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REVIEW ARTICLE **OPEN ACCESS**

Natural Waste Reducing Method: Composting

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ABSTRACT
The fast advancement of industrialization and urbanization has led to an increase in waste production, with the bulk of it being biowaste. Traditional waste management solutions (such as landfills) produce environmental issues such as greenhouse gas emissions, leachate formation, and poison release, hence this has become a global issue. Composting is a long-term and cost-effective method of dealing with biowaste. This review covers a variety of topics related to composting, including compost quality and composting systems.Composting has emerged as a preferred method of treating organic wastes in order to produce a last steady cleaned item that can be utilized as a natural fertilizer. Composting method is one of only a handful of exceptional strategies that can be utilized at any size, from home fertilizing the soil to huge city garbage removal plans. Composting has multiple advantages, including improved manure handling, enhanced land application, weed seed and pathogen eradication through high temperatures in the compost heap, reduced risk of pollution and health concerns, and effective soil condition.
Keywords: *waste management, organic, soil, manure, biowaste, composting*

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INTRODUCTION

Waste Management

In every country, waste management has become a major issue. As a result, proper waste management and disposal is critical for living a healthy life in a clean environment. Waste management is commonly used to refer to the process of reducing waste.Factors such as urbanisation, industrialization, commercialization, overpopulation contributes to waste generation.We produce a variety of wastes, like agricultural residues, household waste,medical waste, toxic waste, and organic waste. These wastes come in three varieties: solid, liquid, and gas. Modern waste management methods emphasize not only the removal of waste but also the conversion of waste into useful substances.

Advantages of Waste Management:

It aids in energy conservation. It is possible to do so through recycling, which is a critical component of waste management. Recycling materials consumes less energy than producing new goods. We help in keeping our environment clean when we manage garbage, and we should all try our best to keep our immediate and non-immediate surrounds clean to achieve the ultimate goal of a clean environment. Waste management can help to prevent global warming and pollution in the air. It helps in lowering the amount and intensity of gases such as carbon dioxide and methane produced and released into the environment by waste. When humans are exposed to waste, it can have a substantial influence on their health, resulting in a number of ailments and disorders. Waste management activities,entail trash collection from different landfills and transportation of trash to sites where it may be disposed of properly without jeopardising our wellbeing.

Disadvantages of Waste Management:

Finance: To be efficient, waste maintenance on a large scale may require a substantial amount of labour and technology. The numerous processes and actions involved in waste management demand planning and implementation.

Workers' Health: Waste management and all of the processes that go along with it can cause a variety of fungal and bacterial illnesses and diseases in those who operate in the waste management sector.

Waste Management Methods:

The following are some of the most used waste management methods:

Landfill: Garbage and waste disposal in landfills is one of the most well-known waste disposal systems. This strategy eliminates issues such as waste odour and risks. The compost is buried adjacent the landfill site. Today, landfills are also considered to contribute to global warming, which is why several countries are rethinking their disposal strategies.

Incineration: This waste management approach entails burying public solid wastes in order to transform them into residue, heat, steam, gases and ashes. It reduces solid waste by approximately 32% of the actual amount.

Composting: Composting is a waste management bio-degradation technique in which organic waste, such as plant leftovers and pantry waste, is turned into flora sustenance.

Recycling: It is a waste management approach in which waste things are reconditioned and reused. Waste things are reprocessed to extract resources or convert them into energy sources like fuel, electricity, and heat.

Anaerobic Digestion: It is a waste management process that uses organic procedures to decompose biological components. It decomposes in a germ-free environment with enough of oxygen. Composting requires the presence of air in order for bacteria to thrive.

Gasification and Pyrolysis: These two waste management procedures are used to decompose organic residual materials by exposing them to a small amount of oxygen and raising the temperature. In the process of pyrolysis, no oxygen is used, and in the process of gasification, only a little amount of oxygen is used.

Composting method

Compost is a crumbly, black, humus-like substance produced by the supervised aerobic biodegradation of organic waste, often known as composting. Humus is a type of soil that comprises lately decomposed organic matter such as plants, dead creatures, and manure, among other things. Biodegradation is the decomposition of the organic substances into their fundamental components and humic material by living organisms, and it is an aerobic process that takes place when there is oxygen present. When working with concentrated wastes created by people, however, a special technique is necessary to ensure that "good compost" is formed.

Objectives of Composting:

Compost deficit in farmlands and reliance on chemical fertilisers have led to weakened soil properties, insufficient or surplus essential minerals, insect infestations, and hardened soil, to name a few consequences. Organic garbage, particularly food waste, is a bioactive substance that decomposes organically. Composting is a biodegradation process in which organic waste is converted into carbon dioxide, water, energy, and organic manure matter[1], has been widely embraced as a method to stabilise organic leftovers across the world over the years [2]. Compost, which is produced from organic waste, could be used as a potential solution for synthetic fertilizers. Composting is an effective way of improving the soil's quality. [3] Composting targets to: (1) treat organic waste like food waste, yard waste, cattle excreta,and deactivate causative microbes, viruses, and weed seeds through warmth of bacterial fermentation; (2) Organic waste, such as food scraps, garden waste, livestock faeces, and other types of waste, are treated in aerobic or anaerobic states to deactivate causative microbes.

Waste suitable for composting –

The following are some instances of waste that is organic that may be utilised as composting resources:

a) Food waste, such as leftovers from meals and cooking residue
b) Tree trimmings and leaves
c) Wheat straw and rice
d) Feces from cattle and pigs
e) Sewage sludge and night soil
f) Fresh or public market vegetable and fruit waste

Due to the difficulties in degrading, composting is not recommended for shells, shrimp shells, nut shells, hog bones, chicken bones, coconut shells, beef bones, and fruit seeds.Despite the fact that these wastes are frequently classified as food waste. Polymers, alloys, glass, gum, oil, cigarette butts, diapers, and other non-biodegradable garbage are not recommended for composting.The atmospheric fermentation process takes ten to three months for composting [4], but paper takes a lot longer to decompose. Toxic material, such as medications, spray cans, dry batteries, pesticides, mercury temperature sensors, and other objects, should not be blended in raw resources for composting because doing so lowers the quality of the compost and poses a health risk to people [5].Sewage sludge is an inorganic and organic residue that remains after wastewater treatment and is high in nitrogen and phosphorus, as well as a lot of organic

elements [6]. Heavy metal content in sewage sludge, on the other hand, has been a key stumbling block for compost made from sewage sludge [7].

Composting Stages:

In the composting period, microbial activities are responsible for decomposing organic materials, resulting in the fairly stable biological end result known as compost. The composting process goes through many distinct phases under ideal conditions, with different populations of bacteria predominating at every stage.These phases are: (i)"Active" phase of decomposition: As the bacterial population grows and starts to degrade the most freely degradable material, the heat produced by the microbe activity piles up within the pile, raising the temperature steadily from thermophilic (25–45 °C) to thermophilic (higher than 44 °C). Thermophilic conditions (55 °C or above) are desirable in composting materials because they kill more viruses, weed seeds, and flies [8]. Compost managers employ aeration and mixing to keep the temperature below 65 degrees Celsius, which kills many microorganisms and slows decomposition. (ii) Cooling phase: As the provision of high compounds depletes, the temperature of the compost progressively declines, and mesophilic microbes reclaim control of the pile. (iii) Maturation "curing" phase: This takes place at a temperature lower, although numerous occurs naturally reactions still take place, despite the lower microbial activity compared to the preceding stages[9].

Factors affecting the composting process

To get high-quality compost, numerous critical characteristics must be monitored during the composting mechanism. Porosity, temperature, moisture content, C: N, pH, proper aeration, & particle size are among these factors. [10-13]

C/N ratio: The C/N ratio is a classic metric used to assess compost maturity and stability since it specifies agronomic quality. Living organisms need around 25 to 35 units of carbon for every unit of nitrogen during active aerobic growth [14]. Poincelot (1975) proved that a C/N ratio around 25 and 35 is optimal for quick and effective composting. If there is a surplus of carbon available (a greater C/N ratio), fast cell growth will deplete available nitrogen and cause a temporary pause in cellar growth.

pH Value: The pH of compost is considered as a measure of the stabilization and degradation processes. The pH value changes rather predictably during composting [15-17]; it dips somewhat early in the process, then rapidly rises to about 8.5 because of ammonification. As the compost settles, the pH value settles to between 7.5 and 8.0. If the pH is more than 8, it indicates that municipal authorities are employing lime or bleaching powder at collection/storage stations.

Temperature: The organic waste composting occurs between two temperature profiles, one thermophilic and the other mesophilic. The breakdown process begins in a thermophilic environment. Within a few days, the temperature of aerobic bacteria's exothermic biological processes rises to 65-70°C. This temperature must be kept constant throughout the life cycle. The temperature of the compost windrow is thermophilic and lowers as the bacterial population in the windrow drops.

Proper aeration: Because aerobic bacteria are utilised in the biological process, appropriate aeration is essential to assure the availability of oxygen. Aeration will be enough if the piles are turned on a regular basis. Turning windrows is necessary to ensure enough aeration. A considerable amount of oxygen should be delivered at the start to commence aerobic composting. [18-19]

Moisture Content: The waste's moisture content should be between 50 and 55 percent. Microbes will die if there is insufficient moisture. A high moisture content of more than 5% is not advantageous for compost piles because it lowers the temperature of the pile by chilling it and reduces the generation of microbial activity and biomass[20].

Particle size: Reducing the size of the material improves the surface area, which enhances microbial activity and speeds up the composting process. While too tiny a material restricts the passage of oxygen and air, reducing microbial activity, the material size should be carefully lowered for air ventilation.

Composting Techniques

Vermicomposting: Vermicomposting is the process by which earthworms decompose heterogeneous organic waste in a wet, a warm and aerobic atmosphere. Worm composting is another term for it [21]. The primary benefits of vermicomposting are that it emits less greenhouse gases, emits less odour, and causes no water contamination.

Windrow Composting: It is an outdoor composting technique which involves placing a huge mass of organic material and biodegradable waste, such as crop residue and animal wastes, in a long and narrow stack (windrow) in a trapezoidal or triangular form that is turned on a routine basis to provide the compost pile with the best moisture and oxygen[22].

In vessel Composting– Composting that takes place in a closed system, such as a plastic or metal vessel or something else, is known as in vessel composting. Various key parameters such as temperature, moisture, and other aspects are regulated in this process for optimal compost. When used correctly, this takes less time. This approach is commonly employed in municipal garbage processing.

Environmental benefits of Composting

A well-organised compost facility boosts clean and easily beneficial end goods, reduces annoyance potential, and is easy to operate [23]. When composting is used as a waste management approach, landfill space is reduced [24, 25]. The WHO estimates that 900 million people suffer from diarrhoea or become infected with illnesses such as typhoid and cholera as a result of polluted water [26]. Waste obstruction of rivers, canals, and drainages might be minimised through composting [23]. Composting produces very little greenhouse gas, which has a negative impact on global warming and climate change [27]. Composting, on the other hand, inhibits water contamination.

Composting as a fertiliser and soil enhancer —

Various forms of waste, marine waste, and biowaste, were recycled into fertilisers and soil additives because their effects are equivalent to those of commercial chemical fertilisers. For example, FW is high in organic matter including carbohydrate, protein, lipid, and organic acids, as well as nutrients like phosphate, nitrogen and potassium, making it a good feedstock for high-quality compost [28, 29].Compost made from biowaste has long used as a soil conditioner and, in certain cases, an organic fertiliser, if the waste has sufficient nutrients. Indeed, if so many of them are processed, mineral fertilisers depending on phosphates might be replaced by up to 30% [30].

Composting as a source of bioenergy—

The conventional energy source, fossil fuel, is expected to decrease over the following five decades, necessitating a change to biofuel that is renewable [31, 32]. Energy recovery from biowaste has been viewed as a cost-effective and sustainable technique. There have been numerous methods for generating energy from waste, with FW serving as a feedstock for the production of ethanol, biodiesel, methane, biohydrogen, and electrical generation[33]. However, anaerobic digestion necessitates rigorous process controls, a costly initial investment, and a long digestion retention time, while the heating power of the generated gas is minimal, resulting in a low return [34, 35].

Challenges and Future Prospects

Various difficulties have arisen with the advancement of the composting. Depending on the collection system, there may be a high percentage of inert elements, such as glass or plastic, in the garbage prior to composting. These weed seeds in compost could be the result of insufficient processing, allowing contaminants to persist [36].Furthermore, factors like aeration rate, moisture content, particle size, and pH can impact the composting, and these variables must be adequately regulated while taking into consideration the qualities of the biowaste feedstock to avoid issues like odour emissions, pollution, and low-quality compost. Composting technologies for synthesising organic fertiliser could also be created and enhanced in order to boost nutritional value and recover energy from compost components.[37]

As a result, research is needed to improve the burning efficiency of compost as a solid fuel and to reduce the pollution created by it. Because use of organic waste as compost can reduce waste pollution concerns, and compost burning has to provide energy as the desired effect while ignoring adverse side effects such as pollution, the process' pollution and hazard management are critical.

CONCLUSION

It is true that composting has a wide range of applications in plant development and environmental clean-up. Composting, as previously said, is a simple, realistic, cost-effective, less-expensive, less-cumbersome, and productive process. Farmers may become self-sufficient in soil amendment (compost) and secure greater yields by using this environmentally beneficial practise.

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CONFLICT of Interest

The authors declare that they have no conflict of interest.

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