iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.62385

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Analysis and Treatment of Tannery Waste Water by using Combined Filtration and Coagulation Treatment Process

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Abstract: ***Industry generates significant volumes of waste water laden with various pollutants, including suspended solids, organic compounds and heavy metals presenting considerable environmental challenges. This study proposes an innovation approach for the analysis and treatment of tannery waste water using a combined filtration and coagulation treatment process. The analysis phase involves a comprehensive characterization of the tannery effluent, identifying key contaminants and their concentrations. This understanding informs the design of an efficient treatment strategy. The treatment process integrates two key techniques i.e. filtration and coagulation.***
Keywords: Tannery effluent, Screening, Coagulation, Flocculation, Sedimentation

I. INTRODUCTION

Tannery waste water severely affects the quality of water bodies into which hit is discharged. Tanning effluent contains organic matter, chromium (Cr) and solid waste such as fleshing, trimmings, shavings and buffing dust. About 60% of the total chromium salts react with hides while 40% of the chromium amount remains in the solid and liquid wastes, which makes it a potential environmental concern. In this research work, tannery waste is processed by the pre-treatment step using a filter media followed by post treatment coagulation process. The later step is analyzed usingn CuSO4 as a coagulant by varying chemical dose and settling time. These parameters were optimized to maximize the pollutant removal efficiencies measured in terms of reduction in concentration of Cr, total dissolve solids (TDS), total suspended solid (TSS), turbidity, biological oxygen demand (BOD5) and chemical oxygen demand (COD).It was observed that by using 150 mg/L coagulant dosewith24hourssettlingtime, maximum removal efficiency of 93%Cr, 71%TDS, 95% TSS, 72% turbidity, 81% BOD and 85% COD was achieved. The hybrid treatment process, investigated experimentally, can be employed commercially as a pretreatment step for tannery waste water. These mainly divided as pollution intensive industrial complexes that create hazardous waste waters. Variability is the complete process regarding to the system The features of tannery wastewater are reviewed in this paper, and an effort has been made to provide a quick overview of a strategy for treating tannery wastewater, with a focus on briefly outlining the biological methods. High concentrations of organic, inorganic, and nitrogenous chemicals, chromium, suspended solids, characteristics of tannery wastewaters, which are also known for their complexity. Wastewater from tanneries is treated using physical, chemical, biological, or a mix of these processes.

II. LITERATURE SURVEY

1) Due to increased population growth there has been an increase in the number of industries to meet the day to day demands of the mankind. Along with the useful products, these industries generate a large amount of toxic materials in various forms of solid, liquid and gaseous contaminations.
2) The quantity and toxicity of these hazardous releases vary and depends on the type of industries. In 1991 analyzed that among all the industrial wastes, tannery effluents are the top ranked toxic releases. A significant part of the chemicals used in leather processing is not actually absorbed or consumed in the process and hence it is discharged into the environment.
3) Due to industrial enlargement, huge amounts of industrial wastes are accruing in the environment and can't be disposed. Liquid effluents from light leather processing comprise about10to100mg/L of organic matter, chromium, sulphide, and solid waste including fleshing, trimmings, and shavings and, buffing dust.

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4) About 60% of the total chromium salts react with the hides and about 40% of the chromium amount remains in the solid and liquid wastes.
5) There are a large number of tanneries (registered as well as un-registered) and footwear manufacturing units. The increase in the number of tanneries can be attributed to the increased demand of tanned leather in the world markets till the end of the fiscal year 2007-08.
6) Waste water treatment methods can be broadly classified as physical- chemical and biological processes. Several studies have been carried out for the treatment of industrial effluents through coagulation and flocculation process.
7) Coagulation is typically employed as a pretreatment process and thus further treatments such as biological (secondary) and advanced (tertiary) treatment are required in the leather industry in order to meet the proposed tannery effluent standards.
8) The inorganic coagulants are compounds that break colloidal suspensions and help the flock formation. The frequently used coagulants in tannery effluent treatment are: -Alum: industrial aluminum sulphate {Al2 (SO4)3 .18H2 O} - Iron sulphate (FeSO4.7H2O)-Iron chloride: industrial (FeCl3.6H2O)-Lime: industrial calcium hydroxide {Ca(OH)2 } Among the commercially employed coagulants, such as FeCl3 , alum, lime, and TiO2 , the coagulant TiO2 at a dosage of 150 mg/L has been reported to yield a removal efficiency of BOD 78%, COD 90%, TSS 100%, and Cr 94%. However, TiO2 was reported to be not very economically suitable coagulant.Conversely, Al2 (SO4)3 .18H2 O and FeCl3 produced the least amount of sludge in comparison to Ca (OH) 2. Tannery effluents have also been treated with commercial grade lime. Low values of COD and the removal of chromium, TSS, TDS were observed in this investigation. In this research work, untreated tannery effluent was treated by a combined process of settling, filtration and coagulation with FeCl3 adopted from.

TANNERYWASTEWATERPROPERTIES

The properties are given below:

S.No.	Parameter	Values
1	pH	7.6
2	Colour	Dark brown
3	Turbidity	140 NTU
4	Total Suspended solids	1040
5	Alkalinity	2450
6	BOD	1520
7	COD	3640
8	Sulphide	210
9	Total Nitrogen	257
10	Ammonical Nitrogen	85
11	Total Chromium	10.0
12	Total Phosphate	16
13	Total Kjeldahl Nitrogen	144

Except pH and turbidity all the values are in mg/L

III. METHODOLOGY & PROCESS ADOPTED

To treat effluent from the tannery sector, numerous conventional procedures, such as biological process, were used.Techniques for biological treatment: Industrial effluents are considered to benefit from biological treatment of wastewater. When bacteria are used to treat wastes, the waste is stabilized by being broken down into harmless inorganic particles using either an aerobic or anaerobic method. The rate of decomposition is quicker in an aerobic process than an anaerobic one.

Unlike anaerobic processes, which require longer detention times and produce unpleasant odors, the procedure does not produce any unwanted smells.

Anaerobic processes, on the other hand, assert that they have a number of benefits, particularly in tropical. Yet, a thorough evaluation these two techniques for treating tannery effluent using field data have not yet been done.

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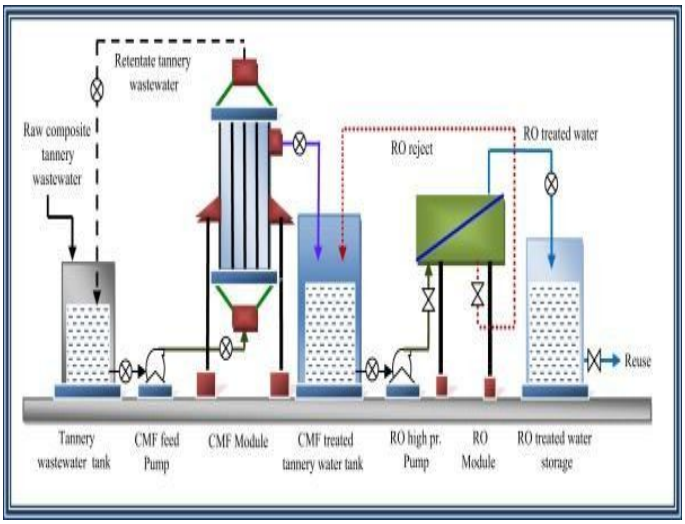


Fig. Complete diagram showing tannery water tank

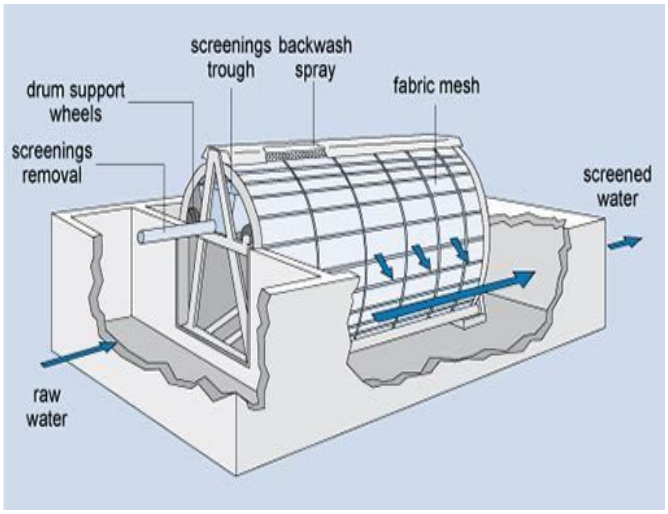


Fig. showing screening process

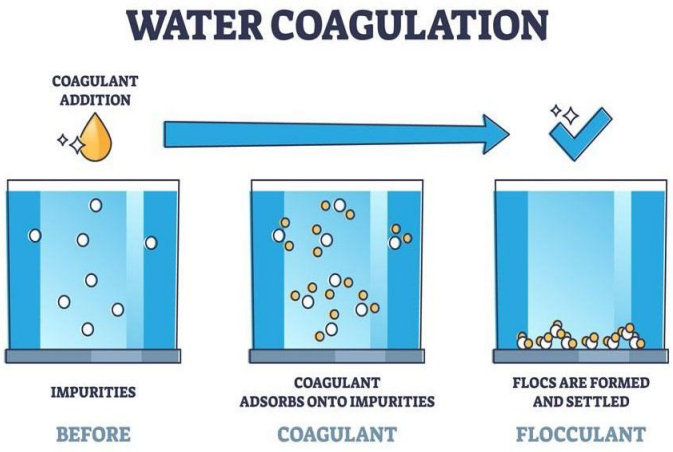


Fig. Diagram showing Coagulation

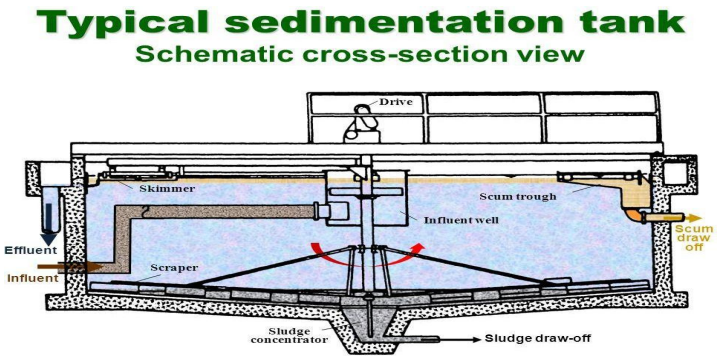


Fig. Diagram showing Sedimentation tank

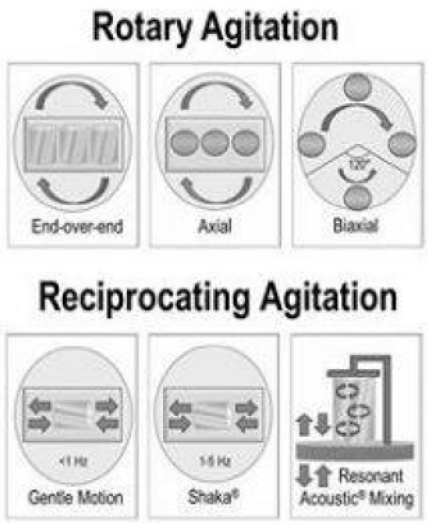


Fig. Diagram showing Agitation

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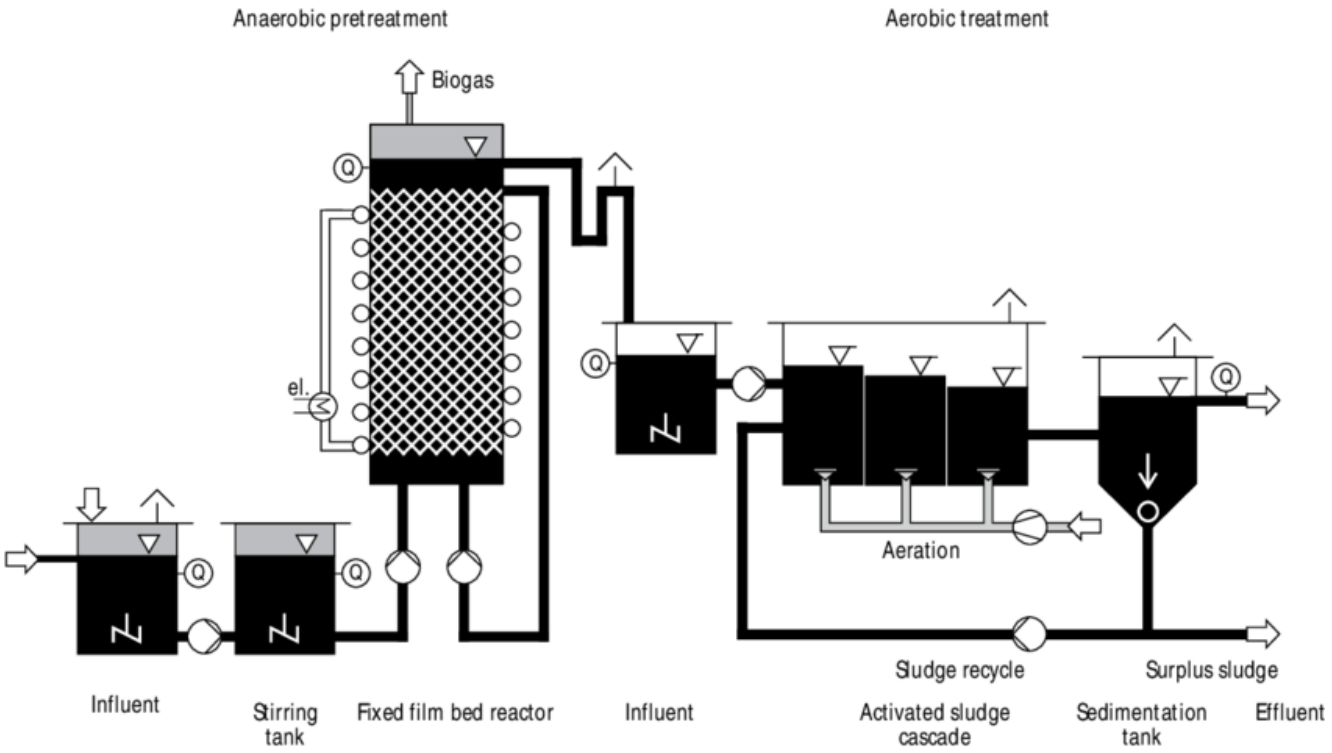


Fig. Diagram showing Aerobic & an aerobic Process

IV. RESULT & DISCUSSION

1) The increased CuSO4 coagulant amount from 500 to 700 mg/ltr increased the removal efficiency of the waste molecules.
2) However, any increase above the 700 mg/ltr outcome in decreased removal efficiency due to hindrance in floc development of waste molecules. Hence, the 700 mg/ltr was recognized as an optimum level and is thus suggested for the longer settling time of 24 hours.
3) The outcome obtained with the use of these recognized optimum value suggested, this step was able to achieve the maximum percentage removal efficiency of 71 % total dissolved solid.

Flask No.	1	2	3	4	5
Concentration of coagulant(mg/Liter)	500	600	700	800	900
pH	9	7	8	6.5	5
TDS (In ppm)	204	272	212	253	274

V. CONCLUSION

1) Anaerobic treatment is often seen as being more advantageous than aerobic treatment in the field of wastewater treatment since it requires less energy. According to this paper, anaerobic treatment facilities are generally more effective at treating tannery effluent. the use of integrated biological and chemical or physical processes.
2) This review study demonstrates the degree of tannery pollution as well as the numerous biological techniques available for wastewater treatment and disposal. After careful consideration, it has been determined that the suggested hybrid treatment method—a combination of filtration and coagulation—can be employed to successfully pre-treat effluent from tanneries.
3) The effectiveness of the contaminants' removal was improved by increasing the CuSO4 coagulant dose from 500 to 700 mg/L.

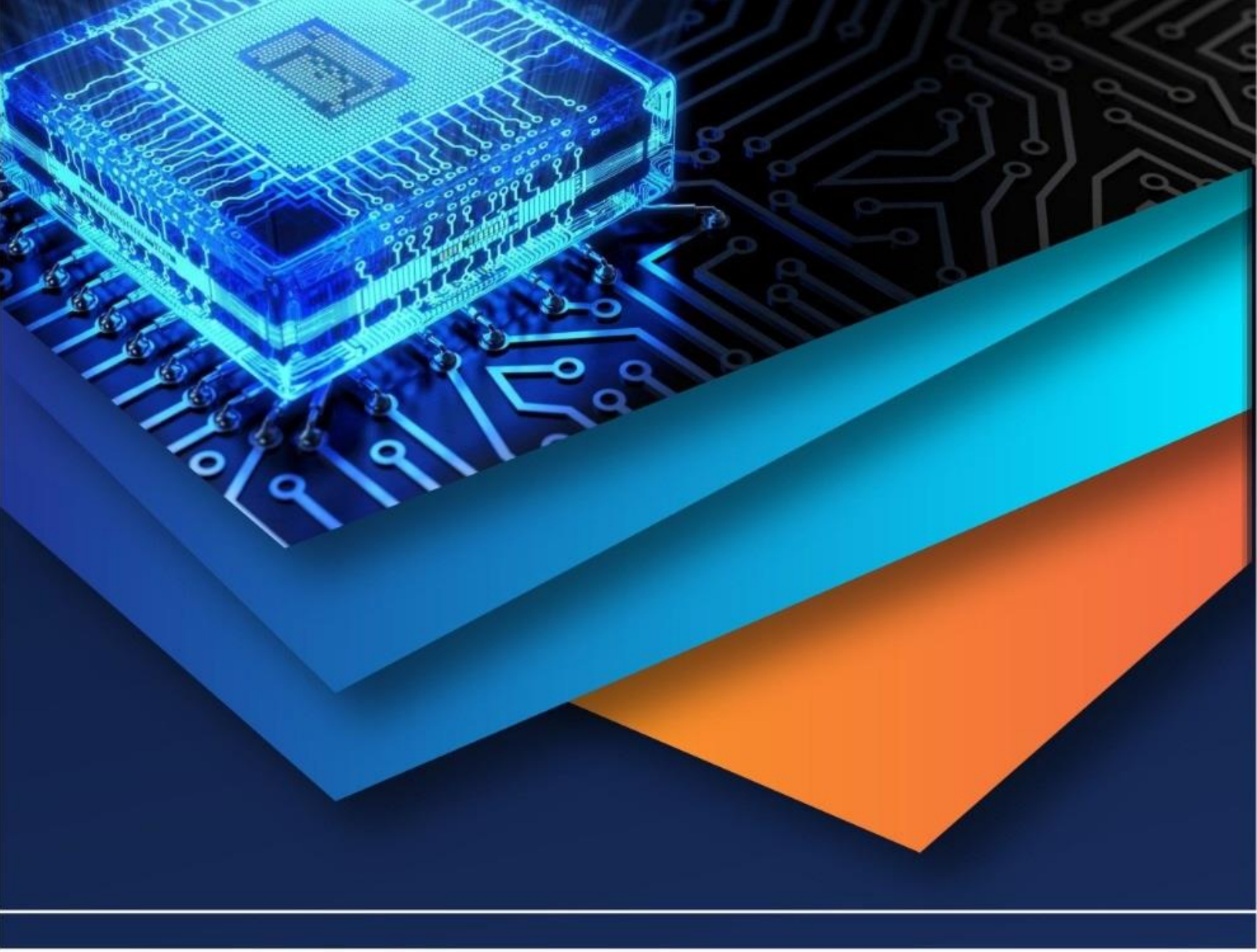
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4) Any increase above 700 mg/L, however, led to lower removal effectiveness because waste particle floc formation was hampered. As a result, an optimal value of 700 mg/L was found, and it is advised to settle for 24 hours.
5) The results obtained with the use of these identified optimum value suggested that this process was able to achieve the maximum % removal efficiency of 71 % TDS.

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