

## Comparative studies of gasification potential of agro-waste with wood and their characterization

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**Abstract.** In this work, an experimental study of the gasification on wood was carried out in downdraft type fixed bed Gasifier attached with 10 kW dual fuel diesel engine. The main objective of the study was to use wood as the biomass fuel for downdraft Gasifier and to evaluate the operating parameter of gasifier unit to predict its performance in terms of gas yield and cold gas efficiency. The influence of different biomass on fuel consumption rate, gas yield and cold gas efficiency was studied. Composition of producer gas was also detected for measuring the lower heating value of producer gas to select the feed stock so that optimum performance in the existing gasifier unit can be achieved. Under the experimental conditions, Lower heating value, of producer gas, cold gas efficiency and gas yields, using wood as a feed stock, are 4.85 MJ/m<sup>3</sup>, 46.57% and 0.519 m<sup>3</sup>/kg.

**Keywords:** gasification; syngas; biomass; agrowaste; filtration; design parameters; diesel blending

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### 1. Introduction

Gasification is the one of the important biomass conversion technology with internal combustion engine which is used for electric power generation. Biomass gasification in gasifier is done with controlled amount of air. During gasification the amount of air supplied in such a way that fuel air ratio is below the stoichiometric fuel air ratio. Due to this a relatively small parts of biomass burns and heat generated to control a series of thermo chemical processes. This results in generation of mixture of gas as final product known as producer gas or syngas. Yang *et al.* (2004) concluded that use of biomass and solid municipal wastes energy, fixed bed gasification is the most common technology. During the biomass gasification process, this biomass undergoes different processes. In a first step, biomass is dried up. Then, due to increase of the temperature, pyrolysis occurs and the lignin and cellulose are decomposed into volatile molecules such as hydrocarbons, hydrogen, carbon monoxide and water. Finally, the remaining solid fraction, which is called char, is oxidized in the presence of excess oxygen is known as combustion. When combustion is done in presence of less oxygen than the stoichiometric, gasification of char is completed by the pyrolysis and oxidation gases. In this process chemical reduction of hydrogen, carbon dioxide and water done by char. The inorganic components in the biomass are non- volatile and remain in solid state as ash. However, at

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**Nomenclature**

HHV	Higher heating value
LHV	Lower heating value
MC	Moisture content
VCM	Volatile combustible matter
FC	Fixed carbon
$\nabla p$	Pressure difference
$h_w$	Deflection of water in manometer
$\rho_w$	Density of water
$Q_{CV}$	Calorific value of producer gas
CV	Calorific value of biomass
$y$	Dry gas yield
$\dot{\eta}$	Cold gas efficiency