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Controlling the Size and Shape of Polypeptide Colloidal Particles: Temperature Dependence of Particle Formation

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Abstract

A promising approach for developing new drug delivery vehicles is by using stimuli responsive hydrogel nanoparticles. Polypeptide surfactants designed in our lab have been shown to form micellar particles of varying sizes and shapes depending on the solution salt concentration. These responsive polypeptide surfactants consist of a small charged protein domain (foldon) with three elastin-like polypeptide (ELP) chains forming a three-armed star polymer. The size and shape of the micelles they form is dependent on the ratio of total ELP volume to head group area. By introducing linear ELP into the ELP-foldon solution, the total volume of ELP in the aggregate would be increased if the linear ELP is incorporated in the micelle. This method could control the particle size and shape. To determine if the linear and three-armed ELPs co-assemble, we have observed aggregation as a function of temperature using turbidity measurements in a UV-vis spectrometer. We have found that higher concentrations of linear ELP increases the difference in transition temperature between the linear and three-armed ELP. At these higher ratios, the linear ELP aggregates prior to micelle formation. When the ELP-foldon subsequently passes through its critical micelle temperature, they break down the linear ELP aggregates resulting in smaller colloidal emulsions. Light scattering will be used to characterize the size and shape of these aggregates.