Polysaccharide Complex Coacervates as Multifunctional Underwater Adhesives

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Résumé

Soft materials from the complexation of oppositely charged polyelectrolytes in water, known as complex coacervates, have shown great promise for the development of underwater (UW) adhesives.(1) Yet, current candidates are based on complicated bioinspired macromolecules or synthetic model polyelectrolytes, with little known about their suitability for biomedical applications.(2) Here we introduce UW adhesives based on complex coacervates of commercial polysaccharides, namely Chitosan (CHI) and Hyaluronic Acid (HA). CHI-HA complex coacervates are prepared via a simple mixing method in NaCl solutions at pH = 5, where both polymers are nearly fully charged. By analogy with soft hydrophobic systems, the viscoelastic properties of the complex coacervates are tuned for optimal adhesive performance in physiological conditions. These water-rich ($>$ 85 wt%) materials feature UW pull-off strengths exceeding 60 kPa in a medium at 0.1 M NaCl. Moreover, the complex coacervate with the best underwater adhesive performance is shown to be non-cytotoxic and antibacterial. The antibacterial properties of these complex coacervates is due to the release of CHI and its interaction with bacterial cell walls at physiological pH. These multifunctional underwater adhesives underline the untapped potentials of bio-based complex coacervates for biomedical applications.

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