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Hydrothermal Processing of Biomass or Organic Wastes at High Pressures

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DESCRIPTION

Hydrothermal processing is heating aqueous slurries of biomass or organic wastes at high pressures to produce an energy carrier with higher energy density, similar to how the planet has produced fossil fuels over millions of years. All fossil fuel reserves were formed through the long-term transformation of biological matter under pressure and heat. In modern hydrothermal processing, the act of applying high pressures and temperatures to organic matter is often described as speeding up nature's natural routes to generate a sustainable fossil fuel. The ability to treat wet feed is one of the key advantages of hydrothermal processing systems. Because the system can handle slurries of biomass and garbage with total solids of 5–15 percent, the feedstock does not need to be dried. This is one of the reasons why hydrothermal processing of microalgae has gotten a lot of interest, because standard biofuel production paths like lipid extraction and transesterification to biodiesel require a drying step.

This chapter includes current understanding on hydrothermal processing of wet forest residues, agricultural wastes, and aquatic biomass for the manufacture of biofuels and chemicals, as well as state-of-the-art information. The remaining technical challenges will be examined in detail, as well as two concepts: process intensification and process integration, which will be introduced. Other researchers have studied the mechanism of thermal decomposition liquid phase in saturated vapour pressure and high-density supercritical fluid are good for decomposing organohalogen compounds because their molecules contain an electron withdrawing group, and other researchers have investigated the decomposition of PVC at high pressure in hot water, and others have studied the process of thermal decomposition liquid phase in saturated vapour stress and constant supercritical fluid are useful for rotting treated and untreated compounds because their merriam an electron withdrawing group.

The goal of this paper is to give an overview of the current state of hydrothermal processing technologies as well as new research. The chapter also covers relevant process chemistry, such as how the characteristics of water change when heated under pressure and the reaction pathways involved in each of the hydrothermal methods. The impact of various feedstocks on process operation, product distribution, and composition is examined. Before drawing conclusions on the state of the technology, recent breakthroughs in reactor design, product upgrading, commercialization, and techno-economic and lifespan analysis are described. While algal biomass has received a lot of attention in terms of hydrothermal processing, other wet biomass feedstocks can also be hydrothermally processed. Feedstocks with high moisture and ash content, such as AD digestate, manures, sewege sludge, dried distillers' grains with solubles (DDGS), food wastes, and municipal wastes, are particularly ideal for hydrothermal processing.

The approach has a number of potential advantages over other technologies, including the flexibility to employ mixed feedstock such as wastes and lignocelluloses, the possibility to produce direct replacements for existing fuels, and the lack of the requirement to predry the feedstock. However, a number of engineering obstacles remain, preventing the technique from being used in large-scale biofuel and chemical production. Furthermore, because hydrothermal media are energy-sensitive, good heat recovery techniques are required to keep the process energy-efficient. This chapter includes knowledge on hydrothermal processing of wet forest residues, agricultural wastes, and aquatic biomass for the manufacture of biofuels and chemicals, as well as state-of-the-art information. The remaining technical challenges will be examined in detail, as well as two ideas, process intensification and process integration, which will be introduced.

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CONFLICT OF INTEREST

There is no conflict of interests whatsoever in publishing this article.