

Carbonate mineralization of $\text{CO}_2(\text{g})$ using $\text{Ca}(\text{OH})_2$ suspensions at the ambient conditions

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$\text{CO}_2(\text{g})$ has been considered as one of the major greenhouse gases bringing about the global warming. Carbonate mineralization has been known to be a potential way to reduce anthropogenic $\text{CO}_2(\text{g})$ release into the atmosphere. It would be also possible that the carbonate solid products of this technique can be recycled as industrial resources. However, the efficacy of the carbonate mineralization for removing $\text{CO}_2(\text{g})$ has not been successful for practical application yet. The main objective of this study is to examine the feasibility of using $\text{Ca}(\text{OH})_2$ suspensions for the removal of $\text{CO}_2(\text{g})$ through carbonate mineralization.

Batch experiments were conducted with $\text{CO}_2(\text{g})$ (purity 99.999%) purged into various concentrations of $\text{Ca}(\text{OH})_2$ suspensions (0.020, 0.027, 0.135, 0.270, 0.675 M) at the ambient conditions (23 ± 2 °C, 1 bar). $\text{CO}_2(\text{g})$ was injected into the suspensions for 60 min at 0.1 L/min. The initial pHs of the $\text{Ca}(\text{OH})_2$ suspensions were 12.5 ± 0.2 . After $\text{CO}_2(\text{g})$ injection, the pH of the suspensions, except that of 0.675 M $\text{Ca}(\text{OH})_2$ (12.5 ± 0.2), all decreased to 6.3 ± 0.2 . Concurrently, the concentration of dissolved Ca^{2+} were suddenly decreased to a minimum value (0.46 mM) in parallel with the decrease in the suspensions' pH. Subsequently, the Ca^{2+} concentrations increased and reached the solubility window of calcite (10.0 mM) at the pH of the suspension (6.3 ± 0.2). Analyses of the residual solid products indicated that 92 wt.% of the original $\text{Ca}(\text{OH})_2$ was rapidly converted to calcite within 2 hr. These results suggest that $\text{CO}_2(\text{g})$ can be readily trapped into a solid phase via carbonate mineralization processes, which need to be further investigated for practical application of carbonate mineralization.