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THE POTENTIAL OF BIOFILMS DEVELOPED FROM HEAVY METAL RESISTANT MICROBES TO REMOVE NICKEL IONS IN AQUEOUS MEDIA

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Excessive Nickel (Ni) in water and soil due to industrial effluents and natural sources may cause cancer. Bioremediation using biofilms has risen up as a novel technique for heavy metal removal via Extra Polymeric Substances (EPS) secreted by biofilms. However, no studies have been reported on Ni removal using Fungal-Bacterial Biofilms (FBBs). The objectives of this study were to develop metal ion resistant microorganisms isolated from Ni rich serpentine soils to remove Ni in wastewaters as a novel waste water treatment technique. Bacteria were isolated from serpentine soils obtained from Wasgamuwa, Sri Lanka. Isolated bacteria were grown in a nitrogen- free medium to isolate the nitrogen fixers due to their ability to fulfill the nitrogen requirement in low fertile soil. Monocultures were coupled with a fungus isolated from garden soil and allowed to form FFBs (hereafter referred to as FB1–FB5). The FBBs were inoculated into biofilm forming medium with a series of Ni concentrations of 50-1350 mg L^{-1}. After 72 hours, the remaining Ni concentrations were measured using the Atomic Absorption Spectrophotometer (AAS GBC 933A). Fourier Transform Infra-Red (FT-IR) spectroscopy was used to understand the participation of the functional groups in FFBs on Ni removal. All five bacterial isolates extracted from serpentine soil showed nitrogenase activity during initial screening and biofilm formation ability with the garden soil fungus. Equilibrium of Ni in the biofilm media was reached around 450 mg L^{-1} for all the monocultures. In the case of FBBs, FB2 reached the equilibrium at 450 mg L^{-1}, but other biofilms (FB3, FB4 and FB5) demonstrated rather high sorption without reaching the equilibrium in the tested concentration range. The highest amount of Ni sorption was shown by FB4, which is 65 % of the initial Ni concentration. A number of absorption peaks were observed in FT-IR, indicating the complex nature of the FBBs and EPS at the presence and the absence of Ni. Changes in peaks in the range from 1550 to 1650 cm^{-1} and the band at 1078 cm^{-1} correspond to –NH bending and the amino groups in proteins respectively are possibly due to the EPS involvement in Ni biosorption.