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# Influence of Ultra-micropore Volume of Activated Carbons Prepared from Noble Mung Bean on the Adsorption Properties of $CO_2$, $CH_4$, and $N_2$

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Figure S1 shows the thermal decomposition curve of mung bean powder used as a raw material for activated carbon with ultra-micropore volume by TGA analysis. It can be seen that three different weight loss stages were observed in the thermal decomposition of mung bean powder under a nitrogen atmosphere. That is, the first stage represents a loss of trapped water molecules (3.20% of the weight loss at 130 °C), while the second stage occurs in the temperature range of about 200-400 °C, resulting in a rapid 82.94% weight loss. This second stage is the main decomposition stage, which is completed at about 400 °C. In this step, the major components such as carbohydrate and protein degradation of mung bean powder occur. In the last stage, the carbonization of mung bean powder occurred between 400 °C and 950 °C. The pyrolysis temperature provides important information in determining the carbonization conditions for producing adsorbents in this study.

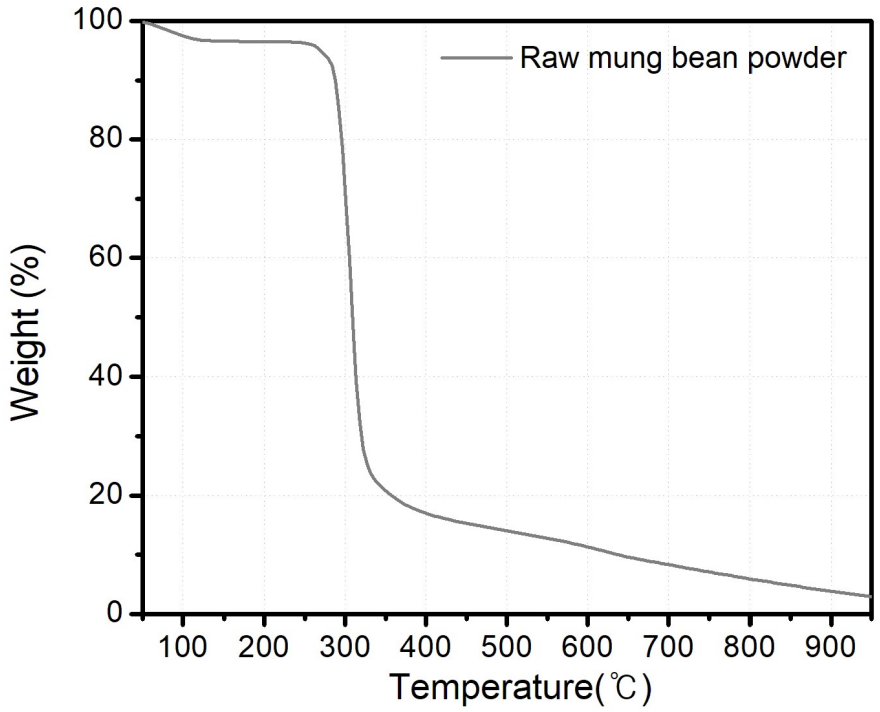


**Figure S1** TGA curves for the raw mung bean powders under $N_2$ gas condition.

**Table S1** Surface composition of C-400 and MACs measured by XPS

| Sample | Atomic content (%) | | |
|---|---|---|---|
| | C | O | N |
| C-400 | 93.4 | 6.2 | 0.41 |
| 1:4-800 | 91.4 | 8.0 | 0.53 |
| 1:4-900 | 88.2 | 11.0 | 0.81 |
| 1:1-800 | 91.9 | 7.6 | 0.49 |

**Table S2** Functional groups obtained from the deconvolution of the $C_{1s}$ peak for C-400 and MACs

| Sample | Graphite [at.(%)] | Phenol [at.(%)] | Carbonyl [at.(%)] | Carboxyl [at.(%)] |
|---|---|---|---|---|
| C-400 | 66.3 | 25.8 | 6.8 | 1.2 |
| 1:4-800 | 46.3 | 36.5 | 10.6 | 6.6 |
| 1:4-900 | 46.1 | 37.4 | 13.5 | 3.0 |
| 1:1-800 | 50.0 | 34.6 | 13.0 | 2.4 |