

Technologies reshaping the electricity supply industry
2017 IERE-TNB Putrajaya Workshop
November 20-23, 2017

Reduction of Biomass Gasification Power Plant Maintenance Problem using Catalysts Mixture of Coal Bottom Ash:Dolomite

Nor Fadzilah OTHMAN
Principal Researcher, Renewable Energy Section, TNB Research Sdn Bhd
Kajang, Malaysia

Keywords: *biomass, catalyst, coal bottom ash, dolomite, empty fruit bunch, gasification, tar*

Abstract

Recently, Biomass Technology was highlighted in TNB Renewable Energy (RE) Road Map and National Biomass Strategy 2020. In the Eleventh Malaysia Plan, focus will include promoting new RE sources. RE capacity is expected to reach 2,080MW by 2020, contributing to 7.8% of total installed capacity in Peninsular Malaysia and Sabah. It is targeted that about 800 MW installed capacity will be from Biomass Technology by year 2020.

Biomass gasification is one of the potential conversion technologies to convert biomass to power, which is mainly due to higher thermal efficiency (about 50%) and low CO₂ emissions to the environment. However, tar formation from biomass gasification is the main culprit, which cause blockage to the narrow pipeline and corrosion of equipment or further reduce the overall efficiency of the process.

Tar cracking/reduction process will also increase syngas composition (e.g. H₂, CO, CH₄) and quality. In this study, different ratios of catalysts mixtures of coal bottom ash (CBA) and dolomite (Do) of 100:0, 75:25, 50:50, 25:75 and 0:100 were used to increase syngas quality. Coal bottom ash is a by-product from coal fired power plant, which is usually being dumped into the ash pond. Dolomite is abundantly available in Malaysia, being used as catalyst or fertilizer. Calcium and magnesium contents in CBA and dolomite are expected to contribute to the catalytic activity. The catalysts mixtures were placed in the catalytic reactor in Fluidized Bed Gasifier. Empty fruit bunch (EFB) pellets were used as biomass source.

EFB gasification processes were conducted with and without catalysts mixtures. The EFB pellets gasification tests with the presence of catalysts mixtures showed some reduction of tar in syngas. The optimum tar reduction occurred when EFB pellets gasification was conducted using catalysts mixture of CBA:dolomite 25:75. The application of this catalysts mixture in the catalytic reactor had reduced tar contents in syngas up to 36%. This finding is meeting tar tolerance level of 50-100 mg/Nm³ in syngas for gas engine and gas turbine application. However, tar can be further reduced with the increase of the plant operating temperature to 900°C and using dolomite as catalyst as gasifier bed material. In conclusion, CBA has a potential to be utilized as catalyst for tar reduction in large scale biomass power plant.