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New process for organic carbonate synthesis with ionic liquid as solvent and dehydrating agent

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PURPOSE OF THE ABSTRACT

Climate change poses one of the major problems and challenges worldwide and is predominantly caused by an increasing amount of greenhouse gases emissions. The utilisation of carbon dioxide as an alternative, unlimited source of carbon has been identified as a priority area in the light of discussions on carbon dioxide capture and storage technologies [1]. In fact, once captured, carbon dioxide will be available in vast quantities and satisfactory purities.

One of the most promising routes to the systematic use of carbon dioxide as a chemical raw material is the synthesis of low energy molecules, such as organic carbonates. The reaction between carbon dioxide and alcohol has been a subject of intensive research and is very promising. One of major difficulties associated with the synthesis of organic carbonates in high yields directly from carbon dioxide and alcohols is the thermodynamic limitation embedded in the process, i.e. the formation of high quantities of water as a by-product. Dehydrating agents can enhance the carbonate yield by shifting the equilibrium towards the product side [2]. However, due to severe operating conditions of temperature and pressure usually applied for such processes, it is practically impossible to utilise physical water traps. The majority of the chemical water scavengers on the other hand are irreversible, and may lead to the formation of undesired by-products and/or deactivation of the catalyst.

In this work the utilisation of highly hydrophobic ionic liquids with a high carbon dioxide up-take, e.g. fluoroalkylphosphate- and tetracyanoborate-based ionic liquids [3, 4], was investigated as water traps for the production of organic carbonates. The dehydrating ability of ionic liquids was studied for the reaction of carbon dioxide with different alcohols and zinc-based catalyst, at varying reaction conditions of temperature and carbon dioxide pressure. To the best of our knowledge, it is the first example of the application of ionic liquid as physical dehydrating agent for the synthesis of organic carbonates directly from carbon dioxide and alcohol.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

carbon dioxide utilisation | ionic liquid | dehydrating agent | organic carbonate

BIBLIOGRAPHY

[1] E. Alper, O. Yuksel Orhan, Petroleum. 2017, 3, 109

[2] M. Honda, M. Tamura, Y. Nakagawa, K. Tomishige, Catal. Sci. Technol., 2014, 4, 2830

[3] M.E. Zakrzewska, M. Nunes da Ponte, J. Supercrit. Fluids, 2016, 113, 31

[4] M. Nunes da Ponte, M.E. Zakrzewska, J. Supercrit. Fluids, 2016, 113, 61