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Editorial

Special Issue on Biowaste Treatment and Valorization

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1. Introduction

Biowaste has been defined as "Biodegradable waste from gardens and parks, food and kitchen waste from homes, restaurants, collective catering services and retail establishments, and comparable waste from food processing plants" (Directive (2008)/98/EC (EC—European Commission, 2008). Biowaste includes food and kitchen waste from homes and small-size green waste, but also several types of organic wastes collected from different origins. The most significant benefits of the adequate management of biowaste, in addition to avoiding the emission of greenhouse gases, would be the production of good-quality compost or other organic products, as well as biogas that would contribute to improving soil quality and resource efficiency, together with a higher level of energy self-sufficiency. For the management of biodegradable waste diverted from landfills, there appear to be several environmentally friendly options. While the waste-management hierarchy also applies to biowaste management, in specific cases it may be justified to deviate from it, as the environmental balance of the various options available for managing biowaste depends on a number of local factors, such as the collection systems; the composition and quality of the waste; the climatic conditions; and the potential use of various products derived from waste, such as electricity, heat, and gas rich in methane or compost. Therefore, strategies for the management of this type of waste must be determined based on a structured and comprehensive approach, such as the life cycle concept.

2. Strategies to Deal with Biowaste

In light of the above points, this Special Issue aims to collect the latest research on the relevant topics, the mature, conventional, and innovative technologies used to address the challenging issues, at present, with the treatment and valorization of different flows of biowaste. Fourteen papers have been published in this Special Issue. When revisiting past Special Issues, it can be observed that various topics have been addressed, mainly concerning biotreatment processes, such as anaerobic digestion, composting, and bio-augmentation, but also other areas about physical processes, such as evaporation, membrane separation, or the production of bio-adsorbents and other processes that promote the recovery of valuable products obtained from biowaste, such as proteins or volatile fatty acids.

Three studies address anaerobic digestion and biogas production. Sailer et al. [1] studied the anaerobic digestion of the organic fraction of municipal solid waste and digested sewage sludge at lowered temperatures, indicating that operation at 25 °C could be beneficial regarding energy input (heating costs) and output in terms of methane yield. Montes et al. [2] assessed the possibility of energetic valorization for solid wastes from alcoholic beverage production. They concluded that brewers' spent grains were a suitable feedstock for anaerobic digestion, whereas distilled gin spent botanicals presented problems for its mono-digestion due to the presence of toxic compounds for anaerobic digestion. The energy balance of lean-burn turbocharged engines using biogas as fuel for a wastewater treatment plant enhanced by thermal hydrolysis and co-digestion with cheese whey and microalgae was also reported [3]. Other biological treatments reported in the research included backyard composting [4]. The results of the research show that the quality properties of the composts are greatly influenced by the different techniques and raw materials used, showing that with a plan of basic education for composting, there is potential to encourage farmyard composting.

Some approximations for the recovery of other kinds of resources obtained from biowastes were also presented. Lara-Musule et al. [5] studied the feasibility of using multiscale analysis to diagnose and monitor the key variables in VFA production by the anaerobic treatment of raw-cheese whey. Facing the problem of the world's significant demand for protein in the subsequent few decades, an emerging alternative for the recovery of proteins from microalgae by means of biodegradable solvents was reviewed by Moldes et al. [6]. Protein separation by the use of membranes was also reported by Mazzei et al. [7]. In line with the biorefinery concept, García-Montalvo et al. [8] contributed with a study on the extraction of antioxidants from grape and apple pomace using different solvents of industrial interest, concluding that that ethanol/water mixtures are adequate solvents for the extraction of polyphenols due to their high efficiency and environmentally benign nature.

Other strategies used to enhance the biological processes for biowaste involve bio-augmentation. In their study, Ravi et al. [9] evaluated the efficacy of anaerobic fungi as a hydrolytic pretreatment of lignocellulosic biomass for agricultural biomass. Biyada et al. [10] developed the potential of autochthonous inoculums through bio-augmentation tests to improve the compost quality of textile waste. They observed a reduction in the composting time from 44 to only 12 weeks in comparison to classical composting treatments used for the assayed waste.

Emerging uses for biowaste have been proposed by other authors. For instance, Aguilar-Rosero et al. [11] presented a review on the production of bio-adsorbents obtained from agricultural wastes with the aim of being applied in wastewater treatment plants to remove toxic compounds. Ali et al. [12] studied the impact of biochar applications on the germination behavior and early growth of maize seedlings. They observed the biochar application to be an attractive approach to improve the initial phase of plant growth and provide better crop stand and essential, sustainable high yields.

On the other hand, two studies addressed with the treatment processes used for municipal landfill leachate and the wastes derived from olive oil production. Pandis et al. [13] proposed an easy way to manufacture tubular ceramic electrodes, coated with an oxygen-reduction catalyst, to be used in a single-chamber MFC for the treatment of municipal landfill leachate. Slama et al. [14] reported on the environmental threat of uncontrolled olive-mill wastewater and olive-mill pomace disposal in evaporation ponds.

3. Perspectives on the Future of Biowaste Treatment

Biowaste poses a considerable problem to the environment due to the high volume of waste generated worldwide, and its easy degradability when deposited in landfill sites, which in turn represent a great source of methane emissions. It must be acknowledged that landfilling is not a good management option for biowaste. Therefore, the future research should focus on treatment processes aiming to recover the resources contained in the biowaste, such as energy, nutrients, and organic compounds. Also on the use of biowaste to replace tools that are produced, at present, using other non-renewable materials.

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