

Efficiency of Neem Leaf Powder and Banana Pith Powder as a Natural Coagulant

AUTHOR

ABSTRACT

It is necessary to treat the water before use in households because of poor wastewater collection systems contaminates the surface water and poorly managed urban runoff. The essential treatment process of drinking water and wastewater are coagulation and flocculation. Banana pith powder can remove wide variety of contaminants and Neem is one of the flexible trees and it helps in treatment of waste water. The cultivation of neem trees is extremely encouraged in most emerging countries. Protein present in this tropical tree performs as an effective coagulant. Use of chemical coagulants for Treatment of wastewater costs excessive, hence nearly all village inhabitants go for supplies usually which is of minimal quality and disclosing them to waterborne infections. This study objective is to determine the ability of two coagulants which are *Azadirachta Indica* leaf powder (Neem leaf powder) and *Musa paradisiaca* pith powder (Banana pith powder) as a natural coagulant by checking certain parameters such as PH, turbidity, hardness, conductivity, TSS, DO, BOD and jar test is conducted. These experiments were conducted without adding and addition of these coagulants with different dosage for treating canteen waste water and river water. Canteen waste water is collected from our college canteen (KMCT College of engineering for women, Kozhikode) and Kallai river water which is contaminated by industrial effluents is taken as samples for treating. This project shows natural and environment friendly solution for waste water treatment.

IndexTerms—Canteen waste water, Kallai river water, Natural coagulant, *Azadirachta Indica*, *Musa paradisiaca*, TSS, BOD, DO, PH, Turbidity, Hardness, Conductivity.

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I. INTRODUCTION

Water is usually used for variety of purposes like drinking, washing, bathing, recreation as well as numerous other varied industrial applications. According to World Health Organization (WHO) reports, wholesomeness of water means absence of suspended solids, inorganic solids and pathogens. Even though 71% of earth surface is covered by water, only less than 0.3% of all fresh water is in river, lakes and the atmosphere, and an even small amount of earth fresh water contained within manufactured products and biological bodies. Now a days due to poor land use management, drinking water has become scant. Most of the Surface water is being polluted by industrial water discharge, sewage, and run off from the land, while ground water is polluted by waste dumping site and salt water intrusion. Health issues like gastrointestinal illness, reproductive problems caused by presence of certain contaminants in water and immune compromise person may be especially at risk for becoming ill after drinking contaminated water. So this contaminated water must be treatment process before it can be circulated to the consumers for domestic use, including drinking. One of the most simple and essential effective process that can be adopted for waste water treatment is coagulation. From the olden days onwards use of seeds, leave roots, barks, fruit peels, and vegetable peels obtained from the plants are used in purification method. Natural coagulants reveal various benefits which comprise a reduction in collection of sludge, reduced cost, non-poisonous, ecosystem friendly etc.

This project is aimed to evaluate efficiency of natural coagulants such as *Azadirachta Indica* leaf powder (Neem leaf powder) and *Musa paradisiaca* pith powder (Banana pith powder) by treating two different samples such as canteen waste water and kallai river water.

II. OBJECTIVE

- To examine the efficiency of banana pith powder and neem powder as a hypothetical coagulant to treat waste water from canteen and kallai river, with different dosages of coagulant
- Conventional jar test procedure performed
- To compare effectiveness of coagulants in three different samples

III. METHODOLOGY

3.1 Sample Collection

In this project canteen waste water and Kallai River water is used to analyze the efficiency of natural coagulants. Canteen waste water was collected from canteen outlet of KMCT College of Engineering for Women and Kallai River water collected from kadupinimankavu.

3.2 Coagulant Preparation

3.2.1 Preparation of Azadirachta Indica leaf powder

Neem leaves collected and washed with water to remove dust and pulp. Clean leaves dried in sunlight for a period of seven days before crushing. By using common home grinder the leaves were made into fine powder. Powder of 500 g collected in sterile bottle with airtight cap.



Fig-1: Azadirachta Indica leaf powder

3.2.2 Preparation of Musa paradisiaca pith powder

Banana pith collected from the local fruit market at Kozhikode. Kept in sunlight for 2 weeks, and dried pith is collected. This banana pith was made into fine powder by using common home grinder. Powder of 500 g is collected in sterile bottle with airtight cap.



Fig-2: Musa Paradisiaca pith powder

3.3 Treatment Technique

3.3.1 Coagulation flocculation by jar test

Two separate experiments are performed: first, Neem leaf powder as coagulant, second, Banana pith powder as coagulant. The jar test apparatus is used for finding optimum dosage of coagulants and study the effect of coagulant dosage on coagulation. Various parameters such as turbidity, conductivity, TSS, pH, Chloride, Hardness, DO, BOD were measured before and after the coagulation.

Five different dosage of the coagulants were placed in each beaker, the first having 5g, and the remaining five varying from 5-35 g at 5g interval in order to determine the optimum dosage. Five jars were filled with 1000ml of waste water sample and the jars were then placed in the jar test apparatus and the stirrers lowered into each. The stirring speed was set at 100rpm for rapid mixing for 1 minute and 40rpm for slow mixing for 20 minutes. After completing jar test, these samples were allowed to settle for 30 minutes and then the supernatant was taken for analysis. From the results obtained, the dosage of coagulant with best results in removal of turbidity of waste water is taken as optimum.

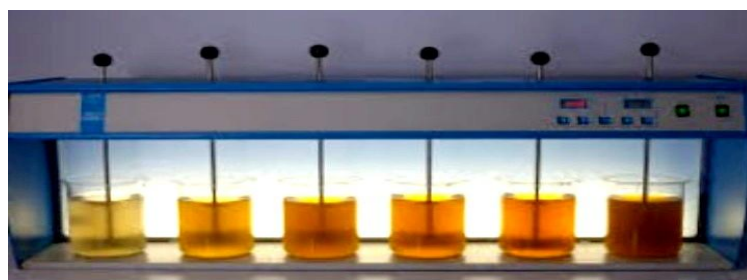


Fig-3: Jar Test

IV. RESULT AND DISCUSSION

This section deals with the various test results and its discussion of coagulation-flocculation in waste water treatment using natural coagulants (neem leaf powder and banana pith powder) in different samples of different sources such as canteen waste water and kallai river water .

4.1 Results of Canteen Waste Water Treatment by Using Neam Leaf Powder and Banana Pith Powder

Table-1: Characteristics of canteen waste water before treatment

Parameters	Before treatment		
	Sample 1	Sample 2	Sample 3
pH	4.16	5.61	5.84
Turbidity(NTU)	80	60	110
Conductivity(mmhos/cm)	4.720	5.28	5.54
Hardness(ppm)	33	23.5	26
TSS (mg/l)	1400	2200	1200
Chloride	Ab	Ab	Ab

Table -2:Effect of coagulant dosage

Sample	Coagulant	Parameters	After treatment						
			5g	10g	15g	20g	25g	30g	35g
1	neem	pH	5.29	5.58	5.40	5.35	5.41	-	-
		Turbidity(NTU)	47	33	43	58	57	-	-
		Conductivity(mmhos/cm)	2.510	1.145	1.603	1.900	2.218	-	-
		Hardness (ppm)	20	8	15	23	32.5	-	-
		TSS(mg/l)	200	100	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana pith	pH	4.42	4.12	4.33	4.50	4.58	-	-
		Turbidity(NTU)	32	28	16	9	7	-	-
		Conductivity(mmhos/cm)	4.02	3.26	2.35	1.80	1.53	-	-
		Hardness(ppm)	25.3	18.2	8.35	6.3	3	-	-
		TSS(mg/l)	600	800	600	400	200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
2	Neem	pH	6.37	6.43	6.22	5.89	5.87	-	-
		Turbidity(NTU)	14	13	17	21	31	-	-
		Conductivity(mmhos/cm)	4.3	1.531	2.28	2.63	3.72	-	-
		Hardness(ppm)	8.7	4	18.5	22	23	-	-
		TSS(mg/l)	800	400	600	1000	1400	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana Pith	pH	5.72	5.64	5.83	5.96	6.12	-	-
		Turbidity(NTU)	23	18	10	8	7	-	-
		Conductivity(mmhos/cm)	4.65	3.95	4.03	3.26	2.77	-	-
		Hardness(ppm)	22.3	20.65	15.7	9.7	5.6	-	-

3		TSS(mg/l)	800	400	600	400	200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Neem	pH	5.95	6.36	6.28	5.93	5.89	-	-
		Turbidity(NTU)	46	35	38	49	51	-	-
		Conductivity(mmhos/cm)	3.142	1.986	2.320	2.62	2.843	-	-
		Hardness(ppm)	13.5	8	16.5	20.83	23	-	-
		TSS(mg/l)	600	200	600	400	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana Pith	pH	-	-	6.12	6.26	6.30	6.	6.30
		Turbidity(NTU)	-	-	28	26	18	22	26
		Conductivity(mmhos/cm)	-	-	4.23	3.16	2.47	3.03	3.102
		Hardness(ppm)	-	-	16.5	10.17	5.98	8.1	9.20
		TSS(mg/l)	-	-	600	400	200	600	800
		Chloride	-	-	Ab	Ab	Ab	Ab	Ab

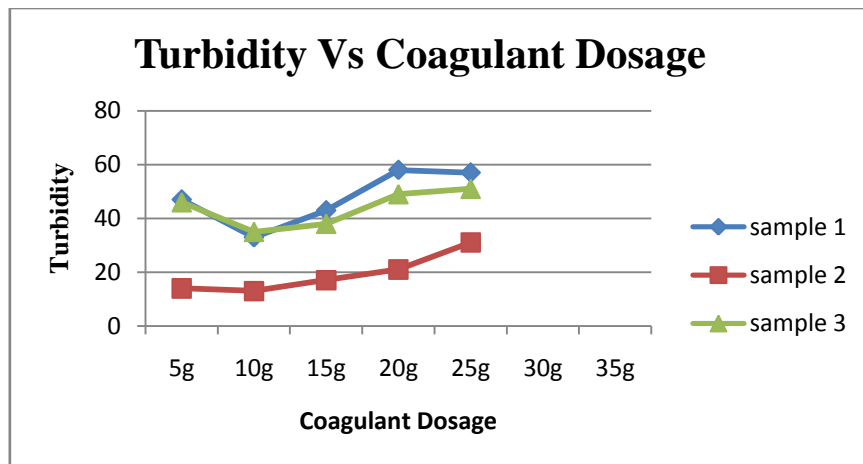


Fig 4: Turbidity Vs Coagulant dosage (Neem leaf powder) graph of canteen waste water

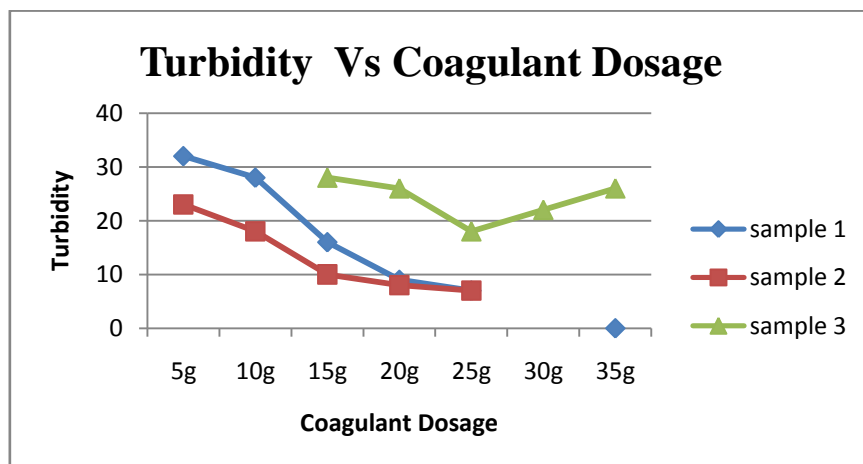


Fig 5: Turbidity Vs Coagulant dosage (Banana pith powder) graph of canteen waste water

Three samples of canteen waste water is collected and tested. Optimum dosage of neem leaf powder is obtained as 10g and optimum dosage of banana pith powder is 25g.

4.2 Resultsof Kallai River Water Treatment by Using Neam Leaf Powder and Banana Pith Powder

Table-3: Characteristics of river water before treatment

Parameters	Before treatment		
	Sample 1	Sample 2	Sample 3
Turbidity(NTU)	20	22	24
Conductivity(mmhos/cm)	23.2	25.8	25.90
Hardness(ppm)	Ab	Ab	Ab
TSS(mg/l)	1600	1400	1200
Chloride	Ab	Ab	Ab
DO	8.3	7.9	8.9
BOD	1.89	1.85	1.88

Table -4:Effect of coagulant dosage

Sample	Coagulant	Parameters	After Treatment						
			5g	10g	15g	20g	25g	30g	35g
1	Neem	Turbidity(NTU)	18	10	12	14	15		
		Conductivity(mmhos/cm)	23	21.5	21.9	22.2	22.4	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	800	200	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	9.6	10.8	9.4	9.1	8.7		
	Banana pith	Turbidity(NTU)	16	15	13	10	8	-	-
		Conductivity(mmhos/cm)	23	22.8	22.9	22.9	22.5	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	800	400	400	200	100	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	8.5	8.9	9.2	9.8	10.6		
2	Neem	Turbidity(NTU)	19	9	14	16	17	-	-
		Conductivity(mmhos/cm)	23.5	21.3	21.9	22.6	23.1	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	600	200	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	8.4	8.8	6.9	6.6	6.2	-	-
	Banana Pith	Turbidity(NTU)	20	17	15	9	12		
		Conductivity(mmhos/cm)	23.8	23.1	22.7	21.3	21.6		
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab		
		TSS(mg/l)	1000	800	600	200	400		
		Chloride	Ab	Ab	Ab	Ab	Ab		
		DO	8	8.2	8.5	10.3	9.5		
3	Neem	Turbidity(NTU)	17	9	12	14	14	-	-
		Conductivity(mmhos/cm)	22.30	20.32	21.03	23.60	23.15	-	-

		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	600	200	400	1000	1200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	9.3	10.2	9.5	9.3	8.6	-	-
	Banana Pith	Turbidity(NTU)	-	-	15	9	13	11	12
		Conductivity(mmhos/cm)	-	-	22.4	21.8	21.9	21.96	21.98
		Hardness(ppm)	-	-	Ab	Ab	Ab	Ab	Ab
		TSS(mg/l)	-	-	600	400	600	200	200
		Chloride	-	-	Ab	Ab	Ab	Ab	Ab
		DO	-	-	9.2	10.55	9.72	9.2	8.5

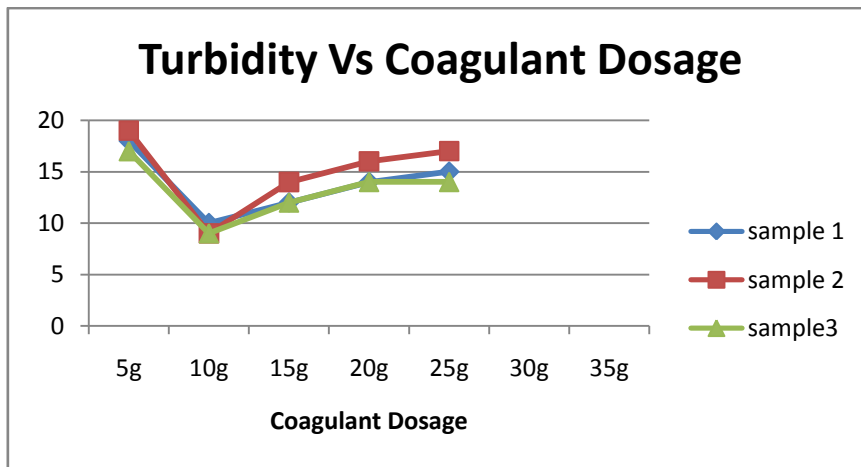


Fig 6: TurbidityVs Coagulant dosage (Neem leaf powder) graph of Kallai River Water

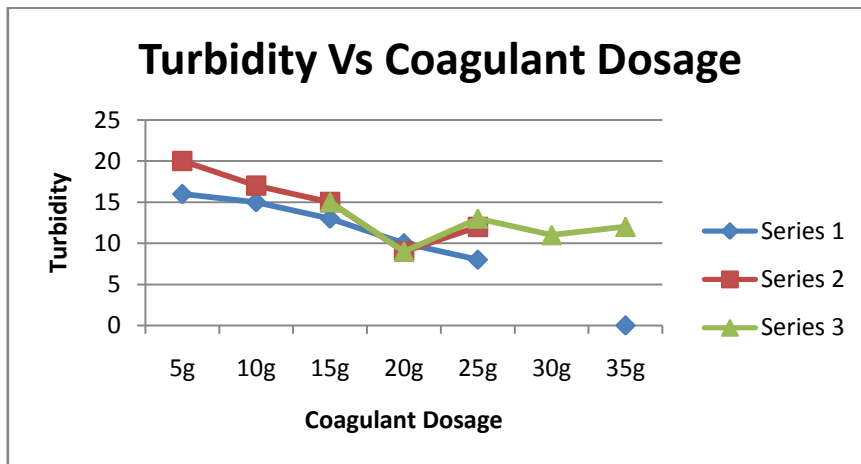


Fig 7: TurbidityVs Coagulant dosage (Banana pith powder) graph of Kallai River Water

Three samples of Kallai River water was collected and tested. Optimum dosage of neem leaf powder for all three samples is 10g and optimum dosage of Banana pith powder for sample 1 is 25g and for sample 2 and 3 it is 20 g .Hence optimum dosage of banana pith powder is taken as 20g.

V. CONCLUSIONS

A study of waste water treatment by using natural coagulants such as neem leaf powder and banana pith powder. Optimum dosage of neem leaf powder as a natural coagulant in treatment of canteen waste water and River Water is 10g and optimum dosage of banana pith powder as a natural coagulant in treatment of canteen waste water is 25g and River water is 20 g by removal of turbidity,pH,conductivity,hardness,TSS,Chloride,DO .

For canteen waste water, removal efficiency of turbidity is 58.75, 68.18, and 78.33 for three different samples by using neem leaf powder as natural coagulant and removal efficiency of 91.25, 83.63 and 88.33 by using banana pith powder as a natural coagulant. According to the results obtained, for canteen waste water Banana pith powder is more efficient in reduction of various parameters of canteen waste water.

For Kallai river water, removal efficiency of turbidity is 50, 59.1 and 62.5 for three different samples by using neem leaf powder and removal efficiency of 60, 59.09 and 62.5 by using banana pith powder as a natural coagulant. According to the result obtained, for Kallai river water both neem powder and banana pith powder is equally efficient in reduction of various parameters.

From the above results banana pith powder is more efficient as a natural coagulant for treatment of canteen waste water and Kallai river water.

Natural coagulants are also used in treatment of various other wastewaters such as tannery waste water, dairy waste water, textile waste water treatment etc. The use of these natural coagulants which are locally available was found to be environment friendly, more cost effective and safe method of treating waste water.

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