processes

MDPI

Editorial

Special Issue on "Composting in the Framework of a Circular Economy"

Antoni Sánchez

Department of Chemical, Biological and Environmental Engineering, Autonomous University of Barcelona, Bellaterra, 08193 Barcelona, Spain; antoni.sanchez@uab.cat

Composting has been recognized as a sustainable technology to treat and manage organic waste. Based on the principles of composting published in Haug's classical handbook thirty years ago [1], compost research has been regularly published in the environmental scientific literature, ranging from the first typical composting works, where the evolution of some parameters were monitored, to current studies focused on advanced aspects of composting, such as the microbiology of composting and its role in complex biorefineries. In general, composting is a technology that, together with its closer relative solid-state fermentation, is destined to change the paradigm: from waste to resources.

In parallel with this increase in research activity and knowledge, composting has gained the acceptance of society. Once its main initial problems, typically related to odors, have been overcome [2], composting will be massively implemented worldwide. Three factors will play a key role in this expansion:

(1) Enforcing new regulations that help avoid or tax the disposal of organic matter in sanitary landfills and convert the source selection of domestic organic matter through mandatory rules. This is the case in Europe, for example.
(2) Desertification in many parts of the world, which implies a lack of organic matter; compost is well known for its restoration purposes.
(3) The flexibility of composting, which makes this technology adaptable to a wide range of organic waste, climate conditions, sizes, and dimensions, ranging from simple turned-pile systems to highly controlled bioreactors.

In summary, composting is experiencing a "second youth" and the number of plants, as well as the uses of compost, is increasing exponentially all over the world. Recently, the same phenomenon can be observed with the "sister" technology of composting: anaerobic digestion. Today, the exponential growth of anaerobic digestion is very perceptible in some parts of the world because of the need for renewable and locally available energy. Although anaerobic digestion is not as flexible and robust as composting, it is a technology with a negative carbon balance in terms of global warming, which makes it very attractive [3]. Additionally, anaerobic digestion results in digestate, making it a very good substrate for composting.

The papers published in this Special Issue on "Composting in the Framework of a Circular Economy" are good examples of the interest in composting. Although composting has been widely studied and thousands of excellent papers can be found in the scientific literature, it is also a very complex process that has critical implications in fields such as solid-state heat and mass transfer, multiphasic reactions and bioreactors, microbiology, and scale-up processes, among others [4]. Therefore, any composting researcher agrees that composting and compost research is far from being finished [5].

In this Special Issue, we collected relevant articles related to the current aspects of composting research. It is also worthwhile to mention that some of the articles are from developing countries, especially in South America and Africa, where composting is in the initial stage of being a substitute to traditional landfills, which have severe sanitary and environmental problems.

Citation: Sánchez, A. Special Issue on "Composting in the Framework of a Circular Economy". *Processes* **2023**, *11*, 1573. https://doi.org/10.3390/pr11051573

Received: 10 April 2023
Accepted: 19 May 2023
Published: 21 May 2023

Regarding some of the topics presented in this Special Issue, one review paper is related to the gaseous emissions from composting [6]. This topic is critical for the proper development of composting plants, since it determines the environmental impact of composting, as well as possible influences on the stakeholders that finally decide to use composting for managing organic waste. The review provides the updated state of the art of these emissions, together with good practices and abatement technologies to mitigate the effect of these gases. The addition of biochar, for instance, to remove the emissions of methane and nitrous oxide (two powerful greenhouse gases) and volatile organic compounds causing unpleasant odors is in an early stage of research.

Another important research line treated in this Special Issue is the agronomic value of composting. This is critical for the restoration of polluted soils, or simply for soils with low levels of organic matter. One article is dedicated to assessing the agronomic value of the material resulting from the compost-bedded pack in dairy barns, with this resulting material having potentially valuable characteristics such as organic amendment of the soil [7]. Another paper examines the regional management of hospitality food waste by exploiting the municipal waste management infrastructure and carrying out intensive composting at the source [8]. The results show that the co-maturation experiment with animal by-products and municipal green waste primary composts proves that the phytotoxicity parameters of the cured compost were in the optimal range or below the thresholds. Both papers are good examples on how diverse materials can result in compost with evident benefits to soil. A very interesting paper is also presented that addresses the effect of compost in favoring the growth of specific vegetal clones, and how some genotypes are sensitive to the use of different substrates, which is a scarcely treated topic. These clones might be a good option for evaluating compost-based substrates for forestry applications [9]. Finally, a review is presented on the fate of the major components of organic matter, such as C, N, P, and K, during the composting process, a point that is critical for exploiting the benefits of compost in soil [10].

The rest of the papers see composting researchers exploring new findings on the use of specific inoculums for composting, technology advances, or new analytical tools to monitor the process.

To summarize, this Special Issue compiles useful information for composting researchers, including reviews and original research papers which give the reader a reliable picture of what fields of composting research are predominant in the current literature.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Haug, R.T. *The Practical Handbook of Compost Engineering*; CRC Press: Boca Raton, FL, USA, 1993.
2. González, D.; Gabriel, D.; Sánchez, A. Odors Emitted from Biological Waste and Wastewater Treatment Plants: A Mini-Review. *Atmosphere* **2022**, *13*, 798. [CrossRef]
3. Colón, C.; Cadena, E.; Pognani, P.; Barrena, R.; Sánchez, A.; Font, X.; Artola, A. Determination of the energy and environmental burdens associated with the biological treatment of source-separated Municipal Solid Wastes. *Energy Environ. Sci.* **2012**, *5*, 5731–5741. [CrossRef]
4. Cerda, A.; Artola, A.; Font, X.; Barrena, R.; Gea, T.; Sánchez, A. Composting of food wastes: Status and challenges. *Bioresour. Technol.* **2018**, *248A*, 57–67. [CrossRef] [PubMed]
5. Komilis, D.P. Compost quality: Is research still needed to assess it or do we have enough knowledge? *Waste Manag.* **2015**, *38*, 1–2. [CrossRef] [PubMed]
6. Sayara, T.; Sánchez, A. Gaseous Emissions from the Composting Process: Controlling Parameters and Strategies of Mitigation. *Processes* **2021**, *9*, 1844. [CrossRef]
7. Llonch, L.; Gordo, C.; López, M.; Castillejos, L.; Ferret, A.; Balanyà, T. Agronomic Characteristics of the Compost-Bedded Pack Made with Forest Biomass or Sawdust. *Processes* **2021**, *9*, 546. [CrossRef]
8. Stunžėnas, E.; Kliopova, I.; Kliaugaitė, D.; Pranas Budrys, R. Industrial Symbiosis for Optimal Bio-Waste Management and Production of a Higher Value-Added Product. *Processes* **2021**, *9*, 2228. [CrossRef]

9. Yang, Z.; Muhayodin, F.; Larsen, O.C.; Miao, H.; Xue, B.; Rotter, V.S. A Review of Composting Process Models of Organic Solid Waste with a Focus on the Fates of C, N, P, and K. *Processes* **2021**, *9*, 473. [CrossRef]
10. Rizzo, P.F.; Salinas, M.C.; Della Torre, V.; Diez, J.P.; Sallesses, L.F.; Riera, N.I.; Pathauer, P.S.; Komilis, D.; Sánchez, A. Effect of Poultry Manure-Derived Compost on the Growth of *eucalypts* spp. Hybrid Clones. *Processes* **2022**, *10*, 2182. [CrossRef]