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Sustainable management of food wastes using effective microorganisms compost

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ABSTRACT

Food waste has become a serious issue in recent years. Due to increase in over population, solid waste also more generated and affect public health and environment. Food wastes produce methane gas that results greater impact on global warming than carbon dioxide. The composting technology is one of the alternatives, as it is the highest form of recycling of biodegradable solid waste. The study was undertaken to utilize food waste generated, into organic manure using effective micro-organism. A total of 100 kg of food wastes were collected from 100 households in Allahabad over 15 days. The pit was dug for composting using Effective Microorganisms (EM) and natural composting for remediation of organic contaminants. The compost was analyzed and the effectiveness of compost was studied through cultivation of vegetables at households. Results revealed that EM compost had fast decomposition rate, rich in nutrients, more microbial activities, good germination and more yields compared with natural compost. Thus, the study paves way for effective management of food waste in order to minimize potential human and environment risks and composting using effective microorganisms as an option of waste management operation that is cheap, Eco- friendly and sustainable.

1. Introduction

Fig. 1:

Most challenging issues humanity is currently facing food waste worldwide. During the past few decades as the world population has drastically grown due to which the wastage of food become a serious issue globally. Discharge of methane which causing greenhouse effect due to pathogenic microorganisms. Composting can be implemented to manage and reduce waste to achieve with global sustainable development goals. During composting process, microorganisms play a crucial role in transforming organic material into stable material through the various biochemical processes thereby producing fiber rich carbon containing humus rich inorganics. The final output of composting can be utilized as fertilizers. The garbage-wastes produced by each and every home makeup the municipal results in environmental problem. India

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produces about 39 million tons of municipal waste in each year[1–3] which causing increased food prices and the resources required. Composting[4–6] is a sustainable alternative method in managing food waste as it produces bio fertilizers, relatively low air and water pollution. The process of composting decomposed organic matter by microorganism under certain moisture, aerobic or anaerobic conditions to produce a product in a form of compost which are stable, low in moisture and free from pathogen. The product from composting process can be applied directly to soil as bio fertilizer that contain nutrients for plant grow. However one of the issues in composting process is the long time duration that is required to complete the process. The exposure of heavy metals may cause blood and bone disorders, kidney damage and decreased mental capacity.

Effective microorganisms[7–9] is a type of microbial inoculant was proven to accelerate composting process. The rate of conversion of food waste into compost was accelerated to 45 days due to the inoculation of effective microorganisms when compared to the natural process of aerobic digestion which normally took 2 months. Composting is an old process, ideal technology for waste. The use of effective microorganisms may have wide range of applications, including agriculture, livestock, gardening and landscaping.[10] Sustainable management of food waste is a reasonable research area that has rapidly grown in recent years. Several studies have showed that EM is produced from organic waste such as kitchen and fruit waste. In addition, the homemade EM produced from kitchen waste reduced the BOD, COD, nitrate, phosphate and sulphate in the industrial waste water treatment. Though EM has been widely researched but limited study has emphasized on the production of EM from food waste composting.

1.1. Sampling technique

The composting process was carried out in plastic bin containers. The size of container was 0.3 m height x 0.2 m width, respectively. They were easily available, inexpensive and can readily be used at home. The plastic bin composter was covered with aluminium foil to enable the absorption of heat from the sun. Food wastes were the main materials in the composting process with the inclusion of EM as additive. Water was added in the course of mixing organic waste with effective microorganism. Dry leaves are added on the pit before putting new wet waste to provide minimum aeration and to absorb the moisture to accelerate the microbial activities in the initial stage. Add activated EM solution on top of the pit to develop the microbial growth.

1.2. Collection of food waste

Food waste collected from several food stalls and restaurants in Allahabad which was then washed with tap water before they were used in the composting process. This process required to remove excess oil in food waste. Then it was analyzed for pH, temperature, moisture content before composting process was carried out.

1.3. Composting process

Allahabad city is selected for the purpose of collection of waste and for establishment of compost unit based on sampling technique. It was carried out in plastic bin containers were easily available, inexpensive and can be readily used at home of 0.3 m height x 0.2 m width. The plastic in composter was covered with aluminium foil to enable the heat absorption from sun. The microbial activities digest and decompose bio degradable waste from complex to simple inan aerobic condition.[11–13]

Fig. 2:

To collect waste three types of colored plastic bags were used. The kitchen waste in black bags that included vegetable peels, leftover foods, fruit peels and egg shells from residential areas were collected[14–16] left over rice were collected in white bags and waste from restaurants and hostels were collected in red colored bags. Dry leaves were collected from the hostel using black bags. The waste was collected for a period of 15days personally and weighed separately. A pit of 2x2x2feet was dug for this purpose of natural composting.

2. Results and Discussion

Solid waste management is necessary to keep safeguarding of public health and the environment. The kitchen waste generated from the various households at township were collected every day for a period of 15 days. Waste collected was computed and observed that quantity of waste generated range of 5 kg and 60 kg per day. The quantity of waste generated every day depend on the items prepared[17] based on the menu. The appearance of the compost as dark brown color and strong agricultural soil odor with 40 percent

Table 1: Nutrient content of compost

Parameters	Type of Compost	
	Natural compost	EM. Compost
N (%)	0.8	1.2
P (%)	1.4	1.9
K (%)	0.4	0.3
Organic carbon (%)	6.2	5.8
pH	6.6	6.8

Table 2: Yield of selected crops

Vegetables and Ornamental plants	Plot size in feet	No. of plants cultivated	Total yield from households (n=12)	
			Yield (EM compost) in kg	Yield (natural compost) in kg
Lady‘s finger	(10 x 10) in feet	10	58	56
Brinjal	(10 x 10) in feet	10	22	18
Tomato	(10 x 10) in feet	10	11	08

moisture was considered as endpoint for the bio conversion in the pit.

It is obvious from the result that the entire nutrient analyzed were enriched in the manure obtained through inoculation of EM it as against natural compost. The effective microorganisms enrich the compost by means of producing enzymes. Enzyme such as amylase, rubisco and melibiase are produced by photosynthetic bacteria. The waste can be utilizedto obtain useful rich nutrient compost through composting as it ensures good hygienic environmental conditions and helps to lead a betterment of life.

Composting enhances the soil structure and improve water retention. The usage of chemical fertilizers could be reduced as they may cause ground water pollution. Therefore, composting of food waste should become an alternative to chemical fertilizers. Composting also encourages the growth of favorable microorganisms such as fungi and bacteria. Also, composting provides essential nutrients to the oils. These nutrients help to support the growth of crops and increase their yield. The most evident benefit of composting is the food waste can be reduced and reused.

3. Conclusion

Food waste is a serious issue that contributes to the environmental, economic and social problems. It leads to higher rates of food insecurity causes environmental pollution. The complexity of the food system enhances the comlexity of the food waste problem, but this issue is neverthless reversible and steps toward a more sustainable food system can be undertaken locally. Individual behavior can reshape food waste at home and lead to broader changes in the ecosystem. To combat this issue, effective microorganism compost is an environmentally friendly approach of waste management operatio.

4. Source of Funding

None.

5. Conflict of Interest

None.

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