

Hydrogels from wastes for the conservation

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The development of sustainable materials from renewable resources is a key strategy for reducing environmental impact and promoting circular-economy approaches. In this study, bacterial nanocellulose (BC) recovered from Kombucha production by-products was investigated as a versatile bio-based platform for applications in both cultural heritage conservation and active food packaging. Purified BC exhibited a porous nanofibrous structure, high crystallinity and purity, strong water-holding capacity, and good mechanical and viscoelastic properties. For conservation purposes, BC was successfully formulated as an organogel for the removal of hydrophobic substances and as an EDTA-loaded hydrogel for the removal of copper corrosion products from stone surfaces. In parallel, BC was functionalized with bacteriocins produced by *Lactiplantibacillus plantarum* to obtain a fully bio-based antimicrobial film. The resulting material showed good mechanical resistance and effective antimicrobial activity against *Listeria monocytogenes* and *Salmonella enterica*, maintained for up to three months. These results highlight BC derived from Kombucha waste as a sustainable, multifunctional material with promising applications across different fields.