity of nanoparticles depends more on their size and the extent to which their surface area is charged than on their chemical composition.

"The problem of nanotoxicity became particularly relevant in connection with the prospects of using nanocrystals in medicine as an element for diagnostics and in therapeutic nanosystems," Igor Nabiev, study co-author and Professor at the University of Reims Champagne-Ardenne explained.

"We have managed to solve the problem of controlling the toxicity of nanocrystals, which allows us to either increase or practically eliminate the nanotoxicity of particles of an extremely diverse nature, regardless of their chemical composition," the scientist added.

According to Professor Nabiev, one of the major possible reasons for the molecular toxicity of nanoparticles is their interaction with proteins in the body, which in turn leads to changes in their biological composition.

These changes lead to the disruption of the protein 's function as a hormone or enzyme, sparking an autoimmune reaction, with the body fighting the altered proteins as if they were an intruding organism, and protein aggregates forming as fibrils and plaques, which are thought to cause neurodegenerative diseases such as Alzheimers and Parkinson's.

Accordingly, by altering the size and surface charge of nanoparticles, as the scientists' study suggests, their toxicity can also be altered.

Researchers say their findings help expand our understanding about the nature of nanotoxicity, and opens up the prospect of creating a new generation of pharmaceuticals capable of destroying the harmful fibrils and protein plaques.

More information: Alyona Sukhanova et al. Nanoparticles With a Specific Size and Surface Charge Promote Disruption of the Secondary Structure and Amyloid-Like Fibrillation of Human Insulin Under Physiological Conditions, *Frontiers in Chemistry* (2019). DOI: 10.3389/fchem.2019.00480

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