Topic: Upgrading of Pyrolysis Bio-Oil by Catalytic Deoxygenation Using CoMo and NiMo based Catalysts.

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ABSTRACT

Bio-oil produced from the fast pyrolysis of biomass is a potential candidate to replace conventional fossil-derived fuels. The fast pyrolysis derived oil generally has high oxygen contents (30-40 % wt) that make it unstable, corrosive and have low heating value. Because of unstable properties of bio-oil, a model bio-oil, which is the mixture of pure chemicals mainly present in real bio-oil, was used in this study. This study aims to investigate the upgrading of model bio-oil by deoxygenation method for oxygen removal using various catalysts. The composition of model bio-oil used resembles that derived from pyrolysis of eucalyptus bark, which is well known as major residue from paper production. The experiments were done in a high-pressure autoclave reactor operated on a batch mode with CoMo and NiMo based catalysts. The effects of stirring rate, operating temperature, catalyst type and dosage, initial pressure of H_2 and presence of water on oxygen removal performance from bio-oil and properties of upgraded bio-oil products were investigated.

At 350°C, solid formation and oil cracking were observed from experiments using the CoMo catalyst, which resulted in a low yield of the upgraded oil product and low deoxygenation efficiency. The operating temperature of 325°C was then used as the maximum temperature in all further experiments. The results illustrate that increasing the stirring rate to 1000 rpm could minimize the mass transfer limitation and also increased the efficiency of oxygen removal at temperature range of 250-325°C. NiMo catalyst gave higher deoxygenation efficiency throughout the temperature range of 275-325°C compared to CoMo catalysts. Initial pressure of H_2 was another factor that affects deoxygenation efficiency. The higher the initial pressure, the higher the deoxygenation efficiency. The presence of water in bio-oil was also found to inhibit the oxygen removal performance of catalysts.