

NOVEL POLYMERIC MATERIALS AS BIOCONTROL AGENTS

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Introduction Numerous pathogens may cause plant diseases, which are a global problem and generate considerable losses in agriculture. Chemical pesticides remain the primary control method, but their overuse has caused significant environmental and health concerns. Eco-friendly agricultural practices and materials are urgently needed. Developing novel biocontrol agent materials could greatly reduce dependence on conventional pesticides. Nanotechnology offers innovative solutions, as polymer fibers with micro- and nanoscale diameters exhibit unique properties such as high specific surface area and porous structures, and can be produced efficiently using electrospinning techniques. Encapsulation of biocontrol agents via electrospinning provides considerable advantages for agricultural applications. In this study, we developed innovative biohybrid materials as biocontrol formulations using electrospinning, electrospraying, and/or dip-coating techniques.

Experimental part Microbial species including *Bacillus*, *Trichoderma*, and various yeasts were encapsulated in biopolymer fibrous matrices composed of poly(3-hydroxybutyrate) (PHB), poly(L-lactide) (PLA), cellulose derivatives [1], and chitosan [2,3]. Results and Discussion Scanning electron microscopy (SEM) was used to analyse the morphology of the biohybrid materials and encapsulated microorganisms, while ATR-FTIR spectroscopy confirmed their surface chemical composition. Mechanical properties of the materials were also evaluated. Viability tests demonstrated that the polymer carriers supported normal growth of the bioagents and preserved their viability during long-term storage. Conclusion These results highlight the potential of electrospun biohybrid polymer materials as effective biocontrol formulations, offering promising applications for plant protection and growth promotion in sustainable agriculture.

Keywords: *electrospinning, electrospraying, dip-coating, biopolymers, biocontrol agents*

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