Interaction between PEG-PACA nanoparticles and amyloid peptide highlighted by Capillary Electrophoresis.

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Alzheimer’s disease (AD) is a neurodegenerative disorder characterized by progressive loss of cognitive functions and specific pathological changes in the brain: the formation of extracellular β-amyloid (Aβ) peptide aggregates (or fibrillar plaques) and tangles of hyperphosphorylated Tau protein inside neurons. Aβ peptide aggregates are widely regarded as the main cause of neuronal cell degeneration and oligomeric forms are considered as neurotoxic.

By adapting a methodology published by Sabella et al in 2004, we propose here a capillary electrophoresis method able to monitor the different states (monomeric and oligomer species) of an in vitro aggregation process of the Aβ amyloid 1-42 as a function of time. The ability of nanoparticles (NPs) to slow down or disrupt the aggregation has been investigated through kinetic studies performed on mixtures containing the Aβ 1-42 peptide and biodegradable NP generally developed for drug delivery in the field of therapeutic strategies for cancer treatment. The investigated PEGylated Poly Hexadecylcyanoacrylate NPs have not only a relatively high in vivo long circulation in blood but also the ability to overpass the Blood Brain Barrier (Calvo et al. 2001, Brigger et al. 2002).

Assignment of the peaks in the CE profile was achieved by performing the same kind of experiments but on a CE-LIF system and using synthesized rhodamine-tagged nanoparticles (Brambilla et al. 2009) or FITC labeled Aβ amyloid. Surface Plasmon Resonance was used to check the affinity between PEG-PHDCA NPs and Aβ peptide 1-42 while confocal microscopy clearly confirmed the accumulation/aggregation of the peptide onto the NPs surface and the formation of Aβ 1-42 coated NPs- with various sizes depending on the peptide concentration.

Finally all these experiments clearly demonstrated the ability of our NPs to link the Aβ peptides. This interesting property could prevent or slow down the formation of Aβ toxic oligomers or aggregates under physiological conditions. This finding opens the route to new therapeutic options based on nanotechnologies in the field of Alzheimer’s disease.


