Phusit Saechia 2011: Hydrogen Production via Catalytic Steam Reforming of Acetic Acid and Acetone as Representative Components of Bio-oil by Using Nickel over Calcium Aluminate-Ceria-Titania Catalyst. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Apinya Duangchan, Ph.D. 112 pages.

Production of hydrogen via catalytic steam reforming by using nickel based catalyst over mixed oxides of calcium aluminate ($12CaO.7Al_2O_3$, denoted as 12C7A), ceria (CeO_2) and titania (TiO_2) from acetic acid and acetone as representative components of bio-oil was investigated**.** The catalysts were prepared by using dry impregnation method and 12C7A, CeO_2, and TiO_2 were mechanically mixed with different molar ratios of 2:1:1 and 1:1:1 used as a support. Catalytic steam reforming reactions were carried out over a catalyst in a fixed bed tube reactor at temperatures between 750 and 900^oC. Effects of reaction temperature, steam to carbon ratio (S/C), and promoted metals over nickel based catalyst (Cu, Co, Cr, and Mg) on H_2 yield and selectivity of gaseous products were studied. The results showed that high temperature and S/C enhanced H_2 generation. The best conditions for producing the highest H_2 yield were operated at 850^oC, S/C of 8, and 1 h. The addition of ceria and titania over 12C7A affected an increase of H_2 yield, selectivity and coke resistance. The Ni-Cu catalyst indicated the highest activity for H_2 production and selectivity of 43.07% and 0.83, respectively, whereas the Ni-Co catalyst is inferior to the Ni-Cu catalyst for acetic acid reforming. Moreover, the bimetallic over 12C7A–CeO_2–TiO_2 catalysts enhanced coke resistance compared to the Ni based catalyst for the same support. The acetone reforming showed a high selectivity of CH_4. It can be attributed to a decrease of H_2 yield. An aqueous phase of bio-oil produced from pyrolysis of coffee bean residue was tested by using 15%Ni-5%Cu /12C7A-CeO_2-TiO_2 and it provided 21.18% of H_2 yield.

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