iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 10 **Issue:** VIII **Month of publication:** August 2022

**DOI:** https://doi.org/10.22214/ijraset.2022.46327

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 10 Issue VIII Aug 2022- Available at www.ijraset.com*

# Treatment of Domestic Waste Water Using Organic Bio-Enzymes Extracted from Seasonal Citrus Fruits

Yatin Shivalik[1], Amit Goyal[3]
[1, 2]*Civil engineering department, National Institute of Technical Teachers Training and Research, Chandighar*

***Abstract:*** ***Humankind has significantly degraded the quality of the world's water supplies as a result of massive industrialization in emerging nations like India. Due to these high levels of pollution, not just humans but all other life forms are now at jeopardy from the water's quality. Several measures have been taken to preserve the ongoing cycle of survival as water is a necessity for all life forms to flourish. Researchers have been working on new methods for water reclamation for a several years already, focusing on biological or physical wastewater treatment rather than chemical treatment, which degrades the quality of groundwater and damages the ecosystem. The wastewater is digested for 3, 5, and 8 days by mixing it with (1:1000) bio enzyme solution. COD (chemical oxygen demand), BOD (biological oxygen demand), alkalinity, pH, nitrate-nitrogen, nitrite nitrogen, ammoniacal nitrogen, phosphorus, and e. coli were measured. Organic biocides were found to be capable of removing COD, BOD, ammoniacal nitrogen, nitrate nitrogen, and nitrite nitrogen from samples while lowering the phosphorus content to acceptable levels specified by Indian Standard Codes. There were no significant differences in the pH characteristics observed. Organic biocides can be used as a cost-effective option for wastewater treatment in both urban and rural areas to improve water quality and make it suitable for various agricultural uses.***
***Keywords: Bio-enzymes, ratios, greywater, enzymatic digestion, submerged fermentation.***

## I. INTRODUCTION

Large water reservoirs exist on our planet in the form of seas, oceans, glaciers, rivers, and lakes. More than 70% of freshwater carrying bodies, such as rivers and lakes have been polluted and groundwater has been reduced to nearly zero in many places. Contaminated water is not useful AND HARMS all life forms and the environment. Wastewater contains numerous potentially harmful elements that, if consumed, could have a negative impact on public health. To reduce the negative effects, wastewater must be treated before it is released into bodies of water. To reclaim the usefulness of water, various treatments and purification technologies have been developed. These technologies are built around three processes: physical, chemical, and biological. Since household wastewater contains more organic matter, the biological method is a preferred choice. Biological processes are slow processes which if used on daily basis cannot be used to treat large quantities of wastewater. So, to make use of biological processes more mainstream, it is required to accelerate the rate of reaction by some catalyst. Therefore, to increase the efficiency of the biological processes enzymes are used as catalysts. These enzymes not only increase the rate of reaction by many folds but also reduce the consumption of energy. In living cells, various metabolic functions are performed by the biocatalysts which are produced to work for a specific biochemical action/response required for the proper functioning of the body. These biocatalysts are known as enzymes. An enzyme is a natural liquid formulation obtained from the fermentation of fruits (citrus in our research). It is non-poisonous in nature and does not catch any fire or cause corrosion. These enzymes are specific to their substrates and catalyze one or few organic compounds. These enzymes are mostly proteins and peptides, which means they are biodegradable and can be expelled from the contaminated stream without causing any pollution. Enzymes used in wastewater treatment fall under the category of biological supplements/additives. Bio enzymes, biocides, or garbage enzymes are enzymes produced under anaerobic conditions from the fermentation of organic waste material such as citrus fruits (e.g. oranges, pineapple, mosambi, etc.) in a fixed ratio with brown sugar/jaggery and water. These bio-enzymes can be used for cleaning, as natural insecticides and floor cleaners, as a substitute for chemical detergents, for body care, as a natural antiseptic, and as fertilisers. These enzymes also help in the removal of odours and toxic air emitted by vehicle exhausts. It keeps drainage pipes clear and aids in the purification of bodies of water. It also reduces greenhouse gas emissions by dumping less organic waste into landfills. This paper presents the result from the digestion of the greywater using bio-enzymes/biocides from the citrus fruits with dilution factor (1:1000) after 3, 5 and 8 days. Our attempt is to understand the effectiveness of the bio-enzymes produced from the citrus fruits on reducing various parameters.

 

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## II. MATERIALS AND METHODS

### A. *Materials*

The materials used for the production of organic biocides are:

- Citrus fruits
- Jaggery
- Water (free from any impurities)
- Plastic containers with openable lid

### B. *Methods*

Methodology flowed in the study can be divided into two steps:

- Bio-enzymes preparation
- Wastewater treatment using organic biocides

### C. *Preparations of Bio-enzymes*

Citrus fruits waste in the required quantity was collected as organic substances to make organic biocides. Jaggery, citrus fruit waste & water were mixed in a ratio of 1:3:10 to prepare the waste enzyme. The mixing process is done in an airtight plastic container. Gases are formed during the submerged fermentation process and are required to be released into the atmosphere. [22] The container is kept in a safe place which is away from direct sunlight. The food waste is broken down into smaller compounds by microbes along with the release of the gases.

Third week onwards, the production of gas is reduced. In between the process, the gases need to be released regularly. After the completion of 45 days, the container is tightly closed and left for digestion. The time required to complete the entire process is 3 months as recommended by previous studies.

After the completion of 3 months of digestion, an orange to brown colored liquid along with many small particles and some undigested residue is obtained. This raw enzyme is needed to be filtered so as enhance its structural and functional properties.

### D. *Wastewater Treatment using Bio-Enzyme*

The wastewater is collected from a local pond located in village Suahana in dist. Mohali, Punjab, India. [10-11] Drain water from the local household flowed into the pond making the pond water rich in organic waste material along with the deposition of algae. After the raw water is collected from the pond, it is poured into 9, 1-litre containers. Dosages are added into these containers in various proportions as 1:200, 1:500, and 1:1000 respectively. Every dose is poured into a group of three containers. Each set of three containers mixed with various proportions is left for the digestion period of 3, 5 and 8 days and was analyzed. After the completion of 3 months of digestion, orange to brown coloured liquid along with many small particles and some undigested residue is obtained. This raw enzyme is needed to be filtered so as enhance its structural and functional properties.

## III.EXPERIMENTATION AND RESULTS

### A. *Characteristics of Wastewater*

Table-1 Characteristics of wastewater

| Parameter | Units | Value |
|---|---|---|
| COD | Mg/l | 322 |
| BOD | Mg/l | 71.83 |
| Alkalinity | -- | 543 |
| pH | -- | 8.4 |
| Nitrate nitrogen | Mg/l | 0.165 |
| Ammoniacal Nitrogen | Mg/l | 0.1 |
| Nitrite nitrogen | Mg/l | 0.21 |
| Phosphorus | Mg/l | 7.68 |
| Faecal coliform | MPN/100 ml | $1 \times 10^7$ |

*B. Characteristics of Wastewater Sample after the Completion of Enzymatic Digestion*

The indicators such as performance, cost and sustainability are significant to determine the success of the treatment of waste water using bio-enzymes. Taking these factors into priority, the enzyme was tested in several calculated proportions as mentioned above. Out of all these proportions selected the main aim is to opt for the most optimal dosage which can be used to achieve quick and efficient results in a given amount of time. The results of various dosages are as follows:

Table-4 Results after treatment with 1:1000

| Sno. | Parameters | Effects after 3 days | Effects after 5 days | Effects after 8 days |
|---|---|---|---|---|
| 1 | COD (Chemical oxygen demand) | 13 mg/l | 11 mg/l | 10 mg/l |
| 2 | BOD (Biological oxygen demand) | 62.55 mg/l | 53.55 mg/l | 52.65 mg/l |
| 3 | Alkalinity | 393 mg/l | 386 mg/l | 351 mg/l |
| 4 | pH | 8.25 | 8.2 | 8.16 |
| 5 | Nitrate nitrogen | 0.012 mg/l | 0.01 mg/l | 0.01 mg/l |
| 6 | Ammoniacal nitrogen | 0 mg/l | 0 mg/l | 0 mg/l |
| 7 | Nitrite nitrogen | 0.0772 mg/l | 0.07 mg/l | 0.068 mg/l |
| 8 | Phosphorus | 6.11 mg/l | 5 mg/l | 4.5 mg/l |
| 9 | Faecal coliform | 1000 MPN/100 ml | 996 MPN/100 ml | 989 MPN/100 ml |

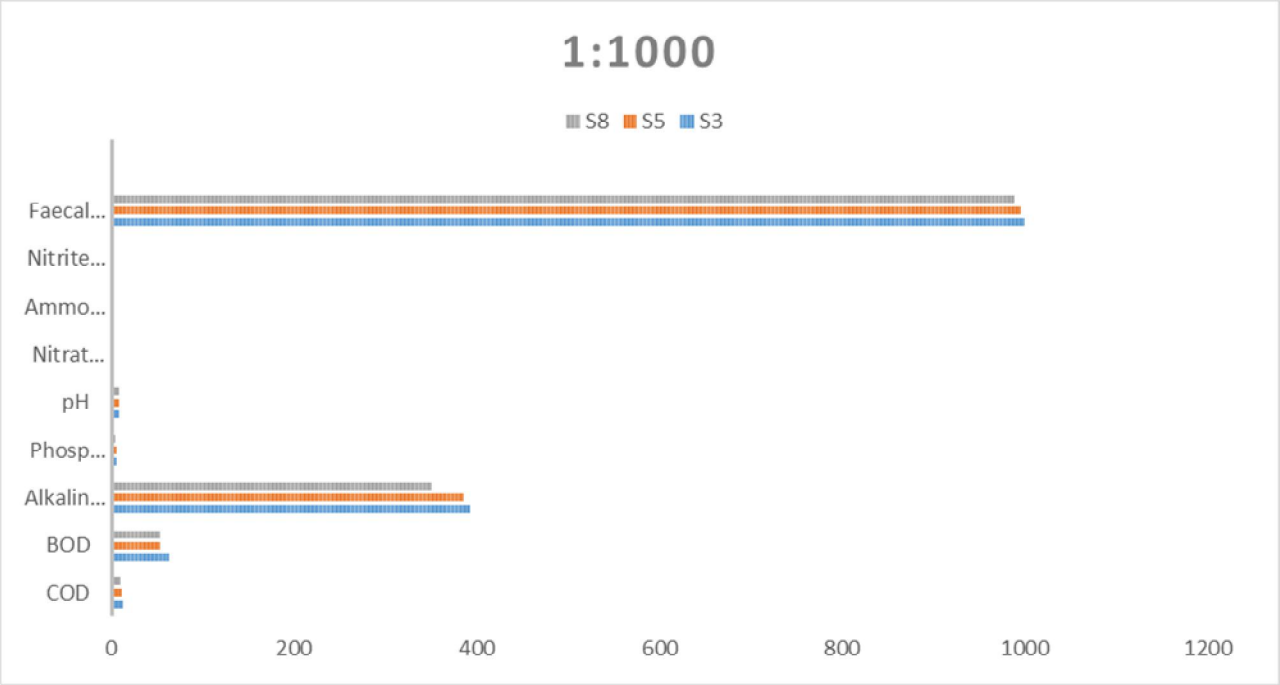


Fig-1 Variation in wastewater characteristics treatment with (1:1000)

## IV. DISCUSSIONS

1) *COD:* The variations in the value of COD are shown in Fig.1. The decrease of 96% was observed in the value of COD after treatment with (1:1000) on the 3rd day of dilution. The rate of reduction is almost constant at about 96% on the 5th and 8th day of digestion as shown in Fig.1.
2) *BOD:* the BOD characteristics of the effluent underwent a sharp decline. The value observed a decline of 96% after treatment with bio-enzyme the variation in the effluent characteristics is shown in the given Fig.1.
3) *Alkalinity:* 27% of alkalinity is removed after 3 days of digestion. The value of alkalinity has reduced after treatment with organic biocides. As shown in Fig.1, after 3 days, the reduction in the value of alkalinity has been constant for 5 days and 8 days.

4) *pH:* After treatment with the organic biocides observations in the pH value of the effluent were made after the 3rd day, 5th day and 8th day. The pH value of the water treated with bio enzyme came into the neutral range from 8.4 to 8.16 on 3rd day of the treatment. Consequently, the reduction on the 5th and 8th day is 8.12 and 8.1 respectively.
5) *Phosphorous:* In the case of phosphorus characteristics, 31% of phosphorus was removed on the 3rd day of the digestion. While 33 % and 35% reduction was observed in 5th and 8th day respectively.

## V. CONCLUSION

According to the results of the study, the eco enzyme produced was acidic and contained a large amount of organic material, resulting in a high initial BOD. Eco enzyme is ineffective at removing TDS from domestic waste water. It can effectively remove coliform bacteria from domestic waste water as the digestion days increase. The results indicate that an Eco enzyme solution with a dilution factor of 1:1000 can effectively remove BOD, COD, and MPN from domestic waste water. Eco enzyme is inexpensive and efficient. As a result, they can be used as a low-cost alternative tool for domestic waste water. The Eco enzyme can be used as a decentralised treatment aid in domestic waste water treatment to treat effluent while maintaining a neutral pH range of effluent in sewer.

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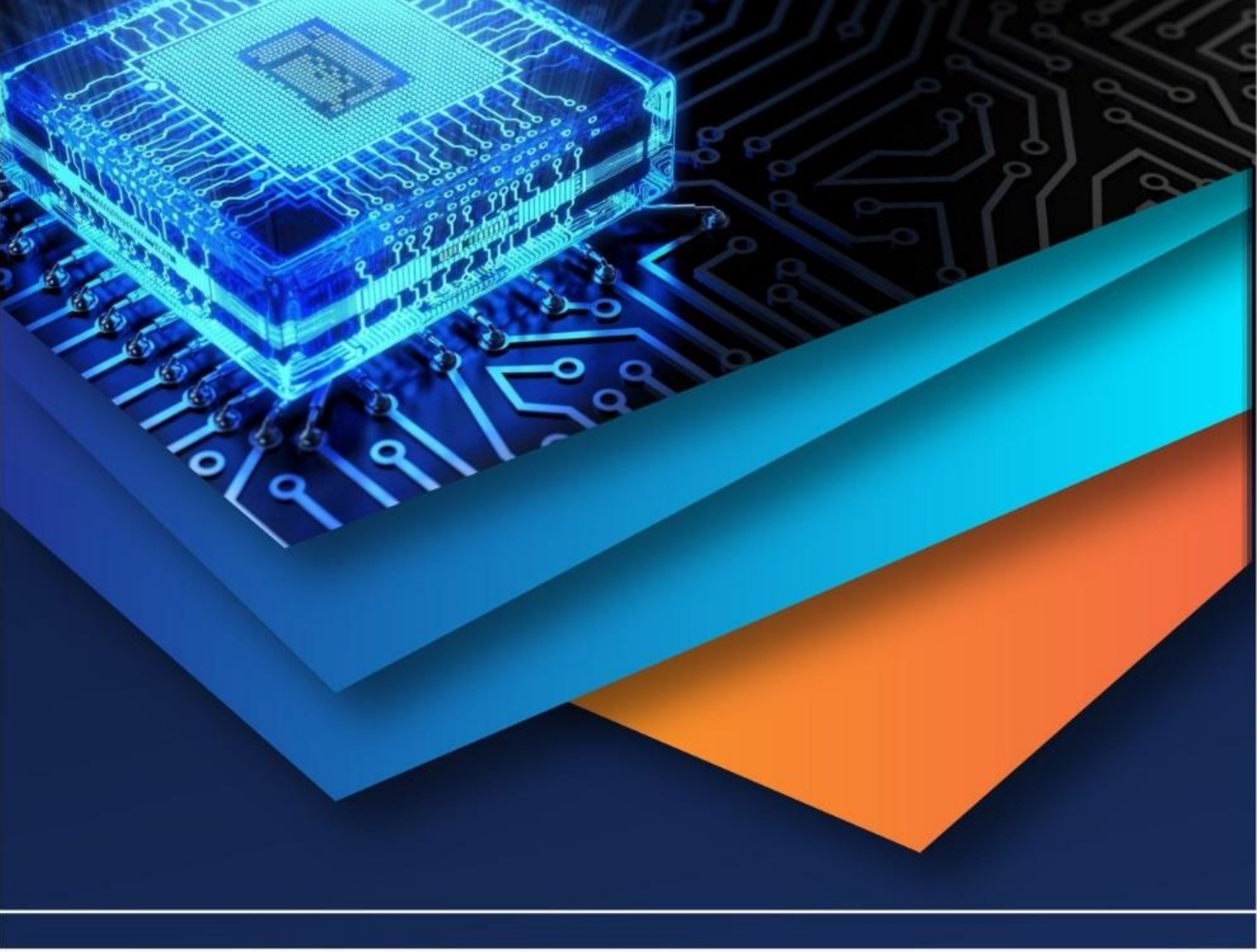

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