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MASTER THESIS PROJECT

RHIZOSPHERE BACTERIAL COMMUNITIES: UNVEILING METAL RESISTANCE FOR APPLICATION IN MICROBIAL-ASSISTED PHYTOREMEDIATION OF DIGESTATE AMENDED SOIL

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ABSTRACT

Application of anaerobic digestate (AD) land, for instance for land restoration, may pose environmental risks due to the introduction of digestate pollutants to soils, including trace metals (TMs). Phytoremediation can be employed in combination with AD to immobilize or remove contaminants from it while simultaneously improving overall soil health. Central to this process is the crucial role played by the rhizosphere, which serves as a hotspot for interactions among plants, soil, and the microbiome. To realize the full potential of the rhizosphere microbial communities, sanger sequencing combined with culture-dependent approaches was used to understand diversity and composition of bacterial strains isolated from Panicum virgatum (switchgrass) rhizosphere after the plant being exposed to TMs contaminated digestate upon application on soil. Furthermore, a preliminary screening of the resistance of those strains to TMs such as Cu, Zn, Cr and Pb was performed through disk diffusion method, serving as an initial step in identifying relevant species for future use in microbial-assisted phytoremediation. The 57 isolated bacterial strains were categorized into three phyla: Bacillota, Actinomycetota, and Pseudonomodota. Among them, 16 different genera were identified, with Bacillus sp. exhibiting the highest relative abundance. Regarding TMs resistance, seven strains demonstrated complete resistance to TMs, including Curtubacterium sp. R14.2, Providencia sp. R17.1, Achromobacter sp. R23.4, Bacillus sp. R5.1, Bacillus pumilus R8.4, Bacillus cereus R9.2 and Pseudarthrobacter sp. R9.3 all identified based on their closest relatives. Previous studies have confirmed the plant-growth and stress regulation capabilities of these bacterial strains, making them potentially suitable candidates for microbial-assisted phytoremediation. Further confirmatory studies are needed to validate both the TMs resistance, and plant-growth promoting (PGP) traits of these strains.