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Carpet Waste Water Treatment using Natural and Chemical Coagulant

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Abstract—*Water quality is an increasing concern for environmentalists and regulatory bodies. It is becoming a global concern of increasing significance, as risks translates directly in to social economic impacts .Treatment strategies range along a continuum from high technology, energy intensive approaches to low technology low energy , biologically and ecologically focused approaches. Among the ecological options available, Moringa oleifera is a tropical plant whose seeds contain water soluble substances that have potential for coagulation activity in water. In the present study, the coagulation activity of the Moringa oleifera seed solution in carpet waste were studied and compared with alum, which is presently the most widely used industrial coagulant. The experiments were carried out in a completely randomized design and carpet waste water was procured from Badohi. In this experiment natural coagulant Moringa oleifera and chemical coagulant Alum and combination of Moringa oleifera and Alum of 50mg/l, 100mg/l and 150mg/l dosages were used for treatment of waste water generated from carpet industry. The waste water treated with different dosages of coagulant are kept in a rotary shaker for 2hrs for floc formation followed by filtration for further analysis of different physicochemical parameters. The parameters studied were pH, EC, TDS, Acidity, DO, COD, hardness, sodium and potassium content .The efficiency is more in treatments with combination of Moringa oleifera and Alum. Moringa seed as a natural coagulant being non-toxic and ecofriendly could be potentially viable substitute to alum in water treatment.*

Keywords: *Alum, Moringa oleifera, coagulation.*

1. INTRODUCTION

A large portion of wastewater generated by the textile industry originates from dyeing operations and contains a wide range of contaminants that must be treated prior to disposal. The dyeing wastewater is known to have strong colour, chemical oxygen demand (COD), highly fluctuating pH and high temperature [1,2]. Textile industries are the major source of pollution due to the nature of operations which require high volume of water that eventually results in higher waste water generation[3]. Uptake of textile effluents through food chain in an aquatic organism may cause various physiological disorders like hypertension, sporadic fever, renal damage, etc,[4]. India's environment becoming fragile and environmental pollution is one of the undesirable side effect of industrialization, urbanization, population growth unconsicious attitude towards the environment. At present environment protection is the main need of the society. In India environmental pollution has became a cause of concern at various level[5].In this study presents the change in pH, EC, TDS, Hardness, DO, COD, Sodium and Potassium content before and after treatment with the natural coagulant, Moringa oleifera and a chemical coagulant Alum. The *Moringa oleifera* act as a natural absorbents and antimicrobial agent. Its seed contain 1% active polyelectrolyte's that neutralize the negative charged colloid in the dirty water. It reduces the turbitity in the carpet waste water[6]. The results has been discussed below.

2. MATERIALS AND METHODS:

2.1 Effluent Sample Collection:

Effluent sample were collected from Bhadoi region, Varanasi, UP, India (Latitude: 25.42000^0 N; longitude:82.57000^0 E) in a sterile bottle.

Fig. 1: Raw Effluents

2.2 Collection and Identification of *M. oleifera* seeds:

Seeds of *M. oleifera* used in this study were collected from a tree in Kovilpatti district, Tamilnadu. The Seed collected for the purification purposes are naturally dried seeds from the tree. And the husk over the seeds can be removed manually

and the protein part inside the seed can be used for the waste water purification purposes[7].

Fig. 2: Moringa seeds

2.3 Preparation of *M. oleifera* seed powder

The good quality dried *Moringa* seeds were de-shelled and dried at ambient temperatures (23 to 25°C) for a period of five days before milling. The white kernels were milled into a fine powder with the aid of a Mixie or by using pestle and mortar and were sieved through a small mesh to get the fine powder. The powder were collected into a air tight plastic bottles. The powder has a shelf life of about 2 months

T_1	50 mg moringa seed powder / litre
T_2	100 mg moringa seed powder / litre
T_3	150 mg moringa seed powder / litre

There are about 3 different dosages were taken for study

Fig. 3: Moringa seed powder

2.4 Preparation of alum coagulant

- The alum used for this study was obtained from the local market and also using the chemical Aluminium Potassium Sulphate(Extra Pure, $AlK(SO_4)_2 .12H_2O$. The alum was totally soluble in the water.

There are 3 different dosage of Alum Under Study:

T1	50mg Alum / litre
T2	100mg Alum / litre
T3	150 Alum / litre

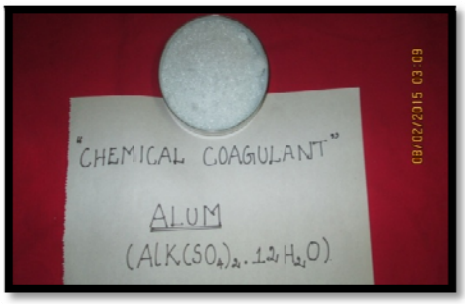


Fig. 4: Alum

2.5 Samples Treatment with Coagulants

The collected Effluent has been treated with different coagulants (Moringa oleifera and Alum) at different concentration, the treated samples has been keep it in shaker for 2 hrs for flocculation process, after shaking process the samples has been keep it for half an hour without any disturbance and filter it using Watmann No1 filter paper, then it has been used for further analysis.

Fig. 5: Treated Samples

2.6 Physicochemical analysis of the water sample

Physicochemical parameters of the water sample were determined prior and after treatment with *M. Oleifera* seed powder and alum by using specific methods. The parameters determined and methods adopted are given in Table1.

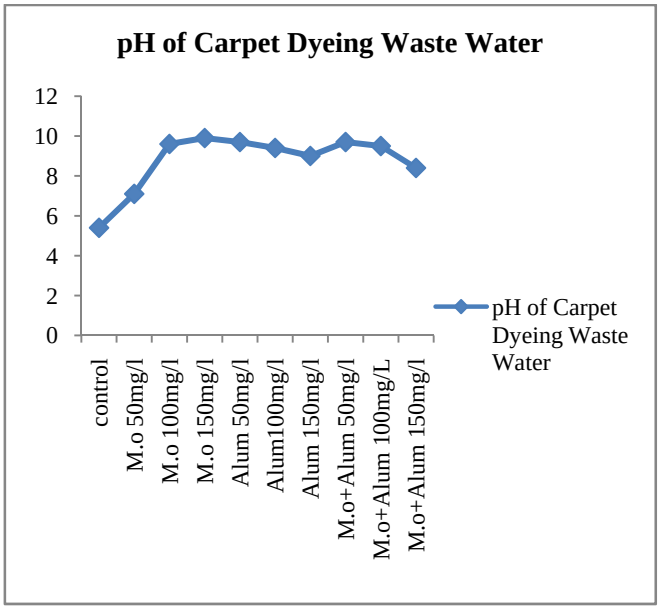
Table 1: Methods used for Physio-chemical Analysis

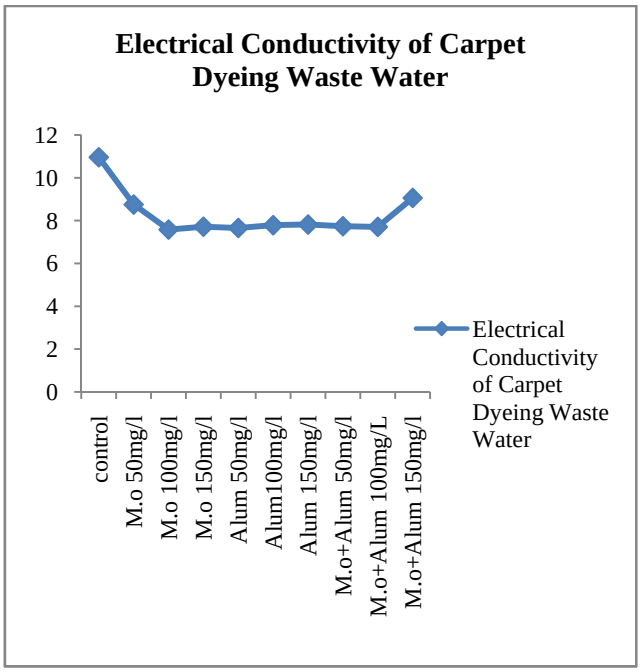
S. No	Parameter	Method
Physical Parameters		
1.	pH	pH Meter
2.	EC	EC meter
3.	TDS	Pen Type pH Meter
Chemical Parameters		
4.	Hardness	Titration
5.	DO	Titration
6.	COD	Titration
7.	Sodium	Flame Photometer
8.	Potassium	Flame Photometer

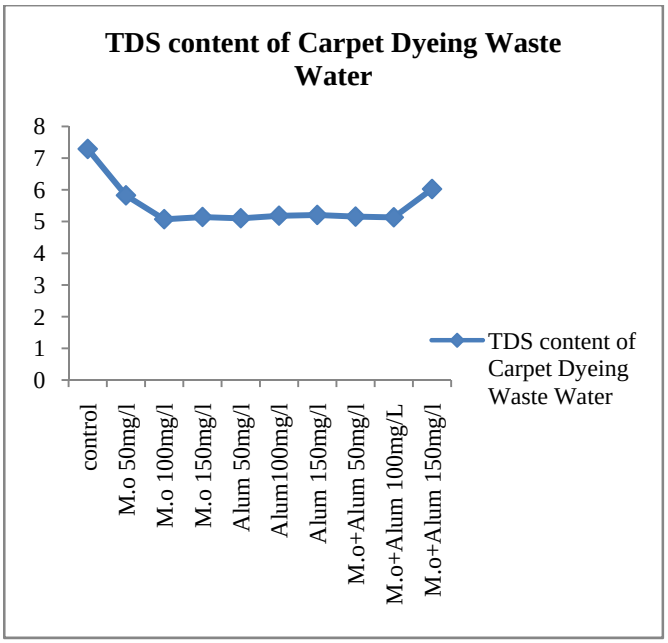
3. RESULTS AND DISCUSSION

3.1 Effect of Chemical and Natural Coagulant on pH, EC and TDS

The initial pH, EC and TDS value of Carpet dyeing waste water 5.4, 10.96 and 7.29 respectively. Where the observed pH, EC and TDS values after treatment with coagulants are varied rapidly, the pH value of carpet dyeing waste water was increased with increase in concentration, where the EC and TDS values where decreased with increase in concentration of both the chemical and natural coagulants. It has been shown in the graph below.

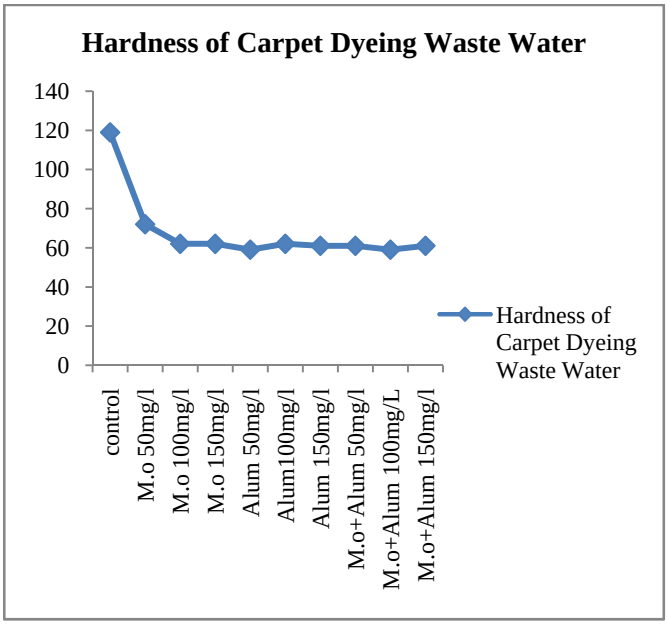






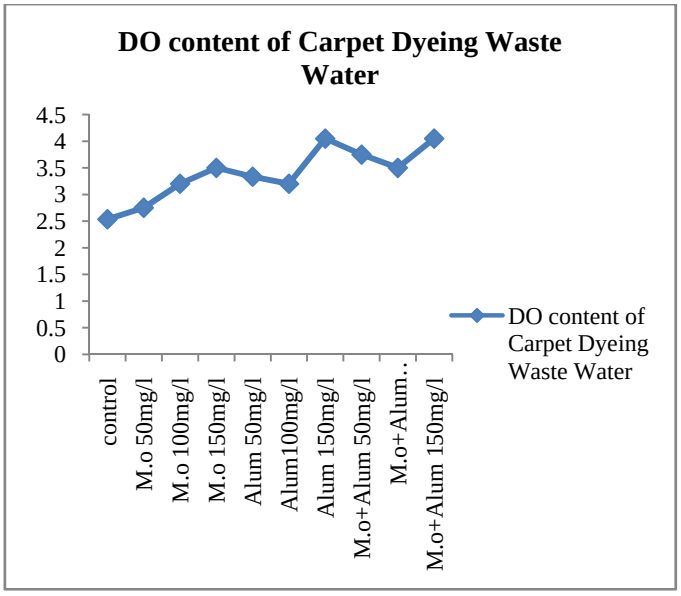
3.2 Effect of Chemical and Natural Coagulant on Hardness

The carpet dyeing waste water is initially hard(119mg/l), but it hardness can be reduced after treating with the Moringa oleifera and Alum[8]. The reduction in hardness after treating with Moringa oleifera at 50mg/l,100mg/l and 150mg/l the observed values are 72mg/l, 62mg/l and 62mg/l respectively. After treatment with Alum the values observed are 59mg/l,62mg/l and 61mg/l respectively. And the combination of Moringa oleifera and Alum the values observed are 61mg/l,59mg/l and 61mg/l respectively. It shows that after treatment with the coagulants the constant reduction in hardness has been observed, it has been shown in the graph below.

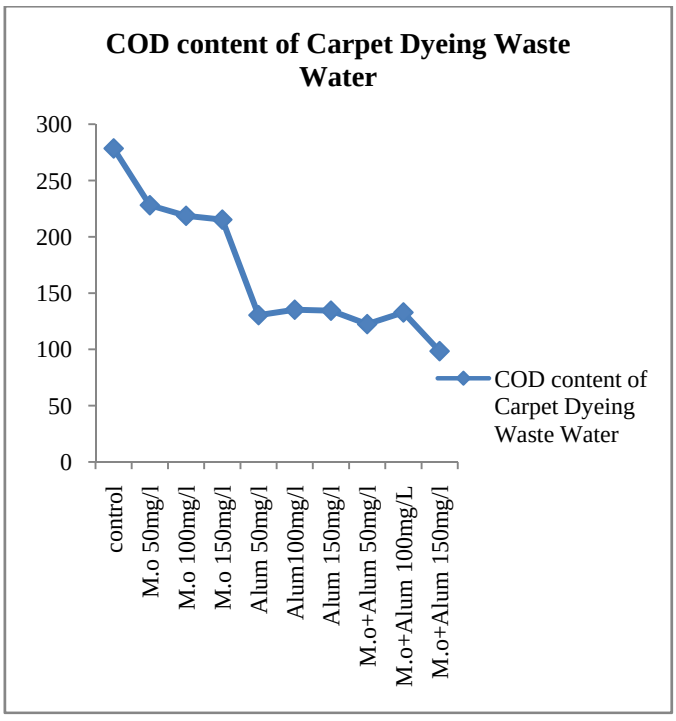


3.3 Effect of Chemical and Natural Coagulant on Dissolved Oxygen

The initial Dissolved Oxygen Content of Carpet Dyeing waste water observed are 2.53mg/l, and after treatment with Moringa oleifera and Alum each at 50mg/l, 100m/l and 150mg/l the change in values observed are 2.75m/l, 3.20mg/l, 3.50mg/l, 3.33mg/l and 3.20mg/l respectively. And the combination of Moringa oleifera and Alum the values observed are 3.75mg/l, 3.50mg/l and 4.05mg/l respectively. Th has been represented in the graph below:



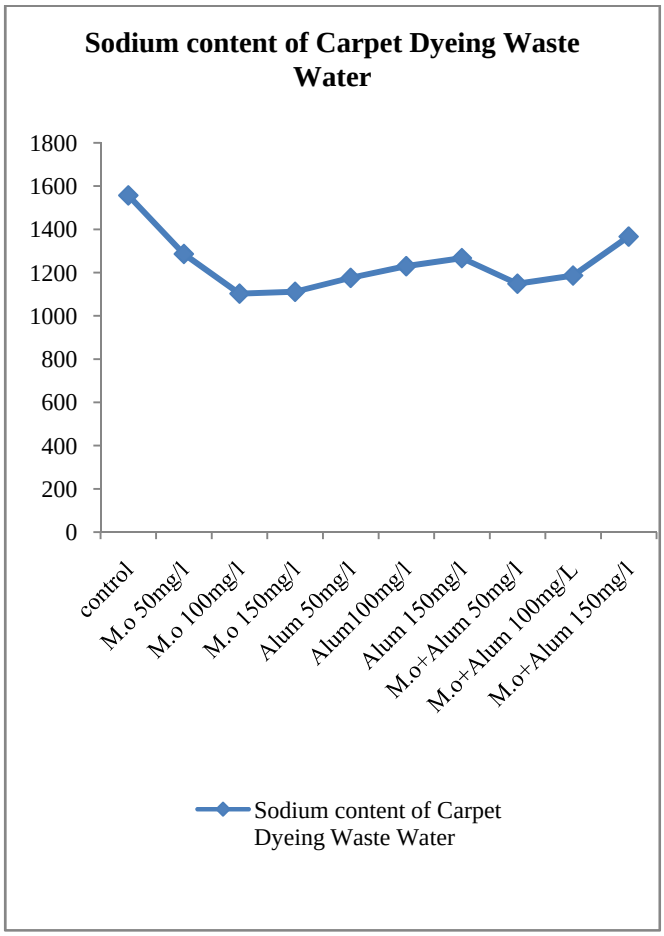
3.4 Effect of Chemical and Natural Coagulant in COD:



The initial COD level of carpet dyeing waste water observed is 278.40mg/l, the values has been observed after treatment with Moringa oleifera and Alum each at 50mg/l, 100m/l and 150mg/l are 228mg/l, 218.60mg/l, 215.20 and 130.40mg/l,135.21mg/l,134.40mg/l respectively. And the combination of Moringa oleifera and Alum at 50mg/l,100mg/l and 150mg/l the change in values has been observed are 122.40mg/l, 132.80mg/l and 98.40mg/l respectively. It has been represented in the graph below:

3.5 Effect of Chemical and Natural Coagulant in Sodium and Potassium

The initial Sodium and Potassium Content in the Carpet Dyeing waste water observed as 1557ppm and 341.25ppm respectively. The changes has been observed are after treatment with Moringa oleifera and Alum each at 50mg/l, 100mg/l and 150 mg/l. The Sodium content has been observed are 1286ppm, 1102.33ppm, 1111ppm, 1175.33ppm, 1229.33 and 1267ppm respectively. The potassium values has been observed as 285.6ppm, 20.77ppm, 26.32ppm, 51.07ppm, 108.40ppm and 137.85 respectively.



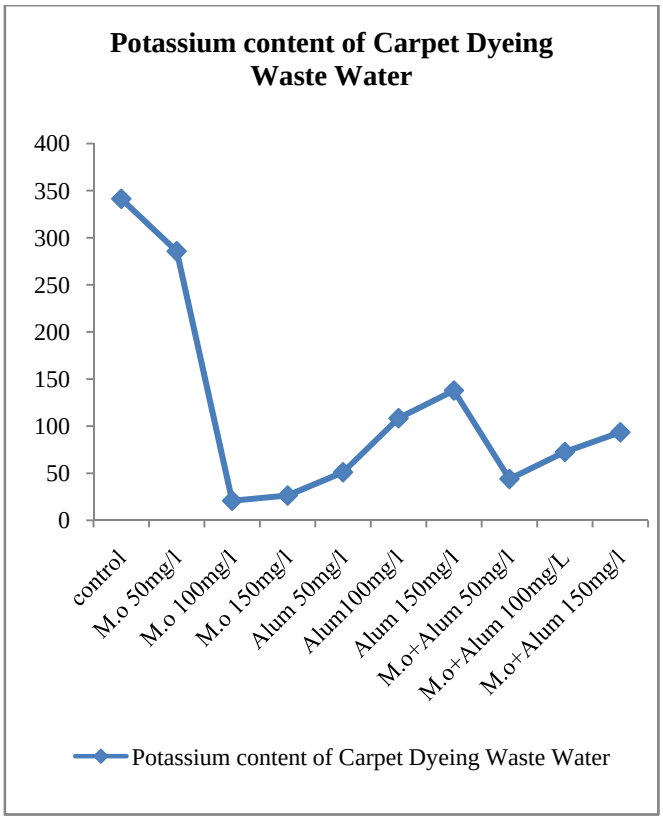


Table I: Physio–Chemical Analysis of Carpet Waste Water Before and After treatment

S.No	Parameters	Before treatment	After treatment (M.oleifera)			After treatment(Alum)			After treatment(M.Oleifera+ Alum)		
			50 mg/l	100 mg/l	150 mg/l	50 mg/l	100 mg/l	150 mg/l	50 mg/l	100 mg/l	150 mg/l
1.	pH	5.4	7.13	9.60	9.93	9.73	9.40	9.03	9.70	9.53	8.40
2.	Electrical Conductivity	10.96	8.75	7.58	7.72	7.66	7.79	7.82	7.74	7.71	9.06
3.	Total Dissolved Solids	7.29	5.82	5.07	5.14	5.10	5.18	5.20	5.15	5.13	6.02
4.	Hardness	119	72	62	62	59	62	61	61	59	61
5.	Dissolved Oxygen	2.53	2.75	3.20	3.50	3.33	3.20	4.05	3.75	3.50	4.05
6.	Chemical Oxygen Demand	278.40	228	218.60	215.20	130.40	135.21	134.40	122.40	132.80	98.40
7.	Sodium	1557	1286	1102.33	1111	1175.33	1229.33	1267	1148.33	1186.33	1366.33
8.	Potassium	341.25	285.6	20.77	26.32	51.07	108.40	137.85	43.93	72.65	93.45

4. SUMMARY

The overall effect of the Chemical and Natural Coagulant in Carpet Dyeing Waste Water was observed are pH, EC, TDS can be increased with increase in increasing the concentration, while the Hardness can be decreased with increasing the concentration. And the DO content of the sample not giving that much changes after the treatment, COD values has been showing slight changes after treatment with the coagulants. The sodium and Potassium Content increases with increasing the concentration of the coagulants. It is due to *Moringa oleifera* and Alum contain naturally a small amount of potassium and sodium[9].

The values observed before and after treatments has been given in Table I.

5. CONCLUSION

From the above study it is evident that the efficiency is more in treatments with combination of Moringa oleifera and Alum. Moringa seed is having enormous potential as a natural coagulant being non-toxic and eco friendly could be potentially viable substitute to alum in water treatment.

6. ACKNOWLEDGEMENT

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