Catalytic upgrading of pyrolysis vapours over metal modified HZSM-5 via in-situ pyrolysis of sugarcane bagasse: Effect of nickel to cerium ratio on HZSM-5

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ABSTRACT

The main objective of the present work is to investigate the influence of nickel to cerium ratio on Hydrogen exchanged Zeolite Socony Mobil-5 (HZSM-5) towards the catalytic upgrading of sugarcane bagasse derived oxygenated pyrolysis vapours into $C_6 – C_8$ hydrocarbons in pyrolysis oil via in-situ fixed bed reactor. The pyrolysis reaction temperature and catalyst to biomass mass ratio were kept constant at 500 °C and 1:1 respectively for all the investigated samples. The HZSM-5 was used as a support at 94 wt.%, while the balance 6 wt.% was impregnated with various weight of nickel and cerium as promoters based on the nickel to cerium ratios via incipient wetness impregnation method. The nickel to cerium ratios are as follows: 1:5 (NC1), 2:4 (NC2), 3:3 (NC3), 4:2 (NC4), and 5:1 (NC5). The results show that all the metal modified HZSM-5 catalysts had greatly suppressed the formation of coke contents (9.0–10.5 wt.%) compared to the HZSM-5 catalyst (NC0) (15.1 wt.%). The highest pyrolysis oil yield (60.5 wt.%) was achieved by NC2 catalyst. Among the tested nickel to cerium ratios, the NC3 catalyst has demonstrated to be the potential candidates in the catalytic upgrading of sugarcane bagasse derived oxygenated pyrolysis vapours into higher contents of $C_6 – C_8$hydrocarbons in pyrolysis oil (8.82%).

KEYWORDS:

Catalytic upgrading; Pyrolysis vapour; HZSM-5; Cerium; Nickel