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Influence of microfluidic flow on amyloid aggregation of hen egg white lysozyme

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Amyloid aggregation (AA) is a specific type of protein aggregation responsible for numerous serious human diseases, such as Alzheimer disease, Parkinson disease, type II diabetes, liver cirrhosis. Despite a vast number of scientific groups has been attempting to understand processes underlying AA, the exact molecular mechanism has still not been deciphered. This knowledge on AA would make seeking for therapeutic solutions much more efficient. As many different amyloid-prone proteins misfold in a similar way, there is a chance of finding one medicine for a few different diseases. AA research is not only focused on dealing with AA mechanism, but also on a quest for substances that could hamper AA aggregation, as there is a hope of finding a medicine among them.

There has been an increased interest in using microfluidics – a branch of technology and science that makes use of microchips – devices enabling flow of samples in channels of small cross-sections – in studying amyloidogenesis process. Microfluidics helped to overcome limitations of or enhance potential of traditional, 'bulk' methods. For example, there have been reported: ability to detect single nucleation sites of amyloidogenesis and trace its propagation in time, determination how flow rate of sample flowing in a chip can influence the morphology of amyloid aggregates or rapid profiling of specific proteins in bodily fluids. Some groups used microfluidics to mimic *in vivo*-like conditions, by testing the effect of confinement and flow on AA, but very few studied how long circulation in a chip – similar to this taking place in blood vessels – can itself influence amyloidogenesis.

Here we mounted a microfluidic system to study the effect of long circulation on AA. We chose hen egg white lysozyme (HEWL) to study these phenomena. HEWL is a well-studied model protein, amyloid-prone, comprising 129 amino acids, taking part in bacteria lysis. It is an alpha helix-rich protein. We also used gemini surfactants in our study to seek substances effectively influencing AA. Gemini surfactants' molecules consist of two polar heads with attached hydrophobic tails and a linker between the heads. They exhibit quite unusual properties as in comparison to their conventional (monomeric) surfactants they have higher surface activity, better solubility or lower critical micellization concentration and are a promising group of surfactants. The microfluidic system used in our research is not commonly used; microfluidic chips are rather utilised as mixing, droplet forming or single flow stages. The main goal of our research is to contribute to understanding of AA mechanism by revealing the role of shear forces occurring in microfluidic flow on AA.

The results of measurements carried out in this project, including SAXS data, will be presented on the conference.

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