



Biosorption of heavy metals from tannery effluent by using macrofungi

S.Surumbar Kuzhali¹, ManiKandan N² and R.Kumuthakalavalli²

¹Department of Biology, Gandhigram Rural Institute, Gandhigram, Tamil Nadu, India-624 302.

²Department of Biology, Gandhigram Rural Institute, Gandhigram.

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ABSTRACT

The article extends, study on the removal of heavy metals such as Cr, Zn and Ni from tannery effluent by using macrofungi in the form of mycelial biomass. Mycelial biomass of cultivated mushrooms namely *Pleurotus florida*, *Calocybe indica* were collected and subjected for biosorption studies. Among the chosen two mushrooms *Pleurotus florida* showed the maximum biosorption. Both the mushrooms were found to have the biosorption efficiency of heavy metals namely Cr, Zn and Ni. *Pleurotus florida* has 88.5% biosorption efficiency of Cr; 68.4% Zn and 58.8%; while *Calocybe indica* has recorded 55% biosorption efficiency of Cr; 37.9% Zn and 49.1% Ni respectively. As biosorption of heavy metals using macrofungi is an ecofriendly method, it could be an excellent and viable method for the removal of heavy metals from tannery effluent.

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Introduction

In developing countries, many industries are being operated in small and medium scales and these small units operated considerable pollution by discharging their effluents directly into the environment. Heavy metal pollution caused by industries is a major threat to environment. Electroplating and leather industries are the major cause for the high influence of heavy metals to the biosphere. Tanneries have inherent product of the tanning process but also significant amounts of ZN, Mn, Cu and Pb [1].

Over 62% of ordinary people and 72% of tannery workers have contracted one or more problems like cancer, respiratory infections, tuberculosis loss of eyesight liver and abdominal diseases, kidney and urinary infections[2].

Under the circumstances it is very important to develop and apply comprehensive methods of waste water management that would facilitate the sustainable use of water resources, preserves environmental integrity and improve livelihood on a long term basis. Different physico ,chemical and biological methods have been developed for the removal of heavy metals from waste water, some of which are precipitation ion exchange, electrolysis reverse osmosis, solvent extraction, adsorption and filtration, bioabsorption and bioaccumulation etc. Among these bioabsorption using macro fungi from tannery effluent is attempted in this study.

Numbers of basidiomycetes are reported to have shown a great promise for heavy metal ions removal from waste water since their mycelium excretes enzymes that breakdown complex substances into simpler molecules and absorb heavy metals[3]. This suggests that mushrooms possess potential for the uptake of heavy metals from the effluents hence in this study selected macrofungi are tested for their heavy metal absorption from tannery effluent.

Material and methods

The effluent samples were collected from the tannery industries, Begambur, Dindigul, Tamil Nadu during November[4]. Stored in waste water container, maintained at

room temperature[5]. This effluent was immediately used for experimental study.

In the meantime pure culture of *Pleurotus florida* and *Calocybe indica* were prepared and subcultured at 30⁰ C for a period of seven days. The 2 g of mycelium of the chosen two mushrooms were taken from the culture washed and used for biosorption study [6]. The tannery effluent was filtered using whatman No 1 filter paper and treated with the mycelia of the two chosen mushrooms namely *Pleurotus florida* and *Calocybe indica*. The experimental setups were maintained for a period of seven days .After seven days the treated effluents samples were analysed for heavy metal by using AAS. The results were analyzed and calculated using the following formula

$$E = \frac{C_0 - C_X}{C_0} \times 100$$

E=Efficiency of % removal

C₀=initial metal ion concentration

C=Final metal ion concentration

Results

Physico chemical properties of effluent were tabulated in Table 1. presence of heavy metals namely Cr, Zn and Ni present in the effluent prior and after the treatment is tabulated table 2. According to physico chemical and biological properties after the treatment pH, BOD, COD was decreased.

Table 1. Physico chemical parameters of the tannery effluent

S.no	Parameters	Before Mean ± SD	After Mean ± SD
1.	pH	3.53± 0.66	2.9± 0.27
2.	Temperature	27 ± 1.00	27± 1.00
3.	EC	60.36 ± 3.44	52.17± 1.62
4.	BOD	3.57± 0.41	2.93± 0.61
5.	COD	3493.3± 208.4	2756.1 ± 301.4
6.	TSS	45 ± 6.29	29.1± 5.61
7.	Salinity	46 ± 7.93	44 ± 1.51
8.	Sulphate	222.3 ± 10.96	186.5± 11.23

Both the mushrooms were found to have the biosorption efficiency of heavy metals namely Cr, Zn and Ni. *Pleurotus florida* has 88.5% biosorption efficiency of Cr; 68.4% Zn and

58.8% (fig: 1) while *Calocybe indica* has 55% biosorption of efficiency of Cr; 37.9% Zn and 49.1% Ni respectively (fig: 2).

Fig: 1



Fig:2



Discussion

The present study recorded the pollution of tannery effluent by its physico chemical properties including heavy metals such as Cr, Zn and Ni.

Conventional waste water treatment are reported to be effective at removing heavy metals and involve high costs, besides these they involve formation of hazardous byproducts and intensive energy requirements.

Hence alternate ecofriendly method can be sought for wastewater treatment. Similarly [7] reported that removal of Cadmium ions from tannery effluents by mycelia biomass of *P.florida* was investigated. *P.ostreatus* mushroom showed maximum uptake of cadmium, zinc [8].

The mycelium excretes enzymes that breakdown complex substances into simpler molecules. They can also take up heavy metals into their fruiting bodies. The fungal subjected to varied concentration of Cr (III) ions from 4.20 mg/l exhibited an increase metal concentration and maximum uptake was evident

at the highest applied concentration. This assessment is in line with previously reported data on sorption of Cr (II) ions by *P.chryso sporium* [10]. There is a evidence that at high metal concentration the number of ions sorbed is more than at low metal concentration [11]

In this present study it is recorded that two cultivated mushrooms namely *P.florida* and *C.indica* were found to be potential biosorbent of heavy metals like Cr, Ni, Cr and zn

Conclusions

From this study it is evident that the macrofungi are available having the capacity of effective biosorption of heavy metals which can be taken as ecofriendly method.

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