QUATERNARY AMMONIUM METHYL CARBONATES: A NEW GREEN PROCESS

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ABSTRACT

Quaternary ammonium compounds, which are ionic liquids, are used in a variety of industrial products and processes. Until recently, environmentally hazardous and toxic compounds have been used in these processes. Due to legislation and other concerns, making these products and processes “green” has become desirable.

This research uses a known reaction which reacts an aliphatic tertiary amine with dimethyl carbonate to produce a quaternary ammonium ionic liquid. Previously this reaction was carried out in methanol, and the kinetics data were obtained using our “birthday cake reactor” and a refractive index detector on an HPLC. It was also determined that a solvent was necessary as no solvent produced virtually no product. As a way of making the process more environmentally friendly, the reaction was carried out in ethanol and the kinetics of the reaction was determined and compared to that of the known methanol reaction.

In ethanol, a rate constant of $3.5 \times 10^{-06}/\text{Ms}$ was determined. This was compared to the reaction in methanol where the rate constant is $9.5 \times 10^{-06}/\text{Ms}$. This shows the reaction is significantly, 2 to 3 times, slower in ethanol. Since this is an $S_N2$ reaction, and such reactions are favored by polar solvents, the difference is thought to be a result of the slightly less polar ethanol solvent.