An Approach to Carbon Dioxide Capture and Storage at Ambient Conditions: Laboratory Studies

Researcher: Brett Spigarelli

Abstract

Carbon dioxide capture and storage experiments were conducted at ambient conditions in alkali solutions. Experiments concluded that a 2% alkali solution, by weight, was the most efficient solution at capturing CO_2. The solution was able to absorb 0.5 kg CO_2/kg alkali. These results led to studies to determine how the gas bubble size and % CO_2 in the feed stream affect carbon dioxide absorption. Studies were conducted using ASTM porosity gas diffusers (fine, medium, and extra coarse) to vary the bubble size. With a medium porosity gas diffuser, the alkali solution was able to absorb roughly 50% of the CO_2 fed to the system. Variation in the bubble size concluded that absorption rate of carbon dioxide into the alkali solution does depend on the bubble size, thus is mass transfer limited. The % CO_2 in the feed stream was varied at 16%, 13%, and 9% CO_2 while keeping the total gas flow rate constant at 17.14 ml/sec. The alkali solution was able to absorb the same amount of CO_2 regardless of the percent in the feed stream. However, as the %CO_2 was decreased CO_2 absorption time increased. These results indicate that the system is mass transfer limited at the current operating conditions. CO_2 was successfully absorbed –can it be now stored as a carbonate mineral? Studies of CO_2 sequestration at ambient conditions have shown that it is possible to sequester CO_2 in the form of calcium carbonate and regenerate a fraction of the alkali absorbent using an industrial waste.