Investigation of recombinant spidroins structural organization

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Abstract.

Substance secreted from spider's major ampullate glands attracts scientific attention for many decades due to its unique rheological and biochemical properties. Dragline silk is formed after the hardening of the spinning dope and consists of two proteins different in their structure: MaSp1 and MaSp2. Their different ratios in solution allows spider to vary durability and elasticity of the line. Spider silk's mechanical properties make it the ideal biomaterial for new generation fabrics and air industry composite materials production. That said obtaining natural spider silk in high volumes is problematic. Recombinant analogues of native spidroins are easier to produce, even though they come with a number of challenges like lower molecular weight and lack of terminal domains which leads to their low solubility in water as well as change in aggregation ability in solutions.

In this work rheological properties of low-concentration recombinant spidroins rS1/9 and rS2/12 aqueous solutions were studied. It was shown that spidroin solutions with concentration of 1 mg/ml appear to be gel-like bodies and structured liquids with flow stress. Hydrodynamic radius examination of particles showed two peaks indicating presence of both single particles and aggregates. Structures of recombinant spidroins were studied in solutions and on the substrate. Their ability for self-organization into fibrils under shear stress was demonstrated.

Studying properties of spidroin molecular structures in solutions will allow us to choose optimal spinning conditions required to produce fibrous materials with tunable physicochemical features.

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