# Characteristics of Hybrid Coal from Co-Pyrolysis of Lignite and Corn Cob

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**Abstract**

Lignite is the lowest rank coal which has less economic value. Corn cobs are solid waste biomass as a by-product of corn processing. The processing of these two materials can produce a product in the form of hybrid coal through the co-pyrolysis process. This study aims to determine the optimum temperature and mixing ratio of co-pyrolysis of lignite and corn cob and to characterize the hybrid coal produced by co-pyrolysis. The lignite is dried and crushed to a particle size of 20-50 mesh. Corn cob was cleaned, cut into pieces, and sieved to a size of 0.4-2 mm. Then it was dried using an oven at 105$^{o}$C for 24 hours. Lignite and corn cob were mixed with a ratio of 3:1, 1:1, and 1:3 (mass of lignite: mass of corn cob). The mixture of materials is inserted into the pyrolysis reactor as much as 400 grams. The pyrolysis process was carried out at temperatures of 350$^{o}$C, 400$^{o}$C, 450$^{o}$C, 500$^{o}$C, and 550$^{o}$C for 1 hour by flowing nitrogen gas into the reactor with a flow rate of 1.5 L/minute. The results showed that increasing the mixing ratio and co-pyrolysis temperature would decrease the yield of hybrid coal. Increasing the pyrolysis temperature will increase the calorific value of hybrid coal. Still, the effect of the mixing ratio of lignite and corn cob shows a decrease in heating value at a mixing ratio of 1:1 and an increase in a mixing ratio of 1:3. Other parameters such as moisture content and volatile matter content decreased with increasing temperature and mixing ratio. In contrast, ash content and fixed carbon content increased. So, an optimum temperature and mixing ratio of 450$^{o}$C and 1:3 is the best condition to get hybrid coal that met the requirements to be a solid fuel.

***Keywords:*** *biomass; co-pyrolysis; corn cob; hybrid coal; lignite*