Chapter 6

Overall conclusions and recommendations

The important conclusions made out of this research work and recommendations for future study are summarized in this chapter.

6.1 OVERALL CONCLUSIONS

- Addition of AEEA into aqueous MAE + AEEA and EAE + AEEA blends resulted in increased equilibrium CO_2 solubility into these amine blends.
- Maximum equilibrium CO_2 solubility in aqueous MAE + AEEA and EAE + AEEA blends had occurred 0.944 and 1.033 mol CO_2/mol amine, respectively, at 298.15 K, 20.27 kPa of CO_2 partial pressure, 10 weight % total concentration with 0.30 weight fraction AEEA in the amine MAE + AEEA and EAE + AEEA blends.
- Equilibrium CO_2 solubility in aqueous MAE + AEEA and EAE + AEEA blends had occurred 0.632 and 0.748 mol CO_2/mol amine, respectively, at 313.15 K, 15.20 kPa of CO_2 partial pressure, 30 weight % total concentration with 0.30 weight fraction AEEA in the amine MAE + AEEA and EAE + AEEA blends.
- Modified Kent-Eisenberg model with newly introduced correction factor (F_k) for MAE+AEEA+H_2O+CO_2 system was useful for estimation of equilibrium CO_2 solubility with 4.17 % AAD.

- Semi-empirical modified Kent-Eisenberg model and empirical model predicted equilibrium CO_2 solubility data for aqueous EAE + AEEA blend were in good agreement with experimental solubility data with 2.56 % and 0.45 % AAD, respectively.
- Heat of CO_2 absorption using Gibbs-Helmholtz equation was determined as -73.4 kJ/mol for MAE+AEEA+H_2O+ CO_2 system.
- Heat of CO_2 absorption for aqueous EAE+AEEA blend was -72.2 kJ/mol that was 15.13 % less heat of CO_2 absorption than MEA solution resulting less energy requirement for CO_2 capture in compared to MEA.
- The aqueous blend of EAE and AEEA had 48.18 % more cyclic capacity than aqueous MEA.
- Initial change of CO_2 solubility during absorption in 30 wt. % (21wt. % + 9 wt. %) aqueous EAE + AEEA was 21.1 % more than in 30 wt. MEA solution.
- Rate of change of CO_2 solubility during desorption in 30 wt. % (21wt. % + 9 wt. %) aqueous EAE + AEEA was almost double of 30 wt. MEA solution.
- Density of aqueous EAE and aqueous EAE + AEEA blend (at fixed EAE/AEEA weight ratio) decreased by increasing amount of amine in the mixture but aqueous AEEA showed increased density by increasing concentration of AEEA.
- Density of aqueous EAE + AEEA blend was correlated to a new empirical model and AAD % for this model was 0.02.
- Density of CO_2-loaded solution increased by increasing CO_2 loading (α) and decreased by increasing temperature.

- Viscosity of all mixtures increased by increasing amine concentration and decreased by increasing temperature of samples.
- Experimental viscosity data were correlated to newly proposed models and average absolute deviation (AAD) % was 1.51, 2.02, and 2.88 for viscosity of EAE + H_2O, AEEA + H_2O, and EAE + AEEA + H_2O, respectively.
- Viscosity of CO_2 loaded solution was decreased by increasing temperature and slightly increased by increasing CO_2 loading (α).
- CO_2 loaded viscosity data was correlated with Wieland model and AAD % for this fitting was 2.85.
- A new empirical model was also proposed to calculate CO_2 loaded viscosity for aqueous EAE + AEEA and AAD % was 4.74.
- Diffusivity of CO_2 into the aqueous EAE + AEEA blend was increased by increasing temperature.

6.2 RECOMMENDATIONS FOR FUTURE WORKS

On the basis of the findings and conclusions of this study, some works for research in the future can be recommended as follows:

- Experimental reaction rate kinetics study should be performed for aqueous MAE + AEEA and EAE + AEEA blends.
- Desorption study for aqueous MAE + AEEA blend should be done.
- Heat of CO_2 absorption for aqueous MAE + AEEA and EAE + AEEA blends should be measured experimentally.
- Mass transfer coefficients should be measured.
- CO_2 removal efficiency measurement for aqueous MAE + AEEA and EAE + AEEA blends should be carried out in the continuous process.
- Effects of the presence of NO_x and SO_x in the flue gases on CO_2 removal efficiency should be studied.
- Study for degradation and corrosion should be performed.
- A pilot plant study should be carried out using these absorbents for CO_2 capture from flue gases
- Some new amine blends also should be studied for post-combustion CO_2 capture from flue gases.