EFFECT OF TEMPERATURE AND DURATION PARAMETERS ON PYROLYSIS PRODUCT QUALITY IN THE CATALYTIC CO-PYROLYSIS OF WASTE COTTON FABRIC AND PLASTIC

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By

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ABSTRACT

Plastic and biomass waste have a huge potential to be converted into energy and other useful products by pyrolysis. In addition, co-pyrolysis of biomass with other materials can increase oil production and quality while requiring minimal modifications to the system's operation, and the catalyst's presence has further advantages. In this study, the catalytic co-pyrolysis of waste cotton fabric (WCF) and polypropylene (PP) plastic at different temperatures and pyrolysis duration in the presence of chromium-alumina (Cr-Al) catalysts in a fixed bed reactor were carried out. The catalyst was prepared by using the wet impregnation method with different concentrations of Cr-Al (10% Cr-Al, 15% Cr-Al and 20% Cr-Al). The catalytic co-pyrolysis of WCF and PP with different concentrations of Cr-Al were performed to choose the best catalyst. 20% Cr-Al was chosen as a catalyst since the highest liquid product yield was achieved during this process. The effect of temperatures and pyrolysis durations on the quantity of the catalytic co-pyrolysis of WCF and PP products were analysed by calculating the product yield. According to the findings, when the process temperature rises, the yield of the liquid product rises. The ideal pyrolysis temperature and pyrolysis durations are 600°C and 30 minutes, respectively. At a temperature of 600°C, the highest amount of liquid was produced (40.60 wt%), with the lowest amount of char yield (9.20 wt%) and the highest amount of gas yield (50.20 wt%). Due to the same source of biomass material used in all studies, the obtained gas and liquid products have a similar functional group. The most desirable components in liquid and gas products were produced during 60 minutes of pyrolysis durations at a temperature of 600°C. The largest liquid product yield in terms of quantity was achieved during 30 minutes of pyrolysis, whereas the best product quality was achieved for 60 minutes. The ideal pyrolysis time was determined to be 60 minutes because catalytic co-pyrolysis intends to address product quality issues brought by the pyrolysis process. Therefore, 600°C for 60 minutes of pyrolysis time was the optimal temperature for the catalytic co-pyrolysis of WCF and PP with 20% Cr-Al as the catalyst.