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Tackling the Food Waste Problem: Advanced Technologies and Biorefinery Approaches

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Abstract

The generation of food waste (FW) is increasing rapidly yearly due to the rapid global population growth and the different food habits of humans. Globally, one-third of food produced for human consumption is lost or wasted each year (i.e., approximately 1.3 billion tons per year). Conventionally, FW is managed by incineration and landfilling, which demand high cost, and cause several adverse environmental impacts such as air pollution, landfill leachates generation, groundwater contamination, and greenhouse gas emissions. Therefore, more advanced technologies are explored for the safe disposal of FW and value-added bioproduct generation. Composting is preferable, as it is a natural way to return nutrients to the soil. Additionally, FW with high energy contents (i.e., protein, lipid, and carbohydrate) can be treated through anaerobic digestion (AD) for different types of biofuels production such as biohydrogen via dark fermentation (DF), biomethane via AD and biohythane via two-stage AD. Recently, the biochemical composition of FW has drawn the great attention of researchers to recover various types of bioplastics such as polyhydroxyalkanoates (PHAs), polylactic acid (PLA), and polyglycolic acid (PGA), etc. Among these bioplastics, PHAs have great potential to replace traditional plastics in the global market, as it can be produced as storage components in the form of intracellular granules among a broad range of bacteria. Thus, the bioconversion of FW to PHAs can be considered a sustainable biorefinery way, which can simultaneously treat organic wastes, reduce petrochemical plastics waste, and generate green products.

Keywords: Food waste, Value-added bioproducts, Bioplastics, Polyhydroxyalkanoates, Biorefinery.