CHAPTER 8

GASIFICATION IN CLEAN ENERGY PRODUCTION

Ragıp YILDIRIM[1]
Kazım KUMAŞ[2]
Ali Özhan AKYÜZ[3]

INTRODUCTION

Gasification can generally be described as the altering of carbonaceous substances and oxidants into gaseous products (flammable gases). In other words, gasification is a thermo-chemical procedure that turns carbon-containing substances like biomass into suitable gaseous or chemical materials [1]. The combustion process can be expressed as gasification. In the gasification process, there must be less oxygen than the oxygen essential for 100% combustion. Combustion produces carbon dioxide (CO_2) and vapor. In the formation of gasification, also, carbon dioxide and water vapor, combustible gas mixtures with certain heating values are obtained. In the process, transformation is achieved with some physical and chemical reactions. Initially, a fuel (solid or liquid) is converted into a new type of fuel in the gas phase. Substances that provide these reactions are used as steam, air, or a mixture of them. Gasification comes about at temperatures in the range of 650-1000 °C and the result is a low-energy mid-range gas, based on the type of process and conditions. This gas is called "gas product" or "synthesis gas". The product is a gas with a certain calorific value and is mainly composed of carbon monoxide (CO), hydrogen (H_2), methane (CH_4), CO_2, and hydrocarbons like ethane (C_2H_6), propane (C_3H_8), and tar. The gas coming out of the gasifier goes to the cyclone and is cleaned from the hot ashes. Hot air is directed to the treatment system for cooling, heat recovery, and gas cleaning. The content of these gas mix-

[1] Dr. Öğr. Üyesi, Burdur Mehmet Akif Ersoy University, Bucak Emin Gülmez Technical SciencesVocational School, Department of Electrical and Energy, Burdur/Türkiye ryildirim@mehmetakif.edu.tr
[2] Öğr. Gör., Burdur Mehmet Akif Ersoy University, Bucak Emin Gülmez Technical SciencesVocational School, Department of Electrical and Energy, Burdur/Türkiye kkumas@mehmetakif.edu.tr
[3] Assoc. Doç. Dr., Burdur Mehmet Akif Ersoy University, Bucak Emin Gülmez Technical Sciences Vocational School, Department of Electronics and Automation, Burdur/Türkiye aakyuz@mehmetakif.edu.tr

bubble fluidized bed. Bubbly fluidized bed and circulating fluidized bed systems are completely different from each other in terms of hydrodynamics. Here, the fuel is fed into the fluidized bed as in a gasifier. Since the fluid velocity is too high, some solid particles are dragged out of the reactor. Then, these particles are separated from the gas stream by passing through the cyclone and fed back into the reactor. Thus, carbon conversion is improved [56-59].

ENTRAINED FLOW GASIFIERS

In entrained flow gasifiers, small fuel particles and gasifiers are fed together into the gasifier. Entrained flow gasifiers provide high efficiency as they operate at high temperatures and pressure. Gasification reactions take place in a very short time with yields close to one hundred percent. As a result of pyrolysis, tar and oil are decomposed into H_2, CO, and light hydrocarbon gases. Entrained flow gasifiers are capable of producing clean and tar-free syngas. Considering the high operating temperatures, ash is removed as molten in this type of gasifier [60-62].

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