

# Removal of coliforms from waste water using biochar



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## ABSTRACT

Wastewater contains coliforms and many pathogens that are harmful to the humans and other living organisms. Various agroindustry by-products such as peanut shell, corncob, wheat husk, bagasse, sawdust, rice straw, etc. are generated in huge amount. These agroindustry by-products are just thrown or get piled up. Hence, they can be used for the environmental clean-up purposes that will be helpful globally. These can be used for the removal of coliforms from wastewater due to their adsorption capacity. The study here reports the use of bagasse in removal of coliforms from wastewater by most probable number method. About 72 and 78 % removal of coliforms was observed in presumptive and confirmatory tests of most probable number respectively. This will help in the treatment of wastewater that is very essential. This use of bagasse based biochar technology for the removal of coliforms from wastewater is very eco-friendly and cheap.

## 1. Introduction

The waste water contains coliforms [1] which are a serious problem. The use of chemicals to remove coliforms from waste water is not economical and also causes environmental pollution [2]. Various agroindustry by-products e.g. rice, wheat husk, bagasse, sawdust, corncob, coconut husk, etc. are produced in large quantity. These agroindustry by-products are directly burned without making any use. They can be used for the making of 'biochar'. The research on biochar for the removal of coliforms from waste water is achieving immense interest [3]. Biochar is in charcoal like form which is obtained by pyrolysis by incineration of agroindustry by-products or residues, forestry wastes, etc. at high temperature. Biochar has the ability of adsorption [4]. The research work here describes the use of bagasse-based biochar for the removal of coliforms from wastewater.

## 2. Materials and Methods

### 2.1. Collection of Samples

### 2.1.1. Waste Water Sample

The wastewater sample was collected from Bhosari MIDC area, Pune, Maharashtra, India.

The sample collection area of wastewater is represented in Fig. 1.



Fig. 1. Sample collection site of waste water

### 2.2. Agricultural By-Product

The biochar was prepared using the agricultural by-product i.e., bagasse which was brought from Theur sugar factory, Pune, Maharashtra, India.

### 2.3. Processing of bagasse

The bagasse was washed under water to remove any dirt particles [5] and then

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completely dried in sunlight for 48 h. After drying, bagasse was powdered using mixer.



Fig. 2. Powdered form of bagasse

#### 2.4. Preparation of Bagasse Based Biochar

Finely powdered bagasse was placed in the muffle furnace at 550°C for 3 h to get biochar (Fig. 3). The bagasse based biochar was collected in plastic bag for further use.



Fig. 3. Bagasse based biochar

#### 2.5. Study for Removal of Pathogens from Waste Water Using Biochar

##### 2.5.1. Filtration of the Waste Water Sample

The waste water sample (50 ml) was filtered using Whatmann filter paper No. 1.

##### 2.5.6. Removal of Coliforms from Waste Water Using Bagasse Based Biochar

The bagasse based biochar was used to see the removal of coliforms from waste water by the most probable number (MPN) method. The biochar used was 1.0 g in each tube for the MPN method. In control, the tubes were without any bagasse-based biochar. The MPN was performed in three steps, presumptive, confirmatory and completed tests (<https://microbeonline.com/probable-number-mpn-test-principle-procedure-results/>).

### 3. Results

In presumptive tests in case of control, the no. of tubes 5 of 10 ml, 5 of 1 ml and 5 of 0.1 ml positive were 2-1-0. By comparing with the standard table (<https://microbeonline.com/probable-number-mpn-test-principle-procedure-results/>), the no. of coliforms/100 ml was 7. In case of use of bagasse based biochar, the no. of tubes 5 of 10 ml, 5 of 1 ml and 5 of 0.1 ml positive were 1-0-0. The no. of coliforms was 2.

In confirmatory tests in case of control, the no. of tubes 1 of 50 ml and 5 of 10 ml positive were 1-3. By comparing with the standard table, the no. of coliforms/100 ml was 9. In case of use of bagasse based biochar, the no. of tubes 1 of 50 ml and 5 of 10 ml positive were 0-2. The no. of coliforms was 2. So, in comparison to the control, the no. of coliforms in waste water is reduced when bagasse based biochar is used as seen from the presumptive and confirmatory tests. The % removal of coliforms in presumptive and confirmatory tests was 72 and 78 respectively. This is the first on use of bagasse based biochar for the removal of coliforms from waste water.

### 4. Discussion

There are very few reports on removal of pathogens from waste water using agroindustry by-products. There are very few reports on bagasse based biochar for the removal of pathogens from waste water. There is a report on biochar for removal of pathogens from waste water [6]. The study is novel as bagasse based biochar for the removal of pathogens from waste water will be helpful globally. This technology for the treatment of waste water can be applied worldwide and is very easy.

### 5. Conclusion

The bagasse based biochar can be used for the removal of coliforms from waste water. This will also help in the management of agroindustry by-product bagasse that is just incinerated or disposed to the landfills, thus minimizing the pollution. The use of bagasse

based biochar for the removal of coliforms from wastewater is novel, simple, eco-friendly and economical.

### Conflict of Interests

All authors declare no conflict of interest.

### Ethics approval and consent to participate

No human or animals were used in the present research.

### Consent for publications

All authors read and approved the final manuscript for publication.

### Availability of data and material

All the data are embedded in the manuscript.

### Authors' contributions

All authors had equal role in study design, work, statistical analysis and manuscript writing.

### Informed Consent

The authors declare not used any patients in this research.

### Conflict of Interest

There is no conflict of interest among the authors.

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