

The added-value of food waste: a review of pre-treatments for biofuel production through thermal conversion methods

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Abstract

The United Nations states that one third of the food produced worldwide is wasted (World Food Programme, 2020), an average of 74 kilograms/person being lost every year (United Nations, 2022). In Europe, around 57 million tons of food are wasted per year, meaning approximately €130 billion and around 10% of global greenhouse gas emissions (Directorate-General for Health and Food Safety, 2023). Thus, alternative ways of addressing these wastes should be implemented to benefit the society as a whole, and avoid detrimental impacts (whether these are environmental, economic or ethical/social). Using food waste as a feedstock for waste-to-energy (WtE) techniques may be an option, in the view of sustainability principles. These WtE techniques concern thermal procedures that, in a dedicated reactor and operational conditions (such as temperature, pressure, and presence of oxidizing agents), convert feedstock into an energy intermediate (e.g. heat, vapour, or a synthetic gas) which can further be used for final applications such as electricity, fuels, or chemicals production (Pan, Du et al., 2015). The global trends in biofuel production point to more than 2 million barrels of oil-equivalent per day in a near future, revealing worldwide increasing needs to explore new renewable energy sources (Our World in Data, 2021). With the recent global energetic crisis and the increasing demand for energy dependent-assets, the application of WtE techniques to produce biofuels has been considered a promising integrated approach due to the efficiency and flexibility towards various types of biomasses (Elgarahy, Hammad et al., 2021). This review discusses recent literature on pre-processing procedures assisting biomass waste thermal conversion, to promote the production of biofuels and other commodities. These will ultimately replace fossil-based alternatives under an environment-friendly framework, and contribute to the attainment of circular economy goals. Pre-processing methods enable cleaner and proficient conversions, once a more homogeneous, dry, suitable and consistent feedstock is achieved, lessening the impacts of the overexploitation of natural resources. Key thermal conversion techniques were summarized and the relation among these and the most convenient pre-treatment options was identified. Knowledge gaps and future opportunities to enhance circularity in the field were also detected.

Keywords: food waste, waste-to-energy, biofuels, sustainability

References

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