WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

AN EXPERIMENTAL STUDY ON USAGE OF BANANA PITH AND ORANGE PEELSAS NATURAL COAGULANTS TO TREAT RIVER WATER

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ABSTRACT –

The use of Recycling of water has become an effective treatment to reduce water scarcity. It is essential to meet the essential requirements of water to use wisely by following sustainable treatment methods. Natural macromolecular coagulants show bright future and are concerned by many researchers because of their abundant source, low price, multifunction and biodegradation. In this study Banana pith and orange peels are used as natural coagulants. The present study deals with the evaluation of treatment efficiency of natural coagulants Banana pith and orange peels. The experiments were conducted at various proportions of dosages of natural coagulant (Banana pith (NC1) and the Orange peels (NC2)). The physio-chemical parameters of river water are measured before and after the treatment to evaluate the removal efficiency on the major pollutants of concerned in river water treatment, such as pH, Turbidity, Total Dissolved and Suspended Solids. Then, the experimental studies were carried out to find out the optimum dosage of natural coagulants. In this project, The optimum dosage of Banana pith and orange peels was indicated at 90 mg/L, respectively for Chitravathi river water. The Turbidity removal efficiency is about 70% to 99% after treatment with NC1 and NC2 for dosage 70 to 100 Mg/L, respectively. From this study, high turbidity removal indicates that Banana pith and orange peels powders has the potential for wastewater treatment application.

Keywords: Natural coagulant, Banana pith, orange peels.

Introduction

In the global pursuit of sustainable solutions for water treatment, the utilization of natural coagulants presents an important asset. Amidst concerns over the environmental impact of conventional chemical coagulants, this experimental study delves into the efficacy of two readily available and biodegradable alternatives: banana pith and orange peels. In this project, we investigate the potential of these organic materials to serve as natural coagulants to treat river water. The present study focuses on the efficiency of coagulant activity of Banana pith and orange peels for physio – chemical parameters removal from river water.

MATERIALS & APPARATUS :

Water samples Banana pith Orange peels Filter Paper Sieves (300µm) Knifes
Digital pH Meter
Turbidity Meter
Digital Weighing Machine Hot Air Oven
Jar Test Apparatus Glass Jars, Beakers Standard Filter Papers Conical Flask

METHODOLOGY :

COLLECTION OF WATER SAMPLES : Water samples was collected from the Chitravathi river, The Chitravathi is an inter-state river in southern India that is a tributary of the Penna River. Rising in Karnataka, it flows into Andhra Pradesh and its basin covers an area of over 5,900 km2. The pilgrim town of Puttaparthi is located on its banks. It was observed that the sample was highly turbid and dark Black in colour. Sample was collected and stored in clear plastic containers.

Collection of water sample PREPARATION OF NATURAL COAGULENT – 1 (NC-1) :

Dry Banana pith powder was prepared by cutting fresh Banana pith into strips and sun dried for 1week and dried in Hot Air Oven at 60°C for an hour. Dry Banana pith was grind in a grinder and sieved to get particles of the size 300 µm.

PROCESS PREPARATION OF NC – 2 :

Peels of Orange was sun dried for 1week and dried in Hot Air Oven at 60°C for an hour. Then ground in a grinder and sieved to get the particles size 300 µm.

Banana pith Powder Orange Peels Powder EXPERIMENTAL ANALYSIS – JAR TEST

To evaluate the optimum dosage of natural coagulants jar test apparatus was used. In the jar test apparatus, 1000ml of water samples were put into each 4 one liter beakers and placed under paddles of jar test equipment. The required amount of doses of Natural coagulant powder i.e 70, 80, 90, and 100 mg/l was added instantaneously followed by rapid & slow mixing process and all allowed for settling and the required tests are performed such as pH ,Turbidity, TDS & TSS .

Experimental Analysis

Table.1. Variation of pH values with increase in the coagulant Banana pith powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	pH BEFORE TREATMENT	pH AFTER TREATMENT
1.	Sample-1	70	8.67	8. 54
2.	Sample-2	80	8.67	8. 42
3.	Sample-3	90	8.67	8. 36
4.	Sample-4	100	8.67	8. 52

Table.1 shows the values of pH of river water samples before treatment and variation of pH values with increase in the coagulant Banana pith powder dosage**.** In this study, coagulation efficiency of Banana pith was determined. It was observed that pH of waste water decreases with increase of coagulant dosage. The optimum dosage of coagulant was found at 90 mg/l , pH was determined by using digital pH meter.

Table.2. Variation

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	pH BEFORE TREATMENT	pH AFTER TREATMENT
1.	Sample-1	70	8.67	8. 59
2.	Sample-2	80	8.67	8. 45
3.	Sample-3	90	8.67	8. 39
4.	Sample-4	100	8.67	8. 59

Table.2 shows the values of pH of river water samples before treatment and variation of pH values with increase in the coagulant Orange peels powder dosage**.** In this study, coagulation efficiency of Orange peels was determined. It was observed that pH of waste water decreases with increase of coagulant dosage. The optimum dosage of coagulant was found at 90 mg/l, pH was determined by using digital pH meter.

OPTIMUM COAGULANT DOSE - Turbidity

Table.3. Variation of turbidity values with increase in the coagulant Banana pith powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	TURBIDITY BEFORE TREATMENT (NTU)	TURBIDITY AFTER TREATMENT (NTU)
1.	Sample-1	70	263	15.83
2.	Sample-2	80	263	9.9
3.	Sample-3	90	263	4.08
4.	Sample-4	100	263	7.93

Table.3 shows the values of turbidity of river water samples before treatment and variation of turbidity values with increase in the coagulant Banana pith powder dosage**.** In this study, coagulation efficiency of Banana pith was determined. It was observed that turbidity of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using jar test. Jar test is simple experiment which will help in determining the optimum coagulant dose required The results from this study indicates that powdered Banana pith (NC-1) and Orange peels (NC-2) are very effective in removing Turbidity, TSS, TDS, Colour from the waste water.

Table.4. Variation of turbidity values with increase in the coagulant Orange peels powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/L)	TURBIDITY BEFORE TREATMENT (NTU)	TURBIDITY AFTER TREATMENT (NTU)
1.	Sample-1	70	263	18.67
2.	Sample-2	80	263	12.93
3.	Sample-3	90	263	7.98
4.	Sample-4	100	263	9.63

Table.4 shows the values of turbidity of river water samples before treatment and variation of turbidity values with increase in the coagulant Orange peels powder dosage**.** In this study, coagulation efficiency of Orange peels was determined. It was observed that turbidity of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using jar test. Jar test is simple experiment which will help in determining the optimum coagulant dose required.

TOTAL DISSOLVED SOLIDS (TDS)

Table.5. Variation of TDS values with increase in the coagulant Banana pith powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (Mg/L)	TDS BEFORE TREATMENT (Mg/L)	TDS AFTER TREATMENT (Mg/L)
1.	Sample-1	70	783	385
2.	Sample-2	80	783	357
3.	Sample-3	90	783	329
4.	Sample-4	100	783	354

Table.5 shows the values of TDS of river water samples before treatment and variation of TDS values with increase in the coagulant Banana pith powder dosage. It was observed that TDS values of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using standard method.

Table.6. Variation of TDS values with increase in the coagulant Orange peels powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	TDS BEFORE TREATMENT (mg/l)	TDS AFTER TREATMENT (mg/l)
1.	Sample-1	70	783	489
2.	Sample-2	80	783	465
3.	Sample-3	90	783	433
4.	Sample-4	100	783	459

Table.6 shows the values of TDS of river water samples before treatment and variation of TDS values with increase in the coagulant Orange peels powder dosage**.** It was observed that TDS values of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using standard method.

TOTAL SUSPENDED SOLIDS (TSS)

Table.7. Variation of TSS values with increase in the coagulant Banana pith powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	TSS BEFORE TREATMENT (mg/l)	TSS AFTER TREATMENT (mg/l)
1.	Sample-1	70	147	67
2.	Sample-2	80	147	52
3.	Sample-3	90	147	44
4.	Sample-4	100	147	49

Table.7 shows the values of TSS of river water samples before treatment and variation of TSS values with increase in the coagulant Banana pith seeds powder dosage**.** It was observed that TSS values of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using standard method.

Table.8. Variation of TSS values with increase in the coagulant Orange peels powder dosage

S.NO	SAMPLES	COAGULANT DOSAGE (mg/l)	TSS BEFORE TREATMENT (mg/l)	TSS AFTER TREATMENT (mg/l)
1.	Sample-1	70	147	72
2.	Sample-2	80	147	61
3.	Sample-3	90	147	56
4.	Sample-4	100	147	62

Table.8 shows the values of TSS of river water samples before treatment and variation of TSS values with increase in the coagulant Orange peels powder dosage**.** It was observed that TSS values of waste water decreases with increase of coagulant dosage. The optimum dosage was found at 90mg/l, determined by using standard method.

Summary of coagulant dosages of Banana pith seeds, Raw water characteristics and variation of Turbidity, TDS and TSS with the increase of coagulant dosage

Table:9

S.no	Parameters	Effluent values	Dose of Banana pith (Mg/L)				Standard values
			70	80	90	100	
1.	Turbidity (NTU)	263	15.8	9.9	4.08	7.93	< 5
2.	Total dissolved solids (mg/l)	783	385	357	329	359	< 500
3.	Total suspended solids (mg/l)	147	67	52	44	49	< 75

Summary of coagulant dosages of Orange peels, Raw water characteristics and variation of Turbidity, TDS and TSS with the increase of coagulant dosage

Table:10

S.no	Parameters	Effluent values	Dose of Orange peels (Mg/L)				Standard values
			70	80	90	100	
1.	Turbidity (NTU)	263	18.6	12.9	7.98	9.63	< 5
2.	Total dissolved solids (mg/l)	783	489	465	433	459	< 500
3.	Total suspended solids (mg/l)	147	72	61	56	62	< 75

Turbidity, TDS and TSS removal efficiency by Banana pith

S.no	Parameters	Before treatment	After treament	Effective % removal
1.	Turbidity (NTU)	263	4.08	98%
2.	Total dissolved solids(TDS) mg/l	783	329	57%
3.	Total suspended solid (TSS) mg/l	147	44	70%

Table 11: shows the effectiveness of Banana pith seeds as coagulants in powder form, to remove Turbidity, TDS and TSS from water. Effective Turbidity removal by Banana pith is 98 % at the dosage of 90 mg/l.

Turbidity, TDS and TSS removal efficiency by Orange peels

S.no	Parameters	Before treatment	After treatment	Effective %removal
1.	Turbidity (NTU)	263	7.98	93%
2.	Total dissolved solids(TDS) mg/l	783	433	44%
3.	Total suspended solid (TSS) mg/l	147	56	61%

Table 12: shows the effectiveness of orange peels as coagulants in powder form, to remove Turbidity, TDS and TSS from water. Effective Turbidity removal by Orange peels is 93 % at the dosage of 90 mg/l.

Conclusion:

- In the present study, Turbidity removal efficiency was found to be 70% and 99% after treatment with Banana pith (NC-1) and Orange peels (NC-2), Respectively for the Chitravathi river water.
- TSS removal efficiency was found to be 70 % and 61 %, after treatment with Banana pith (NC-1) and Orange peels (NC-2) Respectively
- TDS removal efficiency was found to be 57 % and 44 %, after treatment with Banana pith (NC-1) and Orange peels (NC-2) , Respectively.
- Hence, it can be concluded that Banana pith (NC-1) and Orange peels (NC-2) can be used as coagulants in water treatment.
- TDS removal efficiency was found to be 57 % and 44 %, after treatment with Banana pith (NC-1) and Orange peels (NC-2) , Respectively.
- Hence, it can be concluded that Banana pith (NC-1) and Orange peels (NC-2) can be used as coagulants in water treatment.

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