Evaluation of CO_2 diffusion on aluminum based metal organic frameworks

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Metal-organic frameworks(MOFs), highly porous crystalline materials, are composed of metal clusters connected by organic linkers. As they have high porosity, large surface area and large pore volume, a considerable amount of specific gases can be adsorbed onto these pores. Hydrogen, a clean energy fuel can be produced by Steam Methane Reformer (SMR) processes. Steam methane reformer off-gas, gas produced by steam methane reformer contains mainly H_2 besides to CO_2, (10-25%v/v), CH_4 (1.3-8%v/v), CO (0.25-10%v/v) as impurities. It is critical to remove CO_2 from the gas mixture not only for up-grading of SMR-off gas but also natural gas to obtain high purity H_2 or CH_4, respectively. MOFs are considered as a potential adsorbent material to be used in gas purification and separation. Zero Length Column (ZLC) technique was conducted to measure the intraparticle diffusion properties of porous adsorbents. The response curve, yielded from quadrupole mass spectrometer, is used to determine adsorption parameters such as Henry's constant and diffusion coefficient.The adsorption kinetics of CO_2, on aluminum based organic framework was studied at 30 ^oC. The flow rates of inert carrier gas Helium will be changed as 30, 50, 70 and 100 ml/min in order to determine whether the system will be favored by equilibrium or kinetic control. CO_2 adsorption kinetics of aluminum based organic framework synthesized were compared with the commercial one (MIL-53(Al)). The results show that the calculated diffusivity values are weakly dependent on purge flow rate. The study reveals that transport is controlled by intracrystalline diffusion. The study shows that the ZLC method is an effective tool to investigate the diffusion kinetics of CO_2 gas in MIL 53 (Al).