BIO ENZYMES FROM ORGANIC WASTE

Varun Dhavale [1], Tejas Shimpi [2], Varsha Koli [3], Rutuja Kamble [4], Smita B. Patil [5]

U.G. Students[1,2,3,4] Assistant Professor[5]

Datta Meghe Collage of Engineering, Navi-Mumbai-400708, India.

Abstract- The enzymes are biological catalysts (also known as biocatalysts) that speed up reactions in the living organisms, and which can be pulled out from cells and then used to catalyse a wide range of commercially important processes. Bio Enzymes are organic compounds produced by fermentation of fresh vegetable/fruit waste in the presence of water and jaggery. It is proving that the bio enzyme is the best solution for domestic and agricultural applications. It is a natural, non-toxic, non-flammable, non-corrosive liquid enzyme formulation fermented from vegetable extracts that improve the engineering qualities of soil, facilitates higher soil compaction densities and increases stability. Improvement and stabilization of soils are widely used as an alternative to substitute the lack of suitable material on site. Soils may be stabilized to increase strength and durability or to prevent erosion and dust generation. The use of non-traditional chemical stabilizers in soil improvement is growing daily. A bio enzyme was developed to improve the mechanical performance and applicability of clayey soils. Enzymes increase the rates of reactions allowing them to occur within a biologically useful time scale. The waste generated from fruits and vegetables are organic and supply a major share in pollution of air, water, and soil. Enzyme Bio-cleaners are an organic compound including enzymes produced by the simple fermentation of fresh vegetable wastes, fruit wastes with the addition of brown sugar and water by using the selective micro-organisms like Yeast and Bacteria. This anaerobic fermentation generates natural chains of the capacity to breakdown, modify, create and catalyse functions that make it an astonishing cleaning support in a household as well as other applications. This paper reviews the investigations and significant work done on the bio enzymes. It 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.

Keywords: **Bio-Enzymes, Bio-Catalyse, Fermentation, Stabilizer, Extract, Astonishing**

I. INTRODUCTION

This paper studies on the bio-enzymes. These are organic solutions produced by fermentation of fruits, vegetables, sugar, and water. These cleaners use good bacteria to digest wastes, soils, stains, and bad odours. The bacteria do this by producing enzymes specifically designed to break down certain molecules (waste and soils) into smaller pieces. Sounds too simple to be true? It is indeed a miraculous solution according to thousands of users. There is an urgent need to move towards natural and sustainable living. The planet is reeling under the unchecked pollution of harmful chemicals. Water bodies are severely contaminated due to the usage of chemical-filled products.

Bio Enzyme (also referred to as Garbage Enzyme or Fruit Enzyme) is a multi-purpose, 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, odour, getting rid of other harmful microbes, etc. They also greatly neutralize toxins and pollutants.

Figure No. 1: Bio-Enzymes

Enzymes were known to catalyse more than 5000 biochemical reaction types. The cell is the structural and functional unit of life the basic building block of living systems. Cells can effectively utilize biocatalysts, known as enzymes, which have outstanding catalytic efficiency and both substrate and reaction specificity. They have amazing catalytic power and their high level of specificity for their substrate makes them suitable for biological reactions. They are biological catalysts (also known as biocatalysts) that speed up biochemical reactions in living organisms. They can also be extracted from cells and then used to catalyse a wide range of commercially important processes. For example, they have important roles in the production of sweetening agents and the modification of antibiotics, they are used in washing powders and various cleaning products, and they play a key role in analytical devices and assays that have clinical, forensic and environmental applications. the active site of an enzyme is the region that binds substrates, co-factor & prosthetics groups and contains residual that helps to hold the structure. active sites generally occupy less than 5% space in the total enzymes. The active site has specific shapes due to the structure of a protein. Active site

divided into two parts Binding site it chooses the substrates and binds active site and the Catalytic site performs the catalytic action in the enzymes. The second part is the co-factor which is the non-protein molecule which carried out the chemical reaction that cannot be performed by the amino acid. There are two types of molecules required in the co-factors for the activity of the enzymes 1. organic molecules 2. inorganic molecules. The substrates are the reactant in the biochemical reaction. When the substrates bind to an enzyme it forms an enzymes-substrates.

Bio enzymes along with another additive like lime, murrum, cement, and other such materials can be used together with the waste and it varying in quantity for the best use of soil stabilization the terrazyme effect of the soil with varying doses can increase the soil stabilization Because it reacts with the bad bacteria due to these it has a large scope in the medical industries. The waste is used for preparing the bio enzymes due to these it can also use as a fertilizer on the agriculture land. The Enzymes are adsorbed by the clay lattice and then released upon exchange with metals cations. They have an important effect on the clay lattice, initially causing them to expand and then to tighten. They can be absorbed also by colloids enabling them to be transported through the soil electrolyte media. The enzymes also help the soil bacteria to release hydrogen ions, resulting in pH gradients at the surfaces of the clay particles, which assist in breaking up the structure of the clay

II. LITERATURE REVIEW

By the late 17th & early 18th centuries, the ingestion of meat by stomach secretion and the conversion of starch to sugars by plant extracts and saliva but the mechanisms by which these occurred had not been known to people. French chemist Anselme Payen was the first to discover the enzyme in 1833. A few years later, when studying the fermentation of sugar to alcohol by yeast, Louis Pasteur concluded that this fermentation was caused by a vital force contained within the yeast cells called "ferments", which were thought to function only within living organisms. He wrote that "alcoholic fermentation is an act correlated with the life and organization of the yeast cells, not with the death or putrefaction of the cells."

Eduard Buchner (1897) submitted his first paper on the study of yeast in a series of experiments at the University of Berlin, he found that sugar was fermented by yeast even were no living yeast cells present in the mixture. He named the enzyme that brought about the fermentation of the cells as "zymase". he received the Nobel Prize in Chemistry for his discovery of cell-free fermentation in the year 1907. The biochemical identity of enzymes was still unknown in the early 1900s. Many scientists observed that enzymatic activity was associated with proteins, but other scientists argued that proteins were carriers for the true enzymes and that proteins incapable of catalysis. In 1926, James B. Sumner showed that the enzyme was a pure protein and crystallized it he did the same procedure for the enzyme in 1937. He discovers that the enzymes can be crystallized eventually and allowed their structures to be solved by x-ray crystallography. This was first done for lysozyme which digests the coating of some bacteria, this structure was solved by a group of David Chilton Phillips and published in 1965. This high-resolution structure of lysozyme begins the field of structural biology and to understand how enzymes work at an atomic level of detail.

M B Mgangira et.al. (2009) present laboratory results on the effect of enzyme-based liquid as soil stabilizer. the soil had a plasticity index of 35 and 7. When the test like Atterberg limits, Standard proctor and unconfined compressive strength were performed it shows that the Treatment with enzyme-based products shows a slight decrease in the plasticity index of both soils. Enzyme based chemical treatment of two soils using the bio enzyme showed a mixed effect on the UCS. No consistent improvement in the UCS could be attributed to treatment.

Shukla M. et.al (2010) perform the experiments on the black cotton soil treated with an organic, non-toxic, eco-friendly bio-enzyme stabilizer to reduce the swelling of the expansive soil. The experimental results indicate that the bio enzyme stabilizer used in the present investigation is more effective and the swelling of an expansive soil reduces on the wet side of optimum moisture content

Goutami Banerjee et.al (2010) These papers described the cost of enzymes for converting plant biomass materials to fermentable sugars is a major impediment to the development of a practical lignocellulosic ethanol industry. In this paper, the research on enzyme optimization to reduce the cost of converting biomass materials such as corn Stover into glucose, xylose, and other sugars is being actively pursued in private industry, academia, and government laboratories. Under the auspices of the Department of Energy Great Lakes Bioenergy Research Centre, we are taking several approaches to address this problem, including "bioprospecting" for superior key enzymes, protein engineering, and high-level expression in plants. A particular focus is the development of synthetic enzyme mixtures, to learn which of the hundreds of known enzymes are important and in what ratios. A core set comprises cellobiohydrolase, endoglucanase, β-glucosidase, endoxylanase, and β-glucosidase. Accessory enzymes include esterases, proteases, nonhydrolytic proteins, and glycosyl hydrolases that cleave the less frequent chemical linkages found in plant cell walls.

C. Venkatasubramanian et.al (2011) studied the three types of soils with four different dosages for the period of 2 and 4 weeks after application of enzyme on its strength parameters were studied from these results that addition of bio enzyme shows the improvement in unconfined compression test values of selected samples. These soil stabilizing enzymes catalysed the reactions between the clay and the organic cations and accelerate the cat-ionic exchange without becoming part of the end product of the result.

Faisal Ali et.al (2012) focus on this research is on the improvisation of engineering properties of three natural soils and mixed at different proportions of the liquid enzyme. The series of laboratory tests on engineering properties, such as unconfined compressive strength (UCS), consistency limits, moisture-density relationship (compaction) test was done to evaluate the effectiveness and

performances of these enzymes as soil stabilizing agent. The results show that the addition of the liquid stabilizer can decrease the plasticity and shrinkage by eliminating reabsorption of water molecules & It reduces optimum moisture content by the exchanging of the water molecules on the surface of the clay particles. Due to these, the maximum dry density is increasing by neutralizing and orderly rearranging the clay partials and increases the compressive strength of the soils by increasing the inter particles bonding between them.

Venika saini, Priyanka Vaishnava (2015) this paper presents the study of starch and the activities of enzymes involved in starch biosynthesis were examined in germinating grains of field-grown rice, sorghum, millet, and maize plants. Enzyme activities were monitored throughout the grain germinating periods for three days. The activities in which most of the grain enzymes involved in starch biosynthesis increased and reached. their maxima during the initial period of grain development, then gradually declined towards the later stages.

Bisswanger H. (2015) explains enzymes are biological catalysts that speed up biochemical reactions in living organisms, and which can be extracted from cells and then used to catalyse in a wide range of commercially important processes. This paper covers the basic principles of enzymology, such as classification, structure, kinetics, and inhibition, and also provides an overview of industrial applications of the enzyme. Besides the techniques for the purification of enzymes are discussed.

Sandeep Panchal M.D. Khan et.al. (2017) presented studies that provide an effective technique of ground improvement using bio-enzyme. They study a bio- enzyme named terrazyme which is California bearing ratio (CBR) value in road construction. Terrazyme is a basic, natural, non-toxic and liquid enzyme. It is made from the fermentation of plants, vegetable extract, and fruit extract. They show the Terrazyme can be used as a soil stabilizer and also it can improve the CBR value in road construction. The dosage of terrazyme are taken as 500ml/m3, 700ml/m3, 900ml/m3 and 1000ml/m3in the soil sample and result are analysed. A significant increase is found in the CBR value of the soil sample as the dosage of terrazyme has been increased.

III. OBSERVATIONS OF LITERATURE REVIEW

Based on the literature about the bio-enzymes reviewed here, the following observations were made:

i. It is observed that the concept of fermentation was first introduced in the early 18th century which states that the fermentation was caused by the vital force containing the yeast cell later it is named as the substance enzyme.
ii. The biochemical identity of the enzyme was elaborated a few decades later in 1926 by James summer who discover that the enzymes can be crystallized in a structure that can be solved by the x-ray crystallography.
iii. It has been the fact that when the bio-enzymes were mix in the soil sample for testing of consistency limits, dry density & CBR it is found that it shows the improvement in the result of soil sample.
iv. When the CBR was tested for 4 different doses of 500 ml/m3, 700 ml/m3, 900ml/m3 & 1000ml/m3 then after the test was conducted it is observed that the CBR value is increased up to 23% with the third sample within the two weeks of curing period.
v. It is also stated that the catalyst is a substance that affects the rate of the chemical reaction without permanently change it is a biological system that belongs to a special class of proteins called enzymes.
vi. It is seen that enzymes work at a rapid rate when all active sites are occupied by substrate molecules.
vii. The rate of reaction is increased until the enzymes are completed saturated and working at its max. possible rate.
viii. Enzymes have two significant features in which the enzymes frequently bind and act on the targeted site with high offense & they are also converting the numerous targets into the desired product.
ix. It is also giving medical evidence in the use of cancer studies and various production of medical products.
x. With the aging of the addition of terrazyme enzyme to the soil, it is observed that the liquid limit is reduced and the plastic limit of the soil was increased.
xi. The water holding capacity of the soil is increased by adding the enzyme compared to the plastic limit so it leading the better electrolyte movement in the soil.
xii. Enzyme stabilized the soil with increasing the organic matter, carbon, calcium, phosphorus, potassium, nitrogen leading micro-aggregation of soil.
xiii. It is observed that the enzyme can improve the performance of soil or roads, dams & airports as its increased cohesion, stability, reduces permeability and helps in erosion control of treated soil.
xiv. Bio-enzymes is a natural, non-toxic, non-flammable liquid fermented from organic waste that improves engineering quality of soil facilitates the higher compaction and stabilization.
xv. Because of soil stabilization of soil by using the enzyme, it is observed that the curing period of the soil is increased.
xvi. The decrease in OMC is observed due to effective cation exchange process which generally takes a long period.

IV. EXPERIMENTAL WORK

After studying the literature and observations, prepared a sample of bio-enzyme by taking the ratio of 1:3:10. In this ratio the 10 parts of water, 3 parts of organic waste, 1part of sugar. We prepare the bio-enzymes of mint, orange, tulsi & mogra. After that, we kept it for fermentation for three months in an airtight container. In the process of three months in the first month, the gases generated were allowed to evolved and then later two months kept in the airtight container for further fermentation of the waste. After three months the enzyme will be ready for use.

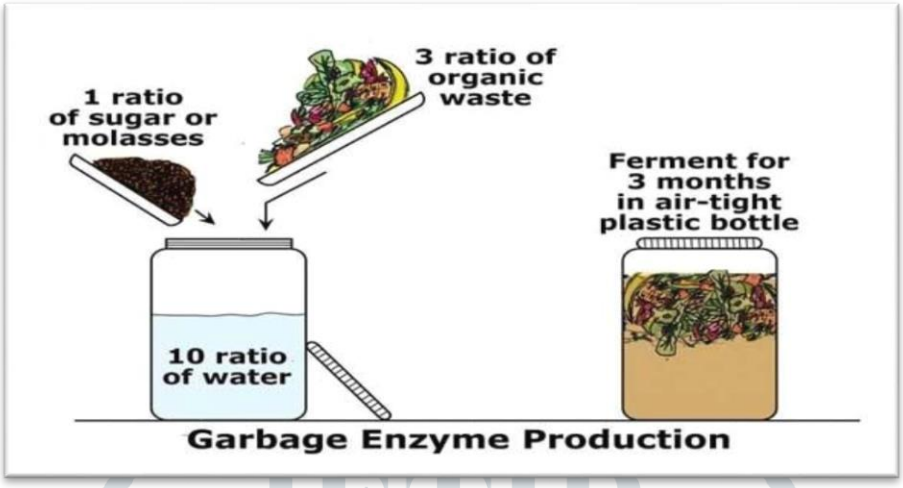

Figure No 2: Garbage Enzyme Production

Figure no 2 shows the production of the enzyme from the garbage while the figure no 3 shows the preparations made in the laboratory there are two samples prepared in the laboratory 1. Oranges (left) 2. Mint (right) the ratio taken for these samples is 2:6:20 where 2 is a part of jaggery which is 200gms, 6 is a part of waste which is 600 gms for both samples (i.e. mint & orange) and the last 20 parts of water which is 2 liters of water. Till now the enzymes sample is stabilized with two months hence it requires one more month for complete stabilization. After the complete stabilization, the test will be conducted.

Figure No 3: Preparation of Bio Enzymes in Laboratory

V. SUMMARY & 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.

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