Bioinspired complex coacervate-based adhesives

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The underwater adhesives secreted by mussels and sandcastle worms have inspired a very active research direction over the last decades: the investigation of what is required for attachment to wet surfaces, and how this knowledge can be turned into new strategies to join wet surfaces [1]. Early on, the presence of catecholic residues (hydroxylated tyrosine, DOPA) has been implicated to be the key component that governs adhesion and cohesion of the adhesives. More recently, other functional groups in the proteins were identified to be (equally) important. The developments evidence the potential of using the supramolecular toolbox for underwater adhesion. A picture is emerging that combinations of (noncovalent) interactions are highly important to ensure good underwater adhesive performance. In other words, adhesive systems may be developed by selecting multiple supramolecular moieties, in which a combination of different types of interactions is critical: (1) to promote adhesion, (2) to adjust cohesion, and (3) to facilitate processing.

In our work, we explore the versatile supramolecular interactions used in the protein-based adhesives secreted by sandcastle worms and mussels, in synthetically designed adhesives [2-4].

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