CHEMICAL UTILIZATION OF CO_2 IN THE SYNTHESIS OF ORGANIC CARBONATES AND OXAZOLIDINONES

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Development of catalytic methods for chemical transformation of CO_2 into useful compounds is of paramount importance from a standpoint of C1 chemistry and so-called green chemistry. Efforts to convert CO_2 to useful chemicals will inevitably rely on transition metal catalysts. Organic carbonates have come to occupy an important position as excellent solvents and useful intermediates. In particular, Dimethyl carbonate (DMC) has been drawing much attention as a safe, noncorrosive, and environmentally friendly building block for the production of polycarbonate and other chemicals. Also, DMC is of interest as an additive to fuel oil owing to the high octane number, reducing particulate emission from diesel engines.

The reaction of CO_2 with oxiranes to produce cyclic carbonates has been of interest as a useful method for its fixation by a chemical process. Two preparative processes employing solid catalyst or CO_2-phlilic homogeneous catalyst were devised for environmentally benign synthesis of cyclic carbonates under supercritical CO_2.The designing of effective binary catalysts for two steps and judicious choice of reaction conditions are keys to one-pot synthesis of DMC. It was found that the recyclable binary catalyst system and single catalyst displayed highly active for this process under mild reaction conditions.

We also developed an efficient and recyclable catalyst for high selective synthesis of 5-substituted oxazolidinones from CO_2 and various aziridines without any added organic solvents or co-catalysts. It is also found that selective formation 5-substituted oxazolidinone or 4-substituted isomer relies on substituents at the carbon of the substrate. One of the salient features of this protocol would be that the catalyst can be readily recovered by centrifugation and reused with retention of high catalytic activity and both chemo- and regioselectivities. This process represents a greener pathway for the environmentally benign chemical fixation of CO_2 to afford 5-substituted oxazolidinones.

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