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Treatment of Wastewater Using Orange Peel Powder as Coagulant

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Abstract

In recent days identifying natural and unconventional coagulant supplies for the treatment of wastewater is concentrated very high. In the current experimental investigation, the efficiency of orange peel in the treatment of lake wastewater is carried out. The sample was collected from a lake across the industrial belt in GUEST LINE. Krishna Sagara lake is encircled in a larger zone, and it is a natural lake situated in Anekal taluk, Bangalore. It is also one of the well-retained lakes of Bengaluru and wastewater categorization was made with traditional approaches. Orange peels were added in various dosages (10g, 20g,30g, 40g,50g, & 60g) as coagulants to evaluate the efficiency and dosing intensity. Earlier outcomes using several natural products as coagulants revealed a significant rise in the quality of wastewater with initial and final findings. Current work aims to get the highest effectiveness of selected natural coagulant orange peel powder and proves natural coagulants have a high level of adsorption and elimination of greater concentration of chemical components from wastewater. An investigational study was conducted for the treatment of wastewater from the lake using low-cost adsorbents. In this study, the peels of orange were used as adsorbents and the effect of adsorbent with variant dosages were carried out and evaluated for wastewater. The study shows orange peel was more effective in the removal of pollutants like chlorides 50%, residual chlorine 70%, total hardness 100%, magnesium hardness 100%, and calcium hardness up to 47%. The optimum contact time for orange peel powder of 120min was maintained. The optimum dosage of orange powder is found to 30gm/L.

Keywords: *orange peel powder, coagulant, sedimentation, flocculation, dosages*

1. Introduction

Water demand is increasing day by day worldwide due to rapid increase in the population and industrial growth, on the other hand, constant decrease in ground and surface water intensities due to overdevelopment. Attempts are being carried out to discover the replacements for water resources and a leading result for treatment and re-use of industrial wastewater. Lake water collected consists of various industrial pollutants like organic and biodegradable materials which disturb marine and terrestrial ecologies. Due to the high pollution load in lake water from industries proper method is adopted to treat wastewater which causes dangerous environmental challenges. Hence the simple and economic method is required to treat water. Besides, the Indian administration has enforced very rigorous regulations and rules for sewage discharge to safeguard the atmosphere. The wastewater treatment will not give any benefit to industrial people, so they release wastewater directly into nearby water streams, lands nearby water streams, or on land by providing information about primary treatment; this can be minimized. In this research work, we have worked to reduce the cost of the treatment setup using orange peels by jar test methods were carried out. The effect of pH, contact time, adsorbent dose, and adsorbent grain size in the elimination of contaminants current in wastewater was estimated.

1.1 Need of the Project

Wastewater from industries includes mostly organic and biodegradable materials that can interrupt aquatic and terrestrial ecologies. High-level contamination content present in wastewater leads to serious ecological difficulties. Henceforth treatment of wastewater is very important to improve a simple and efficient technique to treat the wastewater. Additionally, the Indian administration has enforced exceptionally rigorous regulations and guidelines for the sewage flow and to safeguard the ecosystem. Treatment of wastewater is not carried out properly by industries as it will not give any use to them, hence they release wastewater immediately into

neighboring lakes and streams or on land following primary treatment. In this research work, we have tried treatment of wastewater using orange peel powder in jar test apparatus and the effect of dosage pH and adsorbent particle size plays a vital role in the removal of pollutant from wastewater is evaluated.

2. Objectives of the Study

The objective of the experimental work is to remove organic content present in wastewater. Remove or minimize contaminants that cause pollution of receiving wastewater and remove or inactive possible pathogenic bacteria or parasites.

To recognize a workable, low-cost, nearby accessible, easy, trustworthy, appropriate, eco-sociable, domestic level use of wastewater management technology is more appropriate for rural inhabitants of emerging countries. Usage of various low adsorbents such as organic waste is used to minimize the contaminants. To achieve the optimum dosage of adsorbent, particle size, and efficient contact time. Removal of pollutants from wastewater by the efficient process. To determine the appropriate filtration procedure trailed by appropriate technique for removal of flocs formed by low-cost adsorbents

3. Materials and methods

3.1 Alum

Alum is the most commonly used coagulant for wastewater treatment, in wastewater treatment it is majorly used to remove small colloidal particles i.e. total suspended solids present in the raw water due to its tiny size settling by gravity method requires lengthy time but in alum, it can settle even small particles which is difficult to settle due to presence of negative ion charges. Due to which contact time is varied and colloidal techniques are called "stable". The method of affecting the colloidal particles to settle down is termed "destabilization". "Coagulation" is required as any procedure required to disrupt colloidal methods. Removal of colloidal particles in wastewater is generally carried out as a mechanism of coagulants. Neutralization involves the surface charge on the elements so that they can stick to each other particles making larger particles settle by gravity at a sufficient point in time. Even though it is complex and slightly mysterious. The other method, which we will examine, is repeatedly described as the "sweep-up floc" principle. This concept claims that the coagulants combined produce a precipitate that clears by gravity in a sufficient period. These coagulant floc fragments collide along with and mix colloidal particles evenly.

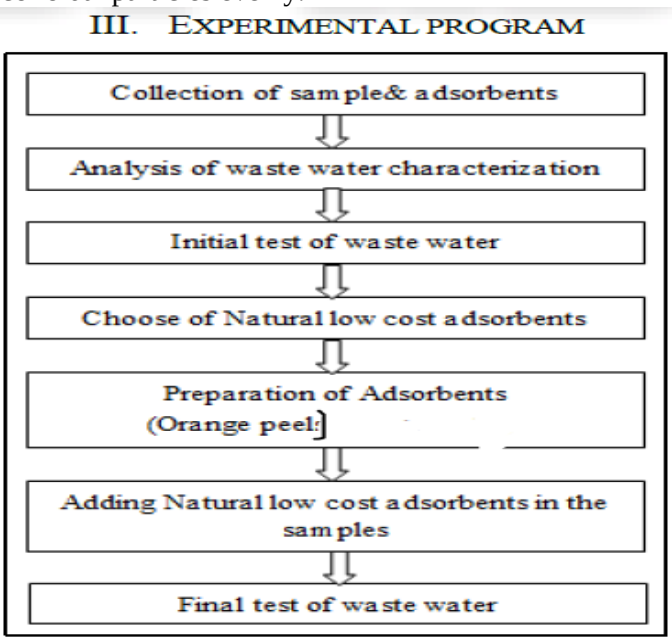


Fig:1 Experimental process

3.1 Orange peel powder

Orange peels were collected from the local market at Chandapura and then washed numerous times with tape water to remove colloidal particles. Orange peels were dried in sunlight for a week and made into small pieces by manual cutters and then later it is crushed into small particle size powder and sieved. As natural coagulant helps to form a low-cost coagulant agent in the coagulation process in the wastewater treatment plant and it is an important economical and environmentally friendly product.

Fig2 : Orange peel powder

3.2 Coagulation

The process of coagulation is very essential which involves adding iron, aluminum salts namely, alum (AlCl3), ferric chloride (FeCl3) and polyaluminium chloride (PAC) to the water .these coagulants sustain a positive charge and these positive charges of the coagulant neutralize the negative charge of suspended and dissolved particles coagulate, this process can also be called as flocculation. The efficiency of these chemicals as coagulants is well-predictable, they are nevertheless, difficulties related to the usage of these coagulants such as uselessness in low-temperature water, comparatively high obtaining costs, harmful effects on human well-being, manufactures the huge sludge bulks and it will also effect on the pH of the wastewater.

3.3 Jar test apparatus

The most common laboratory procedure to find the optimum dosage of coagulant is a jar test. It includes the operation of sedimentation and coagulation. In the jar test, we are allowing the sedimentation of the coagulant added in the jar, We will be using 1 Liter jar of 6 numbers, which will be arranged accordingly and the set up will be made for the flocculation process coagulant with different variations were added in the laboratory and tested with different speeds to find out the effectiveness of a huge scale treatment process. Usually, a jar test is selected to carry out coagulation and sedimentation studies. Time restraints supported in coagulation sedimentation findings are: Rapid mixing or combining for 2 min at 100 rpm, Slow mixing for 20 min at 40 rpm, and Sedimentation for 45 minutes.

3.4 Characteristics of wastewater

Krishna Sagara lake is enclosed in a larger area, and it is a natural lake situated in Anekal taluk, Bangalore. Krishna Sagara lake is 80years old and extends an area of approximately 5 acres. It is presently extremely contaminated along with sewage. The average result of wastewater characteristics collected from 10 am to 3 pm on individual times displays that total hardness of 273.2mg/L, magnesium hardness of 56.068mg/L, calcium hardness of 98.112mg/L, chlorides of 820.94mg/L, and residual chlorines of 609.912mg/L. Currently, most of the industries from guest line Bcx bio organics, Ashirwad plumbing Taurus private limited, hydraulics Pvt ltd, etc, this wastewater treated and untreated sewage is released into Krishna Sagara lake. The investigational

experiments were scheduled and performed because of disposal of wastewater and alternate technique for additional treatment of discharge in waterbodies.

Fig 3: view of krishna sagara lake and collection of sample water

4. Results and discussion

4.1 Experimental runs for coagulation studies with orange peel powder (coagulant)

Wastewater used for the treatment of coagulation research with orange powder as the coagulant. The key objective of coagulation research is to investigate the efficiency of neem leaf coagulant for decreasing wastewater characteristic parameters such as total hardness, magnesium hardness, calcium hardness, chlorides, and residual chlorines all through elimination of organic colloidal particles. Experimental work was performed employing the Jar Test apparatus. Rapid mixing at 100 rpm for 2 minutes and gentle mixing at 30-40 rpm for 20 minutes trailed by 45 minutes settling was remarked throughout investigational work. Six orange peel powder coagulant doses in the range of 10 to 60g/l were utilized to treat wastewater.

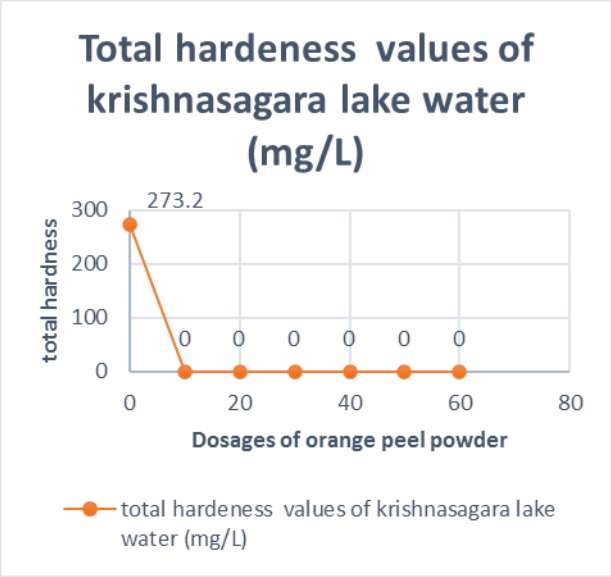
The hardness was found to be nil with the dosage of 10g, 20g, 30g, 40g, 50g, and 60g. the consequent values of hardness and other parameters such as magnesium hardness, calcium hardness, chlorides, and residual chlorines are given in the table below.

4.2 Result experimental

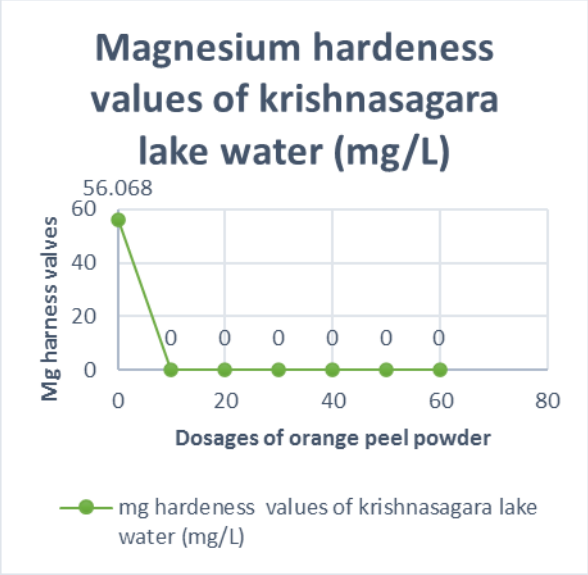
a) Hardness

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	Pre-testing	-----	273.2	56.068	98.112
2	Post-testing of water	10gm/L Orange peel powder.	AB	AB	112.56
3	Post-testing of water	20gm/L Orange peel powder.	AB	AB	52.08
4	Post-testing of water	30gm/L Orange peel powder.	AB	AB	52.08
5	Post-testing of water	40gm/L Orange peel powder.	AB	AB	47.04
6	Post-testing of water	50gm/L Orange peel powder.	AB	AB	47.88
7	Post-testing of water	60gm/L Orange peel powder.	AB	AB	53.76

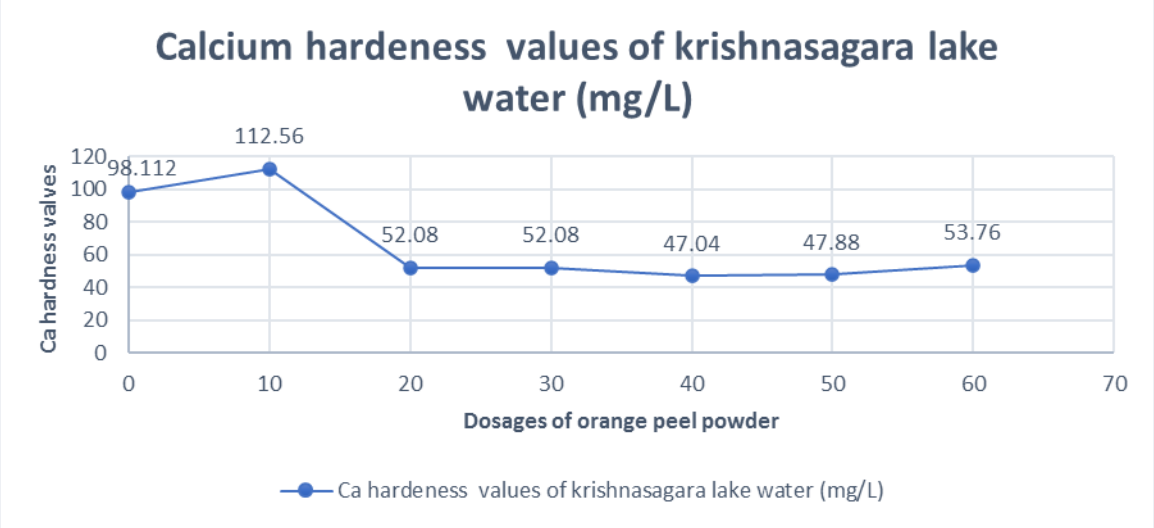
Table:1 Hardness of water with different dosages



Graph:1 Total hardness of water after treatment



Graph:2 Magnesium hardness of water after treatment

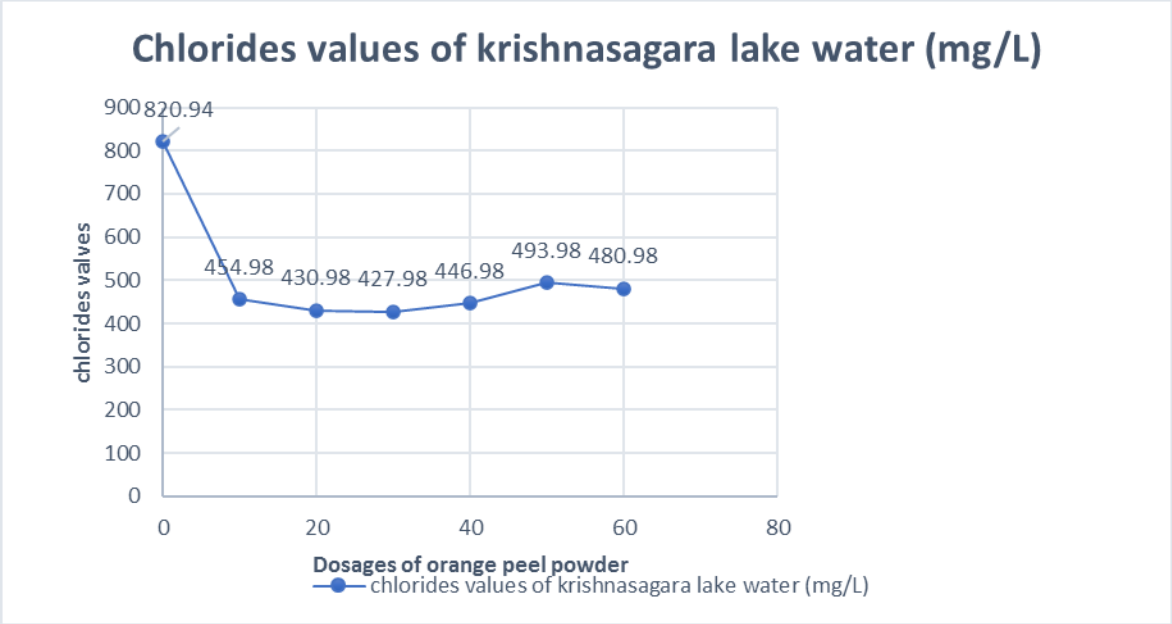


Graph:3 Calcium hardness of water after treatment

b) Chlorides test

Sl no	**SAMPLE**	**Coagulant dosage**	**Chlorides test values in (mg/L)**
1	Pre-testing	-----	820.94
2	Post-testing of water	10gm/L Orange peel powder.	454.98
3	Post-testing of water	20gm/L Orange peel powder.	430.98
4	Post-testing of water	30gm/L Orange peel powder.	427.98
5	Post-testing of water	40gm/L Orange peel powder.	446.98
6	Post-testing of water	50gm/L Orange peel powder.	493.98
7	Post-testing of water	60gm/L Orange peel powder.	480.98

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 chlorines test values in (mg/L)
1	Pre-testing	-----	820.94
2	Post-testing of water	10gm/L Orange peel powder.	180.846
3	Post-testing of water	20gm/L Orange peel powder.	145
4	Post-testing of water	30gm/L Orange peel powder.	154
5	Post-testing of water	40gm/L Orange peel powder.	244.67
6	Post-testing of water	50gm/L Orange peel powder.	386.51
7	Post-testing of water	60gm/L Orange peel powder.	303.18

Table:3 Residual chlorine of water with different dosages

5. Applications, advantages, and disadvantages of orange peel powder

Applications of orange peel coagulant

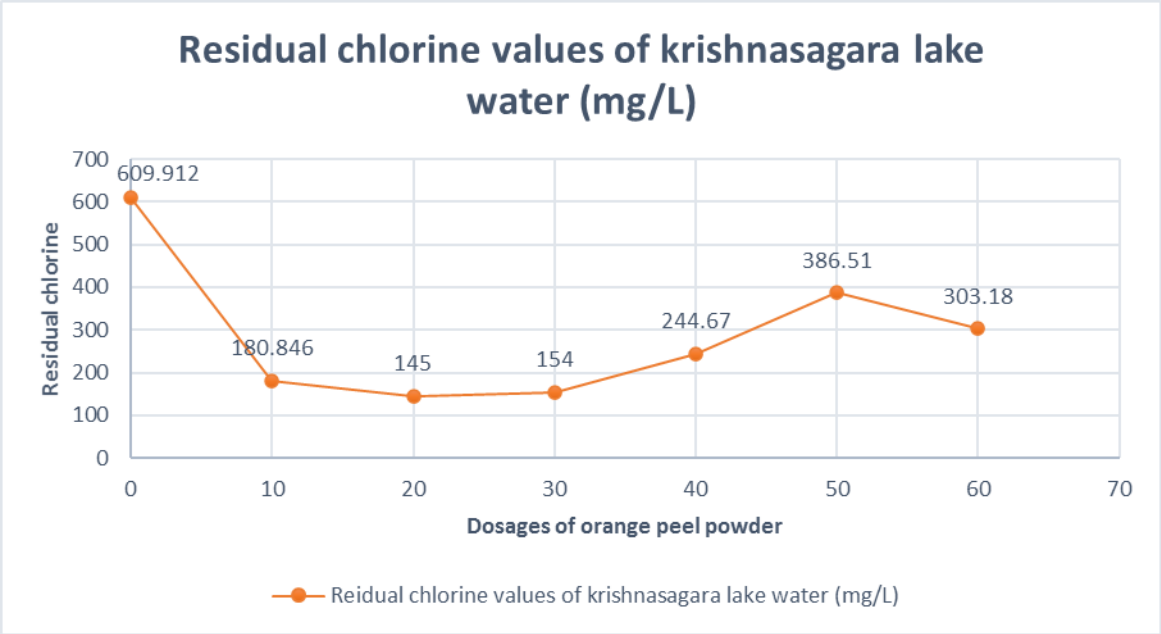
- To recognize a workable, easy, nearby available coagulant.
- Eco-friendly water treatment expertise is further appropriate for the earth to safeguard it from contamination affected by chemical coagulants.
- Assess the optimum doses of orange peel powder for unique concentrations to remove chlorides.
- Removal efficiency is very high in orange peel powder.

Advantages of orange peel coagulant

- It is non-poisonous and reliable for intake
- It is eco-friendly
- Safe for drinking.
- Orange peel is rich in organic compounds
- Orange peel has high-level nutrients.
- Orange peel has lignin
- Orange peels are a great source of acid

Disadvantages of banana pith coagulant

- Accessibility of dried pith is a bit difficult.
- It involves a huge capacity of increasing.
- The smell may affect after applying in water treatment.



Graph:5 Residual chlorine of water after treatment

6. conclusions

a) The chloride content of the sample water gradually decreases with the addition of orange peel powder.
b) Orange peel is buyer-friendly and eco-friendly, a replacement for minor-size water treatment.
c) Orange peel is a renewable supply that can be grown on a huge scale.
d) Using Orange peel as an alternative coagulant that gathers up water quality factors.
e) Orange peel is easy to use, naturally obtainable, easy to preserve and can be used as a domestic coagulant.
f) The Orange peel can remove Hardness, Chlorides, and Residual chlorine
g) It is eco-friendly proficiency which has additional benefits more than other treatment alternatives.

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