Control of peptide nanotube diameter by the condensation of acid-basic molecule

Prado Enora[1], Rault Damien[1,3], Bizien Thomas[2], Mériadec Cristelle[1] , Moréac Alain[1], Richard Joel [3], Paternostre Maïté[4], Artzner Franck[1*]

[1] Soft matter Department, University of Rennes, Rennes, France
[2] Synchrotron Soleil, Saclay, France
[3] Ipsen Pharma, Dreux, France
[4] CNRS URA2096, CEA Saclay, Saclay, France

**franck.artzner@univ-rennes1.fr*

Supramolecular self-assembly is an attractive pathway for bottom-up synthesis of novel nanomaterials. In particular, this approach allows the spontaneous formation of structures of well-defined shapes and monodisperse characteristic sizes. Because nanotechnology mainly relies on size-dependent physical phenomena, the control of monodispersity is required, but the possibility of tuning the size is also essential. For self-assembling systems, shape, size, and monodispersity are mainly settled by the chemical structure of the building block [1].

In water, a model octapeptide self-assembles into highly monodisperse supramolecular nanotubes, whose structure was previously determined. A mixture of this peptide in pure water at 10% (w/w) allows to obtain monodisperse nanotubes of few hundred micrometers length with a diameter and wall thickness of 24,4 nm and 1,8 nm, respectively. These nanotubes result from the lateral interaction between β-sheets filaments made of peptide dimers. The building blocks is mainly driven by amphiphilicity and a systematic aromatic aliphatic side chain segregation [2-3]. Moreover, a previous study demonstrated that anionic counterions play an important structural role, since they can tune the diameter of the nanotubes in a 19-26 nm range [4]. Here, we modulated in a controlled way the diameter of peptide nanotube by the condensation of an acid-basic molecule. The charge variation of the acid-basic molecule allows a pH-tunning of the nanotube diameter control, with an excellent monodispersity in a 23 (low pH)-36 (high pH) nm range. Several techniques, as X-ray diffraction and vibrational spectroscopies (Raman and ATR-FTIR) has been used to validate and to elucidate the key elements of the molecular origins of the diameter modulation. We will present you this original and simple system which allow to obtained different diameter of monodisperse nanotubes.

Acknowledgements The financial support of Région Bretagne and Agence National de la Recherche.....

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