CONVERSION OF GLYCIDOL TO GLYCEROL CARBONATE UNDER ATMOSPHERIC CO_2 PRESSURE USING HALOGEN FREE BIO-BASED ORGANIC SALTS

Jitpisut Poolwong[a], Vatcharaporn Aomchad[a], Silvano Del Gobbo[a], Arjan W. Kleij[b,c,*] and Valerio D' Elia[a,*]

[a]Department of Materials Science and Engineering, School of Molecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology (VISTEC), 555 Moo 1, 21210, Payupnai, Wangchan, Rayong, Thailand
[*]valerio.delia@vistec.ac.th
[b]Institute of Chemical Research of Catalonia (ICIQ), Barcelona Institute of Science & Technology (BIST), Av. Països Catalans 16, 43007 - Tarragona (Spain)
[c]Catalan Institute for Research and Advanced Studies (ICREA), Pg. Lluis Companys 23, 08010 - Barcelona (spain)
[*]akleij@iciq.es

Carbon dioxide (CO_2) is one of the major greenhouse gases which leads to global warming. Therefore, several research groups tried to develop the new catalysts for reduce and convert CO_2 into value-added products. One of the most valuable products is cyclic carbonates. Glycerol carbonate (GC) has obtained much interest due to this material possesses specific reactivity, biodegradability, lack of toxicity or flammability, low vapor pressure and solubility in water. Moreover, this material can be used in a wild range of applications such as using as a building block for organic and polymer synthesis, as a polar organic solvent and as an electrolyte in lithium-ion batteries.[1] In this work, we discovered several bio-based organic salts can be used as homogenous catalysts for the cycloaddition of CO_2 to glycidol to produce glycerol carbonate with moderate to high conversion under atmospheric CO_2 pressure at 60 °C for 24 h. Among homogeneous catalyst, sodium citrate exhibited the best catalyst thanks to its moderate pK_b value at 7.6 and hydrogen bond donor in its structure. Sodium citrate exhibited >99% conversion of glycidol with 99% selectivity toward glycerol carbonate. Furthermore, sodium citrate was investigated in the other challenging epoxides such as 3-phenyl-2-oxiranemethanol, 3-methyl-2-oxiranemethanol and α-methyl-2-oxirane-methanol, sodium citrate showed moderate to high conversion about 76% to more than 99% conversion with harsher reaction at 10 bar of CO_2. The most challenging epoxide is 1-(oxiran-2-yl)-1-phenylethanol because of steric hindrance of substrate, sodium citrate exhibited 22% conversion of glycidol with harsher reaction at 30 bar of CO_2 for 72 h.

---

[1] a) Z. Wang, R. Gérardy, G. Gauron, C. Damblon and J.-C. M. Monbaliu, *Reaction Chemistry & Engineering* **2019**, *4*, 17-26; b) M. O. Sonnati, S. Amigoni, E. P. Taffin de Givenchy, T. Darmanin, O. Choulet and F. Guittard, *Green Chemistry* **2013**, *15*, 283-306; c) N. Yadav, F. Seidi, D. Crespy and V. D'Elia, *ChemSusChem* **2019**, *12*, 724-754.