Kinetics of the Reaction of Propylene Oxide with Carbon Dioxide in the Presence of Tetrasubstituted Ammonium and Phosphonium Halogenides

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Abstract—Reactions of alkylene oxides with carbon dioxide underlie the industrial technology of ethylene- and propylene carbonates. Looking for new catalytic systems for these processes remains of interest due to the possibility of creating a new energy-saving process for the production of ethylene and propylene glycols. This work is aimed at comparing the catalytic activity of halogenides in the reaction of propylene oxide (PO) and carbon dioxide in the presence of tetrasubstituted ammonium and phosphonium halogenides, and evaluating the feasibility of using them in designing industrial technologies for the production of alkylene carbonates and glycols as active catalytic systems. Triphenylphosphine halogenides have been shown to possess high catalytic activity as compared to triethanolamine-based analogs. In terms of efficiency, triphenylphosphonium bromides are as good as the familiar catalysts based on potassium iodide. The high activity of these catalysts in the reaction for propylene carbonate (PC) production and their good solubility in the reaction medium allow us to propose them for the development of industrial technology for the subsequent production of alkyl carbonates and alkylene glycols.

Key words: propylene oxide, propylene glycol, propylene carbonate, carbon dioxide, hydration, hydrolysis, homogeneous catalysts, kinetics, reaction rate constant, alkyl-triphenylposphonium halogenides.

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