SCALING CHARACTERISTICS OF BIOMOLECULAR AGGREGATES AND BIOCONJUGATES VIA ASSYMMETRIC FLOW FIELD FLOW FRACTIONATION

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ABSTRACT

Tailored nanostructured biomolecular and biohybrid materials gained rising attention over the past decades due to their potentially extraordinary and synergetic properties and functions. One example are dendritic glycopolymers, in which combination of dendritic branching and sugar units enables improvement of a number of physiologically relevant properties. The combination of these synthetic structures with natural components allows an applicability going far beyond the biomedical field including such diverse matters as bio-sensors, artificial enzymes, light harvesting systems, photonics and nanoelectronic devices. Thus, the formation of higher order molecularly organized structures has been explored widely, in particular to gain more control over shape, size and function.

In our study artificial supramolecular structures of dendronized glycopolymers as well as glycodendrimers were investigated. On the one hand, for dendronized polymers with huge molecular sizes and number of functional groups pH-sensitive aggregation was observed. The molecular shape as well as the aggregate formation can be triggered via pH, concentration and dendron generation number.

On the other hand, the biohybrid formation between biotynilated glycodendrimers and avidin were in the focus of our investigations. These structures possess great potential in applications as drug-delivery systems, polymeric therapeutics and polymer-protein-conjugates. The strong, non-covalent biotin-avidin interaction leads to formation of supramolecular nanostructures.

In both cases information on the distribution of the molecular assemblies and their scaling characteristics is of immense importance in order to adjust their properties for further bio-applications. Due to a number of advantages we chose the Assymmetric Flow Field Flow Fractionation (AF4) for the separation and detailed characterization of these broadly distributed nanostructures. A combination with static light scattering and calculation of the hydrodynamic radii gave essential information on the geometry of these structures. Complementary techniques as dynamic light scattering and microscopy were applied to evaluate these results.