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Impact of different type of surfactants on molecular mechanisms of amyloid β-peptide aggregation

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One of the most common neurodegenerative disorder is Alzheimer's disease. It is estimated that in 2050 at least 1.25 % of population might have Alzheimer's disease [1]. It is supposed that the most critical changes relevant for the progress of this disease are related to development and deposition of amyloid plaque whose main components are amyloid β-peptides (Aβ) [2]. An innovative research approach is an attempt to create a prototype of medical nanosystem, which supports breaking process of formed fibrils into soluble forms.

The aim of our study was characterization of the structure and conformational changes of β-amyloid peptides in the presence of a several different surfactants. In our work we selected two groups of surfactants (dicationic and zwitterionic) and different types of β-amyloid peptides. The effect of surfactant concentration was tested on 1-42 Aβ peptide and its several shorter variants (N-terminal with hydrophilic properties and hydrophobic C-terminal fragment).

Analysis of the secondary structure of Aβ peptide in different concentrations of surfactants was carried out using FTIR spectroscopy (Bruker, Tensor 27 spectrometer) and circular dichroism (Jasco, J-815 spectropolarimeter) methods. The kinetic study of the aggregation behavior of different peptides in solution was also undertaken. The kinetics of aggregation processes of the peptides and formation of plaques was studied using fluorescence spectroscopy (Jasco, FP-6300 spectrofluorimeter) and Thioflavin T assay. The size distribution of aggregates of Aβ peptide was evaluated on the basis of gel electrophoresis.

Results of our study showed different impact of surfactants studied on the conformations of beta-amyloid peptides. A series of the small angle scattering of X-ray measurements using the synchrotron radiation (SR-SAXS) were performed for selected solutions of tested surfactants. The SAXS data for these surfactants were collected on P12 beam line of EMBL Hamburg Outstation on PETRA III storage ring at DESY. Preliminary examination of the cytotoxicity of selected surfactants on HeLa and fibroblasts cells was conducted in order to verify their suitability for therapeutic purposes.

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