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Penicillium janthinellum Biomass - A Bio-sorbent for Lead and Chromium

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ABSTRACT

To check heavy metal pollution at disposal sites due to industrial waste water, the treatment process is required, which involves removal heavy metals from industrial waste water. Various methods used for removal of heavy metals from industrial effluents / waste water are precipitation of metals, ion exchange resin, electrochemical reduction, membrane separation processes and bio-sorption etc. In this bio-sorption seems to be eco-friendly and viable method, removal of heavy metals by bio- sorbents developed from fungal biomass become a good choice. Using non-immobilized *Penicillum janthinellum* bio-sorbent showed removal lead and chromium from refinery effluent.

Key Words : *Penicillum janthinellum* Bio-sorption, Lead, Chromium.

INTRODUCTION

Bio-sorption of metal ions strongly depend on pH. The biosorption of Cr, Ni, Zn and Pb by *P. chrysogenum* was observed to be very low below pH 3.0. It was found to increase with pH from acidic to basic range (Volesky *et al.*, 1993; Tan and Chang, 2003). Barror *et al.* (2003) observed that Cd biosorption on various fungal strains was pH sensitive. *A. oryzae*, *A. niger*, *F. solani* and *Candida utilis* were found to perform better in the acidic range.

Process of bio-sorption is a non-directed physico-chemical interaction between metal or radionuclide species and cellular compounds of biological origin (Shumate and Strandberg, 1985). From a long time activated carbon and peat occupied the case of biosorbent, but they are geographically restricted in distribution. but there availability was geographically restricted (Lodeiro *et al.* 2006 Garni, S., Ghanem, M. and Bahobail, A.S. 2009, Kumar R. 2014 Kumar R, Sharma AK, Singh P, Dhir B, Mehta D. 2014). Hence, biosorbents developed from plant such as wheat crop and microbes could resolve this problem (Ahluwalia, S.S. and Goyal, D. 2005, Tahir, A. and Zahid, S. 2008, Khambhaty *et al.* 2009, Sangwan, S and Dhankhar, R. 2010 & 2016, Rajfur M, Kłos A, Wacławek M. 2012). Furthermore, removal of pollutants from refinery effluent by using low cost and easily available wheat straw bio-sorbents seems to be promising.

The change in the sorption capacity with pH can be explained on the basis of proton-competitive adsorption (Huang *et al.*, 1991). Biosorption is also affected by biomass concentration (Merrin *et al.*, 1998). Lower cadmium uptake was observed at higher concentrations of *A. niger* (Barros *et al.*, 2003). The amount of chromium biosorbed per unit weight of biomass decreased with an increase in concentration of *R. arrhizus*, *R. nigricans*, *A. oryzae* and *A.niger* (Sudha Bai and Abraham, 1998, 2001; Niyogi *et al.*, 1998).

MATERIAL & METHODS

Lead and chromium were analysed in refinery effluent and control by the method as outlined in Gupta (2000) by using atomic absorption spectrophotometer.

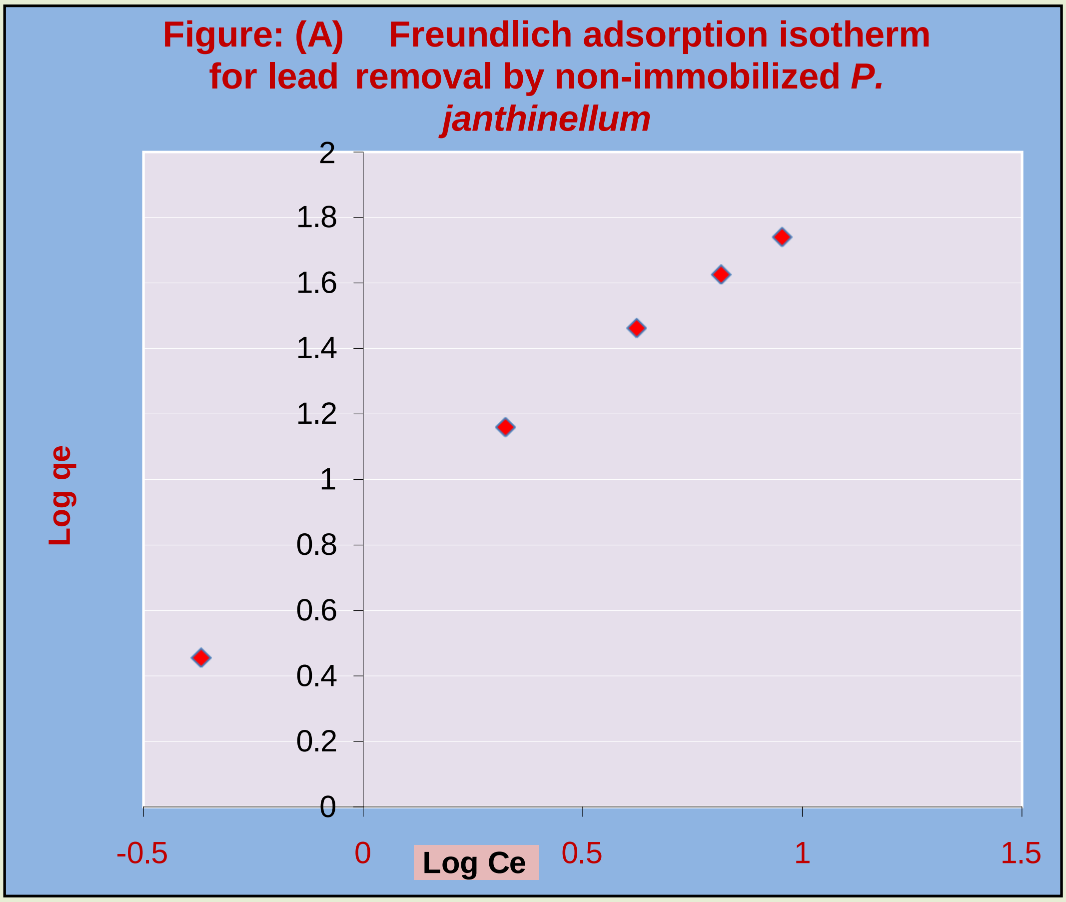
Isolation of pure colonies of fungi were done on the solid rose-bengal agar medium (Gupta, 2000). Isolated pure colonies were sent to Pathology Division, IARI, New Delhi for identification.

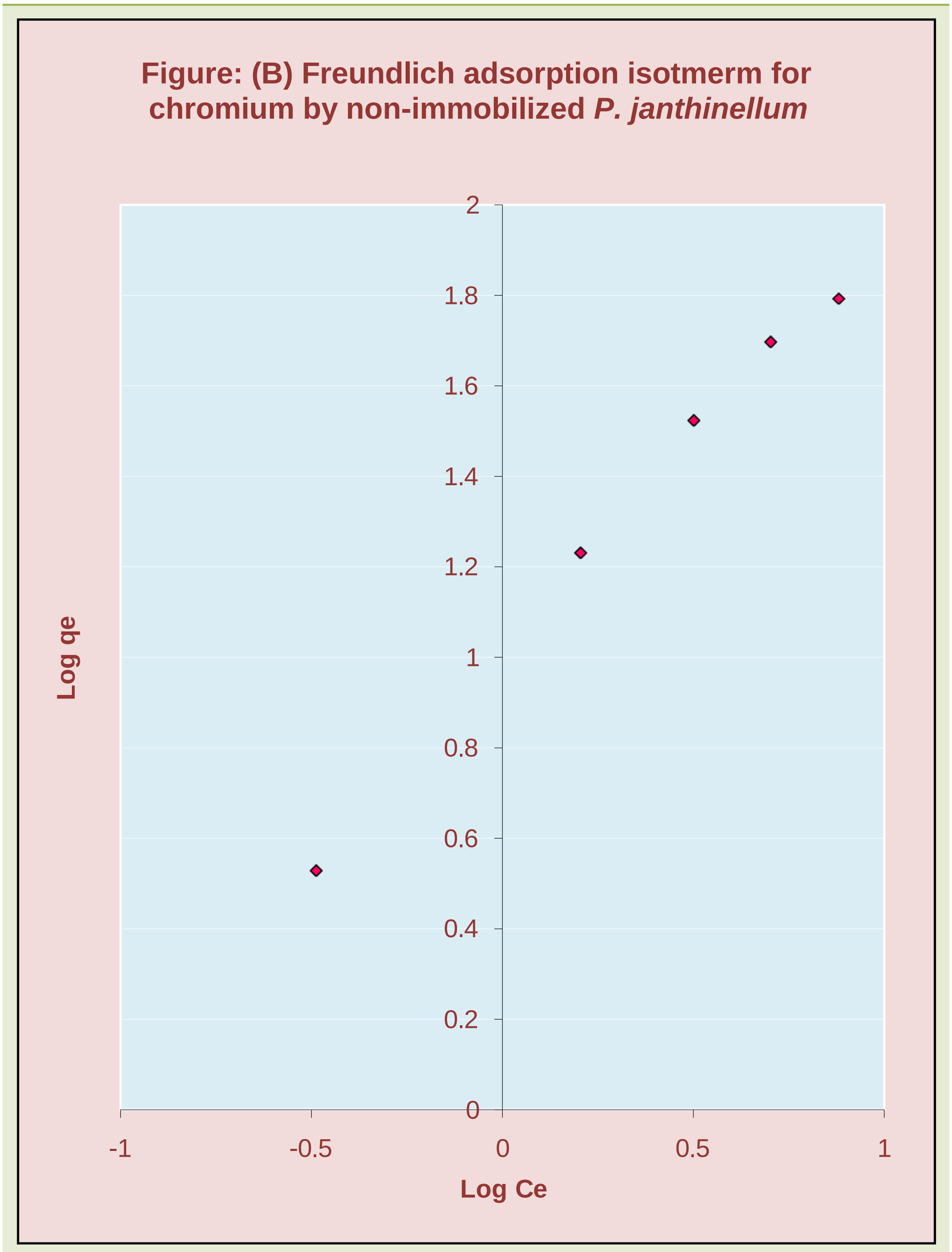
The biomass of *Penicillum janthinellum* was produced and collected by batch experimentation outlined by Kapoor *et al*., (1999).

RESULT & DICUSSION

The results of the batch experiments carried out for the removal of lead, from synthetic samples using non-immobilized bio-sorbent from fungal biomass of *Penicillum janthinellum* are shown in Figure: (A) & (B) compares the percent removal of lead with increasing concentration of lead in aqueous solutions. Non-immobilized *Penicillum janthinellum* bio-sorbent showed removal of lead and chromium from aqueous solution.

Equilibrium occurring during adsorption at a definite concentration range could be represented by Freundlich adsorption isotherm. Analysis of above data by Freundlich adsorption isotherm indicated linearity between logarithm of toxicants adsorbed on the surface of biomass and logarithm of residual toxicants concentration in the solution. Observed value of adsorption intensity (n) and adsorption capacity (k) of biosorbent were shown in table (1).





A plot between log qe and Ce yielded a linearized form of Freundlich isotherm. The high value of log k indicated a high adsorption capacity which is adsorbate adsorbed per unit weight of biosorbent. 1/n is the measure of adsorption intensity. Higher the n value, higher is the intensity of adsorption (Seravanan *et al*. 2000). The higher values of k and n shows higher affinity of the biosorbent for biosorption.

Table: (1) Freundlich isotherm constants and correlation of coefficient of biosorption of various toxicants by different non-immobilized biosorbents

Bio-sorbent	Toxicants	Log k	n	r^2
P. janthinellum	Lead	0.9315	1.1105	0.9954
	Chromium	1.0908	1.1582	0.9705

CONCLUSION

Batch studies were conducted for dead fungal biomass of *Penicillium janthinellum*. Bio-sorption results revealed that bio-sorption was found to be 58% of lead, 68.3% of chromium by *Penicillium janthinellum.*

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REFERENCES

APHA, 1985. Standard methods for the examination of water and waste water American Public Health Association, Washington, DC.

Anae, D., Hakerlerler, H., M.E.,, Fragoso, M.A.C (Ed), Beusichem, M.I.V. 1993. The use of Industrial waste as manures: A case study with effluent made from an olive processing plant. Eighth International Colloquium for the Optimization of Plant Nutrition, 31 August-8 September, 1992, Lisbon, Portugal, 63-86.

Ahluwalia, S.S. and Goyal, D. 2005. Removal of heavy metals by waste tea leaves from aqueous solution. *Eng. Life Sci.*, 5: 158–162.

Arther, M. and Vohra, B.S. 1995. *Heavy metal and environment*. Wiley Eastern Limited, New

Delhi.

Balu, T.R. 2002. Great leaps forward in environment plants. *Environment Plus*, New Delhi, 1(5): Jan. 24-30.

Bahadir, T., Bakan, G., Altas, L. and Buyukgungor, H. 2007. The investigation of lead removal by biosorption: An application at storage battery industry wastewaters. *Enzyme Microb. Technol.*, 41: 98–102.

CPCB 1995. Pollution control acts, rules and notifications issued thereunder, *Cont. Poll. Cont. Board*, New Delhi.

Chhonkar, P.K., Dutta, S.P., Joshi, H.C. and Pathak, H. (2000a). Impact of industrial effluents on soil health and agriculture – Indian experience: Part 1 – Distillery and Paper Mill Effluents. *Journal Sci. and Industrial Res.*, **59(5):** 350-361.

Chhonkar, P.K., Dutta, S.P., Joshi, H.C. and Pathak, H. (2000b). Impact of industrial effluents on soil health and agriculture – Indian experience: Part 11 – Tannery and Textile Industrial Effluents. *Journal Sci. and Industrial Res.*, **59(6)**: 446-454.

Das, N., Vimala, R. and Karthika, P. (2008). Biosorption of Heavy Metala- An Overview. *Indian Journal of Biotechnology*. 7: 159-169

Dhankhar, R. And Dahiya, J.S. 2000. Effect of steel re-rolling factory effluent on soil properties and physiological responses of native plant species. *Proc. Acad. Environ. Bio*., 9(1): 79-83.

Garni, S., Ghanem, M. and Bahobail, A.S. 2009. Biosorption characteristics of *Aspergillus fumigatus* in removal of cadmium from an aqueous solution. *Afr. J. Biotechnol.*, 8: 4163–4172.

Gupta P.K. 2000. Methods in Environmental analysis – Water, soil and Air. Agrobios, Jodhpur, India.

Kapoor, A., Viraraghavan, T. And Cullimore, D.R. 1999. Removal of heavy metals using the fungus *Aspergillus niger*. *Biores. Tech.*, 70:95

Khambhaty, Y., Mody, K., Basha, S. and Jha, B. 2009. Biosorption of inorganic mercury onto dead biomass of marine *Aspergillus niger:* Kinetic, equilibrium, and thermodynamic studies. *Environ. Eng. Sci.*, 26: 531–539.

Khan H.J. (2000). Clean-up act. Science Reporter. **37(4):** 42-43.

Kumar R (2014) Potential of Some Fungal and Bacterial Species in Bioremediation of Heavy Metals. Journal of Nuclear Physics, Material Sciences, Radiation and Applications 1: 213-223.

Kumar R, Sharma AK, Singh P, Dhir B, Mehta D (2014) Potential of Some Fungal and Bacterial Species in Bioremediation of Heavy Metals. Journal of Nuclear Physics, Material Sciences, Radiation and Applications 1: 213-223.

Lee Y-C, Chang S-P (2011) The biosorption of heavy metals from aqueous solution by Spirogyra and Cladophora filamentous macroalgae. Biores Technol 102(9): 5297–5304

Lodeiro, P., Barriada, J. L., Herrero, R. And De Vicente, M.E.S. 2006. The marine macroalga *Cystoseira* baccata *as* biosorbent for cadmium(II) and lead(II) removal: Kinetic and equilibrium studies. *Environ. Pollut.*, 142: 264–273.

Martins LR, Lyra FH, Rugani MM, Takahashi JA (2015) Bioremediation of Metallic Ions by Eight Penicillium Species. Journal of Environmental Engineering C4015007. 46. Ghosh A, Ghosh Dast

Mohammed Umarm, Mustapha and Normala Halimoon (2015) Microorganisms and Biosorption of Heavy Metals in the Environment: A Review Pape. Journal of oJ Microbial & Biochemical Technology 7(5): 253-256

Pan, X., Meng, X., Zhang, D. and Wang, J.(2009). Biosorption of strontium ion by immobilised *Aspergillus niger*. *Int. J. Environ. Pollut.*, 37: 276–288.

Ranganathan, R., Sheela, R., Venkatesan, A., and Ravindran, K.C. (1999). Sea water effect on growth and photosynthetic parameters of *Avicennia oficinalis L*., *Geobios*, **26(4):** 179-182

Rao, A.P. and Rao, P.V.V.P. (2002). Pollution potential of sago industry: A case study. *J.Ecotoxicology Environmental Monitoring*, **12(1):** 53-56.

Sangwan, S. and Dhankhar, R. (2010). Biomass of Aspergillus sydowi act as a bioadsorbent for removal of heavy metals from refinery effluent. *Journal of Interdisciplinary and Multidisciplinary Research (JIMR)* : **5(7): 33-42**

Sangwan, S. and Dhankhar, R. (2016). Removal of Cr, Ni and Pb from Refinery effluent by Using Wheat Straw bio-adsorbant. *International Research Journalof Natural and Applied Sciences*: **3(12): 197-204**

Sangwan, S., Sushma and Dhankhar, R. (2016). Analysis of Panipat Oil Refinery Effluent- A Case study. *Journal of Interdisciplinary and Multidisciplinary Research (JIMR)*: **5(7): 33-42**

Tahir, A. and Zahid, S. 2008. Ni(II) biosorption by *Rhizopus arrhizus Env* 3: The study of important parameters in biomass biosorption. *J. Chem. Technol. Biotechnol.*, 83: 1633–1638.

Tom Shultz, Jan. 2005

Vijayaraghavan, K. and Yun, Y.S. 2008. Biosorption of C.I. Reactive Black 5 from aqueous solution using acid-treated biomass of brown seaweed *Laminaria sp.*. *Dyes Pigm.*, 76: 726–732.

Rajfur M, Kłos A, Wacławek M (2012) Sorption of copper (II) ions in the biomass of alga *Spirogyra* sp. Bioelectrochemistry 87:65–70

Zabochnicka-ÅświÄ tek M, Krzywonos M (2014) Potentials of Biosorption and Bioaccumulation Processes for Heavy Metal Removal. Mercury 6: 145.