

Hydrogen production from gasification of palm kernel shell in the presence of Fe/CeO₂ catalysts

ABSTRACT

Biohydrogen is a renewable source of clean fuel and energy which can be derived from biomass. One of the suitable candidate as a source of biomass is palm kernel shell (PKS). Our initial work shows that biohydrogen may be produced from PKS in the presence of zeolite supported catalysts. The potential of using cerium oxide (CeO₂) supported catalysts for the production of biohydrogen from PKS is explored in this work using 2.5 – 10 % Fe loading. The catalysts were prepared by incipient wetness impregnation method and calcined at 500 °C for 16 h. The physicochemical properties of these catalysts were characterized using BET and XRD. The catalysts were tested in dry and steam gasification of PKS at 700 °C using PKS feeding rate of 2 g h⁻¹ under N₂ atmosphere with biomass to catalyst ratio of 3:1 (wt/wt). Steam to biomass ratio of 3.5:1 (wt/wt) was used in steam gasification reaction. The gaseous products were analyzed using an on-line gas chromatography equipped with thermal conductivity detectors (TCD) and fitted with Molsieve 5A and Hayesep Q columns. Result shows that 2.5 % Fe/CeO₂ gave the highest hydrogen production in both the dry and steam gasification of PKS.

Keyword: Biohydrogen; Palm kernel shell; Ceria supported catalysts; Gasification