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# Treatment of Wastewater using Banana and Lemon Peels as Adsorbents

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## ABSTRACT

*An experimental investigation was carried out for the treatment of wastewater using low cost adsorbents. The peels of banana and lemon were used as adsorbents by carbonization method and the effect of pH, contact time, adsorbent dosage, and adsorbent particle size in removal of pollutants present in wastewater was evaluated. The studies showed that the lemon peels are more effective than the banana peels in the removal of pollutants from the wastewater. The carbonization method is found to be more efficient for both lemon and banana peels, the lemon peel found to be more efficient with the highest percentage removal of BOD. The optimum pH for both orange and banana peels found to be in a range between 6-8. The optimum contact time for carbonization method of banana peel and lemon peel is 100 min. The optimum adsorbent dosage for carbonization of lemon peel and banana peel is 0.32g and the optimum particle size for lemon peel and banana peels are 300µm.*

**Keywords:** Adsorbent, lemon peel, Banana peel, sewage waste water, Carbonization method.

## INTRODUCTION

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. In 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 in Erode. Tones 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 adsorbents in wastewater treatment. carbonization method were used to prepare the adsorbents from these peels and the effect of contact time, pH, dosage and particle size in removal of pollutants from the wastewater was evaluated.

## 2 Materials and Methods

lemon and banana peels wastes were collected from houses and wastewater was collected from sathyamangalam in erode. The rotatory shaker was used to stir the samples at 100 rpm. The pH of the samples was measured using digital pH electrode and turbidity was measured by Nephelo turbidity meter.

4 sets of conical flasks labelled with respective parameters (pH, contact time, adsorbent dosage and adsorbent particle size) were taken at a time and 20 ml of sample is added to each conical flask. The flasks

were kept in a rotary orbital shaker at 100 rpm and then samples were withdrawn from the shaker, filtered using a filter paper and BOD was measured at respective time intervals.

### 3. Preparation of Adsorbents

#### 3.1 Carbonization Method:

The collected peels were cut into small pieces, washed with distil water to remove dirt and suspended impurities and then dried for 48 hours in an oven at 100°C to remove the moisture content from the peels. After the drying process, the peels were removed from the oven and kept in the desiccators for 30 minutes and then the dried peels kept in the furnace for 3 hours at 200°C to convert it into carbon. After that the peels were removed, cooled and ground to fine powder and sieve through 600µm, 425µm, 300µm for different particle size.

### 4. Results and Discussion

#### 4.1 Effect of pH:

0.1g of 300 µm adsorbent was weighed using electronic balance and added to each of the samples. The maximum adsorption 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 adsorbent at different contact times of 30,60,90,120, and 150 minutes respectively. The removal percentage increases gradually as the time is increased. It can be attributed to the fact that more time becomes available for the organic substances to stick with the adsorbent surface, as well as surface adsorption increases with time. However, a slight decrease on the percent removal at 100 min in Lemon peel and banana peel carbon, this may be due to desorption of pollutants from the adsorbent surface due to continue stirring process.

#### 4.3 Effect of Adsorbent Dosage:

0.1 g of 300 µm of adsorbent 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 adsorbent dosage was increased. At 0.35g maximum removal was obtained.

#### 4.4 Effect of Particle Size:

0.1 g of 300 µm of adsorbent at different particle size 300, 425, and 600 µm respectively. Decrease in adsorbent particle size results, an increase of percent removal of BOD and this may be due to the increase in the available surface area for the adsorption process

The following table shows the percentage of removal efficiency of adsorbent

Table 1

parameters	before treatment ( mg/l)	Standard values ( mg/l)	After treatment ( mg/l)
TURBIDITY	25	5-10	8
HARDNESS	736	300-600	365
BOD	200	LESS THAN 30	17
PH	5.9	6.5 – 8.5	7.6
DO	0	4-14	6.8

Table 2

PARAMETERS	BEFORE TREATMENT ( mg/l)	STANDARD VALUES ( mg/l)	AFTER TREATMENT ( mg/l)
TOTAL SOLIDS	947	100	117
DISSOLVED SOLIDS	750	500-2000	624
SULPHATE	366	250	267
CHLORIDES	549	250	256

### CONCLUSION

The removal of organic substance from waste water using carbonization methods for lemon and banana peels was studied by investigating the effect of pH, time, adsorbent dosage and particle size. The carbonization method is found to be more efficient for both, lemon and banana peels with highest percentage removal of organic substance. The carbonization method is considered to be better since carbon is a strong oxidant and has a unique pores structure which adsorbs the organic substances to its surface easily. The lemon peel found to be more efficient than banana peel. This is due to the characteristics of lemon peels in its content fibre which contain more hydroxyl radicals, hence more adsorption capacity. The optimum pH for both methods, lemon and banana peels are found to be in a range between pH 6-8. The optimum time for carbonization method of banana peel and lemon peel is at 100 min. The optimum adsorbent dosage for carbonization method of lemon and banana peel is at 0.35g. The optimum particle size for both methods, lemon and banana peels are at 300µm.

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