https://doi.org/10.53230/tgm.1310-912X.2024.1001.10

ELECTROSPUN POLYMER MATERIALS AS CARRIERS FOR BIOAGENTS

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Introduction Every year, plant diseases cause huge losses on agricultural crops all around the world. Numerous plant pathogens are the primary sources of this kind of diseases. Currently, chemical pesticides are widely used to combat plant diseases. However over the years, their overuse pollutes the air, water, and soil, harms animals, birds, and insects, and may even be harmful to human health. Thus, it is necessary to implement so-called "eco-friendly agriculture" in large quantities in order to gradually eliminate the usage of chemical pesticides. The use of microorganisms to manage pests or plant diseases is known as biocontrol. In nature, bacteria, fungus, viruses, yeasts, and protozoa are commonly found and are referred to as "biocontrol agents" because they have the ability to either directly or indirectly control plant diseases. Encapsulation of selected bioagents into targeted designed polymer carriers is a rational way to develop innovative biohybrid materials as biocontrol formulations.

Experimental part The following materials were used: poly(3-hydroxybutyrate) (PHB) with an average Mw 330,000 g/mol and 2-hydroxyethyl cellulose (HEC) with three different molecular weights: low (HEC-L), middle (HEC-M) and high (HEC-H). The beneficial microorganisms were obtained from the collection of Biodinamika Ltd., Plovdiv, Bulgaria.

Results and Discussion The electrospinning of the PHB solution under the selected conditions prior to dip-coating resulted in the formation of uniform and defect-free fibers. Following dip-coating in HEC solutions or HEC/bacterial suspension, the fibrous structure remained intact. The study examined the effects of the type and molecular weight of these cellulose derivatives on film formation, mechanical properties, bacterial encapsulation, and growth. Morphological studies revealed that the incorporated bacterial cells were uniformly distributed throughout the biohybrid material. Microbiological tests confirmed that bacterial cells embedded in electrospun PHB mats coated with HEC remained viable and grew normally. After 72 h of incubation, bacterial growth from the hybrid materials covered the entire Petri dish. These novel biocontrol formulations hold significant potential for sustainable eco-agriculture, providing effective solutions for plant protection and growth promotion.

Conclusion Eco-friendly biohybrid materials were successfully obtained using a simple and effective approach that combines the advantageous properties of electrospun PHB materials, cellulose derivatives and beneficial microorganisms. Due to their valuable properties the obtained biohybrid materials possess significant promise as biocontrol formulations for plant protection and growth promotion in sustainable agriculture.

Keywords: *electrospinning; dip-coating; PHB; 2-hydroxyethyl cellulose; beneficial microorganism; eco-agriculture;*

Acknowledgments: This research was funded under the Project BG-RRP-2.011-0005-C01 with the financial support by 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". Some of the research equipment of Distributed Research Infrastructure INFRAMAT (part of the Bulgarian National Roadmap for Research Infrastructures), supported by Bulgarian Ministry of Education and Science, was used in this study.