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

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CO₂ 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 CO₂ loading on the CO₂ desorption rate were studied. It was found that the CO₂ desorption rate was most sensitive to the desorption temperature. The CO₂ desorption almost reached equilibrium when the solution residence time was about 7s, indicating the advantages of using microchannel reactors for rapid CO₂ 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; CO₂ 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 CO₂ 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 CO₂ emissions. It includes several technologies that are available for the separation of CO₂ 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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