Supplementary Information

Description of adsorption models and equations:

To clearly describe the CO_2 adsorption behavior on the synthesized zeolite, the Toth, Freundlich, and Langmuir models were used to fit the isotherm using the software Origin 7.0®.

The Toth isotherm model is a three-parameter equation derived from the Langmuir equation. This model assumes a quasi-Gaussian energy distribution and is a successful isotherm representing the adsorption of gases at both low and high pressure on heterogeneous surfaces.[31] This model was chosen because it takes the energetic heterogeneity of the active sites of sorbent and is represented in Equation 2[32]:

$$q = q_m \frac{bp}{(1+(bp)^n)^{1/n}} \quad (2)$$

where q_m is the maximum adsorbed amount (mmol/g), b is the Toth constant (bar^{-1}), p is the pressure (bar), and n indicates the heterogeneity of the active sites of the sorbent. The expression reduces to the Langmuir adsorption isotherm when **n**=1.

The Freundlich isotherm model was the earliest known equation describing the adsorption process. It is an empirical equation used for non-ideal sorption that involves heterogeneous sorption. The Freundlich isotherm is commonly given by the nonlinear Equation 3:

$$q = kp^{\frac{1}{n}} \quad (3)$$

where q is the adsorbed amount (mmol/g), K and n are constants for a given adsorbate and adsorbent at a particular temperature, and n represents the heterogeneity factor, becoming more heterogeneous as its value gets further from one.[33]

The Langmuir model, originally developed for the adsorption of gases into solids, assumes that adsorption occurs in a monolayer or that adsorption may only occur at a fixed number of localized sites on the surface with all adsorption sites identical and energetically equivalent. Therefore, the Langmuir equation is based on the assumption of a structurally homogeneous adsorbent. The model can be represented as follows[34]:

$$q = q_m \frac{bp}{1+bp} \quad (4)$$

where q (mmol/g) is the adsorbed amount in equilibrium with the gas phase, qm (mmol/g) is the maximum adsorbed amount, p is the equilibrium pressure of the gas phase, and b is the Langmuir affinity constant.