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Research Article

Removal of colour from textile industry waste water using natural coagulant

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Abstract: Mostly the waste water arising out of textile industries are matching the inorganic industrial waste water condition, in this research an attempt is made at finding the efficiencies of powdered natural coagulant alternative to the use of synthetic chemicals to treat the waste water of textile industry. The result obtained by adding *M.oleifera* proved that the plant can be use for the treatment of turbidity and transmittance in textile industry waste water. The results obtained when the natural coagulant combined with alum were much better. It is found that nearly 97% removal of turbidity is achieved during this study and also 95% transmittance level is achieved, also complete odour removal is obtained by the coagulation process. Hence *Moringa oleifera* can be effectively used as a coagulant aid with any chemical coagulant like alum for treatment of waste water from dying industries.
Keywords: Coagulation, *Moringa oleifera*, Alum, transmittance, colour removal.

INTRODUCTION

The waste water arising from the textile industries was a major problem around the Thirupur district. Due to the bad effect of textile wastes in environment many industries were forced to close their industries. So they introduced some methods to treat the waste water but all of the methods were based on the chemicals. Here we made an attempt to know the effect of natural coagulants in the colour and turbidity removal of textile waste water alternative to the use of synthetic chemicals. The natural coagulant which we used in this work is *Moringa oelifera*. Mostly the waste water arising out of textile industries are matching the industrial waste water condition. Similarly, the efficiency of mixture of each of the plant with ferric chloride and poly electrolyte were tested. The result obtained by adding *M.oleifera* proved that the plant can be use for the treatment of turbidity transmittance and removal of colour in dying industry waste water.

Turbidity and colour removal is one of the most important steps in water treatment process, which is generally achieved using coagulants. Many coagulants are widely used in conventional water treatment processes, based on their chemical characteristics. These coagulants are classified into inorganic, synthetic organic polymers, and natural coagulants. The application of natural materials for clarifying turbid waters of rivers is an ancient and home-based practice in tropical developing countries where these natural materials act as primary coagulants. One example of these coagulants is the seed of the tropical tree *Moringa oleifera* (MO), which contains active agents with excellent activity [7-8]. and coagulating properties. The extract of the seeds has been mentioned for drastically reducing the amount of sludge and bacteria in sewage [1]. In laboratory and field studies, seeds of *S. potatorum* and *M. oleifera* have shown promise as coagulant in the clarification of turbid water

MATERIAL AND METHODS

Study area

In this study the waste water is collected from Balakumaran dying unit situated in Tirupur district which is a textile industry which has a daily wastage of 20,000 lit. The industry consumes about 20,000 lit as its intake and the whole water is becoming waste at the end of dying process.

In these water input 100% is converted into wastage is sending to some zero liquid discharge plants or common effluent treatment plants, the initial characteristics of the waste water is given in table 1 which shows that the values obtained above the discharge norms of pollution control board standards. Also it is evident that this water should be treated before letting it into sewers or letting it for evaporation process. This study aims to introduce newer technologies in the treatment plants to make the treatment process efficient. Most of the industrial waste water treatment plants involve the units like screening, grit removal, coagulation with sedimentation, filtration

or aeration with biological treatment process, sludge removal, reverse osmosis process.

Table 1: Initial waste water characteristics

Sl.no	Parameter	Value
1	pH	6-6.5
2	TDS	5240 ppm
3	Absorption	.13 ms/cm
4	Turbidity	40-45 NTU
5	Transmittance	72% in colorimetry
6	Odour	Objectionable level
7	Colour	Greenish black

Sampling

Sampling of waste water is done at the main collecting tank by using grab sampling method, the sampling bottles are of 20 litre capacity which are cleaned three times with tap water, then with distilled water and rinsed fully with 6N HNO_3 for removal of any sign of pathogens or odour. Samples collected are used immediately for the study. Before conducting the study initial characteristics of the waste water is noted. The raw water is characterized in terms of some physical and chemical parameters before treatment. The evaluated parameters were color turbidity, pH, transmittance, turbidity, absorbance etc. The water samples were maintained in a pH of 4 otherwise it will significantly affect the reactions. The coagulant solution of *M.oelifera* was made ready on the day of testing by mixing 10 g of M.O in 300 ml of distilled water. The coagulation sedimentation process was conducted by using jar test apparatus. The efficiency of the process is evaluated by measuring the turbidity and transmittance by using Turbidity meter and calorimeter.

Effect of natural coagulants in industrial waste water

G.vijayaraghavan et al [2] says that the plant based coagulants sources processes effectiveness and relevant coagulating mechanisms for treatment of waste water, these coagulants are, in general, used as point-of-use technology in less developed communities since they are relatively cost effective compared to chemical coagulants. Sonal choubey says that, the seed coagulant contain significant quantities of a series of low molecular weight, water soluble proteins which, in solution, carry an overall positive charge, the proteins are considered to act similarly to synthetic, positively charged polymer coagulants. When added to raw water the proteins bind to the predominantly negatively charged particulates that make raw water turbid. Under proper agitation these bound particulates then grow in size to form the flock, which may be left to settle by gravity or be removed by filtration.

T.Dhanalakshmi et al[3] concluded that the *Moringa oleifera* seed as a natural coagulant removes the turbidity of water inhibits the growth of water borne pathogens. The seed was taken with oil and deoiled powder to treat the waste water, among the treatment the deoiled powder has more effectiveness to remove turbidity. Ravikumar et al concluded that *Moringa oleifera* is an environmental-friendly natural coagulant most suitable for the treatment of waste water containing undesirable heavy metal concentrations. The optimum dosage of *Moringa oleifera* aqueous extract for synthetic water sample was 2g/L.

Sonal choubey et al [4] says that using some locally available natural coagulants, like *Moringa oleifera* significant improvement in removing turbidity from the raw water was found. Maximum turbidity removal is found for high turbid water. Beltran Heredia et al[5]concludes that tannin derived coagulants are a satisfactory new agent for waste water treatment. It seems very effective in the *azo dye* colour removal. The physical system of dye coagulant may be ruled by adsorption like relationships.

Vasudevan and Gopala Krishnan [6] says that the size of the formed with natural coagulant was superior to that produced by alum. And the flocs were never found disintegrable when subjected to rapid mixing, the natural coagulants when mixed with alum in varying combinations gave more results.

Solution preparation

In this study an effort is made to identify the effect of natural coagulant (*Moringa oleifera*) in dying industry waste water treatment. This coagulant is readily available in the study area since it's an agricultural zone, the seeds of the *Moringa oleifera* are collected from the nearby market which is used in this study. Since *Moringa oleifera* cannot act properly alone in the waste water an additional coagulant catalyst like Alum (industrial grade-50% pure) is added in various dosages as a coagulant aid. Alum solution is prepared by adding 50 grams per 500 ml of de ionized water and stirred for 20 min using magnetic stirrer, the solution is preserved for dosing. *Moringa oleifera* seeds are crushed using domestic mixers, the power is sieved using 75 micron sieve and stored in bottles. From this, 25 grams of powder is added with 250 ml of distilled water and mixed rapidly using magnetic stirrer for 15 minutes. The solution is filtered using Watman filter paper and the filtered solution is used in this study. The dosage of this solution is increased from 3 ml to 30 ml keeping the coagulant aid as 3 ml per sample. This solution is prepared in a 500 ml beaker and the jar test is conducted as per the procedure with rapid mixing for 10 minutes and slow mixing for 15 minutes. The mixed solution is allowed to settle for 60 minutes and the final readings were taken.

RESULTS AND DISCUSSION

The table 1 shows that while increasing the content of M.O by keeping the amount of alum constant (3ml), the turbidity value is decreasing in range and while added 32 ml of M.O along with 3ml of alum, the turbidity value reached 5NTU which is approximately equal to that of normal drinking water (00NTU). At the same time the transmittance value increased and reached at a range of 100% that is, the transmittance value of normal water. The amount of sample used is 400 ml and an even dosage of 3 ml per sample of Alum (industrial grade) is added with varying percentage of *Moringa oelifera* solution.

Table 1: parameters of various samples after coagulation

Sl.No:	Amount of *Moringa oeifera*	Absorbance	Transmittance	TDS	pH
1	1ml	.13	72%	5240	6.49
2	2 ml	.3	50%	7310	3
3	3	.09	81%	6720	5.6
4	4	.06	86%	6310	5.6
5	5	.09	80%	6450	5.58
6	6	.09	80%	6340	5.58
7	7	.03	93%	6340	5.56
8	8	.02	95%	6290	5.58
9	9	.04	90%	6270	5.55
10	10	.09	81%	6150	5.56
11	11	.03	92%	5840	5.47
12	12	.02	100%	5120	5.58

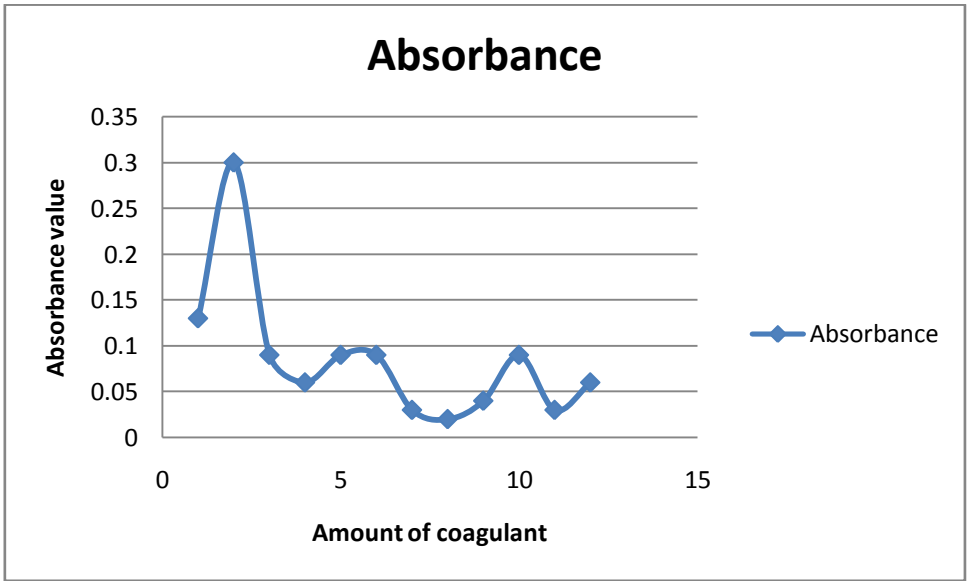

Figure 1: Absorbance Vs Coagulant dosage for the sample

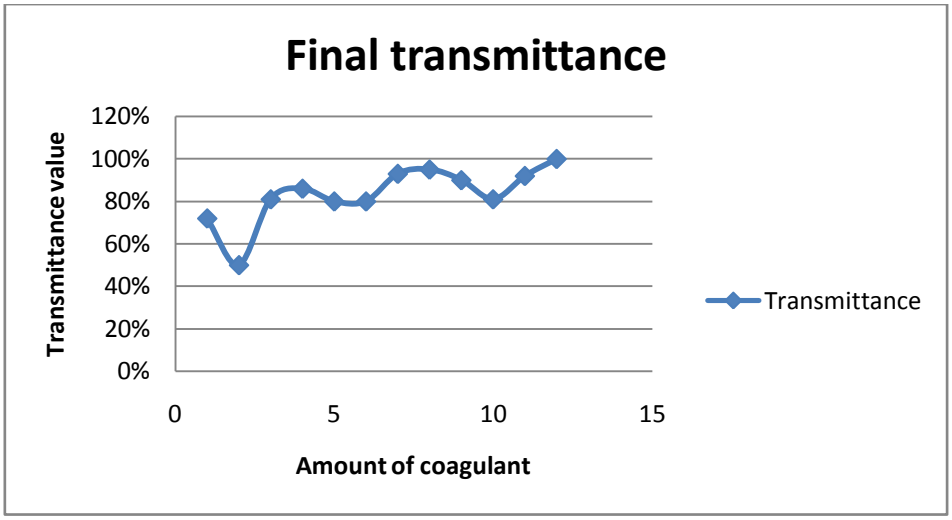

Figure 2: Transmittance Vs Coagulant dosage for the sample

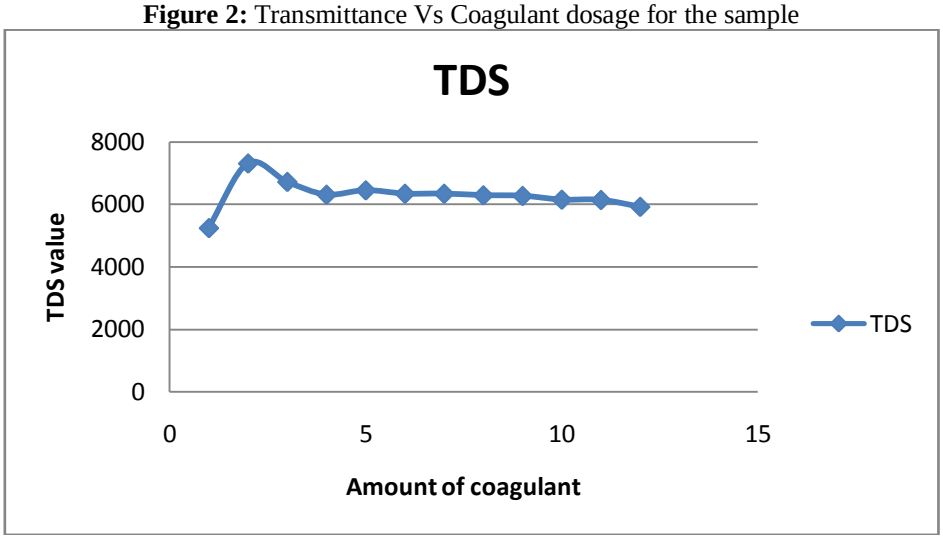

Figure 2: TDS Vs Coagulant dosage for the sample

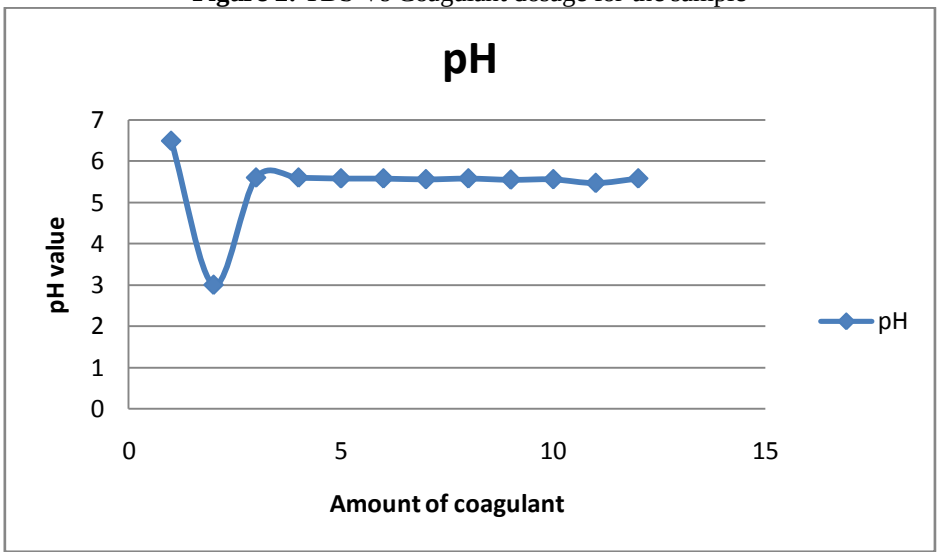

Figure 2: pH Vs Coagulant dosage for the sample

Conclusion

Seed coagulants (M.O) are satisfactory new agents for water treatment. In this work we obtained that while adding the M.O along with alum, the result is becoming more acceptable. That is, by increasing the dosage of M.O, the value of transmittance is increasing

(100%) and became equal to that of water. The pH value is increasing and came to a range of 6-7.this indicates that the effect of M.O is satisfactorily working in the dying industry waste water treatment. So the usage of natural coagulants will avoid the common problems obtained by the chemical coagulation treatment. In this study it is proved that the odour is completely removed by this simple coagulation process and it become unobjectionable. Moringa Oleifera is a plant which is readily available in Tamilnadu can be effectively used as a coagulant aid for removing color, odour, and absorbance. The waste water can be simply send for filtration process after which it can be disposed off in the public sewers.

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