Abstract

The aim of this study was to synthesize the sodium dodecyl sulfate (SDS)-treated hydrotalcite (HT) functionalized with different loading of tetraethylenepentamine (TEPA) and to find the optimized CO_2 adsorption capacity via statistical design and analysis. The TEPA-SDS/HT sorbents were characterized by X-ray diffraction, Fourier transform infrared spectrometry, CHN analysis and Brunauer-Emmet-Teller. The condition of CO_2 adsorption/desorption was performed under atmospheric pressure and dry basis. The main factors, which were of TEPA loading (30-50% (w/w)), SDS loading (0-10% (w/w)), adsorption temperature (60-100 °C), and CO_2 concentration (10-30% (v/v)), and their interactions were used to evaluate a significant influence on the CO_2 adsorption capacity by using a full 2^4 factorial design. The CO_2 adsorption capacity increased as each of these four main effects increased, suggesting that the four main effects had a positive influence on the CO_2 adsorption. The optimal condition for CO_2 adsorption on TEPA/HT obtained by a response surface method (RSM) was TEPA loading of 43-47% (w/w), SDS loading of 4-8% (w/w), adsorption temperature of 86-94 °C, and CO_2 concentration of 30% (v/v). The maximum CO_2 adsorption capacity was around 5.6-6.0 mmole g^{-1}. The CO_2 adsorption/desorption cycle tests indicated that the sorbent was stable under the studied condition.

Key Words: (1) Carbon dioxide capture (2) A full 2^4 factorial design (3) Tetraethylenepentamine (4) Hydrotalcite