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Waste Water Treatment Using Banana Stem Extract From Textile Industries

Anupriya J*, Naufal Rizwan P S, Jansi Sheela S, Muthu Prema K , Chella Gifta C
Department of Civil Engineering, National Engineering College, K.R.Nagar, Kovilpatti
Corresponding Author: J Anupriya, Assistant Professor, Department of Civil Engineering, National Engineering, College, Kovilpatti

Abstract

The Textile Industry has grown up to great heights due to the population growth and modernization in urban culture etc.. To produce 1 kg of textile we have spent around 200-500 Liters of water. This is one of the main reasons for water scarcity across the world. The water utilized for the production of the textiles are not even suitable for irrigation standards also. The main aim of this paper is to analyze the different characteristics of water by adding banana stem extract with the waste water collected from the textile industry in to the natural stream in and around the southern parts of Tamil Nadu. In the preliminary study Virudhunagar and Thoothukudi district have been selected and the waste water has been collected from the textile industries. The Possible methodologies to covert the wastes in to irrigation standards are described in this paper and the applications of banana stem extract has also been discussed

Keywords: Natural Adsorbent, Banana Stem Extract, Low cost adsorbent

INTRODUCTION

The population of India is reached above 100 Cr. now a days. Food cloth and shelter are the basic needs for a human. So that the development of textile Industries. As per the statistics every district in India has minimum of 10 Textile industries (Approximately). The production of textile requires a lot of fresh water that has to be used for irrigation purposes. A small scale textile industry uses 250 litres of water to produce one kilogram of textile. The waste water coming from the industries are simply doesn't have any characteristics that has to be used for the irrigation standards. The Waste water coming out from the industry has large amount of Total Suspended solids, Hardness and other chemical parameters. This leads to the water is unsuitable for even irrigation standards. The waste created due to the dye from the textile industry leads not only high in Biological Oxygen Demand but also high in chemical

oxygen demand. Due to the growth of textile industry, large amount of waste water contains the wastes coming from the dye industry creates different kinds of diseases to the Humans. This is the main reason to treat the waste water. However the treatment of waste water creates high cost due to the resource availability. This can be reduced by using natural adsorbents which are also known as low cost adsorbents.

Adsorption was found to a best alternative method for treatment of waste water that has coming out from the dying Industry [1]. The adsorbents used from the wastes collected from the saw industry was found to be a better treatment method reported by Nitin[2].The usage of the natural coagulants that has collected from the plants give better results while treating the waste water using the plant extracts as adsorbent as reported by G. Vijayaraghavan[3].

The main objective of this paper is to remove the suspended solids, Hardness, turbidity and the colour from the waste water collected from textile Industries in virudhunagar and Tuticorin Disrtict by using banana stem extract.

EXPERIMENTAL PROGRAM

Different kinds of treatment methodologies are available among that the coagulation has been taken for the initial study. The study area selected has been given in Figure1.

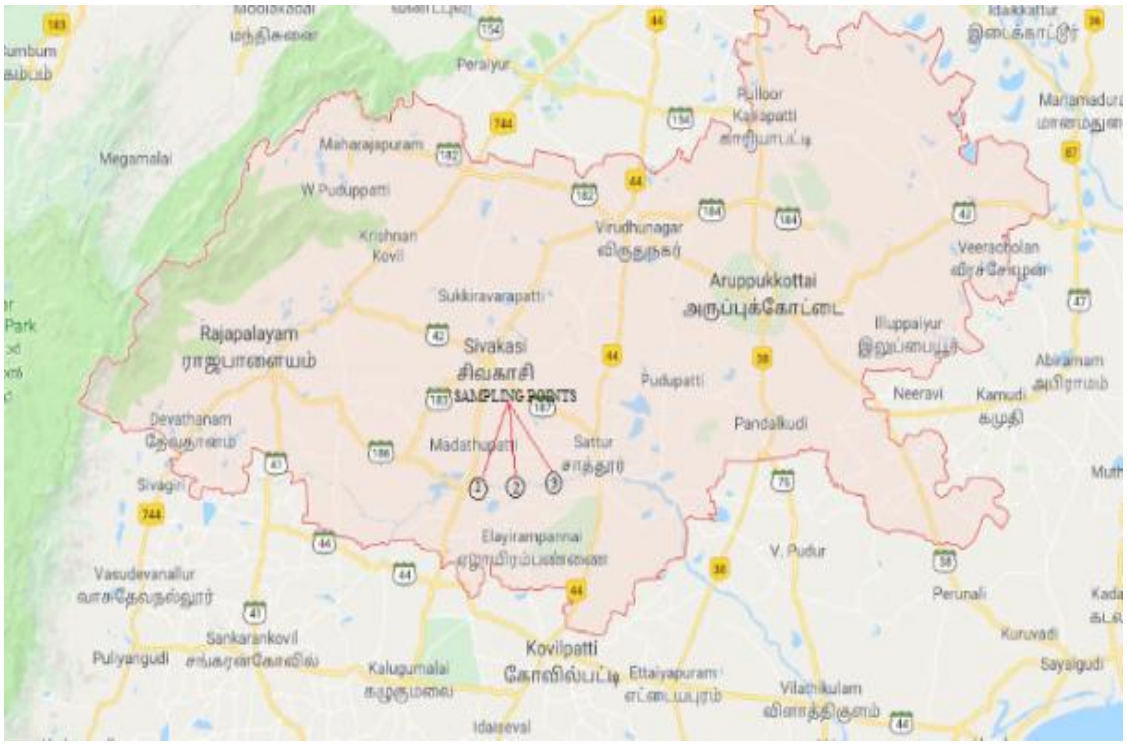

Figure 1: Virudhunagr District Map with sampling points

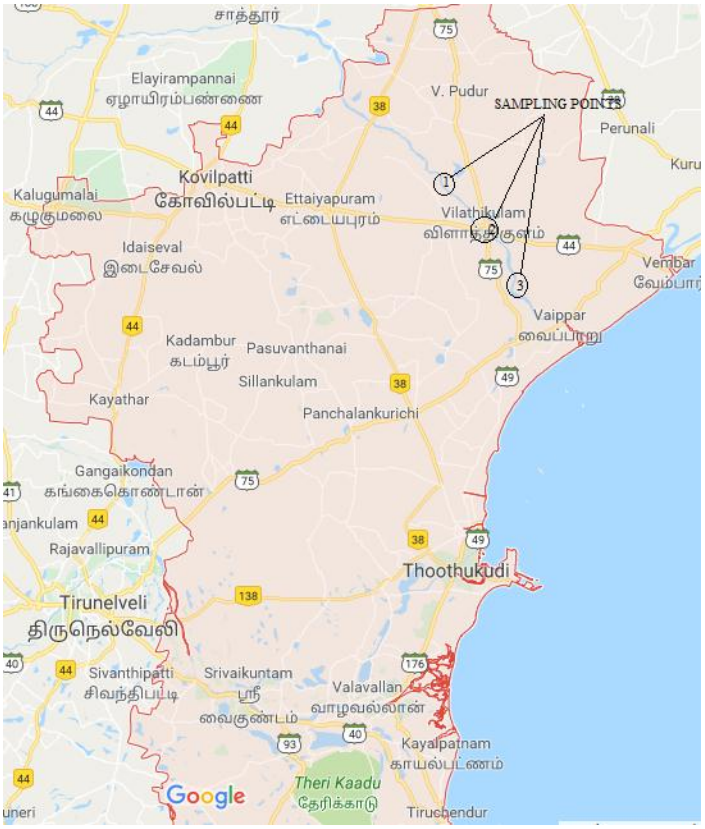

Figure 2. Tuticorin District Map with sampling points

From figure 1 we came to know that there are 15 textile industries present in the study area and the waste waters are collected from different positions in order to observe the initial characteristics of waster. There are three sampling points has been created the first sampling point has been selected at the very close the point of disposition of the textile industry. The second point has been chosen 4 km after the disposal of the waste water and third point has been chosen after 8 km from the disposal of waste water. The banana stem and the banana stem extracts have been shown in Figure 3.

Figure 3: Banana stem and banana stem Extract

Matured banana plants were collected. The thorns were removed and the pith of the stem was then separated from the foliage. 100 g of small pieces of the pith were mixed with 10mL of distilled water using a mixer. The mixed pith was then filtered and the juice was collected. The fresh juice of banana stem was stored in a refrigerator at 7ºC to ensure its freshness. To avoid any fermentation, the coagulation experiments using this banana stem juice as a natural coagulant were carried out on the same day.

Coagulation Jar test has been carried out to find the optimal mix for a litre of waste water this has been carried out for the samples by adding 100 ml per litre to 150 ml per litre and the testing of the samples as shown in figure 4.

Figure 4: Coagulation Jar Test

After the results obtained from the Coagulation jar test the tests to find the solids has been carried out. The hardness tests also has been carried out. The testing of the samples is shown in Figure 5.

Figure 5: Hardness test setup

RESULTS AND DISCUSSION

The waste water is collected at three sampling points for two industries in each district. The initial characteristics of waste water as shown in Table 1.

Table 1 Initial characteristics of waste water

Parameters	Values			
	I1	**I2**	**I3**	**I4**
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

The table 1 shows the different characteristics of wastes that has been analyzed in sampling point 1. The I1 I2 are the two industries identified in Thoothukudi District and I3 and I4 are the two Industries identified in Virudhunagar District. The suspended solids value is very high from the test results. The comparison with the Indian standards are given in Figure 6.

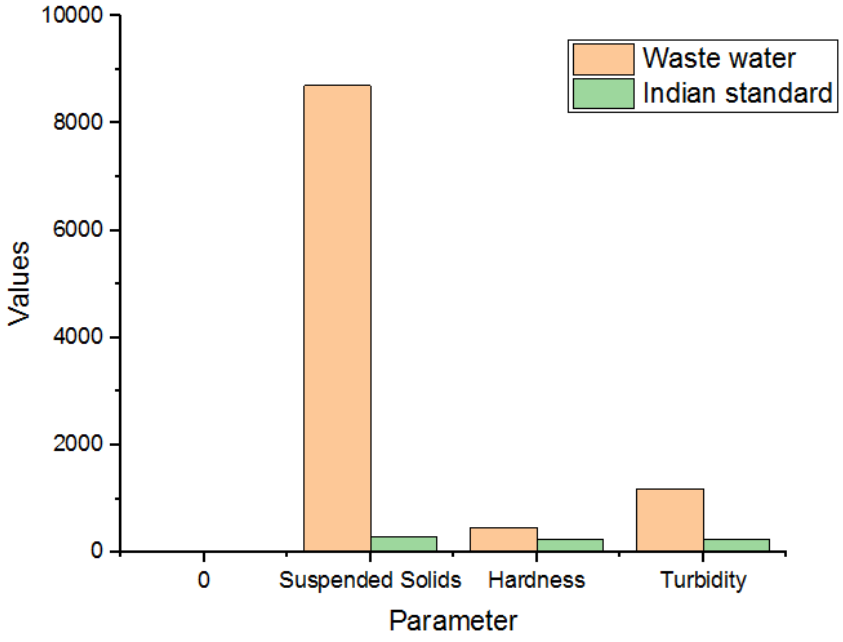

Figure 6: Comparison with Indian standards

From the figure 6 it is revealed that the suspended solids, Hardness and turbidity values are very high in the stream that has been located very near to the industries. The variation on the test samples without adding any adsorbent along the distance of 4

km ,8 km are shown in the Figure 7.

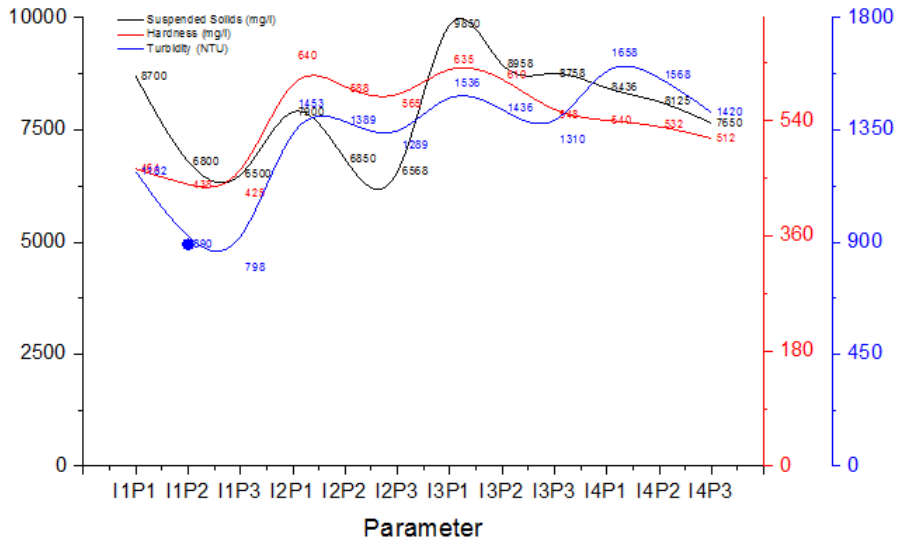

Figure 7: Variation of parameters under Different Samples

From the figure 7 it is revealed that the reduction in the values of suspended solids are very low along the length direction of the stream. This happens not only for suspended solids but also for hardness and turbidity also. The variation across the length indicates once the waste water has very high amount of suspended solids, Hardness and Turbidity the values are remains almost equal for all the Industries. This is one of the main reasons for removing the wastes from the waste water. The causes of this are mainly due to the usage of dyes present in the textile industries which is the main reason for all the parameters that has been given in figure 7. Not only the following parameters if the industrial waste water collected directly from the textile industry the colour of the sample also changed to the colour of the dye that has been used by the industry. Figure 8 shows the initial colour that has collected directly from the textile industry as shown.

Figure 8: Intensity of dye colour in waste water sample

From the figure 8 it is clearly indicates the colour intensity of the dyes that has been present in the waste water coming out from the industry.

From the Coagulation jar test results as shown in figure 9. From the results it is noted that 140 ml of prepared banana stem extract is most suitable for the formation of flocs. It is clearly observed from the figure9.

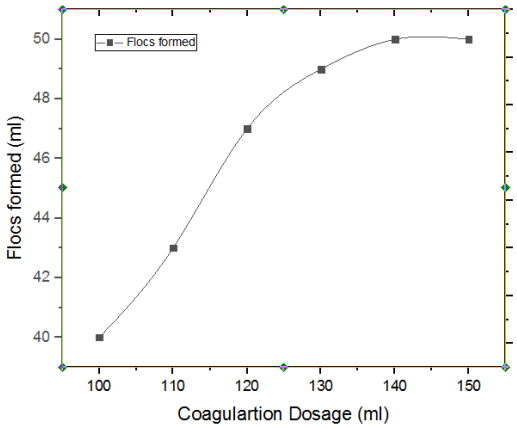

Figure 9: Jar Test Results

The removal of suspended solids also high when 140 ml of ban stem extract is added to the 500 ml of waste water. The removal of suspended solids is shown from Figure 10.

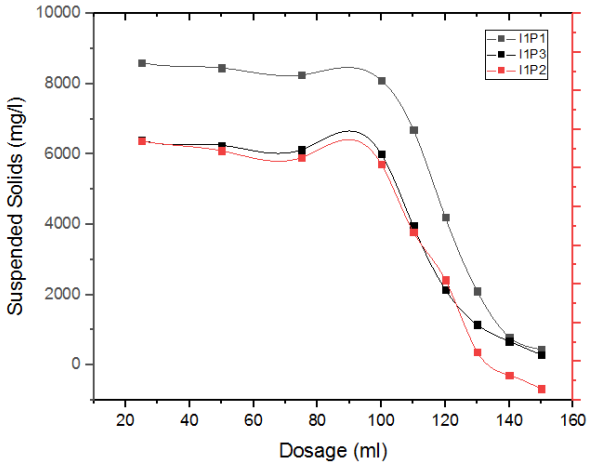

Figure 10: Removal of SS from Industry 1

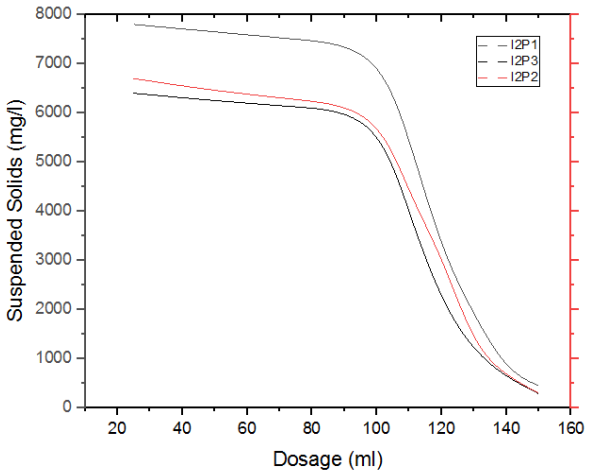

Figure 11: Removal of SS from Industry 2

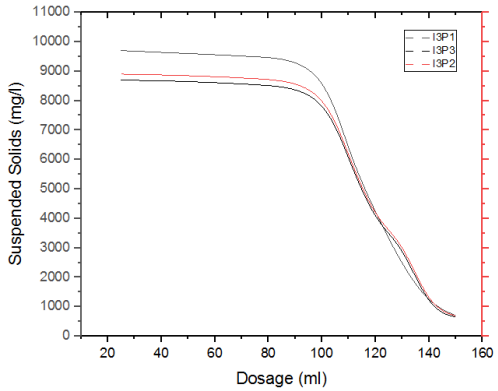

Figure 12: Removal of SS from Industry 3

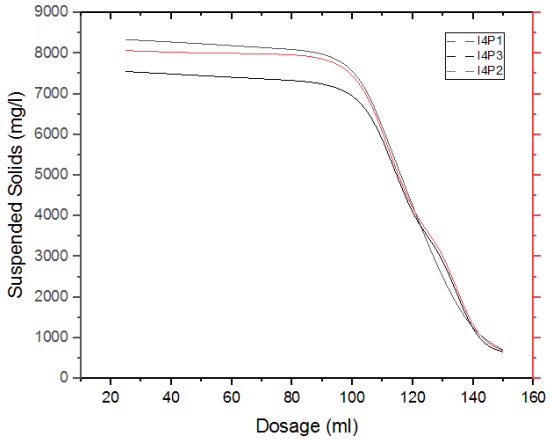

Figure 13: Removal of SS from Industry 4

From the figures as listed figure 10 to figure13 it is noted that there is very steep decrease when the dosage of the banana stem is added more that ¼ of its volume. This is mainly due to the banana stem adsorbs the smaller particles on the surface of the banana stems particles and allows to settle down very quickly the particle size of the SS are found to be very low after the addition of the banana stem extract. The filter paper also removes the bigger particles so that the considerable amount of decrease in the suspended solids. However the banana stem extract removes the suspended solids the suspended solids value lies above 300 mg/l in the waste water collected in sample point 1 it is comparatively higher compared with the irrigation standard purposes. It fails to remove the suspended solids well below the waste water used for the irrigation purposes. The waste water collected very far away that is sample point two and three are lies below the Suspended solids value indicated by the Irrigation standards that can be used for irrigation purposes. The waste water present very near to the point of disposal of The wastes from the industry requires more level of treatment for the removal of suspended solids. The average percentage of removal from the four industries are shown in Figure 14.

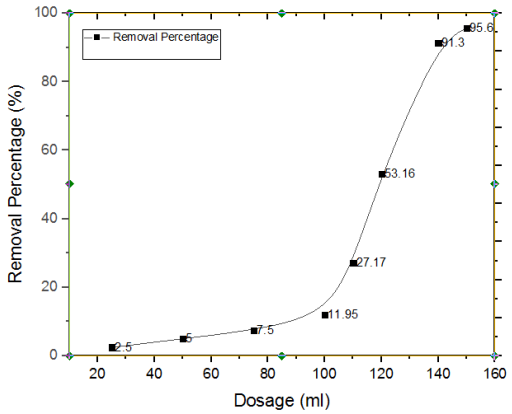

Figure 14: Removal Percentage of SS for different dosage

From Figure 14 it is noted that adding 150 ml of banana stem extract to the waste water of 500 ml removes 95% of suspended solids due to the adsorption capacity of the banana stem extract.

The same way the hardness value also decreases while adding banana stem extracts to the same amount of waste water. The removal of hardness value as shown in Figure 15.

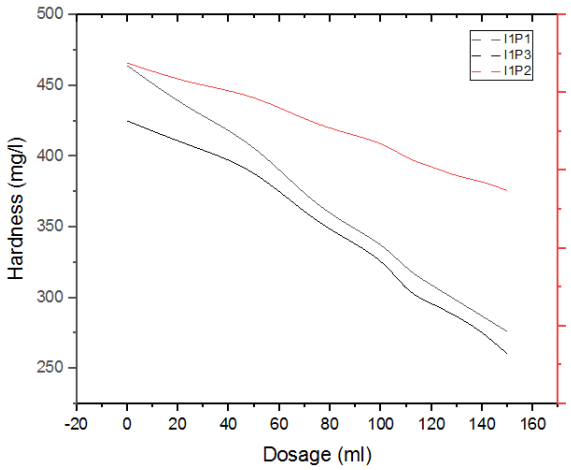

Figure 15: Removal of Hardness from Industry 1

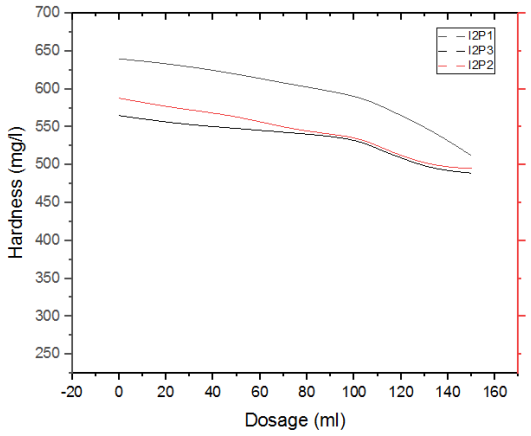

Figure 16: Removal of Hardness from Industry 2

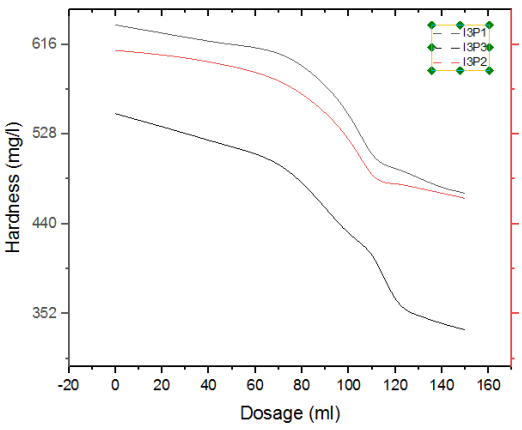

Figure 17: Removal of Hardness from Industry 3

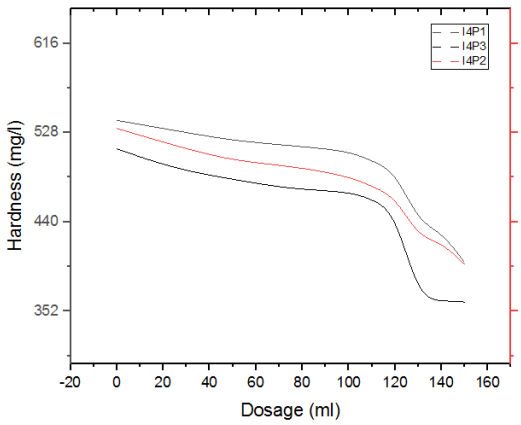

Figure 18: Removal of Hardness from Industry 4

From the Figures 15 to Figure 18 it is revealed that there are subsequent amount of decrease in hardness value due to the increase in dosage of the banana stem extract. The banana stem extract forms the different kind of chemical compound which is not a major participant for presence of hardness. The carbonate and bicarbonates are converted in to some other forms of the chemical compounds. The tests are conducted only on the same day. Within 24 hours, there is a huge amount of reduction in the hardness value. However the hardness value doesn't fall under the range that has been used for the purpose of irrigation purposes. So that further treatment is necessary for the samples collected at sample collection point 1. (very close to the stream located near the industry). The values of hardness taken after a dosage of 100ml will results in huge amount of reduction in hardness value which lies under the limits that has been used for irrigation purposes. The percentage of reduction in hardness values that are described in Figure 19.

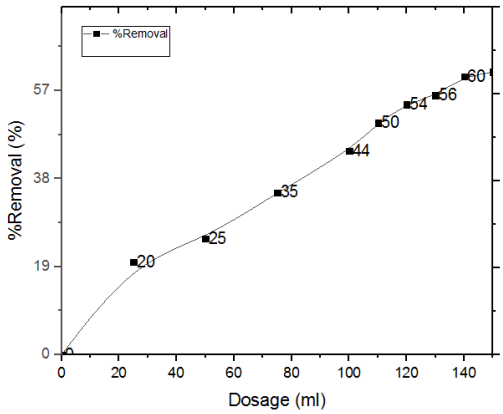

Figure 19: Percentage removal of Hardness

From the Figure 19 it is revealed that the hardness value decreases when 1/4th amount of banana stem extract is added to the waste water. This is mainly due to the conversion of the chemical compounds that are the main cause to create hardness in waste water in to some other forms of simple chemical compounds which are not even detectable with the help of titration methods. The increase in dosage amount also decrease the turbidity values. The decrease in percentage of the turbidity as described in figure 20.

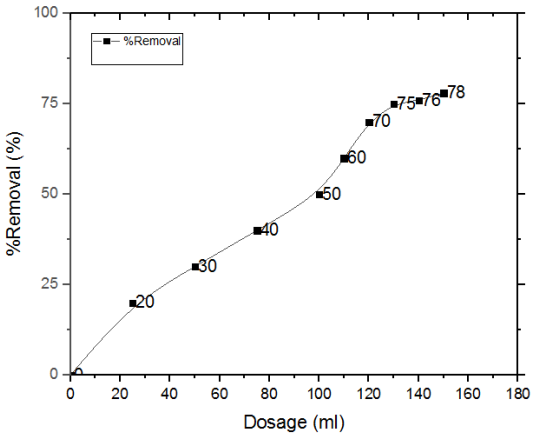

Figure 20: Removal of turbidity values

Figure 20 shows the average removal of turbidity values from the four industries. The main reason for decrease in turbidity is the banana stem extracts adsorb the smaller particles in the waste water is the major cause for the turbidity and allows the particle to settle down. and the turbidity value decreases. In irrigation standards the turbidity is not a dominant factor so that not more emphasis has been given for turbidity. The turbidity is mainly due to the settling of the particles which may result in the colour change. The colour change for the waste water effluents are as shown in figure 20.

Figure 20: Colour Change in Industrial Waste water 1

Figure 21: Change in Colour in Industrial waste water 2

From the corresponding Figures 20 and 21 it is revealed that the addition of the banana stem extract results in the formation of settling particles so that the colour change has been happened.

CONCLUSION

1. From the experimental results it is concluded that the industrial waste water discharged from the textile industry has very high amount of Suspended solids, hardness and turbidity values.
2. The characteristics of waste water are almost similar in a particular stream when textile industrial wastes are discharged into a same stream.
3. When banana stem extract is added to $1/4^{th}$ of the volume of the waste water the amount of suspended solids decreased at a percentage of 96% due to the adsorption capacity of the banana stem extracts.
4. The hardness value of waste water is decreased at a percentage of 66% when banana stem extract is added at a percentage of $1/4^{th}$ of the volume of the waste water
5. The turbidity of the samples also decreased due to the addition of banana stem extract by a percentage of 78% when $1/4^{th}$ volume of banana stem extract that has been added to the waste water.

RECOMMENDATIONS FOR FUTURE WORK

- The banana stem extract removes the suspended solids to a particular amount that has been collected from stream which is located very near to the point of discharge. So that it is recommended that the further treatment process can be used using different Natural adsorbent.

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