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PREPARATION OF ORGANIC FERTILIZER FROM BIODEGRADABLE WASTES

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Abstract

Changing life style and increase in population has increased the quantity of organic waste in the environment. Nearly 700 million tons of Biodegradable waste are generated in India. As a result, the existing waste dumping sites are full beyond capacity, which leads to pollution of water resources, spreading communicable diseases, foul smell etc. To mitigate this problem all the waste can be converted into highly valuable nutrient-rich compost in an environment friendly manner. Vermicomposting is better option to tackle all these problems. Present study examines the potential of the Red Wriggler (Eisenia Foetida) in the vermicomposting of Kitchen (Biodegradable) waste through tank method. In this process, the digestive tracts of certain earthworm species (e.g., Red Wriggler) are used to stabilize organic wastes. A mixture of Kitchen waste and cow dung in the ratio of 1:2 was found to be the addition of best substrates. The final product is an odourless peat like substance, which is produces from the guts of earthworm, known as Vermicast (BLACK GOLD) that has good structure, moisture-holding capacity, relatively large amounts of available nutrients, and microbial metabolites that may act as plant growth regulators. Vermicomposting is becoming popular as a major component of organic farming system, as it offers immense scope to small and marginal farmers in creating their own organic manorial resources and ways to generate alternative income.

Keywords: Organic Fertilizer, Biodegradable Wastes, Vermicast, Red Wriggler

1.0 MATERIALS AND METHODS

1.1 COLLECTION OF VEGETABLE AND FRUIT WASTES:

Degradable wastes such as vegetable peels and other fruit skins are collected from College Mess and Canteen. The collected organic wastes is dried under shady areas in order to avoid direct exposure of sunlight, as it will consume all the biocontents of the peels. No citric acid fruits should be included as it kills the entire life of the earthworms.

1.2 COLLECTION OF BEDDING STOCKS AND DRY COW DUNG:

Bedding materials such as Pebbles, Sand, Soil, Neem leaves, Cartons, Coconut Fibres, Rice husk, Straw, Egg shells, Litters, Vegetable peels, Fruit skins (Banana peels) etc., Pebbles are purchased from India Mart, with a quantity of 25 Kg. Sand is collected from the constructional area of our college premises. Soil is taken from the garden of our house. Neem leaves, Litters, Grasses are collected from the lawn near to Bhavani Reference Point. Rice husk, Straw are collected from nearby houses surrounding our college. Vegetable peels and Fruit skin such as Banana peels, Egg shells, Cartons, Coconut Fibres are collected from the Canteen and Hostel Mess. Dry Cow Dung is collected from the cricket ground near to our college premises, where many cows will graze the grass and it will excrete its wastages and that will be dumped to the corner of the ground.

1.3 COLLECTION OF RED WORMS:

The Red Wriggler Worms are collected from the nursery near Madhavaram, Chennai. These are the only worms which will intake the biodegradable waste as their food. These worms will not make burrows in the soil, as it feeds exclusively on decomposting Organic matter. These worms will not stay permanently as it cannot bear more tropic or temperate environment.

1.4 TYPES OF COMPOSTING:

There are two fundamental types of composting: They are, Aerobic and Anaerobic

AEROBIC COMPOSTING

Composting is the decomposition of organic waste in the presence of oxygen (air); the process includes CO2, NH3, water and heat. This can be used to treat any type of organic waste but, effective Composting requires the right combination of ingredients and conditions. These include the moisture contents around 60-70% and Carbon to Nitrogen (C / N) ratios of 30/1. Any significant variation inhibits degradation process. In general, wood and paper provide an important source of carbon, while sewage sludge and food waste provides nitrogen to ensure an adequate supply of oxygen at all times. Ventilation of waste, either forced or passive is essential.

ANAEROBIC COMPOSTING

Anaerobic Composting is the decomposition of organic wastes in the absence of O2, the products being methane (CH4), CO2, NH3 and trace amounts of other gases and organic acids. Anaerobic composting was traditionally used to compost animal manure and human sewage sludge, but recently it is become more common for some municipal solid waste (MSW) and green waste to be treated in this way.

2.0 COMPOSTING METHODS:

2.1 PIT BELOW THE GROUND:

Pits made for vermicomposting are 1m length and 1.5m wide. The lengh and depth may vary as required.

2.2 HEAP ABOVE THE GROUND:

The organic wastes are spread on a polythene sheet placed on the ground and then covered with cattle dung. Considering the biodegradation of wastes as the criterion, the heap method of preparing vermicompost was better than the pit method. Earthworm population was high in the heap method, with a 21-fold increase in Eudrilus eugenae as compared to 17-fold increase in the pit method. Consequent production of vermicompost was also higher in the heap method (51Kg) than in pit method (40Kg).

2.3 TANKS ABOVE THE GROUND: (PREFERRED METHOD FOR THE PROJECT)

Tanks made up of different materials such as normal bricks, hollow bricks, and locally available rocks were evaluated for vermicompost preparation. Tanks can be constructed with the dimensions suitable for operation. The commercial bio-digester contains a partition wall with small holes to facilitate easy movement of earthworms from one tank to another.

2.4 CEMENT RINGS:

Vermicompost can also be prepared above the ground by using cement rings. The size of the cement ring should be 90 cm in diameter and 30 cm in height.

3.0 RESULT AND DISCUSSION:

3.1 PH:

The pH of the compost was lower in all the experimental set ups than their initial values. The decrease in pH value at the final stage of compost formation may be due to the production of CO2 and organic acids by microbial metabolism during decomposition of different substrates in the vegetable waste.

3.2 NITROGEN:

Decrease in pH may be an important factor in Nitrogen retention as this element is lost as volatile ammonia at highest pH (Gautham et al., 2010). According to Viel et al., (1987) loss in organic carbon might be responsible for nitrogen enhancement. Pseudomonas bacteria also have great impact on nitrogen transformation in manure, by enhancing nitrogen mineralization, so that mineral nitrogen may be retained in the nitrate form (Atiyeh et al., 2000). However in general the final nitrogen content of compost is dependent on the initial nitrogen present in the waste and the extent of decomposition (Gaur and Singh 1995). In the present study, the vegetable wastes were effectively decomposed by the applied microbes. It is due to increased microbial activity continues in the casts and results in an increased rate of mineralization of organic nitrogen.

3.3 PHOSPHOROUS:

The total phosphorus increased significantly in the experimental setup than the control Increase in TP during compost formation by bacterial action is probably due to mineralization and mobilization of phosphorus and enzymatic activity of bacteria (Edwards and Lofty, 1972).

3.4 POTASSIUM:

Acid production by the micro organisms seems to be prime mechanism for solubilizing the insoluble potassium.

3.5 C:N RATIO:

The CN ratio traditionally considered as a parameter to determine the degree of maturity of compost. C N ratio below 20 is an indication of acceptable maturity. While a ratio of 15 or below being preferable. (Marais and Queda, 2003).

4.0 CONCLUSION

The present study was revealed that Vermicomposting is an alternate technology for the management of biodegradable organic wastes. During the course of Vermicomposting, while the TOC content can decrease' considerably, the fertilizing capacity (NPK content) will increase sharply. The results obtained during this study indicate that Vermicomposting of VFM organic waste mixed with different types of bedding materials can convert this waste to valuable product suitable for different applications. Vermicomposting analysis was also shown that the type of the initial substrates has little effect on the product properties.

Our review identified that vermicomposting may be the viable and a very lowcost option to handle solid waste in an eco – friendly way. Based on the above discussion, it can be concluded that vermicomposting is a waste management technology that involves decomposition of organic fraction of solid waste in an eco – friendly way to a level in which it can be easily stored, handled, and applied to agricultural fields without any adverse effects. Integration approach of composting and vermicomposting processes provides better results by combining both processes and choosing one of the two forms as

(i) Pre vermicomposting followed by composting or (ii) Pre composting followed by vermicomposting. Further, to optimize the process of vermicomposting, codigestion of organic wastes provides better opportunity for both microorganisms and earthworms to convert the organic fraction of solid waste under controlled environmental conditions. Feeding, stocking density, pH, C/N ratio, temperature, and moisture, by inference, seem to be the critical factors that influence the vermicomposting process. Furthermore, the end product of vermicomposting, the nutrient-rich compost, could be used for biogas production. Hence, the management of solid waste and energy production can be achieved at the same time with no further costs. Thus, vermicomposting technology can be used for economical recycling of solid organic waste in developing countries. It is strongly recommended that this technology can be used to manage the waste placed in landfill or in open dumps, sewage sludge, incineration waste, and dumps in the agricultural fields to avoid/reduce groundwater contamination and toxicity of soils and plants through different contaminants.

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