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Utilization of organic wastes for compost preparation

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Abstract
Organic wastes are generated from many sources such as agricultural waste, kitchen waste, market waste, municipal solid waste and urban solid waste. Organic wastes are generally biodegradable but this waste could create several environmental problems without proper management. However, composting has become a preferable option to treat organic wastes to obtain a final stabilized product that can be used as a soil conditioner. Therefore, composting is the alternative solution to overcome this problem as it is low-cost and environment friendly method. In the present investigation, composting of organic waste along with leaf litter was carried out in pit house located at CCS HAU, Hisar. Cattle dung was mixed with organic waste in different ratio. The compost samples were withdrawn at interval of 15 days and analyzed for change in organic carbon, N, P, K and C:N ratio. After 90 days of composting organic carbon decreased from 43.86 - 30.08%, nitrogen varied between 0.92 - 1.36% and C/N ratio decreased from 47.67 to 22.11. P % increased from 0.31 to 0.53 and K % increased from 0.79 to 1.09 respectively. Thus, utilization of organic wastes for the preparation of compost will provide new perspective in nutrient management of soil.

Keywords: Organic waste, composting, eco-friendly, amendment, agriculture

Introduction

Organic waste has become one of the main global issues in the environment due to its large scale production. Improper management of organic waste such as the use of landfill and incineration can cause several environmental problems. However, decomposing organic wastes by using biological processes is considered as more suitable method. (Rawat *et al.*, 2013) [17]. The composting can degrade all types of organic wastes such as fruits, vegetables, plants, garden waste and others. Composting is a low cost biological decomposition process in which microbes such as bacteria, fungi and actinomycetes break down complex organic compounds to a stable product known as compost (Gonawala and Jardosh, 2018) [6]. This process is considered to be environmentally safe and most efficient method where compost can be used as a soil conditioner (Rama and Vasanthy, 2014) [16]. The application of compost can enhance the soil health by improving the soil properties that are badly in need of renewal, as it increases the organic carbon contents in the soil. In the meantime, compost also acts as a soil intervention to improve soil structure, water retention capacity and water infiltration rate (Mahath, 2016) [9]. Many factors can contribute to the quality of compost such as Nitrogen, Phosphorus and Potassium (N, P, K) that are the common nutrients present in fertilizers. Parameters such as temperature, moisture content, pH and carbon nitrogen ratio (C: N) can contribute to the efficiency of the composting process. The high organic carbon content and biological activity of compost improves the soil fertility which in turn enhances the plant growth as well as prevents soil erosion. Compost application reduces the negative impact of chemical fertilizers and pesticides in the ecosystem (Anastasi *et al.*, 2005) [1]. Beside usage as fertilizer, compost is useful in bioremediation (Ventorino *et al.*, 2016) [18], plant disease control (Pane *et al.*, 2019) [15], weed control (Coelho *et al.*, 2019) [4], pollution prevention etc. Composting also increases soil biodiversity and reduces environmental risks associated with synthetic fertilizers (Muliyadi *et al.*, 2021) [10]. This study was carried out to explore the utilization of domestic waste and leaf litter along with cattle dung for compost preparation.

Materials and Methods

Composting Substrates

Domestic waste samples were collected from various dumping sites such as Gangotri Hostel CCS HAU, Hisar, Azad Nagar, Chandan Nagar, Hisar and leaf litter samples were collected from waste dumping sites behind the COBS&H CCS HAU, Hisar.

Preparation of composting piles

Composting of domestic waste and leaf litter with cattle dung was carried out using following treatments

T_1: Domestic waste
T_2: Domestic waste + cattle dung (1:1)
T_3: Domestic waste + leaf litter + cattle dung (1:1:1)
T_4: Domestic waste + leaf litter (1:1)
T_5: Domestic waste + leaf litter (2:1)
T_6: Domestic waste + leaf litter (3:1)

Cattle dung @ 10% was added as inoculum in all treatments except T1

Cemented pits of size 1.5×1.5×1.5 ft were used for composting process and each pit was filled with 5 kg of composting material. For proper aeration, turnings of substrate material was done at regular intervals. Samples were drawn from the pits at 15 days interval for physicochemical analysis of different parameters.

Chemical analysis of compost samples

During composting procedure, changes in different chemical parameters such as TOC, N, P and K were determined using standard methods. Dry combustion method (Nelson and Sommers, 1982) [12] was used for the estimation of total organic carbon. Total nitrogen content was estimated by Kjeldahl's method (Bremner and Mulvaney, 1982) [3]. Available phosphorus was determined by Olsen's methods (Olsen *et al.*, 1954) [14] and available potassium in compost samples was detected by Jackson's methods (Jackson 1965) [8].

Results and Discussion

Composting of domestic waste and leaf litter along with cattle dung in various combinations was carried out in cemented pits of size 1.5× 1.5 ×1.5 ft.

Total organic carbon decreased in all the treatments during the process of composting. It was observed that after 90 days of composting organic carbon significantly decreased from 43.86 - 30.08%. Treatment T2 having domestic waste mixed with cattle dung had significant decline of organic carbon (from 34.23 to 30.08%) followed by treatment T3 (Domestic waste + Leaf litter + Cattle dung) in which total organic carbon declined from 35.25 to 30.70% as compared to all the other treatments (Fig.1). The declining TOC value, which was 30.08% for T2 and 30.70% for T3, is similar to that reported by Benito and co-workers (2003) [2]. Nguyen *et al.* (2020) [13], studied the composting of food waste and dry leaves and similar to our reports, they observed that total organic carbon content declined to range 24.6% to 30.1% at the end of composting.

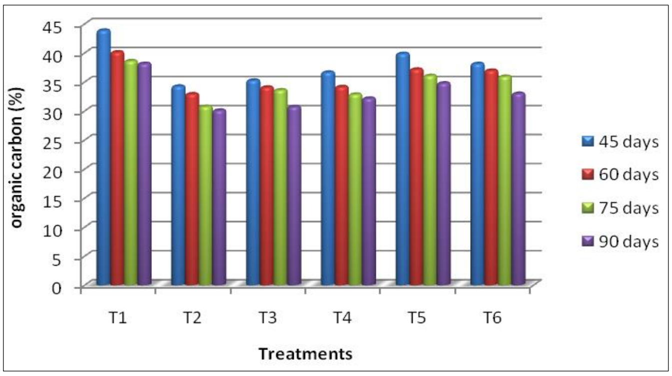

Fig 1: Changes in total organic carbon (%) after 15 days interval

The initial value of N after 45 days of composting was 0.92% for treatment T1 which increased significantly and found to be maximum in treatment T2 (1.36%) after 90 days of composting (Fig. 2). At the end of composting all treatments showed an increase in total N content. Similarly, Musa and co-workers (2020) [11] in their investigation observed that total N content increased significantly with composting time in all the composting materials prepared from fruit and vegetable wastes along with municipal solid waste which was found to be increased from 1.52% to 2.56%.

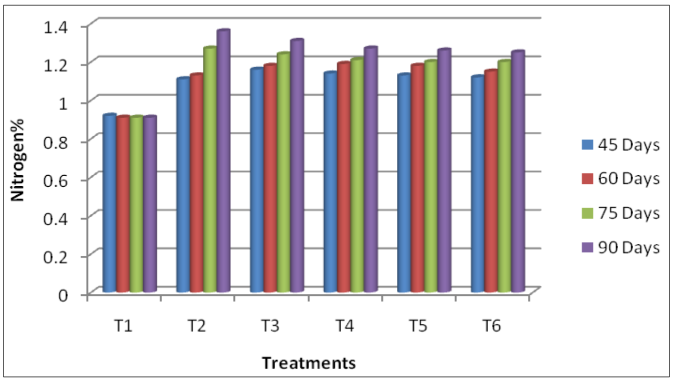

Fig 2: Changes in Total Nitrogen (%) after 15 days interval

As the decomposition progressed, C/N ratio significantly decreased in all treatments. After 45 days of composting maximum C/N ratio was recorded in treatment T_1 (47.67) and it was found to be minimum (22.11) in treatment T2 after 90 days of composting process (Fig.3). Indumathi (2017) [7], also reported significant decrease in C:N ratio at the end of composting in all the treatments. Zaher and co-workers in 2009 [19], concluded in their study that C:N ratio below 25 is an indication of acceptable maturity, while a ratio of 20 or below is being preferable. Referring to this study, in the present research, C:N ratio of the compost prepared is also within the acceptable limit.

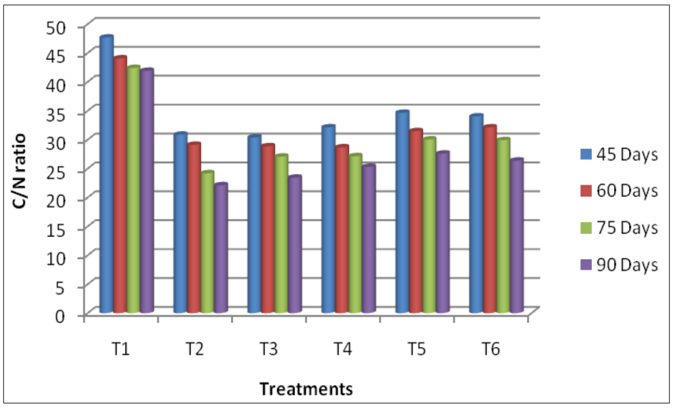

Fig 3: C/N ratio observed after 15 days interval

The initial P value was detected as 0.31% for treatment T1 after 45 days and as the decomposition progressed, it was observed that the P content in the compost increased significantly and was found to be maximum (0.53%) in the treatment T6 (Fig. 4). Similar to our findings, Ektare and Didolkar (2016) [5] in their study utilized the garden waste for composting and observed an increase in the P% with the time of composting which may be due to phosphorus mineralization by microbial activity.

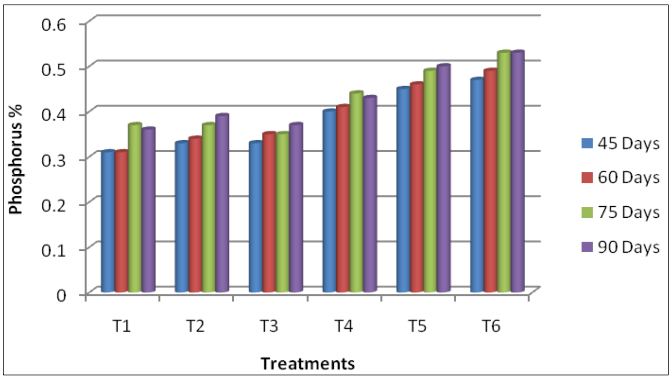

Fig 4: Changes in phosphorus % after 15 days interval

K% increased from 0.79 to 1.09 respectively. The K percentage on the 45th day was found to be minimum 0.79% for treatment T1 and T3. At the end of the composting period, the K value increased significantly in all treatments and it was recorded maximum *i.e.* 1.09% in treatment T6 (Fig.5). Similar to our findings, Indumathi in 2017 [7], reported that during the decomposition process of vegetable waste, potassium contents increased at the final stage of composting. Table 1 depicts the P, K and C/N ratio of the compost after 90 days of decomposition process.

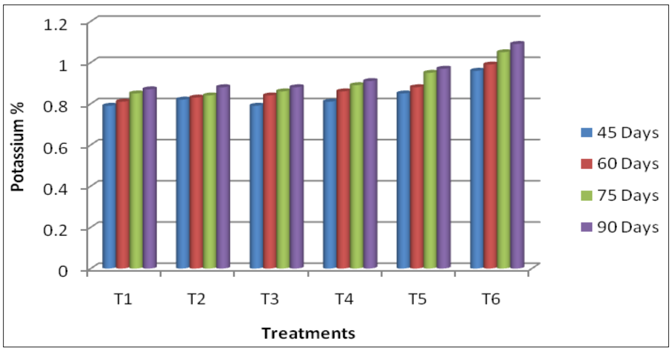

Fig 5: Changes in Potassium % after 15 days interval

Table 1: Analysis of compost at different time intervals

Treatments	45 D			60 D			75 D			90 D		
	P %	K%	C:N	P%	K %	C:N	P%	K %	C:N	P %	K %	C:N
T1	0.31	0.79	47.67	0.31	0.81	44.07	0.37	0.85	42.41	0.36	0.87	41.91
T2	0.33	0.82	30.87	0.34	0.83	29.11	0.37	0.84	24.19	0.39	0.88	22.11
T3	0.33	0.79	30.38	0.35	0.84	28.86	0.35	0.86	27.08	0.37	0.88	23.43
T4	0.40	0.81	32.13	0.41	0.86	28.68	0.44	0.89	27.14	0.43	0.91	25.31
T5	0.45	0.85	34.65	0.46	0.88	31.48	0.49	0.95	30.04	0.50	0.97	27.59
T6	0.47	0.96	34.03	0.49	0.99	32.13	0.53	1.05	29.92	0.53	1.09	26.38

Conclusion

Vegetable and fruit waste provides good amount of nutrients for inhabiting microbes, which are neither pathogens nor concerned with human health. The aim of the study was to convert domestic waste into a useful product such as compost for better crop growth and soil health, thus this low cost technology of converting waste to compost has environmental, economic and societal relevance. So, in this research work, different available types of organic wastes such as domestic waste (fruits and vegetables), garden waste (leaf litter) and cow dung were utilized as substrate material which resulted in to a good quality compost with C/N ratio 22.11. Therefore it was concluded that proper management of organic waste by means of composting, reduces or eliminates adverse impacts on the environment, human health and supports Economical development for the better quality of life.

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References

1. Anastasi A, Varese GC, Filipello Marchisio V. Isolation and identification of fungal communities in compost and vermicompost. Mycologia. 2005;97(1):33-44.
2. Benito M, Masaguer A, Moliner A. Chemical and microbial parameters for the characterization of the stability and maturity of pruning waste compost. Biol Fert Soils. 2003;37:184-189.
3. Bremner JM, Mulvaney CS. Total nitrogen methods of soil analysis. American Society of Agronomy Mongrn. 1982;10(2):594-624.
4. Coelho L, Osorio J, Beltrao J, Reis M. Organic compost effects on *Stevia rebaudiana* weed control and on soil properties in the Mediterranean region. Revista de Ciências Agrárias. 2019;42(1):109-121.
5. Ektare A, Didolkar R. Physico-chemical parameters of vermicompost using *Eisenia fetida* in garden waste. Journal of Entomology and Zoology Studies. 2016;4(5):255-257.
6. Gonawala SS, Jardosh H. Organic Waste in Composting: A brief review International Journal of Current Engineering and Technology. 2018;8(1):36-38.
7. Indumathi D. Microbial conversion of vegetable wastes for bio fertilizer production. IOSR Journal of Biotechnology and Biochemistry. 2017;3(2):43-47.
8. Jackson ML. Free oxides, hydroxides, and amorphous aluminosilicates. Methods of Soil Analysis, Part 1 Physical and Mineralogical Properties, Including Statistics of Measurement and Sampling. 1965;9:578-603.
9. Mahath CS. Effective Disposal of Sewage Sludge by Composting Method. Imperial Journal of Interdisciplinary Research. 2016;2(6):97-504.
10. Muliyadi M, Purwiningsih DW. NPK Level in anaerobic and aerobic composting using spoiled rice mol strada. Jurnal Ilmiah Kesehatan. 2021;10(1):817-825.
11. Musa AM, Ishak CF, Karam DS, MdJaafar N. Effects of fruit and vegetable wastes and biodegradable municipal wastes co-mixed composts on Nitrogen Dynamics in an Oxisol. Agronomy. 2020;10(10):1609.
12. Nelson DW, Sommers L. Total carbon, organic carbon, and organic matter. Methods of soil analysis, Part 2 chemical and microbiological properties. 1983;9:539-579.
13. Nguyen VT, Le TH, Bui XT, Nguyen TN, Lin C, Nguyen HH, *et al*. Effects of C/N ratios and turning frequencies on the composting process of food waste and dry leaves. Bioresource Technology Reports. 2020;11:100527.
14. Olsen SR. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. US Department of Agriculture; c1954. p. 939.

15. Pane C, Spaccini R, Piccolo A, Celano G, Zaccardelli M. Disease suppressiveness of agricultural greenwaste composts as related to chemical and bio-based properties shaped by different on-farm composting methods. Biological Control. 2019;137:104026.
16. Rama L, Vasanthy M. Market waste management using compost technology. International Journal of Plant, Animal and Environmental Sciences,(IJPAES). 2014;4(4):57-61.
17. Rawat M, Ramanathan AL, Kuriakose T. Characterisation of municipal solid waste compost (MSWC) from selected Indian cities-a case study for its sustainable utilisation. Journal of Environmental Protection. 2013;4:163-171.
18. Ventorino V, Parillo R, Testa A, Viscardi S, Espresso F, Pepe O. Chestnut green waste composting for sustainable forest management, microbiota dynamics and impact on plant disease control. Journal of environmental management. 2016;166:168-177.
19. Zaher U, Li R, Jeppsson U, Steyer JP, Chen S. General integrated solid waste co-digestion model. Water research. 2009;43(10):2717-2727.