Comparison of absorption rates between single lipophilic hexylamine and mixture of dimethylcyclohexylamine/hexylamine aqueous solutions on the CO2capture

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Abstract

Although anthropogenic greenhouse gas emissions, among them CO₂, are expected to be reduced, attractiveness and competitiveness of Carbon Dioxide capture processes show values against their enhanced deployment. Besides considerable investment costs and potential leaks into the environment, conventional amine solvent based CO₂ capture technologies need steam at temperatures ranging from 393 K till 413 K for the regeneration of solvent. Moreover, regeneration at this temperature range promotes amines’ degrading. The capture process removes CO₂ from a fumes or natural gas with an energy consumption of about 4 GJ/tonne of CO₂. In order to avoid solvent degradation and reduce energy consumption when capturing CO₂, the work presented concerns the selection of lipophilic amine based solvents. The advantage of these types of solvents is that aqueous-organic-gaseous (rich CO₂) phases separate while temperature increases from ambient up to maximum 90°C. Regeneration takes place partially at this temperature and avoids steam to be used. After a thorough assessment of amines available, 3M hexylamine aqueous solvents and mixtures with DMCA (dimethylcyclohexylamine) are tested in a Lewis cell reactor in order to evaluate the absorption kinetics of CO₂. The tests are performed at 293, 303 and 313 K. Experimental results show the impact of amine blends on the kinetics of absorption and enable novel solvents to be suggested for low energy carbon capture processes.