Removal of chromium(vi) from the tannery waste water by using tamarindus indica fruit shell and mangifera indica seed as adsorbents

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***Abstract*— Waste water contamination is ever increasing problem which the whole world is now facing. Industrial waste constitutes the major source of metal pollution in natural water. The surface water also contaminated by various industrial activities. When the effluent from various industries like Tannery Industry, Textile Industry, Electroplating Industry, etc., is discharged into the water bodies, it will causes the water pollution. The global population is on the rise, increasingly concentrating in urban centers. This pattern is particularly pronounced in developing nations, where urbanization is expected to swell by over 2.1 billion individuals by 2030. Tamarindus indica fruit shells have found application in agriculture to bolster productivity under heavy metal stress. They present a low-cost, effective alternative for chromium removal from tannery wastewater, which originates from industries like tanneries, textiles, and electroplating. Utilizing Tamarindus indica fruit shell waste and Mangifera indica seeds as adsorbents is a strategic move, considering their potential in filtration, detoxification of contaminated water, effluent treatment, and wastewater adsorption. This study focuses on removing chromium from tannery wastewater using Tamarindus indica fruit shell powder and Mangifera indica seeds. Both materials exhibit notable chromium removal capabilities, with Tamarindus indica fruit shell achieving 59.78% and Mango seed achieving 98.58% removal efficiency at an optimal pH of 5. Maximum removal efficiency occurs at 15 minutes and 120 rpm for time and speed variations, respectively, with equilibrium reached once maximum efficiency is achieved for both parameters.**

***Keywords*: Adsorption, Tamarindus indica fruit shell powder, Mango seed.**

I. INTRODUCTION

While effluent from various industries such as tannery and textile industries electrical-hydraulic works, etc., discharged into the water will cause water pollution. A global crisis is possible in the coming years Start with water, food and energy. Water is essential for both social and professional activities Development of society. The world population is growing and with a focus on urban areas. The tanning industry is one of the oldest in the world. Alright Polluting activities are often alleged. Producing a wide range of products A variety of highly potent toxic chemicals. They know its serious Environmental risks due to high levels of chemicals. Lots of water Used in tanning system with 90% water environment. The sewage must be treated to contaminate this water this affects disease and plants and animals. 80 to 90% worldwide Tanners use Cr(VI) salts in tanning processes .Chromium is removed in large quantities from various industries and It destroys the environment. The effects of chromium contamination in water ways Construction, paints and dyes, pharmaceutical industry, textile factory, pottery and woodworking areas. It causes headaches, coughs, cancer and bronchitis. The EPA has set the permissible limit for Cr (6) in drinking water at 0.1mg/l. Although the U.S. Of the Environmental Protection Agency (US EPA). agree that Cr (VI) is harmful. The maximum contaminant level is 100, which is included in the drinking water standard µg/L. There is an urgent need to avoid adverse effects of Cr (VI) on human health. To implement stringent environmental limits to control Cr (VI) levels. which can be released into the

environment. Adsorption is a mass transfer process between two Phases. Adsorbents are used to adsorb a specific pollutant (adsorbate). with the help of intermolecular forces from wastewater. There are two types Interactions between solid surface and adsorbents, i.e. physical adsorption and. Drug absorption. When it is weak in contact, the process is called physical absorption Physical properties such as Vander Waals forces and resulting order It can be turned around. Thus, the low-. Effective and cost-effective costing methods. The drying method is good Provide high energy and low wastewater. Addiction is one Effective purification and separation methods commonly used in industry Water and wastewater treatment.

II. COLLECTION OF MATERIAL

A. collection of adsorbents

TAMARIND is mainly grown in the surrounding areas the world of. TAMARIND FRUIT Shells are one of the most abundant in the world popular inexpensive adsorbents for adsorption of heavy metal ions. Mangoes are a seasonal tropical fruit grown in many countries. And the worldwide one Production in 2013 was about 43 million metric tons and India. The largest produced 18 million metric tons. Mango fruit makes up about 5% of the total weight of fresh fruit.

B. collection of wastewater

The waste water was collected from TANNERY industry. Volume of Sample Collected is 10 Liters. Method of Sampling is Grab Sampling.

C. Preparation of adsorbents

Tamarind fruit shells piled and mango seed washed several times Distilled water to remove particles, other unwanted particles, that cling to the surface soluble impurities and concentrated water. The eluate was a biosorbent. It is then dried in sunlight and ground in mills to form the powder. The biomass was stored in an airtight plastic bag for protection.

III. RESULTS AND DISCUSSION

A. Characterization of wastewater

The collected Sample was tested and the basic parameters of the wastewater sample were determined. The basic parameters tested in this study are pH, Conductivity Turbidity Total Solids Total Suspended Solids, Total Dissolved Solids, Chlorides, Sulphates, COD, and Chromium.

Table. 1 *Characterization of wastewater*

S. no	parameters	Concentration
1	pH	11.45
2	Turbidity	211 NTU
3	Total solids	1170 mg/l
4	Hardness	735 mg/l
5	Alkalinity	1056 mg/l
6	Sulphates	930 mg/l
7	COD	830 mg/l
8	Chromium	13.62 mg/l

B.Effect of adsorbent dosage

Tamarindus indica fruit shell:

The minimum amount of Adsorbent required to remove maximum percentage of chromium is studied through the effect of adsorbent dosage study. A series of 100ml of waste water were taken in conical flasks and 0.1 to 0.5 g of adsorbents were added and equilibrated in rotary mechanical shaker for about 30minutes. After equilibration period the absorbance of the supernatant liquid was measured using AAS and percentage of Chromium removal was established from standard graph.

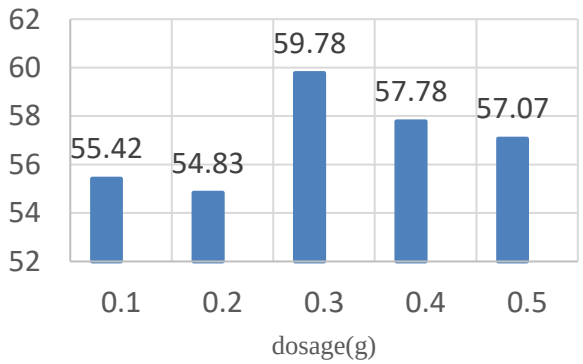

Figure 1

Mangifera indica seed:

The minimum amount of Adsorbent required to remove maximum percentage of chromium is studied through the effect of adsorbent dosage study. A series of 100ml of waste water were taken in conical flasks and 0.1 to 0.5 g of adsorbents were added and equilibrated in rotary mechanical shaker for about 30 minutes. After equilibration period the absorbance of the supernatant liquid was measured using AAS and percentage of Chromium removal was established from standard graph.

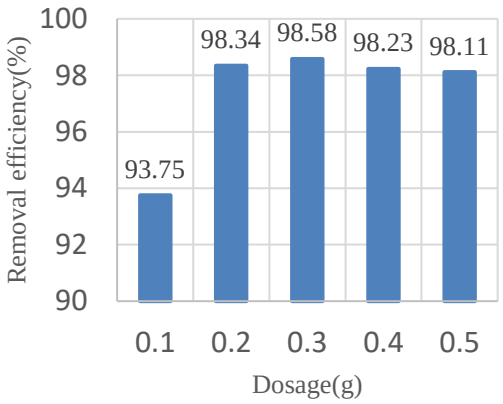

Figure 2

C. Effect of pH

Tamarindus indica fruit shell

100ml of varying pH solutions in the range of 3 to 11 were prepared and added 0.3 Gram of Tamarindus indica fruit shell and equilibrated for 30 minutes in a rotary mechanical shaker. After the equilibrium period the absorbance of the supernatant liquid was measured using AAS.

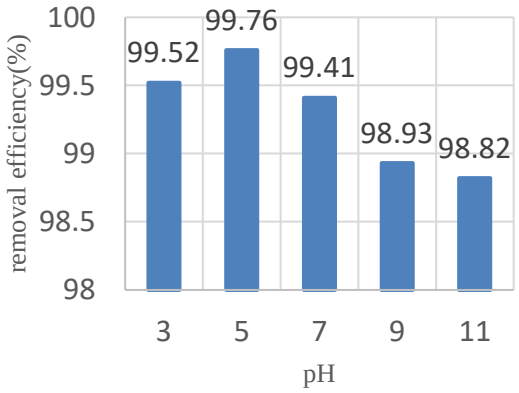

Figure 3

Mangifera indica seed:

100ml of varying pH solutions in the range of 3 to 11 were prepared and added 0.3 Gram of mangifera indica seed equilibrated for 30 minutes in a rotary mechanical shaker. After the equilibrium period the absorbance of the supernatant liquid was measured using AAS.

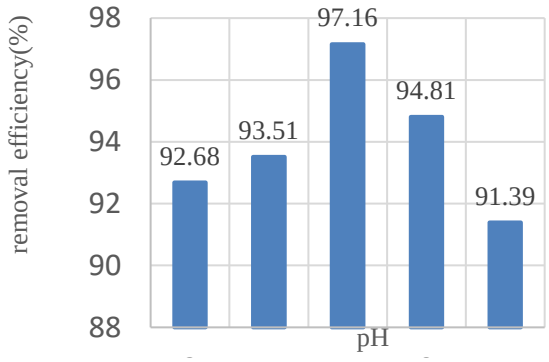

Figure 4

D.Effect of contact time

Tamarindus indica fruit shell

A series of conical flasks of 100ml was taken with optimum pH and respective optimum Tamarindus indica fruit shell dosewere added. The conical flasks were allowed under shaking in a rotary mechanical shaker. After shaking, they are withdrawn at regular intervals of 5 minutes and absorbance of chromium was measured at AAS.

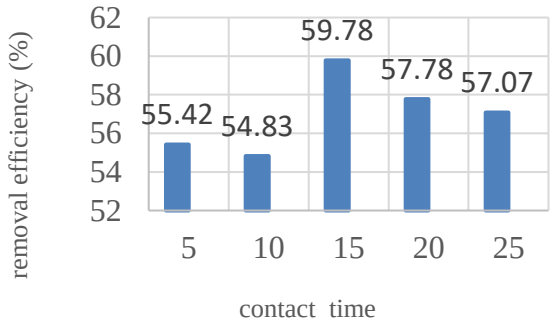

Figure 5

mangifera indica seed:

A series of conical flasks of 100ml was taken with optimum pH and respective optimum Mangifera indica seed dose were added. The conical flasks were allowed under shaking in a rotary mechanical shaker. After shaking, they are withdrawn at regular intervals of 5 minutes and absorbance of solution was measured at AAS.

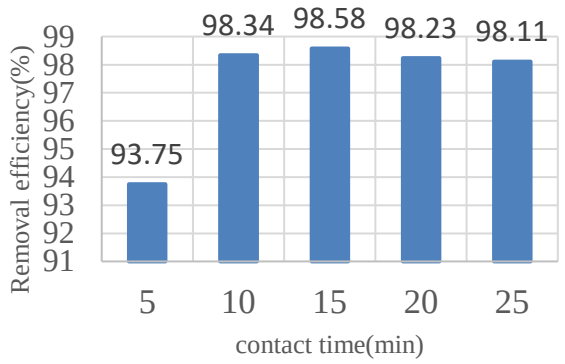

Figure 6

E.Effect of speed

Tamarindus indica fruit shell:

Batch studies will be carried out using series of 250 ml conical flask to investigate the effects of rotation speed on the adsorption of chromium for Tamarindus indica fruit shell. The fixed dosage of adsorbent as determined from isotherm study will be added each Beakers. During this study the contact time will be constant.

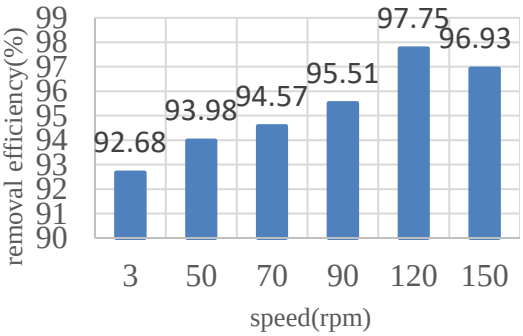

Figure 7

Mangifera indica seed:

Batch studies will be carried out using series of 250 ml conical flask to investigate the effects of rotation speed on the adsorption of chromium for Mangifera indica seed. The fixed dosage of adsorbent as determined from isotherm study will be added each beakers. During this study the contact time will be kept constant as.

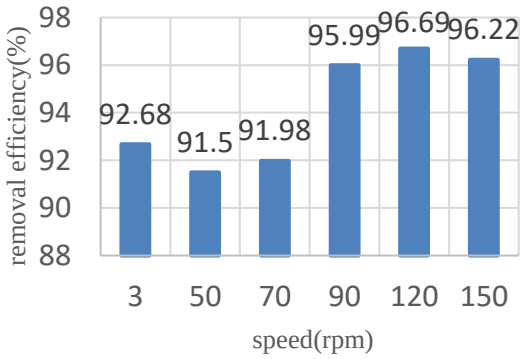

Figure 8

V.CONCLUSION

Both materials exhibit notable chromium removal capabilities, with Tamarindus indica fruit shell achieving 59.78% and Mango seed achieving 98.58% removal efficiency at an optimal pH of 5. Maximum removal efficiency occurs at 15 minutes and 120 rpm for time and speed variations, respectively, with equilibrium reached once maximum efficiency is achieved for both parameters.

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REFERENCE

[1] Abinaya R, Hemapriya G, Dhinesh kumar S (2015)., 'Removal of Chromium from Tannery Effluent Using Fly ash', International journal of innovative research and development, vol.4, pp 380-384.

[2] A.Merly Xavier, A.Logeswari, S.Mano (2013)., 'Removal of Chromium from Real Tannery Effluent by Using Bioadsorbents', International Journal of Engineering and Science, vol.2, pp 35-40.

[3] Amaresh, N.P. Hoolikantimath (2015)., 'Removal of Chromium from Synthetic Wastewater using Adsorption Technique', International Research Journal of Engineering and Technology (IRJET), vol. 2, pp 486-490.

[4] A. Rahaman, Md. R. Hosen, M. A. Hena, U. H. B. Naher, M. Moniruzzaman (2016)., A Study on removal of chromium from tannery effluent treatment of chrome tanning waste water using tannery solid waste', Int. J. Hum. Capital Urban Manage, vol 1 (4), pp 237-242.

[5] B. Lkhagvadulam, B. Tsagaantsetseg, D. Tergel, and S. Chuluunkhuyag (2017)., 'Removal of Chromium from a Tannery Wastewater by Using a Maghemite Nanoparticles', International Journal of Environmental Science and Development, Vol. 8, pp. 10-14.

[6] Christine Jeyaseelan and Astha Gupta (2015)., 'Green Tea Leaves as a Natural Adsorbent for the Removal of Cr(VI) From Aqueous Solutions', Air, Soil and Water Research, vol. 9, pp 13-19.

[7] Dagang Song (2016)., 'Adsorptive Removal of Toxic Chromium from Waste- Water Using Wheat Straw and Eupatorium adenophorum', International Journal of research article, Vol 6, pp 1-16.

[8] Geetha K.S and Belagavi S.L (2013)., 'Removal of Heavy Metals and Dyes Using Low-Cost Adsorbents from Aqueous Medium', IOSR Journal Of Environmental Science, Toxicology and Food Technology, vol. 4, pp 56-68.

[9] IS: 460-1962, Indian standard specification for test sieves.

[10] Jobin John Jacob, R. Varalakshmi, S. Gargi, M. A. Jayasri and K. Suthanthiran (2017)., 'Removal of Cr (III) and Ni (II) from tannery effluent using calcium carbonate coated bacterial magnetosomes', International Journal of Engineering Research and General Science, vol 2.