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Study on biofertilizers from organic (Fruit) wastes

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Abstract:

The objective of this study is aimed at producing Biofertilizer from organic waste using solid state fermentation. Three types of wastes are being used in this study. They are wastes from banana, watermelon and tomato. It is an ecofriendly method both for environment and farmers. The Biofertilizer and biological waste are used to replace the usage of chemical fertilizers as it does not contain any toxic substance and makes the soil enriched.Solid State Fermentation has been defined as a fermentation process which is used in cultivation of microorganisms under controlled conditions in the absence or near absence of free water. Physical property tests were done on the plant samples of 5 weeks of age in order to determine the effectiveness of the biofertilizer. The results of the experiment showed thatthe plant samples treated with biofertilizer from banana, watermelon and tomato wastes had promising physical characteristics. Other tests such as analyses of pH values and potassium content in the biofertilizers were also done in this study. **Keywords:** Biogas, digestion, scrubbing, bottling, application of bio methane

1. Introduction

India's agriculture is composed of many crops especially besides wheat and rice besides pulses, potatoes, sugarcane, coffee, oil seeds and jute. Currently, the total agricultural output is lost due to inefficiencies in harvesting, transport and storage of government subsidized crops. Decline of agriculture is due to depletion of soil fertility and also partially associated with unfavorable distribution of rainfall, drought, storm and floods. The major problem faced by the farmers are high cost of inorganic fertilizers require for the plant growth. The chemical fertilizer pollutes the air, soil and water polluting agents during the production of crops. Biofertilizer is commonly referred to as the fertilizer that contains living micro-organisms and it is expected that their activities will influence the soil ecosystem and produce supplementary substance for the plants. In the present study, organic wastes are used as bio fertilizers to check the efficiency in improving plant growth. Organic waste is material that is biodegradable and comes from either a plant or an animal. Organic waste is usually broken down by other organisms over time and may also be referred to as wet waste. Most of the time, it is made up of vegetable and fruit debris, these wastes are often useless and are discarded. The accumulation of wastes may cause health, safety, environmental, and esthetic concern. Each year, approximately 38 billion metric tons of organic wastes are produced all over the world. Thus, this represents a problem which requires safe disposal. The wastes such as decaying part of plants are the primary source of organic matter in soil. Therefore, organic wastes from fruits are the cheapest source that can be used by farmers to improve the fertility of soil. Biofertilizer is commonly referred

to as the fertilizer that contains living micro-organisms and it is expected that their activities will influence the soil ecosystem and produce supplementary substance for the plants. Recently, many studies and research have been focused on developing and commercializing organic-waste-based biofertilizer. Over the years, there are plenty of interests of using solid-state fermentation (SSF) process in development of various bioprocesses and products. SSF can be defined as a process that occurs in the absence of free water using solid substrates or support. In SSF, microbial growth and product synthesis are affected by various environmental factors such as water activity, moisture content, temperature, pH level, oxygen levels, and concentration. Moisture content is a critical factor on SSF processes because this variable will influence growth and biosynthesis of different metabolites. Lower moisture content causes reduction in solubility of nutrients of substrates, low degree of swelling, and high water tension. On the other hand, higher moisture levels can cause reduction in enzymes yield due to steric hindrance of the growth of the production strain by reduction in porosity (inter particle spaces) of solid matrix, thus interfering oxygen transfer. Thus, the objective of this study was to overcome the problems of the organic waste accumulation in the environment by utilizing them to produce biofertilizer using SSF method. This study also investigates the applicability of the biofertilizer in vegetable plantation.

2. Materials and Methods:

2.1 Collection of samples:

Agro – wastes (rotten fruits) were collected from the fruit market. The three different fruits used for the present study are watermelon, banana and tomato. Fruits were cut into small pieces and smashed. They were used for Solid-State Fermentation (SSF). The materials used for SSF are Polyethene bottle, Fruit wastes (rotten) and Distilled water.

2.3 Preparation for Fermentation Process:

Two batch of fermentation process were carried out - BATCH – I & II.

BATCH- I: 500 grams of water melon wastes was placed in a polyethene bottle which has a capacity of 2.5 L. 100 milliliters of water was added to it. The bottle was kept undisturbed for 30 -40 days until the soluble product was formed. This soluble product was filtered with a fabricated filter. The fermented solution is the first batch water melon biofertilizer.

BATCH –II: 100 milliliters of this filtered solution was used as inoculum precursor to the next SSF process. 500 grams of new water melon wastes were placed in a polyethene bottle. The precursor increases the rate of fermentation and minimizes the duration of SSF process. The bottle was kept undisturbed for 20-30 days at room temperature until the soluble product was formed. This soluble product was filtered with a fabricated filter. This filtered solution is called second batch water melon biofertilizer. Organic wastes from banana and tomato were also used to produce first and second batches of biofertilizer.

3. Result and Discussion

3.1 Biofertilizer analyses:

PH and potassium content analyses in the biofertilizer were performed. Purpose of pH test was to analyze the acidity of the biofertilizers, and this test was done using digital pH meter. Analysis of potassium content was done to determine the amount of potassium species in the biofertilizers. The analysis was carried out using atomic absorption spectrometer (AAS, Thermo Scientific,).

3.2 Applicability of the biofertilizer in vegetable plantation:

The Biofertilizer were applied on the Mustard plant (Brassica Juncea Var Rugosa) samples of 2 weeks of age in order to determine the effectiveness of the biofertilizer. Each batch of the biofertilizers was applied on plant samples. At the same time, controlling samples and another sample were planted in the absence of any

fertilizer.Seeds of plant samples were treated with mixture ofbiofertilizer and water (1:10 mL v/v). Then, the seeds were exposed to high intensity of sun ray (21–34℃) for about 12 h daily. Observation and collection data were performed for each seed after 3 weeks. The collection data were length of the longest roots, number of leaves, and weight of the seeds.

4. Conclusion

The present work aimed at producing biofertilizer from organic wastes and showed that SSF method is suitable to produce effective and economical biofertilizer, which could increase the yield of crop. Efficient utilization of the biofertilizer is reflected by crop growth rate. Solid state fermentation aided in the formation of soluble product and helped to produce the microorganism such as bacteria, fungi and yeast. The fermented solution was applied to vegetation to check the efficiency of the Biofertilizer. The organic wastes are usually fruits, vegetables, weeds and organic manure. The elongation of root, shoot and germination of seeds were compared. Watermelon, fertilizer showed the best efficiency in comparison to others.

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