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RESEARCH ARTICLE

Bioremediation of colour removal in dye effluent by *Moringa oleifera* seed powder

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ABSTRACT: Textile industries produce effluent that are highly complex and are characterized by high Color, COD, suspended solid, turbidity etc. In the present study we are using *Moringa oleifera* seed powder as coagulant to treat the dye effluent. *Moringa oleifera* seed powder is used to reduce the Colour, Total Suspended Solids, Turbidity and colloidal materials responsible for the COD of waste water. The seed powder is used as a natural coagulant to reduce turbidity, Color, COD, pH and TDS of the textile effluent. The tests were carried out using the textile effluent with standard Jar test method. Various concentration of *Moringa oleifera* seed powder (0.5 g/l, 1 g/l, 1.5 g/l, 2g/l, 2.5 g/l and 3g/l) were taken to treat dye effluent. From the result it is found that the effective dosage for Colour reduction, COD, Suspended Solids and Turbidity was found to be 3g/l. The intensity of Colour of the raw effluent was reduced to 74% which is more or less equivalent to the chemical treatment using hypochlorite solution. *Moringa oleifera* seed powder (3g/l dose) is very effective in treating the dye effluent. The turbidity was reduced to NTU 65%, TSS (84%), and COD (39%) respectively. From this it can be clearly seen that the *Moringa oleifera* seed powder acts as an excellent alternative to chemical bleach (sodium hypochlorite) for dye effluent treatment and serves as a promising hope for our future research.
Keywords: Bioremediation, *Moringa oleifera* seed powder, Dye effluent

INTRODUCTION

Textile industries are one of the most public and essential sectors in the world. On the other hand, high capacity of water consumption and varying wastewater characteristics are the factors that have caused a sustained effort to find appropriate technologies to treat textile industry wastewater. Major pollutants in textile wastewaters are high suspended solids, Chemical Oxygen Demand (COD), heat, Colour, Turbidity, and other soluble substances (Adel–Kdasi et al., 2005). The waste water generated during these processes is discharged into the water streams. So, the toxic pollutants which are present in that effluent gets mixed up with the water streams and pose threat to both environment and human beings. They are one of the largest of water users and polluters. Therefore, need arises to focus our attention on treating the textile effluent before its disposal. The removal of dyes from textile effluent can be carried out through several chemical and/or physical methods. One of the most popular processes in effluent treatment is coagulation. The uses of synthetic coagulants are not considered as suitable due to health and economic considerations. Natural coagulants are promising and have attracted the attention of many researchers because of their abundant source, low price, multi-purpose and biodegradation.

Many researchers tested and reported Moringa oleifera seed is a good natural coagulant to treat drinking and waste water like sewage, industrial effluents tannery and textile effluent. Previously removal of dye, surfactant and other contaminations using Moringa oleifera seed was studied by scientists (Beltran-Heredia and Martin, 2008; Bhatia et al., 2006; Kwaambwa et al., 2010). The chemical composition and other properties like active agent of seeds of Moringa oleifera L was demonstrated by Ndabigengesere et al. (1995) and Gassenschmidt et al. (1995). Based on the above background the present study focused on the Colour removal effect of Moringa oleifera seed powder and compare with Chemical treatment (hypo). The main objective of this work is to use the Moringa oleifera seeds as a decolorizing natural coagulant for the treatment of Textile effluent.

MATERIALS AND METHODS

SAMPLE COLLECTION

The effluent samples were collected from the Common Effluent Treatment Plant (CETP) treated at Angeripalayam CETP, in Tirupur. Effluents from 58 dyeing units are treated in this CETP.

PREPARATION OF MORINGA OLEIFERA SEED POWDER

The Moringa oleifera seeds are collected from recently harvested dry seed. The seed coat and wings were removed and the seeds were ground to powder using domestic blender. Then the powder was sieved through 600µ stainless steel sieve. Coagulation and

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flocculation process are be governed by on a multitude of variable of interrelated factors: Temperature, Color, Alkalinity, nature coagulant and intensity and duration of stirring duration mixing and flocculation. The optimal dose of the coagulant cannot be found by analyzing the raw water. Rather, it must be determined by an experiment on laboratory scale. Such a test ought to follow this procedure. Previous studied in textile waste water treatment process. Despite the frequent use of adsorption in wastewater treatment systems, commercially available Moringa oleifera seed powder remains an expensive material (Hameed and El-Khaiary 2008),

1. Addition if the coagulant in different dosages to six samples of 1000 ml each (e.g. 5, 1.0, 1.5, 2.0, 2.5, 3.0 g/l)
2. High speed stirring initially for 1 min and low speed for 10 minutes.
3. The stirring is done with the help of a Jar Test Apparatus.
4. Allow the water to settle 30 min.

PHYSICO CHEMICAL PARAMETERS

Textile industries are major sources of industrial effluents (Ghoreishi and Haghighi, 2003) due to the nature of their operations, which requires high volume of water that eventually results in high wastewater generation. Characterization of textile process effluent streams is very important to develop strategies for water treatment and reuse (Yusuff and Sonibare, 2004). The effluent was characterized and the following table shows the values of various parameters like pH, TDS, TSS, Chloride, Alkalinity, Turbidity, and Colour, Total Hardness, Calcium hardness, Magnesium hardness, free residual chloride and COD. The effluent characteristics are shown in Table 1.

TABLE -1. RAW DYE EFFLUENT CHARACTERISTIC

S.No	Parameters	Raw dye effluent
1	Colour (ptco)	3961.32
2	pH	5.04
3	Turbidity(NTU)	64.24
4	TDS	7540.42
5	TSS	181.34
6	Total hardness (mg/l)	380.56
7	Calcium hardness	210.24
8	Magnesium hardness	170.32
9	FRC	-
10	Total alkalinity	480.12
11	Chloride	3482.13
12	COD	1184.26
13	Sludge	-

TABLE-2 EFFECT OF *MORINGA OLEIFERA* SEED POWDER AND HYPO ON DYE INDUSTRY EFFLUENT

SI.NO	PARAMETERS mg/l	Raw Effluent	Hypo 2.3 ml	Concentration of *moringa* seed coagulant					
				0.5g/l	1g/l	1.5 g/l	2 g/l	2.5g/l	3g/l
1	Color (pt co)	3961.32	890.02	1610	1600	1560	1230	1170	1030.2
2	pH	5.04	6.92	5.02	5.22	5.17	5.23	5.14	5.20
3	Turbidity	64.24	35.2	35.1	34.4	31.7	31.1	27.4	22.4
4	Total dissolved solids (mg/l)	7540.42	7670	7554	7610	7518	7596	7532	7571
5	Total suspended solids (mg/l)	181.34	53.43	106.24	924.17	74.37	62.12	45.04	28.34
6	total hardness (mg/l)	380.56	400.26	370.87	380.28	370.04	370.06	380.04	360.33
7	Calcium hardness (mg/l)	210.24	220.14	220.42	230.14	220.03	210.05	220.01	200.12

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8	Magnesium hardness (mg/l)	170.32	180.12	170.45	150.14	150.01	160.01	160.03	160.21
9	Free Residual chloride (mg/l)	-	39.6	-	-	-	-	-	-
10	Chloride (mg/l)	3482.13	3578.24	3528.14	3506.8	3497.32	3524.23	3520.36	3492.04
11	Total alkalinity (mg/l)	480.12	980.04	560.05	600	540.12	580.51	580.23	560.02
12	COD (mg/l)	1184.26	1296.41	2140.23	1844.45	1358.73	1224.32	922.04	724.05

FIG.1 EFFECT OF NATURAL (*MORINGA OLEIFERA* SEED) AND CHEMICAL (HYPO) TREATMENT OF COLOR REMOVAL AND COD OF DYE EFFLUENT

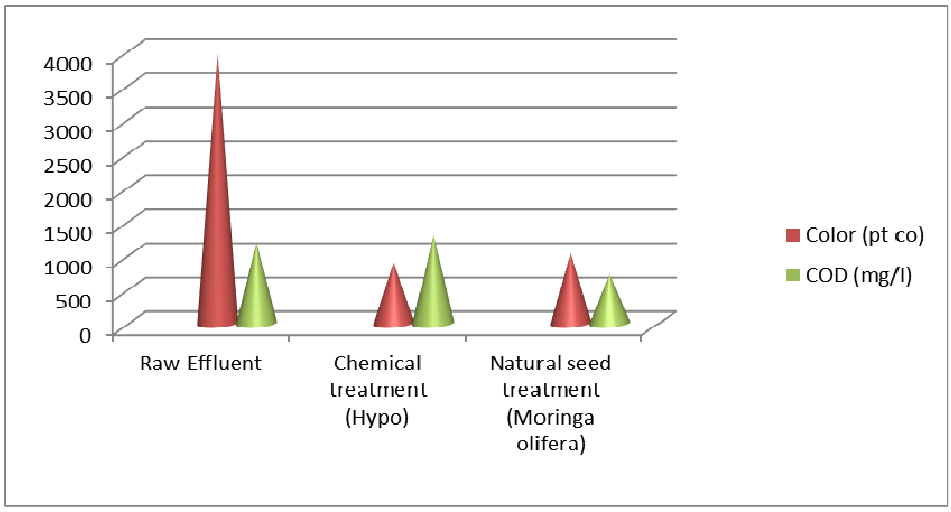
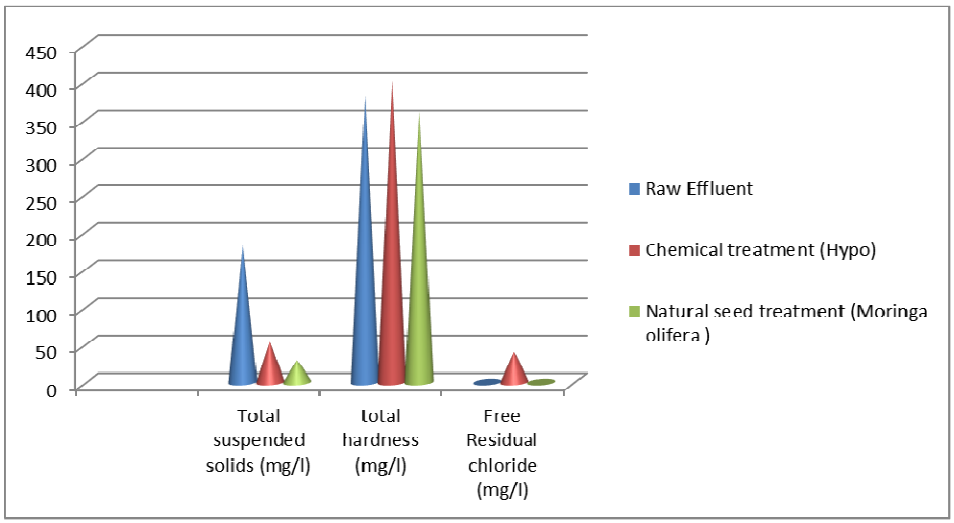


FIG.2 EFFECT OF NATURAL (*MORINGA OLEIFERA* SEED) AND CHEMICAL (HYPO) TREATMENT OF TSS, TOTAL HARDNESS AND RESIDUAL CHLORIDE OF DYE EFFLUENT



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RESULTS AND DISCUSSION

Textile effluent collected from Tirupur, exhibited higher level of water quality parameters and above permissible limit of ISI and FAO standard. The effects of natural decolorizing coagulant for textile effluent treatment by using seed of *Moringa oleifera* were studied. It was treated with different doses from 0.5 to 3 g/l. From the result it is found that the effective dosage (3g/l) for Colour reduction, COD, Suspended Solids and Turbidity. The intensity of Colour of the raw effluent was 3960 pt co reduced to 890 pt co by chemical bleach (hypo) and treating with *Moringa oleifera* seed was found to be 1030 pt co which is more or less equivalent to chemical treatment (table -2). *Moringa oleifera* seed powder (3g/l dose) effectively treat the dye effluent, Turbidity was reduced 65% NTU, TSS (84%), and COD (39%) respectively. It was comparatively high then the chemical treatment (Fig-2). From this it can be clearly seen that the *Moringa oleifera* seed powder acts as an excellent alternative to chemical bleach (sodium hypo chlorite) for dye effluent treatment and serves as a promising hope for our future research. In the Present study color reduction by M. olifera seed coagulant was 74% and 77% for hypo treated on textile effluent. Similarly another study revealed by Sujith and Vinodha (2014), *Moringa oleifera* seed coagulant was used for color removal on textile effluent, for their report 99% of Colour was removed. As previously study was NTU 72% removed for *Moringa oleifera* (Diaz et al., 1999), present researched of NTU 65% (Fig 2), reduced on textile effluent. *Moringa oleifera* seed coagulant (40 to 85%) results which is close to the (75%) Hypo treatment (Pritchard et al 2010). Thus based on the present study, *Moringa oleifera* seed can be successfully used in place of hypo for treatment of textile effluent. The use of seed showed potential Colour removal with coagulant effect on textile effluent treatment since they are eco-friendly, economical, traditional and easy to implement and ideal for rural areas. The natural seed act as more effective coagulant and it is useful to avoid water pollution. These processes are easy to operate and require little or no maintenance

CONCLUSION

The feasibility for treatment of dye wastewater using naturally prepared coagulants *viz M.olifera* seed and hypo in order for removal of Colour, COD are analyzed. The comparative study of these treatments Hypo and Natural *Moringa oleifera* seed powder in which Natural coagulant was more preferable than Hypo and removal of Colour, TSS, COD and Hardness was found to be more effective when compared to the chemically treated sodium hypochlorite solution. As the coagulant used is a natural substance which is available abundantly in nature it does not cause any harm to the environment. It is highly economical when compared to the synthetic chemicals used for the treatment purposes. Hence this seed is found to be most effective on all aspects thereby reducing pollution as well.

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CONFLICTS OF INTEREST
"The authors declare no conflict of interest".