

Wastewater Treatment Using Banana Pith Powder

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Abstract

Water is one of the major considerations for economic improvement globally as it is extensively utilized in various productive zones which includes agricultural products, industry, and urban supply. The rapid-paced industrial development, financial growth, and inhabitant's growth in emerging countries have involved in unexpected requirement of water in towns. Over the last few times, the quantity of water used and production of wastewater in household segments has risen extremely. There is a lot of existing methods used for the treatment of wastewater, usually, coagulation and flocculation are the process that is widely used. This treatment process is usually being put into practice because it is cost-efficient, consistent, simple, and considered as minimal energy using methods. The recognized physical-biochemical method eliminates suspended, soluble particles and colloidal, cost-effectively by encouraging the removal of large-scale and small by sedimentation. Several types of coagulants are used in the traditional treatment process, with varying chemical dosages depends on impurities present in wastewater. Ferric chloride, alum, calcium carbonate comes under organic polymer and inorganic polymer coagulants, also poly aluminum chloride is commonly utilized for the treatment of wastewater. But this treatment also causes severe disposal challenges due to sludge accumulated following the treatment utilizing aluminium salts to run the risk of accumulation in the ecosystem. Along with these synthetic organic polymers such as acrylamide have carcinogenic and neurotoxic impacts. The unconventional solution to these challenges is the alternative of metal and synthetic coagulants with natural coagulants which are an additional ecological approach.

Keywords: *natural coagulants, banana pith powder, flocculation, sedimentation.*

1. Introduction

From ancient times seeds, leaves, roots, barks, fruit peels, and vegetable peels obtained from the plant is been used for the purification process. Natural coagulants show numerous advantages which consist of a decrease in accumulation of sludge, lesser cost, control differences in the pH of purified water, non-toxic and environment friendly. Scholars used various coagulants that have been studied comprises okra, nirmali plant, Moringa Oleifera, banana pith juice, tamarind powder has also performed investigational analysis on performing of these various coagulants in purifying water.

In this current work, banana pith powder is converted into a supply of natural coagulant. Banana plant fit in the family of Musaceae and species of Musa cultivated global which consist of M. Acuminata, M. Sapientum, M. Paradisiaca, and M. Cavendishii. The banana tree generates a huge amount of biomass waste and bears fruit nearly 3 to 20 hands in a gathering in its lifetime.

In India, Japan, Malaysia, and other southeast Asian countries cultivate the banana plant. However, a few varieties are seen to be hereditarily associated with types of banana from Africa. The various parts of banana can be employed like banana fruit peels, banana piths, banana trunks, banana leaves, and banana pseudo-stems. These various wastes obtained

from banana plants can be extensively analyzed and used as adsorbents to eliminate different contaminants. Banana fruit is consumed highly and creates roughly 40% of the total weight of the fresh fruit and one of the key wastes produced in enormous quantities is banana peel. Banana skin is abundant in organic complexes such as cellulose, hemicellulose, pectin elements, chlorophyll pigments, and other complexes of small molecular weight. Various experimental works carried out show that banana peels are great traces of galacturonic acid, pectin (10-21 %), lignin (6-12 %), cellulose (7.6-9.6 %), and hemicelluloses (6.4-9.4 %).

2. OBJECTIVES

The objective of this investigation is to examine the efficiency of banana pith powder as a hypothetical coagulant to decrease turbidity of wastewater from a lake with different dosages of coagulant, remove pH, and other chemicals with the optimum dosages of 10 gm/L. Hence, this study demonstrates the potential of banana pith powder to treat wastewater. The traditional jar test was conducted to identify the performance of extracted banana pith powder about its coagulation action. Lake sewage wastewater from Krishna Sagara lake is used in this work; it is a natural lake located in Anekal taluk, Bangalore. It is also one of the well-maintained lakes of Bengaluru, with many residential buildings and industries across the lake.

3. MATERIALS AND METHODS

3.1 COAGULANT MATERIALS

Banana (*Musa Acuminata* species) peels were collected from the local fruit market, at Chandapura. Analytic-grade hydrochloric acid (HCl), sodium hydroxide (NaOH), and sodium chloride (NaCl) were used available in the laboratory at the college. Banana pith powder of 600 grams was made naturally. The peels were collected and kept in sunlight for 2 weeks, and dried peels were collected and powdered using a household mixer jar used in the kitchen. This peel powder was finely powdered and used as coagulant right into the sample for additional adsorption process in wastewater treatment using banana pith. Samples of wastewater were collected for experimental purposes. Hardness, chlorides, and residual chlorine of water sample were tested before and subsequently after adding coagulant. Dosages of banana pith powder i.e., 5, 10, 15, 20, 25 and 30 gm/L were added.



Fig 1: Banana pith powder

3.2 Removal of Hardness, chlorides, and residual chlorine

Calcium and magnesium ions present from bicarbonates, chlorides, and sulfates cause hardness in water. Hardwater leads to the increase of scaling, affects plumbing, and leads to corrosion effects. In industrial range water-softening factories, the sewage flow from the rejuvenation method can lead to scaling that can disturb the sewage practices.

Chlorides are formed naturally found in surface and groundwater resources such as rainwater, seawater, and even tap water. it is also associated with total dissolved solids. Usually in the chemical treatment process the percentage of chlorides increases due to chemical agents. Chloride content will vary based on rocks containing salts, runoff from agricultural land to wastewater.

Residual chlorine is due to the presence of free chlorine ions enough chlorine in water inactivates bacteria and viruses which leads to water-borne diseases. If chlorine is present in excess, then when such water is consumed, and chlorine enters the body it affects breathing and also leads to other various disorders.

Removal of these is commonly carried out by the process of flocculation, in this procedure gentle and constant mixing of coagulated samples is achieved, which promotes the formation of ‘flocs’ during the mixing of coagulant and turbid particles present in the water. Flocs formed can be usually removed by settling or filtration process. In this experimental work jar test was performed with the addition of alum before treatment and a jar test was also carried out after the addition of banana pith powder in different dosages.



Fig 2: Jar test apparatus setup

3.3 Collection of sample water

In this analysis sample water was collected from Krishna Sagara lake is 80years old and spreads an area of nearly 5 acres. the entire surface water belt in the GUEST LINE Industrial Area is heavily contaminated with untreated industrial effluents. Various tests were conducted before and after the addition of banana pith powder.



Fig 3: view of krishna sagara lake water

3.4 Process of water treatment using banana pith powder as coagulant

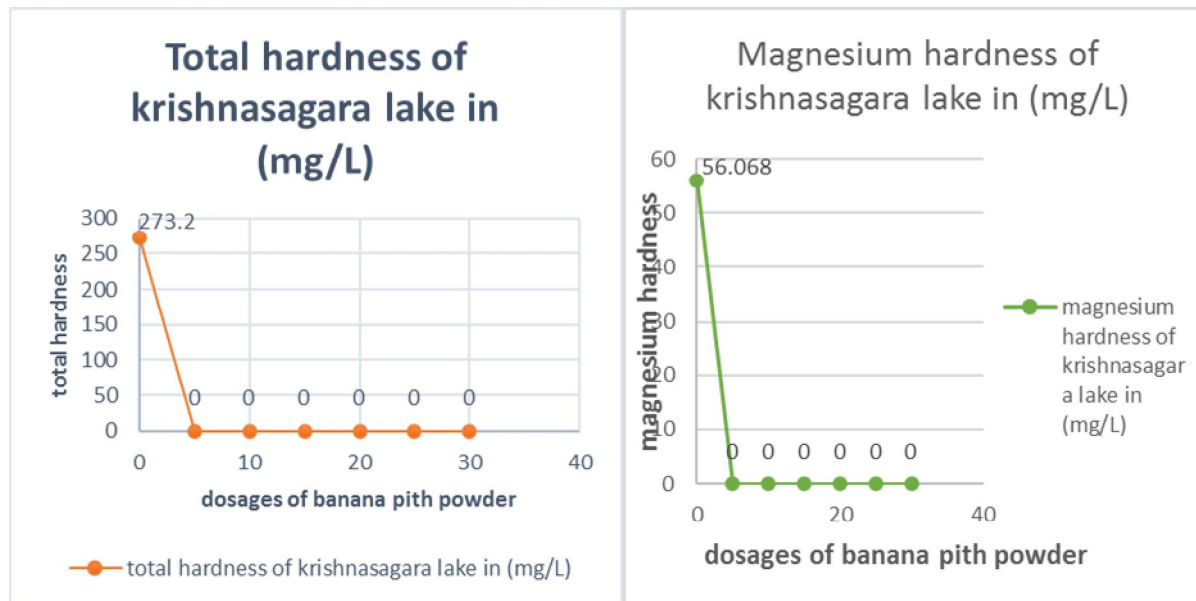
Our country is a developing nation for this kind of emerging nations its very essential to take out low-cost testing as an alternative instead of excessive cost and low availability treatment methods. However chemical coagulants such as ferric chloride, aluminum sulfate, and other ferric salts involve coagulation, flocculation, and sedimentation. This is a scientific method that provides several applications of easily and locally obtained banana pith powder as a coagulant which shows a replacement method and as a substitute instead of using costly chemical coagulants.

4. RESULTS AND DISCUSSIONS

a. Hardness test

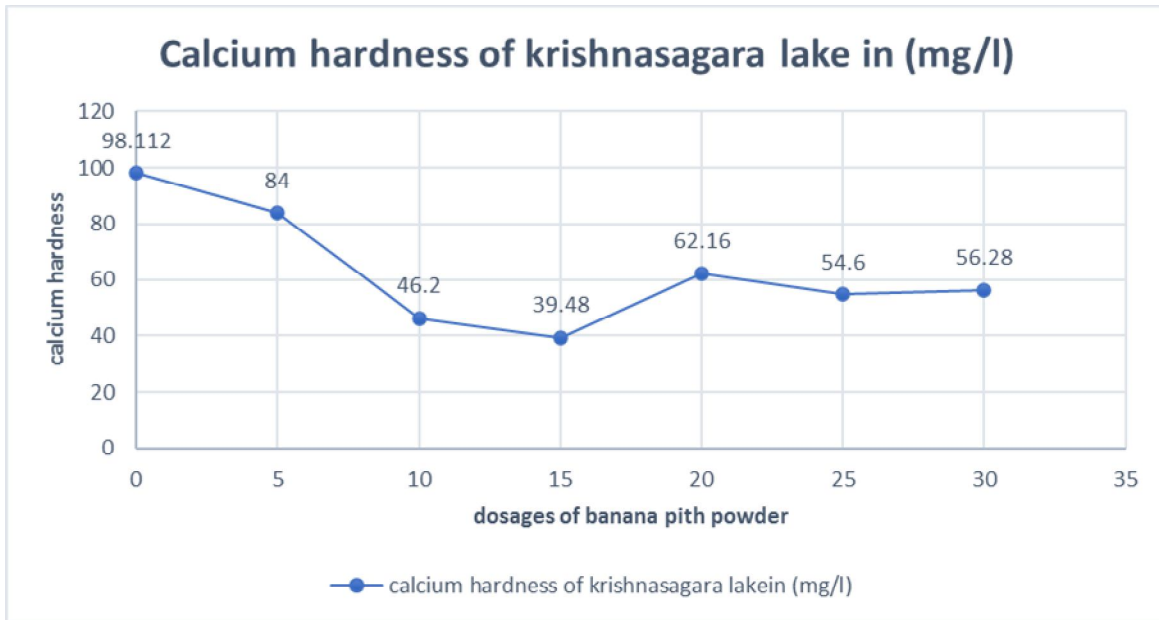
Sl no	SAMPLE	Coagulant dosage	Total Hardness test values in (mg/L)	Magnesium Hardness test values in (mg/L)	Calcium Hardness test values in (mg/L)
1	Per-testing	-----	273.2	56.068	98.112
2	Post-testing of water	5gm/L Banana pith powder.	AB	AB	84
3	Post-testing of water	10gm/L Banana pith powder.	AB	AB	46.2
4	Post-testing of water	15gm/L Banana pith powder.	AB	AB	39.48
5	Post-testing of water	20gm/L Banana pith powder.	AB	AB	62.16
6	Post-testing of water	5gm/L Banana pith powder.	AB	AB	54.6
7	Post-testing of water	5gm/L Banana pith powder.	AB	AB	56.28

Table:1 Hardness of water with different dosages



Graph:1 Total hardness of water after treatment

Graph:2 Magnesium hardness of water after treatment

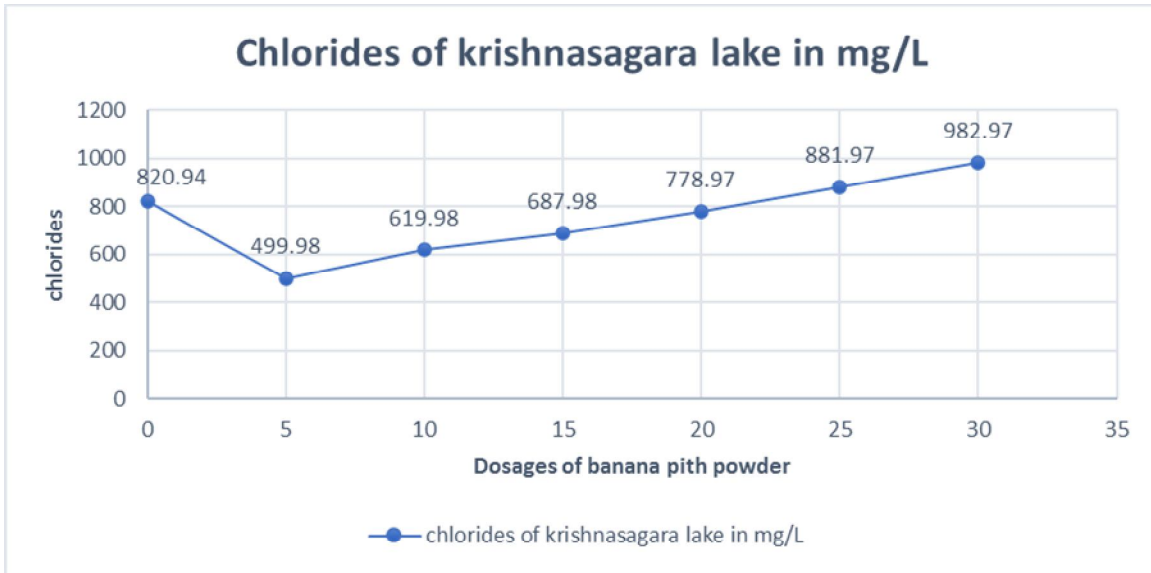


Graph:3 Calcium hardness of water after treatment

b. Chlorides test

Sl no	SAMPLE	Coagulant dosage	Chlorides test values in (mg/L)
1	Per-testing	-----	820.94
2	Post-testing of water	5gm/L Banana pith powder.	499.98
3	Post-testing of water	10gm/L Banana pith powder.	619.98
4	Post-testing of water	15gm/L Banana pith powder.	687.98
5	Post-testing of water	20gm/L Banana pith powder.	778.97
6	Post-testing of water	5gm/L Banana pith powder.	881.97
7	Post-testing of water	5gm/L Banana pith powder.	982.87

Table:2 Chlorides of water with different dosages

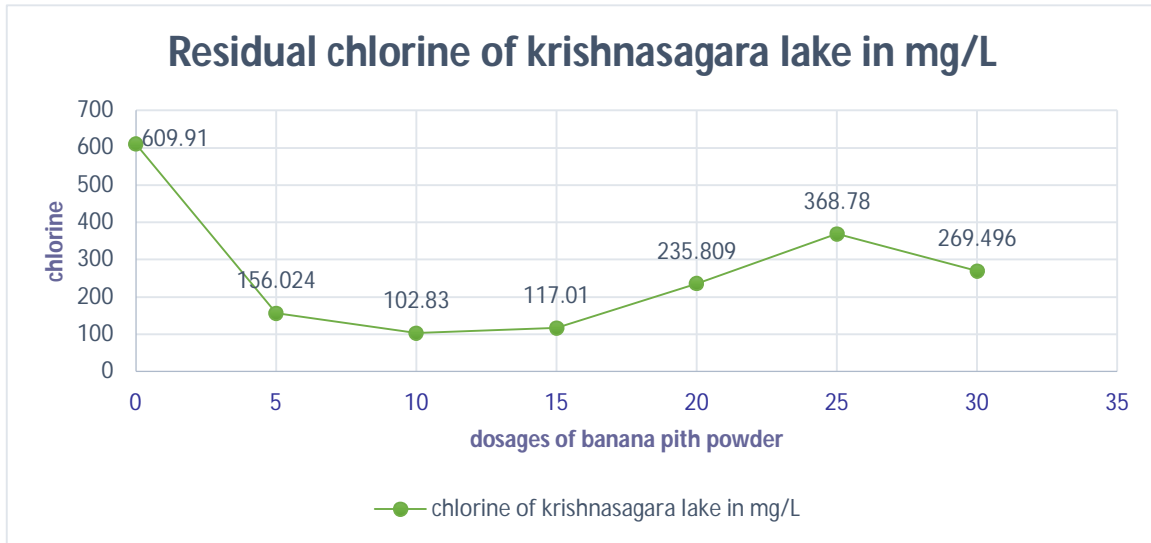


Graph:4 Chlorides of water after treatment

c. Residual chlorines test

Sl no	SAMPLE	Coagulant dosage	Residual chlorides test values in (mg/L)
1	Per-testing	-----	609.912
2	Post-testing water	5gm/L Banana pith powder.	156.02
3	Post-testing water	10gm/L Banana pith powder.	102.83
4	Post-testing water	15gm/L Banana pith powder.	117.01
5	Post-testing water	20gm/L Banana pith powder.	235.80
6	Post-testing water	5gm/L Banana pith powder.	368.78
7	Post-testing water	5gm/L Banana pith powder.	269.49

Table:3 Chlorides of water with different dosages



Graph:5 Chlorides of water after treatment

5. APPLICATIONS, ADVANTAGES AND DISADVANTAGES OF BANANA PITH POWDER

Applications of banana pith coagulant

- To identify a sustainable, simple, locally available.
- Ecofriendly water treatment technology which is more suitable for the earth to protect it from pollution caused by chemical coagulant.
- Evaluate the optimum dosages of banana pith powder for a different level to remove turbidity.
- Removal efficiency is very high in banana pith powder.

Advantages of banana pith coagulant

- It is non-toxic and safe for consumption
- It is biodegradable
- Safe for consumption.
- Banana peel is rich in organic compounds
- Banana pith has high nutrients.
- Banana pith has lignin
- Banana peels are a good source of galacturonic acid

Disadvantages of banana pith coagulant

- Availability of dried pith availability is a bit difficult.
- It requires a large quantity of growing.
- The smell may cause after using in water treatment.

6. CONCLUSIONS

- a) Banana pith is consumer approachable and eco-friendly, a substitute for minor size water treatment.
- b) Banana pith is a renewable source that can be grown on a huge scale.
- c) Using Banana pith as an alternate coagulant that meets up water quality factors.
- d) Banana pith is simple to use, effortlessly available, easy to maintain and can be used as a domestic coagulant.
- e) The banana pith can remove Hardness, Chlorides, and Residual chlorine
- f) It is eco-friendly proficiency which has additional benefits more than other treatment alternatives.

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