

Removal of Heavy Metal by using Hatchery Residual Bio Sorbent

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Abstract— Water is essential to all forms of life and makes up 50-96 % of the weight of all plants and animals. In recent years pollution of aquatic environment by heavy metals has increased. The continuous mixing of industrial effluents containing heavy metals discharged to the natural resources, deposits toxic compounds in natural water. Due to their potential toxic effect and ability to bioaccumulate, it is very difficult to remove them from wastewater stream. Electroplating industry is one of the potential source of heavy metal containing waste water. Even though conventional processes were witnessed for the treatment of this wastewater it still contains rational concentration of heavy metals so it is very necessary to affix supplementary treatment processes. The removal of Cu and Cd was investigated by using hatchery residual biosorbent. The effects of contact time, HRB dosage concentration and pH for the electroplating industry effluent was studied at lab scale by conducting batch experiments. The maximum adsorption capacity for Cd was 115.02 mg/l for 30gm of HRB dosage.

Key words: Hatchery Residual Biosorbent, Heavy Metals, pH

I. INTRODUCTION

Due to rapid increase in the concentration of heavy metals there is a necessity of efficient methods for the removal of heavy metals from industrial wastewater stream before discharge so as to eliminate the risk on the human life as well as on the aquatic environment. If this heavy metals are exposed to natural ecosystem, accumulation of heavy metals takes place in the human body through food chain and direct intake. In order to reduce environmental pollution due to heavy metals a number of studies are being conducted to minimize the problem. Though conventional method such as membrane process, chemical precipitation, electrochemical process, ion exchange etc. are adopted still number of studies are being carried on the development of other process such as biological treatment, treatment based on the bio sorption process etc. to supplement the conventional process so as to increase removal efficiency. Eggshell waste has been widely used as biosorbent for the removal of heavy metals from industrial wastewater. Physical and chemical properties of treated eggshell are studied and were found to have the applicability in removal of heavy metal.

Industries	A g	C d	C r	C u	F e	H g	M n	N i	P b	T i	Z n
General industry and mining			X	X	X		X		X		X
Plating		X	X	X				X	X		X
Paint products			X						X	X	
Fertilizers		X	X	X	X	X	X	X	X		X
Insecticides and Pesticides				X		X					

Tanning			X								
Paper products			X	X		X		X	X	X	X
Photographic	X		X								
Fibres				X							X
Printing and Dyeing			X						X		
Electronics	X										
Cooling water			X								
Pipe corrosion				X						X	

Table 1: Source distribution of heavy metals

II. BIOSORPTION PROCESS

The mechanism of biosorption is complex. The mechanism comprises of a sorbent (can be biosorbent) and a solvent (i.e. here wastewater). The solvent to be treated is exposed to sorbent. The sorbents consists of various chemical groups, which would attract the certain chemical group of solvent from the water and retain them back on the sorbent.

Similarly in case of biosorbent biological agents are used as sorbents they have affinity for selective type of metals hence they uptake the metals from the effluent according to their metals selectivity.

The complex structure of microorganisms implies that there are many ways for the metals to be taken up by the microbial cell hence the biosorption mechanisms are various. They may be classified according to various criteria. According to the dependence on the cell's metabolism, biosorption mechanisms can be divided into: Metabolism dependent and Non –metabolism dependent.

III. REMOVAL OF HEAVY METALS BY USING HATECHARY RESIDUAL BIOSORBENT

Industrial wastewater contaminated with heavy metals is commonly produced from many kinds of industrial processes. Therefore, if this wastewater is not treated with a suitable process or leaked from storage tanks, it can cause a serious environmental problem in the natural eco-system.

Eggshells were collected from different sources and were washed with distilled water several times in order to remove dirt. The washed eggshells were then sun dried for 2 days. Then the eggshell were dried in oven at 150 C and then cooled and crushed to fine powder of 80-120µm particle size. This dried eggshell powder was then used as bio sorbent. The chemical composition of the eggshell powder was

- CaCO₃: 92%
- MgCO₃: 4%
- Protein: 3%
- Organic Matter: 1%

IV. ADSORBATE SOLUTION

The sample collected consisted of 167 mg/l of Cd and 0.011mg/l of Cu, thus the cadmium perchlorate was used as Adsorbate solution.

V. EXPERIMENTAL DETAILS

The sample was neutralized to pH 5-6 from initial pH of 1.02. The eggshell so prepared was activated using the cadmium perchlorate solution for 2-3 hours and then 10,

Sr. No.	Sample ml	HRB gm	Time hr	Cd(mg/l)
1	250	10	1	134.63
2	250		2	128.15
3	250		3	121.65
4	250		4	121.11
5	250		5	120.76
6	250	20	1	108.64
7	250		2	103.76
8	250		3	98.77
9	250		4	97.58
10	250		5	97.16
11	250	30	1	82.23
12	250		2	76.24
13	250		3	53.47
14	250		4	52.66
15	250		5	51.98

Table 2: Result for different dosage of HRB

Concentration of Cd and Cu in the raw effluent was 167 mg/l and 0.1001 mg/l Beakers. Then the effect of different HRB dosage and the different contact time was studied. The result obtained for 10, 20, 30 gm and for 1, 2, 3, 4, 5 hrs were as following.

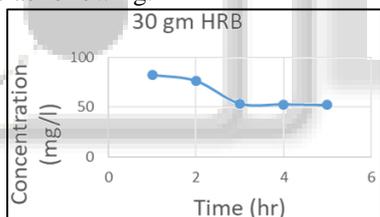


Fig. 1: Result

VI. CONCLUSION

Biosorption is being an alternative to conventional methods for the removal of toxic heavy metals from industrial effluents. These Conventional methods are expensive, hence the use of low cost, abundant environmentally friendly biosorbents have to be used. The advanced development of the biosorption processes requires further improvement in the direction of modelling, regeneration of biosorbent material and of testing immobilized raw biomasses with basic industrial effluents.

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