## Equilibrium, Kinetics, and Thermodynamic Studies on Heavy Metal Biosorption by Trichoderma Species

Authors : Sobia Mushtaq, Firdaus E. Bareen, Asma Tayyeb

Abstract : This study conducted to investigate the metal biosorption potential of indigenous Trichoderma species (T. harzianum KS05T01, T. longibrachiatum KS09T03, Trichoderma sp KS17T09., T. viridi KS17T011, T. atrobruneo KS21T014, and T. citrinoviride) that have been isolated from contaminated soil of Kasur Tannery Waste Management Agency. The effect of different biosorption parameters as initial metal ion concentration, pH, contact time , and temperature of incubation was investigated on the biosorption potential of these species. The metal removal efficiency and (E%) and metal uptake capacity (mg/g) increased along with the increase of initial metal concentration in media. The Trichoderma species can tolerate and survive under heavy metal stress up to 800mg/L. Among the two isotherm models were applied on the biosorption data, Langmuir isotherm model and Freundlich isotherm model, maximum correlation coefficients values (R 2 ) of 1was found for Langmuir model, which showed the better fitted model for the Trichoderma biosorption. The metal biosorption was increased with the increase of temperature and pH of the media. The maximum biosorption was observed between 25-30 o C and at pH 6.-7.5, while the biosorption rate was increased from 3-6 days of incubation, and then the rate of biosorption was slowed down. The biosorption data was better fitted for Pseudo kinetic first order during the initial days of biosorption. Thermodynamic parameters as standard Gibbs free energy (G), standard enthalpy change (H), and standard entropy (S) were calculated. The results confirmed the heavy metal biosorption by Trichoderma species was endothermic and spontaneous reaction in nature. The FTIR spectral analysis and SEM-EDX analysis of the treated and controlled mycelium revealed the changes in the active functional sites and morphological variations of the outer surface. The data analysis envisaged that high metal tolerance exhibited by Trichoderma species indicates its potential as efficacious and successful mediator for bioremediation of the heavy metal polluted environments.

Keywords : heavy metal, fungal biomass, biosorption, kinetics

**Conference Title :** ICAMSM 2022 : International Conference on Agricultural Microbiology and Soil Microbiology **Conference Location :** Vienna, Austria **Conference Dates :** July 28-29, 2022