Revista científica Sociedad & Tecnología

ISSN: 2773-7349

fecha de presentación: 09/11/2025, fecha de aceptación: 12/12/2025, fecha de publicación: 01/01/2026

José João Matchala[1]
E-mail: josejmatchala@gmail.com
Orcid: https://orcid.org/0000-0003-4906-7145

Martins Kamota-Abel[2]
E-mail: martinshadji@gmail.com
Orcid: https://orcid.org/0000-0002-2403-1472

Akaz Malassa Bumba[2]
E-mail: akaz2345d@gmail.com
Orcid: https://orcid.org/0009-0004-5725-5167

[1](Department of Engineering and Technology / Polytechnic Institute of Technologies and Sciences, Angola)
[2](Departament of Biology/ Faculty of Sciences of the University of Porto, Portugal)

Cita sugerida (APA, séptima edición)

Matchala, J. J., Kamota-Abel, M., & Bumba, A. M. (2026). Valorization of Domestic Composting for Organic Fertilizer Production and Pollution Reduction. *Revista Sociedad & Tecnología*, 9(1), 31-44. DOI: https://doi.org/10.51247/st.v9i1.679.

==== o ====

Valorization of domestic composting for organic fertilizer production and pollution reduction

ABSTRACT

The inadequate management of organic waste represents a significant challenge for environmental sustainability, especially in urban areas. This study aims to evaluate the effectiveness of home composting in producing organic fertilizer and reducing soil and environmental pollution. The adopted methodology comprised three main stages: a literature review to theoretically support home composting and its environmental benefits; an experimental research, where a home composter was built and adapted for the treatment of organic waste such as fruits, vegetables, and grains; and a quantitative analysis, with monitoring of the composting process over 45 days, including measurements of temperature, humidity, and analysis of the physical characteristics of the compost. The final compost presented desirable characteristics, such as dark color, earthy smell, and loose texture, resulting in significant plant growth after applying the fertilizer in a home garden. Based on the results, it is concluded that home composting is an effective practice for managing organic waste, contributing to the reduction of waste in landfills and promoting more sustainable agriculture.

Keywords: Environmental sustainability, home composting, organic fertilizer, soil pollution, waste management

==== o ====

Valorización del compostaje doméstico para la producción de abono orgánico y la reducción de la contaminación

RESUMEN

La gestión inadecuada de los residuos orgánicos representa un desafío significativo para la sostenibilidad ambiental, especialmente en las zonas urbanas. Este estudio tiene como objetivo evaluar la eficacia del compostaje doméstico en la producción de abono orgánico y en la reducción de la contaminación del suelo y del medio ambiente. La metodología adoptada comprendió tres etapas principales: una revisión bibliográfica, para fundamentar teóricamente el compostaje doméstico y sus beneficios ambientales; una investigación experimental, en la que se construyó y adaptó una compostera doméstica para el tratamiento de residuos orgánicos como frutas, verduras y granos; y un análisis cuantitativo, com seguimiento del proceso de compostaje durante 45 días, incluyendo mediciones de temperatura, humedad y análisis de las características físicas del compost. El compost final presentó características deseables, como color oscuro, olor a tierra y textura suelta, lo que resultó en un crecimiento vegetal significativo tras la aplicación del abono en un huerto doméstico. Com base en los resultados, se concluye que el compostaje doméstico es una práctica eficaz para la gestión de residuos orgánicos, contribuyendo a la reducción de los desechos en los vertederos y promoviendo una agricultura más sostenible.

Palabras clave: Sostenibilidad ambiental, compostaje doméstico, abono orgánico, contaminación del suelo, gestión de residuos.

==== o ====

Valorização da compostagem doméstica para produção de adubo orgânico e redução da poluição

RESUMO

A gestão inadequada de resíduos orgânicos representa um desafio significativo para a sustentabilidade ambiental, especialmente em áreas urbanas. Este estudo visa avaliar a eficácia da compostagem doméstica na produção de adubo orgânico e na redução da poluição do solo e do meio ambiente. A metodologia adotada compreendeu três etapas principais: uma revisão bibliográfica, para fundamentar teoricamente a compostagem doméstica e seus benefícios ambientais; uma pesquisa experimental, onde foi construída e adaptada uma composteira doméstica para o tratamento de resíduos orgânicos como frutas, verduras e grãos; e uma análise quantitativa, com monitoramento do processo de compostagem ao longo de 45 dias, incluindo medições de temperatura, humidade e análises das características físicas do composto. O composto final apresentou características desejáveis, como cor escura, odor terroso e textura solta, resultando em um crescimento significativo das plantas após a aplicação do adubo em uma horta doméstica. Em função dos resultados conclui-se que a compostagem doméstica é uma prática eficaz para a gestão de resíduos orgânicos, contribuindo para a redução de resíduos em aterros sanitários e promovendo uma agricultura mais sustentável.

Palavras-chave*:* Compostagem doméstica, adubo orgânico, gestão de resíduos, poluição dos solos, sustentabilidade ambiental

==== o ====

INTRODUCTION

Inadequate management of organic waste represents a growing challenge in many parts of the world, including Angola, particularly in the province of Namibe. The constant increase in population and the resulting rise in food demand intensify the problem, generating larger volumes of organic waste. When not managed properly, this waste is often mixed with other materials and sent to inappropriate disposal sites, leading to serious environmental and public health impacts. These include soil and water pollution, unpleasant odors, and the proliferation of disease vectors, directly affecting the health of local communities (Amorim et al., 2016; Abbas et al., 2024).

Improper decomposition of organic waste generates leachate—highly polluting liquids that, when in contact with rivers, streams, or wells, contaminate drinking water sources. These leachates contain nutrients and chemical compounds that can alter water quality and affect aquatic ecosystems. Moreover, the accumulation of untreated waste encourages the presence of harmful fauna such as flies, ants, cockroaches, rats, and mosquitoes, increasing the risk of disease transmission among the population and creating public hygiene issues (Bento, 2013; Li et al., 2023).

The improper disposal of organic waste also has socioeconomic consequences. Informal dumpsites near urban areas can reduce residents' quality of life, devalue property, and hinder local economic activity (Tang et al., 2025; Uçaroglu & Atalay, 2024). Additionally, poorly managed organic waste can become a source of cross-contamination, threatening food safety and public health. The lack of infrastructure for proper collection and treatment, combined with low environmental awareness among citizens, worsens the situation and limits the implementation of sustainable long-term solutions (Smith et al., 2022; Korf et al., 2021).

In this context, home composting emerges as an effective and accessible alternative for organic waste management. This technique transforms household waste into high-quality organic fertilizer suitable for home gardens and community green spaces. Besides reducing the amount of waste sent to landfills, composting improves soil fertility, enhances water retention, and promotes sustainable urban agriculture, generating environmental, economic, and social benefits (Catorza et al., 2023; Oviedo-Ocaña et al., 2021).

For such solutions to be effective, environmental education must be combined with public policies that promote waste separation and composting practices. Implementing training programs for residents and providing adequate infrastructure are fundamental steps to ensure that organic waste is managed safely and sustainably (Li et al., 2024). Moreover, integrating composting strategies into urban planning and municipal waste management can help mitigate issues related to pollution, vector proliferation, and negative impacts on public health (Panisson et al., 2022; Yao et al., 2024).

Improper management of organic waste also directly impacts local biodiversity. Leachate and waste accumulation alter natural habitats, harming the region's fauna and flora. Soil and water contamination jeopardize ecosystems' ability to regenerate and perform essential ecological functions, such as water filtration, organic matter decomposition, and nutrient cycling. Continued exposure to such pollutants may also lead to the bioaccumulation of toxic substances in aquatic organisms, affecting not only environmental health but also the food security of communities dependent on local fishing (Raviv, 2023; Silva et al., 2022).

On the other hand, implementing solutions such as home composting must be accompanied by monitoring and evaluation strategies. It is essential to establish tracking systems that can measure the efficiency of composting, the reduction in waste sent to landfills, and the resulting environmental benefits. Furthermore, educational programs on proper waste management and sustainable urban agriculture practices can encourage active community participation, strengthen environmental awareness, and promote responsible consumption habits. The combination of education, infrastructure, and integrated public policies offers an effective approach to tackling organic waste challenges in Namibe and other regions facing similar issues (Zhang et al., 2024; Zigmontienė & Šerevičienė, 2023).

Home composting is an effective solution to reduce pollution in agricultural soils and the environment. This technique transforms organic waste into high-quality fertilizer, contributing to the development of a more ecological and healthier agriculture. By reducing reliance on chemical fertilizers, it promotes more sustainable production and the consumption of safer, healthier foods (Manea et al., 2024).

In the Angolan context, particularly in the province of Namibe, this practice becomes even more relevant. Namibe faces various environmental challenges, including improper disposal of organic waste, which leads to soil and environmental pollution. Given this reality, composting presents itself as a practical and viable alternative for waste management, offering both environmental and social benefits.

The valorization of composting can stimulate more productive agriculture, adapted to local climatic conditions, and contribute to the recovery of degraded soils. It also promotes food security by encouraging the cultivation of family gardens that provide fresh, nutritious, and chemical-free foods (Jones & Williams, 2021). This strengthens community resilience to poverty and food insecurity.

Furthermore, the promotion of home composting is an important educational tool to raise awareness about environmental sustainability. Involving communities in practices such as waste separation and compost use in agriculture can foster lasting environmental consciousness and a culture of environmental stewardship.

Therefore, this study is justified by the urgent need to implement sustainable solutions for the management of organic waste in Namibe. Its objective is to reduce negative environmental impacts, strengthen local agriculture, and promote responsible habits that ensure the well-being of future generations (Manea et al., 2024).

The main objective of this study is to analyze the importance of home composting as an effective solution for the valorization of organic waste. It aims to demonstrate its potential in producing high-quality organic fertilizer while contributing to the reduction of pollution in agricultural soils and the environment.

Firstly, the study seeks to identify the main environmental and public health problems caused by the improper disposal of organic waste, and to evaluate the effectiveness of home composting as an alternative and sustainable treatment method.

Secondly, it aims to promote the adoption of composting practices at the household level, in order to reduce the volume of waste sent to landfills and to encourage the production of natural, accessible fertilizers free of harmful chemical components.

Finally, the study intends to encourage the development and maintenance of family gardens that use the compost produced to grow food sustainably. This contributes to healthier eating habits and strengthens food security at the household level.

MATERIALS AND METHODS

Study Area

Moçâmedes is a city, municipality, and the capital of Namibe province, Angola. Between 1985 and 2016, the city had the same name as the province, being called "Namibe." The municipality is composed of the communes of Moçâmedes, Lucira, Bentiaba, and Forte Santa Rita.

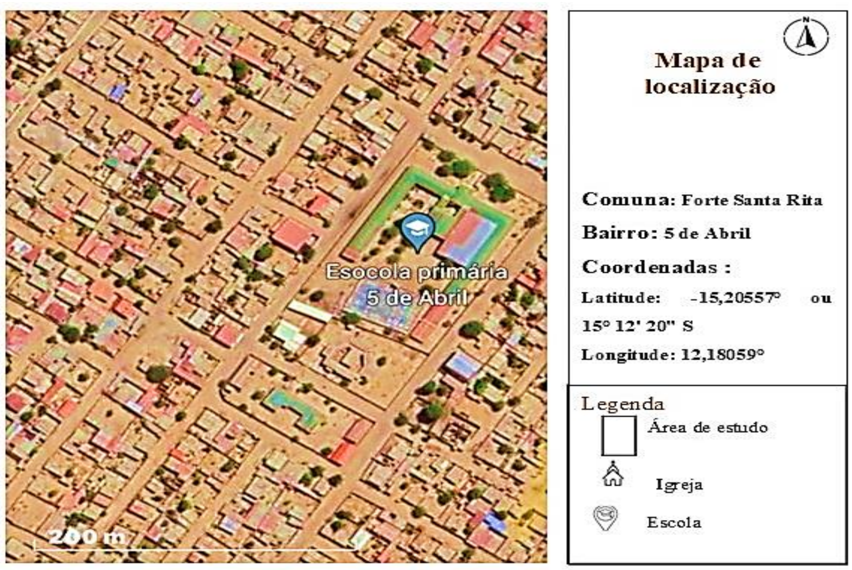
This work was developed and implemented in a residence located in the municipality of Moçâmedes, Namibe, specifically in the neighborhoods of Forte Santa Rita and 5 de Abril, both situated in the commune of Forte Santa Rita. This region is known for its historical significance and picturesque beaches. The geographical coordinates of the location are 14º 45′ 32′′ S and 44º 13′ 11.48′′ W. Figure 1 and Figure 2.

Figure 1.

Study area (Forte Santa Rita neighborhood)

Figure 2.

Study area (5 de Abril neighborhood)



LITERATURE REVIEW

The first stage of the study consisted of an extensive literature review, which included monographs, dissertations, scientific articles, manuals, books, and other relevant sources. These materials addressed key themes related to organic waste management, composting practices, sustainable agriculture, and environmental preservation. This review provided a theoretical foundation for the development of the project and offered essential references for the analysis and discussion of the results obtained throughout the study (Smith et al., 2022; Panisson et al., 2022).

The literature review was not only fundamental for understanding the context and challenges associated with organic waste disposal but also served as a comparative tool. By examining the outcomes and methodologies of previously implemented composting projects, it was possible to identify best practices and lessons learned (Garcia et al., 2024; Uçaroglu & Atalay, 2024). This comparison helped to refine the project's approach and to adapt solutions to the specific environmental and social conditions observed in the province of Namibe.

For the practical implementation of the composting system, particularly the construction of the composter, adaptations were made based on detailed guidance found in technical manuals. Among the key references used were the *Manual of Domestic Composting with Worms* by Célio Oliveira and João Fernandes (2018), the *Manual of Vermicomposting* by Bento (2013), and the work of Gimenez et al. (2023). These resources provided valuable instructions on materials, techniques, and maintenance practices, which were crucial for the successful adaptation of composting methods at the household level.

Preparation of the Adapted Domestic Composter

The second stage of the project focused on the construction of a domestic composter, adapted to local conditions and based on the guidelines provided in the EMBRAPA manual *"How to Set Up a Domestic Composter"* (EMBRAPA, 2020. This step aimed to create a functional, low-cost, and replicable model that could be implemented in households with limited resources (Oliveira & Fernandes, 2018). The design was chosen for its simplicity, efficiency, and ease of maintenance, making it suitable for both urban and rural environments in the province of Namibe.

To build the composter (Urbaiti et al., 2023), a set of accessible and affordable materials was used. These included three 3.6-liter plastic buckets, a 1 ½ inch PVC tap for draining leachate, a 20 cm PVC pipe (cut in half) for aeration, a 1 ½ inch PVC flange and elbow to facilitate assembly, ten screws with nuts for securing the structure, and silicone for proper sealing and leak prevention. These materials allowed for the creation of a compact and efficient composting unit, capable of processing household organic waste in a hygienic and environmentally friendly way.

The composter was manufactured according to the following steps:

Bucket 1: Several 6 mm holes were made in the lid, 2 cm apart from each other, and the tap was installed 3 cm from the base (Figure 3).

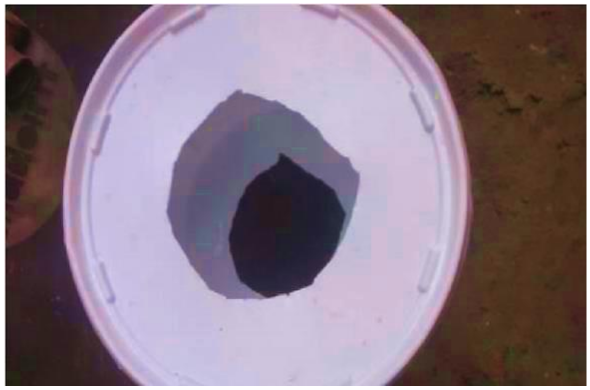
Figure 3.

6 mm diameter holes made in the first bucket

Bucket 2: the lid and the bottom were cut to allow the passage of waste (Figure 4)

Figure 4.

Opening made in the lid and the bottom of the second bucket



Bucket 3: the bottom was cut to install the flange with the two 20 cm pieces of pipe connected by the elbow (Figure 5). At the air outlet, cotton/charcoal was inserted, creating a filter. The buckets were stacked, and between the first and second buckets, as well as between the second and third, five sets of bolts and nuts were placed to join the lid to the upper bucket. Silicone was used to seal the connections between the buckets, as illustrated in Figure 6.

Figure 5.

Installation of the elbow.

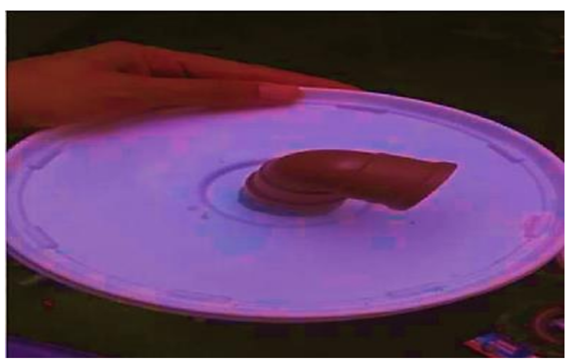


Figure 6.

Installation of piping in the third bucket for air outlet..

Separation and Monitoring of Organic Waste

The third stage consisted of separating the organic waste generated by the family. The types of waste used included fruit peels, vegetables, grains, seeds, coffee grounds, cooked or spoiled food scraps, and eggshells (Figure 7). This waste was deposited in the household composter and monitored weekly. After about 45 days, the compost was ready to be used.

Figure 7.

Separation of domestic organic waste

Application of Organic Compost and Garden Monitoring

The produced compost was applied to a garden at the residence where the project was implemented. The garden contained bell peppers, green onions, tomatoes, and other vegetables. The seeds used were from the plants cultivated in the garden. A more satisfactory growth of the vegetables was observed after fertilization with organic compost, which favored the production of quality vegetables for domestic consumption.

RESULTS

During the composting period of organic waste, no bad odors or presence of vectors were observed, indicating that the maturation process occurred under adequate conditions of aeration, humidity, and temperature. This can be attributed to the methodology used in the construction of the domestic composter (Figure 8) and the proper separation of materials, using only organic waste (Figure 9).

Figure 8.

Domestic composter

Figure 9.

Organic matter

Throughout the maturation process, a great diversity of small arthropods was observed in the composted waste mass (Figure 10). This phenomenon is considered normal, as microorganisms such as fungi and bacteria play a crucial role in the degradation of matter during the composting process.

Figure 10.

Maturation process in the compost pot

After 45 days from the start of composting, the fertilizer was ready for use. The organic compost obtained was characterized by its degree of stability and maturity, presenting a dark color, earthy smell, loose consistency, and absence of pathogenic organisms, characteristics that indicate a quality organic fertilizer (Figure 11).

Figure 11.

Mature organic fertilizer.

Fertilization is a crucial step for obtaining quality products in home gardens, as it allows plants to absorb nutrients effectively. Thus, after collecting the organic compost, it was applied to the existing home garden (Figure 12) at the residence where the project was implemented. After a few days of using the compost, a more vigorous development of plants and vegetables was observed, confirming the efficiency and quality of the organic fertilizer produced during the project.

Figure 12.

Use of fertilizers in the garden

DISCUSSION

The results of the study reveal significant insights into the effectiveness of composting as a sustainable waste management practice. The absence of bad odors and vectors during the composting process indicates that the conditions for compost maturation - such as aeration, humidity, and temperature - were adequately maintained. This fact aligns with recent studies that emphasize the importance of these factors in preventing anaerobic conditions that could lead to unpleasant odors and attract pests (Korf et al., 2021; Raviv, 2023). The presence of a diverse range of small arthropods in the compost mass, although initially concerning, was ultimately considered normal. These organisms, along with microorganisms such as fungi and bacteria, play a vital role in the decomposition and stabilization of organic matter. The role of these biological agents is well documented in the literature, where they are recognized as essential for the decomposition of complex organic compounds into simpler, nutrient-rich substances that are beneficial for plant growth (Smith et al., 2022; Panisson et al., 2022). After a composting period of 45 days, the resulting organic fertilizer exhibited key indicators of high quality, such as a dark color, earthy smell, and loose texture, along with the absence of pathogenic organisms. These characteristics are crucial to ensure the safe and effective use of the compost in agriculture, as they reflect a mature and stable product that can enhance soil fertility without posing health risks (Jones & Williams, 2021; Tang et al., 2025). The application of this organic compost in a home garden demonstrated a marked improvement in the growth of plants and vegetables, underscoring the effectiveness of the compost as a nutrient source. This result is consistent with recent findings that highlight the benefits of organic fertilizers in improving soil health and plant productivity, particularly compared to chemical fertilizers, which can have long-term detrimental effects on soil quality and the environment in general (Garcia et al., 2024; Uçaroglu & Atalay, 2024). Overall, the study supports the growing body of evidence advocating composting as a sustainable waste management practice that not only reduces the burden on landfills but also produces valuable organic fertilizers. This dual benefit is particularly important for mitigating pollution of agricultural soils and the environment, as the use of organic compost helps reduce dependence on synthetic fertilizers and their associated environmental impacts.

CONCLUSION

Domestic composting has proven to be an effective and sustainable practice for managing organic waste, producing high-quality compost. The obtained compost, characterized by its dark color, earthy smell, and absence of pathogenic organisms, has shown to be suitable for application in home gardens, promoting vigorous plant growth and improving the quality of cultivated food.

The advantages of this practice include a significant reduction in the amount of waste sent to landfills and a contribution to the reduction of agricultural soil pollution. Additionally, composting offers an alternative to chemical fertilizers, favoring environmental sustainability and soil health.

However, the practice of composting is not without limitations. It requires adequate conditions of aeration, humidity, and temperature, as well as continuous commitment to monitoring and maintaining the process. The presence of arthropods during composting, although normal and beneficial, can be seen as a disadvantage by some people.

The potential applications of organic compost are vast, especially for use in home and community gardens, where the compost can be employed to improve soil fertility and promote the production of healthy, chemical-free food. Thus, domestic composting not only contributes to the efficient management of organic waste but also promotes more sustainable and accessible agricultural practices.

For future research, it is recommended to investigate methods that can optimize the composting process in different climatic and spatial contexts, as well as the development of technologies that facilitate its adoption in densely populated urban areas. Additionally, analyzing the economic and environmental impact of large-scale composting could provide valuable data for the formulation of public policies aimed at sustainable waste management.

Study Limitations

This study presented some limitations inherent to its experimental design. The composting process was monitored for only 45 days, which does not allow for a comprehensive assessment of the stability and maturity of the compost under different seasonal conditions. In addition, the research was conducted in a single household, which restricts the generalization of the results to other regions with different climates, waste types, and management practices. Detailed laboratory analyses of the chemical and microbiological composition of the produced compost were not performed, which could have provided more accurate data regarding its quality and agronomic potential.

Future Studies

Future research could expand the number of composting units evaluated, including different composter models and socio-environmental contexts, in order to compare performance among methods and regions. It is also recommended to carry out detailed physicochemical and microbiological analyses of the obtained compost, to better characterize its nutrient content and the presence of beneficial microorganisms. Long-term studies could further assess the continuous use of compost on soil fertility, crop productivity, and environmental benefits resulting from the reduction of organic waste sent to landfills.

Acknowledgements

The authors express their sincere gratitude to the Faculty of Engineering and Technology of the University of Namibe, technical, and scientific support throughout the development of this study.

The authors also thank the families who collaborated in the practical implementation of the project by providing and monitoring the organic waste used during the composting process.

Special appreciation is extended to professors, colleagues, and other contributors who directly or indirectly supported the research stages, the discussion of results, and the revision of the manuscript.

Authors' Contributions

José João Matchala: Responsible for the practical execution of the experiment, construction of the domestic composter, data collection and analysis, preparation of figures, and initial drafting of the methodology, results, and discussion sections.

Martins Kamota Abel: Responsible for the overall study design and conception, methodological guidance, scientific supervision, and critical review of the manuscript, ensuring technical consistency and the final quality of the text.

Akaz Malassa Bumba: Contributed to the literature review, theoretical systematization, and integration of experimental data, as well as assisting in the normalization, linguistic revision, and adaptation of the article to scientific standards.

REFERENCES

Abbas, R. I., Al-Azzawi, M. N., & Hameed, R. S. (2024). Aerobic composting of organic waste: An efficient solid waste management solution. American Journal of Water and Environment Protection, 12(4), 45–53. https://doi.org/10.3233/AJW240051

Amorim, V.F, Garcia, N.L, Da Silva, F.L, Da Silva, M.T, & Oliveira, R.F. (2016). *Vermicompostagem doméstica como alternativa na decomposição de resíduos orgânicos*, 10º Simpósio Internacional de Qualidade Ambiental, Porto Alegre. Disponível em: http://www.abesrs.uni5.net/centraldeeventos/_arqTrabalhos/trab_20160929194143000000987.pdf. Acesso em: 13 de setembro de 2019.

Bento, G.A.P. (2013). *Manual de vermicompostagem - restos e sobras fazem a diferença*, Universidade Federal do Paraná, Programa de Desenvolvimento Educacional. Disponível em: http://www.pr.gov.br/arquivos/File/Minha_Escola/manual_vermicultura.pdf. Acesso em: 13 de maio de 2019.

Catorza, M. T., Van Elk, C., & Passos, C. (2023). Potential of carbon credits generation from organic waste composting of large generators: An alternative to final disposal in sanitary landfills. Revista Brasileira de Ciências Ambientais, 58(3), 72–84. https://doi.org/10.5327/Z2176-947820230989

Empresa Brasileira de Pesquisa Agropecuária. (2020). *Como montar uma composteira doméstica*. EMBRAPA. https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1114706/como-montar-uma-composteira-domestica

Garcia, E, Silva, P e Martens, T. (2024). *Práticas sustentáveis na agricultura: O papel dos fertilizantes orgânicos*. *Revista de Gestão Ambiental*, vol. 245, pp. 112-120, 2024.

Gimenez, F. L., Costa, J. R., & Rodrigues, M. A. (2023). Pilot-scale composting for organic solid waste generating solid and liquid biofertilizers and bedding material. Research, Society and Development, 12(5), e45195. https://doi.org/10.33448/rsd-v12i5.45195

Jones, A e Williams, B. (2021). *Saúde do solo e aplicação de composto: Compreendendo os benefícios e desafios*. *Agricultural Sciences Journal*, vol. 38, no. 2, pp. 95-103, 2021.

Korf, E. P., Müller, J., Panisson, J., & Treichel, H. (2021). Composting and vermicomposting as an alternative for treatment and disposal of organic waste. Revista Verde de Agroecologia e Desenvolvimento Sustentável, 16(3), 1–10. https://doi.org/10.18378/rvads.v16i3.6136

Li, F., Xu, Y., & Liu, Y. (2023). From waste to wealth: Innovations in organic solid waste composting. Environmental Research, 229, 115834. https://doi.org/10.1016/j.envres.2023.115834

Li, W., Wang, Y., & Zhang, J. (2024). A review of the definition, influencing factors, and mechanisms of rapid composting of organic waste. Environmental Pollution, 332, 122785. https://doi.org/10.1016/j.envpol.2023.122785

Manea, E. E., Bumbac, C., Dinu, L. R., Bumbac, M., & Nicolescu, C. M. (2024). *Composting as a Sustainable Solution for Organic Solid Waste Management: Current Practices and Potential Improvements. Sustainability*, 16(15), 6329. https://doi.org/10.3390/su16156329

Oliveira, C., & Fernandes, J. (2018). *Manual de compostagem doméstica com minhocas*. Lisboa: Câmara Municipal de Lisboa. Editora Egipto/ Egipto commercial. https://hdl.handle.net/10400.21/10390

Oviedo-Ocaña, E. R., Marmolejo-Rebellón, L. F., & Torres-Lozada, P. (2021). A comparison of two-stage and traditional co-composting of green waste and food waste amended with phosphate rock and sawdust. Sustainability, 13(3), 1109. https://doi.org/10.3390/su13031109

Panisson, J., Muscope, C., Müller, J., Treichel, H., & Korf, E. (2022). Increased quality of small-scale organic compost with the addition of efficient microorganisms. Revista Brasileira de Ciências Ambientais, 55(1), 49–60. https://doi.org/10.5327/Z2176-947820220954

Raviv, M. (2023). *Compostagem: Princípios e usos comerciais*. *Horticultural Reviews*, vol. 47, pp. 23-56, 2023.

Silva, M. E., Rocha, F. J., & Lamarte, F. (2022). Production of organic compost from different plant waste generated in the management of a green urban space. Revista Ciência Agronômica, 53(2), e202184790. https://doi.org/10.5935/1806-6690.20220008

Smith, L, Thompson, R & Lee, J. (2022). Comunidades microbianas na compostagem: Key players and their roles in organic matter degradation, *Microbial Ecology*, vol. 83, no. 4, pp. 569-580, 2022.

Tang, Z., Li, Y., Chen, Y., & Zhang, H. (2025). Nitrogen transformation mechanisms and compost quality assessment in sustainable mesophilic aerobic composting of agricultural waste. Sustainability, 17(2), 575. https://doi.org/10.3390/su17020575

Uçaroglu, S., & Atalay, Y. (2024). Wastewater treatment sludge and agricultural wastes: Management by composting process. Water, Air, & Soil Pollution, 235, Article 363. https://doi.org/10.1007/s11270-024-07142-0

Urbaiti Gimenez, V., Lima da Graça, J., Lopes da Costa, M. A., Menna Junior, D., de Oliveira Júnior, J. M., & Hanai-Yoshida, M. M. (2024). Pilot-scale composting for organic solid waste generating solid and liquid biofertilizers and bedding material. (2024). *Research, Society and Development*, *13*(3), e1113345195. https://doi.org/10.33448/rsd-v13i3.45195

Yao, X., Zhang, L., & Wu, S. (2024). Research on composting of garden waste and its application in cultivation substrates. Sustainability, 16(18), 8216. https://doi.org/10.3390/su16188216

Zhang, Q., Wang, X., & Zhao, T. (2024). Advances in controlling composting odor: A review of the last decade. Journal of Engineering and Applied Science, 72, 118. https://doi.org/10.1186/s44147-025-00606-y

Zigmontienė, A., & Ševičienė, V. (2023). Nitrogen sequestration during sewage sludge composting and vermicomposting. Journal of Environmental Engineering and Landscape Management, 31(2), 157-163. https://doi.org/10.3846/jeelm.2023.19298