CO2 separation using modified MCM-41 in PSA system

Abstract

Prevention of excessive amounts of CO2 is one of the main serious environmental problems facing humanity, due to its significant impact on climate change. Today, CO2 from natural gas is normally separated with alkanoamines in aqueous solution. Nevertheless, this liquid amine based processes pose operating difficulties due to equipments corrosion, solvent leakage, large equipment size and high regeneration energy. Adsorption is recognized as an economically attractive and proficient separation method toward substituting conventional CO2 separation processes as it is predicted to offer low requirements of energy for porous adsorbent regeneration while able to combine high productivity and selectivity. In this study, mesoporous material MCM-41 was synthesized and modified using monoethanolamine, MEA directly to the surface of the solid sorbents. The MCM-41 structures and physical properties were characterized using powder X-Ray Diffraction (XRD), BET surface analysis on nitrogen adsorption at 77K and thermogravimetric analysis. CO2 adsorption and desorption measurement were determined using of Pressure Swing Adsorption (PSA) system. It was found that incorporation of MEA into MCM-41 showed better result compared to unmodified MCM-41 in term of improvement in physical and chemical properties, high CO2 adsorption capacity and modified adsorbents were ease of regeneration.