

EFFECTIVE USE OF ARTOCARPUS HETEROPHYLLUS LEAF AND CITRUS LIMON LEAF AS COAGULANT FOR PURIFICATION OF WATER FROM CHALAKUDY RIVER

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ABSTRACT

Water pollution has become a major concern all over the world due to rapid industrialization. The objectives of this study were to assess the Effective use of Artocarpus Heterophyllus Leaf and Citrus Limon Leaf as natural Coagulants for Purification of Water from Chalakudy River an alternative to the current commercial synthetic coagulant such as aluminium sulphate and to optimize the coagulation process. Various coagulant combinations with which the raw water from 3 sites of

Chalakudy river is treated. Based on the experimental results, shows Citrus Limon Leaf powder used as coagulant increased pH and it is negatively affected on turbidity removal. And in natural coagulants Artocarpus Heterophyllus Leaf powder used for coagulation, the optimum dosage of Jackfruit tree leaf powder as coagulant is found to be 10mg/l. The optimum pH of jackfruit leaf powder found to be 7.7. The reduction of turbidity is 51.9%. reduction BOD is 45.8%, reduction in total dissolved solids is found to be 57.5%. Natural coagulant is a naturally occurred plants based coagulant that can be used in coagulation-flocculation process of wastewater treatment for reducing turbidity. It could be concluded that Artocarpus Heterophyllus Leaf powder showed tremendous potential as a natural coagulant for after treatment purposes and could be applied in the pretreatment stage. The results proved that the use of jack fruit leaf powder is natural coagulant is a feasible option in

enhancing the efficiency of turbidity removal in water treatment. Furthermore, the usage of this natural coagulant will reduce the production of non-biodegradable chemical sludge to the environment, lower the sludge handling and treatment costs and it works as a low cost natural coagulant agent for coagulation process in water treatment plant and act as a significant environmental friendly product.

KEYWORDS: Artocarpus Heterophyllus (Jackfruit tree), Citrus Limon (Lemon tree), Natural Coagulant, Turbidity Removal.

1. INTRODUCTION

As pollutants enter water through many sources, scientists are motivated to develop new purification and extraction methods. Some of these techniques have been successful, but at great cost or with detrimental effects to environment. Water pollution has become a major concern all over the world due to rapid industrialization. Water of high quality is essential to human life and water of acceptable quality is essential for agriculture, industrial, domestic and commercial activities.

The river water resources in Kerala state are subjected to substantial stress due to changes in riverine ecology. Pesticides and chemical fertilizers used for agriculture and the industrial wastes are polluting the rivers of Kerala. The environmental status and the water quality of Chalakudy river has been continuously changed.

Kerala Chemicals and Proteins Ltd. (KCPL) is located near the Chalakudy river at Kathikudam in Kadukutty panchayat, Kerala. The company KCPL started operations in 1979 and produces ossein ($C_{102}H_{149}N_{31}O_{38}$), an intermediary product in the processing of gelatin. The raw materials used are crushed bones of animal origin and HCl (35%). The by-product is dicalcium phosphate.

The present analysis was conducted at three sites in Chalakudy river. The site 2 (S2) is at Kathikudam near the company KCPL. The other sampling sites are Kannapuzha Ambbalakadavu (S1, upstream) and Pulikkakadavu (S3, downstream) of Chalakudy river and the surface water samples were collected in the month of January 2018. The samples were carried to the laboratory for the analysis of physicochemical parameters. The temperature, turbidity, pH, acidity, alkalinity, total hardness, total dissolved solids (TDS).

2. MATERIALS AND METHODS

A. Materials

The main material used as a natural coagulants are *Artocarpus Heterophyllus* (Jackfruit tree) Leaf powder and *Citrus Limon* (Lemon plant) Leaf powder.

B. Preparation of leaves Powder

Jackfruit leaves and lemon leaves collected locally and washed with tap water to remove impurities and dirt present in it. The leaves are then dried under sun light for 5 days and it is then grinded to make fine leaf powder.

C. Collection and Analysis of Water

First, The water collected from three sites in Chalakudy river. The site 2 (S2) is at Kathikudam near the company KCPL. The other sampling sites are Kannapuzha Ambbalakadavu (S1, upstream) and Pulikkakadavu, Valoor (S3, downstream) of Chalakudy River. The samples were collected in 2L plastic containers and were tested for different waste water characteristics as per the standard methods.



Fig. 1: Citrus Limon leaves powder and *Artocarpus Heterophyllus* leaves powder.

3. RESULTS AND DISCUSSIONS

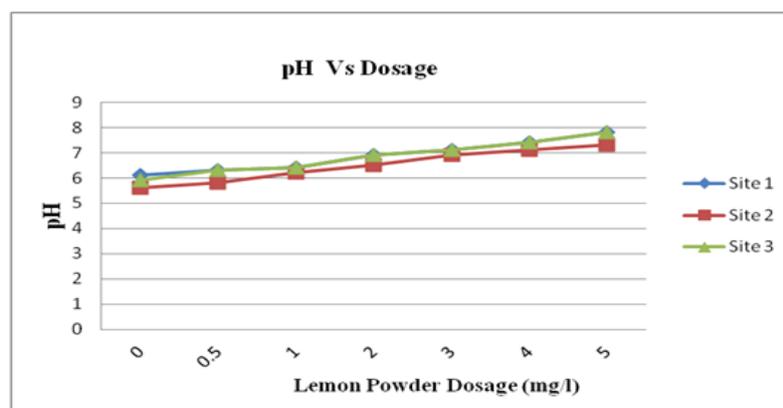
Based on optimisation results it is found to be jackfruit leaf powder is more effective than lemon leaf powder. As dosage increases pH increases and turbidity decreases in case of jackfruit leaf powder as coagulant. In the case of lemon leaf powder it is seen that as dosage increases pH and turbidity simultaneously increases. Lemon leaf powder is negatively affected in coagulation. So further study based only with Jackfruit leaf powder as coagulant to find optimum Coagulant Dosage And optimum pH for Site 2 sample near KCPL.

Table. I: Characteristics of waste water sample from Chalakudy River.

Parameter	Concentration			Specification as per IS 10500	
	Site 1	Site 2	Site 3	Acceptable limit	Permissible limit
pH	6.1	5.6	5.9	6.5 to 8.5	No Relaxation
Temperature(°C)	27.1	29.8	28.2	Not exceed 5
Turbidity(NTU)	12.8	18.9	27.4	5	10
COD	4	11	5	<250
BOD	1.8	7.2	4.2	2	3
DO	4.8	2.5	1.2	> 6
TDS(mg/l)	124.4	223.6	206.8	500	2000
Acidity(mg/l)	13	14	18
Alkalinity(mg/l)	28	83	51	200	600
Total Hardness	57	69	54	300	600
Conductivity(μ mhos/cm)	131	338	112.8	<250 at 25° C
Chloride(mg/l)	18	52	26	250	1000
Nitrate(mg/l)	1.21	11.78	3.45	45	No relaxation

Table. II: Lemon leaf powder as coagulant.

Site	Characteristics	Before coagulation	Lemon leaf powder Dosage (mg/l)					
			.5	1	2	3	4	5
1	Turbidity (NTU)	13.8	14.1	14.3	14.2	13.8	12.7	14.5
	pH	6.1	6.3	6.4	6.9	7.1	7.4	7.8
2	Turbidity (NTU)	18.9	18.5	19.1	20.1	22.1	21.9	24.6
	pH	5.6	5.8	6.2	6.5	6.9	7.1	7.3
3	Turbidity (NTU)	23.4	23.8	24.5	24.9	25.9	28.5	27.5
	pH	5.9	6.3	6.4	6.9	7.1	7.4	7.8

**Fig. 2: pH vs Dosage.**

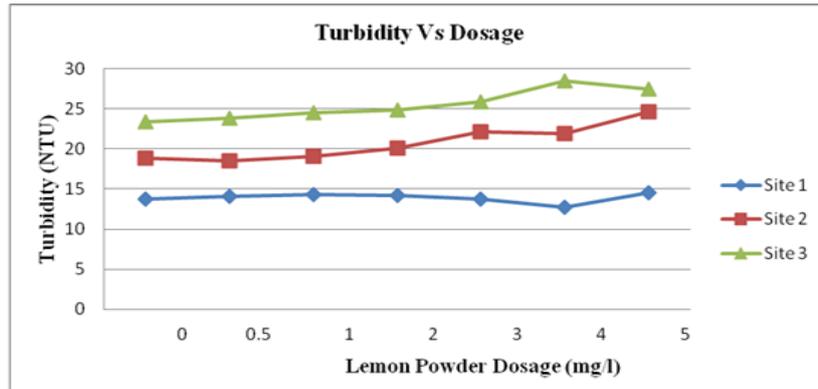


Fig. 3: TurbidityVs Dosage.

Table. III: Jackfruit leaf powder as coagulant.

Site	Characteristics	Before coagulation	Jackfruit leaf powder Dosage (mg/l)					
			.5	1	2	3	4	5
1	Turbidity (NTU)	13.8	13.7	12.5	11.7	10.9	9.5	8.3
	pH	6.1	6.2	7.1	7.3	7.4	7.5	8.3
2	Turbidity (NTU)	18.9	17.5	16.4	15.1	14.8	13.3	12.5
	pH	5.6	5.9	6.2	6.5	6.8	7.1	7.4
3	Turbidity (NTU)	23.4	22.2	20.9	16.8	15.7	14.2	13.5
	pH	5.9	6.3	6.6	6.9	7.1	7.2	7.3

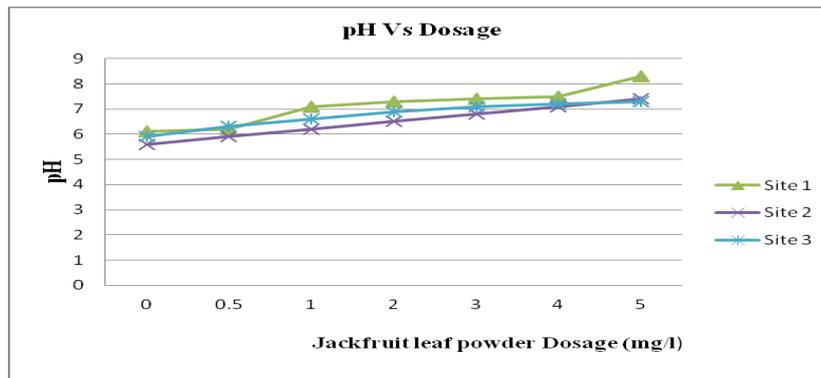


Fig. 4: pH vs Dosage.

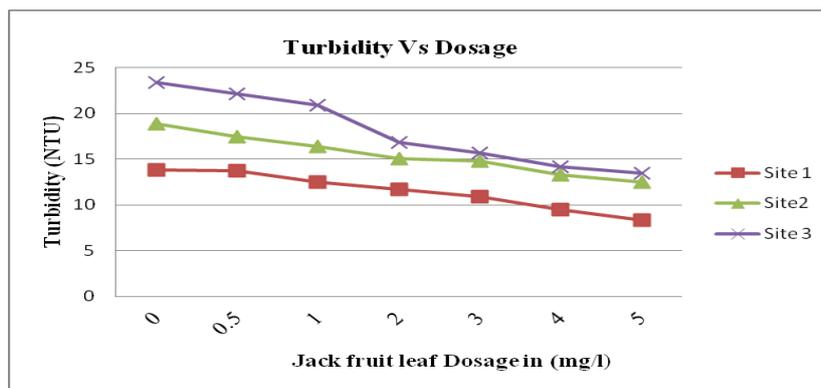


Fig. 5: TurbidityVs Dosage.

A. Optimum Coagulant Dosage

The optimum dosage of coagulants are determined by varying the dosage of coagulants are 2 mg/l, 4 mg/l, 6 mg/l, 8 mg/l, 10 mg/l..to 20mg/l at pH of 5.6 collected from site 2 near KCPL. The optimum coagulant dosage adopted for natural coagulant *Artocarpus Heterophyllus* Leaf powder is 10mg/l and the turbidity removed by 51.9%.

Table IV: Optimum Coagulant Dosage.

Jackfruit leaf powder dosage (mg/l)	Before coagulation	2	4	6	8	10	12	14	16	18	20
Turbidity	18.9	15.1	13.3	12.5	11.7	9.8	10.9	11.9	13.1	14.8	16.1
Turbidity Removal %	0.0	79.9	70.4	66.1	61.9	51.9	57.7	63.0	69.3	78.3	85.2
pH	5.6	6.5	7.1	7.2	7.4	7.7	8.1	8.9	9.5	10.1	11.1

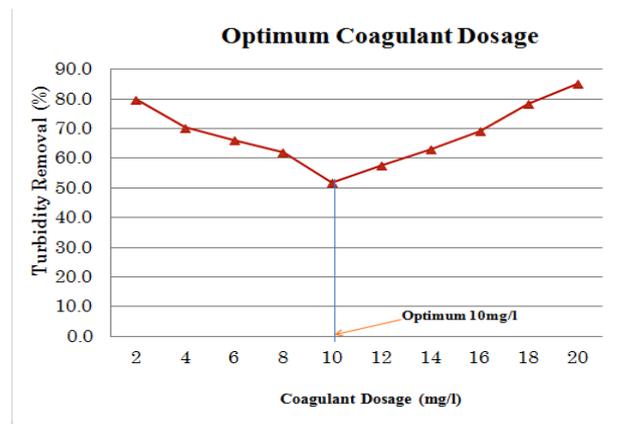


Fig. 6: Optimum Coagulant Dosage.

The water collected from Site 2 is being treated with coagulant *Artocarpus Heterophyllus* Leaf powder with optimum coagulant dosage of 10mg/l and final characteristics of treated water is being analysed.

Table. V: Final Characteristics values of treated water from site 2.

Parameters	Before	After	%Removal
pH	5.6	7.7
Turbidity(NTU)	18.9	9.8	51.9
TDS(mg/l)	223.6	128.6	57.5
BOD	7.2	3.3	45.8
Alkalinity	83	51	61.4

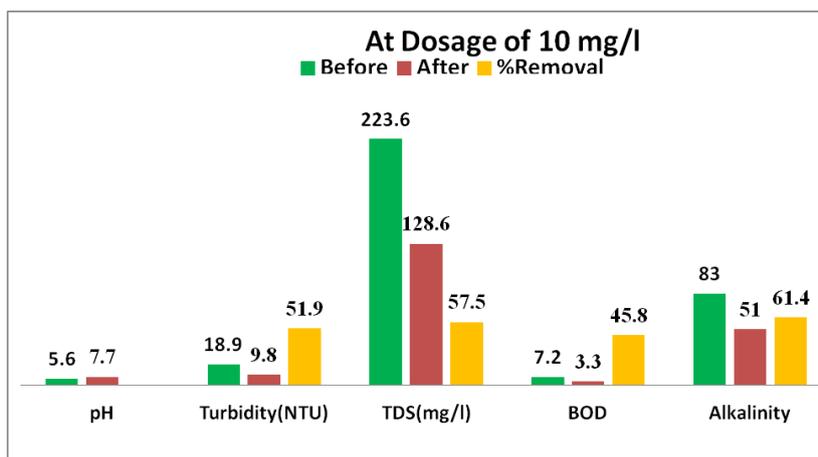


Fig. 7: At Dosage of 10 mg/l.

4. CONCLUSION

This project investigated the performance of Effective Use of *Artocarpus Heterophyllus* Leaf and *Citrus Limon* Leaf as Coagulant for Purification of Water From Chalakudy River. The performance of coagulation flocculation treatment of water from chalakudy river studied. The effectiveness of *Artocarpus Heterophyllus* Leaf (jackfruit) and *Citrus Limon* Leaf (lemon) powder to treat water from Chalakudy river for increased dosage and effect of pH were compared. A set of experimental runs that reduce the number of runs that reduce the number of runs needed to optimize the operating conditions. Using lemon leaf powder increased pH and negatively affected on turbidity removal.

The optimum dosage of Jackfruit tree leaf powder as coagulant is found to be 10mg/l. The optimum pH of jackfruit leaf powder found to be 7.7. The reduction of turbidity is using jackfruit leaf powder as coagulant is obtained as 51.9%, reduction BOD is 45.8% and reduction in total dissolved solids is 57.5%. The results proved that the use of jack fruit leaf powder is natural coagulant is a feasible option in enhancing the efficiency of turbidity removal in water treatment.

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