

## Kinetics of CO<sub>2</sub> absorption in aqueous solutions of Diethylenetriamine and Piperazine

Meng-Hui Li, Guan-He Chen and Rhoda Leron

Chung Yuan Christian University, Taiwan

Aqueous diethylenetriamine (DETA) solutions are potential alternative solvents for CO<sub>2</sub> capture. Compared to alkanolamines, they have lower vapor pressure, more resistant to oxidative degradation, and less energy intensive. Also, DETA contains three amine functionalities, and its aqueous blend with an amine activator such as piperazine can be expected to have high absorption capacity and fast reaction with CO<sub>2</sub>. In this work, we investigated the kinetics of absorption of CO<sub>2</sub> in aqueous solutions of DETA + PZ (total amine concentration = 30 wt%). The absorption experiments were performed at temperatures 303.15, 308.15, and 313.15 K using a wetted-wall column apparatus. The concentrations of the solvent systems were DETA (26 wt%) + PZ (4 wt%), DETA (22 wt%) + PZ (8 wt%), and DETA (18 wt%) + PZ (12 wt%). Physical properties of the solvents such as density and viscosity were measured, while Henry's constant (physical solubility) and diffusivity of CO<sub>2</sub> in the solvents were estimated by applying an N<sub>2</sub>O analogy. The pseudo-first order apparent reaction rate constants for the CO<sub>2</sub> absorption were estimated from the obtained kinetics data. Results show that the absorption rate of CO<sub>2</sub> in the aqueous DETA + PZ blends was significantly higher than in conventional amine solvents. The absorption was described via hybrid reaction rate model, which assumed a pseudo-first order reaction and a zwitterion mechanism for the reactions of CO<sub>2</sub> with PZ and DETA. The values of the apparent rate constants predicted from the model was in reasonable agreement with the values estimated from the measurements (AAD < 3%).

### Biography

Meng-Hui Li completed his Ph.D. and postdoctoral studies from the University of Oklahoma, U.S.A. He is currently the Dean of the College of Engineering of Chung Yuan Christian University. For more than 20 years, he has been working on carbon dioxide absorption in advanced solvents, amines, ionic liquids, deep eutectic solvents, etc. He published more than 100 papers in international SCI journals.

[mhli@cycu.edu.tw](mailto:mhli@cycu.edu.tw)