Abstract

CO2 is a greenhouse gas that mainly contributes to major environmental issues such as global warming, ocean acidification, and acid rain. Several strategies have been developed to alleviate the effects of the increased atmospheric absorption of CO2 such as capture, utilization, and storage (CCS). Among all the developed methods, the selective CO2 capture and utilization as C1-feedstock for preparing high-value chemicals and fuels has been considered as a promising step towards reducing the growing absorption of atmospheric CO2. Various catalysts have been synthesized for the cycloaddition (CA) of CO2 and Epoxide (EO) to form cyclic carbonates (CCs). These catalysts include Metal-organic framework (MOFs), nitrogen-based, metal complexes, metal oxide, and silica-based materials. Among them, MOFs have been considered promising candidates, for the introduction of CO2 to epoxide due to the extraordinary features of MOFs. i.e., high surface area, high porosity, mass transfer of reactants, exposed acidic and basic sites, and ease of separating from the product. The catalysts exhibiting acidic sites to assist the opening of EO ring and basic sites to capture the CO2 molecule via electrophilic carbon contribute significantly to the of CO2. The efficiency of a reaction depends on acidity of the central metal atom of the MOF. This review covers the most recent MOFs synthesized for the CA of CO2 to CCs.

In our work, we synthesized the 3D structure, Calf-20 that is composed of zinc, triazolate, and oxalate filled with nanometer scale holes for CO2 conversion to useful products. The catalyst was prepared by hydrothermal method because this method improved the catalytic efficiency of the reactant. The designed catalyst was then characterized by UV-visible, FTIR and SEM. The FTIR and SEM results shows that the fabricated catalyst is free of any impurity. SEM results revealed the fact that the prepared catalyst have porous morphology.

The synthesized catalyst was used to fix the CO2 into different epoxide to obtain cyclic carbonates. Our designed catalysts were very efficient for the reaction without any solvent & co-catalyst because it contains Lewis acid- Lewis base pair. The major products obtained were cyclohexene carbonates, Aliphatic carbonates, monomers of carbonates, polycarbonates, styrene and carbonate. Various factors like time, temperature and amount of catalyst influenced the conversion and selectivity of cyclic carbonates. It has been notes that the conversion efficiency increases with the increase of temperature and reaction time. viii

The prepared catalyst was found to be efficient, cost-effective, and environment friendly catalyst for the fixation of CO2 and the resulting products have many applications on industrial level.