CHEMICAL REGENERATION OF AMINE SOLVENTS USING CALCIUM HYDROXIDE FOR CO_2 CAPTURE PROCESS

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Since the industrial revolution, large quantities of greenhouse gases have been emitted into the atmosphere, where they have accelerated global warming. To reduce CO_2 emission, various methods have been identified as carbon dioxide capture and storage (CCS) processes. Various amine absorbents have been developed and commercialized to capture CO_2 because aqueous amine solvents have been shown to exhibit high CO_2 absorption capacity through their acid-base reaction. However, development of commercial CO_2 capture technologies is expensive, energy-intensive, and results in equipment corrosion, thereby reducing plant efficiency. Especially the regeneration energy of amine solvents consumes about 70% of the total energy used for CO_2 capture. Many studies have attempted to find better methods to reduce regeneration energy. In this study, we have developed a novel method to replace thermal regeneration to chemical regeneration by using Ca-containing chemicals. The CO_2 desorption efficiency of chemical regeneration with $CaCl_2$ was 97.3% at 40^oC, which meant that chemical regeneration required less regeneration energy than that of thermal regeneration. However, the amine solution could not reuse after chemical regeneration with $CaCl_2$ because the Cl anion binds the protonated amine to form NH_3Cl to prevent protonated amine to convert free amine. As a method to solve the problem of the decreased pH after treatment with $CaCl_2$, $Ca(OH)_2$ was injected as a pH swing agent and a Ca^{2+} source. As $Ca(OH)_2$ was applied in amine solution, the regeneration efficiency of absorbent was high and could be reused. It is concluded that the suggested process of chemical regeneration using $Ca(OH)_2$ could be able to solve the most important problem with current amine capture process, which is the high regeneration energy.