Experimental report

02/04/2016

Proposal: 9-10-1410 **Council:** 10/2014

Title: Effects of the ionic strength on the supramolecular electrostatic self-assembly of dendrimers-dyes

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: PAMAM dendrimer generation 4
Organic Azo dyes Ar18, Ar26, Ar27, APhAcOHRAc, ABnOHRAc

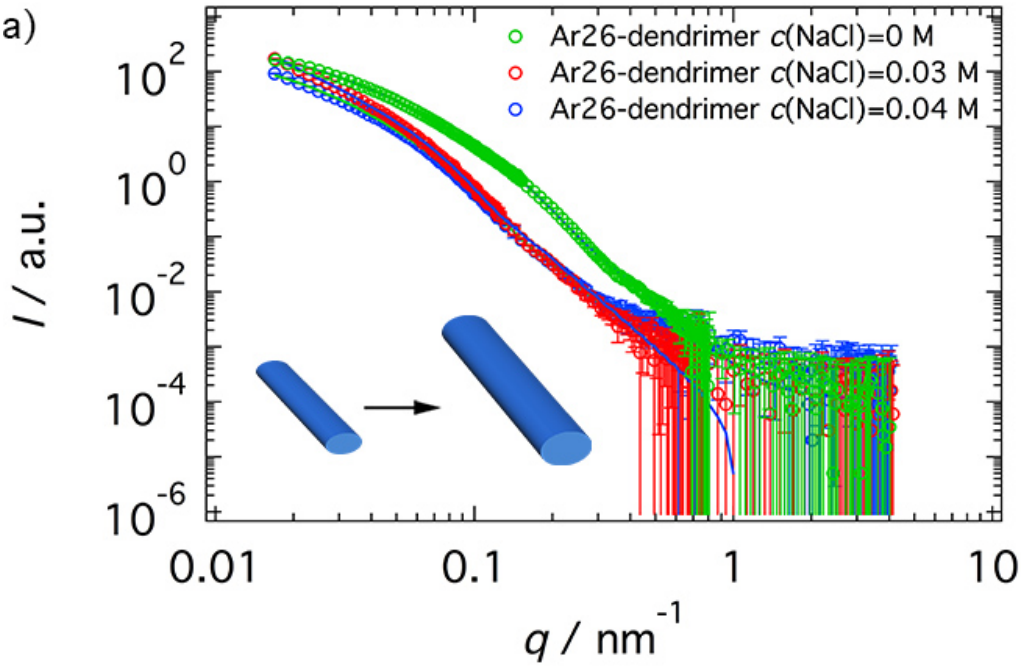
Instrument	Requested days	Allocated days	From	To
D11	2	2	13/05/2015	15/05/2015

Abstract:

Complex macromolecular structures that can respond to external triggers can be obtained by self-assembly through non-covalent interactions. Recently we have introduced electrostatic self-assembly as a new concept for the formation of well-defined pH-triggerable supramolecular nano-objects in aqueous solutions. So far, the structure of the nanoparticles has been characterized in detail, finding that it is strongly related to the thermodynamical parameters of the interaction between polyelectrolytes and counterions. Goal of this experiment is to fundamentally understand the electrostatic interaction between the polyelectrolyte and the counterions and the electrostatic stabilization of the nanoparticles. To achieve this the structure of the particles will be investigated as a function of the ionic strength of the solution and of the electrostatic screening.

Experimental report

During the experiment 9-10-1410 we have investigated the role of solution ionic strength on the shape of electrostatic self-assembled nanoparticles. The model system under investigation consisted of polyamidoamine (PAMAM) dendrimers of generation 4 and oppositely charged azo dyes. Two dye species with different valency and molecular structure have been used: Ar26 (divalent) and Ar27 (trivalent). This experimental set-up permits to vary two crucial parameters in the self-assembly process: the strength of the electrostatic interaction of dye and dendrimer and of the mutual dye interaction. Some of the experimental curves are reported in Figure 1. The experimental results have been fitted according to structural models. In both the cases, as the ionic strength increases the nanoparticle shape remains unchanged, while the systems form larger nanoparticles. The fact that the shape of the assemblies does not depend on the ionic strength is an extremely interesting result and indicates that the nanoparticle shape is defined by the π-π mutual interaction of the dyes rather than by the electrostatic interaction of dyes and dendrimers. However, the change in ionic strength results in a change of the nanoparticles stabilization and hence the size changes.



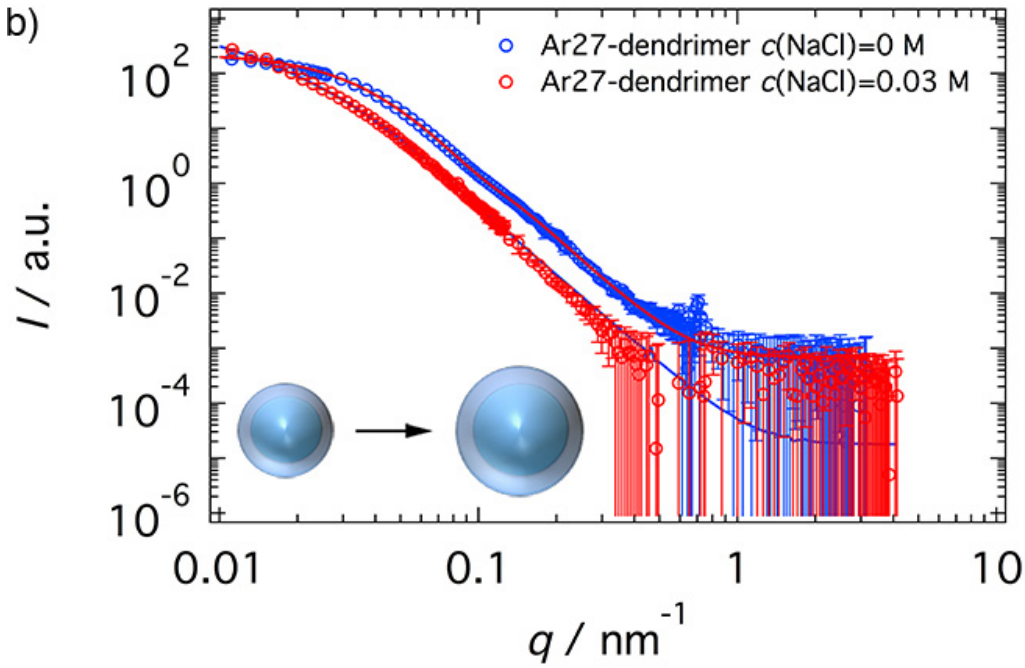


Figure 1. a) Ar26-dendrimer with l = 1.8 at different salt concentrations, b) Ar27-dendrimer with l = 1.8 at different salt concentrations, continuous lines represent the best fit.