Effect of Amine Structure in CO_2 Adsorbent on Ad/desorption Behaviors

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Recently, as interest in global warming and climate change has increased, research on technology development for capturing carbon dioxide has been carried out. Among the technologies used to reduce greenhouse gases is carbon dioxide capture from post-combustion gases [1].

The organic - inorganic hybrid adsorbent, in which amine is functionalized in silica pores, exhibits high selectivity and adsorption capacity when applied in CO_2 capture [2].

The important factors to consider when applying amine-based adsorbent to TSA process are working capacity and regeneration stability. Working capacity is the actual capability of the CO_2 adsorbent to be repeatedly operated in the adsorption column and the regeneration column [3].

The primary amine and CO_2 produce urea while the secondary amine and O_2 produce amide which are irreversible species and consequently, reduce adsorption capacity when the adsorbent is reused [4].

In this study, N-[Trimethoxysilyl]propyl] ethylenediamine (2NS) and 2,2-Dimethoxy-1,6-Diaza-2-silacyclooctane (2NSS) were functionalized in amorphous silica using incipient wetness method. The working capacity and regeneration stability of each adsorbent under dry and wet conditions were evaluated by TGA. The CO_2 adsorbed species and irreversible compounds were confirmed using in-situ IR.

Figure 1 is the in-situ IR spectra showing the chemical species produced during the CO_2 adsorption of each adsorbent. Each adsorbent underwent adsorption at 30 ^oC and gradually increased to 150 ^oC. The main chemical species produced during adsorption in 2NS/konasil95 and 2NSS/konasil95 was carbamate. In the case of 2NSS/konasil95, desorption was completed at a temperature lower than 2NS/konasil95.

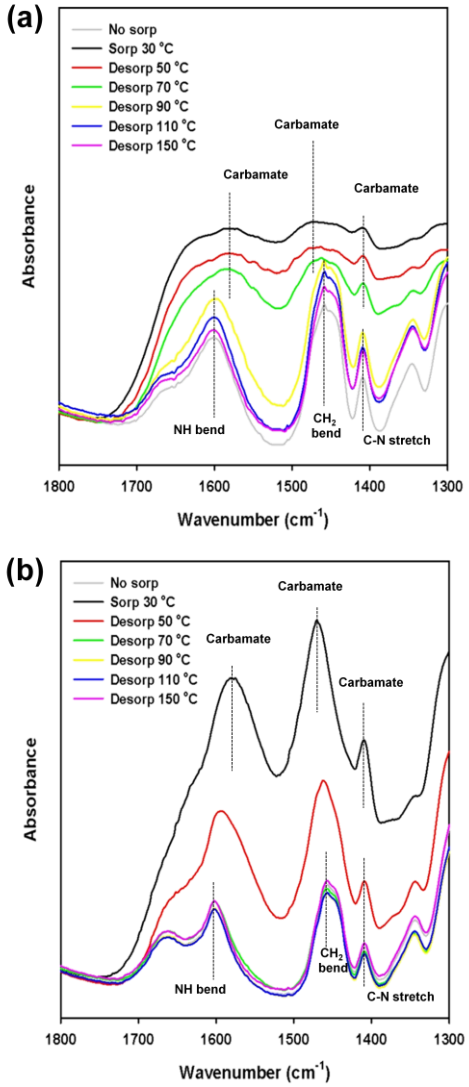

Fig.1 In-situ IR spectra (a) 2NS/konasil95 (b) 2NSS/konasil95

REFERENCES

[1] A. Samanta, A. Zhao, G. K. H. Shimizu, P. Sarkar, R. Gupta, Ind. Eng. Chem. Res., 51, (2012), 1438

[2] A.V. Krasnoslobodtsev, S.N. Smirnov, Langmuir, 18, (2002), 3181

[3] W. R. Lee, H. Jo, L. M. Yang, H. Lee, D. W. Ryu, K. S. Lim, J. H. Song, D. Y. Min, S. S. Han, J. G. Seo, Y. K. Park, D. Moon, C. S. Hong, Chem. Sci., 6,(2015), 3697

[4] C. S. Srikanth and S. S. C. Chuang, ChemSusChem, 5, (2013) 1435