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Editorial: Energy and Resource Valorization of Biomass and Waste Toward Sustainable Environment *via* Thermochemical and Biological Application

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Editorial on the Research Topic

Energy and Resource Valorization of Biomass and Waste toward Sustainable Environment *via* Thermochemical and Biological Application

Innovation toward a sustainable environment is important in maintaining a circular economy and making it a key priority in most countries. This demands practical efforts in resource recovery from biomass, energy production, waste valorization, and reducing environmental pollution through joint ventures among education, research institutions, public services, and private industry.

This Frontiers Research Topic was designed to inaugurate the ongoing developments of thermochemical and biological approaches, including the novel and latest measures that have been initiated in resource and energy valorization of biomass and its wastes, revolutionizing our society toward a sustainable environment.

Ten research articles have been received, reviewed, and published in this research topic. The articles were contributed by academics and researchers from various institutions at different countries including Finland, Ireland, Thailand, China, Belgium, Malaysia, Sweden, Greece, and Colombia. The editorial team of this research topic expresses gratitude to all the authors for their contributions toward the successful publication of this research topic.

THERMOCHEMICAL APPLICATION TO BIOMASS AND WASTE

Bonilla et al. studied fixed-bed gasification of coffee husk using pure oxygen-steam blends to convert agro-industrial waste into fuel. This study also highlighted the estimation of uncertainty in the flows of oxygen, steam, biomass fuel, and syngas composition, energy recovery from gasification process, and the performance of oxygen-steam blends vs. airsteam.

In this research topic, Vamvuka et al. investigated and developed a multi-fuel residential boiler for combustion of agricultural residues. This study also discussed raw fuel analysis,

combustion performance of agricultural residues, and co-combustion performance of agricultural residues blends. Prurapark et al. studied the effect of temperature during pyrolysis of high-density polyethylene and polyethylene terephthalate on the production and properties of pyrolysis oil.

BIOLOGICAL TREATMENT OF BIOMASS AND WASTE

Zhang et al. in this research topic highlighted on how to convert agricultural biomass wastes (e.g., pig manure, corn straw, and fertilizers) into energy using mixed fermentation technology. The authors have also discussed the pretreatment methods including physical, chemical, and biological means to improve the biomass anaerobic and mixed fermentation.

Nickel et al. proposed an evaluation framework for a wheat straw–based ethanol biorefinery derived from multi-scale variability analysis using a flow sheet process model, life cycle assessment, and techno-economic analysis to describe the simultaneous saccharification and ethanol fermentation.

The biological treatment of dairy wastewater in this research topic was also studied by Singh et al., who performed methanization of long-chain fatty acid in a dynamic sludge chamber–fixed film bioreactor. Vergote et al. compared the effect of composition fraction separation between unseparated liquid pig manure and its separated fecal fraction on the stability of thermophilic mono-digestion process.

An proposed a new model for the circular economy development in the garden industry by introducing a static composting treatment for landscape waste recycle. Another study by Zhang et al. demonstrated a potent extraction method for *Cinnamomum camphora* leaves that are rich in bioactive compounds. The study shows the potential conversion of *Cinnamomum camphora* into chemical materials, bioenergy, and biomedicine.

APPLICATION OF NOVEL MATERIALS (E.G., CATALYSTS) IN WASTE AND BIOMASS TO ENERGY

Mohammed et al. improved gasification reaction and tar cracking efficiency of empty fruit bunch using primary Malaysian dolomite catalysts. The effects of calcined dolomite catalysts on product yield (especially syngas), gasification performance, and tar cracking were discussed.

CONCLUSION

This research topic highlights the potential, recent development and needs to retrieve the chemical and energy value of biomass materials and its wastes for various applications, while hindering the waste dumping to landfill sites. This effort is realized by the innovations of emerging thermochemical and biological processes for useful products manufacture especially as chemical feedstock and energy carriers rather than opting the common volume-reducing "incineration." The aim is placed on the description of the design, operation, and products of advanced thermochemical and biological technologies, along with understanding of their fundamentals and applications.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.