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VERMICOMPOSTING OF ORGANIC FRACTION OF MUNICIPAL SOLID WASTE OF GUNTUR CITY

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Abstract: The rapid generation of organic waste has led to significant environmental challenges, including improper waste disposal and greenhouse gas emissions. Composting organic waste using vermicompost provides a sustainable solution to manage biodegradable materials effectively. This study focuses on composting the organic fraction of municipal solid waste using vermicompost. The project involves the collection of organic waste such as mirchi waste(2kg), fruit waste (3kg) and vegetable waste (3 kg) from local markets. Three experiments were conducted to analyze the physical and chemical properties of the organic waste like pH, nitrogen content, phosphorus, potassium, organic carbon, and micronutrients like zinc, iron, manganese, and copper. Quantity of vermicompost applied was varied – 250 g, 500 g and 750 g and applied systematically, ensuring proper mixing to promote microbial activity. The properties were quantified both before and after composting. The lab results indicate significant increase in proportion of Nitrogen (59%), Phosphorous (43.5%) and Potassium (29%) whereas the organic carbon content and the C:N ratio exhibited a declining pattern as the quantity of vermicompost was increased. The study concludes that using vermicompost accelerates the composting process, improves the quality of compost and offers a viable method for managing organic waste sustainably. The findings suggest that compost produced through this method can be used as a high-quality.

INTRODUCTION

The rapid pace of urbanization and population growth in Indian cities has led to a significant increase in municipal solid waste (MSW) generation. Among the various components of MSW, the organic fraction constitutes a major share, often exceeding 50% by weight. If not managed effectively, this biodegradable component contributes to environmental pollution, greenhouse gas emissions, and public health hazards. Guntur, a prominent city in the Indian state of Andhra Pradesh, is no exception. With its expanding urban landscape, Guntur faces mounting challenges in the collection, segregation, and sustainable disposal of organic waste.

Vermicomposting, a bio conversion process involving the use of earthworms, has emerged as a sustainable and eco-friendly method for managing organic waste. This technique not only reduces the volume of biodegradable waste but also transforms it into nutrient-rich compost that can enhance soil fertility and support organic agriculture. The process is low-cost, energy-efficient, and suitable for decentralized waste management systems, making it particularly relevant for medium-sized urban centers like Guntur.

This study aims to evaluate the potential of vermicomposting in treating the organic fraction of MSW generated in Guntur city. By analyzing key parameters such as compost quality, decomposition rate, and earthworm efficiency, the research seeks to assess the viability of integrating vermicomposting into the city's waste management framework. The findings of this study are expected to contribute valuable insights toward developing a sustainable, community-based approach to organic waste management in urban India.

LITERATURE REVIEW

Kumar and Bhattacharyya (2015) showed that vermicomposting of segregated organic municipal waste improved nitrogen and phosphorus content, and reduced C:N ratio from 35:1 to around 15:1 within 45–60 days. Yadav and Garg (2011) compared vermicomposting with traditional composting and found vermicompost to be richer in macro- and micronutrients and more stable in terms of maturity. Lazcano and Domínguez (2011) highlighted that the presence of earthworms increases microbial biomass and enzymatic activity, speeding up decomposition. Garg et al. (2006) emphasized the importance of pre-treatment (e.g., partial decomposition or mixing with cow dung) to improve earthworm

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survival and activity when dealing with urban organic waste. Ndegwa and Thompson (2001) reported improved pH stabilization, reduced phytotoxicity, and better plant growth performance using vermicompost derived from OFMSW. Frederickson et al. (1997) noted that contaminants in mixed MSW can harm earthworms and reduce compost quality, stressing the importance of effective waste segregation.

EXPERIMENTAL PROCESS

Materials

Mirchi waste, collected from the Mirchi Yard, consists of spoiled or dried chili peppers and weighs 2 kg. It is carbon-rich but has a low nitrogen content, which makes it an ideal dry component for composting when paired with other nitrogen-rich materials. Fruit waste, weighing 3 kg, was collected from the local market and includes peels, pulp, and spoiled fruits. It is rich in moisture, sugars, and organic carbon, making it highly degradable and a valuable component for microbial activity. Vegetable waste, weighing 3 kg, was sourced from the local market and includes discarded peels, leaves, stems, and spoiled vegetables.

RESULTS AND DISCUSSION

Parameter	Initial Value	Final Value For 250g Vermicomposting	Final Value For 500g Vermicomposting	Final Value For 750g Vermicomposting
pH	4.65	6.8	7.2	7.4
Organic carbon (%)	34.1	16.8	19.8	22.2
Nitrogen(N) (%)	0.81	1.64	1.90	2.10
Phosphorus (P) (%)	0.62	0.70	0.82	0.89
Potassium(K) (%)	1.51	1.69	1.72	1.95
C: N Ratio	42.09	9.7	12	13.20

CONCLUSION

Vermicomposting of Municipal Solid Waste (MSW) is a sustainable and efficient method for managing organic waste. It accelerates organic matter decomposition, reduces pathogens and heavy metals, and produces nutrient-rich compost that enhances soil fertility and structure. By diverting waste from landfills and cutting methane emissions, it also lowers environmental impact. However, challenges such as temperature regulation, heterogeneous waste, and infrastructure needs must be addressed. With proper management, vermicomposting offers scalable potential for sustainable waste management and soil improvement.

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