

## ABSTRACT

The increasing global energy demand encourages the development of sustainable alternative energy, one of which is biofuel from used cooking oil. Conversion of used cooking oil into biofuel through hydrocracking reaction requires an efficient catalyst, such as Ni-Cu with mesoporous silica as a carrier. Mesoporous silica was chosen because it has a high surface area, uniform pore size, and good thermal stability. The pH condition greatly affects the synthesis process of mesoporous silica. This study aims to determine the effect of pH variations (1, 3, and 6) in the synthesis of mesoporous silica as a carrier for Ni-Cu catalysts in hydrocracking reactions. Mesoporous silica was synthesized using the reflux method with CTAB and Pluronic P123 templates. The Ni-Cu/mesoporous silica catalyst was synthesized by the wet impregnation method using Ni-Cu metal at a ratio of 3:1. Catalyst characterization includes GSA, XRD, FTIR, and acidity tests. Activity and selectivity tests were carried out through the hydrocracking reaction of used cooking oil with a catalyst:feed ratio of 1:100. GSA results showed that the K-6 catalyst had the highest surface area and acidity, 413.44m<sup>2</sup>/g and 7.63mmol/g, respectively. XRD data showed the amorphous nature of silica and the presence of Ni and Cu metals. FTIR spectra showed Lewis and Brønsted acid sites on all catalysts. Activity tests showed that the K-6 catalyst had the highest selectivity towards biofuel at 78.99%. These results indicate that pH variations affect the characteristics of the catalyst and that the Ni-Cu/mesoporous silica catalyst has the potential for sustainable conversion of waste cooking oil into biofuel.

**Keywords:** Ni-Cu catalyst, mesoporous silica, pH variation, hydrocracking, biofuel, waste cooking oil