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Novel Waste Biomass-Plastic Co-Gasification for Hydrogen rich Syngas production

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Abstract

Biomass and plastic in Agro residue, organic industrial and civic waste provides a huge potential to harvest energy from waste. Biomass gasification is a quite mature technology finding its use in various sectors. Plastic is also a solid hydrocarbon waste like biomass. Biomass-Plastic co-gasification has been performed successfully with upto 25% plastic mix in biomass waste. Plastic yields more Hydrogen than biomass and is having high energy density. Oxy-steam gasification, in a downdraft configuration, yields syngas of high energy density (8-10 MJ/Nm³). Oxy-steam biomass gasifier is designed using oxygen and superheated steam mixture as reactant. Steam to biomass ratio is varied from 0.75 to 2.7 and ER from 0.2 to 0.3. H₂ yield of 104 g/kg of biomass is obtained. System efficiency is evaluated and CFD based numerical model developed from fundamentals. Oxy-steam gasification has proved to be highly efficient system with over 80% efficiency achieved at lower steam to biomass ratio of 0.75. The high energy density in the range of 8-9 MJ/Nm³ has been achieved which makes it better fuel compared to producer gas obtained from air gasification.

Keywords: Biomass Gasification, Hydrogen Production