Asia-Pacific Biofilms 2024

Scientific Program

November 12-17, 2024 | Guangzhou, China

Soil biofilm induction to increase crop production and bioremediation: a novel approach

Gamini Seneviratne

National Institute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka

Abstract: Soil biofilms, complex microbial communities encased in a self-produced matrix, are pivotal to soil health, nutrient cycling, and plant growth. The novel approach of inducing soil biofilm formation is through the application of biofilm biofertilizers (BFBFs). They are specialized formulations containing beneficial biofilms which secrete specific biochemicals that break dormancy of soil microbial seed bank. This enhances microbial diversity, abundance, and hence cell density-dependent quorum sensing and biofilm formation in the soil. These soil biofilms with diazotrophs, nutrient solubilizers, growth hormone producers, biocontrolling agents etc. increase biological nitrogen fixation, mineral nutrient availability, plant growth, and pest and pathogen suppression. In addition, an ultrafast transfer of the biofilm-associated electrons takes place in the soil biofilms, triggering quantum effects, and hence it provides electrical energy which can be converted to biological energy via ATP production. The biofilm electron pool and the produced ATP catalyze biochemical reactions in the soil-plant system. Thus, this acts as a natural microbial fuel cell linking the soil biofilm, mycorrhizal network and the plant, facilitating soil bioremediation processes too. That results in enhanced bioremediation of environmental pollutants, including heavy metals and organic contaminants, thereby contributing to soil detoxification. This dual functionality not only supports sustainable agricultural production but also addresses pressing environmental concerns related to soil contamination. In this manner, the BFBF application uplifts the plant growth in a holistic approach by enhancing ecosystems through the quantum effects for sustainability. The induction of soil biofilms also leads to improved soil aeration and water retention. Furthermore, the biofilm matrix serves as a protective habitat for beneficial microbes, enabling them to thrive in the soil environment, thus bolstering the overall health of the agroecosystem. It can be concluded that by integrating the BFBF into agricultural practices, we can create resilient, productive soils that support sustainable food production and ecological restoration, ultimately contributing to global food security and environmental sustainability.

Keywords: Soil biofilms, Plant growth, Bioremediation, Biofilm biofertilizer, Agroecosystems

华南理工大学
South China University of Technology

南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCELSE
Singapore Centre for Environmental Life Sciences Engineering