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Utilization of Bottom Ash as Catalyst in Biomass Steam Gasification for Hydrogen and Syngas Production: Lab Scale Approach

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Abstract : Bottom ash is a solid waste from thermal power plant and it is usually disposed of into landfills and ash ponds. These disposal methods are not sustainable since new lands need to be acquired as the landfills and ash ponds are fill to its capacity. Bottom ash also classified as hazardous material that makes the disposal methods may have contributed to the environmental effect to the area. Hence, more research needs to be done to explore the potential of recycling the bottom ash as more useful product. The objective of this research is to explore the potential of utilizing bottom ash as catalyst in biomass steam gasification. In this research, bottom ash was used as catalyst in gasification of Palm Kernel Shell (PKS) using Thermo Gravimetric Analyzer coupled with mass spectrometry (TGA/MS). The effects of temperature (650 – 750 °C), particle size (0.5 – 1.0 mm) and bottom ash percentage (2 % - 10 %) were studied with and without steam. The experimental arrays were designed using expert method of Central Composite Design (CCD). Results show maximum yield of hydrogen gas was 34.3 mole % for gasification without steam and 61.4 Mole % with steam. Similar trend was observed for syngas production. The maximum syngas yield was 59.5 mole % for without steam and it reached up to 81.5 mole% with the use of steam. The optimal condition for both product gases was temperature 700 °C, particle size 0.75 mm and cool bottom ash % 0.06. In conclusion, the use of bottom ash as catalyst is possible for biomass steam gasification and the product gases composition are comparable with previous researches, however the results need to be validated for bench or pilot scale study.

Keywords : bottom ash, biomass steam gasification, catalyst, lab scale
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