Nanoarchitectonics in aqueous media containing antennary oligopeptides: general trends and specific phenomena

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The general nanoarchitectonic trend in aqueous media is based on the concept that structure-property relationships of certain molecules may result in the initial onset of nanostructural units, which act further on as building blocks of larger, usually well-ordered, nano-objects. This quasi-equilibrium (self-assembling) tendency is strongly dependent on the specific composition, and on the fine-tuning of the conditions in the solution formulation.

Recent investigations on specific self-assembling phenomena in aqueous solutions of non-toxic and biocompatible antennary oligopeptides (with two, three and four antennae) will be presented [1-3]. The key nanotectonic trend in these systems is initiated by hydrogen-bonding interactions which promote molecular recognition propensities, involving the onset of Polyglycine-II non-canonical architecture portions. The presence of a central connecting element, in combination with peptide antennae of optimal lengths, has a profound effect on the structure and properties of the aqueous formulations. Specific intra-molecular interactions are promoted among the antennae, attached to the central portion of the molecule, thus altering the original molecular conformation. Consequently, auxiliary inter-molecular options for further self-assembly are initiated, resulting in the formation of highly ordered noncovalent supramolecular species – tectomers (ultra-regular coatings, bulk nanoplatforms, peptide hydrogel portions, micellar entities). These structural reorganizations can be precisely regulated and gradually modulated upon variations of the fluid composition. In addition, the system's performance is controlled through fine-tuning of the parameters of the aqueous environment: pH, temperature, ionic strength, presence of low-molecular mass additives, synthetic and natural amphiphiles.

The newly acquired findings about the conditions for the onset and time evolution of the tectomers open novel application prospects, regarding the design of biomimetic and biocompatible materials to be used in medicine, biotechnologies, and for the environmental protection. Several examples related to biomedical procedures and water purification processes, will be discussed.

Keywords:
antennary oligopeptides, Polyglycine II, self-assembly, tectomers

References:

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