Carbon Dioxide Sequestration to form Calcium Carbonate Nanoparticles

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The emission of carbon dioxide caused by burning fossil fuels is one of the leading sources of global warming. Reducing the amount of CO_2 released into the atmosphere through carbon sequestration can mitigate this problem. One method of carbon sequestration is the use of a carbon dioxide scrubber. Once captured, CO_2 can be used to create a valuable chemical commodity such as calcium carbonate nanoparticles. To create $CaCO_3$ particles in the 50-100 nanometer range, a chemical additive is necessary to limit particle size. The study used a laboratory scale carbon dioxide scrubber to react CO_2 with calcium chloride and OH^- ions to form calcium carbonate nanoparticles. Varying $CaCl_2$ concentrations were tested as well as two chemical additives (AOT and PEG) in varying amounts. The resulting $CaCO_3$ nanoparticles were analyzed to determine average particle size using dynamic light scattering. The study confirmed that the scrubber process effectively reduced CO2 released from the system. In general, larger quantities of additive led to smaller particles, but while AOT and PEG both limit CaCO3 particle size, AOT was the most effective. Unexpected results showed that larger concentrations of $CaCl_2$ reduce the formation of bubble build-up in the reactor. Future work can be done to explore this effect of $CaCl_2$ on sud formation by monitoring and recording bubble levels during the reaction.