Experimental Study on Textile Wastewater Treatment using Moringa Oleifera & Azadiratchta Indica

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Abstract

Textile industries are one of the most potential pollutants to the environment and human health. These industries discharge large volume of waste water which is characterized by high BOD, COD, turbidity, suspended solids, dissolved solids, sulphide, chloride, chromium, animal hairs, epidermic fats and other bio-contaminants. Usually these untreated effluents are treated by the current commercial synthetic coagulant such as ferrous sulphate, aluminium sulphate (alum), poly aluminium chloride which is harmful for livelihood. Natural coagulants are organic based coagulant that can be used in coagulation stage of waste water treatment to reduce turbidity, colour and organic matters. Based on the experimental results, it was concluded that natural coagulants which have been obtained from Moringa oleifera, Azadiratchta indica have shown improved performance of coagulation comparing to commercial alum. The COD and BOD reduction for textile effluent were 68.67 % and 73.33 %. It is also observed that among the two natural coagulants the maximum reduction was observed in Moringa oleifera.

Keywords: Moringa Oleifera, Azadiratchta Indica, COD, BOD, Wastewater

I. INTRODUCTION

Textile industries in India are one of the largest manufacturing sectors in the country. These industries are considered as highly polluting industries due to improper treatment of wastewater. In wastewater treatment, coagulation has been practiced since earliest times. Generally coagulant is a chemical which is added to the water to remove the colloidal impurities and other bio-contaminants. Aluminium and iron coagulants are commonly used in most industries. Hence nowadays, there has been a great attention in the improvement and implementation of natural coagulants in wastewater treatment. Natural coagulants are organic based coagulant that can be used in coagulation stage of wastewater treatment to reduce turbidity, colour and organic matters. Natural coagulants are harmless and more economical. These natural coagulants can be formed or extracted from plants, microorganisms and also plants.

II. MATERIALS & METHODS

A. Natural Coagulants

The natural materials of plant origin to clarify turbidity of treated water are not a new idea. Sanskrit writing in India dating from several centuries BC makes reference to seeds of the tree S. potatorum as a clarifier. Peruvian text from 16^{th} and 17^{th} centuries detailed the use of powder roasted grains of Zea Mays as a means of settling impurities. More recently, Chilean folkore texts from the 19^{th} century refer to the water clarification using the sap from Tuna cactus (Opentiafiscus indica). However, of all the plant materials that has been investigated over the years, the seeds from Moringa Oleifera and Neem have been shown to be most effective primary coagulant for textile effluent treatment.

B. Moringa Oleifera

Moringa oleifera is the thirteenth species of the genus Moringacae. Moringa was highly valued in the ancient world. Moringa Oleifera seeds are used as a primary coagulant in drinking water clarification & waste water treatment due to the presence of a water- soluble cationic coagulant protein which are able to reduce turbidity of treated water. Seeds are powdered and added to the water straight or after preparing crude extract. The seed kernel contains significant quantities of series of low molecular weight and soluble protein which carry positive charge to solution. The protein is considered to act similarly to synthetic and positively charged polymer coagulant.

Common Names of Moringa oleifera: Benzolive, Drumstick tree, Kelor, Marango, Mlonge, Saijhaand Sajna Mulangay. (Powder of Moringa oleifera is given in Figure 1)

Fig. 1: MO Powder

C. Azadirachta Indica

The Azadirachta indica (neem tree) is available in tropical South East Asia. It is fast growing, can survive in drought and poor soil and keeps its leaves all year around. It is a tall tree, up to 30 meters high, with leafy spreading branches. Neem trees can be grown in areas which have 400 mm and 1500mm of rain each year. It performs best at an attitude of less than 1500 meters. Neem trees will survive very hot temperatures, up to 44°C and as low as 4°C

Common Name of Azadirachta indica: Nim, Intaran, Margousier, Betain, Agas, Nimba. ((Powder of neem is given in Figure 2)

Fig. 2: Neem Powder

D. Collection of Samples

The samples were collected from Textile industry in Erode before subjecting it into wastewater treatment plant.

E. Analysis of Samples

The wastewaters that were collected in the field were transported to laboratory. Then these samples were analyzed to study the physio- chemical characteristics using appropriate experiments such as pH, turbidity, Total solids, Chlorides, dissolved oxygen, BOD and COD in laboratory.

III. RESULT & DISCUSSION

A. Characteristics of Textile Effluent

Table – 1
Characteristics of Textile Effluent before Treatment (in mg/l)

S.NO	*PARAMETERS*	*D/B SAMPLE*
1	*pH*	*10.17*
2	*TDS*	*6235 mg/l*

3	*TOTAL HARDNESS*	*250 mg/l*
4	*BOD*	*810 mg/l*
5	*COD*	*2430 mg/l*
6	*CHLORIDE*	*80.5 mg/l*
7	*TSS*	*2450 mg/l*
8	*TOTAL SOLIDS*	*8685 mg/l*
9	*TURBIDITY*	*87.1 NTU*

The textile effluent has the parameter values which are shown in Table no 1 to 3. The effluent are treated with natural coagulants at various dosages are also shown in Table no 1 to 3.

Table – 2
Characteristics of Textile Effluent after Treatment for 6 ml

S.NO	*PARAMETERS*	*D/B SAMPLE*	
		MO Powder	*Neem powder*
1	*pH*	*8.81*	*8.87*
2	*TDS*	*2150 mg/l*	*2215 mg/l*
3	*TOTAL HARDNESS*	*148 mg/l*	*200 mg/l*
4	*BOD*	*320 mg/l*	*410 mg/l*
5	*COD*	*1005 mg/l*	*1285 mg/l*
6	*CHLORIDE*	*65.4 mg/l*	*71.9 mg/l*
7	*TSS*	*1015 mg/l*	*1212 mg/l*
8	*TOTAL SOLIDS*	*3165 mg/l*	*3727 mg/l*
9	*TURBIDITY*	*52.2 NTU*	*58.1 NTU*

Table – 3
Characteristics of Textile Effluent after Treatment for 8 ml

S.NO	*PARAMETERS*	*D/B SAMPLE*	
		MO Powder	*Neem powder*
1	*pH*	*5.5*	*6.16*
2	*TDS*	*1855 mg/l*	*2030 mg/l*
3	*TOTAL HARDNESS*	*180 mg/l*	*7165 mg/l*
4	*BOD*	*112 mg/l*	*275 mg/l*
5	*COD*	*521 mg/l*	*765 mg/l*
6	*CHLORIDE*	*42.3 mg/l*	*59.8 mg/l*
7	*TSS*	*520 mg/l*	*810 mg/l*
8	*TOTAL SOLIDS*	*2635 mg/l*	*2940 mg/l*
9	*TURBIDITY*	*31.7 NTU*	*45.8 NTU*

B. Percentage of Removal of Samples in Textile Effluent

The percentage of removal of parameters which includes pH, total solids, total hardness, COD, BOD, turbidity in textile wastewater is shown in Table no 4 & 5.

Table – 4
Characteristics of Textile Effluent for 6 ml (in %)

S.NO	*PARAMETERS*	*% OF REMOVAL*	
		MO Powder (in %)	*Neem Powder (in %)*
1	*TDS*	*65.51*	*64.44*
2	*BOD*	*60.49*	*49.33*
3	*COD*	*58.54*	*47.1*
4	*TSS*	*58.57*	*50.59*
5	*TOTAL SOLIDS*	*63.56*	*57.1*

Table – 5
Characteristics of Textile Effluent for 8 ml (in %)

S.NO	*PARAMETERS*	*% OF REMOVAL*	
		MO Powder (in %)	*Neem Powder (in %)*
1	*TDS*	*70.2*	*67.44*
2	*BOD*	*86.17*	*66.05*
3	*COD*	*78.7*	*68.52*
4	*TSS*	*78.88*	*66.93*
5	*TOTAL SOLIDS*	*70*	*66.15*

1) Textile Effluent

The values of raw effluent and dosages of coagulants of MO powder and Neem powder of textile waste water are represented in X axis and the values of parameters are represented in Y axis is shown in the Figure no 3 to 9

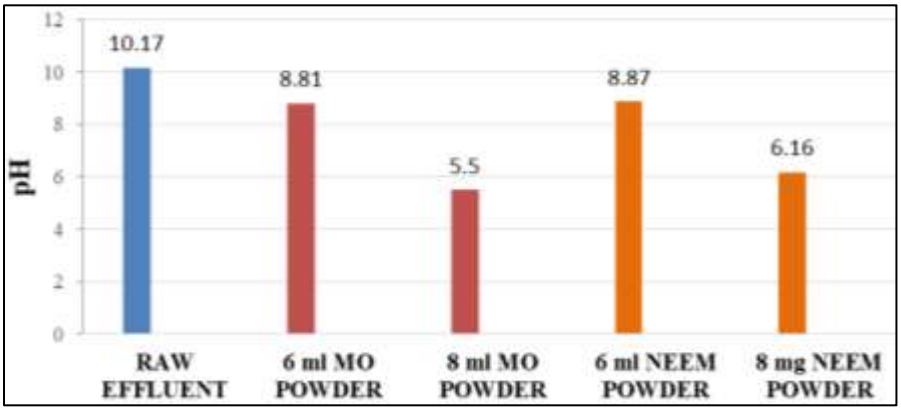

Fig. 3: pH for Textile Effluent

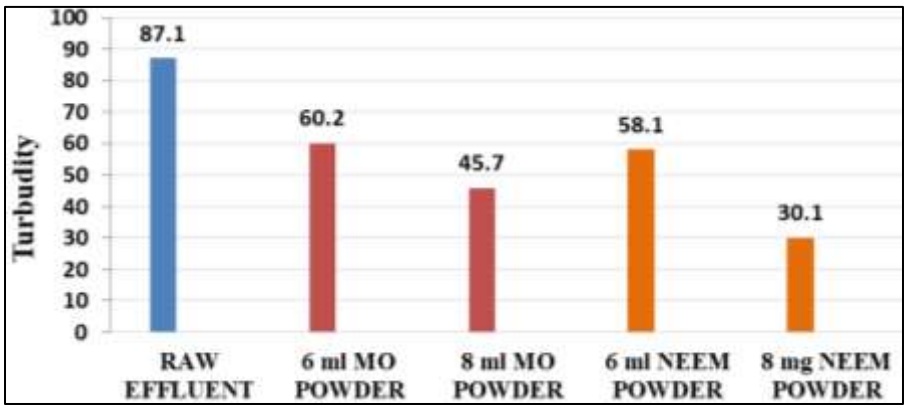

Fig. 4: Turbidity for Textile Effluent

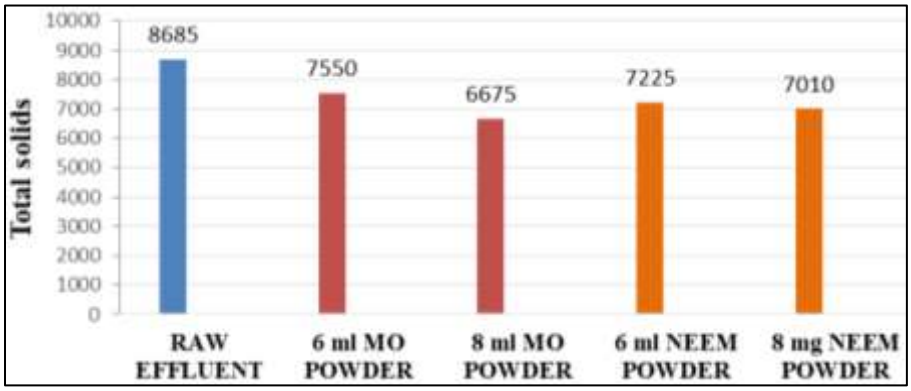

Fig. 5: Total solids for Textile Effluent

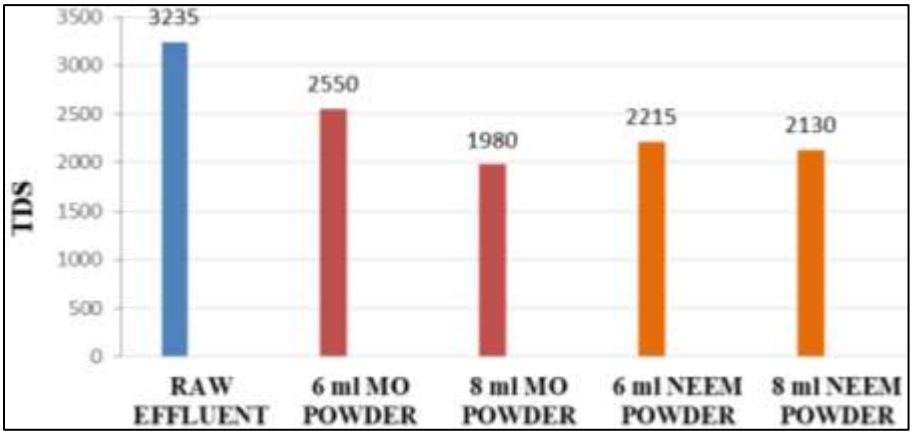

Fig. 6: Total Dissolved Solids for Textile Effluent

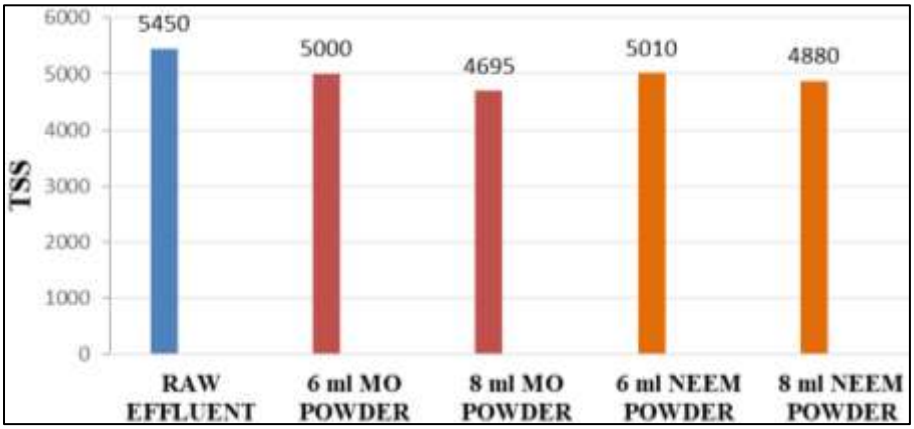

Fig. 7: Total Suspended Solids for Textile Effluent

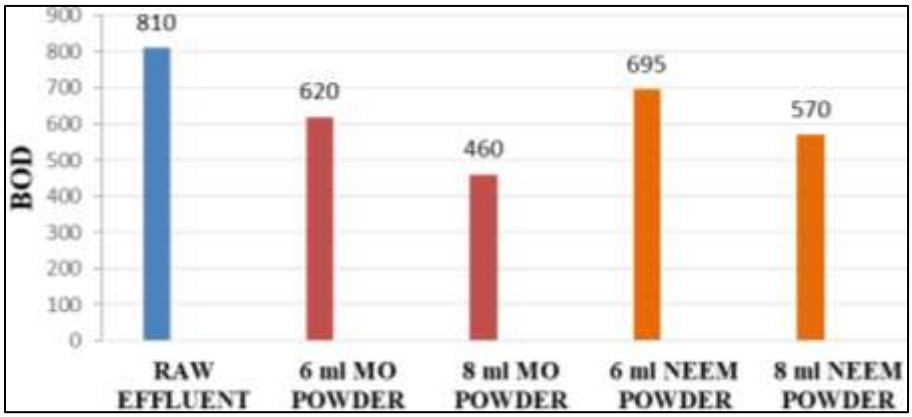

Fig. 8: BOD for Textile Effluent

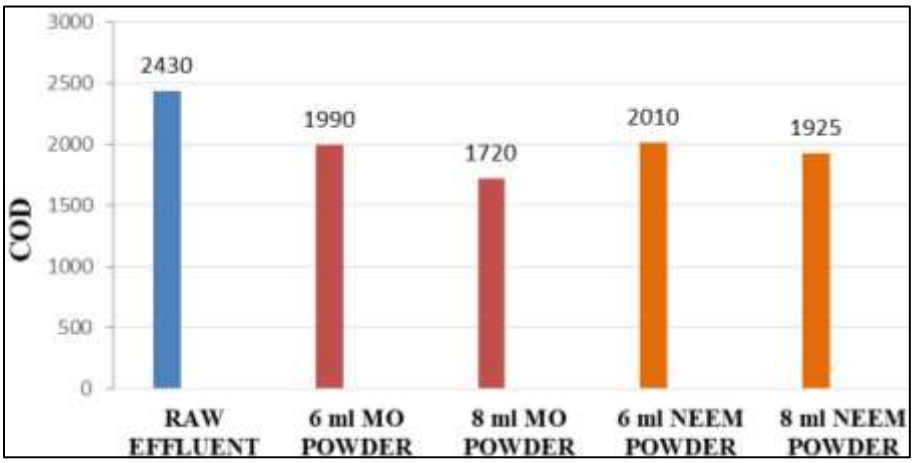

Fig. 9: COD for Textile Effluent

Textile effluent has the characteristics ; pH – 10.17, COD - 2430 mg/l, BOD –810 mg/l, Total solids – 8685 mg/l, Dissolved solids - 6235 mg/l, Suspended solids - 2450 mg/l, Turbidity – 87.1 NTU , chlorides –80.5mg/l, Hardness – 250 mg/l.

IV. CONCLUSION

The following conclusions are drawn from the experimental study conducted on treatment of textile effluents using natural coagulants:

- Among the two natural coagulants used in the study, maximum TDS reduction is found to be 67.96% with Moringa oleifera.
- Maximum BOD reduction is found to be 73.33% with Moringa oleifera.
- Among the two natural coagulants used in the study, Moringa Oleifera has the COD reduction of 68.67%. Hence it is concluded that comparison with two coagulants, Moringa oleifera is the effective coagulant in treating textile effluent.

From the above results, it is observed that the resulted parameters are within the permissible limits of irrigation purpose. So the treated textile wastewater can be used for irrigation purpose more efficiently.

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