

Investigation of Coagulation Activity of Lemon and Banana Peel Powder in Water Treatment

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ABSTRACT

Health problems caused by alum have been recently reported. Various reports have mentioned the direct and indirect toxic effects of metals in the form of tumours, cancers, and allergies. In order to replace alum as coagulants, the combination of banana peel and lemon peel used as coagulants in water treatment via coagulation-flocculation processes were investigated. pH and coagulants dosage were identified for banana peel, the combinations of banana peel with lemon peel. The 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 120 min. The optimum adsorbent dosage for lemon peel, drumstick seed and banana peel is 0.25g and the optimum particle size for lemon peel and banana peels are 300µm.

Keywords: Jar Test, Coagulation, Flocculation, Natural Coagulants, Turbidity.

I. INTRODUCTION

Water is one of the essential requirements for life. All living things need water for their survival. Water is used for a variety of purposes, including drinking, food preparation, irrigation and manufacturing. Although water covers more than 70% of the Earth's surface, less than 1% of that resource is available as fresh water – and this is not evenly distributed throughout the world. More than one billion people worldwide, mostly in developing countries, lack safe drinking water. Apart from the scarcity of water, there are many other challenges in providing a safe, adequate and reliable water supply in many parts of the world. Many technologies are in practice to treat the wastewater and in the present study, an attempt was made to investigate the application of natural coagulant from lemon and banana peels for the treatment by considering the water in Erode. Tons of lemon and banana peels were discarded and sent to garbage as useless materials and it is very significant and even essential to find applications and uses for these peels, as the management of wastes nowadays is becoming a very serious environmental issue. These waste peels are low cost, non-hazardous and environment friendly bio-materials which can be used as coagulant in water treatment. Dehydration process was used to prepare the coagulant from these peels and the effect of contact time, pH, dosage and particle size in removal of pollutants from the water was evaluated.

II. MATERIALS AND METHOD

Lemon and banana peels wastes were collected from houses in Sathyamangalam in Erode. The pH of the samples was measured using digital pH electrode and turbidity was measured by Nephelo turbidity meter. All

coagulation experiments were carried out using synthetic artificial turbid water. A conventional jar test apparatus was used in the experiments to coagulate sample of synthetic turbid water using coagulants.

III. PREPARATION OF SYNTHETIC WATER

Synthetic turbid water for the jar tests was prepared by adding clay materials to tap water. About 30 g of the clay materials was added to 1 liter 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

IV. STOCK SOLUTION 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 45 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 (such as change in pH and coagulation activity). Solutions were shaken vigorously before use.

V. 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 homogeneously. 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.

VI. CONSTRUCTION OF FILTER

It was observed that after coagulation of wastewater with Banana peel powder, the colour of wastewater became 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 liters 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 colour and odour. 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.

VII. RESULTS AND DISCUSSION

4.1 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.

4.2 Effect of Contact Time

0.1 g of 300 µm of coagulant at different contact times of 30,60,90,120, and 150 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.

4.3 Effect of Adsorbent Dosage:

0.1 g of 300 µm of coagulant at different dosages of 0.05, 0.1, 0.15, 0.2, 0.25, 0.3g and 0.35g respectively. Removal increased as the mass of coagulant dosage was increased. At 0.25g maximum removal was obtained.

4.4 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.

The following table shows the percentage of removal efficiency of coagulant

parameters	Before water treatment (mg/l)	Standard values (mg/l)	After water treatment (mg/l)
TURBIDITY	38	5-10	5.2
HARDNESS	684	300	311
BOD	98	Less than 30	11
pH	6.7	6.5- 8.5	7.6
DO	5	4-14	12

Table1

VIII. CONCLUSION

Using some locally available natural coagulants, for example banana peel and lemon peel significant improvement in removing turbidity and BOD from synthetic raw water was found. Maximum turbidity reduction was found for highly turbid waters. After dosing, water-soluble extract of *banana peel and lemon peel* reduced turbidity from 38 to 5.2 NTU after dosing and filtration. It was also found that these natural coagulants reduced about 89–96% BOD. Among the natural coagulants used in this study for turbidity reduction, lemon peel was found most effective. It reduced up to 95.89% turbidity from the raw turbid water.

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