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EFFECT OF OPERATIONAL PARAMETERS ON REMOVAL OF CHROMIUM FROM TANNERY EFFLUENT BY USING *AZADIRACHTA INDICA*

NEHA MUMTAZ[1] , SHAILENDRA KR. SHARMA[2] , TABISH IZHAR[3]
[1] ASSISTANT PROFESSOR, DEPT. OF CIVIL ENGINEERING, INTEGRAL UNIVERSITY, LUCKNOW
[1]EMAIL-NEHAMUMTAZ@IUL.AC.IN
CONTACT NO.9452111709

[2] M.TECH (ENVIRONMENTAL ENGINEERING), DEPT. OF CIVIL ENGINEERING, INTEGRAL UNIVERSITY, LUCKNOW
[2]EMAIL-SKUMAR.SAMARTH@GMAIL.COM
CONTACT NO.8765191109

[3]ASSISTANT PROFESSOR, DEPT. OF CIVIL ENGINEERING, INTEGRAL UNIVERSITY, LUCKNOW
EMAIL-TIZHAR@IUL.AC.IN

Abstract - Heavy metal contamination of the rivers is a world wide environmental problem and its removal is a great challenge. The tanneries release their treated effluent in the near by water ways containing Cr metal that eventually merges with the river. The effluent of tannery industries are the major source of chromium contamination in the ground and surface water. Neem leaves powder adsorbent used in this study has been prepared at laboratory scale and has been observed to be very effective for removal of chromium from aqueous solution. In this study, different method of investigation and detailed experimental procedure were taken into consideration to obtain the effect of pH, dosage concentration and contact time on batch absorption. The biosorption of metal show in the present study that the naturally occurring microbes have enough potential to mitigate the excessive contamination of their surroundings and can be used to reduce the metal concentrations in aqueous solutions in a specific time frame. The removal of chromium (VI) by activated Neem leaves powder adsorption by batch adsorption studies expose that Neem leaves powder has a essential capacity for biosorption of Cr-(VI) from effluent. The maximum removal efficiency is tends up to 94.5% for bio sorbent prepared form Neem leaves.

Key Words – Chromium, Neem leaves powder (NLP), Biosorption, Batch Process, adsorption, efficiency, UV-spectrophotometer.

Introduction-

The most common forms of chromium that occur in natural waters in the environment are trivalent chromium (chromium-III), and hexavalent chromium (chromium-VI). Both valences of chromium are potentially harmful being mutagen and also carcinogen (Altundogan 2005; Dakiky *et al*., 2002). Heavy metal chromium is the one of most abundant metal founded in the high proportion in is untreated municipal wastewater. Industrial effluent discharged from different industries such as a tannery, paint, coating, electroplating etc. the major industrial activities that lead to chromium pollution to the environments. Natural materials that are available in large quantities or certain waste products from industrial or agricultural operations may have possible as low-cost .

sorbents (Ahalya *et al*., 2010).Chromium is metallic elements periodic table and it found naturally in rock, plants, soil, volcanic ash, human and animals that most common form chromium in the environment trivalent (Cr-III), hexavalent (Cr-VI), chromium -3 occurring naturally in Many groups, yeast, meals, fruits and vegetable. Cr-(VI) is produced by industrial process, and major source of chromium VI in drinking water are discharged from tannery and tends to erodes naturally deposit of chromium-III. Some of the

researchers have used both natural and synthetic material as adsorbent for removal of heavy metals and few authors used chemically treated natural materials as adsorbent for removal of heavy metals from the aqueous solution. Some of the adsorptive material such as green algae (Malkoc *et al*. 2003,Gupta *et al*. 2001) ,maple sawdust (Yu *et al*. 2003), a sugar industry waste (Gupta &Ali 2004a), oriental beech sawdust (Acar&Malkoc 2004), distillery sludge , soya cake (Daneshvar *et al*. 2002), persimmon tannin gel (Nakajima&Baba 2004), duolite (Gupta *et al*. 2004b), bagasse fly ash (Gupta *et al*. 2003), red mud (Gupta & Sharma 2002), activated carbon derived from fertilizer waste (Mohan *et al*. 2001), activated rubber wood sawdust (Kalavathy*et al*. 2005)**,** tea factorywaste (Malkoc& Nuhoglu 2005, Cay *et al*.2004) granular ferric hydroxide (Mukhopadyay *et al*.2007) has used in heavy metal removal from wastewaters and drinking water in meeting standards. Among all the natural adsorbent Azadirachta Indica (neem) leaves has high potential to remove the heavy metals. In India, Azadirachta Indica is a tree which is commonly seen in all over of India, the leaves of this tree is burnt and the burnt carbon can be utilized for the purification of water at a cheaper cost without heavy operation. Cr (VI) has been removed by neem leaves powder (Tawde and Bhalerao, 2010). Some of the study reports the biosorption kinetics and the biosorption equilibrium of Zinc by Neem leaves and stem bark powder (Arshad, *et al* 2010). Neem bark powder (NBP) has also been used as an adsorbent for the removal of hexavalent chromium from aqueous solutions (Saravanakumar and Phanikumar 2012). The potentiality of Neem has been widely studied by different researchers for solving various problems related to agriculture, public health, population control and environmental pollution (Arshad, *et al* 2010). Hence in the present work, Azadirachta indica (Neem) leaf powder is studied for their adsorptive capacity to remove chromium (VI) from aqueous solution.

Method and Materials –

In this method of absorbent is made by neem leaves to remove chromium from industrial effluent. The various parameters is display to pre-treatment of absorbent and analytical method for preparation of chromium ions solution.

Preparation of Adsorbent

The Neem leaves were washed many times with normal water & distilled water to remove dust and soluble impurities then dried the leaves in tray dryer for complete removal of moisture. It takes nearly 2-3 hrs at 110^0C. Then the dried leaves crushed and kept in muffle Furnace for 3-1/4 hrs at 250^0C. The heating period depends on the atmospheric temperature. After heating a blackish gray powder, form of Neem Leaves powder was obtained.

S.No.	Chemical Requirement	S.No.	Equipment Requirement
1.	Neem leaves	1	Glass Bakers
2.	Distilled Water	2.	Weighing Machine

3.	Muffle Furnace	3.	Potassium Chromate/Dichromate
4.	HCL, NaOH, H_2SO_4	4.	Measuring Cylinder
5.	DPC	5.	Burettes and Pipettes
	-	6.	Filter Paper
	-	7.	Conical Flaxes
	-	8.	UV-Spectrophotometer
	-	9.	pH meter

Determination of Maximum wavelength for operation-

The stock solution of 1000 mg/L of chromium prepared by dissolving 1 gm of chromium chloride in 1000 ml of distilled water. Then their absorbance was recorded at different wavelength by using UV-Spectrophotometer. Up to certain wavelength % absorption increases and then decreases, at the point where the % absorption is maximum that point is considered as maximum wavelength of operation.

Determination of standard calibration curve for chromium

For this purpose, solution of chromium chloride of different concentration was prepared and their absorbance was recorded by sing UV Spectrophotometer. The Spectrophotometer is set to Zero absorbance with the reference solution (Distilled water) and then the absorbance of standard solution was measured. With the help of these Reading standard calibration curve plotted between% absorption an standard chromium chloride solution of various concentrations.

The standard calibration curve for chromium

Concentration (ppm)	Absorbance
1	0.1
2	0.19
3	0.32

4	0.38
5	0.48
6	0.5
7	0.64
8	0.7
9	0.87
10	0.99

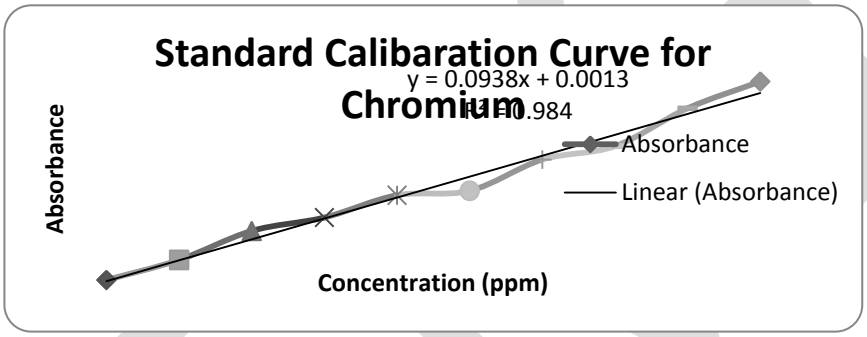

Fig.1 – Standard Calibaration Curve for Chromium

Result and Discussion –

Biosorption studies were performed through Batch Technique to obtain the rate and Equilibrium data. The removal efficiencies of neem leaves powder during the investigation of batch adsorption process had been studied.

Effect of pH -

pH affects the solution of chromium ion to a great extent. The pH of aqueous solution is the controlling factor in the adsorption process: hence, it becomes necessary to determine at what pH, max adsorption will takes place. Percentage removal of chromium goes on decreasing with increases in pH values. The maximum removal efficiency was 93.67% at pH 5 value. The Chromium removal was higher at lower pH values.

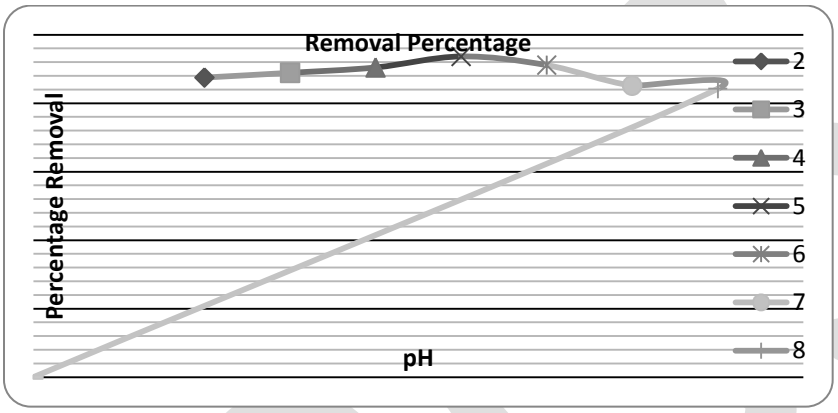

Fig.2- Effect of pH on removal of Cr- (VI) ion

Effect of Contact Time

Graph shows that Removal efficiency of Cr-(VI) ion increases with respect to increase in contact time (in min.) of adsorbent. Thus the contact time is found to be directly proportional to the removal efficiency.

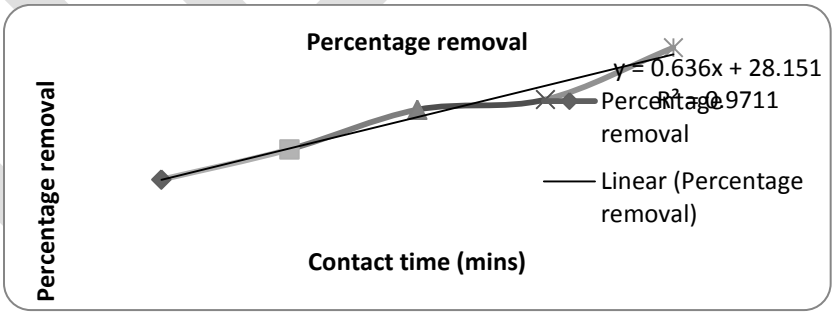

Fig.3 – Effect of contact time on removal of Cr-(VI) ion

Effect of Initial Metal Ion Concentration-

It was observed that the activity of adsorbent material falls sharply with an increase in initial concentration of chromium ion. The max Cr removal efficiency for all the set of optimized parameter was found to be 100% for Neem Leaves at initial concentration of 100mg/l. This is evident that the lower the concentration of the initial dose the higher the removal efficiency is observed.

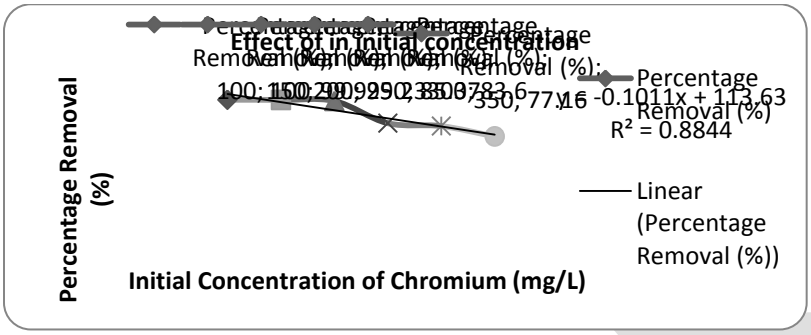

Fig.4- Effect of initial concentration on removal of Cr-(VI) ion

Effect of adsorbent Dose-

It can be seen that the rate of the removal of chromium ions increase with an increase in the amount of adsorbent dosage (in gm). The amount of adsorbent dose varies from 2gm/100ml to 10gm/100ml. the removal efficiency is maximum at dose of 10 gm/100 ml which is up to 94.5%.

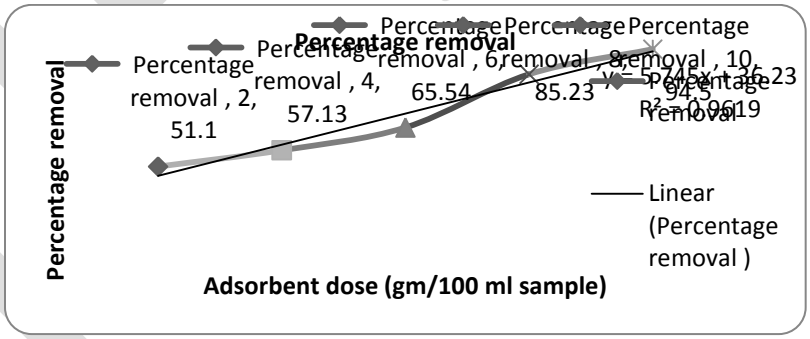

Fig.5- Effect of adsorbent dose on removal of Cr-(VI) ion

Conclusion

The present work is attempt for the systematic studies of removal of chromium from waste water using low cost adsorbent prepared form Neem Leaves. From the Experimental Findings it has been observed that the adsorbent material can be used successfully for

removal of chromium form waste water. The maximum efficiency was observed up to 94.5% for biosorbent prepared form Neem Leaves at the optimum values of parameters.

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