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Desorption of carbon dioxide from aqueous MDEA solution in a microchannel reactor

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CO_2 desorption from N-methyldiethanolamine (MDEA) rich solutions was investigated experimentally in a highly efficient microchannel reactor. The effects of various parameters including MDEA concentration, desorption temperature, solution flow rate and CO_2 loading on the CO_2 desorption rate were studied. It was found that the CO_2 desorption rate was most sensitive to the desorption temperature. The CO_2 desorption almost reached equilibrium when the solution residence time was about 7s, indicating the advantages of using microchannel reactors for rapid CO_2 desorption. The value of k_La was in the range of 0.36-2.68 s^{-1} in the experiments, which is comparable to that of absorption in microchannels and much larger than in conventional equipment. For the design of micro-desorbers, empirical correlations were proposed to predict the mass transfer coefficient with good prediction performance.

Keywords: microchannel reactor, CO_2 capture, desorption, N-methyldiethanolamine, mass transfer

1. Introduction

In recent years, climate change due to global warming is a major challenge to the world. The annual global emissions of CO_2 from human activities are more than 40 billion metric tons, 86% of which comes from the combustion of fossil fuels [1]. In order to curb global warming, carbon capture and storage (CCS) is regarded as a critical strategy to reduce CO_2 emissions. It includes several technologies that are available for the separation of CO_2 from various industrial gas streams, such as physical/chemical absorption, adsorption, membrane, cryogenic and biotechnology, etc. Among all these technologies, chemical absorption using alkanolamines is commercially available and comparatively mature capture process. The

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