IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 3, February 2026
Impact Factor: 8.2

Adsorption Studies on Tannery wastewater using Almond Husk

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Abstract: *Almond husk can be employed as a better adsorbentfor preliminary treatment of tannery wastewater. In this study it was found that the pollutant parameters of tannery wastewater like turbidity, BOD, COD were reduced to the satisfactory level, among the primary treatments available for tannery wastewater like lime treatment ferrous sulphate treatment and coagulation processes it was found that adsorption is the best available method of treating tannery wastewater due its low cost and heavy metal removal*

Keywords: *wastewater*

I. INTRODUCTION

Due to the industrial growth in developing countries like India, the ground water system has been largely polluted, especially heavy metals like chromium which causes severe health problems to human. The removal of such heavy metals from industrial effluents especially from tannery industry has become a subject of keen interest. This paper deals with the removal of chromium and other pollutants like COD, iron and sulphate from the tannery wastewater by using a almond husk as an adsorbent. Wheat is available abundantly in India, Wheat and its by-products are used for several purposes. The major by-product of wheat is wheat husk. They are used for burning purposes and even its ash is used for several purposes. Due to its abundant availability and low cost almond husk were employed for adsorption studies on tannery wastewater. The biochemical oxygen demand (BOD) represents the amount of dissolved oxygen (DO) consumed by biological organisms when they decompose organic matter in water. The chemical oxygen demand (COD) is the amount of oxygen consumed when the water sample is chemically oxidised. BOD and COD can reduce the DO of lakes and rivers, and low concentrations can cause eutrophication and harm aquatic life.

II. MATERIALS AND METHODS

Adsorbent Preparation:

Almond husk from nearby was collected and washed using deionised Water. The washed Wheat husks were sun dried for several hours till it completely loses the moisture content present in it. They were stored in a clean and dry plastic box for further use. The almond husk were weighed accurately using electronic balance. The samples were given with dosage of 2 mg to 10 mg per 250ml of waste water. In this study, the analytical grade chemicals from Merck, Rankem and Fisher brands were used for testing various parameters in synthetic tannery waste waters. The absorbance and transmittance value of synthetic tannery wastewater were found using Elico SL-159 UV-VIS spectrophotometer. The pH value was found using Venire pHmeter and the conductivity was found using Elico conductivity meter. The TDS and turbidity were found using Equiptronics TDS and turbidity meter. The C.O.D in the synthetic tannery wastewater was found using Open reflux method and other parameters like chromium and B.O.Dwere tested as per APHA standards (Standard method for examination of water and wastewater, 20th edition, 1998).

Experimental Condition

The collected samples were taken in clean Erlenmeyer flask for capacity 250 ml. The samples were maintained at uniform pH (Neutral level) and temperature. The initial parameters of the waste water were found only after taking it out from container. The studies were conducted in a clean, sterilised conical flask for performing adsorption and were placed in

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orbitalshaker with at most care for performing better process and obtaining better results. The orbital shaker was operated at the speed of 120 rpm which was optimized before conducting the batch studies Rubber gloves were used to avoid contact of waste water to skin and cross checked twicebefore conducting batch studies.

III. RESULT AND DISCUSSION

Characterization of Adsorbent (FT-IR)

The IR spectra of almond husk were measured on a Fourier transform infrared spectrophotometer (Varian 1600 FT-IR Scimitar Series) to elucidate the functional group presenton the surface of the adsorbent (Fig. 2). For measuring IR spectra, modified almond husk(MWH) was encapsulated in 400 mg of KBr. The spectra were recorded on a FTIR within the range of 500–6000 cm^{-1}. MWH exhibited an O-H stretching band in the spectrum in the 3200–3400 cm^{-1} range.

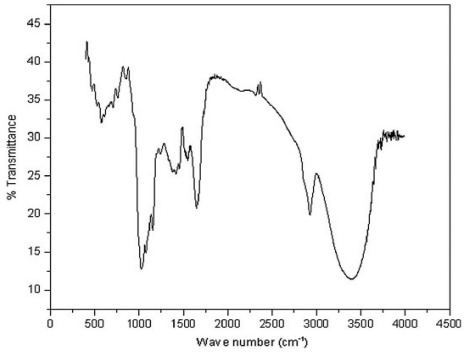

FIG 1 FTIR OF MODIFIED ALMOND HUSK

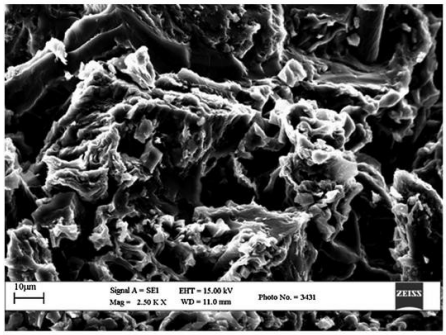

FIG 2 SEM OF THE MODIFIED ALMOND HUSK

SEM ANALYSIS

An SEM image (Fig. 3) of MWH confirmed the amorphous nature of modified wheat husk. Also shown in Fig. 3 is that the surface of the adsorbent has enough roughness with many humps indicating that the adsorbent is a proper material for the adsorption of dyes.

ADSORPTION STUDIES

In this study it was found that the adsorption technique is one of the efficient mode of physicochemical treatment for tannery wastewater. The results obtained through this study was very effective on tannery wastewater and they are represented in the form of graphs below. In figure 4, the pH level of wastewater for different adsorbant dosage is given. Throughout this study the pH was maintained at same level and it was clear that by giving adsorbant dosages the pH value doesn't vary much. Finally the pH value was brought to a neutral level (pH 7).

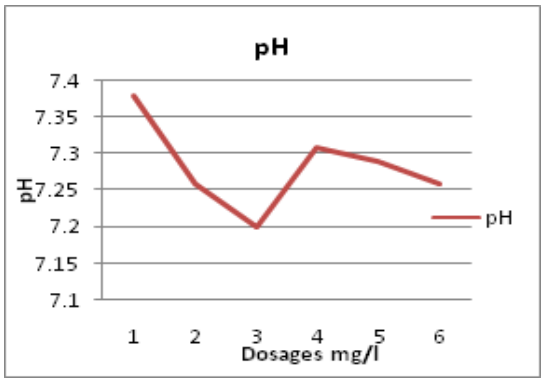

FIG.3ADSORBANT DOSAGE VS PH

DOI: 10.48175/568

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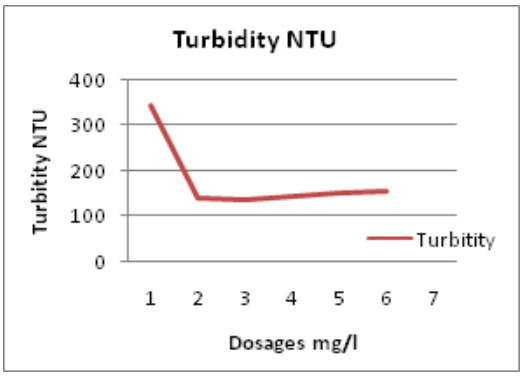

FIG 4 ADSORBANT DOSAGE VS TURBIDITY

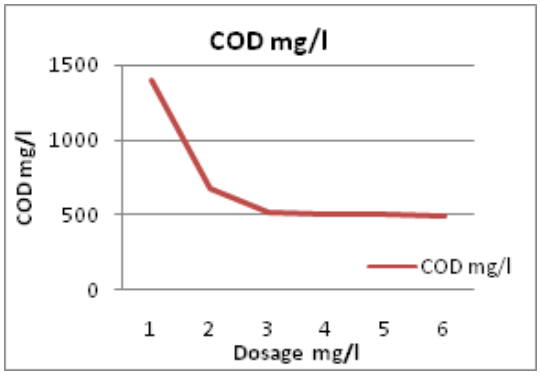

FIG.5 ADSORBANT DOSAGE VS COD

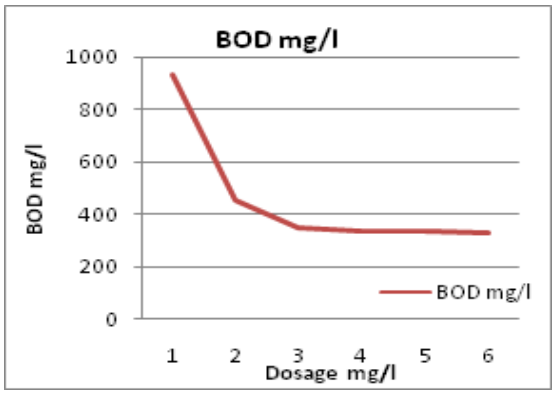

FIG.6 ADSORBANT DOSAGE VS BOD

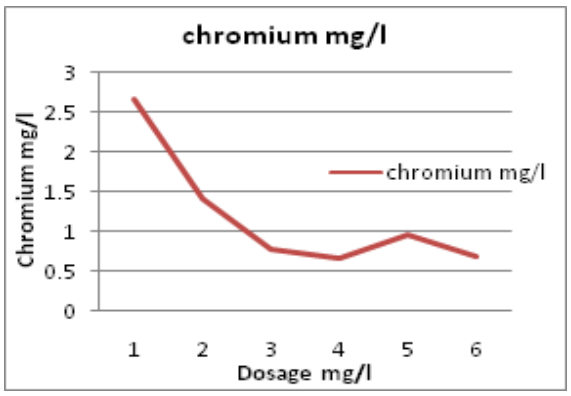

FIG 7 ADSORBANT DOSAGE VS CHROMIUM

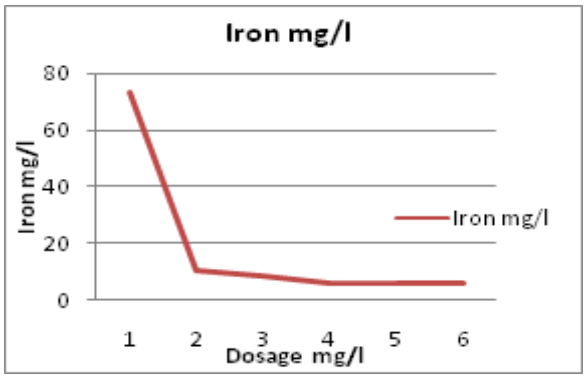

FIG 8 ADSORBANT DOSAGE VS IRON

Figure 4 represents the reduction in turbidity of the wastewater from its initial concentration against varying adsorbant dosages. From the initial concentration of 344 NTU, turbidity was reduced to a level of 147 NTU.

Figure 5 shows the TDSabsorbance of the waste water. The major pollutant of the tannery wastewater is the presence ofchromium in it, the reduction of chromium from the wastewater is shown in figure 7, initially chromium concentration was 3.34 mg/l and by giving the different adsorbant dosage thechromium was reduced to a level of 0.67 mg/l. The reduction in concentration of iron from levelof 61 mg/l to 8 mg/l is shown in figure 8.

Figure5 shows the reduction in COD from the level of 1400 mg/l to 506.6 mg/l. The change in BOD upon varying adsorbant dosages from the level of 933.33 mg/l to 337.07 mg/l is shown in figure7 . Thus it is shown that almond husk is thebest available low cost adsorbant for treatment of tannery wastewater.

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IV. CONCLUSION

Through this study it was found that almond huskcan be employed as a better adsorbantfor preliminary treatment of tannery wastewater. In this study it was found that the pollutant parameters of tannery wastewater like turbidity, BOD, COD were reduced to the satisfactory level, among the primary treatments available for tannery wastewater like lime treatment ferrous sulphate treatment and coagulation processes it was found that adsorption is the best available method of treating tannery wastewater due its low cost and heavy metal removal. So, almond husk can be used effectively as an adsorbant for pre-treatment for tannery wastewater.

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