

Crystalline Products of CO₂ Capture by Amines

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Primary and secondary amines can react directly with CO₂ to form crystalline products. For this reason, amines have been studied for their potential industrial application in carbon dioxide capture and storage (CCS). CCS is a growing technology intended to prevent the further release of CO₂ into the atmosphere. To study the role of amines in CCS, experiments were conducted using a variety of amine reagents to determine their capacity for CO₂ capture. Crystalline products were obtained by using different reaction conditions of chosen amines with CO₂. The following amines were used: piperidine, 4-methylpiperidine, morpholine, thiomorpholine, diethylenetriamine, piperazin-2-one, hexamethylenediamine, and aminoethylpiperazine. Saturated amine solutions were prepared in water, ethanol, and methanol solvents; two-component amine mixtures and pure samples of liquid amines were also tested. The samples were allowed to react with CO₂ by means of dry ice, CO₂ gas, or atmospheric CO₂. The crystalline products obtained from these reactions were analyzed. Single crystal X-ray diffraction analysis revealed the formation of zwitterionic carbamate derivatives that have been previously observed, with the addition of newly-obtained products. More research is required to establish which amines are favorable for the CO₂ capture process.