

## SIMULATION OF CARBON DIOXIDE CAPTURE BY ADSORPTION ON ACTIVATED CARBON

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### Abstract

Rapid global warming has triggered global efforts to reduce concentration of the most contributing Green House Gas carbon dioxide (CO<sub>2</sub>). Carbon dioxide capture and storage (CCS) is considered a crucial strategy for meeting CO<sub>2</sub> emission reduction targets. The selection of specific CO<sub>2</sub> capture technology heavily depends on the type of CO<sub>2</sub> generating plant and fuel used. Among the CO<sub>2</sub> separation processes, adsorption is the most mature and commonly adopted due to its higher efficiency and lower cost. Operating conditions (temperature and pressure), CO<sub>2</sub> selectivity and cyclic stability are the important parameters in selecting suitable adsorbent for the process. Many adsorbents have been developed and studied for their performance. Among the various adsorbents, Activated Carbon (AC) materials were found to have higher selectivity and cyclic stability. The adsorption process is very complex. Adsorption and desorption kinetics depend on pore size, pore charge, bed characteristics and flow regime. In this paper, simulation was carried out to study the rate of adsorption of the gas on ACs, and analyzed along with the unsteady heat transfer. A parametric analysis was carried out to study the effect of various crucial parameters like radius of bed, fluid temperature, and heat transfer coefficient (h) on the adsorption amount. The results are validated with literature data. The simulation results show that initial bed temperature, bed radius, and heat transfer coefficient play significant roles in the effectiveness of CO<sub>2</sub> capture process.

*Keywords:* Activated carbon; Bed radius; Carbon dioxide capture and sequestration; Mathematical model; Unsteady heat transfer