

## CHAPTER V

### CONCLUSIONS

Zeolite NaX samples with varied crystallinity were synthesized by adjusting hydrothermal time from 0 to 24 h. HT0 and HT4 displayed similar characteristics, with crystallization beginning after 4 h. Complete zeolite crystallization occurred with treatment times of 8 hours or longer. Impregnation with potassium acetate buffer and subsequent calcination transformed the precursor into potassium carbonate. Catalysts employing zeolite NaX with higher crystallinity exhibited stronger and higher basicity, consequently enhancing catalytic efficiency in transesterification reactions, despite possessing similar surface areas, morphology, elemental compositions, and functional groups. K/HT8, K/HT12, and K/HT24 effectively facilitated the transesterification reaction, each achieving biodiesel yields about 80%. However, the spent catalysts proved ineffective for reuse due to the leaching of potassium carbonate from the support surfaces by methanol.

The synthesis of gamma-valerolactone (GVL) from methyl levulinate (ML) utilizing 2-propanol as a solvent via catalytic transfer hydrogenation has been successfully demonstrated, employing NiCu alloy as a catalyst in comparison to Ni catalysts. Both Ni and NiCu catalysts exhibited significant ML conversion rates and GVL yields under high-temperature conditions (200 °C). Notably, the NiCu catalyst displayed superior performance even at lower temperatures, achieving a GVL yield of 75% within a 6 h, reaction temperature at 140 °C. Conversely, the Ni catalyst demonstrated comparable performance solely at 200 °C, yielding inadequate GVL (28%) at 160 °C and exhibiting no catalytic activity below this temperature.

This thesis has provided a deeper understanding and data for the development of catalysts such as K/NaX and NiCu alloy for the conversion of both liquid and solid biomass into high-value chemicals such as biodiesel and GVL.