Covalent organic polymer for CO_2 capture

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The climate change caused by carbon dioxide is an indispensable adjunct to the means of industrial development. This being so, substantial scientists from all over the world are focused on capture & sequestration of CO_2. Hence, lots of materials already prepared as a solution for CO_2 problems. Especially, liquid absorbent MEA (Monoethylamine) which contain amide functional group is most commonly used for CO_2 capture in these days. However, flue gas is heterogeneous and temperature is up to 40°C. This occur the corrosion and thermal degradation of MEA to be loss, decrease the efficiency of capturing the gas (8-35%) and, unable recycle by chemically irreversible change. Therefore in this research we design the materials which keep the benefit of the MEA, CO_2 capturing capacity, and improve their drawbacks.

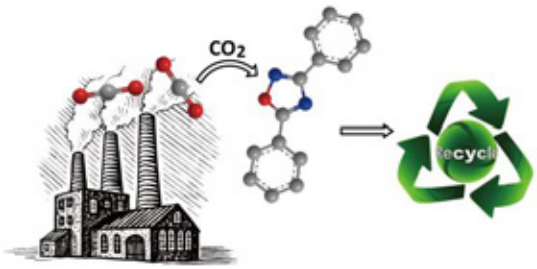

Figure 1. Porous solid adsorbent, covalent organic polymer, capture the CO2 selectively from flue gas and recycle easily.

To present new sorbent, we need to consider about several things. Affinity to capture the carbon dioxide(Zulfiqar et al., 2011), possible to selectively pull the target gas(Patel et al., 2013) and, suitable cost and be a green chemistry. Here, we synthesize solid adsorbent covalent organic polymer (COP) which inspired from adsorbing mechanism of tree and lung in human body. This solid adsorbent captured 59mg/g of CO_2 at 1bar and is comparable with MEA (60mg/g of CO_2). Also, without expensive or harmful catalyst it can be synthesized simply by organic compound. Heat of adsorption shows 26 kJ/mol which means this COP is easy to regenerate and recycle for CO_2 capture. Additionally, COP shows high selectivity, captured 61 times of CO_2 than N_2, and thermal stability up to 450°C.

From this research, we show that new idea of CO_2 adsorbent, COP, can alter conventional adsorbent by bio-mimic green chemistry. Furthermore, capturing capacity and stability can be improved more with tethering on the solid wall or impregnating metal ion or amine in the pore of structure.

Patel, H. A., Je, S. H., Park, J., Chen, D. P., Jung, Y., Yavuz, C. T., & Coskun, A. (2013). Unprecedented high-temperature CO2 selectivity in N2-phobic nanoporous covalent organic polymers. *Nat Commun, 4*, 1357. doi: 10.1038/ncomms2359

Zulfiqar, S., Karadas, F., Park, J., Deniz, E., Stucky, G. D., Jung, Y., . . . Yavuz, C. T. (2011). Amidoximes: promising candidates for CO2 capture. *Energy & Environmental Science, 4*(11), 4528. doi: 10.1039/c1ee02264d