Detecting the structural and conformational changes of silk fusion proteins

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Silk protein based materials are attracting an increasing interest in many applications, from the textile to the material science and biosensors[1], due to its biocompatibility, biodegradability and the good mechanical properties[2]. For its potential applicability, a deep knowledge of the structural features in response to stimuli, as applied stress or chemical environment, is demanded.

In the present work, silk fusion proteins are investigated at a single molecular level and the conformational changes associated with different salt solutions are studied. In detail, the technique employed is the *Atomic Force Spectroscopy*, which permitted to pull and stretch single silk proteins and to identify the extensional length in function of different salts and concentrations. Briefly, the proteins of interest are bound to both gold coated tip surface using a Cys terminated SpyTag that reacts with an engineered SpyCatcher terminated silk molecule. By the analysis of the FD peaks recorded at the different environments, changes are observed in contour length, number and force of the unfolding peaks attributed to α-helices or β- sheets. Eventually, the morphology of the AFM images and the analysis of the force distance curves suggested a more compact structure in presence of phosphate, and an extended coiled one when the salt is exchanged with sodium chloride. The main scope of the work, in a long term prospective, is to develop new functional materials, which the components are bio-based, in order to increase the sustainability and lower the plastic consume.

[1] S. Ling et al., Nature Communications, 8 (2017).

[2] Mohammadi et al., Communication Biology, 1, 86 (2018).