

An Experimental Investigation on Treatment of Tannery Effluent Using *Azadirachta Indica*

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Abstract— A preliminary investigation was carried out for the feasible use of *Azadirachta indica* leaf powder as a natural coagulant to the treatment of tannery effluent. In this paper, *Azadirachta indica* leaf powder of 1, 2, 3 and 4mg/L dosages were used. Floc formation in coagulation process had been studied in the laboratory scale to determine the optimum dosage of natural coagulant. The above dosages were used in pre-treated tannery effluent with coagulants were considered to evaluate the percentage removal efficiency on the major pollutants of concern in tannery effluent such as turbidity, TSS, TDS, COD and BOD. From the observed results, dosage of 3 mg/L gives better removal efficiencies with respect to turbidity, TSS, TDS, COD and BOD and appears to be suitable for tannery effluent treatment, when compared with other dosages.

Keywords— *Azadirachta indica* (Neem leaf), Coagulation, Chemical oxygen demand (COD), Tannery, Turbidity.

I. INTRODUCTION

Indian leather industry has established to a large range and is the second larger producer following to China. The industry is equipped mostly with a potential for employment generation, growth and exports, with the annual export touching 2 billion USD. Presently it is on an ever increasing phase with optimum utilization of available raw materials and returns from exports.

Ever increasing industrialization and rapid urbanization have considerably increased the rate of water pollution. The dwindling supplies of natural resources of water have made thus a serious constraint for industrial growth and for reasonable standard urban living. Tanning industry is one of industries, which considered as highly polluting industry [1]. Tannery effluents contain lot of hazardous elements which can affect human immunity when it is directly discharged in water bodies [2]. Tannery generate effluent in the range of 30 – 35 L/kg skin or hide processed with variable pH and high concentration of suspended solids, BOD, COD [1].

In effluent treatment, coagulation has been practiced since earliest time and the main objective is to remove colloidal

impurities hence also removing turbidity from water. Coagulant is a chemical used that is added to the water to withdraw the forces that stabilizes the colloidal particles and causing the particles to suspend in water. Once the coagulant is introduced into the water, the individual colloids must aggregate and grow bigger so that the impurities can be settled down at the bottom of the beaker and separate from the water suspension. Aluminium and iron coagulants are commonly used in most industries. However, when aluminium is used as a coagulant in waste water treatment, it can cause several bad effects on human health such as intestinal constipation, loss of memory, convulsions, abdominal colic's, loss of energy and learning difficulties [3].

In recent years there has been considerable interest in the development and usage of natural coagulants which can be produced or extracted from microorganisms, animal or plant tissues. The coagulants should be biodegradable and less voluminous sludge that amounts only 20 – 30% that of alum treated counterpart [4]. Therefore this study is carried out to analyze the effect of *Azadirachta indica* leaf powder as a primary coagulant in clarifying tannery effluent in coagulation process at its optimum dosage. The optimum dosage and its removal efficiencies of *Azadirachta indica* leaf powder on pH, turbidity, TSS, TDS, COD and BOD were determined.

II. MATERIAL AND METHODOLOGY

2.1 Collection of *Azadirachta indica* leafs

In this study *Azadirachta indica* leaf (Neem leaf) was used as natural coagulant. It was collected from road side of Tiruchengode city. Figure 1 shows the pictorial view of *Azadirachta indica*.



Fig.1: Azadirachta indica

2.2 Preparation of Natural Coagulant

Azadirachta indica leaves were picked from the branches of the tree and dried in oven at 60° for 24 hours. Then dried leaves were ground to fine powder and sieved to get particles of size 600 µm. Figure 2 shows the pictorial view of Azadirachta indica leaves powder.



Fig.2: Azadirachta indica leaves powder

2.3 Collection of raw water

The raw effluent was collected from the tannery industry at Brahmana Periya Agraharam in Erode District. Sample was taken from the equalization tank and their initial parameter shown in table 1. Figure 3 shows the pictorial view of equalization tank.



Fig.3: Equalization Tank

Table.1: Initial tannery effluent characteristics

Sl. NO	PARAMETERS	RAW EFFLUE NT	BIS LIMITS IS 2490-2009
1	pH	10.92	5.5 – 9.0
2	Turbidity(NTU)	1283	-
3	TDS(mg/L)	13300	2100
4	TSS(mg/L)	520	100
5	COD(mg/L)	960	250
6	BOD(mg/L)	768	30

2.4 Coagulation Studies

Jar test is the most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus was used in the experiment to coagulate sample of tannery effluent using natural coagulant.



Fig.4: Jar test apparatus

This apparatus consists of four beakers to be agitated simultaneously. 500ml of tannery effluent sample is taken into one-liter beakers and placed under the jar test apparatus. Previously prepared powder of Azadirachta indica leaves powder is taken into various dosages i.e., 1, 2, 3 and 4 mg/L was added simultaneously and stirred for 10min at 180 rpm, followed by 10 min slow stirring for flocculation [5]. Then the solution is allowed to settle for twenty four hours and measure the turbidity, pH, COD, BOD, TSS and TDS.

2.5 Optimization of Coagulant Dosage by turbidity and pH

This is found by using jar test apparatus. The turbidity and pH was measured after 24 hours, the turbidity and the pH for dosage of 1, 2, 3, 4 mg/L was found to be 510, 348, 184, 440 NTU and 7.84, 7.98, 7.79, 8.07. Optimum dosage from above is found as 3mg/L.

III. RESULTS AND DISCUSSIONS

3.1 Effect of Azadirachta indica leaves powder on the removal of turbidity

It was found by using CL 52D Nephelometer. For the various dosage of natural coagulant with sample and their

percentage of removal is shown in table 2 and chart 1. Initial turbidity is noted as 1283NTU before coagulation. At various dosages like 1, 2, 3 and 4mg/L the percentage of removal of turbidity was 60.26, 72.88, 85.66 and 65.71 % respectively. The turbidity removal percentage was higher in dosage of 3mg/L.

Table.2: Turbidity of sample

Sl. No	Volume of sample (ml)	Dosage (mg/L)	Turbidity reading (NTU)		Turbidity removal %
			Initial	Final	
1	1000	1	1283	510	60.25
2	1000	2	1283	348	72.88
3	1000	3	1283	184	85.66
4	1000	4	1283	440	65.71

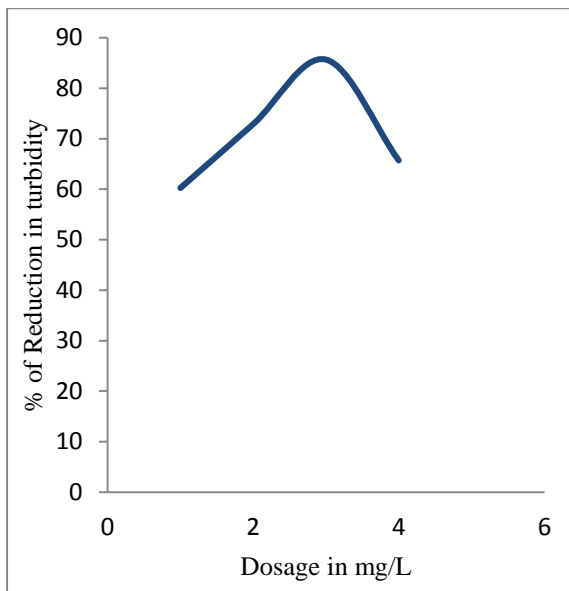


Chart.1: Azadirachta indica dosage vs. Removal of turbidity

3.2 Effect of Azadirachta indica in pH of sample

pH of sample was found by using LI120 pH meter, for various dosage of Azadirachta indica with sample is shown in table 3 and chart 2. At various dosages like 1, 2, 3 and 4mg/L the pH of the sample was 7.84, 7.98, 7.79 and 8.07 respectively. The maximum reduction in pH was found at dosage of 3mg/L.

Table.3: pH of sample

Sl. No	Volume of sample(ml)	Dosage (mg/L)	pH	
			Initial	Final
1	1000	1	10.92	7.84
2	1000	2	10.92	7.98
3	1000	3	10.92	7.79
4	1000	4	10.92	8.07

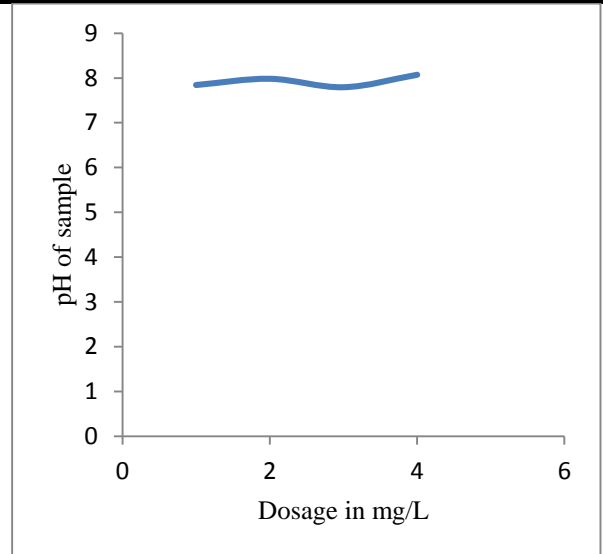


Chart.2: Azadirachta indica dosage vs. pH

3.3 Effect of Azadirachta indica leaves powder on removal of COD of sample

For the various dosages of Azadirachta indica leaves powder with sample and their effect on removal of COD is shown in table 4 and chart 3. At dosages like 1, 2, 3 and 4mg/L the percentage of removal of COD of the sample is 72.81, 74.79, 80.42 and 75.83%. The maximum removal percentage of COD was found in 3mg/L.

Table.4: COD of sample

Sl. No	Volume of sample (ml)	Dosage (mg/L)	COD (mg/L)		COD removal %
			Initial	Final	
1	1000	1	960	260	72.81
2	1000	2	960	242	74.79
3	1000	3	960	188	80.42
4	1000	4	960	232	75.83

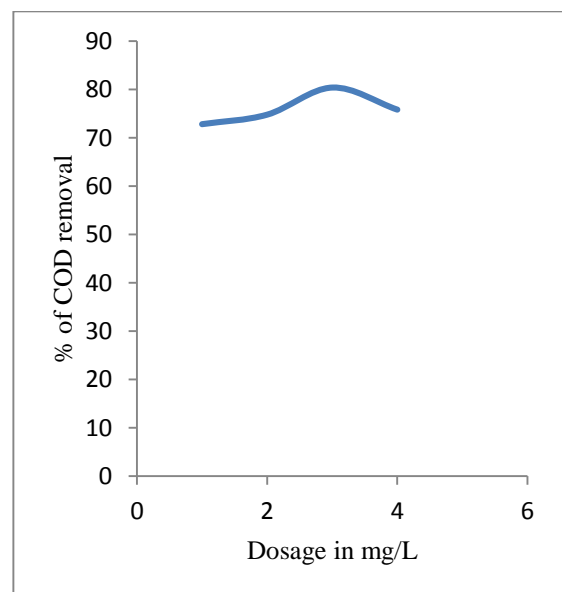


Chart.3: Azadirachta indica dosage vs. % of COD removal

3.4 Effect of Azadirachta indica leaves powder on removal of BOD of sample

For the various dosages of Azadirachta indica leaves powder with sample and their effect on removal of BOD is shown in table 5 and chart 4. At various dosages like 1, 2, 3 and 4mg/ L the percentage of removal of BOD of the sample is 79.42, 87.23, 96.74 and 89.71%. The maximum removal percentage of BOD was found in 3mg/L.

Table.5: BOD of sample

Sl. No	Volume of sample (ml)	Dosage (mg/L)	BOD (mg/L)		BOD removal %
			Initial	Final	
1	1000	1	768	158	79.42
2	1000	2	768	98	87.23
3	1000	3	768	25	96.74
4	1000	4	768	79	89.71

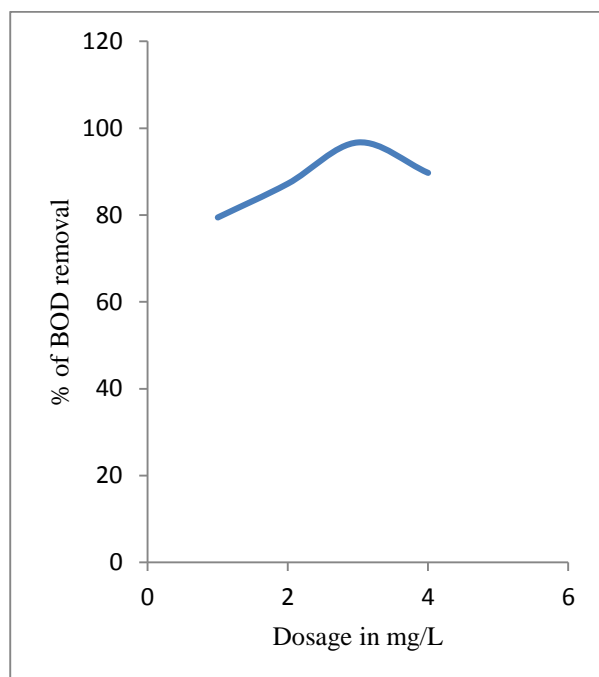


Chart.4: Azadirachta indica dosage vs. % of removal of BOD

3.5 Effect of Azadirachta indica leaves powder on removal of TSS of sample

For the various dosages of Azadirachta indica with sample and their effect on removal of TSS is shown in table 6 and chart 5. At dosages like 1, 2, 3 and 4mg/ L the percentage of removal of TSS of the sample is 76.35, 81.15, 84.81 and 71.73%. The maximum removal percentage of TSS was found in 3mg/L.

Table.6: TSS of sample

Sl. No	Volume of sample (ml)	Dosage (mg/L)	TSS (mg/L)		TSS removal %
			Initial	Final	
1	1000	1	520	123	76.35
2	1000	2	520	98	81.15
3	1000	3	520	79	84.81
4	1000	4	520	147	71.73

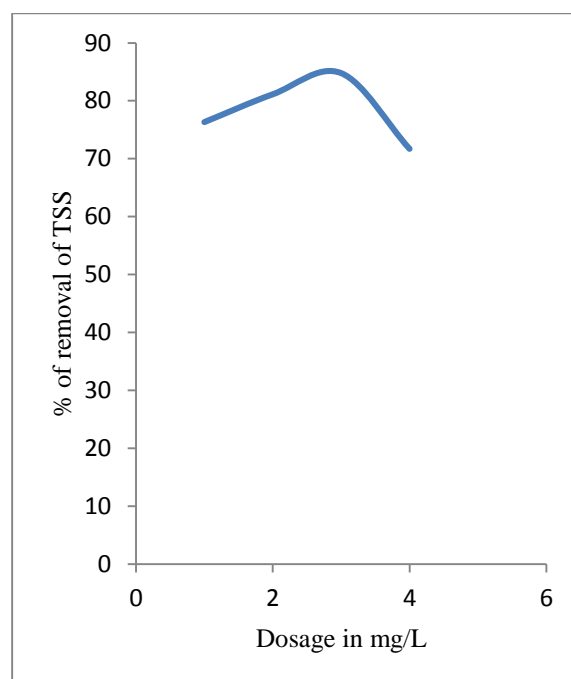


Chart.5: Azadirachta indica dosage vs. % of removal of TSS

3.6 Effect of Azadirachta indica leaves powder on removal of TDS of sample

For various dosage of Azadirachta indica with sample and their effect on removal of TDS is shown in table 7 and chart 6. At dosages like 1, 2, 3 and 4mg/ L the percentage of removal of TDS of the sample is 75.64, 77.52, 87.06 and 82.11%. The maximum removal percentage of TDS was found in 3mg/L.

Table.7: TDS of sample

Sl. No	Volume of sample (ml)	Dosage (mg/L)	TDS (mg/L)		TDS removal %
			Initial	Final	
1	1000	1	13300	3240	75.64
2	1000	2	13300	2990	77.52
3	1000	3	13300	1720	87.06
4	1000	4	13300	2380	82.11

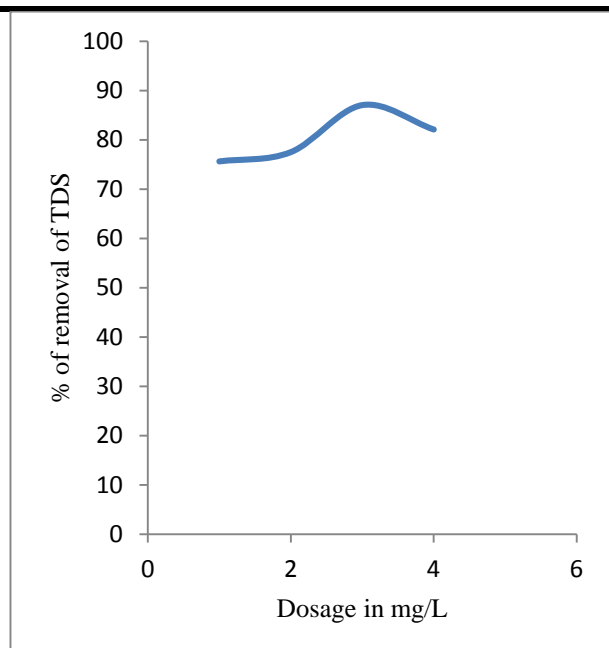


Chart.6: *Azadirachta indica* dosage vs. % of removal of TDS

IV. CONCLUSION

The tannery effluent collected from Erode district was examined for various parameter like Turbidity, pH, TDS, TSS, COD and BOD were not in permissible limit and in need of elimination. The feasibility in the treatment of tannery effluent using natural coagulant *Azadirachta indica* leaves powder had been taken for investigation. Optimum dosage for maximum removal (%) in turbidity, COD and BOD using the dosage of *Azadirachta indica* leaves powder was 3mg/L. When *Azadirachta indica* leaves powder was used as coagulant and added the dosage of 3mg/L found that percentage of removal of turbidity, COD, BOD, TSS and TDS were 85.66%, 80.42%, 96.74%, 84.81% and 87.06%. As compared to the other dosages it has more potential for the removal of tannery effluent.

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