Biochemical Expression of Exudates of a Fungal-Bacterial Biofilm During Growth and Maturation

G.Seneviratne [1], H. M. L. I. Herath [1], D. M. N. Senanayeke[2]*

[1]Microbial Biotechnology Unit, Institute ofFundamental Studies, Hantana Road, Kandy, Sri Lanka.

2Faculty ofAgricultural Sciences, Sabaragamuwa University ofSri Lanka

*Corresponding Author: nirmala.senanayake@yahoo.com

Biofilms are often complex communities of multiple microbial species and remain attached to surfaces. Fungal-bacterial biofllms are formed when the fungal surface is colonized by one or more species of bacteria. These biofilms can enhance microbial effectiveness compared to the monocultures. Beneficial biofilms can be developed in vitro and be used for various agricultural and biotechnological purposes. As a recent development in biofertilizer research, fungal-rhizobial biofilms have been developed and these are termed biofilmed biofertilizers (BFBFs). This research was focused to investigate chemical composition of compounds exuded during growth and maturation of the biofilms. A developed fungal-bacterial biofilm using an Azotobacter species and a Colletorichum fungal species was used for the study. Exudates of the biofilm, fungal monoculture and bacterial monoculture in solid and liquid states were extracted separately by using three organic solvents; hexane, ethyl acetate and methanol. Extraction was done weekly for four weeks during growth and maturation of the biofllm. Then extracted exudates dissolved in organic solvents were evaporated by using a vortex evaporator. Thereafter crude was mixed with potassium bromide (KBr) and pellets were made. The KBr pellets were analyzed using Fourier Transform Infrared (FTIR) spectroscopy. To evaluate the effect of the exudates of the fungal-bacterial biofilm on seed germination and plant growth in comparison to bacterial and fungal monocultures, a plant assay was done weekly by using lettuce (Lactuca sativa) seeds (N 48). During all four harvests, the fungal-bacterial biofllm produced more diverse functional groups than the mono cultures. The developed biofilm produced carboxylic acids and carboxylic salts, which are associated with plant growth promoting hormones, especially in first and second harvests. Significantly higher plant height and high germination of lettuce with the biofilm exudates could be attributed to above fact. During third and fourth weeks, the biofllm produced more amines and amides than fungal and bacterial mono cultures. This may have contributed to increased pH in biofilm cultures compared to the mono cultures. Thus, it can be concluded that biochemical expression of exudates of fungal-bacterial biofilms during their growth and maturation is very useful for breaking dormancy of seeds and their germination and growth, contributing to high plant productivity.

Key words: Fungal bacterial biofilm, Exudates, FTIR