Process for CO_2 Capture Using Zeolites from High Pressure and Moderate Temperature Gas Streams

Opportunity

Research is currently active on the patented technology "Process for CO_2 Capture Using Zeolites from High Pressure and Moderate Temperature Gas Streams." The technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

Overview

This invention discloses a method for separating CO_2 from a high-pressure and moderate- temperature gas stream composed of CO_2 and other gaseous constituents using a zeolite sorbent in a temperature-swing adsorption process, which produces a CO_2 stream at a high CO_2 pressure contributing to low compression costs for CO_2 sequestration. The method also uses CO_2 desorption in a CO_2 atmosphere and effectively integrates heat transfer to optimize overall efficiency. Current commercial processes for CO_2 removal from high-pressure gas streams require gas cooling to ambient temperatures contributing to lower thermal efficiencies of the process. The overall efficiency of the CO_2 removal process in the invention disclosure is higher than that of the commercial processes since the CO_2 removal process takes place at moderate temperatures and CO_2 can be recovered at high pressure. Presence of moisture in the gas stream does not affect the CO_2 sorption/desorption process of the zeolites at the reaction conditions used in the process.

The emission of CO_2 from power plants has been identified as a potential factor in long-term environmental problems. As a result, the separation of CO_2 from gaseous streams by using adsorption of gases and vapors by microporous solids has attracted industry attention due to its importance in the fields of gas separation and gas purification. Therefore, technologies based on CO_2 adsorption/desorption that use natural and synthetic zeolites are among the most effective methods.

Researchers have generally used two methods for CO_2 adsorption/desorption that apply zeolite adsorbents for CO_2 separation: temperature-swing adsorption and pressure-swing adsorption. However, at lower pressures, the CO_2 adsorption capacity of zeolites generally diminish rapidly as the temperature of the gas being separated increases. In addition, moisture sorption contributes to decreasing CO_2 capture capacities during multiple cycles.

Therefore, researchers needed a method to address these issues if zeolites are to be used in the CO_2 capture process. This invention does just that by providing a method of CO_2 separation by using zeolite adsorbents in a manner that preserves adsorption capacities at higher temperatures, recovering CO_2 at high pressure and addressing the moisture issue.

Significance

- Provides an effective method for separating CO_2 from a gas stream
- Uses a zeolite sorbent in a temperature swing adsorption process
- Preserves adsorption capacity at higher temperatures

Applications

- Fossil-fueled power systems
- Natural gas treatment
- Hydrocarbon purification
- Hydrogen gas production

Patent Details

U.S. Patent No. 8,128,735 B1; titled "Process for CO_2 Capture Using Zeolites from High Pressure and Moderate Temperature Gas Streams."

Inventor(s): Ranjani V. Siriwardane and Robert W. Stevens, Jr.

Contact

NETL Technology Transfer Group
techtransfer@netl.doe.gov

April 2012