

## ABSTRACT

Nanotechnology is one of the fastest developing fields of science and technology, nowadays. Nanomaterials (NM), including nanoparticles (NPs), are widely used in industry, while their ability to cross blood-brain barrier (BBB) makes NPs an attractive tool for medical diagnosis and treatment of diseases, including Alzheimer's disease (AD). AD is one of the most prevalent neurodegenerative disorder in the world. A characteristic feature of this disease is the presence of the so-called senile plaques that are extracellular aggregates of the amyloid- $\beta$  peptide ( $A\beta$ ) in the brain. According to scientific literature, NPs are able to bind of monomeric  $A\beta$ -peptide that may inhibit its aggregation or dissolve aggregates that are already formed.

The  $A\beta$  aggregates can be removed from the brain by microglial cells through a receptors dependent phagocytosis. The contribution of microglia to brain clearing from this toxic protein has been well documented and is widely described in literature. Because NPs also interact with the cell surface membrane, it seems likely that they can affect the  $A\beta$  uptake. Therefore, the present study I investigated the effect of three types of NPs: AgNPs,  $CeO_2$ NPs and CdTeQDs on phagocytosis of  $A\beta$  by microglial cells (BV-2 murine cell line). Additionally, the toxicity of the tested NPs and their ability to activate of microglia were analyzed.

My investigation revealed that AgNPs and  $CeO_2$ NPs significantly inhibit  $A\beta$  uptake *in vitro*. Moreover, CdTeQDs significantly affected expression of *Cd36* and *Cd33*, genes associated with uptake and generation of inflammatory process occurring in the pathology of Alzheimer's disease. Evaluation of cytotoxicity has shown that  $CeO_2$ NPs have no negative effect on microglia viability, metabolic activity and do not induce apoptosis. On the other hand, exposure to AgNPs and CdTeQDs leads to a decrease in cell growth rate, metabolic activity and S phase arrest (AgNPs) or G1 (CdTeQDs). However, no effect of AgNPs and CdTeQDs on the secretion of proinflammatory cytokines (IL-1 $\beta$ , IL-6, TNF $\alpha$  and IFN $\gamma$ ) has been demonstrated. It should be emphasized, that potentially non-toxic  $CeO_2$ NPs induced the secretion of TNF $\alpha$  proinflammatory cytokine.

In the light of the results, it can be concluded that the tested NPs show adverse effects on the functions of microglial cells, while by limiting of amyloid- $\beta$  uptake may lead to disturbance of the brain clearing process from this toxic peptide.

Katarzyna  
Sikorska