

Fruit Peel Enzyme Solution for Synthetic Sewage Treatment

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Abstract— the study has conducted in order to check the feasibility of fruit peel enzyme solution in the treatment of synthetic sewage. Fruit peel enzyme is a fermentation product of fruit peels, jaggery and water. Batch test was carried out to determine the effect of 10 %, 15%, 20%, and 25% concentration of fruit peel enzyme solution. The effluent treated with different concentration of fruit peel solution doesn't achieved satisfactory results for TDS,BOD,COD but achieved 100% reduction of phosphate and nitrate. The property of fruit peel enzyme solution to reduce the nutrients can promote the usage of fruit peel enzyme solution as biological additive for decentralized approach in wastewater treatment.

Keywords— Fruit Peel Enzyme, Fermentation, Wastewater Treatment

I. INTRODUCTION

Due to the increase of worldwide population problem of sewage disposal and industrial waste management has become increasingly critical. Terrible impacts on human health and on the environment could result if pollution of receiving waters is allowed to continue. An effective means of solving this problem must be developed to preserve water quality for future generations. Wastewater treatment technology is improving, and currently it is possible to treat wastewater efficiently and cheaply. The problem of sewage disposal and industrial waste management has become increasingly critical. Due to the increase of the worldwide population nearly 70-80% of rivers and streams carry polluted water. Hence suitable treatment technology wants to adopt for treating wastewater. [7]

The major aim of wastewater treatment is to achieve maximum efficiency with constant improvements in using the lowest costs, time and area. In wastewater treatment systems, additives may be added into so that specific pollutants can be degraded to a higher degree within a shorter time. Additives in wastewater treatment are those available as biological and chemical. Chemical additives may be harmful to the environment. They are generally discouraged or banned because of the presence of strong acids, bases or toxic contents possibly result in adverse effects on system components, the soil structure, or ground water quality.

Biological additives have significant beneficial impacts. They do not directly harm traditional onsite systems. Enzymes used in wastewater are of biological additives category. Garbage enzyme is a fermentation product of fruit vegetable waste (FVW). It can be used as a biological additive for waste water treatment [6].

India is a heavily populated country. The increase in population releases enormous wastes being produced regularly out of household & industrial activities. Fruit vegetable wastes are generated by Peeling and cutting of raw fruit vegetable waste prior to processing, eating, and cooking inadequate solid waste disposal results in serious environmental and health problems. Garbage dumped in

open places cause heavy pollution [3] so converting this fruit peel into a value added product which can apply for sewage treatment will be a milestone in zero waste concepts.

II. OBJECTIVE

The objective of study is

- 1) Preparation of fruit peels enzyme solution as per prescription.
- 2) Study on the parameters of fruit peel enzyme.
- 3) Preparing synthetic sewage as per prescription.
- 4) Application of fruit peels enzyme solution for synthetic sewage treatment.

III. MATERIALS AND METHODS

A. Fruit Peel Enzyme Solution Preparation

In this study pre consumer organic waste of fruits are collected separately fruit market. A large batch of fruit peel enzyme solution had been produced for this study, from the methodology and recipes published in Medias, using clean water without chlorine content. To produce about 10L of fruit peel enzyme, 3kg of fruit biomass was fermented together with 1kg Jaggery and 10L water for three months. The fermentation yielded a brownish liquid, which was separated from the solid.

An air-tight plastic container which was able to expand was used during the mixing process. It was noticed that during the first month, gases were released during fermentation process. To avoid rupturing Pressure built up in the container was released daily. Fruit peels were pushed downward every once in a while during the period of fermentation. A cool, dry and well ventilated place was selected for placing all those containers. It was left to fermentation of 3 months to produce enzyme. The fermentation resulted a brownish liquid, which was separated from the solids.

After three months of fermentation the solution was filtered to obtain enzyme solution. It was then transferred to a plastic bottle. Pure garbage enzyme solution was tested in the CEPC laboratory to find out the protein content.

B. Synthetic Sewage Preparation

Synthetic sewage which imitates the quality of sewage effluent was prepared. Synthetic sewage used in this study was prepared by adding the compounds in defined concentration in distilled water. For inoculating biological parameters and in order to achieve a natural texture of sewage, effluent from a sewage plant also added.

C. Treatment of synthetic sewage using fruit peel enzyme solution

Batch test was carried out to determine the effect of 10%, 15%, 20% and 25% fruit peel enzyme solution in treating synthetic sewage. For this study four plastic beakers covered with aluminium foil are used. Beakers are filled with six liters of synthetic waste water. Out of eight beakers

four beaker of synthetic waste water were added with fruit peel enzyme solution.

IV. RESULT AND DISCUSSION

The protein content of the fruit peel enzyme was 20 mg/l.

A. Characteristics of Synthetic Sewage

The pH of synthetic sewage was 9.21, which is alkaline in nature. TDS observed was 200mg/l. The BOD and COD were 121mg/l and 480mg/l respectively. Phosphate and nitrate concentrations were obtained as 10.4mg/l and 5.4mg/l respectively. Nitrite of synthetic sewage was 0.01.

B. Effluent Characteristics after Treatment With fruit peel enzyme Solution

1) pH

It was noted the effluent treated with fruit peel enzyme solution can achieve and maintain a neutral pH range. Due to denitrification process also the pH of value of the solution can reach to neutral range. Denitrification process is best in pH value of 6.5 to 8. The optimum pH for denitrification in activated sludge lies in the 6.5-7.5 range according to. At lower pH values denitrification rates tend to decrease due to the inhibition of nitrous oxide reductases, resulting in an accumulation of N₂O [8]. Hence the ability of fruit peel enzyme maintaining neutral pH in synthetic sewage is advantage in synthetic sewage treatment.

2) TDS

The permissible limit for disposal of effluent to irrigation purpose on land is as per E (P) rules is 2100 mg/l. The effluent treated with fruit peel enzyme solution doesn't reached within the permissible limits on the first two weeks of treatment. It was observed that effluent treated with 10% and 15% concentration of fruit peel enzyme reached the permissible limits during the third week. For effluent treated with 20% concentration of fruit peel enzyme solution reached permissible limits only at the fourth week of treatment and in the case of 25% concentration it can't achieve the permissible limits even in the fourth week also. It was observed during the treatment period that the effluent treated with fruit peel enzyme solution shown a rich presence suspended matters

3) BOD

As per E(P) Rules permissible limits of BOD for effluent discharge are 30 mg/l for inland surface water, 350 mg/l for Public Sewers. Permissible limit of BOD are 100mg/l for discharging effluent to marine coastal areas and land for irrigation. BOD of effluent treated with fruit peel enzyme solution doesn't satisfied the permissible standards of effluent disposal. Considerable reduction doesn't achieve on BOD of effluent treated with fruit peel enzyme solution on any period of treatment. Hence fruit peel enzyme solution is not suitable for reducing BOD of effluent.

4) COD

The effluent treated with fruit peel enzyme solution doesn't reach the permissible limit COD for disposal for effluent as per E (P) rules 1986.

5) Phosphates

Permissible limits of Phosphates for effluent disposal to public sewers marine coastal areas, and land irrigation is nil and for inland surface water 5 mg/l.

The effluent treated with 10%, 15%, 20%, 25% fruit peel enzyme reached the permissible limit for disposal as per E(P) rules within the fourth week.

Bacteria and yeast strains had the capacity to accumulate phosphate [11]. Yeast strains are important in fermentation process for wine making etc. These yeast strains converts sugar in fermentation process of wine grapes to alcohol and carbon dioxide. The most common species of yeast associated with wine making is *saccharomyces cervisiae*. [2]. Accumulation of intracellular yeast has been shown in the strain of *saccharomyces cervisiae* by Liebermann in 1888 [4]. Fruit peel enzyme is making through fermentation process similar to wine making. During the fermentation a white mould formation was observed on the top surface of the solution. These may be B complex Yeast and vitamin C Yeast [6]. So may be these yeast strains also responsible for phosphate reduction of effluent treated with garbage enzyme as well as fruit peel enzyme.

6) Nitrates

Permissible limits for effluent disposal to public sewers and land irrigation is nil and for inland surface water and marine coastal areas is 10 mg/l and 20 mg/l. It was observed that effluent treated with fruit peel enzyme solution achieved the values of nitrate below the permissible limits for effluent disposal. Effluent treated with 20% and 25% fruit peel enzyme solution achieved permissible limits for effluent disposal to public sewers and land irrigation during the third week and effluent treated 10% and 15% concentration achieved the permissible limits effluent disposal to public sewers and land irrigation during the final week.

Nitrates are efficiently removed when an external organic carbon source, generally methanol, ethanol or acetic acid, is added in organic carbon-limited wastewaters, sludge and soil. Organic carbon is often the limiting substrate for biological denitrification and many wastewater treatment plants add extra carbon for denitrification to balance the processes [12] the use of an external carbon source is normally more expensive, but generally results in a more efficient denitrification [9]. The fermented solution called garbage enzyme containing acetic acid. [10]. Hence the acetic acid in these garbage as well as fruit peel enzyme may be working as the carbon sources for nitrate reduction in this treatment

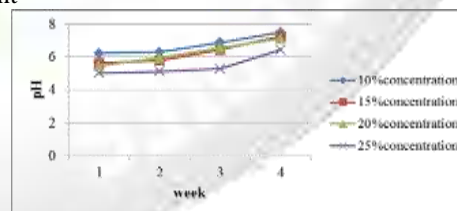


Fig. 1: Weekly variation in pH when treated with fruit peel enzyme solution

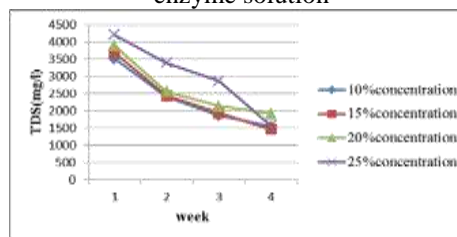


Fig. 2: Weekly variation in TDS when treated with fruit peel enzyme solution

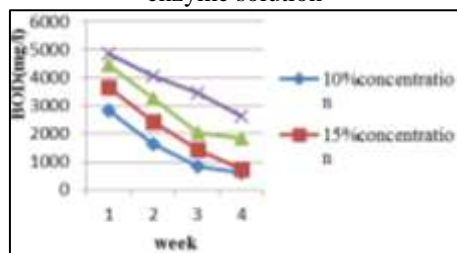


Fig. 3: Weekly variation of BOD when treated with fruit peel Enzyme solution

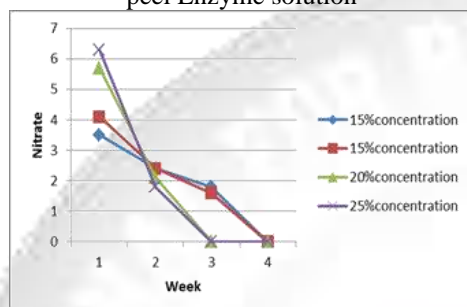


Fig. 4: Weekly variation of BOD when treated with fruit peel enzyme solution

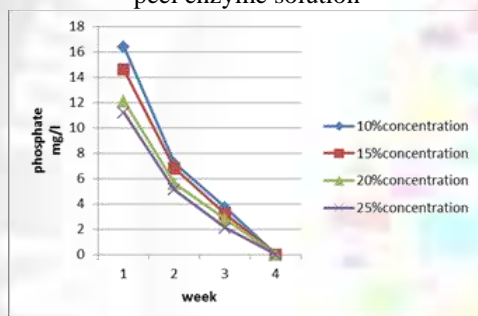


Fig. 5: Weekly variation of BOD when treated with fruit peel enzyme solution

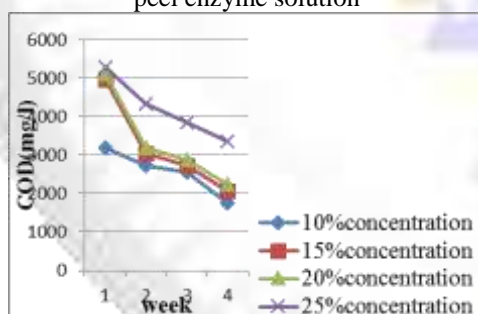


Fig. 6: Weekly variation of BOD when treated with fruit peel enzyme solution

C. The Percentage Reduction of Parameters after Treatment with fruit peel Enzyme Solution

In the case of effluent treated with fruit peel enzyme solution the 100% reduction achieved in the phosphate, nitrate values. All other parameters like BOD, COD, TDS of effluent treated with fruit peel enzyme solution doesn't reduce below the initial values of effluent before treatment. It indicates that BOD, COD, TDS of effluent is not reducing effectively for fruit enzyme solution and thereby can't achieve the permissible limits of effluent disposal specified in E (P) rules.

V. CONCLUSION

From this study it was observed that fruit peel enzyme is suitable in synthetic sewage treatment for Phosphate and Nitrate reduction. Also fruit peel enzyme solution has the property to achieve and maintain neutral pH range to the effluent during treatment. For effluent treated with fruit peel enzyme solution, BOD, COD was not satisfactory as per E (p) rules. The fruit peel enzyme can be used as a decentralized treatment aid in wastewater treatment for treating the effluent in public sewers in order to reduce the nutrients like nitrate, phosphate and also maintain the neutral pH range of effluent in sewer. The use of this biological additive in public sewers connected to centralized treatment plants can improve the efficiency of centralized treatment plants in the removal of Nitrate and Phosphate.

ACKNOWLEDGEMENTS

I express my sincere gratitude to CEPC laboratory for helping me in analysing parameters.

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