CO2 capture by tetramethylenediamine in aqueous solution at different loading

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<u>Introduction</u>: CO2 is the most important of greenhouse gases (contribute to 60%). Developing technologies for CO2 capture are necessary to effectively address global warming. Post-combustion method is considered to be the most mature technology. The use of a solvent with high volatility such as the reference solvent (monoethanolamine, MEA), in addition to the environmental impact of the solvent vapors, will increase the cost of the CO2 capture process because of the need to reload the solvent to optimize the reaction. Several alternative solvents among which tertiary class of amine, compound with several function of amine, ionic liquids ... are studied to assess their CO2 absorption load, degradation and evaporation ratio.

<u>This work</u> investigates the volatilities of two aqueous amine solvents using a static apparatus with on-line GC analysis of the vapor phase: N,N',N'-tetramethylethylene diamine (TMEDA) and monoethanolamine (MEA) for comparison at four temperatures (293-353 K). The compositions of the binary systems are 30 wt% of MEA in water and 10, 30 and 50 wt% of TMEDA in water.

These solutions were also studied at different CO2 loading and the partial pressure of amine, water and CO2 were deduced, Fig1-3. The loading of CO2 was determined by volumetric titration (Mahi et al., 2019).



<u>Conclusion</u>: Vapor-liquid equilibria of binary systems were studied. The partial pressures, P_{MEA} or P_{TMEDA} , P_{H2O} were determined using on-line gas chromatography. A good agreement of the total pressure of the solution, P_t , with literature data is obtained.

In a second step, the systems (water+MEA+CO₂) and (water+TMEDA+CO₂) were studied at several temperatures, different weight percent of amine and various loading of CO₂. In the same way the partial pressures, P_{MEA} or P_{TMEDA} , P_{H2O} along with P_{CO2} were determined. The range of the partial pressure investigated is particularly large, from 2 Pa to approximately 400kPa. Partial pressures of the system (water+MEA+CO₂) are in a good agreement with literature data. As for the mixtures (water+TMEDA+CO₂), no literature data was found for comparison.

The model of (Gabrielsen et al., 2005) and the empirical expression developed by (Xu, 2011) satisfactorly correlate respectively the CO_2 absorption isotherms (for both systems) and the partial pressure of MEA and TMEDA.

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