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An Investigation of Effect of Natural coagulant (Tulsi) for reduction of pH, Turbidity and COD from sewage water

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Abstract - *Sewage is the main sources of water pollution, there is no proper way to handle the sewage, so it pollutes the fresh water source. Activated sludge process, oxidation ponds, aerated lagoons and trickling filters are the standard treatment process, this treatment process requires large area, huge energy and requires time which increases cost of the treatment. Using natural coagulants the cost of the treatment process can be reduced. In this project holly basil are used as natural coagulant. Using this coagulant turbidity of wastewater is to be reduced. Analysed the parameters like pH, Turbidity, Chemical oxygen demand. For 150mg/100ml dosage the efficiency of turbidity reduction by Holy basil and are 69.82%.For 150mg/100ml dosage the efficiency of Chemical oxygen demand reduction by Holy basil powder are 43.11%. Overall, Holy basil leaves as an eco-friendly biomaterial was revealed to be a very efficient coagulant and a promising option for the removal of pH, turbidity and COD from sewage waters.*

Key Words: Sewage waste water, Natural coagulant, Holy basil powder, pH, Turbidity, COD.

1. INTRODUCTION

In present situation suitable management of wastewater is essential. The treatment of wastewater delayed considerably back its collection. Treatment is considered essential only after the self – purification capacity of the receiving water is exceeded and annoyance conditions became insupportable. The intention of wastewater treatment is to eliminate the pollutants from water so the treated water can meet the satisfactory quality standards. The quality standards commonly depend on water will be reused or discharged into receiving stream. The type of treatment required, however depends on the nature and quality of both sewage and source of disposal. Turbidity in wastewater is due to suspended matter, such as clay, silt, and finely divided organic and inorganic matter, soluble colored organic matters. Turbid water has cloudy look and it is pleasantly not attractive. The turbidity goes on increases sewage becomes stronger [12].

Due to the lack of appropriate wastewater treatment systems in these rural or underdeveloped societies, the best instant option is to use simple and relatively cost effective point-of-use (POU) technologies such as coagulation. Coagulation is an important process in the treatment of wastewater. Its application includes removal of turbidity from wastewater.

Holy basil leaves is not giving poisonous effect. It is easily available, eco-friendly and cheaper method of water treatment. In rural areas this type of treatment is better and it is cost effective. After the treatment the sludge settled at the bottom of tank, can be used as bio-fertilizers is another advantage of this method in rural areas [3].

In the ancient times, they don't know the water treatment technologies, so they generally boil the turbid water and filter the water using some cloths. This is how it is done by our ancestors and even in today's poor and some middleclass homes. Our ancestors had a simple solution for this turbid water that is, they just add a little bit of drumstick powder to the water for a minute and this powder settles the dirt particle present in the water down. This process also alters the other parameters like pH, conductivity and hardness of water. An experiment was conducted by Francis Kweku Amagloh and Amos Benang [4] indicated the efficiency of Moringa Oleifera seeds. It removes turbidity up to 97% in high turbid water and 86% in low turbid water.

Sewage is the main source of water pollution. Know a days there no proper maintenance of sewage. So it pollutes the fresh water source. Activated sludge process, oxidation ponds, aerated lagoons and trickling filters are the conventional treatment process in India.

This treatment process basically requires land, energy which increases overall cost of treatment process. So naturally available coagulants were used to reduce the treatment cost. Present work aims to evaluate the use of Holy basil leaf powder as coagulants as well as for removal of turbidity and reports an environmental benefits and it can be used for purification of waste water from domestic sources in rural areas.

2. MATERIALS AND METHODS

2.1 Sewage water:

Sewage was collected from Honnali taluk, Sampling site, APMC channel near Hirekalmata, Honnali, initial concentration of turbidity and Chemical oxygen demand was analyses for understand the initial concentration of the sewage. This sewage was used as stock solution of initial concentration COD is 3488 mg/L concentration and for turbidity the initial concentration is 13.5 NTU.

2.2 Preparation of coagulants:

Holy basil leaves were collected and washed with distilled water and dried naturally under the sunlight for 3 days. The dried holy basil leaves were crushed and powdered and passing through 150micron sieve. Finally these powder used as a natural coagulant in wastewater treatment. Holy basil (Tulsi) leaves were collected from household in Davangere city. The leaves are allowed to dry in the laboratory oven at a temperature of 350C to 500C for 24 hours. The dried leaves were crushed in to medium fine powder with domestic food blender.

2.3 Methodology

After the preparation of coagulant and wastewater sample collection, the samples was analyzed before the treatment and the analyzed parameters like turbidity and COD. The suspension was vigorously shaken for 0.5 h using a magnetic stirrer to promote water extraction of the coagulant proteins and this was then passed through Whatman no. 1 filter paper [5 and 8]. Fresh solutions were prepared daily and kept refrigerated to prevent any ageing effects. Solutions were shaken vigorously before use [1, 6 and 11].

For finding out efficiency of turbidity removal, 500 ml of water sample was poured in four beaker of 1 L capacity. Holy basil leaves suspension was added as coagulant in concentration of 50mg, 100mg, 150mg and 200mg/L. The paddles of jar test apparatus were put in the beaker. The paddles were rotated at fast speed for 1 min so as to thoroughly mix the coagulant. Slow mixing was carried out for 15 min so as to bring coagulant and colloidal particles in intimate contact and form a floc. Settlement period of 15 min was allowed so as to settle down the floc. The residual turbidity was measured after 15 min of settlement.

3. RESULTS AND DISCUSSION:

A preliminary analysis was carried out to determine the preliminary characteristics of sewage water for examining the efficiency of the Holy basil leaves as a coagulant. The characteristics of raw sewage water were presented in Table 1.

Table -1: Characteristics of Raw Sewage Water Sample

Sl. No.	Parameters	Raw Sewage
1.	pH	9.14
2.	Turbidity, NTU	123.50
3.	Electrical Conductivity, µs/cm	798.00
4.	Total Dissolved Solids, ppm	734.00
5.	Chemical Oxygen Demand, mg/L	3488.00

Table -2: Various Dosage of holy basil leaf powder added in 100 ml sewage samples

Sl. No.	Parameter	After treatment with holy basil leaf powder in mg/100ml			
		50 mg/ 100ml	100 mg/ 100ml	150 mg/ 100ml	200 mg/ 100ml
1	pH	8.55	7.23	7.13	7.19
2	Turbidity (NTU)	96.13	64.42	37.23	43.42
3	Conductivity(µs/cm)	582.0	523.0	481.0	496.0
4	TDS (PPM)	528.4	447.2	382.7	396.7
5	COD (mg/l)	2720	2626	1984	2240

3.1 Effect of holy basil leaf powder on the Removal of pH:

Experiment was conducted on sewage sample before treatment showed that the value of pH of the raw sewage sample was 9.14. A plot between pH removal (%) and dosage ratios of holy basil leaf powder was shown in Figure 5. A gradual decrease in pH removal (%) of 8.55, 7.23, 7.13 and 7.19 was attained by 50 mg/100 ml, 100 mg/100 ml, 150 mg/100 ml and 200 mg/100 ml dosage of holy basil leaf powder respectively (Figure 1). The study revealed that decrease the pH in sewage water by holy basil leaf shown coagulants and is more effective [15].

Present study, treatment of holy basil powder was given to Sewage waste water samples in different doses. During the analysis, it was observed that after treatment with holy basil powder, pH was decreased at 50 and 150 dose, but it was partially increased at 200 mg/100ml dose. After treatment the range of pH was 8.5-7.5 and within the limit. The recommended acceptable range of pH for drinking water specified by WHO is between 6.0 and 8.0. The treatments gave a pH range of 8.5 to 7.5 which falls within the reducing trends as the concentrations of the dosing solutions were increased [7].

3.2 Effect of holy basil leaf powder on the Removal of Turbidity

Turbidity indicates the degree to which the water loses its transparency due to the presence of suspended particulate matters. Measurement of turbidity also used to provide an appraisal of the TSS (Total Suspended Solids) concentration. It is essential to eliminate the turbidity of water in order to effectively disinfect it for drinking purposes. Jar test experiments were performed by varying the coagulant dosage (compared in Table 2 for holy basil leaf powder) to find the optimum dosage for maximum turbidity

removal at their optimum Turbidity. Veeramalini [16] reported, a maximum reduction in turbidity was found to be 98% and 70% for estuarine and river water respectively, and also Shilpa [14] investigated in their work, a maximum turbidity removal efficiency of 89.03% was found for lake water when treated with Cactus.

From Figure 2, it was observed that turbidity of collected sewage water sample decreases with increase of coagulant dosage of holy basil leaf powder gave good results. Optimum dosage of holy basil leaf powder for maximum turbidity removal was found to be 150 mg/L Above this dosage suspensions showed a tendency to restores [12]. The initial Turbidity observed was 123.5 NTU in sewage waste water which was beyond the limits of WHO standards. It was observed that the use of holy basil powder showed decrease in turbidity of sewage waste water with increased dose at 50, 100 and 150 mg/100ml respectively. At 150mg/100ml dose turbidity range is 37.26 NTU and at 200mg/100ml dose it is partially increase (Figure 2), so 150mg/100ml is the optimum dosage we concluded [17].

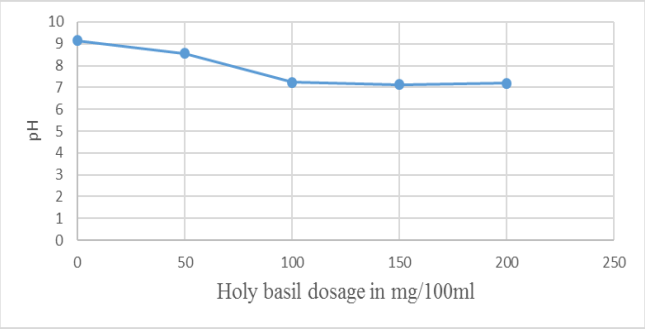

Fig -1. pH of sewage water after treatment with holy basil leaf powder

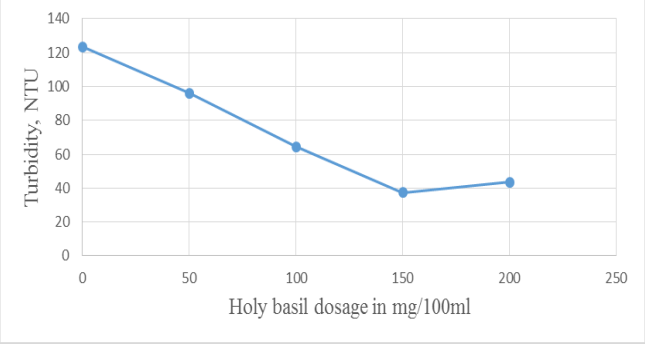

Fig-2. Turbidity of sewage water after treatment with holy basil leaf powder

3.3 Effect of holy basil leaf powder on the Removal of COD

During the current study, treatment with holy basil leaf powder was added to sewage waste water samples in the dosage of 50 mg/100ml, 100 mg/100ml, 150 mg/100ml and 200 mg/100ml. Before treatment with holy basil leaf powder the obtained COD range is 3488mg/100ml. Asrafuzzaman [9] studied the reduction efficacies of Moringa oleifera, Dolichos lablab, Cicer aretinum in treatment of synthetic water and reported that Cicer aretinum is most effective in reduction of turbidity up to 95.89%.

During the analysis it was observed that, after treatment with holy basil leaf powder COD was slowly decreases from 50 to 150mg/100ml and sudden increase in the range of 200mg/100ml. At 150mg/100ml COD range is 1984mg/100ml. So 150mg/100ml is the optimum dosage we observed [10]. Bahman Ramavandi and Sima Farjadfard [2] experimental results indicated that the wastewater could be effectively treated by using a coagulation/flocculation process, where the BOD5/COD ratio of the effluent was improved to 0.48. A low coagulant dose, 1.5mg/L, achieved a high COD removal percentage, 89%, at operational conditions of neutral pH and room temperature. Present study coincide with the results of above researchers.

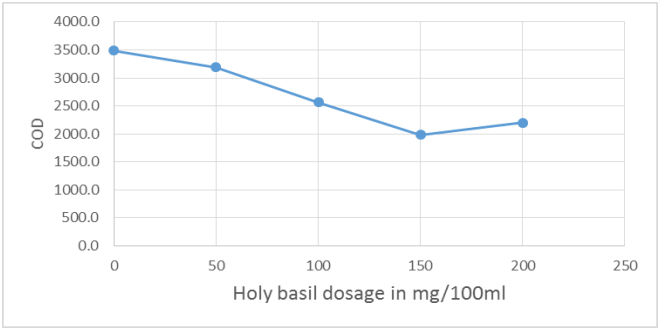

Fig-3. COD of sewage waste water after treatment with holy basil leaf powder.

4. CONCLUSIONS

Holy basil leaf powder acts as a natural coagulant for the treatment of sewage waste water. It reduces the pH, Turbidity and chemical oxygen demand. The reduction efficiency of pH, turbidity and COD at 150mg/100ml is 69.82%, 43.11% and 47.85%. Holy basil leaf powder is not giving toxic effect. It is eco-friendly and cheaper method of water treatment. Holy basil leaf can be used in the rural areas where no facilities are available for the drinking water treatment. After the treatment the sludge settled at the bottom of tank, can be used as bio-fertilizers is added advantage of this method in rural areas. Overall, Holy basil leaves as an eco-friendly biomaterial was revealed to be a very efficient coagulant and a promising option for the removal of pH, turbidity and COD from sewage waters in waste water treatment plants.

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