International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

Treatment of Tannery Effluent using Groundnut Shells

P. Kothai[1], A. Meena[2], E. Meenaloshini[3], A. Revathy[4], N. Vinoth Kumar[5]

[1,2,3,4]Student, Dept. of Civil Engineering, Valliammai Engineering College, Tamil Nadu, India
[5]Proffessor, Dept. of Civil Engineering, Valliammai Engineering College, Tamil Nadu, India

---

Abstract - Effluent from tanneries are considered to be one of the major environmental pollution from industries. Effluent from tanneries contains toxins which are carried downstream and contaminate water used in domestic and irrigation etc., This project present the effluent treatment of tannery effluent using the groundnut shells, an agricultural product. The main constituent of groundnut shell is carbon, potentially making it suitable for making activated carbon for adsorption experiments. The effects of pH, contact time, particle size and dosage of the adsorbent on the adsorption of effluent were studied. Hence using granular activated carbon (GAC), the tannery effluent can efficiently treated which in turns reduce the pollution on land and water. Nowadays treatment plants are costly, need highly trained man power and high electricity. Alternatively for those cost expensive treatments, we are choosing this type treatment using groundnut shells.

Key Words: – Groundnut shells, Tannery effluent, Activated carbon.

I. INTRODUCTION

The project deals with the treatment of effluent from the leather industry using groundnut shells. Manufacturing of leather, leather goods, leather boards and fur produces numerous by-products, solid Wastes, high amounts of waste water containing different loads of pollutants and emissions into the land and water. The uncontrolled release of tannery effluents to natural water bodies increases health risks for human beings and environmental pollution. Effluents from raw hide processing tanneries, which produce wet-blue, crust leather or finished leather contain compounds of copper, nickel, lead, chromium, cadmium etc., in most cases. Organic and other ingredients are responsible for high BOD(Biological Oxygen Demand) and COD (Chemical Oxygen Demand) values and represent an immense pollution lad, causing technical problems, sophisticated technologies and high costs in concern with effluent treatment.

Tanning industries is one of the oldest industries in the world. It is typically characterized as pollutants generated industries which produce wide varieties of high strength toxic chemicals. It is recognized as a serious environmental threat due to high chemical levels. Large quantity of water is used in tanning process of which 90% of the water is discharged into the environment. The necessity for treating effluent is that it pollutes the water there by causing diseases and affecting flora and fauna. 80 to 90% of world-wide tanneries use Cr(III) salts in the tanning processes.

II. STUDY OF RAW MATERIALS

EFFLUENT

Effluent is defined as "waste water-treated or untreated-that flows out of a treatment plant, sewer or industrial outfall. Generally refers to wastes discharged into surface waters", by the united states Environmental Protection Agency.

TANNERY EFFLUENT

Tannery effluent or waste water is the type of waste water released from the manufacturing of leather products. Tannery effluents is among one of the hazardous pollutants of industry. Those industries consume more water during their manufacturing and hence it is polluted. Tannery waste waters are highly complex and are characterized by high contents of organic and inorganic compounds, chromium, nickel, lead, cadmium, copper, etc.,

GROUNDNUT SHELLS

Groundnut shells (Arachis hypogeal L) are an agricultural by-product from an oilseed leguminous crop groundnut. The groundnut shell which is attributed to their high amount of lignin, potassium and zinc content.

OBJECTIVES

1. To treat the raw tannery effluent using groundnut shells effectively.
2. To identify and analyse the metals concentration in the raw effluent.

3. To conduct the volumetric tests on raw and treated effluent.
4. To prepare the Granular Activated Carbon using groundnut shells an agricultural by-product.
5. To reduce and analyse the concentration of metals from the treated effluent.
6. To determine the effect of pH, contact time, particle size and its adsorption levels.

SCOPE

- Treating the tannery waste water with groundnut shells will be more effective and inexpensive.
- This method will highly reduce the pollution which affects the land and water.
- Using of groundnut shells will be more economical.
- Usage of the agricultural waste will keep the environment clean at the same time gaining benefits from those wastes.

III. LITERATURE REVIEW

R.Malik, et al.,(2006), "Removal of toxic metals from industrial waste water using groundnut shell," indicates groundnut shell based powdered activated carbon(GSPAC)could be employed as low-cost alternative adsorbent to commercial activated carbon in the wastewater treatment for removal of acid dyes.

Samson O. Owalude, Adedibu C. Tella, "Removal of chromium by adsorption on modified groundnut hull," in this study therefore, the uptake of hexavalent chromium being among the major pollutants from industries by modified and unmodified groundnut hull was investigated.

IV. COLLECTION OF MATERIALS

The raw tannery effluent were collected from **Star Exports, 47 D Block, Karigalan St, Ranipet, Tamil Nadu 632403.**The effluent was collected after the preparatory stages i.e., after the process of liming and deliming process is completed.

The adsorbent material used in our project is the groundnut shells, an agricultural product. Those groundnut shells were purchased from the near by markets.

V. PREPARATION OF ADSORBENT

ADSORBENT MATERIAL

The main type of materials used in our project was groundnut shells which were brought from the near by markets.

REAGENTS

Potassium hydroxide used for the activation of the adsorbents.
Distilled water for washing the material after the activation process.

METHODS

The groundnut shells so called adsorbent material were ripped off well to remove the dust and muddy particles and washed in water. Then the washed groundnut shells were dried under sun for 8-10 hours for easy burning. The dried shells were grinded and weighed on the electrical balance.

The potassium hydroxide pellets were used as activating agent. The potassium hydroxide of 0.8 gm (80%) is taken in a beaker and 100 ml of distilled water is added in which 7 spatula spoons of groundnut shell is added. The setup is kept undisturbed for 24 hours for activation purposes. Then the activated groundnut shells were removed from the solution and were placed in the muffle furnace for 2 hours, at 600ºC ,then left to cool on dessicator. After cooling, the materials were washed with distilled water and were wrapped in aluminium foils or in filter paper. Then the setup is ready to be in an oven for another 4.5 hours, at 105ºC, then placed in the furnace for 3 hours, at 105ºC for carbonization to take place.

Fig.1 Prepared GAC

CHARACTERIZATION OF THE ADSORBENT

SEM Studies

Scanning Electron Microscopy (SEM) magnifies a specific sample region using a high energy focused beam of electrons. The sample is under vaccum to ensure the electron beam stays focused and does not interact with particles in the air. When the beam of electron hits the sample, it causes secondary electrons to be released from the sample which are detected to provide am image based off the topography of the surface.

The sample region evaluated with SEM analysis can also be analyzed to determine the specific elements that comprise the sample region by utilizing Energy dispersion Spectroscopy(EDS).

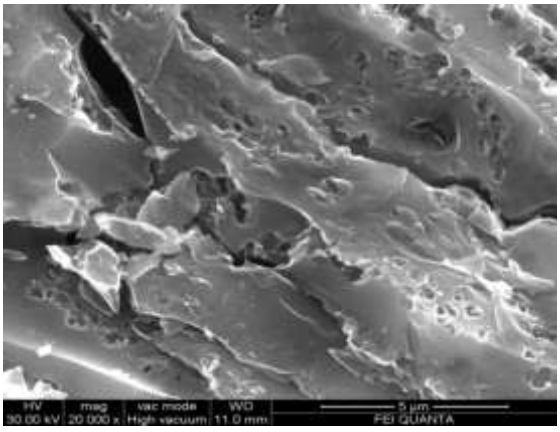

Fig.2 SEM image 1 of Granular Activated Carbon

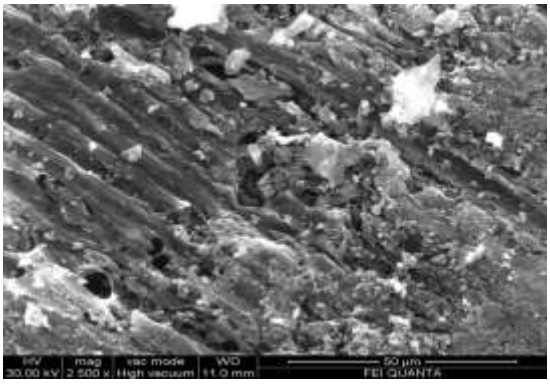

Fig.3 SEM image 2 of granular activated carbon

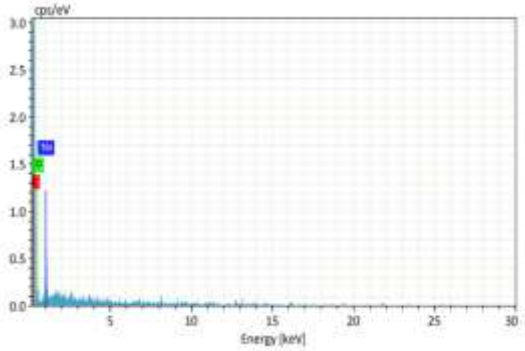

Fig. 4 EDAX Mapping

WASTEWATER CHARACTERIZATION

The tannery effluent collected from the Star Exports was analyzed to determine the main pollutants present. These parameters were the following.

- **BOD_5 analysis**-Materials for the BOD_5 includes BOD bottle, sample solution, distilled water, sodium thiosulphate as burette solution. Reacting agents with starch as indicator.
- **COD analysis**-Materials for COD includes COD flask, Sample solution, FAS as burette solution, reacting agents with ferroin indicator.
- **DO analysis**-Materials used are sample solution, distilled water, BOD solutions, with starch as indicator.
- **Hardness test**-Materials used are sample solution, distilled water, EDTA as burette solution, with EBT as indicator.
- **TDS & TSS**-Total Dissolved Solids and Total Suspended Solids are determined to know the total concentration of dissolved and suspended solids are present in the sample.
- **Metals determination**-Chromium using AAS(Atomic Absorption Spectroscopy) and Copper and Nickel using ICP-OES(Inductively Coupled Plasma-Optically Emission Spectroscopy)

VI. RESULTS AND DISCUSSION

i. TESTING OF EFFLUENT

Table.1 Wastewater characteristics

s.no	Parameter	Before treatment	After treatment with GAC
1	pH	3	4.9
2	BOD	102 mg/l	13.2 mg/l
3	COD	176 mg/l	152 mg/l
4	TDS	781 mg/l	387 mg/l
5	TSS	341 mg/l	91 mg/l
6	DO	13.2 mg/l	4.8 mg/l
7	Calcium	521 mg/l	320 mg/l
8	Ammonia	Nil	Nil

- The above discussed wastewater parameter before and after treatment with the granular activated carbon shows the decrease in their values after treatment with GAC.

ii. Effect of pH in terms of chromium in Groundnut shells.

Table.2 Effect of pH

s.no	state	pH	Removal in ppm	% of removal
1	Raw Effluent	3	3060	-
		4	3060	-
		5	3060	-
2	With GNS	3	1568	48
		4	2384	22

		5	2019	34
3	With GAC	3	1009	67
		4	1865	39
		5	1542	49

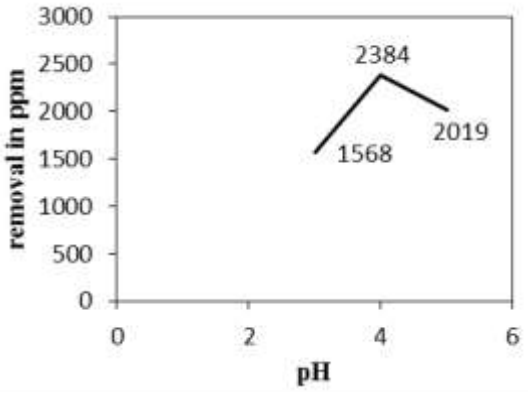

Fig.5 Effect of pH with GNS in ppm

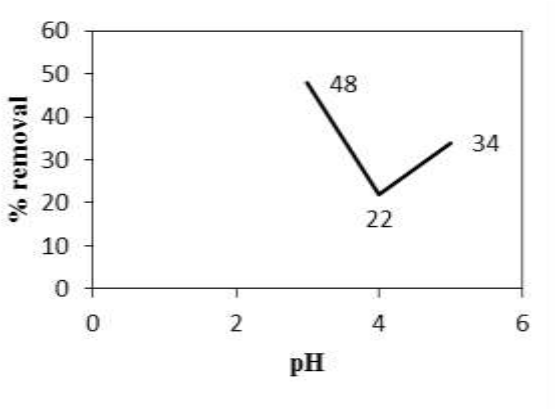

Fig.6 Effect of pH with GNS in %

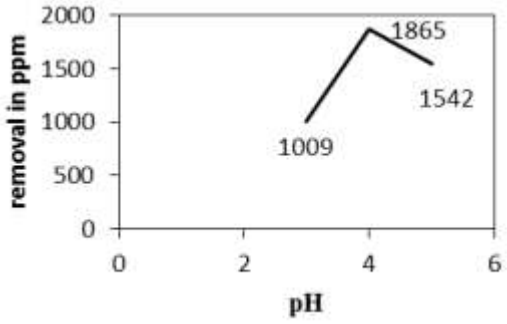

Fig.7 Effect of pH with GAC in ppm

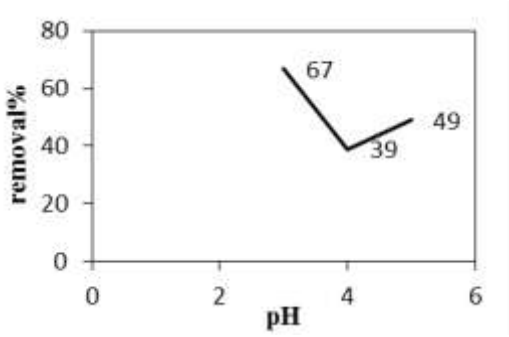

Fig.8 Effect of pH with GAC in %

pH is an important parameter in then adsorption process. The pH test was conducted in our effluent and found by using pH meter. The pH of our sample is 3. The sample when it is diluted the level of pH remains constant and the sample is acidic in nature. Therefore the effect of pH is 3 and the adsorbent will be observed at this pH level for efficient result. Hence the contact is continued at this pH level.

iii. Effect of Contact Time in terms of Chromium in groundnut shells

Table.3 Effect of Contact time

s.no	Contact time in mins	Removal in ppm	Removal in %
1	0	3060	0
2	60	2180	28
3	120	1032	66
4	180	1456	52

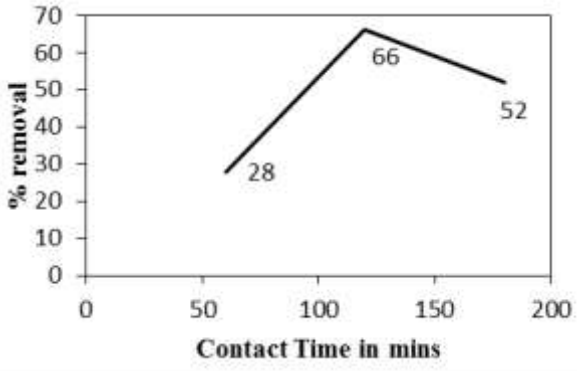

Fig.9 Effect of Contact Time in %

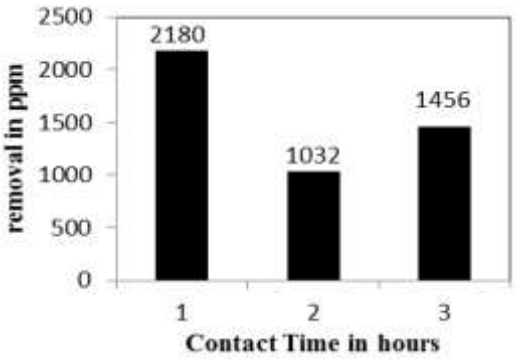

Fig.10 Effect of Contact Time in ppm

The contact time on the adsorption of the metals on GAC is presented. Studies were carried by taking 45 ml of the centrifuged sample in a beaker. Now 2 grams of GAC is added.

The contact time is conducted for 1,2,3 hours for efficient adsorption. So the above mentioned setup is done three times in which one sample is left for 1 hour, another sample for 2 hours and last sample for 3 hours.

It was observed that chromium was adsorbed rapidly at the initial stage of contact time and slowly increased at higher contact time.

In this experiment, adsorption rate increases slowly and the removal efficiency was reached at a maximum of 12% at 3 hours.

60 mins 120 mins 180 mins

Fig.11 Effect of Contact Time

VII. CONCLUSION

The adsorption level of chromium by GAC increases at the contact time of 60 and 120 mins and it decreases in 180 mins.. The adsorption level of chromium increases as the time increases, this is due to the higher interaction between the sorbent surface and metal ions. The chromium removal increased for the first 1 hour and increases more in the next 1 hour and after two hours it brings no significant change in the removal concentration which in turns decrease in the removal. The effect of pH on chromium removal by GAC was investigated and the results are presented that the optimum pH for the maximum uptake of chromium was found to be in pH 3 where the stabilization is more. Thus from this study, the removal of chromium is 80% and it is analysed by using Atomic Absorption Spectroscopy which is effective method of treatment using the groundnut shells.

VIII. REFERENCES

1. Mohammed Modu Aji, et al.,(Feb 2015), "Production & Characterization of activated carbon from groundnut shell", Columban J. Life Sci.,Vol. 17,No.1, 18-24 2015.

2. R.Malik, et al.,(2006), "Removal of toxic metals from industrial waste water using groundnut shell", International Journal of Pure and Applied Mathematics, Vol 119, No. 15, 2018.

3. Samson O. Owalude, Adedibu C. Tella, "Removal of chromium by adsorption on modified groundnut hull", Beni-Suef University of Basic and Applied Sciences 5(2016) 377-388.

4. M.Kamaraj, P.Umamaheswari, "Characterization of groundnut shell activated carbon as an efficient adsorbent",Journal of Materials and Environmental Sciences, 2017,Vol 8,page 2019-2025.

5. K.Raveendran, Anuradda Ganesh , et al., "Influence of mineral matter on biomass pyrolysis characteristics", Butterworth Heinemann Fuel Vol. 74No.12,pp. 1812-1822,1995.

6. Hanna Modin , Kenneth M. Persson, et al., "Removal of metals from landfill leachate by sorption to activated carbon, bone meal and iron fines",Journal of Hazardous Materials 189(2011) 749-754.

7. Prabha R.T. , Dr. Udayashankara T.H., "Adsorption of Copper Metal Ions from aqueous Solution Using Rice Husk and Groundnut Shell", International Journal of Science and Reasearch (IJSR), Impact factor(2012):3.358.

8. S. Idris, Y.A.Iyaka, et al., " Kinetic study of utilising groundnut shell as an adsorbent in removing chromium and nickel from dye effluent", American Chemical Science Journal 2(1):12-24,2012.

9. Dr.R.P. Ugwekar, G.P. Lakhawat , "Recovery of heavy metal by adsorption using peanut hull", International Journal of Advanced Engineering Technology, E-ISSN 0976-3945.

10. S. Boumchita , A. Lahrich , et al ., " Application of peanut shell as a low- cost adsorbent for the removal of anionic dye from aqueous solutions", Journal of Materials and Environmental Sciences, 2017 Vol 8, page 2353-2364.