

R&D of Carbonizing Gasification Power Generation System

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Abstract:

Utilization of “carbon neutral” biomass fuel restrains consumption of fossil fuel, thus leading to reduction of greenhouse gas emission.

CRIEPI has been developing a high-efficiency carbonizing gasifier using biomass and waste. In an early phase of development, it has carried out the gasification tests of woody biomass such as cedar, cypress, etc. in order to study a basic performance. From a viewpoint of economics, it is important to contemplate the use of the waste biomass which can be supplied stably at a lower price. Such as the food processing waste generated in the food factory and the seed dregs emitted from oil-plant in Southeast Asia, these processing wastes are promising as the fuel of the carbonizing gasification process. Then, the carbonizing gasification tests of palm kernel shell (PKS), Jatropha seeds dregs (JSD), coffee dregs and beer dregs were executed using a 5tons/day carbonizing gasification test facility of CRIEPI. The gasification performance of each fuel was compared with one's of the cedar, and the adaptability to the carbonizing gasification fuel was evaluated. As a result, each fuel, excepting the beer dregs, showed an excellent gasification performance as well as the cedar. In the test of the coffee dregs, the power generation test was executed with 320kW class gas-engine generating unit. The power generation efficiency of the gas-engine unit reached approx. 34% in LHV basis. In the test of JSD, the power generation test was carried out with the hot gas cleanup systems developed by CRIEPI and MCFC fabricated by CRIEPI. The operational status of the hot gas cleanup system and MCFC was so stable, and the power generation efficiency of MCFC unit reached approx. 42% in LHV basis. In the commercial scale plant of the biomass carbonizing gasification power generating system, it is predicted that the gross generation efficiency of the systems adopted gas-engine and MCFC will be approx. 23% and approx. 32%, respectively.

Keywords:

Biomass, Wastes, Carbonization, Gasification, Power generation