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Carbon dioxide (CO_2) adsorption by HKUST-1 (MOF-199)

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One approach to mitigating global warming is the capture and storage of CO_2 as the major greenhouse gas [1]. Materials that are commonly used for CO_2 adsorption include activated carbon, zeolites [2], and metal-organic frameworks (MOFs) [3]. HKUST-1 (also known as MOF-199) is a well-known metal-organic framework that has been extensively studied for its potential applications in gas storage and separation. In this work, HKUST-1 was investigated as an adsorbent for CO_2. HKUST-1was synthesized using the hydrothermal method and its chemical properties were investigated using various characterization techniques including XRD, FTIR, FESEM, BET, and TGA. It was shown that HKUST-1 has a crystalline structure with a surface area of over 1704 m^2/g, and a petal-shaped molecular structure. It also showed thermal stability up to a temperature of 366°C. The results of CO_2 adsorption showed that the amount of carbon dioxide adsorption by HKUST-1 at 20°C, 30°C and 40°C and 1bar was 3.788, 3.417, and 3.088mmol/g, respectively. However, in 10 bar and the same temperatures, its adsorbtion improved to 9.090, 8.782, and 7.724 mmol/g, respectively. Therefore, it can be concluded that the amount of carbon dioxide adsorption enhanced with increasing CO_2 pressure and decreases when temperature increases. Therefore, HKUST-1 could be suggested as a promissing CO_2 adsorbent at moderate temperatures.

Keywords: CO_2 adsorption, metal organic frameworks, HKUST-1, CO_2 Capture, greenhouse gas

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