Catalytic gasification of empty palm fruit bunches using charcoal and bismuth oxide for syngas production

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ABSTRACT

The purpose of this research is to evaluate the intent of empty fruit bunches of palm oil ($EFB_{palm\ oil}$) to catalytic gasification of wood produced charcoal ($Wood_{charcoal}$) in order to notify the large-scale application of $Wood_{charcoal}$ as a possible gasification feedstock. In this study, co-catalyst of bismuth oxide (Bi_2O_3) was also used to obtain syngas. The raw samples were characterized by proximate and ultimate analyses, X-ray diffraction (XRD), field emission scanning electron microscope (FESEM), transmission electron microscopy (TEM) and X-ray photoelectron spectroscopy (XPS) analyses. The produced syngas was analyzed by online portable gas analyzer and gas chromatography-thermal conductivity detector (GC-TCD). The syngas composition of H_2 increased from 3.91 to 4.70% (increased 20.20%), CO increased from 5.73 to 6.30% (increased 10.53%), whereas CO_2 decreased from 20.60 to 12.67% (decreased 38.50%) and CH_4 concentration increased insignificantly from 0.35 to 0.37% (increased 5.7%) which was happened due to the use of $Wood_{Charcoal}$ and Bi_2O_3 with $EFB_{palm\ oil}$ during gasification. According to the findings, carbon is abundant in $Wood_{Charcoal}$, which may considerably boost the gasification reactivity with Bi_2O_3. The yield of syngas (H_2 and CO) increased when $Wood_{Charcoal}$ and Bi_2O_3 were used instead of single EFB_{ppo} gasification, indicating that catalyst ($Wood_{Charcoal}$) and co-catalyst (Bi_2O_3) have a high potential for thermal decomposition and dehydrogenation of volatile matter. Therefore, catalytic gasification of empty palm fruit bunches will be the prospective energy sources for the production of syngas with the utilization of $Wood_{Charcoal}$ and Bi_2O_3.

KEYWORDS

Bi_2O_3; Catalytic gasification; $EFB_{palm\ oil}$; Syngas; $Wood_{Charcoal}$

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