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A Study On Strychonomous Potatorum As Natural Coagulant For Treatment Of Textile Waste Water

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Abstract - *A preliminary investigation was carried out for the feasible use of Strychonomous potatorum as a natural coagulant to the treatment of textile waste water. In this paper, natural coagulant Strychonomous potatorum and Chemical Coagulant Alum of 10, 20, 40, 60 and 80 mg/L dosages were used. Floc formation in coagulation process had been studied in the laboratory scale to determine the optimum dosage of natural and chemical coagulants. Various proportions of SP: (Al2(SO4)3 like 0:0 (P0), 10:90 (P1), 20:80 (P2), 30:70 (P3), 40:60 (P4), 50:50(P5),60:40 (P6),70:30 (P7), 80:20 (P8) and 90:10 (P9) were used in Pre and post treated textile wastewaters with coagulants were considered to evaluate the percentage removal efficiency on the major pollutants of concern in textile effluent such as turbidity, TSS, TDS, COD and BOD. From the observed results, the blended coagulant SP: (Al2(SO4)3 of 40:60 dosage ratio gives better removal efficiencies with respect to turbidity, TSS, TDS, COD and BOD and appears to be suitable for textile waste water treatment, when compared with other dosage ratios.*

Keywords- *Alum ,floc, Jar Test, Strychonomous potatorum, Textile Waste Water*

I INTRODUCTION

Waste water disposal is the major problem being faced by developing countries, like India. Presently, only about 10% of the generated waste water is treated and the rest is discharged into water bodies. Textiles are among the basic needs of human being. India is the world's second largest producer of textiles and garments after China .Textile dyeing processes are among the most environmentally unfriendly industrial Processes, because they produce colored wastewaters that are heavily polluted with dyes, textile auxiliaries and chemicals [1]. Wastewater generated by different production steps of a textile mill have a high pH, temperature, detergents, oil, suspended and dissolved solids, dispersants, leveling agents, toxic and non biodegradable matter, color and alkalinity. Important pollutants in textile effluent are mainly recalcitrant organics, color, toxicants and surfactants, chlorinated compounds (AOX)[2].

In the past several decades, many techniques have been developed to find an economic and efficient way to treat the textile wastewater. The treatment methods of industrial wastewater include activated carbon adsorption, oxidation, chemical coagulation/flocculation; electrochemical methods, membrane techniques [3], [4] and biological treatment processes are frequently used to treat textile effluents. These processes are generally efficient for Biochemical oxygen demand (BOD) and suspended solids (SS) removal, but they are largely ineffective for removing color from the wastewater [5]. But coagulation-flocculation is the most common chemical treatment method used for Decolorization [6]. Coagulation or flocculation process was conducted for the treatment of industrial waste water to achieve maximum removal of COD and TSS. [7]. Colloid particles are removed from water via coagulation and the flocculation processes. [8].Many coagulants are widely used in industrial waste water treatment processes. These coagulants can be classified into inorganic coagulants (e.g. aluminum sulfate, polyaluminum chloride, ferric chloride), synthetic organic polymers (e.g. polyacrylamide derivatives and polyethylene amine) or naturally occurring coagulants (e.g. Chitosan, plant extracts) [9].

Aluminium salts are the most widely used coagulants in water and wastewater treatment all over the world. However, the studies by several workers have raised doubts about introducing aluminum into environment [10]. However, some studies have reported that aluminum that remains in the water after coagulation, may induce Alzheimer's disease [11] besides, many developing countries can hardly afford the costs of imported chemicals for water and wastewater treatment. As an alternative to conventional coagulants, seeds, leaves, pieces of bark, roots, fruit extracts and plant ashes can also be used. Some examples of traditionally used coagulants aids are seeds from the Indian Nirmali tree (Strychnos potatorum), seeds of the trees of the family of the Moringacceae: Moringa Oliefera, occurring in India, Senegal, Sudan (Behenus tree) and Moringa

Stenopetala, Kenya, Sap from the steam of the tuna cactus (Opuntia ficus indica) occurring in Peru and Chile, two commercially available extracts are Tunaflex A and B, the bark of the South American tree Schinopsis Quebracho-Colorado which contains tannin: it is known commercially as "Floccatan;"Potato Starch and Seeds from Tamarina indica. Although many plant-based coagulants have been reported, only four types are generally well-known within the scientific community, namely, Nirmali seeds (Strychnos potatorum), Drumstick (Moringa Oliefera), Tamarind (Tamarindus indica), Tannin and Cactus [7],[12],[13],[14].

Therefore, this study was carried out to analyze the effect of blended Strychnos potatorum seed (SP) and alum as a primary coagulant in clarifying textile wastewater in coagulation process at its optimum dosages. The optimum dosage and its removal efficiencies of blended Strychnos potatorum seed (SP) and alum on pH, turbidity, TSS, TDS, COD and BOD were determined.

II. MATERIALS AND METHODS

2.1. Collection of *Strychonomous potatorum* and Alum

Strychonomous potatorum seeds were collected from Tamilnadu Agriculture University, Coimbatore and chemical coagulant Alum was collected from local markets of Erode city. The photo view of Strychonomous potatorum seed powder was shown in Figure 1.

Figure 1. Strychonomous Potatorum Seed Powder

2.2. Collection and sampling of Textile Waste water

Grab sampling technique confined to 1060 –B of APHA-19th Edition was used to collect the effluent. Twenty liters of samples were collected and preserved at 4 °C in the laboratory incubator for further use.

2.3. Preparation of Strychonomous Potatorum Stock Solution

Strychnos seeds, due to their hard structure, could not be powdered in a grinder. The seeds were kept immersed in 50 mL water containing 2mL Conc. HCl. After a week, the mixture was mashed to a soup-like solution, which was washed through a nylon cloth and the material retained on the cloth was oven dried for 24 h at 103 to 105 °C and weighed. Fresh solutions were prepared daily and kept refrigerated to prevent any ageing effects. Solutions were shaken vigorously before use [8], [10], [11].

2.4. Preparation of Alum stock solution

1 gm of the Alum was mixed with 100 ml of distilled water. This mixture was stirred for 5 minutes so that all the Alum powder is soluble into the distilled water.

2.5. Physio-chemical Analysis of Textile Effluent

The wastewater was exemplified in terms of pH, turbidity, SS, TDS, COD and BOD. These parameters were determined following analytical methods given in the series of standard methods for the examination of water and wastewater. Methods - 2130 -B, 2540-C, 2540-D, 5210-B and 5220-D were used for the measurement of turbidity, TSS, TDS, COD and BOD, respectively16. pH was measured using digital SCHOTT pH meter model C G824 (accuracy pH ± 0.1).

2.6. Optimization of *S. potatorum* and Alum Dosage Using Jar Test

The optimizations for *S. potatorum* and alum dosage were performed using the jar test apparatus. The apparatus permitted four beakers to be agitated all together. 0.5 L of textile wastewater were dosed with 10, 20, 40, 60 and 80 mg/L of natural coagulants were stirred rapidly for 10 min at 180 rpm, followed by 10 min slow stirring for flocculation. The coagulant dosage can be selected depending on the turbidity of wastewater. Floc formation can be observed throughout this time. Flocs were permitted to settle for one hour before obtained for samples analysis. These procedures are performed for several times so that the optimum pH and dosage of coagulant can be calculated. [15], [16]. After settling, 30 mL of the sample was taken from the middle of each beaker using a pipette and placed in small beaker for further analysis.

III. RESULTS AND DISCUSSIONS

3. General

An initial experiment was carried out to determine the preliminary characteristics of textile effluent for examining the effectiveness of the *S. potatorum* and Alum as a coagulant. The characteristics of raw textile effluent were presented in Table 1.

Table 1. Characteristics of Raw Textile Effluent

Parameters	Textile effluent
Turbidity, NTU	996
TDS, mg/L	5450
TSS, mg/L	3235
BOD, mg/L	765
COD, mg/L	2100

3.1. Effect of SP: $(Al_2(SO_4)_3$ in Floc Formation

The size formed with *S. potatorum* 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. Figure 2 illustrated the optimum dosage ratio 40:60 dosage ratio of SP: $(Al_2(SO_4)_3$ produces 162 mL of flocs when it was agitated with the textile effluent. Subsequently 0:0, 10:90, 20:80, 30:70, 50:50, 60:40, 70:30, 80:20, 90:10 and 100:0 dosage ratio of SP: $(Al_2(SO_4)_3$ *generates* 0mL, 81ml, 93mL, 137mL, 151ml, 122mL, 104mL, 86 mL and 78 mL of flocs with respect to their corresponding dosages.

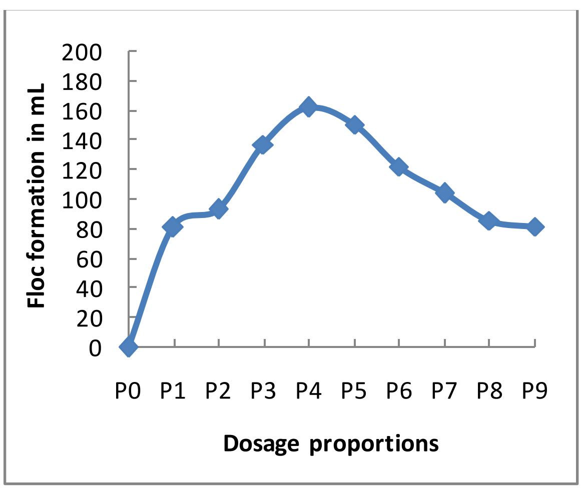

Figure 2. Floc Formations of Various Dosages

3.2. Effect of SP: $(Al_2(SO_4)_3$ on the Removal of Turbidity

The removal (%) of turbidity using various dosage proportions of SP: $(Al_2(SO_4)_3$ was depicted in Figure 3. The initial turbidity was recorded as 996 NTU before coagulation. The highest turbidity removal (%) was found to be 75.2% at 40:60 dosage proportion of SP: $(Al_2(SO_4)_3$. The removal (%) in turbidity with addition of various dosage proportion as 0:0, 10:90, 20:80, 30:70, 50:50, 60:40, 70:30, 80:20 and 90:10 in textile waste water achieves 0, 51.69, 57.26, 68.93, 66.27, 53.11, 51.94 ,50.27 and 40.92 respectively. From the results it is evidently proven, 40:60 dosage proportions of SP: $(Al_2(SO_4)_3$ increases the turbidity removal.

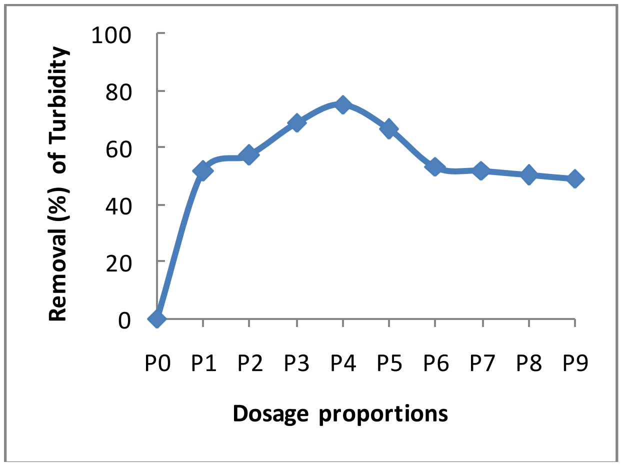

Figure 3. Removal (%) Of Turbidity With Various Dosage Proportions of Sp: $(Al_2(SO_4)_3$.

3.3. Effect of SP: $(Al_2(SO_4)_3$ on the Removal of TDS

Before addition of the blended coagulant, the total dissolved solid (TDS) of the raw textile waste water was 5450 mg/L. A plot between TDS removal (%) and dosage ratios of SP: $(Al_2(SO_4)_3$was shown in Figure 4. A gradual increase in TDS removal (%) of 0, 47.39, 52.47, 60.47 and 67.91 was achieved by 0:0, 10:90, 20:80, 30:70 and 40:60 dosage proportions of SP: $(Al_2(SO_4)_3$ respectively. The maximum TDS removal (%) of 67.91 was shown by 40:60 dosage proportions of SP: $(Al_2(SO_4)_3$.

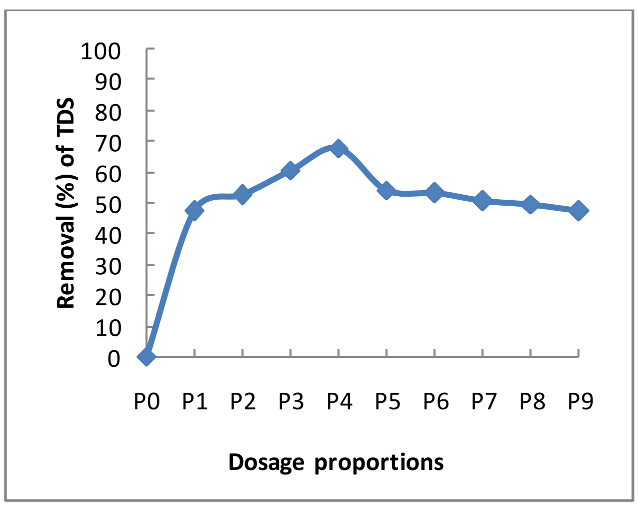

Figure 4. Removal (%) Of TDS With Various Dosage Proportions of Sp: $(Al_2(SO_4)_3$.

3.4. Effect of SP: $(Al_2(SO_4)_3$ on the Removal of TSS

As seen from Figure 5, total suspended solids removal (%) of textile wastewater were gradually increased as 0, 51.21, 57.21, 61.35 and 79.23 at 0:0, 10:90, 20:80, 30:70 and 40:60 dosage proportions of SP: (Al_2 $(SO_4)_3$ respectively. The present study clear that, the TSS removal (%) were registered effectively as 79.23 % at 40:60 dosage proportions of SP: (Al_2 $(SO_4)_3$ and decreased as 65.76, 65.24, 60.62 56.21and 54.36 at dosage proportions of 50:50, 60:40, 70:30, 80:20 and 90:10 respectively.

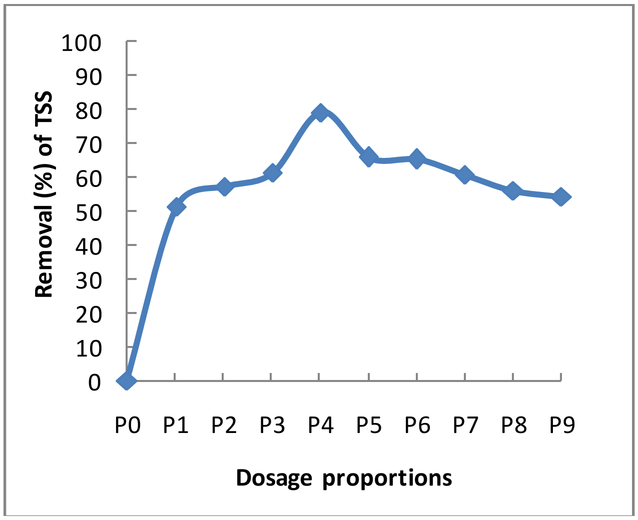

Figure 5. Removal (%) Of TSS With Various Dosage Proportions of Sp: ($Al_2(SO_4)_3$.

3.5. Effect of SP: (Al_2 $(SO_4)_3$ on the Removal of BOD and COD

Figure 6 and 7 depicted the removal of BOD and COD using various dosage ratios of SP: (Al_2 $(SO_4)_3$ respectively. The highest BOD and COD removal (%) was found to be 69.43 and 74.93 at 40:60 dosage proportions of SP: (Al_2 $(SO_4)_3$ respectively. From the results it had been proved that, the effective removal of BOD and COD was achieved by the blended coagulant.

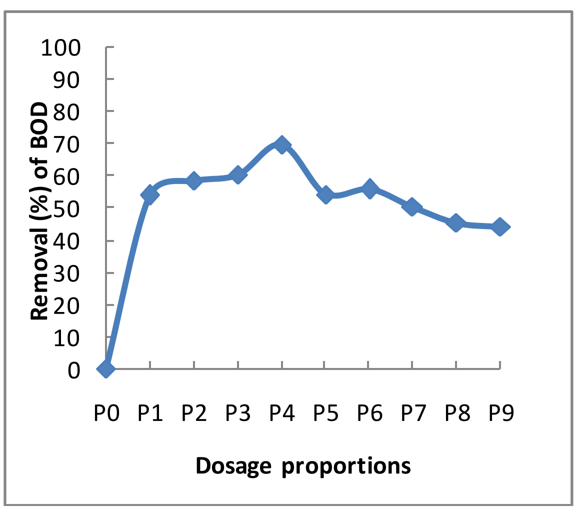

Figure 6. Removal (%) Of BOD With Various Dosage Proportions of Sp: ($Al_2(SO_4)_3$.

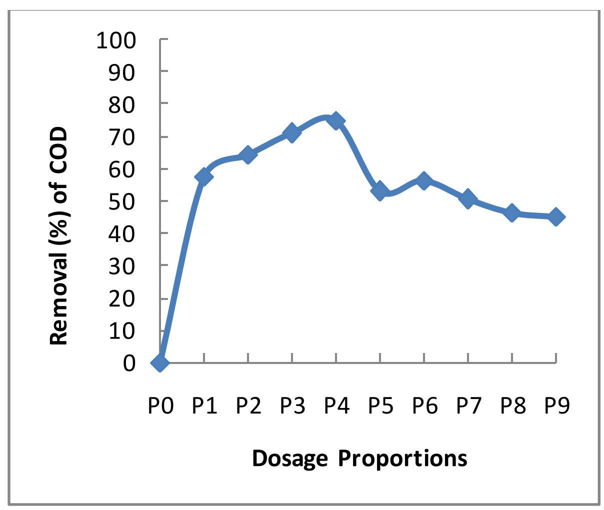

Figure 7. Removal (%) Of COD With Various Dosage Proportions of Sp: ($Al_2(SO_4)_3$.

IV. CONCLUSIONS

The collected textile waste water was examined for the various parameters, in which Turbidity, TSS, TDS, BOD and COD were in superior limits and in demand of elimination. The feasibility in the treatment of textile waste water using natural coagulant *Strychnos potatorum (SP)* and Chemical coagulant Alum (Al_2 $(SO_4)_3$ in various proportions had been taken for investigation. Optimum dosage proportion for maximum removal (%) of physio-chemical parameters using blended coagulant was found to be 40:60. As compared to the other dosage ratios, it was observed from obtained data that 40: 60 of SP: (Al_2 $(SO_4)_3$. has more potential for the removal of concern pollutants in textile waste water. Hence it is recommended to utilize the blended coagulant SP: (Al_2 $(SO_4)_3$ for the treatment of Textile waste water.

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