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Evaluation of Wastewater Treatment Using Banana Fruit Peel Powder as Natural Coagulant

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***Abstract* - For the survival of living life, water is very essential but also provides immensely to the quality of our lives. Water is very essential to improve living life, several articles have revealed the indirect and direct poisonous impacts of heavy metals in the form of cancers, tumors, and skin allergies. Wastewater treatment always costs little expensive since the use of chemical coagulants, hence practically all village residents go for a substitute to easily available materials generally which is of nominal quality and revealing them to waterborne illnesses. In this research work, experiments were performed to investigate the numerous properties of banana fruit peel powder. This was carried out with varying dosages of 5, 10, 15, 20, 25, and 30 g/L of banana pith powder as a coagulant. Experiments were performed with not adding or addition of banana pith powder. Also, the requirements achieved from tests indicate a minimal acidic value. The turbidity ratio achieved showed that tests with a variety of dosages of banana peel powder 5gm/L give clean water all along with a turbidity value of 44NTU. Jar test apparatus was used to investigate the optimal dose of banana peel powder, and pH values indicate it as an acidic range, for the banana peel. Results achieved in this analysis provide support to the earlier works, recommending the use of banana peel to treat wastewater. Outcomes accomplished in this examination support the previous works conducted using banana peel powder as a natural coagulant.**

Keywords: adsorbent, turbidity, hardness, chlorides, banana fruit peel powder.

I. INTRODUCTION

The increase in water demand worldwide is due to the rapid increase in the population, and alternatively, there is a constant decrease in the ground and shallow water intensities due to over development. A lot of efforts are carried out to bring alternatives to the problems caused due to excessive use of water, reuse of water, and treatment of wastewater is one of the prominent solutions. The wastewater is a mixture of kitchenette wastewater, cleaning, and washing, rinsing water which produces huge wastewater which comprises an extremely high intensity of organic elements such as proteins, carbohydrates, and lipids. Several skills are in practice to treat the wastewater and in the current research; an effort was made to examine the low-cost adsorbents application by using banana peels to treat by considering the wastewater.

Banana peel is one of the agricultural trashes that is being thrown out all over the world as a worthless raw material. They produce waste managing challenges although they have advantages such as use in compost and cosmetics production. The material can be utilized in the manufacturing of medicine, in personal care as it is having anti-fungal and antibiotic properties. Along with that, banana peels also have adsorbent properties. It is extremely helpful in purification and refining methods. To be a better coagulant than others in terms of coagulant activity (turbidity removal). Banana peel is composed of polymeric substances such as fiber (11.04%) and protein (10.14%). Banana peels can be used to filter water. Banana peels contain Sulphur, nitrogen, carboxylic acid, and other atoms that function pretty much the same way magnets do in terms of attracting heavy metals.

1.1 Objective of the study

- To examine the physical characteristics of wastewater.
- To know the effect of pH, contact time, and adsorbent dosage.
- To evaluate the influence of turbidity.
- To study the effect and modifications of wastewater parameters like chlorides, hardness, etc.

II. MATERIALS AND METHODS

A) Coagulant Materials

Banana (Musa Acuminata species) fruit peels were collected from the regional fruit shop, at Chandapura. Banana peel powder of 500 grams was produced naturally. New banana peels were accumulated from household wastes and fruit shops, as their accessibility and conveyance were easy. Banana peel comprises lipids (1.7%), proteins (0.9%), crude fiber (31%), and carbohydrates (59%). The numerous minerals comprise of potassium (78.10 mg/g), manganese (76.20 mg/g), sodium (24.30 mg/g), calcium (19.20 mg/g) and iron (0.61

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mg/g). The peels were rinsed numerous intervals with tap water and then distilled water. The cleaned raw material was then chopped into tiny fragments and permitted to become dry in a warm air oven at 80˚C for one day. Due to which moisture content present will be removed and the color changes were noticed from yellow to brownish-black. The dried-up substance was finely ground using a food processor at home and sieved then used as coagulant precisely into the test sample for extra adsorption procedure in wastewater treatment using banana peel powder. Wastewater samples were collected for investigational purposes. Turbidity, Hardness, chlorides, and residual chlorine of wastewater sample was examined before and subsequently later adding up of coagulant Dosages of banana peel powder i.e., 5,10,15,20,25, and 30gm/L were added.

Figure 1: Raw Banana peels

Figure 2: Dried Banana peel powder

B) Removal of Turbidity Hardness, Chlorides, and Residual Chlorine

Turbidity measurement

Turbidity is the measure of colloidal particles that is present in collected water samples from hennagara lake. Samples were shifted into the nepheloturbidmeter tube and then checked reading of turbidity exactly from the nephelometer apparatus LCD panel display.

Hardness measurement

Bicarbonates, chlorides, and sulfates is due to calcium and magnesium ions present in water which causes hardness. Hardwater rises scaling, disrupts plumbing, and increases corrosion impacts. In industrial-scale water-softening plants, the sewage flow from the renewal procedure can lead to scaling which disrupts the sewage procedures.

Chlorides measurement

Chlorides are generated impulsively in surface and groundwater resources such as rainfall, seawater, and even tap water. it is also associated with total dissolved solids. Normally, in the chemical treatment process, the percentage of chlorides increases due to the chemical substance. Chloride issue will vary based on rocks including salts, extra later cultured land to wastewater.

Residual measurement

Residual chlorine is due to the existence of free chlorine ions sufficient in chlorine water which deactivates bacteria and viruses and decreases problems of water-borne diseases. If additional chlorine is present and if such water is utilized, when chlorine enters the body it disrupts inhalation and leads to other several disorders.

Elimination of these impurities is normally carried out by the technique of flocculation, in this method gentle and constant mixing of coagulated samples is performed, which promotes the formation of ‘flocs’ through the mixing of coagulant and turbid fragments exist in the water. Flocs formed can be generally removed by settling or filtration process. In this research work jar apparatus test was carried out with the addition of alum before treatment and a jar test experiment was also performed after the addition of banana peel powder in several doses.

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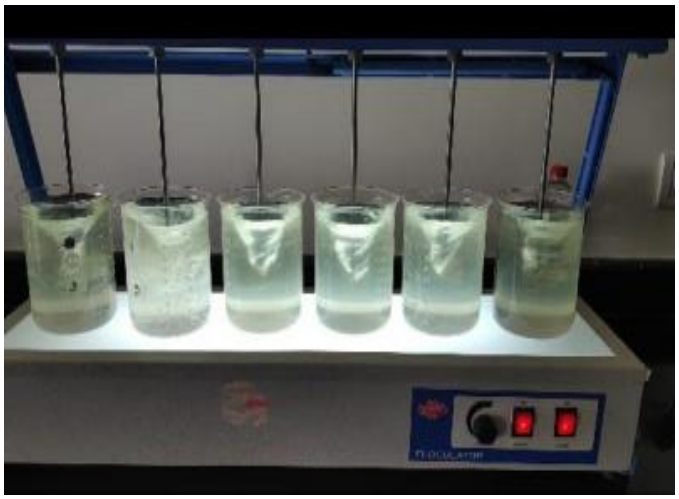

Figure 3: Jar test apparatus setup

C) Collection of Sample Water

In this research laboratory evaluation test sample, water was gathered from hennagara lake, this lake is in the suburban area of Jigani in the southeast locality of Bengaluru city and is one of the biggest lakes. The water was utilized for agricultural objectives in early90's. It is a part of the Jigani drainage scheme that drains the south-eastern and the southern sections of the city. The entire surface water belt in the hennagara is Industrial Area is severely polluted with untreated industrial releases. Several tests were carried out before and after post addition of banana peel powder.

Figure 4: View of Hennagara lake water

Figure 5: Collection of samples from Hennagara lake water

III. RESULTS AND DISCUSSIONS

A) Turbidity test

Table1: Removal of turbidity with different dosages of Banana peel powder

Sl no	SAMPLE	Coagulant dosage in gm/L	Turbidity in NTU
1	Per-testing	-----	141
2	Post-testing of water	5gm/L Banana peel powder	44
3	Post-testing of water	10gm/L Banana peel powder	78
4	Post-testing of water	15gm/L Banana peel powder	81
5	Post-testing of water	20gm/L Banana peel powder	65
6	Post-testing of water	25gm/L Banana peel powder	51
7	Post-testing of water	30gm/Banana peel powder	55

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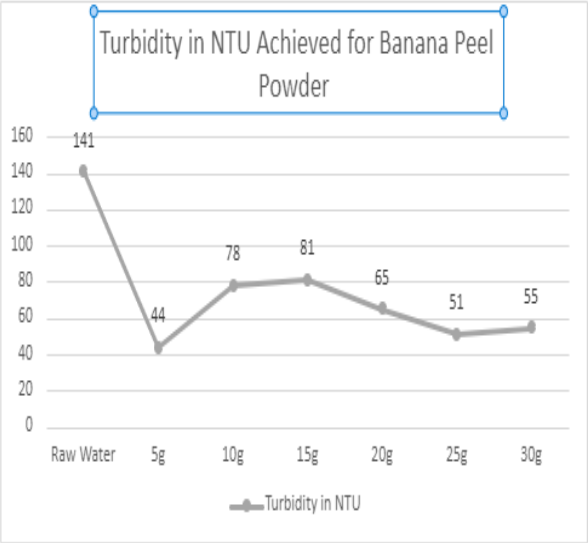
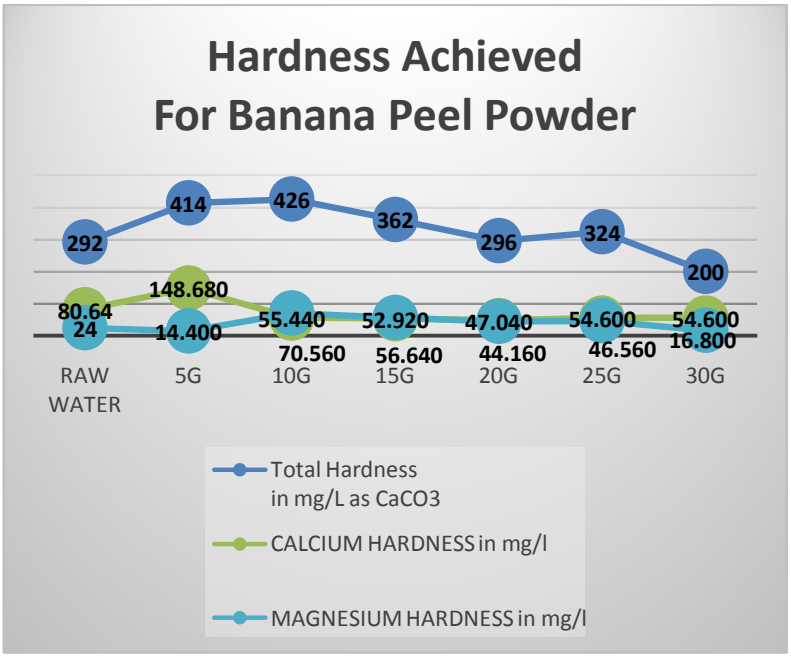


Graph 1: Removal of turbidity using Banana peel powder

B) Hardness

Table 2: Removal of hardness with different dosages of Banana peel powder

Sl no	SAMPLE	Banana peelpowder 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	-----	292	100	192
2	Post-testing of water	5gm/L	414	60	354
3	Post-testing of water	10gm/L	426	294	132
4	Post-testing of water	15gm/L	362	236	126
5	Post-testing of water	20gm/L	296	184	112
6	Post-testing of water	25gm/L	324	194	130
7	Post-testing of water	30gm/L	200	70	130



Graph 2: Removal of hardness using Banana peel powder

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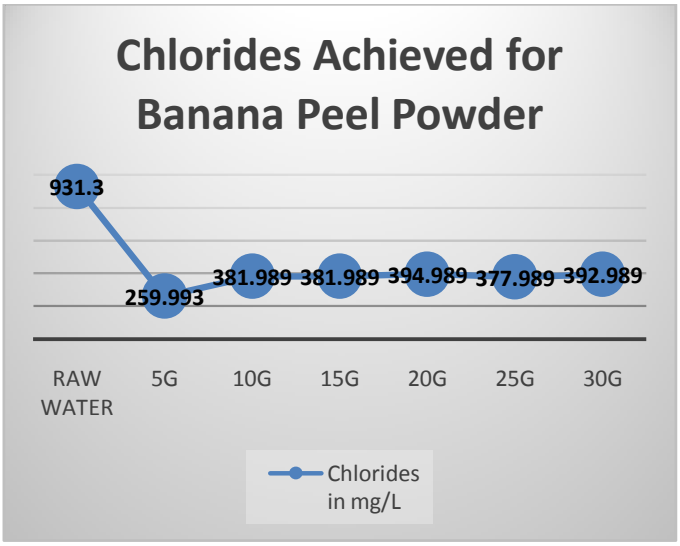
C) Chlorides

Table 3: Removal of chlorides with different dosages of Banana peel powder

Sl no	SAMPLE	Coagulant dosage in gm/L	chlorides in mg/L
1	Per-testing	-----	931.31
2	Post-testing of water	5gm/L Banana peel powder	259.993
3	Post-testing of water	10gm/L Banana peel powder	381.989
4	Post-testing of water	15gm/L Banana peel powder	381.989
5	Post-testing of water	20gm/L Banana peel powder	394.989
6	Post-testing of water	25gm/L Banana peel powder	377.989
7	Post-testing of water	30gm/ Banana peel powder	392.989



Graph 3: Removal of chlorides using Banana peel powder

D) Residual chlorines

Table 4: Removal of residual chlorine with different dosages of Banana peel powder

Sl no	SAMPLE	Coagulant dosage in gm/L	Residual chlorine in mg/L
1	Per-testing	-----	931.31
2	Post-testing of water	5gm/L Banana peel powder	259.993
3	Post-testing of water	10gm/L Banana peel powder	381.989

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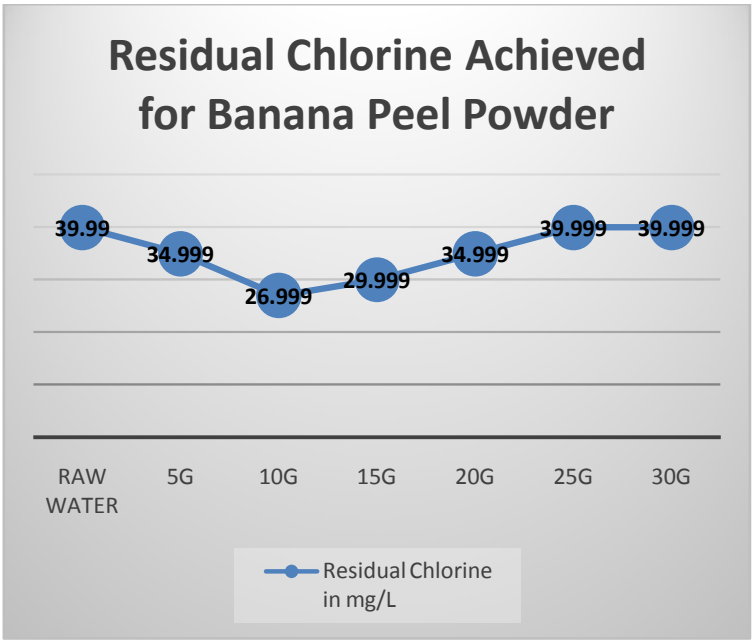
4	Post-testing of water	15gm/L Banana peel powder	381.989
5	Post-testing of water	20gm/L Banana peel powder	394.989
6	Post-testing of water	25gm/L Banana peel powder	377.989
7	Post-testing of water	30gm/ Banana peel powder	392.989



Graph 4: Removal of residual chlorine using Banana peel powder

IV. CONCLUSION

From this current research work, it is been determined that the use of natural coagulants such as banana peel powder can be applied to eliminate impurities in wastewater. Normally, the availability of safe and unpolluted water is challenging especially in rural areas, due to heavy rainfall which turns water cloudy and full of deposits. Thus, using adjacent reachable, plentiful, and unlimited biological coagulants gives the solution to the difficulties faced during the treatment of wastewater. The techniques implicated are cost-effective, conventional, simple to execute, and reduce mortality and diseases caused due to water-borne diseases and this will improve public health in rural regions. In this present study, the turbidity removal efficiency was found to be 68%, the removal efficiency of total hardness was found to be 31%, the removal efficiency of magnesium hardness was found to be 40%, the removal efficiency of calcium hardness was found to be 41%, The removal efficiency of chlorides was found to be 72% and removal efficiency of residual chlorine was found to be 32% after treatment of wastewater using natural coagulant banana peel powder, for hennagara lake water sample. Subsequently, it is observed that natural coagulants are in safe hands for wastewater treatment. Banana peel is consumer-friendly and biodegradable, an alternative for small-size water treatment.

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