

TREATMENT OF INDUSTRIAL WASTEWATER BY USING ECO-FRIENDLY TECHNIQUE

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Abstract

The textile industry is one of the major industries and work as the backbone of economy of Pakistan. It employs thousands of people without any education. It plays important role in the economy of every country around the world. The textile industry has high importance when it comes to the environment because it consumes many environmental resources such as water. Also, it produces a large amount of wastewater which is then discharged into the environment and causes environmental pollution. In this study, *Ocimum basilicum* L. (sweet basil seeds) and *Tamarindus indica* seeds have been evaluated as an active natural coagulant for the removal of pollutants from textile wastewater. The change in pH, Dissolved Oxygen, Electrical conductivity, TDS, COD, and heavy metals/pollutants were analyzed. Also, the dye concentration was found to be the most important parameter affecting color removal. Pollutant removal efficiency was obtained by using a low number of coagulants. The mucilage of *O. basilicum* and the powder of *T. indica* seeds were found to be highly effective in treating textile wastewater as a sole coagulant. The results show that these coagulants help to reduce heavy metals from 0.16 ppm to 0.02 ppm. Utilization of these natural coagulants was found to be suitable, easier, cost-effective, and environment friendly for textile waste water treatment.

Keywords

Pollution, Co-friendly Methods, Water Treatment, *O. basilicum*, *T. indica*, Natural Coagulants and Heavy metals.

Introduction

Water is an essential element of life and without water, life does not exist. It is a colorless, tasteless, odorless, and transparent substance that covers 71% of the earth's surface and mostly in the sea and oceans, and a small part occurs underground known as groundwater. It is important for every living organism, although it does not provide any calories or nutrients but still without water life is not possible (Imtiazuddin, 2012). The chemical formula of water is H₂O, which means it consists of one oxygen and two hydrogen atoms that are connected by a covalent bond and require standard temperature and pressure. Water

can take different forms like when it precipitates from the earth's surface, it will return in the form of rain and aerosols in form of fog. This cycle consists of different stages like precipitation, evaporation, transpiration, condensation, and runoff. Pakistan is a rich country when it comes to water resources including both ground and surface water but nowadays Pakistan is facing serious issues related to water scarcity (Abbas *et al*, 2019). All water resources are under massive pressure due to rapid resident expansion, an increase in industrial pollution, and urbanization. It is the most important element for the survival of living organisms.

The wastewater from commercial, industrial, and other sources contaminates the fresh water in rivers, ponds, etc. Also, the wastewater sweeps down and contaminates the groundwater. The textile sector represents 70% of Pakistan's fares, although the working condition of workers is very poor.

Small assembling workshops, for the foremost part, don't sign trade agreements, the remuneration allowed by law and the use of child labor is common. Major subcontinent brands within the world are additionally subject to law violations where workers may be beaten, angered by their employers, or paid but the earnings allowed by law. Textile factories don't follow safety principles to avoid accidents. The textile industry is one of the best businesses on earth. Different steps of fabric production are searing, resizing, and scouring, blurring, mercerizing, shading, printing, and wrapping up. These systems are used in every textile industry as shown by their need. The use of plant-based coagulants for the treatment of textile industrial wastewater is safe for human health, biodegradable, and cost-effective for small industries (Golob, 2005). Also, so these procedures produce less touch and Residue. *O. basilicum* L., commonly called basil, is an aromatic flowering spice developed within the tropics of Asia, Africa, and Central and South America. The leaves of the plant are used as a flavoring in traditional food. Basil oil has been used a few times to boost nutrition and in dental and oral products. The spice contains bioactive compounds, for instance, flavonoids, and has anti-cancer agents and antimicrobial action. Basil has been utilized in traditional medicine to treat stomach ulcers, indigestion, runs, headaches, insomnia, depression, dermatitis, bug stings, and skin diseases (Kaya *et al.*, 2008). The possible answer to those problems is that

the creation of environmentally friendly coagulants, which are not harmful to the environment.

The development of those coagulants contains some material that's effectively accessible in our native habitats and might be used quite once. If so, these coagulants are often made with materials and other foods. Thus, within the end, these coagulants are small and environmentally adjustable because they produce 20-30% less sludge, which than normal coagulants (Narsih *et al.*, 2020). The present study deals with textile waste water treatment by using *T. Indica* and *O. basilicum*.

Methodology

3.1 Sampling

Samples for the test work were collected from RG textile Industry Lahore, which runs west of town and ends near Gajju Matta. Samples were collected from the three different discharge points. First sample of textile wastewater collected from the printing step of the fabric, second sample collected after the dying of the fabric and the third sample collected from the finishing point. Samples were saved in screw-topped disinfected bottle and duplicates of each sample were prepared. The sample of water was stored within the refrigerator till further analysis so its actual properties remain identical.

3.2 Laboratory Facilities

The Lab work was done in the testing laboratory of the Lahore College for Women University. Equipment utilized in the practical work of research includes electrical weight balance, household kitchen appliance, grinder machine, drying oven, digital hot plate, pH meter, EC meter, turbidity meter, dissolved oxygen meter, chemical oxygen demand meter, and atomic adsorption spectroscopy AAS.

3.3 Eco-friendly Coagulants

Two different natural plant based coagulants seeds were used for the treatment of textile industrial wastewater. *Ocimum basilicum* (Sweet basil seeds) and *Tamarindus indica* seeds ½ kg was bought from the local seeds market, Lahore, Pakistan.

3.4 Parameters

Following parameters were tested before and after the treatment of wastewater samples, tested the pH value, dissolved oxygen (DO), chemical oxygen demand (COD), total dissolved solids (TDS), electrical conductivity (EC), and heavy pollutants concentration in wastewater sample.

3.5 Extraction of *Tamarindus Indica* Coagulant Powder

The powder of *Tamarindus indica* was obtained after drying the seeds at room temperature. The seeds of *T. Indica* grinded with the help of a grinder machine and then used a sieve of size 0.4mm to extract the fine powder of *Tamarindus indica*.

3.6 Extraction of Gum from *Ocimum basilicum* Seeds

The gum of Mucilage was obtained after soaking the seeds of *Ocimum basilicum* in water for one hour. Extract the water from the seeds after one hour and then use a sieve of 0.7mm and rub the seeds with the help of spatula to extract the gum from the seeds.

3.7 Prepare Solutions for both Coagulants

Take three different quantities of coagulants and mix them with three solutions of water. First, take 1 gram of NaCl and add into the 20ml of distilled water in a beaker and mix with the stirrer after mixing, add 5 grams of coagulant powder of *T. indica* in it and continuously mix it with the help of stirrer and name this sample B5g. Again, take 1 gram of NaCl and add 30ml of distilled water in a beaker and mix with the

help of stirrer after mixing, add 8g of coagulant powder of *Tamarind indica* in it and continuously mix it with the help of stirrer and name this sample B8g. This is the third and last sample. Take 1 gram of NaCl and add into the 40ml of distilled water in a beaker and mix with the help of stirrer after mixing, add 10g of coagulant powder of *T. indica* in it and continuously mixing it with the help of stirrer and named this sample B10g. After this filter all these solutions of samples with the help of Whatman 42 filter paper .

Now using another coagulant which is the gum of *Ocimum basilicum*. Take 1 gram of NaCl and added into the 20ml of distilled water in a beaker and mix with the stirrer after mixing add 5g of extracted gum in it and continuously mixing it with the help of stirrer and named this sample A5g. Again take 1 gram of NaCl and added into the 30ml of distilled water in a beaker and mix with the help of stirrer after mixing add 8g of extracted gum in it and continuously mixing it with the help of stirrer and named this sample A8g. This is the third and the last sample, takes 1 gram of NaCl and added into the 40ml of distilled water in a beaker and mix with the help of stirrer after mixing add 10g of extracted gum in it and continuously mixing it with the help of stirrer and named this sample A10g. After this filter all these solutions of samples with the help of Whatman 42 filter paper and after filtered solution of samples added into the sample of textile industrial wastewater and check all the physicochemical parameters like pH, TDS, DO, chemical oxygen demand (COD), electrical conductivity (EC) and co concentration of some heavy metals like Zinc, Nickle, lead and Chromium etc. with the help of AAS.

3.8 Wet digestion process

For wet digestion process, taking 40ml of prepared solution of both coagulants in beakers and also take the original sample of textile industrial waste water and adding 3ml of nitric acid in each beaker with the concentration of 65% and put it into the hot plate for maximum 30 minutes. After the wet digestion, solution remains 30ml approximately. 2ml HCL and deionized water was added in each beaker.

3.9 Statistical analysis

The results were analyzed statistically by using Microsoft Office Excel 2016 (MS Excel) the function of mean, standard deviation and coefficient of variance were applied on each group of coagulant dosage and the comparative graph of each parameter was generated to determine the efficacy of both coagulants.

Results and Discussion

This study was conducted to treat the pollutants discharged from textile industrial wastewater. The sample of the textile wastewater was collected from the discharge point of ERP in textile industry Lahore. After collecting the samples all the physical parameters were checked initial values of pH, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and heavy metals/pollutants. Two different natural coagulants (*Ocimum basilicum* mucilage gum and *T. Indica* Seeds) were used to treat the wastewater and find the efficiency and effectiveness of these natural coagulants. All the samples that were collected from the industry were analyzed after third collection and the results of the initial readings are mentioned in the table below.

Table -01 Physical parameters of sample water before treatment

RG Industry Samples	S1 (Printing)	S2 (Dying)	S3 (Finishing)
pH	9.43	9.56	9.62
TDS (mg/L)	698	710	724
DO (mg/L)	0.4	0.3	0.5
EC (mS/cm)	1021	992	1051
COD	0.659	0.789	0.844
Zinc (mg/L)	1.67	1.67	1.67
Nickel (mg/L)	1.1	1.1	1.1
Chromium (mg/L)	0.96	0.96	0.96
Lead (mg/L)	1.6	1.6	1.6

4.1 Reduction in pH

Graph 1 shows the pH comparison of both coagulants plotted against the pH at the y-axis and treated Mucilage gum and Tamarind Indica seed coagulants at the x-axis by using a pH meter. The standard value of pH of textile industrial wastewater given by NEQS is between 7.5 – 11.5. The collected sample's initial/untreated value of pH collected from the end of the printing process was minimum is 9.43 and from the finishing point of wastewater was highest is 9.62. In the case of Mucilage gum of *Ocimum basilicum* coagulant sample, the minimum value at A5g which was collected from the end of printing process point is 9.23 and the highest value at A10g which was collected from the final discharge point of wastewater is 8.82. On the other hand, in the case of the *T. Indica* seed coagulant sample, the minimum value at B5g which was collected from the end of printing process point is 9.21 and the highest value at B10g which was collected from the finishing discharge point of wastewater is 8.12. So, it means that both natural coagulants help to reduce the acidic level pH of water samples. In a comparison of plant-based coagulants, the value of pH is reduced by 10% using mucilage gum and the value of pH is reduced by 17% by using coagulant of *T. Indica* seeds. So, these results suggested if we increase the quantity of plant-based coagulants to treat the pH of textile industrial wastewater then it will help to reduced

more value of pH. After the treatment, the wastewater is less harmful to marine life and the ecosystem.

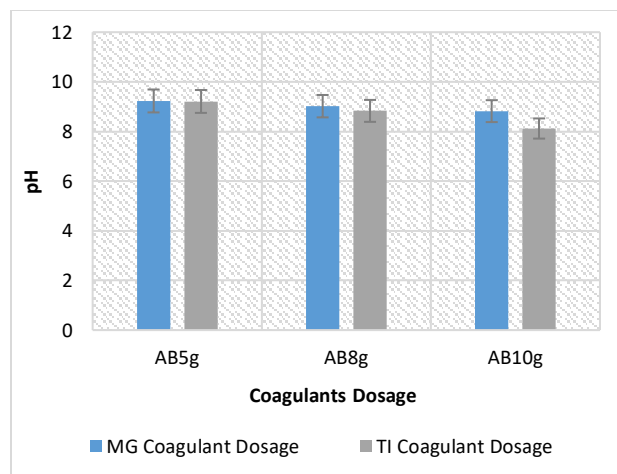


Fig 1: Comparison of Both Coagulants against pH

Fig 1 shows the effect of varying coagulant dosages on the pH of textile industrial wastewater. For sample S1 the initial value of pH is 9.43 and after the usage of natural coagulants, the Minimum PH value at A1 is 9.23 and the highest reduction in PH value at B3 is 8.12. For a better treatment process, it is very important to determine the optimum amount of coagulant and it also helps to reduce the cost of dosage and reduce the Residue. According to the comparison between these two components if we increase the amount of coagulant up to 10g, increase the process of reduction of pH from wastewater. The pH of wastewater can be neutral if increase the amount of natural coagulant. It is very clear and present in the previous examinations that pH is one of the primary boundaries to get to the water quality albeit the World Health Organization has not recommended such a specific firm cutoff points viewing the pH of water as there is no genuine human wellbeing infirmity related with water pH anyway.

The pH of water assumes a significant place in its therapy as this is the fundamental factor to be considered in the purification of water if the pH of the

water is more soluble like 8.5, at that point it will influence the viability of the cleaning cycle and if the pH of water is more acidic 6 or 6.5, at that point, it will ruin the texture and taste of water subsequently as far as possible referenced in the NEQS for the pH of water is between 6.5-8.5. The pH estimation of the two coagulants without radiations with various dose are well inside the NEQS alluring cutoff. It is clear and detailed by the previous examinations that pH is one of the primary boundaries to get to the water quality. As the dose increase, the pH estimation of the MG declines the same is the situation with T.I in regards to the proposed NEQS. It is obvious and announced by the previous examinations that pH is one of the primary boundaries to get to the water quality is incredibly affected by these regular coagulants. As the dose increment, the pH esteem by utilizing normal coagulants MG and T.I decline from 9.21 to 8.12. The properties of the two coagulants portray that in the wake of utilizing theories coagulant subsequently, the pH of water moves towards a less acidic nature (Nordstro, 2002).

4.2 Improvement in Dissolved oxygen

Graph 2 shows the DO (Dissolved Oxygen) comparison among both coagulants plotted against the DO at the y-axis and treated mucilage gum and *T. indica* seeds coagulant samples at x-axis by using DO meter. The standard value of DO of water given by NEQS is between 6.5-8 mg/L. The collected sample's initial/ untreated value of DO collected from the end of the dyeing process was minimum is 0.3 mg/L and from the final discharge, the point was highest is 0.5mg/l. In the case of Mucilage gum of *Ocimum basilicum* coagulant sample, the minimum value at A5g which was collected from the end of printing process point is 1.6mg/L and the highest value at A10g

which was collected from the finishing discharge point is 3.9mg/l. On the other hand, in the case of the *T. Indica* seed coagulant sample, the minimum value at B5g which was collected from the end of printing process point is 1.8mg/L and the highest value at B10g which was collected from the final discharge point is 3.5mg/l. So, it means that both natural coagulants help to improve the dissolved oxygen level of wastewater samples. In a comparison of plant-based coagulants, the value of DO is improved by 48% using mucilage gum and the value of DO is improved by 43% by using coagulant of *T. Indica* seeds.

So, these results suggested if we increase the quantity of plant-based coagulants for the treatment of textile industrial wastewater then it will help to improve the level of DO. After the treatment, the wastewater DO level s improved and is more suitable for marine life and the eco-system.

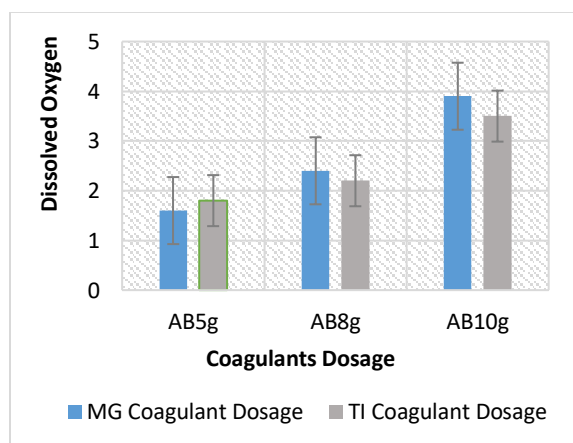


Fig 2: DO Comparison among both coagulant

Fig 2 shows the effect of varying coagulant dosages on the DO level of textile industrial wastewater. For sample S1 the initial value of DO is 0.3mg/L and after the usage of natural coagulants, the improvement in DO value at A1 is 1.6mg/L and the DO value at B1 is 1.8mg/l. For a better treatment process, it is very important to determine the optimum amount of coagulant and it also helps to reduce the cost of dosage and reduce the Residue. According to the

comparison between these two components if we increase the amount of coagulant up to 10g, helps to improve the DO level in wastewater. The standard value of DO can be achieved if we increase the amount of natural coagulant. If the dissolved oxygen content in water is low then the environment is not suitable for all living species. That's why it is important to treat the wastewater before releasing it into the environment. If the dissolved oxygen level decreases it will cause the death of all the Marine ecosystems.

The mean DO estimations of two normal coagulants with various measurements are mentioned in table 2. The advantageous incentive for DO is for the most part relies upon the temperature of the water. Even though it is obvious that the DO estimations of the two coagulants with various measurements are well as it goes about as a marker for the control of contamination. The water test treated utilizing Mucilage gum shows the DO esteem ranges structure 1.6 to 3.9 mg/L and with *T. indica* DO esteem ranges from 1.8 to 3.5 mg/l.

4.3 Reduction in Electrical Conductivity

Fig 3 shows the EC comparison of both coagulants plotted against the EC at the y-axis and treated mucilage gum and *T. indica* seed coagulants at the x-axis by using an EC meter. The standard value of EC of deionized water given by NEQS is between 200 - 800 $\mu\text{S}/\text{cm}$. The collected sample's initial/untreated value of EC collected from the end of the dyeing process was minimum is 992 $\mu\text{S}/\text{cm}$ and from the finishing discharge point of wastewater was highest is 1051 $\mu\text{S}/\text{cm}$.

In the case of mucilage gum of *Ocimum basilicum* coagulant sample, graph 3 showed the maximum EC at A5g which is 868 $\mu\text{S}/\text{cm}$, and minimum EC at A10g which is 590 $\mu\text{S}/\text{cm}$. And in the case of *T. Indica* coagulant samples, the graph showed

the minimum EC at B10g which is $696\mu\text{S}/\text{cm}$, and maximum EC at B5g which is $820\mu\text{S}/\text{cm}$. In the case of the comparison between both coagulants, the minimum EC at AB10g which is $686\mu\text{S}/\text{cm}$, and maximum EC at AB5g which is $854\mu\text{S}/\text{cm}$. So, it means that both natural coagulants help to reduce the EC level of water samples. In a comparison of plant-based coagulants, the value of EC is reduced by 56% using mucilage gum and the value of EC is reduced by 45% by using coagulant of *T. Indica* seeds. So, these results suggested if we increase the quantity of plant-based coagulants to treat the high EC of textile industrial wastewater then it will help to reduced more value of EC. After the treatment, the wastewater is less harmful to marine life and the ecosystem.

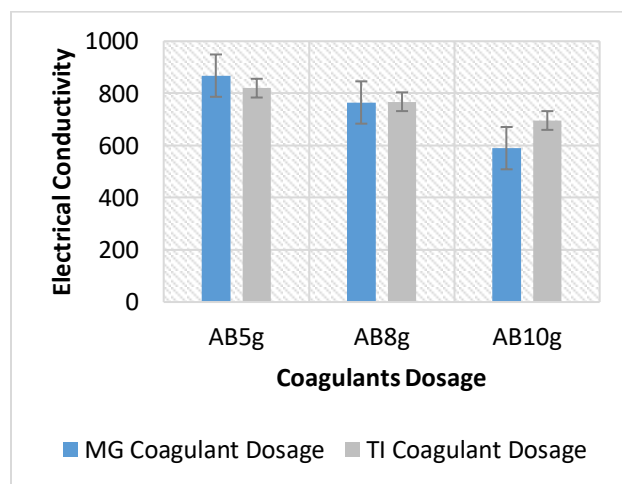


Fig 3: EC comparison among both coagulants

Fig 3 shows the effect of varying coagulant dosages on the EC level of textile industrial wastewater. The conductivity of water treated by control mucilage gum extended from 868 to $590\mu\text{S}/\text{m}$ at various doses while the estimation of conductivity water treated by control *T. Indica* went from 820 to $696\mu\text{S}/\text{m}$ at various dose separately. Electrical conductivity (EC) is the corresponding electrical resistivity. It speaks to a material's capacity to convey

electric flow. The SI unit of electrical conductivity is Siemens per meter (S/m). The proportion of particles that are broken down in the water is known as conductivity.

4.4 Reduction in Total Dissolved Solids

Fig 4 shows the TDS comparison of both coagulants plotted against the TDS at the y-axis and treated mucilage gum and *T. indica* seed coagulants at the x-axis by using the TDS meter. The standard value of TDS in water given by NEQS is 300 mg/L. The collected sample's initial/ untreated value of TDS collected from the end of the printing process was minimum is 698 mg/L and from the final discharge point of wastewater was highest is 724 mg/L. In the case of Mucilage gum of *Ocimum basilicum* coagulant sample, the maximum value at A5g which was collected from the end of the printing process added 5g of natural coagulant is 490mg/L and minimum value at A10g which was collected from the final discharge point, added 10g of natural coagulant in wastewater sample is 335mg/L. On the other hand, in the case of *T. Indica* seed coagulant sample, the maximum value at B5g which was collected from the end of printing process point added 5 g of natural coagulant is 520 mg/L and minimum value at B10g which was collected from the final discharge point, added 10 g of natural coagulant in wastewater is 432 mg/L. So, it means that both natural coagulants help to reduce the TDS of wastewater samples.

In a comparison of plant-based coagulants, the value of TDS is reduced by 51% using mucilage gum and the value of TDS is reduced by 48% by using coagulant of *T. Indica* seeds. So, these results suggested if we increase the quantity of plant-based coagulants to treat the high amount of TDS from textile industrial wastewater then it will help to

reduced more value of TDS. After the treatment, the wastewater is less harmful to marine life and the ecosystem.

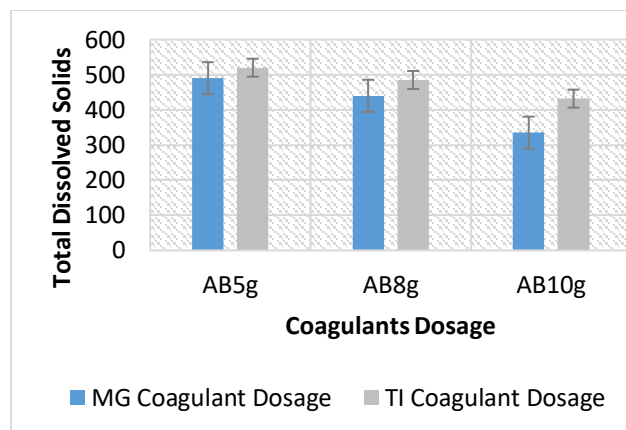


Fig 4: Comparison among both coagulants on TDS

Fig 4 shows the effect of varying coagulant dosages on the TDS level of textile industrial wastewater. The TDS of wastewater treated by control usage of mucilage gum reduced from 490 to 335mg/L at various doses while the estimation of TDS of wastewater treated by control *T. Indica* went from 520 to 432 mg/L at various dose separately. For a better treatment process, it is very important to determine the optimum amount of coagulant and it also helps to reduce the cost of dosage and reduce the Residue. According to the comparison between these two components if we increase the amount of coagulant up to 10g, helps to reduce the TDS level in wastewater. The standard value of TDS can be achieved if we increase the amount of natural coagulant. The mean TDS estimations of two normal coagulants at various measurements are obvious from the above figure 4. The endorsed furthest reaches of TDS given in NEQS are 300mg/L while regarding TDS present in the water there are no sure rules given by NEQS. In textile wastewater discharge, TDS is the main factor to be considered for treatment. Because there is heavy use

of salts during textile processes, which cause the increase in TDS of wastewater (Halder, 2011).

4.5 Improvement in Chemical Oxygen Demand

Fig 5 shows the COD comparison of both coagulants plotted against the COD at the y-axis and treated mucilage gum and *T. indica* seed coagulants at the x-axis by using a COD meter with a standard wavelength. The standard value of COD of water given by NEQS is between 120 mg/L. The collected sample's initial/ untreated value of COD collected from the end of the printing process was minimum is 0.6mg/L and from the finishing discharge point of wastewater was highest is 0.8 mg/L.

In the case of Mucilage gum of *Ocimum basilicum* coagulant sample, the minimum value at A5g which was collected from the end of printing process point is 2.75 mg/L and the highest value at A10g which was collected from the finishing discharge point of wastewater is 4.75 mg/L. On the other hand, in the case of the *T. Indica* seed coagulant sample, the minimum value at B5g which was collected from the finishing of printing process point is 2.98 mg/L and the highest value at B10g which was collected from the final discharge point of wastewater is 4.10mg/L. So, it means that both natural coagulants help to improve the COD of water samples.

In a comparison of plant-based coagulants, the value of COD is improved by 4.98% using mucilage gum and the value of COD is improved by 3.45% by using a coagulant of *T. Indica* seeds. So, these results suggested if we increase the quantity of plant-based coagulants to treat the COD of textile industrial wastewater then it will help to improve more value of COD. After the treatment, the wastewater is less harmful to marine life and the ecosystem because if the COD level is higher in water it means that the

oxidized organic material is greater in the water sample, which affects the DO level in the water. Dissolved oxygen level reduced because of the higher number of COD in water and it causes anaerobic conditions, which leads harmful for the aquatic life.

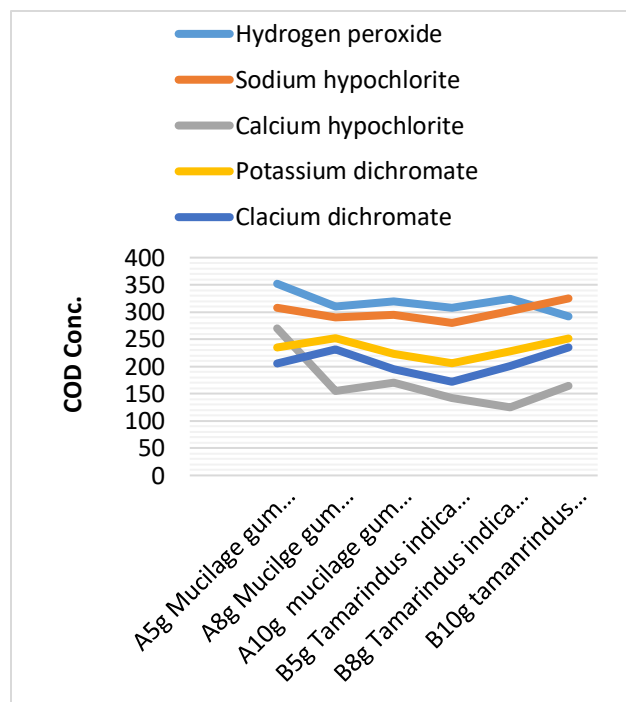


Fig 5: COD Comparison between both Treated samples

The chemical oxygen demand (COD) test just requires 2-3 hours. It gauges every single natural contaminant, including those that are not biodegradable. COD test outcomes would then be able to be utilized to gauge the BOD of a given example. Thus, the COD test can be utilized to quantify the quality of squanders that are excessively harmful to the BOD test. Some natural atoms (e.g., benzene, pyridine) are moderately impervious to dichromate oxidation and may give an erroneously low COD.

Fig 5 shows the effect of varying coagulant dosages on the COD level of textile industrial wastewater. The COD of wastewater treated by

control usage of mucilage gum improved 0.8 – 4.75 mg/L at various doses while the estimation of COD of wastewater treated by control *T. Indica* went from 0.8 – 4.10 m/l at various dose separately. For a better treatment process, it is very important to determine the optimum amount of coagulant and it also helps to reduce the cost of dosage and reduce the Residue. According to the comparison between these two components if we increase the amount of coagulant up to 10g, helps to improve the COD level in wastewater. The standard value of COD can be achieved if we increase the amount of natural coagulant. COD of the untreated wastewater from the material business appeared in graph 4. The COD estimation of material wastewater was 400mg/l. significantly, the oxidizing specialist included should respond totally with the natural matter.

4.6 Pollutants removal from wastewater

Fig 6 shows the treated pollutants comparison among both coagulants plotted against AAS at the y-axis and treated mucilage gum and *T. Indica* seeds coagulant samples at the x-axis by using AAS (Atomic Absorption Spectroscopy). The permissible limit of lead in wastewater given by WHO (World Health Organization) is 0.05 mg/L, Zinc is 1mg/l, nickel is in between 0.02 mg/l, Chromium is 0.1 mg/l. The collected samples initial/ untreated value of Lead is 1.6mg/l, Zinc is 1.67mg/l, nickel is 1.1mg/L and for chromium is 0.96mg/l.

In the case of mucilage gum of *Ocimum basilicum* coagulant sample, the minimum pollutants value at chromium A10g which is 0.02ppm, and maximum pollutants value at zinc A10g which is 1.78ppm. And in the case of *T. Indica* coagulant samples, the graph showed the minimum pollutants value at chromium B8g which is 0.02ppm, and maximum pollutants value at zinc B8g which is

1.85ppm. In the case of the comparison between both coagulants, the minimum pollutants value at chromium B8g which is 0.02ppm, and maximum pollutants value at zinc B8g which is 1.85ppm. So, it means that both natural coagulants help to reduce the heavy metals concentration in water samples.

In a comparison of plant-based coagulants the value of Lead is reduced by 23%, zinc is reduced by 34.5%, chromium is 26%, and nickel is 15.4% using mucilage gum and the value of a lead is reduced by 17%, zinc is 18.8%, chromium is 11.5%, and nickel is 22%. By using coagulant of *T. Indica* seeds. So, these results suggested if we increase the quantity of plant-based coagulants to reduce the heavy pollutants concentration level from textile industrial wastewater then it will help to reduced more value of heavy pollutants. After the treatment, the wastewater is less harmful to marine life and the ecosystem.

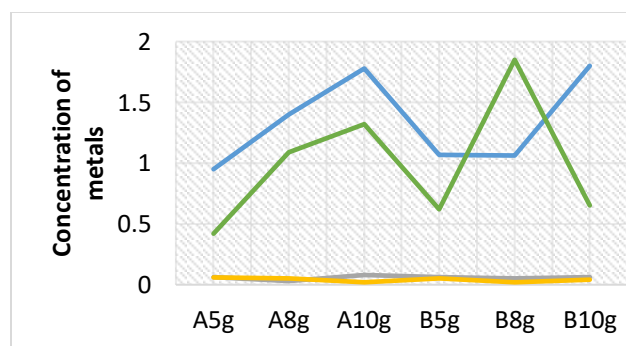


Fig 6: Heavy metals/ pollutants Comparison between both coagulants

Descriptive measurements of the information including wastewater boundaries of four metal focuses have appeared in the above graph. The convergence of four substantial metals or toxins (Pb, Zn, Cr, and Ni) in tests treated with common coagulants of mucilage gum and *T. Indica* were examined by utilizing AAS. The underlying grouping of Zn was 1.67 mg/l. The decrease of a conclusive grouping of zinc was seen after treatment with MG coagulant included with

various measurements. The convergence of Zn after the MG the extravagant treatment was 0.95 mg/l. The underlying grouping of Ni was 1.1 mg/l. The decrease last centralization of Ni was seen after the treatment with MG coagulant included with various dosages. The convergence of Ni after the MG treatment was 0.03 mg/l. The underlying centralization of Pb was 1.56 mg/l. Furthermore, the decrease of a definite grouping of Pb was seen after the treatment with MG coagulant included with various causes, and the centralization of Pb after the coagulant was 0.42 mg/l. The underlying convergence of Cr was 0.96 mg/l. The decrease of definite convergence of Cr was seen after treatment with MG coagulant included with various doses. The grouping of Crafter the MG coagulant treatment was 0.02 mg/L(Ahmad, et.al 2002).

The underlying centralization of Zn was 1.67 mg/L. The decrease of definite centralization of zinc was seen after treatment with TI coagulant included with various measurements. The convergence of Zn after the TI coagulant treatment was 1.06 mg/l. The underlying convergence of Ni was 1.1 mg/l. The decrease of conclusive convergence of Ni was seen after the treatment with TI coagulant included with various dosages. The grouping of Ni after the TI treatment was 0.05 mg/l. The underlying grouping of Pb was 1.56 mg/l. What's more, the decrease of a definite grouping of Pb was seen after the treatment with TI coagulant included with various measurements, and the convergence of Pb after the coagulant was 0.62 mg/l. The underlying centralization of Cr was 0.96 mg/l. The decrease of a conclusive grouping of Cr was seen after treatment with TI coagulant included with various measurements. The centralization of Cr after the TI coagulant treatment was 0.02 mg/L.

Table -02 Physical parameters of treated textile wastewater sample by using *Ocimum basilicum* Mucilage-G and *Tamarindus Indica* seed powder

	Mucilage-Gum Sample			<i>Tamarindus Indica</i> Sample		
Parameters	A5g	A8g	A10g	B5g	B8g	B10g
pH	9.23	9.02	8.82	9.21	8.83	8.12
TDS (mg/L)	490	440	335	520	485	432
EC (mS/cm)	868	765	590	820	768	696
DO (mg/L)	1.6	2.4	3.9	1.8	2.2	3.5
COD	2.75	3.40	4.75	2.98	3.45	4.10
Zinc (mg/L)	0.95	1.4	1.31	1.07	1.06	1.2
Nickel (mg/L)	0.06	0.03	0.08	0.06	0.05	0.06
Lead (mg/L)	0.42	1.09	1.02	0.62	0.80	0.65
Chromium(mg/L)	0.06	0.05	0.02	0.04	0.02	0.04

Conclusion

Present research study concluded that both natural coagulants that are *Ocimum basilicum* (Sweet basil seeds) & *Tamarindus indica* are effective in removal of heavy metals from wastewater. The mucilage gum extracted from *Ocimum basilicum* and *Tamarindus indica* seed powder were used as natural coagulants which shows maximum removal efficacy of major pollutants from the textile industrial wastewater. *Ocimum basilicum* and *Tamarindus indica* has been found to be a highly effective coagulant agent for the treatment of

textile wastewater. Small amount of coagulant has the ability to reduce the concentration of heavy metals. The *O. basilicum* mucilage can be used in treating textile wastewater as a sole coagulant with high efficiency. The obtained results indicate that *O. basilicum* and *Tamarindus indica* has a promising potential to be used as an inexpensive bio-based coagulant for the treatment of industrial wastewaters.

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Conflict of interest

The authors declare no conflict of interest.

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