

Effect of Bio-Enzyme in the Treatment of Fresh Water Bodies

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Abstract: "Bio Enzymes" are organic compounds produced by fermentation of fresh vegetable/fruit waste in presence of water and brown sugar/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 fresh water bodies (mostly ponds) in and around bhimavaram as part of "Mana Ooru Mana Neeru" initiative by SRKR Engineering College. The pH value of the bio-enzyme was found to be 3.5 and upon treating pond water with it, there was substantial change in DO, BOD and COD values of the water. The water bodies were cleaner, lost its foul smell and BOD, COD levels reached permissible levels after the treatment.

Index Terms: bio-enzyme, BOD, COD, DO, pH.

I. INTRODUCTION

Due to the increase of migration to urban in small towns in India, the matter of sewage disposal and industrial waste has become more and more essential. The fresh water bodies (ponds) in urban areas are getting polluted and the authorities lack cleaning mechanism to keep the environment clean. Ruinous impacts on human health and on the atmosphere might result if pollution of receiving garbage into waters is sustained. Therefore, to preserve water quality for future generations, a good means that of finding this drawback should be thought of. Water treatment technologies are up, and presently it's potential to treat these fresh water bodies and get the water back to highly usable state. Though treatment of waste water and its legislation is well instituted in several developed countries, correct sanitation with economical treatment has not been practiced in several places in India.

Domestic water treatment has been suggested as a plausible solution for this problem but largely failed because it depends too much on people being responsible at an individual capacity which requires lot of awareness programs from groups, government bodies etc and could be a long-term holistic solution to the problem. So instead, the treatment of water bodies could be an efficient interim solution which can be implemented by social groups or government health/sanitary bodies. The proposed bio-enzyme solution has yielded good results as part of our work with fresh water bodies in and around bhimavaram (West Godavari District) in Andhra Pradesh.

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II. MATERIALS AND METHODS

The primary need for the experiment is the bio-enzyme itself which takes about 90 days to prepare. The physical cleaning of the water body (pond in our case) along with processes like de-silting, solid waste removal, enzyme treatment, tree plantation and bund heightening are the major methods deployed as part of the experimentation.

A. Bio-Enzyme preparation

CONTAINER: Plastic air-tight container.

INGREDIENTS: Vegetable dregs, fruit waste, Water and sugar (brown sugar, molasses sugar or Jaggery)

COMPOSITION:

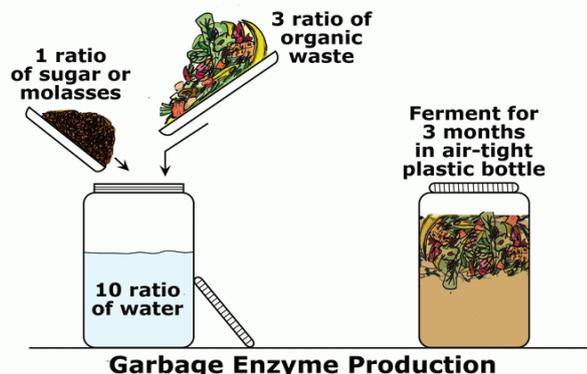
Ratio	Kilograms	grams	Kilograms
Sugar/jaggery	1	300	10
Vegetable/fruit waste	3	900	30
Water	10	3000	100

INSTRUCTION:

1. Prepare Plastic air-tight container. Don't use glass or metal containers that don't permit expansion caused by gas evolved throughout the fermentation method of enzyme.
2. Dilute sugar in water, followed by adding your domestic waste. Use solely fruit waste and vegetable dregs. Avoid oily medium food, fish or meat residues (make those your garden compost materials). To create fresh smelling enzyme (catalyst), add orange/lemon peel or pandan leave etc.
3. Leave some air area for fermentation and confirm the plastic container is air tight.
4. Throughout the first month, gases are going to be discharged throughout fermentation method. Leave go of the pressure build up in the container to avoid rupturing.
5. Push the floating dregs downward each once in a while.
6. Place at cool, dry and airy space. Avoid direct daylight. Let it ferment for a minimum of three months before use. Filter and it's able to use.
7. When three months, extract out the water and leave solely the sediment. The sediment may be dried to become fertilizer or might leave it for next fermentation.
8. The perfect color of eco enzyme (catalyst) is dark brown. If the color addresses black add same quantity of brown sugar to re-ferment it.
9. It should have white, black or brown layer on high of the eco enzyme (catalyst), ignore it. If you encounter worms within the container, leave it for some time can close the cover tightly.



10. If you have got not gathered enough domestic waste, you will top off the container gradually. The three months fermentation period begin from the last day you add in the kitchen.



After 3 months of the fermentation period the enzyme has to be filtered and kept in air packed containers.

A. Physical cleaning of the water body (solid waste removal)

While the fermentation is on, the physical cleaning of the water has to be started. The C O D, B O D and D O values of the water from the water bodies (ponds) before the treatment have been taken and recorded.

Values before the Treatment:

Criteria	D O (mg/L)	B O D (mg/L)	C O D (mg/L)
Value	0.5	39.5	121

The physical cleaning of the water body includes, taking out plastic wastage, solid waste removal etc with the support of volunteers and municipal corporation of the place. Once the physical cleaning is done the pond is ready to be treated with the enzyme.

B. Scaling up the quantity of Bio-Enzyme and water body treatment

The dilution composition for bio-enzyme is varied based on the usage of it. For water bodies the ratio can be 1:10000 i.e, mix 1 Litre of bio-enzyme with 10000 Litres of fresh water and keep it for 24 hours in a closed container. By this process we can scale the bio-enzyme quantity with minimal effort within 24 hours. The enzyme needs to be sprayed all across the pond using sprayers from the tanker. This process has to be repeated after 30 days of the first treatment.

C. Desilting and Bund widening/strengthening.

The desilting and Bund widening using JCB and other machinery can be done after the enzyme treatment to increase the storage capacity of the pond and to recharge the ground water levels. The process is again physical and needs human effort through social groups and govt bodies. Tree plantations is also one of the techniques to reduce soil erosion and increase the green cover around the pond.

D. Analysis of DO, BOD and COD values

Collect the DO, BOD and COD values post the enzyme treatment on a monthly basic and analyze them to draw relevant conclusions.

III. RESULTS AND DISCUSSIONS

Our case study is of ponds in Bhimavaram (west Godavari District) in Andhra pradesh. In our experiments we found the water to be cleaner after the treatment. The study observed an increase in storage capacity, ground water levels, serene environment around the pond and a green cover around the water body. There is a sustained positive impact on the water body post the enzyme treatment across 90 days. The D O, B O D and C O D values have come under permissible levels. The data that is collected has been tested in SRKR Engineering College laboratory for over 3 months. The results we have seen are as following.

Criteria	D O (mg/L)	B O D (mg/L)	C O D (mg/L)
Before enzyme treatment	0.5	39.5	121
After enzyme treatment (2 months)	2.37	16	40
After enzyme treatment (3 months)	3.7	9	24

As mentioned in the table above the D O B O D and C O D Levels have reduced considerably and have come under the permissible values. The other results we have observed during the experiment are as follows:

- Storage capacity of the pond has increased with widening of the pond along the perimeter.
- Ground water levels recharge has improved in 1km radius.
- 100 kgs of plastic wastage has been cleaned during the physical cleaning of the pond.
- Increased sensitivity and vigilance in local community has reduced misuse of pond by miscreants.
- Tree plantation will provide green cover, reduce soil erosion and make the surroundings cooler.

IV. CONCLUSION

The process started with the team started interacting with Municipal Corporation body of Bhimavaram and adopting the pond for cleaning. Initially a survey was done and samples were collected to test the DO, BOD and COD levels. Later for over a week the physical cleaning of the pond was done by Art of Living volunteers under the initiative of “mana ooru mana neeru” campaign. Meanwhile we prepared the Bio-enzyme in the laboratories. The pond was treated with bio-enzyme monthly for 3 months. The DO, BOD and COD values were again tested and saw the team observed a significant change in them. With the success of this initiative we ran awareness program all over the city to create awareness about bio-enzyme.

The whole process is a great success which is evident with results we achieved and is a possible solution which can be replicated in many other



places. All it takes is support from govt authorities and one active group of volunteers and 1 or 2 experts from that place to carry this process.

The experiment can also be a solution for other fresh water bodies and even can be extended to river canals, streams etc. but the methodologies might have to be little different with flowing water bodies and will take consistent efforts from the people involved.

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REFERENCES

1. Hong Gao, Yuebo Xie, Sarfraz Hashim, Alamgir Akhtar Khan, Xiaolin Wang and Huiyong Xu "Application of microbial technology used in bio remediation of Urban Polluted River: A Case Study of Chengnan River, China" Water 2018, 10, 643.
2. Fu E. Tang and Chun W. Tong. "A Study of the Garbage Enzyme's Effects in Domestic Wastewater" International Scholarly and Scientific Research & Innovation 5(12), 2011, 887-892.
3. <http://www.enzymesos.com/what-is-eco-enzyme/how-to-make-eco-enzyme>
4. Rachna Bhateria, Disha Jain "Water quality assessment of lake water" sustainable water resource management, 2016, 2(2), 161-173.