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Effect of copper oxide Nanoparticles on Human Amyloid beta 1-42 peptide aggregation – a Preliminary Studies

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An undoubted challenge for modern biological physics, nanotechnology and medicine is to understand the mechanisms of the development of neurodegenerative diseases on the molecular level and to develop effective diagnostic methods and treatments. There is a chance that understanding the etiology of these diseases would provide opportunities to find a therapy that would effectively cure or even prevent the emergence of diseases. There are some premises [1,2] which suggest that some of the metal ions may influence the process of amyloid beta peptide (Aβ) oligomerization and fibrillization, which are thought to be responsible for the development of Alzheimer's disease. Disturbance of the zinc, iron and copper cations homeostasis was observed in the brain of Alzheimer's disease patients [3,4]. For this reasons it is important to investigate how the metal and metal oxide nanoparticles may influence the aggregation process of Aβ peptide. It is also interesting to compare how the size, shape and charge on the surface of nanoparticles affect the behavior of the Aβ peptide. First part of the studies included synthesis of copper oxide nanoparticles according to the published protocols [5]. Those nanoparticles were characterized using microscopic and spectroscopic techniques. UV-Vis spectroscopy confirmed the presence of plasmon resonance peak at around 250 nm, characteristic for copper oxide (II). The crystalline nature of CuO NPs was verified by the powder X-ray diffraction. Structural studies were conducted using atomic force microscopy and the average hydrodynamic size of the nanoparticles was measured by dynamic light scattering technique. The changes¬ in Aβ peptides structure in the presence of copper (II) oxide nanoparticles was monitored by the circular dichroism spectroscopy. Preliminary studies of the impact of copper oxide (II) nanoparticles of various size on human Aβ 1-42 peptides aggregation were carried out using thioflavin T fluorescence assay (see Figure 1).

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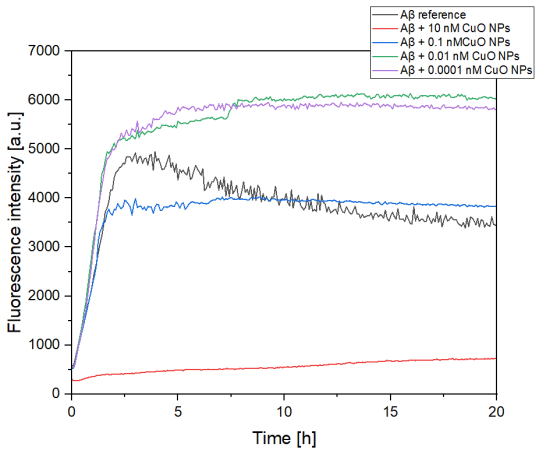

Figure 1. Thioflavin T fluorescence assay of amyloid beta 1-42 peptides in the presence of copper oxide nanoparticles