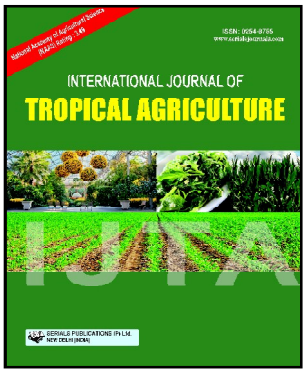

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Effect of metal training on Aspergillus niger (Lin.) and its Biosorption capacity

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Abstract: Currently, heavy metal pollution is becoming a drastic problem throughout the whole world. Conventional technologies to clean up the heavy metal from industrial effluent are less effective and time taking. An alternative to these technologies, biosorption is an inexpensive and promising solution for biodetoxification of the heavy metal pollution from wastewater. The filamentous fungi have great potential to produce a large amount of biomass which is used for metal adsorption. Filamentous fungi have gained an increasing, attention for removal and recovery of heavy metals due to their performance. For the present study Aspergillus niger, Van Tieghem was selected for the in vitro training and adsorption of lead. The species were selected on the basis of their growth rate and overall performance in the soil treated with different metal concentration. Potato Dextrose Agar medium was used for the in vitro training of these selected fungi against the lead sulphate (PbSO4). Training of fungi at a high concentration of heavy metal may increase their metal uptake capacity as a metal resistance mechanism. Aspergillus niger was strained to high concentration lead as lead sulphate (PbSO4) i.e., 1000 ppm, 1500 ppm, 2000 ppm, 2500 ppm. 3000 ppm, 3500 ppm and 4000 ppm by repetitive sub-culture on Potato Dextrose Agar medium containing a high level of lead metal. Different doses of fungal biomass i.e., 10 mg, 20 mg, 30 mg, and 40 mg were used for the present investigation. It has been observed that biosorption capacity increased with increase in the dose of biomass. Present work clearly signified 3000ppm the highest biosorption as 70.39% with 20 mg of fungal biomass. Freundlich' isotherm modal showed much better correlation coefficients than Langmuir's isotherm model in the examined concentration range. Biosorption found strongly dependant on the experimental parameters. Trained fungi can remove much lead from the solution than those of the non-trained fungal biomass.

Keywords: Aspergillus niger. Biosorption, Lead.

INTRODUCTION

- Pollution is the introduction of contaminants into the natural environment that cause adverse change.
- Pollution interacts naturally with biological systems.
- It is the contamination of Earth's environment with materials that interfere with human health, the quality of life, or the natural functioning of ecosystems (living organisms and their physical surroundings).
- Pollutants are the causes of major water quality degradation around the world. Major water pollutants include microbes, nutrients, organic chemicals, oil, heavy metals and sediments.
- Heavy metals are important environment pollutants. Metal contamination of the environment results both from natural sources and industrial activities.(Kar et al., 1992)
- Heavy metals even at low concentrations can cause toxicity to humans and other forms of life, its adverse effects on human health are quite evident. The toxicity of the metal ion is owing to their ability to bind with protein molecules and prevent replications of DNA and, thus, subsequent cell division.
- Microorganisms play an important role in the environmental fate of toxic metals and radio-nucleotides with a multiplicity of mechanisms effecting transformation between soluble and insoluble forms. (Gadd, 2007)
- For the removal of pollutants of heavy metals from waste water various microbes like bacteria, fungi and algae are being employed.
- The process of bioremediation is defined as utilization of various microbes for the removal of pollutants from the environment for which micro organisms can be employed in either living or dead form to eliminate pollutants such as heavy metals from the environment. (Mishra et al., 2013)
- Biological material can bind metals through processes of biosorption and bioaccumulation. In the process of biosorption, ions of metals are adsorbed on the surface of a sorbent. Biosorption is metabolically passive process that uses dead biomass. (Swiatek and Krzywonos, 2013)
- Bioaccumulation refers to the accumulations of heavy metals ions inside the cells of the microbes. It is a property of both living and dead organisms and has been acclaim as a promising biotechnology for pollutants removal from solution. (Adeniji, 2004)
- Fungi are also known to accumulate high amounts of metals (Morley et al., 1995)and fungi are resistant than microorganisms to long term heavy metal contamination. (Fliesbach, et al., 1994)

OBJECTIVE

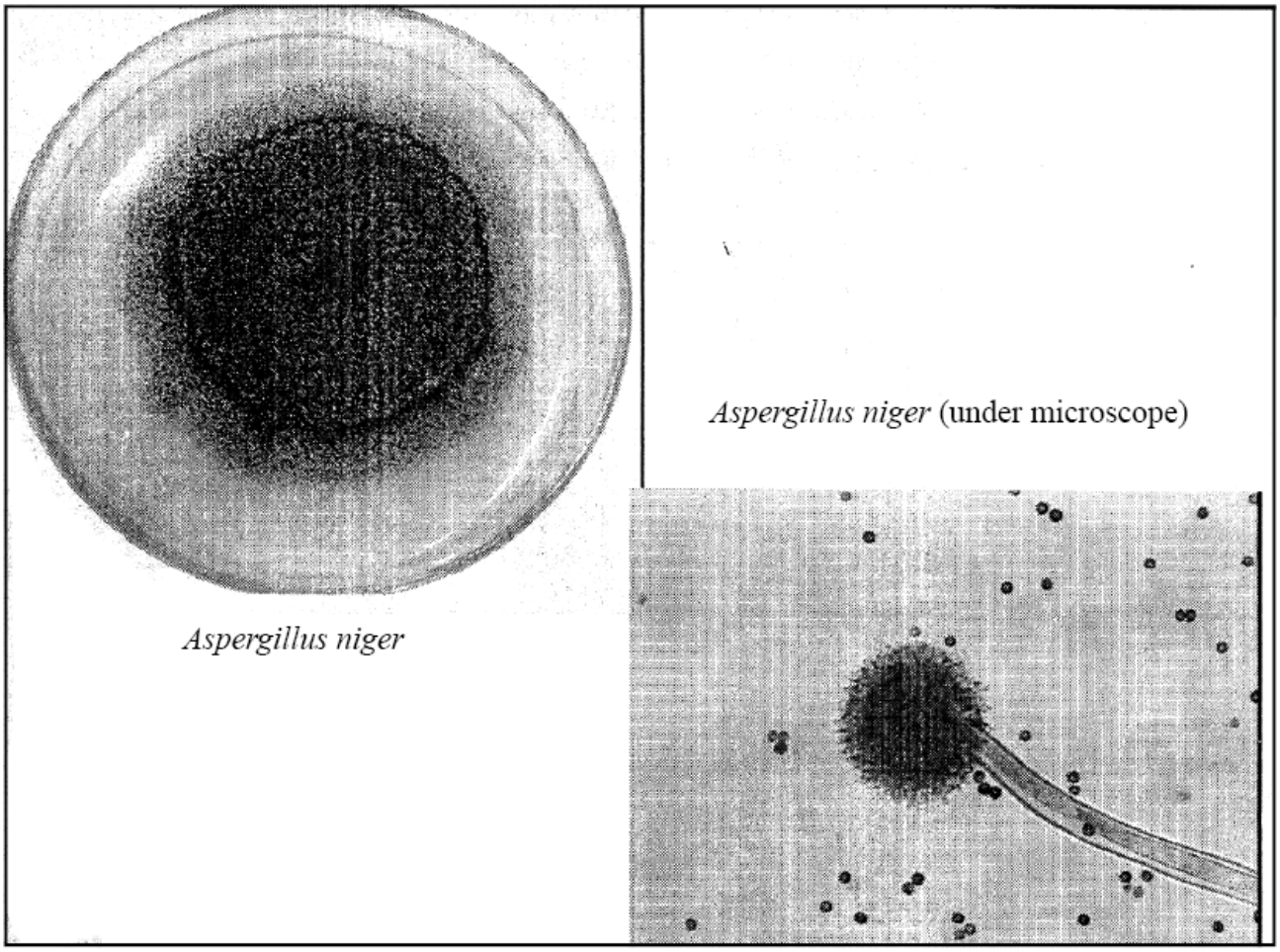
- Isolation and identification of A. niger strain from soil sample.
- Possible in vitro training of isolated A. niger by exposing to different doses/ concentrations of lead metal.
- Assessment of biosorption capacity of different biomasses trained at different metal concentration.

MATERIAL AND METHODS

- Collection of soil samples
- Analysis of composite soil samples for mycobiota
- Morphological identification of the isolated fungi
- Preparation of lead solutions of different concentration
- In vitro training of fungus of metal salts for better biosorption of lead (1000, 1500, 2000, 2500, 3000, 3500, 4000ppm)
- Preparation of fungal biomass
- Biosorption of lead solution by fungal biomass

RESULT

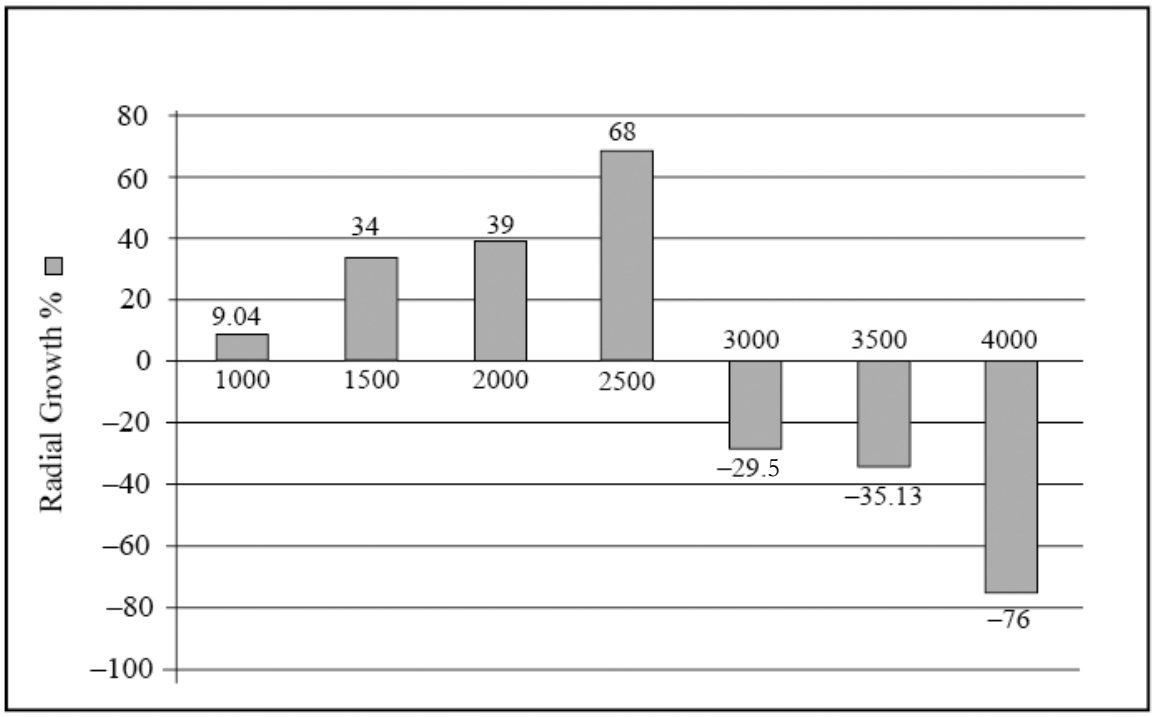
- The filamentous fungi have great potential to produce a large amount of biomass which is used for metal adsorption. These fungi have gained an increasing, attention for removal and recovery of heavy metals due to their performance.
- Training of fungi at a high concentration of heavy metal may increase their metal uptake capacity as a metal resistance mechanism.
- Biosorption capacity increased with increase in the dose of biomass.
- At 3000 ppm the highest biosorption as 70.39% was observed with 20 mg of fungal biomass.



Aspergillus niger

Aspergillus niger (under microscope)

Radial growth of *A. niger* in the medium amended with different concentrations of Lead Sulphate



CONCLUSIONS

- Biosorption of Pb metals by Aspergillus niger biomass is a cost effective technology.
- Biosorption process was found strongly dependant on the experimental parameters.
- Aspergillus niger biomass proved a major component for the development of biotrap devices and it may be used as major component for managing the heavy metal pollution in our country.
- Conventional technologies to clean up heavy metal from industrial effluents are time taking and less effective. An alternative to these technologies, biosorption is inexpensive and promising process towards bio-detoxification of the heavy metal pollution from the waste water.
- Trained fungi can remove much lead from the solution than those of the nontrained fungal biomass, it may due pre treatment of metal more functional groups were exposed for the adsorption.
- Aspergillus niger biomass is a very good biosorbent of Pb ($PbSO_4$) metal and can be used for adsorption based effluent treatment system.

References

Adeniji, A. (2004). Bioremediation of Arsenic, Chromium, Lead and Mercury. *U.S. Environmental Protection Agency*, Washington, DC.

Fliesbach, A. Martens, R. and H.H. Rober (1994). Soil microbial biomass and activity in soils treated with heavy metal contaminated sewage sludge. *Soil Biol. Biochem*. 26: 1201-1205.

Gadd, G.M.(2007). Geomycology: Biogeochemical transformations of rocks, minerals, metals and radionuclides by fungi, bioweathering and bioremediation. *Mycol. Res*. 111: 3-49.

Kar, R.N., Sahoo, B.N. and C.B. Sukla (1992). Removal of heavy metals from pure water using sulphate-

reducing bacteria (SRB). *Poll. Res.* 11:13.

Mishra, A., Kaushik, P. and A. Malik (2013). Innovations in microbiology interventions targeting remedation of toxic metals, technology manual, IIT-Delhi.

Morley, G.F., Sayer, J.A., Wilkinson, S.C., Gharied, M.M. and G.M. Gadd (1995). Fungal sequestration , mobilization and transformation of metals and metalloids. ln:Frankland, J.C., Magan, N. and G.M. Gadd (eds.), Fungi and environmental change. Cambridge University Press, Cambrigde. pp. 235-256.

Sameera, V., Naga, D.C.H., Srinu, B.G. and T.Y. Ravi (2pil). Role of biosorption in environmental cleanup. J. Microbial. Biochem. Technol. Rl:001.Doi:10.4172/1948-5948. Rl-001.

Swiatek, M.Z., M. Krzywonos. (2014). Potentials of biosorption and bioaccumulation processes for heavy metal removal. Pol. J. Env. Stud. 23(2): 551-561.