VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi, Karnataka – 590 018

PROJECT

REPORT ON

"WASTEWATER TREATMENT OF INDUSTRIAL EFFLUENTS USING BANANA STEM EXTRACT"

Submitted in partial fulfillment for the award of degree of

BACHELOR OF ENGINEERING

IN

CIVIL ENGINEERING

Submitted by

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CERTIFICATE

This is to certify that the project entitled **"WASTEWATER TREATMENT OF INDUSTRIAL EFFLUENTS USING BANANA STEM EXTRACT"** has been successfully carried out by **CHANDRALEKHA D, BHOOMIKA S ,SREENIDHI S** and **ABHIJITH G S** in the partial fulfillment for the award of the degree in **Bachelor of Engineering** in **Civil Engineering** of **Visvesvaraya Technological University, Belagavi** during the academic year **2020 - 2021.** It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the department library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the degree of Bachelor of Engineering.

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled **"WASTEWATER TREATMENT OF INDUSTRIAL EFFLUENTS USING BANANA STEM EXTRACT"** is a bonafide work of **CHANDRALEKHA D, BHOOMIKA S ,SREENIDHI S** and **ABHIJITH G S** students of **VIII** semester **B.E Civil Engineering, Channabasaveshwara Institute of Technology, Gubbi, Tumkur** carried out in partial fulfillment for the award of the degree in **Bachelor of Engineering** in **Civil Engineering** of **Visvesvaraya Technological University, Belagavi** under my supervision and guidance.

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UNDERTAKING

We, the students **CHANDRALEKHA D, BHOOMIKA S, SREENIDHI S** and **ABHIJITH G S** students of **VIII Semester B.E Civil Engineering, Channabasaveshwara Institute of Technology, Gubbi, Tumkur** declare that the project work entitled **"WASTEWATER TREATMENT OF INDUSTRIAL EFFLUENTS USING BANANA STEM EXTRACT"** has been carried out and submitted in partial fulfillment of the requirements for the award of the degree **Bachelor of Engineering** in **Civil Engineering** of **Visvesvaraya Technological University, Belagavi** during the academic year **2020 - 2021.**

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ABSTRACT

Because of modernization and population growth in urban culture, industries have risen greater heights. However, this has led to major source of pollution of all types, including air, water, and noise. Many companies use freshwater to transport trash from the plant, then dump the garbage into rivers, lakes, and seas, polluting the water and endangering aquatic life and also cause problems to all those who depend on these rivers and lakes for their daily needs. Industries often need 200-500 litres of water to generate 1kg of goods. This is one of the primary causes of global water scarcity. The water generated by these industries are not even appropriate for agriculture, necessitating wastewater treatment. Because of their adsorbing qualities, many forms of agricultural wastes are presently being investigated for wastewater treatment. Banana stem extract was used as a natural adsorbent in this experiment (Musaceae Zingiberales). In this paper, the different properties of water were studied by mixing banana stem extract with waste water collected from industry. This document discusses the many methods for converting trash into irrigation standards

TABLE OF CONTENTS:

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 General

India's population has surpassed 100 million people. An individual's basic necessities include food, clothing, and shelter. India has a diverse range of sectors that are rapidly expanding. According to data, every Indian district has at least ten textile industries. The textile industry uses a lot of water. It approximately needs 250L of water to make 1Kg of textile. The wastewater let out from these industries doesn't have the necessary characteristics to be used for irrigation.

1.2 Why should the water be treated?

The Wastewater from industry has a huge amount of Hardness, Total Suspended solids, and other unsuitable chemical characteristics. This makes the water not suitable for irrigation, and harms the natural flora and fauna of these water bodies. The waste created because of the dye used in the textile industries causes high Biological Oxygen Demand and high chemical oxygen demand. This is one of main reason to treat the wastewater that is being let out from these industries. However, the treatment of wastewater is extremely expensive. This problem can be tackled by using natural-adsorbents, also called low-cost adsorbents. It was observed that adsorption was a very feasible alternative for treating the wastewater dumped by these textile industries.

The characteristics of the wastewater coming out from these industries are so poor that they can't be used for anything not even for irrigation. This waste water released from the industries have large amounts of hardness, total suspended solids, turbidity and various other chemical characteristics. This makes the water unfit for other uses. The waste created by using dye from the industry causes not just high Biological Oxygen Demand(BOD) but also high Chemical Oxygen Demand(COD).

1.3 OBJECTIVES

The main objectives are:

- The enhance properties of wastewater collected from the diary industries.
- To analyze the different characteristics of water by addition of banana stem extract to wastewater collected from industries present nearby.
- To reduce the suspended solids, hardness, turbidity, pH and dye from the waste water collected from industry by using banana stem extract.
- To recycle the waste water letout from the industries and make it suitable for other uses such as irrigation.

CHAPTER 2

LITERATURE SURVEY

i. Habsah Alwi, Juferi Idris, Mohibah Musa- has directed the examination on **"Preliminary study of banana stem juice as a plant based coagulant for treatment of wastewater"** by examining pH, COD,Suspended solids and Turbidity and gave conclusion that COD of 80%,SS of 88.6% and turbidity of 98.5% were removed. 1.22016 mg/mL was the inulin concentration in banana stem. We may conclude that banana stem juice has a lot of capability as natural coagulant for waste-water treatment and might be employed in the pretreatment stage of Malaysian spent coolant wastewater before it goes for secondary treatment.

ii. Sandhya, Maurya and Achlesh Daverey have directed the investigation on **"Evaluation of plant based natural coagulants for municipal wastewater treatment"** and examined parameters on Turbidity of 59.6%,COD of 66.7% and TSS of 66.6% were removed. The reduction of turbidity, total suspended solids (TSS) and COD from municipal waste-water was investigated using 4 plant-based natural coagulants i.e Banana peel powder, banana stem juice, papaya seed powder, and neem leaf powder.

iii. Anupriya J, Jansi Sheela S, ChellaGifta has directed the examination on **"Removal of effluents from textile industry using natural adsorbent"** and investigated Suspended solids, Hardness and Turbidity. This relative investigation revealed that suspended solids decreased at 96%, hardness 66% and turbidity 78%. The experimental results show that the industrial waste-water letout by the textile industry has extremely high levels of hardness, suspended particles, and turbidity. When textile manufacturing wastes are released into the same stream, the characteristics of waste water are practically identical.

iv. Zawawi Duad and Noorain Suhani have led the examination on **"Feasibility of Banana trunk(Musa sapientum) trunk biofibres for treating wastewater"** by examining the parameters such as Biosorbent , pH, amount. Contact time shaking time. The goal of this investigation was to remove 88% of COD,84% of ammonia nitrogen, 68% of oil and grease , 83% of suspended solids , 67% of colour and 75% of turbidity. The Arked food court at Universiti Tun Hussein Onn Malaysia in Johor provided the raw

kitchen wastewater sample for the investigation (Malaysia). The COD and shaking speed, ammonia elimination, pH, the optimal ratio , and contact time were established.

2.1 LITERATURE SUMMARY

It was shown in the literature summary that

1. The characteristics of wastewater can be enhanced by adding banana stem extract to the wastewater
2. The characteristics like chemical oxygen demand, pH, suspended solids, biochemical oxygen demand, turbidity and hardness can be reduced to some extent.
3. banana stem extract was proved to be the most efficient natural adsorbent off all the adsorbents like neem powder, orange peel powder Etc

CHAPTER 3

METHODOLOGY AND APPARATUS

3.1 GENERAL

To collect water samples from various industries and to collect matured banana stem extract from the local market. Mix the banana stem extract powder that is sun dried/banana stem extract solution that is strained with the waste water sample collected. They are tested using the Coagulation jar test, hardness using titration method, turbidity using Turbidity meter, pH using pH meter and removing dye from wastewater.To analyse the results obtained from the above tests conducted.

Fig1: Bananapith

3.2 METHODOLOGY

Banana plants that had reached maturity were gathered. After separating throns and leaves from the stem. A mixer was used to combine 100g of small fine pieces of pith with 10mL of distilled water. The juice was collected after the mixed pith was strained. To keep the freshness of the banana stem juice, it was stored in freezer at 7°C(44.6F). Mix banana stem extract powder that is sundried/banana stem extract solution that is strained with the waste water sample collected...They are tested using the Coagulation jar test, hardness using titration method, turbidity using Turbidity meter/ Nephlometer, pH using pH meter and removing dye from waste water...To analyse the results obtained from the above tests conducted.

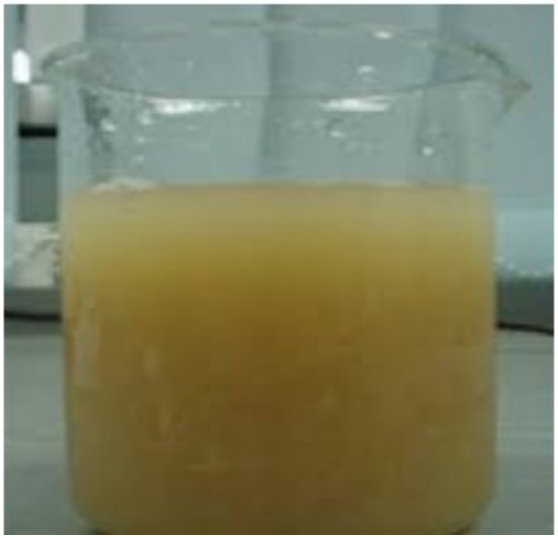


Fig2: Banana stem juice

3.3 APPARATUS

Apparatus needed for this project are:

- **Coagulation jar:**

  Purpose: To check the total suspended solid particles

  IS Code 3025: Part 16: 1984

  Permissible limit: 350mg/l - 1200mg/l

- **Hardness setup:**

  Purpose: To test the hardness of water

  IS Code: IS 3025 : Part 5:1964

  Permissible limit: >180mg/L [very hard]

  60-120mg/L [moderately hard]

  Below 60mg/L [soft]

- **Nephlometer:**

  Purpose: To test the turbidity of water

  IS code: IS 3025 (part 10)

  Permissible limit: 1.0-5.0 NTU

- **Ph meter:**

  Purpose: To check the pH of water

  IS code: IS 3025 (Part11)

  Permissible limit:6.0-8.0

3.3.1 COAGULATION JAR TEST

The following steps are involved in the jar test procedure:

Fill the sample water in containers of the jar testing apparatus. One container will serve as a control, while the other five can be changed according to the conditions being evaluated. To identify optimal working conditions, for example, the pH of the jars can be altered or different coagulant dosages might be added.

- Add the coagulant to each container and mix for 1 minute at about 100 rpm. The rapid mixing stage aids in the dispersal of the coagulant throughout each container.
- Allow 30 to 45 minutes for the containers to settle after turning off the mixers. Then, in each container, determine the final turbidity.
- Reduce the speed of the mixer to 25-35 rpm and mix for another 15-20 minutes. Slow speeds aid floc production by increasing particle collisions, which results in larger flocs.
- The graph showing relationship between coagulant dose and residual turbidity should be plotted, and the best circumstances are identified. To account for actual treatment system, data collected from the experiment are correlated and adjusted.

Fig3: Coagulation jar test

3.3.2 HARDNESS TITRATION METHOD

- Titrate to determine Ca-Hardness and Total Hardness as follows: For each measurement, use a new sample.
- Total Hardness: Add 2ml of solution of buffer and 2-3 drops of Black T to a 100 ml of the sample. Until the last reddish colour disappears titrate it with a standard EDTA solution by continuosly stirring. At the end the solution will turn blue. Calculation of Hardness:
  Hardness (mg/L as CaCO3) = (V×N×50×1000) / (SV)(5) Where: N = normality of EDTA; V = volume of titrant (mL); SV = sample volume (mL); 50 = equivalent weight of CaCO3;
- Ca^{2+}-Hardness: Add 1ml (8%)NaOH solution and a pinch of Mercurex Powder to a sample of 50ml. Until the colour of solution(pink) converts into light blue color titrate with standard EDTA solution.
- If the turbidity is less than 40u, bring the samples to room temperature before analysing them. To properly scatter the solids, mix the sample. Pour the material into the turbidimeter tube after air bubbles have dissipated. Determine the turbidity directly by using instrument scale or from a suitable calibration curve. [u=units]
- If the turbidity is more than 40u: Until the turbidity falls below 40u dilute it (sample) with one or more volumes of turbidity free water. Comput turbidity of original sample from dilution factor and turbidity of the diluted sample. For example, If 1 volume of sample was diluted with 5L of turbidity-free water and diluted sample had turbidity of 30u, the turbidity of the original sample was 180u.
- few turbidimeters have many separate scales. The higher scales should be used as indicators of RDV[required dilution volumes] to decrease readings to less than 40NTU.

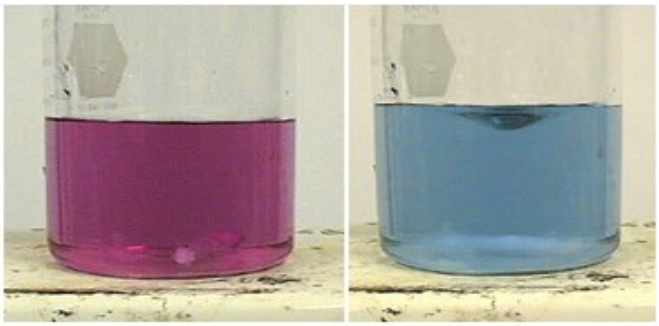


Fig4: Hardness titration method

3.3.3 NEPHLOMETER

A nephlometer can be used to determine the turbidity of water. The turbidity test determines how much light is being dispersed or absorbed in water by suspended particulates.

The size and surface of suspended particles influence absorption and scattering.

This test does not provide a direct measurement of suspended materials. Nephelometer is the most widely used method for measuring turbidity.

Turbidity experiment principle:

Nephelometers are the turbidity meters where the sacttered light detectors are placed at 90 degree to the light. The intensity of light that is being scattered by sample under a defined conditions is compared to the intensity of light being scattered by a standard reference of suspension under same conditions in this approach.

Turbidity of Water Determination:

The turbidity will increase as the intensity of scattered light increases. Formazine polymer is required for turbidity measurement via nephelometer.

The major standard reference suspension is Formazine Polymer. Nephelometric-Turbidity Units are used to measure turbidity (NTU).

Turbidity experiment requirements:

- Nephelometer, with tungsten filament light source and 90^{o} detector system.
- Clean distilled water
- Standard turbidity solution (40 NTU and 400 NTU Formazine Polymer solution)
- Quartz glass' Sample cells

Turbidity Test Procedure

Follow as given in the instruction manual and Calibrate the nephelometer accordingly (With the reading set to 0 insert turbidity free water. set reading to 40 and put 40NTU standard and using 400NTU solution set reading to 400. Repeat)

Read turbidity directly from the display after pouring well mixed sample into cell

Dilute the sample and if turbidity of sample exceeds 400NTU.

AT=(OT)X(DF) [AT=actual turbidity; OT=observed turbidity;

DF= DilutionFactor]

Fig5: Nephlometer

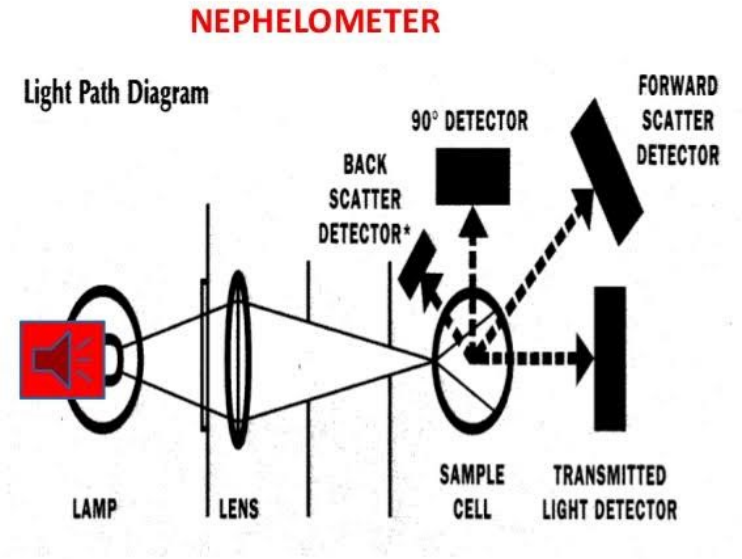


Fig6: Nephlometer mechanism

3.3.4 PH METER

Values of pH are between 0 and 14 if concentration of solution doesn't exceed 1M. if pH is <7 its acidic and pH is >7 its alkaline. pH meter will measure changes in hydrogen ions activity.

Water pH Determination

1. Stir water sample with a clean glass rod.
2. add 35-45mL sample into glass beaker.
3. Allow sample to sit for at least one hour, stirring it every now and then this will stabilize temperature. Measure temperature and set pH meter's temperature controller to match the sample temperature.
4. Standardize the pH meter by using given standard solutions.
5. Immerse electrodes of the pH meter into the water sample and turn the beaker a bit to get good contact.
6. The electrodes require immersion of minimum 30 seconds in sample to stabilize the meter (only required to be done in manual meter).
7. Note down pH to the closest 10th of a whole number. If it reads to the 100th place round it off (If the digit at 100th place is less than 5, leave the digit at10th place. If it is greater than 5, round the digit at 10th place up to 1u. If the digit at 100th place equals 5, round the digit at 10th place to the closest even number.
8. Rinse the electrodes thoroughly with distilled water, then dab the electrodes with tissues to remove any film that has developed. Warning: Do not clean the electrodes, since this may cause polarisation and a delayed reaction.

Fig7: Ph meter

CHAPTER-04

4.1 INDIAN STANDARDS

As per the environmental standards as laid by the ministry of environment and forestry, 1989 inorder to make the wastewater suitable for irrigation purposes

Si no	Parameter	Permissible limit
1	pH	5.5 - 9
2	(Chemical oxygen demand)COD	250mg/L
3	(Total suspended solids)TSS	350mg/L - 1200mg/L
4	Biochemical oxygen demand	100mg/l
5	Turbidity	1.0 - 5.0 NTU
6	Hardness	350mg/L - 1200mg/L

CHAPTER-05

RESULT & OUTCOME

The table below shows different characteristics of waste water that's been analyzed:

Parameters	Values			
	1	2	3	4
Suspended Solids	8700 mg/l	7900 mg/l	9850 mg/l	8436 mg/l
Hardness	520 mg/l	640 mg/l	635 mg/l	540 mg/l
Turbidity	1182 NTU	1453 NTU	1536 NTU	1658 NTU

Indian standards comparision

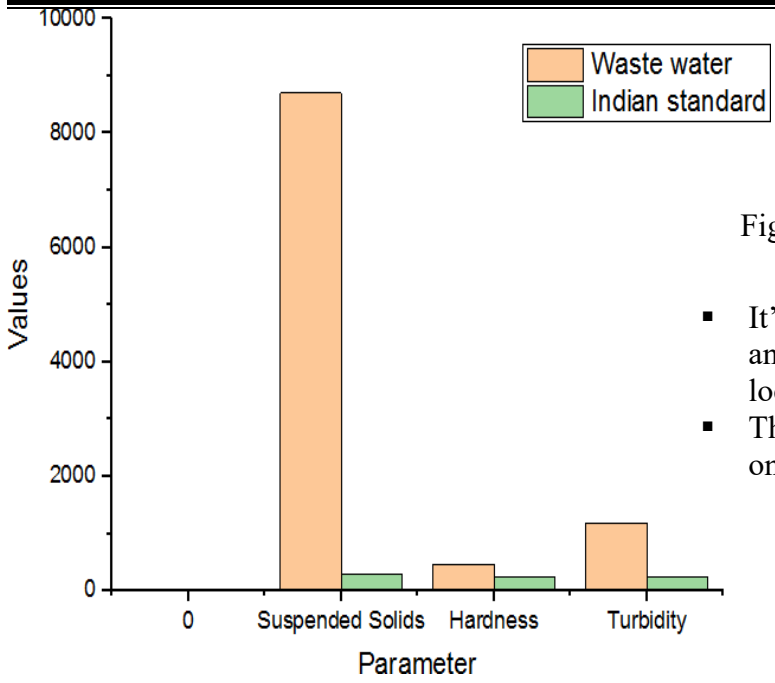


Fig8: Indian standards comparision

- It's clear that Hardness, suspended solids and turbidity are high in the stream that is located near to industries.
- The values without adding any adsorbent on the test samples is shown here.

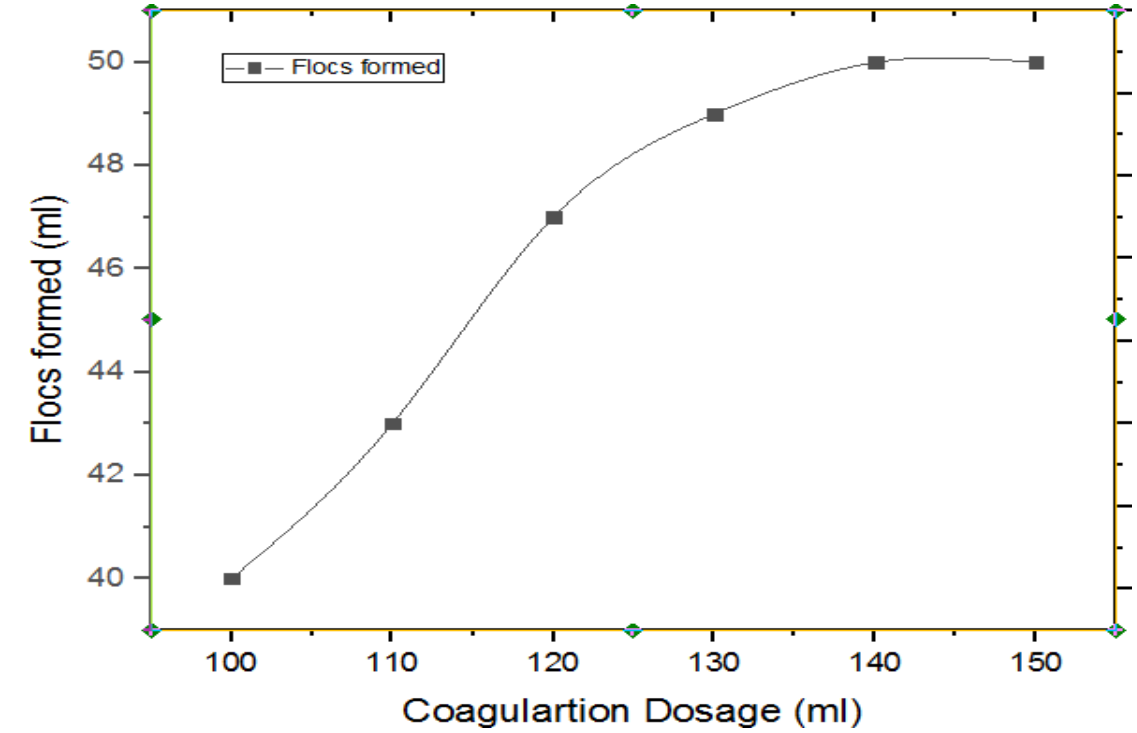
Suspended solids , Hardness and Turbidity are one of the important reasons to remove wastes from waste water. usage of dyes is the main reason for such high levels.
Figure below shows the initial colour of the waste water that has been collected directly from the industry.

Fig9: Intensity of dye in waste water

COAGULATION JAR TEST

Results of Coagulation jar test are as shown in figure below, it's recorded that prepared banana stem extract of 140 mL is best for floc production.

Fig10: Jar test results



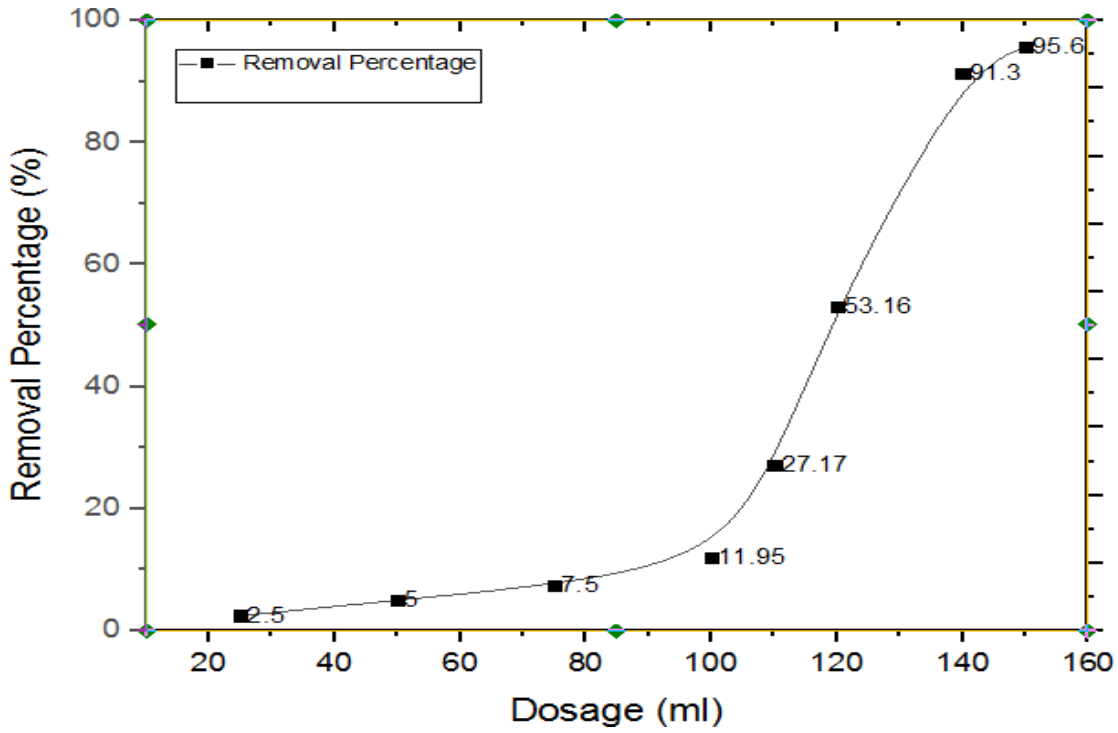


Fig11: Removal percentage of ss from different dosages

- From the test results , it can be seen that there is a steep reduction of SS when dosage of more than ¼ of the banana stem volume is used.
- This is mainly because banana stem has the property to adsorb the smaller particles on its surface and allows to settle rapidly. The particle size of the SS are found to be very low after the addition of extract of banana stem.
- Waste water collected in sample point 1: The suspended particles are removed by the extract of banana stem. The suspended solids value exceeds 300 mg/l, which is significantly higher than irrigation standards.
- It could not remove suspended materials below the level that can be used for irrigation.
- sample points two and three: The values of the waste water collected from a great distance away, are below the Suspended solids value stated by the irrigation regulations.
- from Figure, addition of 150 mL of extract of banana stem to 500 mL of waste-water eliminates 95% suspended particulates due to the banana stem extract's adsorption capacity.

HARDNESS TEST

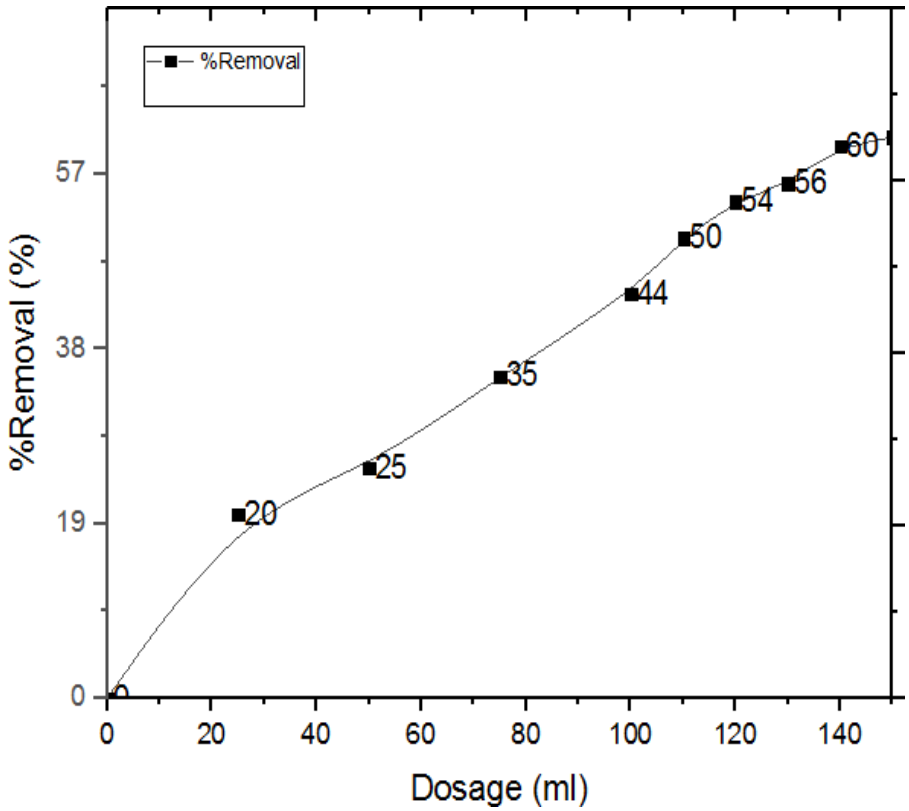


Fig12: Percentage removal of hardness

- From the graph, it is seen that there is significant decrease in hardness by usage of more dosage of extract of banana stem.
- The extract of banana stem forms the different kind of compound which does not cause hardness.
- The carbonate and bicarbonates are converted in to other chemical compounds.
- After tests Within a day, there is a huge reduction in the hardness.
- but, the hardness doesn't fall under the range that can be used for irrigation.
- Therefore more treatment is needed for the samples collected at sample collection point 1.
- The hardness readings obtained after a dosage of 100ml result in a significant reduction in hardness value, which is far below the irrigation-related restrictions.
- It was found that the hardness value reduces when $1/4^{th}$ amount of banana stem extract is added to the waste water.
- This is because the conversion of the chemical components that generate hardness in waste water into simpler chemical compounds that are not detectable using titration methods.

TURBIDITY TEST

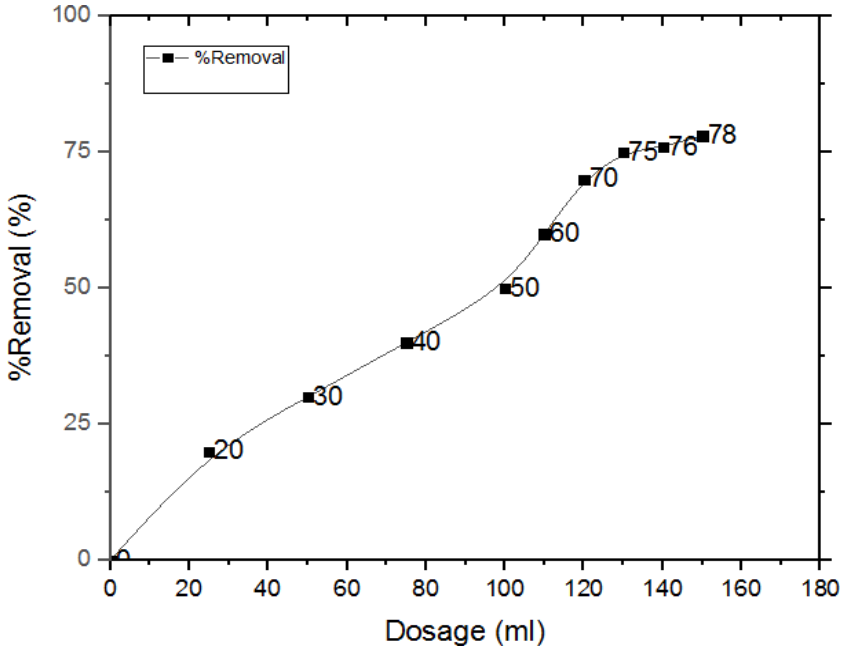


Fig13: Removal of turbidity for different dosages.

- Figure shows the turbidity reduced from the 4 points.
- The reason for this reduction in turbidity is that the extract of banana stem adsorbs smaller particles which are the major cause for the turbidity and allows the particle to settle down.
- The value of turbidity reduces. for irrigation purposes the turbidity is not a important factor so more emphasis is not given for the same.
- Turbidity is mainly due to the settling of particles which changes colour. The below figure shows colour change for the waste water effluents.

Fig14: Intensity Of Dye

From the corresponding figure it is seen that the adding the extract of banana stem resulted turbidity that has led to the change in colour

CHAPTER – 06

CONCLUSION

6.1 INFERENCE

When textile industries wastes are let out into streams, the characteristics of the changes. And this was similar to the characteristic of waste-water.

Because of adsorption capability of extract of banana stem, when 1/4th of the volume of the extract was added to waste water, the amount of suspended solids fell by 96 percent.

When extract of banana stem is applied at a certain amount of 1/4th of the volume of waste water, the hardness value of waste water is reduced by 66%.

When 1/4th volume of extract of banana stem was mixed to waste water, the turbidity of the samples fell by 78%.

According to the results of the experiments, the industrial waste water discharged by the textile sector contains extremely high levels of hardness, suspended particles, and turbidity.

6.2 FUTURE RECOMMENDATION:

- ✓ The extract of banana stem removes the suspended solids significantly from the wastewater that has been collected from point 1 (close to point of discharge)

- ✓ And the further treatment can be done using alternate Natural adsorbents.

CHAPTER -07

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