

Abstract

The ongoing increase in CO₂ emissions has increased global warming and made it necessary to seek sustainable carbon management technologies. One of the possible solutions that is more ecologically friendly in the sense of its foundation on the decrease in greenhouse gases and the implementation of waste as a resource worth using is the transformation of CO₂ with the help of glycerol contained in biodiesel into Glycerol Carbonate (GLC). Glycerol is directly carbonylated using CO₂. Which is an economic process and produces only water as a by-product. High conversion under mild conditions is constrained by CO₂ thermodynamic stability and low solubility in glycerol. To eliminate these drawbacks, very efficient catalysts were needed.

In our work, we synthesized an ionic liquid-based zeolite for glycerol and CO₂ conversion, which acts as a catalyst to form cyclic carbonates via chemical conversion of CO₂, respectively. The catalyst was synthesized using the grafting method, which is good for surface modification. The catalyst was characterized using FTIR, XRD, and SEM-EDX. The FTIR results showed that the catalyst was free from any impurity, but in GC-MS and GC-FID it showed less efficiency than expected.

CO₂ was fixed into cyclic carbonates using the synthesised catalyst. Ionic liquid (Imidazole) allows the functional groups to react directly with the CO₂ Zeolite (ZSM-5) provides surface area for Glycerol is directly carbonylated with CO₂ to produce cyclic carbonates. In contrast to traditional catalytic systems, the synthesized ZSM-5@IMI did not show any indication of the amount of glycerol converted to cyclic carbonates within the tested conditions. FTIR analysis of the product after a reaction showed a weak interaction between CO₂ and glycerol. The fact that less cyclic carbonate was formed may indicate that the conditions are less efficient for activation of CO₂. The FTIR weak interaction shows that there is less adsorption. Therefore, the catalytic action is less practical in fixing CO₂.