

# Citrus Bio-enzyme production and Application for waste water treatment

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## ABSTRACT

Enzymes are high value industrial bio-catalysts with extensive applications in a wide range of manufacturing and processing sectors, including the agricultural, food and household care industries. Bio Enzymes are organic compounds produced by fermentation of fresh vegetable/fruit waste in presence of water and jaggery. It is claimed as a multi-use solution for domestic and agricultural applications. The objective is to clean water bodies with Bio enzymes. By using selective micro-organisms such as yeast, the fermentation process forms mineral salts, organic acids, alcohol, natural chains of proteins and enzymes. This study is carried out on sewage water from an educational institute named Guru Gobind Singh College of Engineering Nashik

**Keyword :** - Enzymes, fermentation , sewage

## I. INTRODUCTION

Bio Enzyme is a universal, natural cleaner produced from vegetable/fruit peels (usually citrus) or waste. It is an effective alternative to harsh chemicals such as bleach, phenyl, and other chemical solutions we typically use in households to wash our bathrooms, clean toilets, wipe our floors, tiles and other surfaces. Chemically, they are a mixture of complex organic substances such as proteins, salts and other materials that are by-products of the bacteria/yeas that we will use to make bio enzymes.

These organic substances are capable of the breaking down of chemical and other organic waste thus helping us in removing stains, odor, getting rid of other harmful microbes, etc. They also greatly neutralize toxins and pollutants. Citrus fruit peels are used due to their distinct properties such as fragrance and sharp flavor, source of vitamin C and also rich in medicinal properties along with high acidity value. The jaggery which is added is utilized by microbes; due to their

metabolism ozone that is derived may kill the bacteria. Bio-enzyme acts as an anti-fungal, anti-bacterial and insecticidal agent. It may also use as cleansing agent. In the present study we work on production of bio-enzyme from citrus fruit peels and their different applications.

## II. OBJECTIVES

- 1) To treat waste water by providing dosage of bio-enzyme.
- 2) To reuse fruit waste generated from juice centers and fruit vendors.
- 3) Pollution control by promoting bio-enzyme as fertilizer and disinfectant.
- 4) To provide alternative to chemical detergents and cleaners.



## III. METHODOLOGY



The primary aim of our project is to treat the institutional wastewater using the Bio Enzyme prepared from the citrus fruit peels. The treatment is done by the utilization of different percentages (2%,4% & 6%) of Bio Enzyme. The flowchart mentioned earlier represents the methodology of our project.

#### IV. TESTING ON TREATED WATER

The tests that have been conducted for the institutional waste water and the effluent after treatment are

- pH- (power of hydrogen) It specifies how acidic or basic a liquid solution is.
- Alkalinity-This test is done to measure how much acid can be neutralized by the liquid sample.
- Biological Oxygen Demand (BOD)-It gives the amount of oxygen consumed by microorganisms and bacteria.
- Chemical Oxygen Demand (COD)-It is a measure of oxygen needed for oxidizing soluble organic matter in water.
- Total Dissolved Solids (TDS)-It gives the concentration of dissolved substances in the water sample.
- Dissolved Oxygen (DO) - This is the amount of oxygen that is present in water. Water bodies receive oxygen from the atmosphere and from aquatic plants.

#### V. RESULTS AND DISCUSSION

The characteristics of raw institutional wastewater were tested immediately after the collection of samples. Figure :4 shows the graphical representation of various parameters of the effluent from the results obtained during the treatment of institutional waste water with different percentages (2%,4%& 6%) of Bio Enzyme on first and third day as digestion period.

The table below gives the characteristics of Ideal usable water recommendations as per BIS-

<b>Ideal Usable Water Recommendations Of Characteristics As Per Bureau of Indian Standards (BIS)</b>			
<b>SR NO</b>	<b>PARAMETERS</b>	<b>Unit</b>	<b>Allowable limits For Treated water</b>
1	PH	-	6.5 to 8.5
2	ALKALINITY	mg/l	200 to 600
3	Turbidity	NTU	1 to 5
4	Total Hardness	mg/l	200 to 600
5	Total dissolved solids	mg/l	500 to 2000
6	Dissolved oxygen (DO)	mg/l	6 to 4
7	Biochemical oxygen Demand (BOD)	mg/l	30
8	Chemical oxygen Demand (COD)	mg/l	250

<b>EFFLUENT CHARACTERISTICS AFTER TREATMENT OF INSTITUTIONAL WASTE WATER USING 2% BIO-ENZYME</b>			
<b>SR NO</b>	<b>TESTS CONDUCTED ON WASTE WATER</b>	<b>UNIT</b>	<b>TEST RESULT (3RD DAY)</b>
1	PH	-	8.3
2	Alkalinity	mg/l	407
3	Turbidity	NTU	4.07
4	Total Hardness	mg/l	422
5	Total dissolved solids	mg/l	1650
6	Dissolved oxygen (DO)	mg/l	5
7	Biochemical oxygen Demand (BOD)	mg/l	20
8	Chemical oxygen Demand (COD)	mg/l	15

<b>EFFLUENT CHARACTERISTICS BEFORE TREATMENT OF INSTITUTIONAL WASTE WATER</b>			
<b>SR NO</b>	<b>TESTS CONDUCTED ON WASTE WATER</b>	<b>UNIT</b>	<b>TEST RESULT (3RD DAY)</b>
1	PH	-	10
2	Alkalinity	mg/l	800
3	Turbidity	NTU	8
4	Total Hardness	mg/l	850
5	Total dissolved solids	mg/l	2500
6	Dissolved oxygen (DO)	mg/l	2
7	Biochemical oxygen Demand (BOD)	mg/l	10
8	Chemical oxygen Demand (COD)	mg/l	150

**Effluent Characteristics After treatment of Institutional Waste Water using 4% Bio-Enzyme**

<b>Sr no</b>	<b>Tests conducted on waste water</b>	<b>Unit</b>	<b>TEST RESULT (3RD DAY)</b>
1	PH	-	6.99

2	ALKALINITY	mg/l	388
3	Turbidity	NTU	3.17
4	Total Hardness	mg/l	401
5	Total dissolved solids	mg/l	1550
6	Dissolved oxygen (DO)	mg/l	4.8

<b>Effluent Characteristics After treatment of Institutional Waste Water using 6% Bio-Enzyme</b>			
<b>SR NO</b>	<b>Tests conducted on waste water</b>	<b>Unit</b>	<b>TEST RESULT (3RD DAY)</b>
1	PH	-	5.3
2	ALKALINITY	mg/l	307
3	Turbidity	NTU	3.43
4	Total Hardness	mg/l	322
5	Total dissolved solids	mg/l	1460
6	Dissolved oxygen (DO)	mg/l	4.2

## VI. CONCLUSION

It is concluded that the enzymes are biological catalysts i.e. biocatalyst hence known as bio-enzymes which speed up biochemical reactions in living organisms, useful in a wide range of commercially imported processes. Thus, the bio enzymes can be used for various purposes since it is organic it won't have any side effects. Bio-enzymes helps to reduce some waste & turn into a useful substance to the society which is economical and cheaply available and the end product can be completely useful. Bio-enzymes act as a soil-stabilizing agent i.e. addition of bio-enzymes to soil maintains the moisture level of soil intern reducing plasticity & shrinkage of soil. It is also concluded that the bio-enzymes maximizes the load-bearing capacity of the soil. There are various applications of bio-enzymes such as to improve the consistency property of soil, to increase the CBR value of soil for construction of road, dam, airport. It also increases the D.O. of the water and wastewater, to decrease the BOD & COD in the wastewater. Hence it concludes that in the view of civil engineering. The bio-enzymes can be effectively used.

## VII. SUMMARY OF RESULTS

1. The Bio Enzyme was found to be Acidic in nature.
2. It contains large number of organic materials.
3. The results indicate that 2% and 4% can effectively reduce the parameters like Alkalinity, pH, Total Hardness, Alkalinity, Turbidity, TDS, DO.

4. It was observed that 4% of Bio Enzyme satisfied all the parameters and it was under permissible limit after 3 days of digestion period.
5. Institutional waste water was treated with 6% of Bio Enzyme all the parameters were under permissible limit on the 1st day itself.
6. Hence, we conclude that 6% of bio enzyme solution can effectively treat Institutional waste water and the treated water can be used for car cleaning, gardening, cleaning and storage purposes.

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