

Author's Accepted Manuscript

Synthesis of Dimethyl Carbonate and Propylene Glycol by Transesterification of Propylene Carbonate with Methanol: Catalyst Screening, Chemical Equilibrium and Reaction Kinetics

Johannes Holtbruegge, Mathias Leimbrink, Philip Lutze, Andrzej Górak



www.elsevier.com/locate/ces

PII: S0009-2509(13)00620-9
DOI: <http://dx.doi.org/10.1016/j.ces.2013.09.007>
Reference: CES11288

To appear in: *Chemical Engineering Science*

Received date: 5 April 2013
Revised date: 28 August 2013
Accepted date: 2 September 2013

Cite this article as: Johannes Holtbruegge, Mathias Leimbrink, Philip Lutze, Andrzej Górak, Synthesis of Dimethyl Carbonate and Propylene Glycol by Transesterification of Propylene Carbonate with Methanol: Catalyst Screening, Chemical Equilibrium and Reaction Kinetics, *Chemical Engineering Science*, <http://dx.doi.org/10.1016/j.ces.2013.09.007>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Synthesis of Dimethyl Carbonate and Propylene Glycol by Transesterification of Propylene Carbonate with Methanol: Catalyst Screening, Chemical Equilibrium and Reaction Kinetics

Johannes Holtbruegge^{a*}, Mathias Leimbrink^a, Philip Lutze^a, Andrzej Górak^{a,b}

^a TU Dortmund University, Department of Biochemical and Chemical Engineering, Laboratory of Fluid Separations, Emil-Figge-Strasse 70, D-44227 Dortmund, Germany.

^b Lodz Technical University, Department of Environmental and Process Engineering, Department of Heat and Mass Transfer, ul. Wólczańska 213, PL-90924 Lodz, Poland.

johannes.holtbruegge@bci.tu-dortmund.de

+49 (0) 231/755-4319

+49 (0) 231/755-3035

mathias.leimbrink@bci.tu-dortmund.de

philip.lutze@bci.tu-dortmund.de

andrzej.gorak@bci.tu-dortmund.de

*Corresponding Author

1. Abstract

This paper investigates the transesterification of propylene carbonate with methanol to form dimethyl carbonate and propylene glycol in preparation for integrating this reaction into a reactive distillation column. The investigation of suitable catalysts matching the operating window of a reactive distillation column is essential to design a feasible process. Hence, a screening of nine heterogeneous and two homogeneous catalysts to identify a suited catalyst for this reaction is presented. Afterwards, the chemical equilibrium and reaction kinetics are investigated using an experimental and theoretical approach. Molar- and activity-based chemical equilibrium constants were determined from the experimental results, and their temperature dependency was described using the van't Hoff equation. The reaction kinetics were measured using the homogeneous catalyst sodium methoxide to enhance the reaction rate. The theoretical description of the reaction kinetics was established using an activity-based approach to account for the non-ideal thermodynamic liquid-phase behavior. The well-known Arrhenius equation was used to describe the temperature dependency of the reaction rate constant.

Keywords: batch reactor, heterogeneous catalyst, homogeneous catalyst, reaction kinetics modeling, reactive distillation, sodium methoxide

Download English Version:

<https://daneshyari.com/en/article/6591520>

Download Persian Version:

<https://daneshyari.com/article/6591520>

[Daneshyari.com](https://daneshyari.com)