DEACTIVATION CHARACTERISTICS OF METAL OXIDE CATALYSTS IN THE CO-PYROLYSIS OF WASTE COTTON AND PLASTIC

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ABSTRACT

Pyrolysis of waste cotton to recycle precious hydrocarbons and produce useful oil products represents an attractive technology for reducing waste that is being disposed in landfills. Pyrolysis provides a viable alternative to landfill disposal by undergo the thermal decomposition of biomass in the absence of air or oxygen. In this study, waste cotton and plastic are used as feedstock in catalytic co-pyrolysis. Along with catalytic co-pyrolysis, coke formation has become a significant challenge in this process by blocking the micropores and reducing the catalyst's life span. Catalyst deactivation or the loss of catalytic activity is a major and ongoing concern in the practice of industrial catalytic processes. Metal oxide catalyst was chosen to study the deactivation characteristic after catalytic co-pyrolysis of waste cotton and plastic. İn this study, Chromium Aluminium (Cr-Al) as a catalyst was synthesized by a wet impregnating method where Aluminium Oxide (Al_2O_3) as support was impregnated to Chromium (III) Nitrate Nonahydrate ($Cr(NO_3)_3.9H_2O$). Then, the catalyst characterization was done to investigate the differences between fresh and spent catalysts using various techniques such as Thermogravimetric analysis (TGA), Fourier Transform Infrared (FTIR), and Brunauer-Emmett-Teller (BET) surface area analysis used to verify the occurrence of deactivation. From the analysis, deactivation Cr-Al as supported by the reduction of BET surface area of the spent Cr-Al catalyst has severely decreased by 86.56 % from 0.9004 m^2/g to 0.1210 m^2/g. The BET result shows the blocking pores occur on the surface area of spent Cr-Al, possibly due to carbon formation during the pyrolysis process. The significant weight loss in TGA result of spent catalyst is happen at a temperature around 160°C to 700°C due to foreign material present, possibly carbon-based components. In conclusion, the Cr-Al catalyst deactivation happens possibly due to coke formation that supports by analysis results from BET, FTIR, and TGA.