

TREATMENT OF WASTE WATER USING LEMON AND BANANA PEEL AS NATURAL COAGULANTS.

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Abstract - Water is essential not only for survival but also contributes immeasurably to the quality of our lives. Since the dawn of time, human beings have harnessed water to improve their lives. Various reports have mentioned the direct and indirect toxic effects of metals in the form of tumours, cancers, and allergies. Hence, health problems caused by alum have been recently reported. In order to replace alum as coagulants, the natural coagulants like in the combination of banana peel and lemon peel are used in water treatment via coagulation-flocculation processes. pH and coagulants dosage were identified for banana peel, the combinations of banana peel with lemon peel. This investigation conducted found that lemon peel can be a good coagulant which can absorb Biological Oxygen Demand. The Dehydration method is found to be more efficient for both lemon and banana peels. The optimum contact time for banana peel and lemon peel is 90 min The optimum adsorbent dosage for lemon peel, drumstick seed and banana peel is 0.3g and the optimum particle size for lemon peel and banana peels are 300 μ m.

Key Words: Natural Coagulants, Lemon, Banana, Turbidity.

1. INTRODUCTION

The Worldwide water demand is increasing day by day due to rapid population, and on the other hand there is continuous decline in ground and surface water levels due to over exploitation. Efforts are being made to find the alternatives for water supply and one prominent solution is treatment and re-use of wastewater. The wastewater is a combination of kitchen waste water, washing and rinsing, bathing water which generates lot of wastewater which contains very high concentration of organic substances such as proteins, carbohydrates and lipids. Many technologies are in practice to treat the wastewater and in the present study, an attempt was made to investigate the application of low-cost adsorbents from lemon and banana peels for the treatment by considering the wastewater.

Banana peel is an agricultural waste that is being discarded all over the world as a useless material. They cause waste management problems although they have some compost and cosmetics potentiality. The substance could be used for medicine as well as personal care and is known for anti-fungal and antibiotic properties. Besides that, banana peels also have adsorbent potentiality. It is very

useful for purification and refining processes. It has adsorption capacities to remove chromium from wastewater, copper and also some dyes.

Lemon peels works as a low cost natural coagulant agent for coagulation process in water treatment plant and act as a significant environmentally friendly product. The potential of lemon peels as a coagulant agent in removing turbidity in synthetic turbid water.

1.1 Objective of study:

1. To study the characteristics of waste water..
2. To know the effect of pH, contact time, particle size and adsorbent dosage.
3. To analysis the effect of turbidity.
4. To analysis the effect and variations of waste water parameters like BOD, DO etc.

1.2 Coagulation Activities

Sand Filtration

Filtration through clean sand is a fast and simple pre-treatment option. Users pour water from a transport container through a container of sand with gravel and a spigot at the bottom. The water then flows into a storage container. The benefits of sand filtration are that it is effective at removing some bacteria, it is simple and fast for the user, and, if sand is available locally, it is inexpensive.

Settling & Decanting

Settling and decanting is a method to reduce turbidity by letting the water sit for 2-24 hours so that the particulates settle to the bottom of the container. The clear water is then decanted off the top into a second container. The benefit of settling and decanting is that it requires no equipment besides the containers.

2. MATERIALS AND METHODOLOGY

2.1 Methods

Lemon and banana peels wastes were collected from houses and the tap water is collected. The pH of the samples

was measured using digital pH electrode and turbidity was measured by Nephelo meter. The rotatory shaker was used to stir the samples at 100 rpm for about 40min. A set of different conical flasks were labelled with different volume were taken at a time and 20ml of sample is added and diluted to 100ml to each conical flask.

All coagulation experiments were carried out using synthetic turbid water. A conventional jar test apparatus was used in the experiment to coagulate the samples of synthetic turbid water using coagulants prepared.

2.2 Preparation of Synthetic Water:

Synthetic turbid water for the jar tests was prepared by adding clay particles to tap water collected from the electronic city area in Bangalore. About 30 g of the clay materials was added to 1 litre of tap water. The suspension was stirred for about 1 hour to achieve a uniform dispersion of clay particles. Then it was allowed to settle for at least 24 hours for complete hydration of the clay materials. The supernatant suspension of synthetic turbid water was added to the sample water to achieve the desired turbidity just before coagulation.

2.3 Stocksolution Of Natural Coagulants:

Lemon and banana peel are allowed to dry naturally to a brown color. The lemon and banana were ground to fine powder using a kitchen blender to make it of approximate size of 300 μm to achieve solubilization of active ingredients in the peel. Distilled water was added to the powder to make 1% suspension of it. The suspension was vigorously shaken for 40 minutes using a magnetic stirrer to promote water extraction of the coagulant proteins, and this was then passed through filter paper. The filtrate portions were used for required dose of natural coagulants. Fresh solutions were prepared daily and kept refrigerated to prevent any ageing effects. Solutions were shaken vigorously before use.

2.4 Jar Test Operations:

Jar test is the most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus was used in the experiments to coagulate sample of synthetic turbid water using some coagulants. It was carried out as a batch test, accommodating a series of six beakers together with six-spindle steel paddles. Before operating the jar test, the sample was mixed homogenously. Then, the samples ought to be measured for turbidity. Coagulants of varying concentrations were added in the beakers. The whole procedures in the jar test were conducted in different rotating speed.

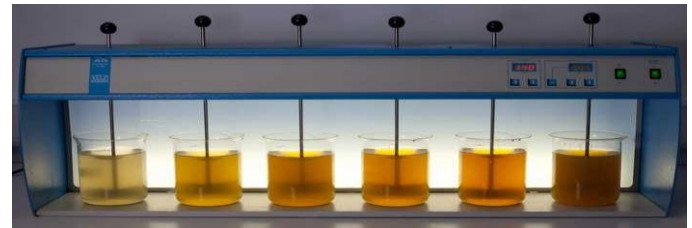


Fig -1: Jar test apparatus

2.5 Construction of Filter:

After coagulation of wastewater with Banana peel powder, the color of wastewater becomes dark brown. Also, the treatment of wastewater with lemon and Banana peel powder was not enough to increase the Dissolved Oxygen (DO), and the removal of BOD. For this a simple and cheap filter was constructed using charcoal and sand. Fresh charcoal was obtained and crushed into small bits. In order to reduce the cost and also to save waste materials, two cylindrical plastic bottles of size 2 litres were taken in a container. A layer of gravel was placed on top of the mesh, and was well compacted. Gravel was placed at the bottom to give a strength and support to the overlying layers. Further the charcoal bits were placed in a thick layer and compacted. Charcoal would act as an adsorbent which would remove color and odor. This layer was followed by a layer of well compacted sand, for mechanical screening, coagulation flocculation and biological activity and coconut fiber for its antifungal nature. The filter was then saturated using tap water to remove all the dust and dirt components.

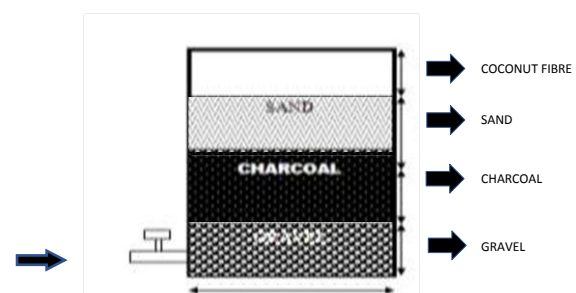


Fig -2: Constructed filter

3. RESULTS AND DISCUSSION

3.1 Effect of pH: 0.1g of 300 μm coagulant was weighed using electronic balance and added to each of the samples. The maximum removal occurs between pH 6-8 in both methods for lemon and banana peels.

3.2 Effect of Contact Time: 0.1 g of 300 μm of coagulant at different contact times of 30,60, and 90 minutes respectively. The removal percentage increases gradually as the time is increased. However, a slight decrease on the percent removal at 120 min in Lemon peel and banana peel.

3.3 Effect of Adsorbent Dosage: 0.1 g of 300 µm of coagulant at different dosages of 0.05, 0.1, 0.2, and 0.3g respectively. Removal increased as the mass of coagulant dosage was increased. At 0.3g maximum removal was obtained.

3.4 Effect of Particle Size: 0.1 g of 300 µm of coagulant at different particle size 300, 425, and 600 µm respectively. Decrease in adsorbent particle size results, an increase of percent removal of BOD. The maximum removal occurs at 300µm.

Table -1: The following table shows the average percentage of removal efficiency of coagulants.

PARAMETERS	BEFORE WATER TREATMENT (mg/l)	STANDARD VALUES (mg/l)	AFTER WATER TREATMENT (mg/l)
TURBIDITY	63	5-10	7.0
HARDNESS	806	300-600	463
BOD	97	<30	22
pH	6.5	6.5-8.5	7.9
DO	4.5	4-14	13

Banana peels are selected to be prepared as a bio-adsorbent and contain high organic carbon (41.37%) and have been subjected to bio-methanation and biogas production. Peels were also used as a material for charcoal and activated charcoal adsorbent.

The potential of lemon peels as a coagulant agent in removing turbidity in synthetic turbid water is tested using JAR test apparatus at a different dosage and pH.

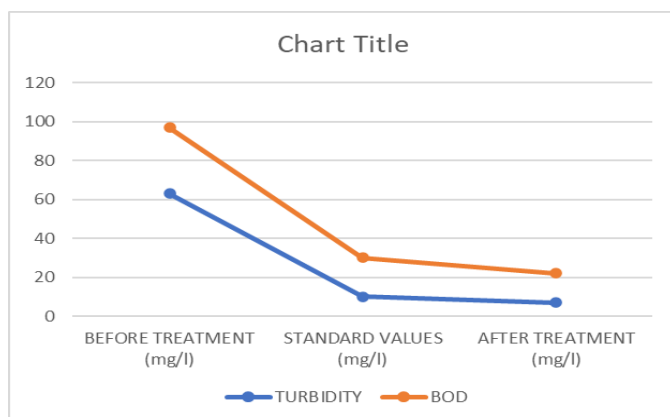


Chart -1: variations of parameters (TURBIDITY & BOD)

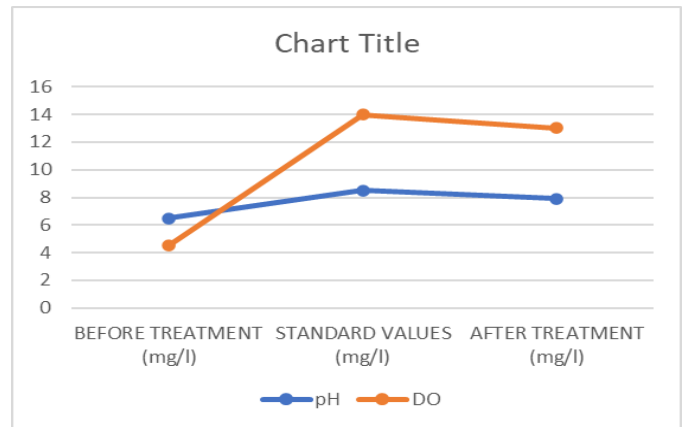


Chart -1: variations of parameters (pH & DO)

4. CONCLUSIONS

Two independent variables, namely amount of dosage and pH were used to determine the optimum dosage, optimum pH and percentage of turbidity removal of water sample. The outcome showed that the increased amount of dosage effect the efficiency of turbidity removal in the synthetic water sample. Using some locally available natural coagulants, for example banana peel and lemon peel significant improvement in removing turbidity and BOD from synthetic tap water was found. Maximum turbidity reduction was found for highly turbid waters. It is very useful for purification and refining processes. After dosing, water-soluble extract of *banana peel and lemon peel* reduced turbidity 63 from to 7 NTU after dosing and filtration. It was also found that these natural coagulants reduced about 70–80% BOD. Among the natural coagulants used in this study for turbidity reduction, lemon peel was found most effective. It reduced up to 75% turbidity from the raw turbid water.

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