Bioactive Preservation: Chitosan/ Poly-γ-glutamic Acid for Cultural Heritage Restoration

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This research delves into innovative approaches for preserving cultural heritage by prioritizing sustainability and environmental consciousness. The study explores the transformative potential of chitosan (CH) and poly-γ-glutamic acid (γ-PGA) in developing hydrogel materials through non-covalent, electrostatic interactions using a physical blending technique. The investigation employs CH derived from crustacean shrimp shells and γ-PGA synthesized by Bacillus species, focusing on specific molecular weights (CH: 285 kDa, γ-PGA fractions: R1=55 kDa, R2=20 kDa). Blended materials are created under acidic conditions (pH 3.5) with different ratios of CHR1 to CHR2. The resulting hydrogels exhibit saloplastic and thermoplastic characteristics, transforming into a dry, solid state at room temperature.
Various characterizations confirm complexation and robust crosslinking between biopolymers, emphasizing the gelation properties of CHR1 with a smooth and compact structure and excellent thermal stability. The study extends to bioadhesive applications on wood and aluminum surfaces, comparing them to a commercial polyvinyl acetate glue. CHR1 and CHR2 demonstrate comparable adhesive strength on wood, exhibiting adhesive/cohesive failure and stress endurance. On aluminum substrates, CHR2 displays the highest adhesive strength and adhesive/cohesive failure, while CHR1 shows similar adhesion strength with adhesive failure. Beyond their adhesive properties, the versatility of these materials opens avenues for applications in heritage formulations, including paint, coatings, and adhesives.

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