CYANOBACTERIAL EXOPOLYSACCHARIDES: FROM PRODUCTION TO APPLICATIONS IN FOREST SEEDLING SUPPORT

Iulia IATCO[1*], Ana VALUȚA[1], Liliana ZOSIM[1], Alexandru SAINSUS[2]
[5.] Institute of Microbiology and Biotechnology, Technical University of Moldova Chisinau, Republic of Moldova
[6.] LuRenOm LTD

[*] Corresponding author: iulia.iatco@imb.utm.md
https://doi.org/10.52757/bsd26.42

Background: Enhancing Forest seedling resilience and improving soil quality are critical challenges under current climate change conditions. Cyanobacterial exopolysaccharides (EPS) represent a promising biotechnological solution due to their capacity to improve water retention, stabilize soil structure, and modulate rhizosphere interactions, thereby supporting plant adaptation to abiotic stress.
Material and Methods: The cyanobacterial strain *Nostoc linckia* CNMN-CB-03 was cultivated on a range of nutrient media to identify optimal conditions for EPS production. Key physicochemical parameters, including temperature, light intensity, and pH, were systematically optimized. EPS were isolated from the culture medium by ethanol precipitation, then dried to constant weight and formulated into a stable powder via spray drying. The resulting product was applied in a nursery experiment on oak seedlings using localized rhizosphere treatment (0.1 g/L), with untreated plants serving as controls.
Results: Comparative evaluation of nutrient media identified MN-1 and BG-11 supplemented with $NaHCO_3$ as the most efficient systems for EPS biosynthesis, with MN-1 providing consistently higher yields under optimized conditions. Implementation of a stage-specific cultivation regime - 30°C and 60 μmol photons m^{-2} s^{-1} during the initial growth phase, followed by reduced temperature (25°C) and light intensity (35 μmol photons m^{-2} s^{-1}), significantly enhanced EPS production, reaching up to 2.68±0.09 g/L after a 16-day cultivation cycle. The developed protocol proved robust and reproducible, integrating biomass cultivation, EPS recovery, and downstream processing into a coherent technological workflow. Spray drying enabled the production of a homogeneous, stable, and easily applicable powder suitable for field use. Nursery trials demonstrated that EPS application did not negatively affect seedling physiological status and contributed to maintaining root system integrity. Moreover, treated seedlings showed indications of improved rhizosphere conditions, likely related to enhanced soil moisture retention and structural stability. These effects are expected to translate into improved establishment rates and root regeneration capacity during the subsequent growing season.
Conclusions: *Nostoc linckia*-derived EPS demonstrate strong potential as a sustainable biostimulant for forestry applications, supporting root protection and improving rhizosphere functionality. The developed technology is experimentally validated, scalable, and relevant for practical implementation in nursery and reforestation systems.

Keywords: cyanobacteria, *Nostoc linckia*, exopolysaccharides; biostimulants, forest seedlings; soil stabilization; stress tolerance.

Acknowledgments: This work was supported by research project 25.80015.7007.06VI funded by the National Agency for Research and Development, Republic of Moldova.