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Clean-up tool to convert waste into wealth through composting: A study

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Abstract: The changed lifestyle of people has enormously increased the problem of solid waste generation in urban areas. The solid waste thus generated in bulk is finally ended in landfill sites thus disturbing the ecological balance through the emissions of greenhouse gases. As a result, the campaign commenced by the government helps to strengthen the solid waste management under "Swachh Baharat Mission" to adopt greener and cleaner technologies, as a solution to this problem. Therefore, composting is one of the prominent methods to decompose organic waste into wealth and helps in achieving environmental sustainability goals. This paper aimed to study the local college adopting various composting techniques to handle their wet wastes within the premises only.

Keywords: lifestyle, solid waste management. Landfills, Greenhouse gas emissions and environmental sustainability goals.

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1. Introduction

Waste management has become a major challenge due to the continuously increasing population and urbanization. Increased use of electronic gadgets and equipment has been a direct increase in the quantity and quality of waste generation. Annually, India generates 65 million tons of waste comprising 70% of e-waste, 12% of the telecom sector, 8% of medical equipment and 7% of electric equipment and over 62 million tons of it is MSW (organic waste, recyclables like paper, plastic, wood, glass, etc.). Only about 75-80% of the municipal waste gets collected, and only 22-28% is processed and treated. The remaining MSW is either deposited at dump yards or in landfill sites. It is estimated that by 2031, MSW generation is projected to increase to 165 million tons, and further up to 436 million tons by 2050. The average daily waste per person averages 0.74 kilograms worldwide and is expected to increase from 0.11 kilograms to 4.54 kilograms. By 2050, it is expected that global waste will grow to 3.40 billion. Presently, India accounts for approximately 18 percent of the world's population and 12 percent of global municipal solid waste generation and stands in the 168th position in Environment Performance Index, 2020. The MSW in India has 51% of organic waste,17.5% recyclable waste (paper, plastic, glass, metal) and 31% inert which shows that the major fraction of waste is organic waste and their management really needs to catch up as per Municipal Solid Waste Management and Handling Rules, 2000. Therefore, various methods of composting are suggested for the proper management of organic waste like vermicomposting, windrow composting, and aerobic (Indore) composting, anaerobic (Bangalore) composting suggested by (SWMG, 2015) depending upon various factors like temperature, climatic conditions and the compost is an eco-friendly soil conditioner. This review paper will give insight to manage wet waste in the study area.

2. Methodology

Raw material i.e. wet wastes generated from the college canteen, hostels and campus (green area) are collected and put in the composter bin/open pits/ vermibeds to get decomposed. The wet wastes are mixed with cow dung manure/soil/ cocopeat/eathworms. The layer of wet waste, mixed and then covered with 1 inch of soil and repeated the process till the

waste gets properly mixed for proper aeration and decomposition till the bins get fully filled and then remain as such. The aerobic bacterial activity helps in the decomposition of waste.

3. Factors Affecting Composting

Moisture content: Low moisture content slows down the activity of microorganisms and high moisture leads to anaerobic conditions causing foul odour and decreasing the degradation of organic matter. Therefore, the moisture content of ideal compost should be 50-60%.

Particle size: Smaller size of the material will increase the surface area thus increasing the microorganism activity and quickening the composting process. While too small material size reduces the oxygen flow and proper air ventilation which decreases the microbial activity.

Aeration: Aeration is necessary for providing favourable conditions for the microbes to avoid anaerobic conditions because optimum aeration fastens the process of composting.

Organism: Fungi, bacteria and other micro-organisms are actively involved in the composting process and their relative proportion is wholly reliant upon the source food, temperature and oxygen supply.

4. Composting Process

Aerobic composting helps in the reduction of large amounts of organic waste in less time. This process accelerates the biological decay of organic waste by providing favourable conditions for the microbes to feed. The end product so formed after the decomposition natural process is bio-fertilizer which is compost that can help gardens plants, vegetables and herbal gardens and trees to grow rapidly. Organic waste should not be applied directly to the soil because plants cannot take nutrients directly from waste and this process converts the waste biomass to soil conditioner to provide nutrients to plants (Bertoldi et al., 1982). There are two types of composting i.e. anaerobic composting; where reduction of organic waste is decomposed by anaerobic micro-organisms thus resulting formation of methane and hydrogen sulfide as by-products and aerobic composting where aerobic microorganism helps to decompose organic waste and converts them into carbon dioxide, nitrogen dioxide and nitrogen trioxide. Aerobic composting consumes less time than anaerobic composting for the completion of the composting process. The process of composting mainly completes in two phases (decomposition and humification). The decomposition phase involves processes mesophilic, thermophillic and cooling in

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which complete degradation(breaking) of simple and complex matters occurs and the humification phase/maturation phase in which organic matter is converted into a stable product i.e compost a fully saturated soil conditioner (Kaiser, 1983).

5. Composting Techniques

Vermicomposting: Decomposition/ breakdown of horticulture/garden organic waste by red earth worms in a moist, warm, and aerobic environment is a very feasible method of composting (Shah et al., 2012).

Fig. 1: Vermicomposting is done in the garden of study area (garden and horticulture waste decompose in 1-2 months

The by-product compost (vermicompost) is granular in texture and thus loaded with various water-soluble soil nutrients to be used as manure in gardens (SBMG, 2015) and this method takes 60-90 days (Neher et al., 2013). The major advantages of vermicomposting are it produces fewer greenhouse gases, odor as well as there is no problem of water pollution in the form of infiltration of leachate (Khan and Ishaq, 2011). The operational and maintenance cost is also low compared to other methods as in Fig. 1. In India focal vermicomposting plants are positioned in Bangalore, Hyderabad, Mumbai and Faridabad.

Windrow Composting: Wet wastes are placed in a long narrow either trapezoidal or rectangular shape (windrow) that are 2-5 meter base width and 1-3 meter high (standard size) and that must be turned periodically for the optimum requirement of moisture and oxygen (CPHEEO, 2016). Windrow composting is an outdoor type of composting technique to handle a large mass of organic matter and biodegradable waste such as hostel wet wastes and wastes from large green open spaces. There are two types of windrow composting i.e. forced aerated windrow composting in which air is introduced externally by mechanical blowers and the other is conventional windrow composting in which the composting pile has not covered the aeration takes place naturally and turning is provided when needed and the area under study adopt conventional windrow composting; best suited for the treatment of a large volume of waste. The efficiency of the

method is based on the size of pile, smaller the size, pile not be able to resist typical weather conditions whereas larger the size pile not be able to aerate (Kuhlman, 1990) as in Fig. 2.

Fig. 2.: Windrow composting of the open green spaces and hostels wet wastes and takes approximately 4-5 months to get fully decomposed

Indore Composting: In 1931 Wad and Howard invented a systematized procedure for composting in Indore, Madhya Pradesh (Fitzpatrick, 2005).

Fig. 3.: Indore method of composting of the canteen wastes takes 2-3 months to get fully decomposed.

This is an aerobic method where organic waste such as fruit and vegetable waste is piled in alternative layers with cocopeat and night soil in a depth of 7.5-10 cm each, the overall depth of 1.5 meters above the ground with proper aeration by turning the pile and thus resulting in good quality compost after 4 -5 months and during this time the aeration is provided by turning the pile as in Fig. 3.

6. Conclusion

This review gives thorough knowledge about the composting process of bulk waste generators. This is a sustainable method for waste segregation and proper management at the source only. Compost is a better option for soil improvement than chemical fertilizer because it improves the quality of soil (Ghorbani et al. 2008). It reduces the mass and volume of waste in an environment-friendly manner thus the adoption of composting is a prominent method for converting waste to wealth in an economic manner.

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