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Monitoring Micelle Formation in Mixtures of Linear and Foldon-capped Polypeptides with Light Scattering Spectroscopy

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Monitoring micelle formation in mixtures of linear and foldon-capped polypeptides with Light Scattering Spectroscopy

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Abstract

Elastin-like polypeptide (ELP) polymers are ideal for producing environmentally responsive micellar systems because they exhibit a transition from being water-soluble at low temperatures to phase-separated at high temperatures. For application development of drug delivery vehicles and bio-sensing nanoparticles, it is important to prepare spherical micelles of controlled diameter and shape. Since at a given salt concentration, the headgroup area for each foldon should be constant, the size of the micelles is expected to be proportional to the volume of the linear ELP available per foldon headgroup. Therefore, adding linear ELPs to a system of ELP-foldon should result in changes of the micelle volume. At higher salts the electrostatic repulsion between headgroups is shielded, reducing the effective size of foldon headgroups, increasing the packing factor of micelles which leads to formation of non-spherical micelles. The effects of addition of linear ELPs on size, shape, and molecular weight of micelles at different salt concentrations were studied by a combination of Depolarized Dynamic Light Scattering (DDLS) and Static Light Scattering (SLS) Spectroscopies. The initial results on 50 μM ELP-foldon samples (at 25 mM salt) show that the apparent hydrodynamic radius of mixed micelles increases more than 5-fold as the amount of linear ELP raised from 0 to 50 μM. The size increase is accompanied by significant increase in depolarized scattering indicating the growing geometrical anisotropy of the micelles with increase of added linear ELP. In addition, the increase of the amount of linear ELP in the mixed micelles significantly increased the relative molecular weight of the micelles.