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# Bioabsorption of Cu(II)and Ni(II) by Non-Treated Edible Mushroom

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**Abstract**

The Non-treated biomass of *Agaricusbitorquis, Pleurotusfloridianus, Volvariellavolvacea, Volvariellladiplasia* and *Pleurotussajor-caju* was used for adsorption of different metal ions at pH 7. The tested mushrooms had more or less similar adsorption for all elements and in the range of 96%-93%. In our work *Pleurotusfloridianus* showed maximum biosoroption for Cd (93.59%) and Ni (96.80 %). Also Per gram adsorbent 'q' value of Cu (II) is more in *Pleurotusfloridianus* (6.50) and but for Ni (II) *Volvariellladiplasia* (3.541) has more 'q' value. Efficiency 'E' of Cu (II) and Ni (II) in solution. From graph it is clear that the Efficiency 'E' of Cu (II) and Ni (II) in solution is more in Psc and V.dip and less in V.V, V.dip and V.dip respectively

***Keywords:****PDA media, Fungal Biomass, Preparation of heavy metal solution, per gram adsorbent 'q' value, efficiency 'E', mean ± standard deviation Cu (II) and Ni (II).*

## Introduction

Rapid industrialization and technological advancements in the 19$^{th}$ and 20$^{th}$century have resulted in several environment problems. One of the problem of heavy metals are some of the important toxic heavy metals and their effects are as follows, Chromium VI (Cr VI), Copper, Zinc, Lead, Aluminium, Antimony etc. Zinc is used for a variety of industrial applications, including coating for steel and iron, galvanization, the manufacture of alloys, such as brass and bronze, and also in fabrication of dry-cell batteries. High Zinc concentrations in the environment are as toxic to microorganisms as other organisms. The Copper metal is also widely used in the industry to produce various products. The Copper II is more toxic as compared to the other ions of Copper. Among all the heavy metals Chromium (VI) is considered to be highly toxic, which is often present in industrial wastewaters as chromate and dichromate ion (Ahalya, 2003). The discharge of Chromium (VI) into aquatic ecosystems has become a matter of concern in all the tannery area in India over the last few decades. Chromium can replace other metals in biological systems with toxic effects and its accumulation throughout the food chain leads to serious ecological and health problems as Chromium (VI) is a known human carcinogen.

In this regard, the increasing awareness of accumulation of heavy metals in the environment has also led to a quest for new and improved cleaner technologies to overcome metal pollution. An innovative heavy metal removal process called bioremediation composed of *phytoremediation* and bio sorption has gained enormous impetus. In the process of *phytoremediation,* certain plants have been found to remove metals from contaminated water. Heavy-metal ions can be entrapped in the cellular structure and subsequently bios orbed onto the binding sites present in the cellular structure. This method of uptake is independent of the biological metabolic cycle and is known as bio sorption (Fourest and Roux, 1992).

Algae, bacteria, fungi and yeasts have proved to be potential metal bio sorbents. The major advantages of bio sorption over conventional treatment methods include, Low cost, good efficiency; minimization of chemical and biological sludge, regeneration of bio sorbent, and possibility of metal recovery. Due to higher affinity of the sorbent for the sorbet species, the latter is attracted and bound there by different mechanisms. InThe process continues till

equilibrium is established between the amount of solid-bound sorbet species and its portion remaining the solution. The degree of sorbent affinity for the sorbet determines its distribution between the solid and liquid phases. Mechanisms of metal bio sorption are essential to be understood first in order to successfully exploit the phenomenon and for regeneration of bio sorbent materials in multiple reuse cycles.

**Materials and methods**

All the glass wares used were of Borosiland the chemicals were of AR grade. Culture of *Agaricusbitorquis* (A.bit), *Pleurotusfloridianus* (P. flori),*Volvariellavolvacea* (V.V), *Volvariella* (V.dip) were purchased from IMTECH (NCL, India) and *Pleurotussajorcaju* (Psc) was isolated from spawn (purchased from MahatmaPhule Agriculture College, Shivajinagar, Pune). Maintenance of culture - All the cultures was maintained on PDA medium (with pH7) at 22 ±1°C, in petriplates and slants by continuous sub culturing.

**Synthesis method**

**Preparation of PDA media**

200 gm peeled potatoes were cut into small pieces, boil it up to half cooked. Then filtered it by using muslin cloth. 20 gm of Dextrose was added into it and dissolved completely. Then 20 gm of agar powder dissolve in separate warm water after complete dissolving add it into filtrate solution and make final volume was made up to1000 ml in conical flask. The pH was maintain upto7.0 by adding NaOH and HCl solution.The conical flasks were plugged with cotton and was autoclaved at 121° C, 15 lbs pressure for 20 min.

**Plate pouring**

The petriplates were washed, cleaned and autoclaved at 121°C, 15 lbs pressure for 25 min and kept under in laminar air flow for 20 min. To the autoclaved PDA media, prior to pouring, a pinch of streptomycin. The media was then poured in petriplates. The plates were kept overnight for setting of the medium.

**Fungal inoculation**

Disc of approximate 2 mm diameter was cut from marginal hyphae of a pure culture with the help of sterile arrow head and was transferred to freshly prepared PDA plates. The plates were kept in BOD incubator at 22 ±1°C.

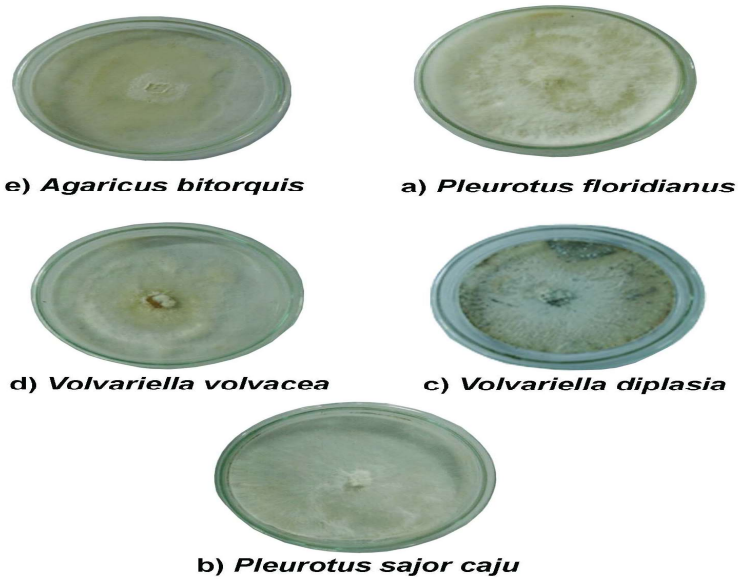



Plate-1 Fig.**a)** *Agaricusbitorquis* (A.bit), **b)***PleurotusFloridianus* (P.flori), **c)***VolvariellaVolvacea* (V.V) **d)** *Volvarielladiplasia* (V.dip) and **e)**Pleurotussajorcaju (Psc)

**Fungal Biomass**

To afford large fungal biomass, a fresh culture was transferred aseptically to PDA broth. The flasks were kept in shaker at 15 rpm with constant shaking till the biomass is grown.

**Harvesting Biomass**

After the biomass has been formed, the media was filtered and the biomass was separated. The biomass was washed with sterile distilled water to remove traces of media and was evaluated for element absorption potential.

**Preparation of heavy metal solution**

Preparation of heavy metal solution was done by dissolving 0.348 mg of CuSo4 (Cu = 796 mg/L) and 0.298 mg of $NiCl_2$ (Ni = 493.84 mg/L) in 250ml of distilled water to afford 5 mm solutions. The solutions were further diluted with PDA media to the concentration of 2 mm. The resultant solutions were autoclaved and were incubated with 300 mg of mushroom biomass by keeping the flask on rotary shaker at 130 rpm for 180 min. After completion of treatment period, the solution was filtered through what man's filter paper to remove mushroom biomass and solution was immediately analysed for element concentration using Atomic Absorption Spectroscopy (A.A.S.).

**Fungal Biomass Inoculation**

Take the large fungal biomass grown which was wash for 4 to 5 times into the distilled water. After the washed biomass was dried well then the dried biomass was weighted 0.3 mg this much amount of biomass was added into each solution of Nickel (II) chloride and Copper (II) sulphate conical flasks. These conical flasks were kept in shaker at 130 rpm with constant shaking up to 3 hour.

Figure 2(a)

Figure 2(b)

Figure 2(a): Conical flasks were kept in shaker at 130 rpm with constant shaking up to 3 hours.

Figure 2(b): The amount of biomass was added into each solution of Nickel(II) chloride and Copper (II) sulfate conical flasks and plates and conicalflasks were kept in BOD incubator at 22 ±1°C

**Results and Discussion:**

**Table 1: Amount of Cu (II) and Ni (II) absorbed in solution**

| Sample Name | Cu mg/L | Ni mg/L |
|---|---|---|
| A.bit | 51.535 | 13.698 |
| Psc | 51.746 | 13.717 |
| P. flori | 51.485 | 13.687 |
| V.V | 51.030 | 15.096 |
| V.dip | 51.064 | 15.191 |

The above table shows the amount of Cu (II) and Ni (II) absorbed in solution. From table it is clear that the amount of Cu (II) and Ni (II) absorbed in solution is more in Psc and V.dip and less in V.V and *P.flori* respectively.

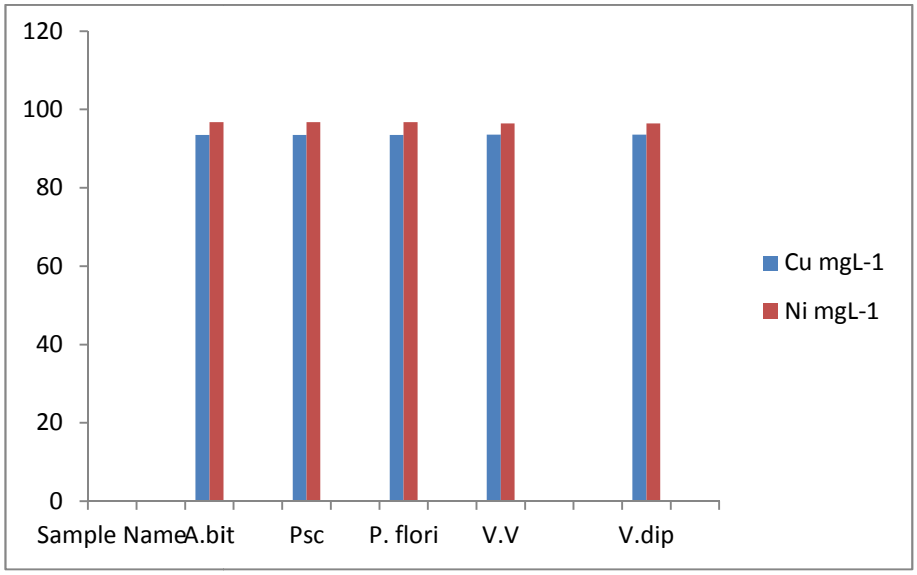
**Table 2: Amount of Cu (II) and Ni (II) remaining in solution**

| Sample Name | Cu $mgL^{-1}$ | Ni $mgL^{-1}$ |
|---|---|---|
| A.bit | 744.465 | 415.302 |
| Psc | 744.254 | 415.283 |
| P. flori | 744.515 | 415.313 |
| V.V | 744.97 | 413.904 |
| V.dip | 744.936 | 413.809 |

The above table shows the amount of Cu (II) and Ni (II) remaining in solution. From table it is clear that the amount of Cu (II) and Ni (II) remaining in solution is more in V.V and P.flori and less in Psc and V.dip respectively.

**Table: 3 Amount of Cu (II) and Ni (II) remaining in solution in %**

| Sample Name | Cu $mgL^{-1}$ | Ni $mgL^{-1}$ |
|---|---|---|
| A.bit | 93.52 | 96.80 |
| Psc | 93.49 | 96.80 |
| P. flori | 93.59 | 96.80 |
| V.V | 93.58 | 96.48 |
| V.dip | 93.58 | 96.45 |

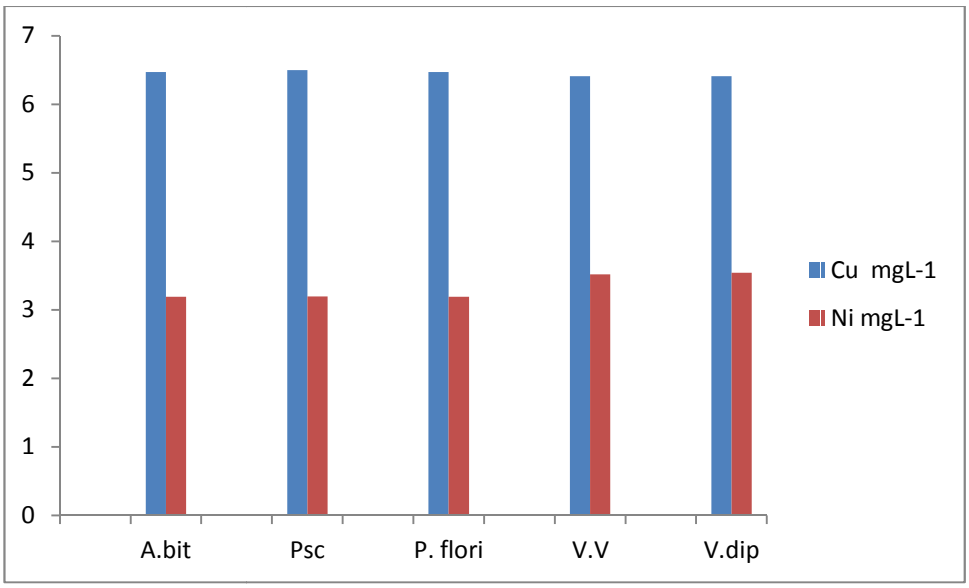



**Graph (a)**

The above graph (a) shows the amount of Cu (II) and Ni (II) remaining in solution by % is more in V.V, P.flori and V.dip, P.flori and less in Psc, V.dip and A.bit respectively.

**Table 4: Per gram adsorbent 'q' value of Cu (II) and Ni (II).**

| SampleName | Cu mgL$^{-1}$ | Ni mgL$^{-1}$ |
|---|---|---|
| A.bit | 6.47 | 3.193 |
| Psc | 6.50 | 3.197 |
| P. flori | 6.47 | 3.190 |
| V.V | 6.41 | 3.518 |
| V.dip | 6.41 | 3.541 |

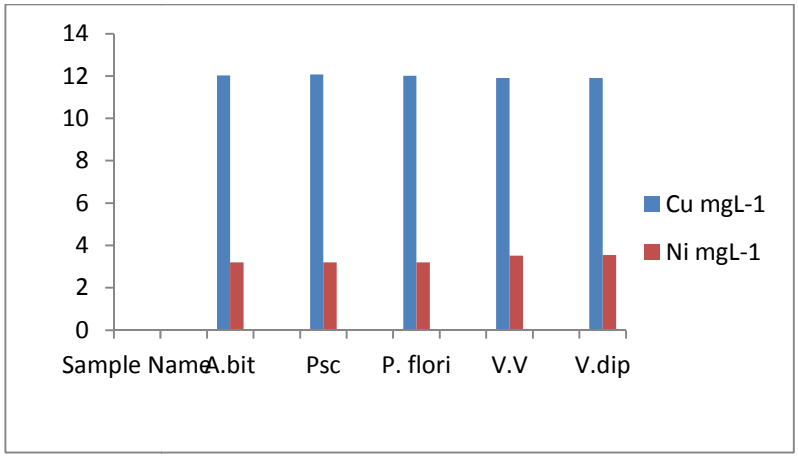



**Graph(b)**

The above graph shows the amount of Cu (II) and Ni (II) adsorbent 'q' in solution. From graph it is clear that the amount of Cu (II) and Ni (II) adsorbent 'q' in solution is more in Psc and V.dip and less in V.V, V.dip and V.dip respectively.

**Table 5: Bio sorptionefficiency 'E' of Cu (II) and Ni (II).**

| Sample Name | Cu mgL$^{-1}$ | Ni mgL$^{-1}$ |
|---|---|---|
| A.bit | 12.02 | 3.1962 |
| Psc | 12.07 | 3.2006 |
| P. flori | 12.01 | 3.1936 |
| V.V | 11.91 | 3.5224 |
| V.dip | 11.91 | 3.5445 |




**Graph(c)**

The above graph(c) shows theEfficiency 'E' of Cu (II) and Ni (II) in solution. From graph it is clear that theEfficiency 'E' of Cu (II) and Ni (II) in solution is more in Psc and V.dip and less in V.V, V.dip and V.dip respectively

**Table 6: The mean ± standard deviation Cu (II) and Ni (II) .**

| Sample Name | Cu $mgL^{-1}$ | Ni $mgL^{-1}$ |
|---|---|---|
| A.bit | 51.535±0.001528* | 13.697±0.002* |
| Psc | 51.74567±0.001154* | 13.716±0.00173* |
| P.flori | 51.484±0.001* | 13.68566±0.001527* |
| V.V | 51.04±0.02* | 15.09733±0.001527* |
| V.dip | 51.0633±0.002082* | 15.194±0.004358* |

* = mean ± standard deviation

The above table shows the mean ± standard deviation ofCu (II) and Ni (II) solution of A.bit, PscP.flori, V.V and V.dip respectively.

**Conclusion:**

From the result and Discussion it is concluded that the Cu (II) and Ni (II)were more absorbed in *Pleurotussajorcaju* (Psc) and *Volvariella Diplacea*(V.dip) and less in *Volvariellavolvacea* (V.V) and *Pleurotusfloridianus*(P.flori) edible mushroom respectively, because the Psc and V.dip has moreaffinity to attract the Cu (II) and Ni (II) particles and V.V and P.flori has less affinity to attract the Cu (II) and Ni (II) particles i.e. it is rejected more of the Cu (II) and Ni (II) particles.

**References:**

1. YL Prasad, DR Sachin - Asian Journal of Experimental Biological Sciences, 2013Biosorption of Cu, Zn, Fe, Cd, Pb and Ni by non-treated biomass of some edible mushrooms
2. Muraleedharan T.R., Mechanism of biosorption of copper (II) by Ganodermalucidum Biotechnol. Bioeng, 35:320-325(1990).
3. Gadd G.M. *et al*.Heavy metals and radionuclide by fungi and yeasts In: P.R Norms and D. P Kelly (editors), Biohydrometallurgy. A, Rowe, Chippenham, Witts, U.K.(1988).

4. Ahaly N., T.V. Ramchandra and R.D.Kanamadi, T.V. (200X) .Removal of hexavalent chromiym using coffee husk.
5. Fourest, E.and Roux, J.C. Heavy metal biosorption by fungal mycelial by-products, mechanism and influence of pH. Applied micobiology and biotechnology 1992, vol.37, p.399-403.
6. Kuyucak N. and Vole sky, Biosorbents for recovery of metals from industrial solutions.Biotechnol. Left. 10(2), 137-142(1988).
7. Vimla R, Das N., Journal of Hazardous material volume 168, issue 1, page 376-382(2009).
8. Gupta V.K.,Rastogi A., Journal of Hazardous material 2008 mar 21; 152:407-14, pub 2007 july 17.
9. Gokhale, S.V., K.K. Jyoti, and S.S. Lele, Bioresource Technology (2008) volume: 99, issue: 9, page 3600-3608.
10. MaliheAmini, HabibollahYounesi, Nader, Bahramifar, chemosphere, volume 75, issue11 June 2009,pages 1483-1491.
11. Haq H.B, Ghafrana S. and Muhammad A.H. industrial Biotechnology Laboratory, Department of chemistry and Bio-chemistry university of Agriculture Faisalabad-380400, Pakistan.
12. N.A.A. Babaride Department of chemical science, olabisiOnabaja University, Ago-lwoye Nigeria