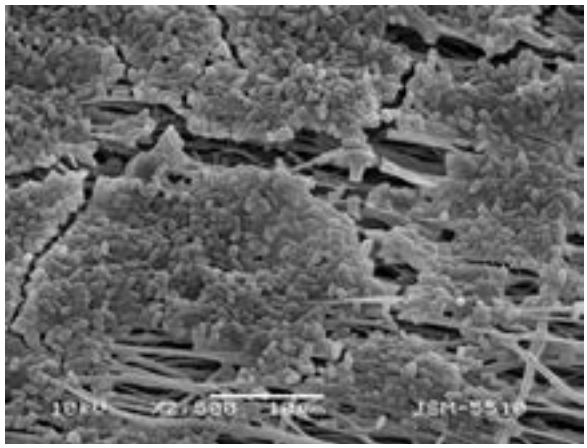
https://doi.org/10.53230/tgm.1310-912X.2025.1001.15

NOVEL CHITOSAN-COATED ELECTROSPUN POLY(3-HYDROXYBUTYRATE) BIOHYBRID MATERIALS FOR SUPPORTING THE GROWTH AND LONG-TERM STORAGE OF BACILLUS SUBTILIS

Vladimir Krastev[1], D. Draganova[2], M. Naydenov[3], M. Spasova[1], O. Stoilova[1]
[1]Laboratory of Bioactive Polymers, Institute of Polymers, Bulgarian Academy of Sciences, Akad. G. Bonchev St., bl. 103A, BG-1113 Sofia, Bulgaria
[2]Biodinamika Ltd., BG-4000 Plovdiv, Bulgaria
[3]Department of Microbiology, Agricultural University, BG-4000 Plovdiv, Bulgaria
v_krastev@polymer.bas.bg



Introduction: Numerous bacterial species are capable of promoting plant growth and suppressing plant diseases. One such species, Bacillus subtilis, enhances plant development and provides effective protection against pathogens, making it highly suitable for various agricultural applications. Polymer-based carriers are increasingly explored as systems for encapsulating and stabilizing beneficial microorganisms, ensuring their viability and activity under variable enviro nmental conditions.

Experimental part: This study reports the successful incorporation of B. subtilis into hybrid biohybrid materials composed of electrospun poly(3-hydroxybutyrate) (PHB) fibers coated with a chitosan-based polysaccharide film [1].

Results and Discussion: The influence of chitosan molecular weight on the viscosity of the film-forming solutions was investigated, along with its effects on film morphology, mechanical properties, and bacterial viability and growth dynamics. Scanning electron microscopy (SEM) was used to analyze the morphology of B. subtilis cells, electrospun PHB fibers, and chitosan-coated PHB fibrous mats. Mechanical testing demonstrated that the chitosan coating improved the tensile strength of the hybrid materials, while microbiological analyses confirmed normal bacterial growth. Viability tests showed that the bacteria remained viable after incorporation and following 90 days of storage. Moreover, the developed biohybrid materials effectively suppressed the growth of the plant pathogenic fungus Alternaria. Conclusion These findings demonstrate the potential of the developed chitosan-coated PHB biohybrid materials to provide efficient and sustainable agricultural solutions. By reducing dependence on synthetic agrochemicals and enhancing environmental compatibility, these systems offer a promising platform for the long-term delivery of active biocontrol agents.

Keywords. *electrospinning; poly(3-hydroxybutyrate); dip-coating; chitosan; B. subtilis; biohybrids; sustainable agriculture.*

Acknowledgements: This research was funded under the Grant BG-RRP-2.011-0005-C01 with financial support from the European Union-NextGenerationEU, Investment C2.I2 “Increasing the innovation capacity of the Bulgarian Academy of Sciences in the field of green and digital technologies”.

References:

[1]. Krastev, V.; Stoyanova, N.; Valcheva, I.; Draganova, D.; Naydenov, M.; Spasova, M.; Stoilova, O. Polysaccharides, 5, 698-714, 2024.