

Use of Bioenzymes as Insecticides

Dr. Kamlesh Rawat

Lecturer in Zoology, SGSG Govt. College, Nasirabad, India

ABSTRACT: Bioenzyme is a multipurpose product that is produced by fermentation of fruit or vegetable peels. Fermentation is a process by which anaerobic microbes decompose organic matter in absence of oxygen. Commonly, bio enzymes are used for cleaning purposes and as pesticide or fertilizer for plants. It is 100% organic and safe to use.

KEYWORDS: bioenzymes, multipurpose, insecticides, fermentation, organic matter, safe, fertilizer

I. INTRODUCTION

Although conventional cleaning agents leave your clothes and dishes sparkling and almost sweet-smelling, they often contain a cocktail of harmful chemicals that have negative side effects on our health. Not to mention that synthetic detergents damage our clothes too and reduce their life-span. Every time we wash using these chemicals, they pollute our water bodies. The packaging of these cleaners is also an environmental waste which usually cannot be reused effectively and ends up in a landfill. Following are some [1,2] of the potentially toxic chemicals present in many cleaning agents - 1. 1,4-dioxane has been identified as a human carcinogen, and is a common ingredient in detergents and shampoos. 2. Sodium Laureth Sulphate (SLS) is known to irritate human skin and is often implicated in conditions such as eczema, rosacea and psoriasis. It is best avoided by those with sensitive, allergy-prone skin. 3. Bleach contained in detergents is Sodium Hypochlorite. When it comes in contact with the skin, [3,4] bleach can cause allergic reactions. It is an eye and lung irritant and is toxic to marine organisms. 4. A common phosphate compound in detergents is sodium tripolyphosphate. Despite their effectiveness, phosphates have been banned in several American states and European countries because of their adverse impact on water bodies. Bioenzyme is a perfect cleaning agent and serves other uses too while avoiding toxic chemicals and producing something valuable from waste. [5,6] Bioenzymes serve as excellent cleaning agents and can be used for the purpose of -

1. Dish wash
2. Clothes wash
3. Surface cleaner
4. Toilet cleaner
5. Domestic insecticide — to keep away flies and mosquitoes
6. Washing off pesticide/chemical residue from fruits and vegetables
7. Natural disinfectant

The natural properties of citrus bioenzyme make it suitable as a biopesticide and fertilizer which can be used as foliar spray. Greywater containing bioenzyme can be safely used for irrigation too, thus. Banana bioenzyme is also an excellent fertilizer. Water bodies like lakes and rivers are starved of dissolved oxygen due to cultural eutrophication. Research on Bioenzyme shows great promise in increasing the amount of dissolved oxygen and reducing the Biological Oxygen Demand and Chemical Oxygen Demand in water bodies and waste-water. These are important parameters which describe water quality. [7,8]

Bio enzyme cleaners comprise different types of enzymes:

- Proteases: Effective in breaking down protein based molecules like blood and food.

- Lipases: Break down fat and grease.
- Amylases: Break down all the starch molecules.
- Cellulases: Soften the fabric and restore colour to its fibres [9,10]

Preparation

- Take jaggery, citrus peels and water in the ratio of 1:3:10 and 1 tsp. of yeast. Note that you can also opt for the peels of carrot, cucumber, pineapple, sweet lime and lettuce.
- Mix all these ingredients in a plastic bottle with a screw bottle cap and leave it aside for 1 month. Do not fill the bottle to the brim.
- Since the mixture will produce gases, the bottle cap should be opened and stirred at least once a day. Note that the solution should always be covered so that the fruit flies do not get into the bottle.
- Ferment the mixture for one month in anaerobic conditions.
- After one month, strain the liquid and store in plastic container or bottles.
- Now the bio enzyme is ready and can be used as a multipurpose cleaner. [11,12]

Applications

- Use it as a multipurpose cleaner and disinfectant various surfaces of the home like the flooring, glass windows, countertops and so on.
- Use bio enzymes for cleaning greasy utensils.
- These can repel small insects, ants and cockroaches at home.
- Deodorise any space by spraying a solution of 1 part bio enzyme with 3 parts of water.
- It is perfect for cleaning the bathroom sink and W.C.
- Bio enzymes are highly recommended for cleaning the tiles and grout because the bacteria can enter small cracks or crevices to remove soils and malodors.
- Also you can de-clog a drain by pouring a solution of bio enzyme into it.
- These are effective in removing limescale deposits from the taps and steel appliances. [13,14]
- The organic solution can be used to clean pesticides and other chemicals from fruits and vegetables.
- These are like natural pesticide and herbicides.

II.DISCUSSION

Eco-enzyme can be used as a natural pest repellent. Diluted eco-enzyme with water drive away disease causing microbes, viruses, insects, mosquitoes, flies, rats, cockroaches etc. from farm land .It also helps in controlling infection in plants and can be used for watering the plants [16]. Using concentrated bio-enzyme on crops also effectively kills weeds [17]. Thus, making bio-enzyme a favourable option for plantation and farming [4]. This is depicted in Fig - 3. Farmers applied garbage enzyme on fields in Fazilka district of Punjab. This activity was carried out by Sri Sri Institute of Agricultural Sciences and Technology Trust (SSIAST), India Garbage Enzyme was applied on Guava tree, it was observed that the plant growth & size increased within twenty days of application and insects were successfully removed [16]. Sri R. Dhawan of SSIAST, INDIA used bio-enzyme on paddy fields and studied its impact on the crops. It was observed that there was reduction of pests attack on the crops [16]. Thus, it can be concluded that eco-enzyme effectively manages plants pest like white flies, bugs, spider mites and aphids [14]. Bio-Enzyme can be efficiently used as natural insecticide and herbicide. The chemical properties of these bioenzymes are similar to those found in other biological systems. It can be used as a natural cleaning agent in the home, as an agricultural fertilizer, insecticide, herbicide, and pesticide, for the purification of grey water and air, for drain de-clogging, road construction, and improving soil quality .It can also be used as a bio-remediation based agent for the removal of heavy metals , from contaminated soil and for bio-catalytic remediation of oil contaminated soil . For the preparation of bioenzymes organic waste like fruits peels (citrus, pineapple, banana), flowers (rose & marigold), [15,16] neem leaves, molasses (jaggery), water, plastic bottles and dry active yeast (of solar sales company) were taken. Fruit peels/flowers/leaves were chopped into smaller pieces with the help of a scissors. 1 part of jaggery, 3 parts of organic waste & 10 parts of water were taken. Then all the ingredients were put into a plastic bottle & to this one gram of yeast was added. After this, bottle mouth was capped tightly & gently shaken till all the jaggery was completely dissolved into the water. Bottle was then kept in cool, dry & dark place at the room temperature & allowed to ferment for one month. During the first week, gas

formed was released on daily basis for about at least two times a day by slowly opening the bottle cap.[17,18] During the second week, gas production was low & gases were released on the alternate days or if necessary. Then the mixture was left to ferment for another two weeks. After one month, garbage enzyme solution is filtered using a sieve. The residue (left-over) can be used again for the production of next batch of bioenzyme or it can be used as a scrubber for cleaning purposes or it can be used as a fertilizer .

Biochemical test were done to confirm the presence of alkaloids, flavonoids, quinones, saponins, tannins, and cardenolides. Alkaloids estimation: The test was performed following the protocol mention in Vama and Cherekar, 2013. To the 2 ml of bioenzyme samples, 1ml of freshly prepared Wagner's reagent (0.25g of iodine and 0.4g of potassium iodide in 20ml of distilled water) was added and observed for the formation of reddish/brown precipitate, Flavonoids estimation: The test was performed following the protocol mention . To the 2ml of bioenzymes samples, few drops of freshly prepared 10% lead acetate (2g of lead acetate in 20ml of distilled water) was added and observed for the formation of dark yellow or orange colour. Quinones estimation: The test was performed following the protocol mention . To the 2ml of bioenzyme samples, 1-2 ml of concentrated HCl was added drop wise and observed for the formation of yellow colour. Saponins estimation: The test was performed following the protocol mention in To the 2 ml of bioenzymes sample, 2-3 ml of distilled water was added and shaken vigorously and observed for the formation of foam. Tannins estimation: The test was performed following the protocol mention. To the 1 ml of bioenzyme samples, 1ml of freshly prepared 5% ferric chloride solution was added and observed for the formation of blackish green colour. Cardenolides estimation: The test was performed following the protocol mention .To the 5ml of crude bioenzyme samples, 2ml of glacial acetic acid along with 1 drop of 5% ferric chloride solution was added in a test tube. This was precisely layered with concentrated sulphuric acid for the formation of brown ring at interface.[19,20]

III.RESULTS

The use of bioenzyme as a pesticide was studied on Tulsi plant (*Ocimum tenuiflorum*) using neem bioenzyme. The plant was already infected by aphids & neem bioenzyme in 1:1 dilution was sprayed on the affected areas at every alternate days for 1 months. To study the anti-fungal property of bioenzyme samples a simple bread mold experiment was conducted. For this 7 slices of fresh bread and 7 plastic zipper bag were taken. 7 plastic bag were labeled as control, water, citrus, pineapple, banana, neem, marigold and rose. 1 slice of bread was sealed in control labeled plastic bag. The plastic bag labeled as water had bread slice sprayed with water. Plastic bag labeled as citrus, pineapple, banana, neem, marigold & rose contain bread sprayed with citrus bioenzyme, pineapple bioenzyme, [21,22]banana bioenzyme, neem bioenzyme, marigold bioenzyme and rose bioenzyme respectively. (All the bioenzyme were taken in 1:1 dilution ratio). After this, all the plastic bags were sealed and were kept in a warm, dark place for about 10-12 days The preparation of bioenzyme was done by following the protocol . Yeast was added during the preparation of bioenzyme because it speeds up the fermentation rate and reduces the time of the fermentation process. Jaggery is used as a source of sugar as it packed with minerals, vitamins and antioxidants. All peels, leaves, and flowers settled down after one month of fermentation, indicating that the bioenzyme is now ready to use . The fermentation of rose and marigold flowers took longer than a month because the petals did not settle down, but they were still harvested. Bioenzymes contains secondary metabolites like alkaloids, flavonoids, quinones, saponins, tannins and cardenolides which are well known for their insecticidal, anti-feedant, anti-microbial, anti-oxidant and foaming properties .Citrus and pineapple bioenzymes were found to be helpful in eliminating lime scale, hard water stains, and debris from taps and tiles, as well as in cleaning of copper and silver utensils, due to the presence of organic acids such citric acid, malic acid, oxalic acid, succinic acid, and glucaric acid [23]. Citric acid, the active ingredient in cleaning solutions, works as a chelating agent and aids in the removal of lime scale from taps, tiles, and boilers, as well as hard water stain from glasses and the dissolution of rust from steel. Long-term usage of inorganic fertilizer kills the beneficial bacteria in the soil, making plants more susceptible to disease. Bioenzyme is utilized as an organic fertilizer to solve these difficulties. Banana peels and neem leaves were used as a natural fertilizer for the growth of Cosmos plant. Both of them act as a growth stimulant for plant. Macronutrients present in them are potassium (in high amount), magnesium, calcium, sodium and phosphorous whereas the micronutrients present are iron, zinc, manganese and copper. Potassium helps in growth and development of plant by enhancing the nutritional uptake by plants. Phosphorous is an essential element of cell membrane, nucleic acid, proteins and is needed for certain major reaction. Nitrogen is available to soil in form of ions and is required for the growth of plant. Beside these minerals, bioenzymes from these peels also contain vitamins, essential amino acid and plant growth hormones which provide proper nutriment to the soil and helps in the growth of plants. They also help plants to fight against abiotic condition like drought and stress . Neem bioenzymes were found to be effective against pest on Tulsi plant. The main active compound found in neem leaves are azadirachtin, nimbolide and salannin. Azadirachtin is a composite tetranortriterpenoid limonoid which is having pesticidal, antifeedant, oviposition inhibitor and repellent properties. It interrupts with the growth and development of insect and hinders with the synthesis of insect molting hormone "ecdysome" and stops the molting and metamorphosis process causing the death of the insect. Two active element of nimbolide are nimbolide B and nimbic acid which are known to have

herbicidal properties. Salannin act as insect growth regulators and mimics like insect hormones and damages the growth and reproduction of insects. It also act as an anti-feedant. Molds need water, nutrients and warm condition to grow. Bread samples sprayed with different bioenzyme samples showed less fungal growth due to presence of propionic acid, acetic acid and alcohol. They prevent the growth of bacteria that cause spoiling of food and slow down mold developments. Alcohol inhibits the development of mold by increasing the permeability of membrane due to which membrane gets leaky and all the solutes get leaked out, ultimately leading cell lysis[24] . Bioenzymes are produced by fermenting organic wastes. Due to its wide range of applications in households, agriculture, and the environment, they are also known as a multi-purpose liquid. They are known for their antibacterial, antifungal, anti-feedant, insecticidal, and foaming properties due to the presence of secondary metabolites in them, and can be used as a cost-effective, degradable, organic, and environmentally friendly alternative to all commercially available chemical products. It does not pollute the water or soil system, emits no toxic fumes, and has no harmful effects on humans or animals.[25]

IV. CONCLUSIONS

These are like herbicides and natural pesticides. the best and mostly used by so many people. Bioenzyme as natural pesticide, many times people fond of growing plants have their terrace full of plants. If the plant is there obviously pest attacks will happen, there are so many pesticides available in market but they doesn't work effectively but also costs very much. Instead of that this bioenzyme which merely requires a hard method to make can be used a natural homemade pesticides which will also not affect the plant in negative way. So, bioenzyme not only is a effective way to do a multipurpose work but also helps in use the waste of kitchen in a different way and can save so much money without doing anything. It also helps in managing the waste of kitchen. It's an easy making solution which can have several uses for a home. Its preparation process is very easy and can ready within a month and can be used for many months.[26]

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