Accepted Manuscript

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Shaharin Anwar Sulaiman, Raihanna Roslan, Muddasser Inayat, Muhammad Yasin Naz

PII: S1743-9671(17)30123-X

DOI: 10.1016/j.joei.2017.05.003

Reference: JOEI 330

To appear in: *Journal of the Energy Institute*

Received Date: 13 February 2017

Revised Date: 1 May 2017

Accepted Date: 4 May 2017

Please cite this article as: S.A. Sulaiman, R. Roslan, M. Inayat, M.Y. Naz, Effect of blending ratio and catalyst loading on co-gasification of wood chips and coconut waste, *Journal of the Energy Institute* (2017), doi: 10.1016/j.joei.2017.05.003.

Effect of blending ratio and catalyst loading on co-gasification of wood chips and coconut waste

Shaharin Anwar Sulaiman[a], Raihanna Roslan[a], Muddasser Inayat[a]*, and Muhammad Yasin Naz[b]

[a]Department of Mechanical Engineering, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak Darul Ridzuan, Malaysia

[b]Department of Physics, University of Agriculture, 38040 Faisalabad, Pakistan

Corresponding author: muddasser_engr@yahoo.com*

Tel: +601136047750

ABSTRACT

Catalytic co-gasification is an important tar reforming technique, which may appreciably improve the quality of syngas through tar reforming reaction. In this study, wood chips (WC) were co-gasified with two coconut wastes, namely coconut shells (CS) and coconut fronds (CF), in a downdraft gasifier. The dolomite and limestone were used as tar reforming mediums. The effect of the blending ratio, catalyst type, biomass type and catalyst to biomass loading on gas composition and heating value of the syngas was investigated for different WC/CS and WC/CF blends. The results revealed that the WC/CS blending ratio of 70:30 produces the highest H_2 amount (11.70 vol.%), which was 31% higher than the H_2 amount of the other blends. The HHV_{syngas} of 70:30 blend was measured about 4.96 MJ/Nm^3, which was also higher among all the tested blends. The co-gasification of 70:30 blend of WC/CS, when compared with same blending ratio WC/CF, produced two times higher CO, 60% higher H_2 and 75% higher HHV_{syngas}. During catalytic co-gasification of WC/CS blends with dolomite and limestone, the dolomite yielded 24%, 13.8% and 25.6% increment in CO, H_2, and CH_4, respectively. It is concluded that the coconut wastes can be substituted or co-gasified with wood after carrying out some major changes in a gasifier geometry.

Keywords – catalytic co-gasification; coconut wasted; mineral catalyst; wood chips.

1. INTRODUCTION

Gasification is one of the most promising thermochemical conversion techniques. It gives the highest conversion efficiency when compared with other thermochemical technologies. However,