The Synthesis of Cyclic Carbonate from Epoxide and CO_2 using Mg-MOF-74 for CO_2 Utilization

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Developments of heterogeneous catalyst system capable of catalyzing the CO_2-epoxide cycloaddition reaction with reusable properties are highly desirable on aspects of resource CO_2 utilization. CO_2 is widely regarded as a ubiquitous and nontoxic C1 feed sources for the preparation of bulk commodity chemicals and it can be considered as a standing out future alternative to depleting carbon-based fossil fuel sources[1].

As shown in Scheme. 1, CO_2 has long been recognized to be an efficient source for five membered cyclic carbonate syntheses from epoxides, since it avoids the use of toxic raw materials such as $COCl_2$ and CO.

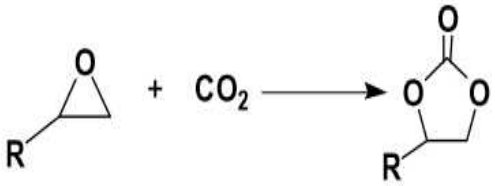
Most recently, lots of researches were aimed on the development of Metal-Organic Frameworks (MOFs). MOFs are well known organic-inorganic high porous materials, have been found to be highly efficient in materializing the epoxide-CO_2 transformation[2-3].

Mg-MOF-74 was synthesized by solvothermal methods using $Mg(NO_3)_2 \cdot 6H_2O$ and 2,5-dihydroxyterephtalic acid organic linker. The synthesized Mg-MOF-74 was characterized using various physicochemical techniques such as XRD, SEM and FT-IR, etc.

Catalytic performance of Mg-MOF-74 were determined by the cycloaddition reaction of CO_2 with epoxide to produce cyclic carbonate.

The product were analyzed by using a gas chromatography. Toluene was used as an internal standard. In this study, we have carried out at various reaction parameters like temperature, times, pressure, catalyst amount and water amount to get the optimum condition of reaction[4]. The heterogeneous catalyst was proved by studying the recyclability of the catalyst. The effects of catalyst amount and water addition for the synthesis of cyclic carbonate were showed the Fig. 1. The conversion of epoxide is founded to be increasing with the increase of catalyst amount and the addition of water. It was contributed that a bicarbonate salt of the Lewis base is formed accelerate upon reaction with carbon dioxide in the addition of water[5].

Moreover, the catalyst was recycle up to 3 times without any change in the catalytic activity.



Scheme. 1 Synthesis of cyclic carbonate from CO_2 and epoxide.

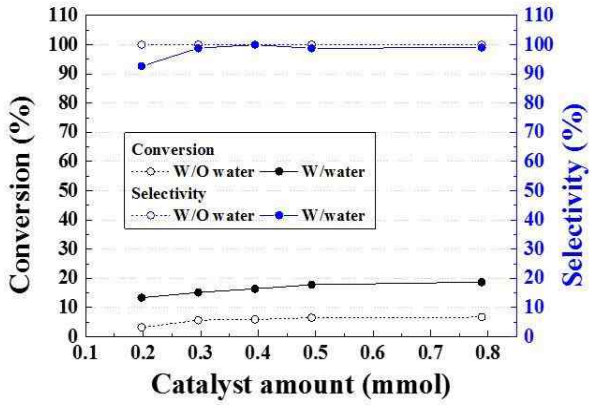


Fig. 1 Effect of catalyst amount and water addition for synthesis of cyclic carbonate.

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