

Editorial

Special Issue on the Application of Municipal/Industrial Solid and Liquid Waste in Energy Area

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Municipal solid waste (MSW) as well as industrial solid and liquid waste (IW) are recognized as reasonable substitutions of energy and material sources in the area of energy. It is accepted that fossil fuels should be substituted by alternative fuels as part of the waste-to-energy (WtE) approach [1]. It is known that the waste management hierarchy, including the general guidelines for the management and the prevention of waste generation, is the most desired method to achieve this. On the other side, landfilling and incineration without energy recovery is the less preferable method as a part of the “disposal” group in the waste management hierarchy [2]. WtE plants are currently under intensive research and development. One of the suggested methods to achieve the above is to apply oxy-fuel combustion (OFC) technology. The most beneficial effect of this approach is negative CO₂ emissions since some part of the carbon in municipal solid waste is biogenic [3]. Efforts toward WtE developments are being made all over the world; nevertheless, different approaches and strategies are being adopted. It is estimated that the current number of global WtE plants is over 1700, and the division between the different regions is as follows: Asia Pacific 62%, Europe 33%, and North America 4.5%. In the US, only 13% of MSW is used for energy recovery and 53% is landfilled. There are many pilot and experimental systems in the US; however, they are still waiting for commercialization due to technical and cost challenges [4]. Europe is the region where the most frequent R&D activity in the field of agriculture WtE is observed [5]. In their work, Minir et al. presented a state-of-the-art WtE approach in New Zealand including conventional and non-conventional waste-to-energy technologies [6]. Foster et al. [7] reviewed the different technologies of WtE (i.e., incineration, gasification, pyrolysis, anaerobic digestion, and hydrothermal liquefaction) and showed the status of WtE technologies in the UK. Malav et al. [8] discussed in their study the current status of WtE technologies in India, including the available technologies. Energy recovery through the application of different technologies includes direct WtE processes (e.g., RDF production), incineration, pyrolysis, gasification, anaerobic digestion/biomethanation, composting, bioethanol production, and landfill gas (LFG). Moreover, torrefaction has recently been presented as the process of MSW valorization. Namely, torrefaction significantly improves waste properties in terms of fuel transportation, storage, and combustion. Improved properties in terms of hydrophobicity, the prevention of particle fragmentation, durability, compression strength, and shear strength as well as the lower emission of gaseous pollutants were observed after the torrefaction of MSW [1,9].

The advantages and disadvantages of the WtE approach are discussed extensively in the literature. In their study, Malav et al. [8] present a comprehensive discussion of arguments “for and against” energy recovery through municipal solid waste management and WtE. For example, the production of RDF generated fuels of high calorific value that can be applied in coal-fired power plants in a co-firing strategy. Incineration significantly reduces the volume of MSW, which is crucial in terms of the limitation of landfilling area. On the other hand, it has been suggested that the non-uniform nature of MSW, the necessity of gas cleaning, and air pollution controls are the main disadvantages of waste application as an energy source [4]. Foster et al. [7] list the most crucial barriers to WtE technologies in their study.



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In the Special Issue “Application of Municipal/Industrial Solid and Liquid Waste in Energy Area,” the aforementioned research issues were intensively investigated. Ten papers were brought together in this Special Issue, of which six are regular articles and four are review papers. The regular articles concern the following issues: the possibility of pellet production from waste generated during the cultivation of selected plants for industrial purposes [10], the repurposing of a common form of biowaste (i.e., the banana stem) to collect solar energy for a desalination application [11], the theoretical research of gas hydrates’ ignition [12], the emission of gaseous pollutants from an incineration plant concerning the emission requirements for incineration plants specified by the European Commission (EC) [13], an experimental work on the physical and chemical characteristics of the steam pyrolysis products of oil sludge [14] and investigations of waste biomass from parks and gardens for the production of pellets in terms of its application as an energy source [15]. The review papers include the field of the valorization of lignocellulosic biomass ash as a substitute material for the production of fired and unfired bricks [16], a discussion on the topic of NO_x as greenhouse gases and the emission contribution from waste incineration and co-incineration plants [17], a discussion on the trends of the thermal degradation of polymeric materials including PET, PP, SBR, ABS, resin, and tier waste [18], and modern achievements in the thermal recovery of industrial and municipal waste [19].

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