Chapter 6
Biofuels From Bio-Waste and Biomass

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ABSTRACT

The planet's limited natural fossil fuel reserves are anticipated to be very soon owing to massive usage. Biofuels would be a critical alternative source that may reduce global warming and CO2 emissions. The food-versus-fuel dilemma is, however, one of the key drawbacks of first-generation biofuels like corn ethanol, sugarcane ethanol, etc. Cellulose and hemicellulose, the primary constituents of lignocellulosic feedstocks, could be reduced to sugars by either thermochemical/biological processes before being fermented to generate biofuels. However, owing to structural heterogeneity, more complicated operational techniques are required before the production technology can be commercialized, and several challenges must be addressed. This chapter provided an assessment of various feedstocks, availability, various processing techniques, obstacles, and current technical developments in the generation of biofuels from biomass.

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INTRODUCTION

The earth's finite natural fossil fuel reserves are being exhausted at a quicker pace as the world's energy demands rise as a result of advances in industrialization and modernization (Mohapatra, Ray, & Ramachandran, 2019; Ruan et al., 2019; Saini, Saini, & Tewari, 2015). Petroleum, coal, natural gas, bitumen, oil shales, and tar are examples of fossil fuels that have aided in the wealth and success of many nations throughout the world, as well as meeting energy demands for power, transportation, and heating (Dahman, Dignan, Fiayaz, & Chaudhry, 2019). Fossil fuels account for almost 80% of all primary energy use. With the transportation sector accounting for only 58% (Raud, Kikas, Sippula, & Shurpali, 2019). From a global point, the energy and transport industry is associated with heavy fossil fuel consumption (Dahman, Dignan, et al., 2019). As the world's population grows and industry and technology advance, this need grows year after year.

According to the 2011 consumption rate, the oil will last 54 years, natural gas 64 years, and coal 112 years (Khattab & Watanabe, 2019). Indeed, the varied technical breakthroughs driven by the use of heavy fossil fuels have improved human existence and made it more comfortable; yet, this comfort has arrived at a significant expense. Global warming and greenhouse gas (GHG) emissions have come from the extensive consumption of fossil fuels. Ozone (O_3), Carbon Dioxide (CO_2), methane (CH_4) and Nitrous oxide (NO_3) are the main greenhouse gases that emit and absorb infrared radiation owing to their unique characteristics and chemical makeup. The elevated level of these gases in the atmosphere had several negative consequences for the planet. Roughly 98% of the greenhouse gases released into the atmosphere are a direct consequence of the production of fossil fuels (Dahman, Syed, Begum, Roy, & Mohtasebi, 2019; Khattab & Watanabe, 2019). The *Mauna Loa* research center revealed CO_2 levels of 413 ppm in March 2019, up from 280 ppm in preindustrial Period. The proportion of atmospheric CO_2 buildup has escalated to 2.28 ppm per year between 2008 and 2017, up from 0.8 ppm per year between 1960 and 1969. The CO_2 content in the atmosphere has increased by 43% since 1750, and as a consequence of this rise, the average surface temperature of the earth has increased by 0.85°C since pre-industrial times (Raud et al., 2019). Each of these elements has shifted the phenomena of global warming from a local myth to a grave concern worldwide that concerns our own humankind's survival on our planet. Because of the continued and increasing release of greenhouse gases, the average temperature of the Earth has been steadily rising. Changes in climate, weather system disruption, glacier retreat, rising sea level, coastal flooding, associated biodiversity loss, and human health effects are the main consequences of fossil fuel consumption (Dahman, Dignan, et al., 2019; Dahman, Syed, et al., 2019). All these collectively coupled with the climb in the energy consumption and demands, depletion of fossil fuels, and severe environmental concerns have sparked to watch out for an alternative, sustainable, renewable, and green energy source that could not only meet the global demand and also helps to lessen the global greenhouse emissions (Agbor, Cicek, Sparling, Berlin, & Levin, 2011; Raud et al., 2019). In this chapter, the focus will be on research into the types, compositions, and application of various forms of biomass accessible for biofuel generation and also the numerous pretreatment and processing options that may be used to various bio-wastes to transform them into useable biofuels cost-effectively and sustainably to fulfill rising energy demand.