Chapter 9
Recent Trend of Renewable Energy From Agricultural Wasted Biomass

Miftahul Choiron
https://orcid.org/0000-0003-3486-9401
Jember University, Indonesia

Andrew Setiawan Rusdianto
Jember University, Indonesia

Winda Amilia
Jember University, Indonesia

ABSTRACT

The environmental issue occurs along with the waste released from the agricultural or agroindustrial sector. Biomass waste from agricultural or agroindustrial activities has potential value due to its composition and cost. The extraction and treatment of biomass could convert the organic compound into valuable material or energy source. A pretreatment or preprocessing needs to be applied before the application of biomass waste. Biogas, biohydrogen, and bioethanol are the most energy-providing source products from agricultural waste biomass. The technology is developed to obtain successful fermentation and generate optimum biogas and bioethanol. Biopellet production from biomass waste is also promising for a solid energy sources that recently developed. Conversion and utilization of biomass waste from agricultural or agroindustrial sectors not only promote environmentally friendly process results, but also deliver a circular economy.

DOI: 10.4018/978-1-6684-5629-3.ch009

INTRODUCTION

Waste is defined as an unavoidable by-product and a consequence of most human activity. It is classified into two main groups, municipal solid waste (including industrial and commercial waste) and agricultural waste (UNECAP, 2003). Biomass includes a variety of materials such as wood, sawdust, straw, seed waste, fertilizer, paper waste, household waste, sewage, etc. Agricultural biomass, a single-carbon renewable energy source, can store solar energy, which can be converted into various forms of fuel as well as chemicals through a sequential conversion process (Deb et al., 2019).

Massive agricultural biomass waste is commonly produced in a large-scale agricultural plantation and processing, for instance, cocoa and coconut husk (Campos-Vega et al. 2018; Akolgo et al, 2021), paddy straw (Zong et al., 2022) sugarcane bagasse (Kumar, Kumar, and Singh, 2021), etc. This causes an environmental problem if not processed properly. In addition, to solve the environmental problem, recent technology of biomass treatment proposes potential materials (Hakeem, Jawaid, aand Alothman, 2015) and renewable energy (Choiron et al., 2020a). The use of biomass waste as a renewable energy resource is projected to increase by 6% per year. One of the main features that make biomass a suitable energy source is that it can be burned directly in a waste conversion plant to generate electricity, or it can generate heat on an industrial and residential scale in a boiler (Perea-Moreno, 2019). Instead of direct burning, thermochemical or biochemical processes can be used to generate bioenergy from biomass in the form of heat, electricity, or biofuels (solid, liquid, or gas) (Clauser et al., 2021). Therefore, bioenergy from biomass waste is more environmentally friendly compared with fossil energy. On the economic potential side, the large-scale production of bioenergy from biomass waste will be feasible and very profitable in some scenarios for the next decade (Winchester and Reilly, 2015; Tomberlin and Mosey, 2013; Reid et al., 2020)

Utilizing agricultural biomass waste as a bioenergy source is facing challenges. Low caloric value and low energy density are the disadvantages of biomass. Most lignocellulosic materials have high water content and must be vaporized before they ignite and indirectly reducing the efficiency of the boiler. It also requires the preparation of individual materials such as compression, pre-treatment, etc. (Sivabalan et al., 2021). Bulky volume and low energy density of fresh biomass affect storage costs and transport efficiency.

The economic aspect cannot be separated from the application of technology to ensure its sustainability. The utilization of agricultural waste as renewable energy directly or indirectly can have a positive economic impact. Economics, Environment, and Energy are 3 main areas that can be interrelated. A circular economy is important in the application of technology for converting agricultural biomass into energy.