Adsorption of Chromium from Tannery Effluent by Using Neem (Azadirachta Indica) Leaves as a Low Cost Adsorbent

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Abstract – The effluent of tannery industries are the major source of chromium contamination in the ground and surface water, to remove the chromium from surface water Neem leaves are used as the absorbent. The removal of chromium (VI) by activated Neem leaves adsorption by batch adsorption studies expose that Neem leaves have an essential capacity for observation cr-(VI) form effluent. in this study absorption is the important industrial process removal of odor color, turbidity, metal ion and the reduction of COD. Neem adsorbent used in this study to prepared at laboratory scale observed to be very effective for removal of chromium form aqua's solution. In this study different method of investigation and detailed experimental procedure to of obtain the adsorption kinetic, adsorption equilibrium and effect of pH, dosage concentration ion and contact time on batch absorption and column adsorption system. The maximum removal efficiency is tends up to 86% for bio sorbent prepared form Neems leaves.

Index Terms – Chromium, Neems Leaves, Adsorption, Absorption Capacity.

1. INTRODUCTION

Heavy metal chromium is the one of most abundant metal founded in the high proportion in is untreated municipal waste water., 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 and 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 and Cr-(VI) is produced by industrial process, and major source of chromium VI in drinking water are discharged from tannery and tends to errosed naturally deposit of chromium-III. According to Natural Toxicology Program (NTP) status chromium-VI clearly carcinogenic, in lab animals leaver and kidney damage, anemia and ulcers, lunges cancer, industrial damage (inhalation) etc. MCL in drinking water .100 mg/l as total chromium & chromium no test method known for chromium-3, Total chromium Cr-Cr(VI) = Cr-3 and 92% to 97% chromium VI reduction possible & generally about 5µg/L to 8µg/L Cr-VI is founded effluent.The proposed work is concern with the removal of chromium ions by using low cost absorbent. There are various method for water treatment, but at present adsorption operation employing solid such as activity carbon synthetic resins are used mostly in industrial application for purification of water and waste water.Adsorption is the adhesion of atoms, ions or molecules from gas liquid or dissolved solid to surface. In the adsorption process a thin layer developed by the adsorbent on the surface of adsorbent. Adsorption phenomena are operative in the most naturally, physically, biologically and chemically system.

Sl. No.	**Chemical Requirement**
1.	Neem leaves
2.	Distlled Water
3.	Muffle Furnece
4.	HCL, NaoH, H_2So_4
5.	DPC
Sl. No.	**Equipment Requirement**
1	Glass Bakers
2.	Weighing Machine
3.	Potassium Chromate/Dichromate
4.	Measuring Cylinder
5.	Burettes and Pipettes
6.	Filter Paper
7.	Conical Flaxes
8.	UV-Spectrophotometer
9.	pH meter

2. MATERIAL AND METHOD

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 of chromium ions solution.

3. PREPRATION OF ADSORBENT

The Neem leaves washed many time 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 2-1/2 – 3-1/4 hrs at 115C. then the dried leaves crushed and kept in muffle Furnace for 3-1/4 hrs at 240 C. The heating period depends on the atmospheric temperature. after Heating then we have gated blackish gray powder form.

4. DETERMINATION OF MAXIMUM WAVELENGTH FOR OPERATION

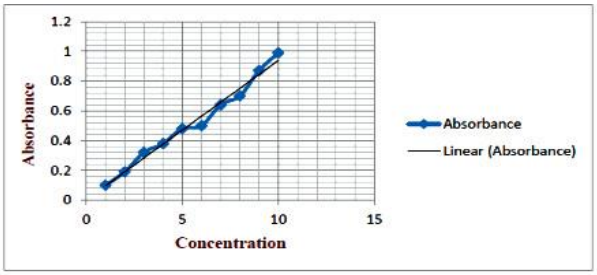
The stock solution of 1000 mg/L of chromium prepared by dissolving 1 gm of chromium chloride in 1000 ml of distilled water. Then their absorbance was recorded at different wavelength by using UV-Spectrophotometer. Up to certain wavelength % absorption increases and then decreases, at the point where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

5. CONSTRUCTION OF 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

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

Figure 1 the standard calibration curve for chromium



BATCH STUDY FOR CHROMIUM REMOVAL

EFFECT OF PH

Fig. 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 become 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 67.5% at 1-3 pH value. The Chromium removal was higher at lower pH values.

EFFECT OF CONTACT TIME

Graph shows that Removal efficiency of Cr-(VI) ion increases with respect ot increase in contact time (in min.) of adsorbent.

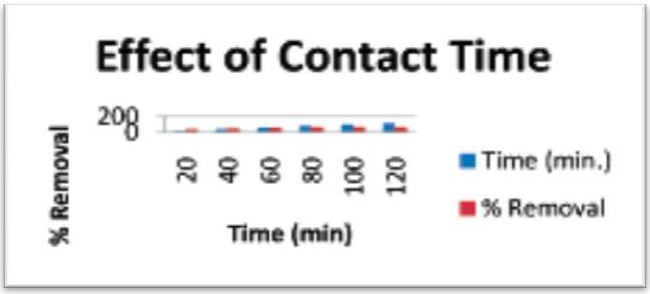
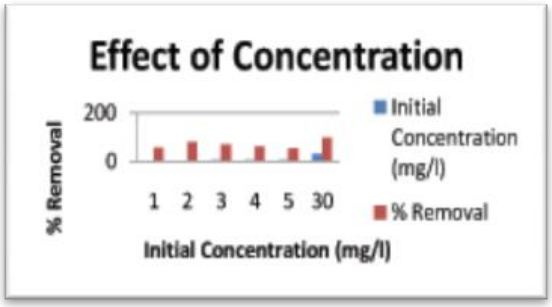


Fig-effect of contact time on removal of Cr-(VI_ion

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 98% for Neem Leaves at initial concentration of 30mg/100ml.

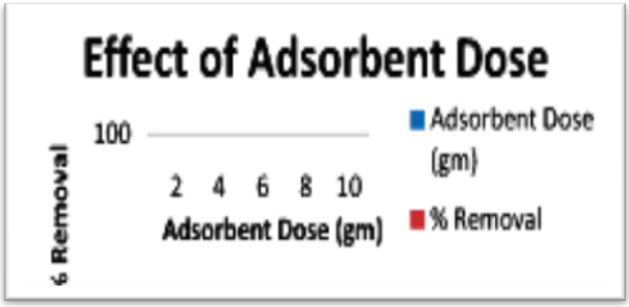
Fig. Effect of initial concentration on removal of (VI) ion



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 8gm/100ml which is up to 86%

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



ADSOPPTION KINETICS

The adsorption isotherm is a functional Expression for the variation of adsorption with concentration of adsorbent in bulk solution at constant Temperature. It is observed that the amount of adsorbed material per unit weight of adsorbent increases with increasing concentration but in direct proportion.

Table R Value based on isotherm

R Value	**Type of Isotherm**
R > 1	Unfavorable
R = 1	Linear
0 < R < 1	Favorable
R = 0	Irreversible

6. LANGMUIR ADSOPRPTION ISOTHERM

Langmuir Isotherm is based on the assumption that points of valence exists on the surface of the adsorbent and that each of these sites is capable of adsorbing one molecule, thus the adsorbed layer will be one molecule thick.

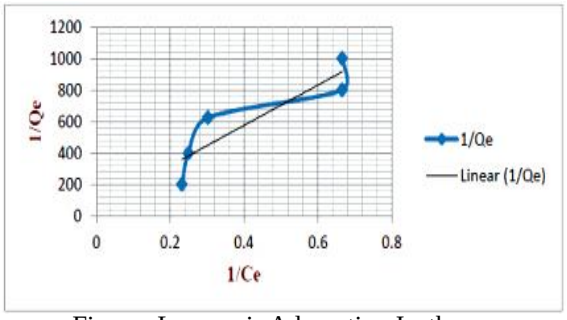


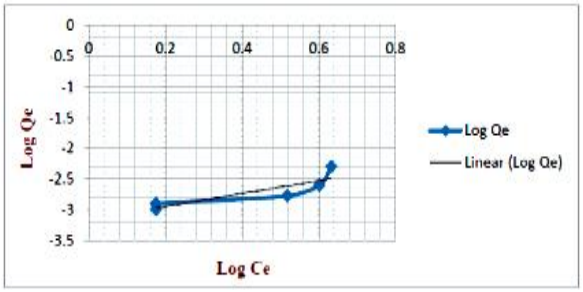
Figure- Langmuir Adsorption Isotherm

When 1/Qe is plotted against 1/Ce for neem leaves as shown in Fig. a straight line with the slope 1/bQo is obtained which shows that adsorption follows the Langmuir isotherm. The Langmuir constants b and Qo are calculated. The separation factor is define by R2= 1/(1+b*Co) it is found that R2 value for Langmuir model follows the condition 0 R 1 and the process of removal of chromium using treated neem leaves follows the Langmuir isotherm in favorable manner.

7. FREUNDLICH ADSORPTION ISOTHERM

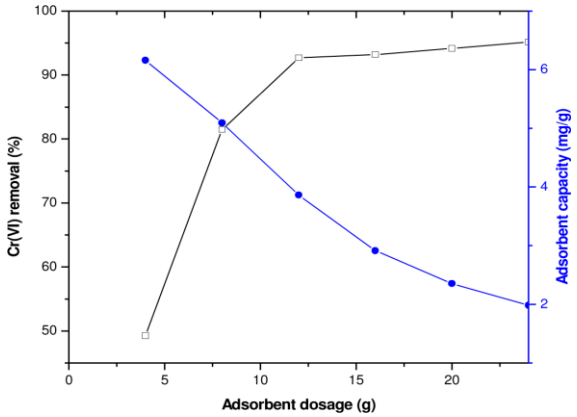
Freundlich Adsorption Isotherm is based on the assumption that the adsorbent heterogeneous. Surface composed of different classed of sites with adsorption on each sites following the Langmuir Isotherm.

A plot of log Qe and Log Ce shown in Fig yields a straight line for adsorption data which follows the Freundlich theory. The values of constants can be determined by plot and it confirms the applicability of Freundlich model.



8. RESULT AND DISCUSSION

Adsorption studies were performed by Batch Technique to obtain the rate and Equilibrium data. The removal efficiencies of low cost Adsorbents during the investigation of batch adsorption process had been studied.



9. CONCLUSIONS

Following conclusion are founded from the above discussed results;

- Activated neem leaves has a good adsorption capacity for the adsorption of cr-vi.
- The equilibrium time for the adsorption of cr-vi on activated neem leaves from aqueous is estimated as required.
- The adsorption process of cr-vi can be described by lanngumuir isotherms and freundlich isotherms model.
- Removal of cr-vi increases with increase of adsorbent dosage.
- The maximum adsorption o cr-vi took place in pH range 1-3.
- This study clear show that neem leaves powder which is cheap and abundantly available may be used as an effective adsorbent from removal of cr-vi from effluent.

REFERENCES

[1] Babu, B.V. and Gupta, S. (2005). "Modeling and Simulation of Fixed Bed Adsorption Column: Effect of Velocity Variation", Journal on Engineering & Technology, 1 (1), pp. 60-66.
[2] Sharma, A. and Bhattacharyya, K. G. (2004). "Adsorption of Chromium (VI) on Azadirachta Indica (Neem) Leaf Powder", Adsorption, 10, pp. 327-338.
[3] Suresh Gupta, B V Babua, Adsorption of Cr(VI) by a Low-Cost Adsorbent Prepared from Neem Leaves.
[4] Bradl, H.B., C. Kim, U. Kramar and D. Stüben, 2005. Interactions of Heavy metals. In H.B. Bradl Ed.,Heavy Metals in the Environment: Origin, Interaction and Remediation. Elsevier Ltd., London, UK, pp: 104-107.
[5] Ho, Y.S. and G. Mckay, 1998. A comparison of Chemisorption Kinetic Models Applied to Pollutant Removal on Various Sorbents, Transactions Industria Chemical Engineering, 76B: 332-340.
[6] Hamideh Radnia, Ali Asghar Ghoreyshi and Habibollah Younesi, 2011. Isotherm and Kinetics of Fe(II) Adsorption onto Chitosan in a Batch Process, Iranica Journal of Energy and Environment 2(3): 250-257, DOI: 10.5829/idosi.ijee.2011.02.03.1837
[7] Bharathi Kandaswamy Suyamboo and Ramesh Srikrishna Perumal, 2012. Equilibrium, Thermodynamic and Kinetic Studies on Adsorption of a Basic Dye by Citrullus Lanatus Rind, Iranica Journal of Energy and Environment, 3(1): 23-34, DOI: 10.5829/idosi.ijee.2012.03.01.0130
[8] Seyed Mahmoud Mehdinia, Khalilollah Moeinian and Tayyabeh Rastgoo, 2014. Rice Husk Silica Adsorbent for Removal of Hexavalent Chromium Pollution from Aquatic Solutions, Iranica Journal of Energy & Environment, 5(2): 218-223, DOI: 10.5829/ idosi.ijee.2014.05.02.15
[9] Bulsu, K.R.Sudarshan, W.G.Kulkarni, and D.N. Thergaonkar,1979, "Chromium in water, chromium removal methods and their Limitations".J. Institute of Engineers (India), Environmental Engineering division60,1-25.
[10] Ghorai, K.K.Pant, "Fixed bed adsorption Technique Using activated Alumina", Chemical Engg.J.98 (2004) 165-173.
[11] A.K.Yadav, C.P.Kaushik, A.K. Haritash, A. Kansal and Neetu Rani, " Removal of chromium from waste water using Bricks as an adsorbent",J. Hazardus materials(2005
[12] Parineeta Pandhram, Shubhangi Nimbalkar, 'Adsorption of Chromium from Industrial Waste Water' By Using Neem Leaves as a Low Cost Adsorbent, International Journal of Chemical and Physical Sciences IJCPS Vol. 2, Special Issue - March 2013 (ISSN:2319- 6602).
[13] N. M. Rane, Dr. R. S Sapkal, Dr. V. S. Sapkal, M. B. Patil and S. P. Shewale," Use of Naturally available low cost adsorbent for removal of Cr(VI) from waste water", International Journal of Chemical Sciences and Applications ISSN 0976-2590.Vol 1, Issue 2, Dec-2010, pp 65-69.
[14] K. Srinivas Raju, and S.V. Naidu, 'A Review On Removal Of Heavy Metal Ions From Wastewater By Rice Husk As An Adsorbent'Journal of Chemical, Biological and Physical Sciences, February 2013- April 2013, Vol. 3, No. 2, 602-606, E- ISSN: 2249 –1929.
[15] Gopalakrishnan S., Kannadasan T., Velmurugan S., Muthu S. and Vinoth Kumar P., Biosorption of Chromium (VI) from Industrial Effluent using Neem Leaf Adsorbent. Research Journal of Chemical Sciences Vol. 3(4), 48-53, April (2013).

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