

## Supplementary Information

### Glycidol-Modified PEI: A Highly Selective Adsorbent for SO<sub>2</sub> Capture

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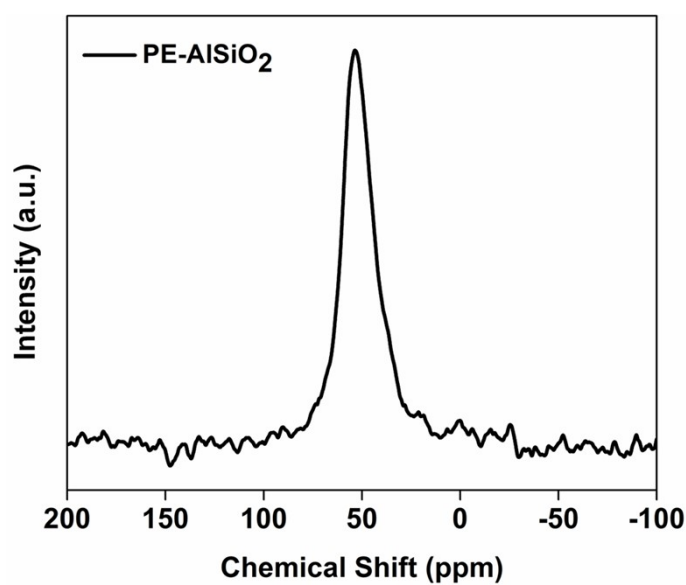
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#### Preparation and Characterization of PE-AlSiO<sub>2</sub> support

PE-AlSiO<sub>2</sub> was synthesized using following method: In solution A, 40 grams of fumed silica and 820 g of TMAOH was added in 800 g of water. In another beaker (solution B), 488 g of CTAB and 157 g of NH<sub>3</sub> solution was added in 4000 g of water. After 30 minutes of stirring, solution B was added in solution A under vigorous stirring. After a duration of 30 minutes, 37 grams of NaAlO<sub>2</sub> (sodium aluminate) was introduced, and the stirring process was sustained for an additional 30 minutes. Thereafter fumed silica, specifically, Cab-O-Sil, was slowly added to the mixture. After stirring the solution for an hour, 460 mL of DMHA (dimethylhexadecylamine) was added to the mixture and stirring continued for an additional 30 minutes. Next, the mixture was loaded in an autoclave and placed in a preheated oven at 70 °C for 3 days. Afterward, the autoclave was allowed to cool down to room temperature. The resulting material was separated through filtration, thoroughly washed with distilled water, and left to dry under ambient conditions. Finally, the material was calcination in a furnace, where it was heated under a flowing nitrogen at a rate of 1°C per minute upto 550 °C. It was then subjected to air treatment at 550 °C for 5 h to eliminate any remaining carbonaceous substances. The resultant support was then named as PE-AlSiO<sub>2</sub>.

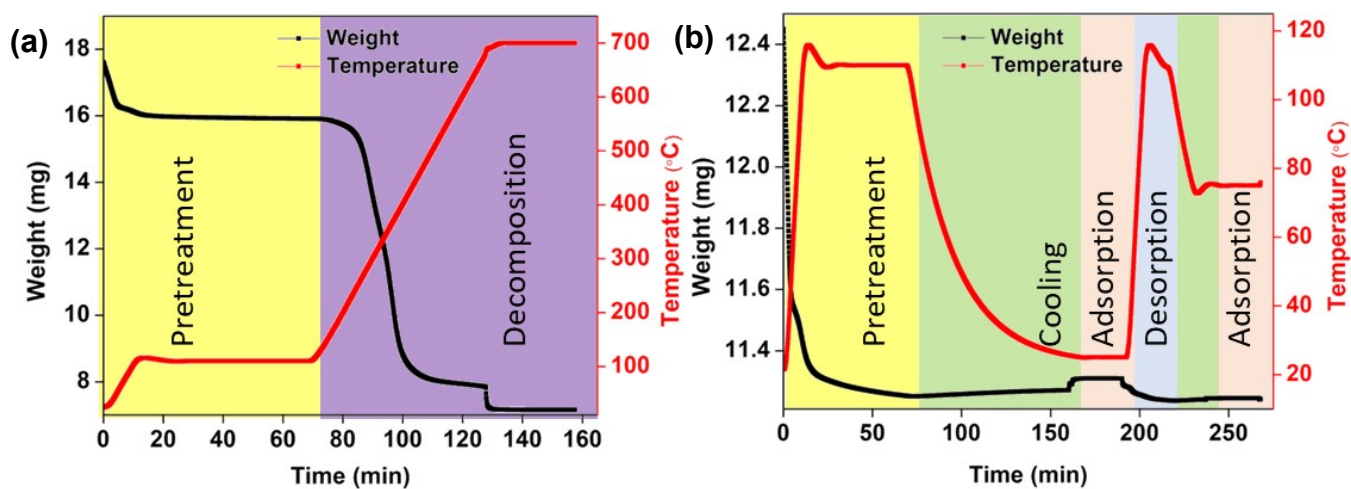
The state of aluminum sites in PE-AlSiO<sub>2</sub> was determined by <sup>27</sup>Al MAS NMR of PE-AlSiO<sub>2</sub> support using a AVIII 400 spectrometer with a MAS probe of 4 mm triple resonance. Echo pulse sequence was

used, and the sample was rotated at 10 kHz. Other parameters include a 1-second delay, 90-degree pulse at 3.6 db for 3  $\mu$ s. Spectra (shown in Figure S1) was referenced to 0 ppm NMR signal of 1M  $\text{Al}(\text{NO}_3)_3$ .



**Figure S1.**  $^{27}\text{Al}$  MAS NMR spectra of PE- $\text{AlSiO}_2$ .

### TGA data

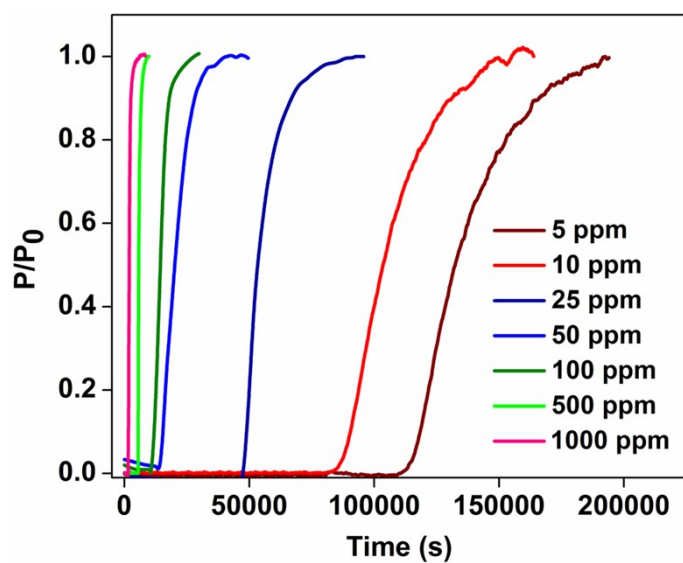


**Figure S2.** TGA graph for (a) decomposition of organic material in GD-PEI/S and (b)  $\text{CO}_2$  uptake measurements at 25  $^{\circ}\text{C}$  and 75  $^{\circ}\text{C}$ .

## SO<sub>2</sub> uptake of GD-PEI/S

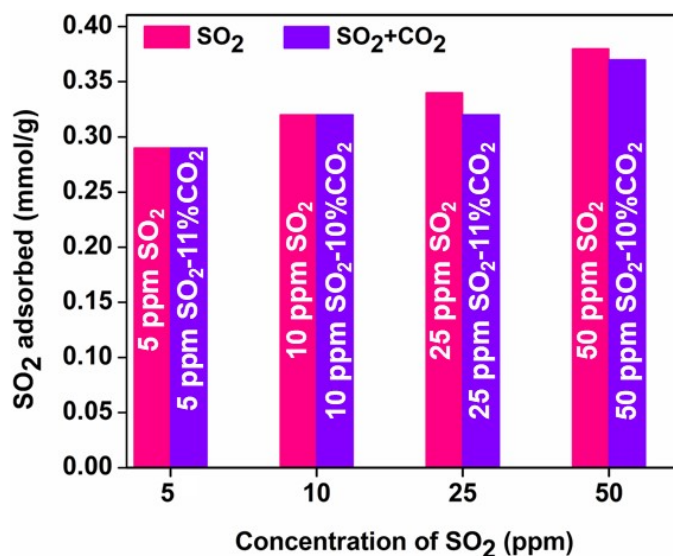
**Table S1:** SO<sub>2</sub> uptake of GD-PEI/S when exposed to various concentrations of SO<sub>2</sub>.

Concentration (ppm)	5	10	25	50	100	500	1000
SO <sub>2</sub> uptake (mmol/g)	0.29	0.32	0.34	0.38	0.47	0.55	0.59



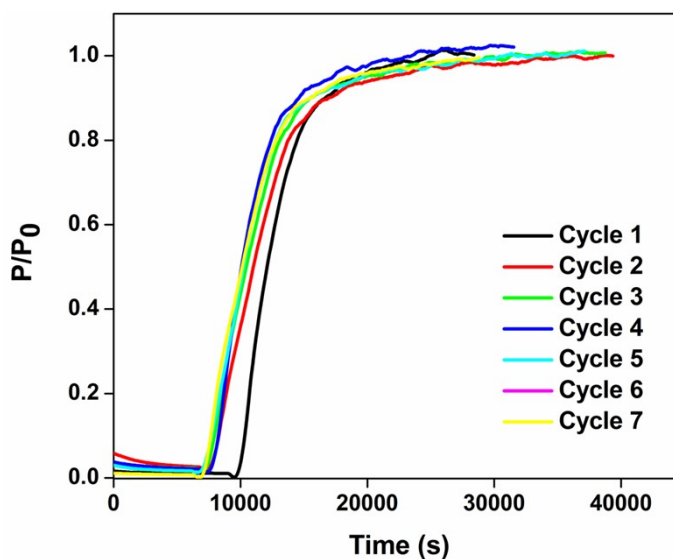
**Figure S3.** Breakthrough curves of GD-PEI/S under different concentrations of SO<sub>2</sub> in N<sub>2</sub>.

## Selectivity of adsorbent towards SO<sub>2</sub> versus CO<sub>2</sub>

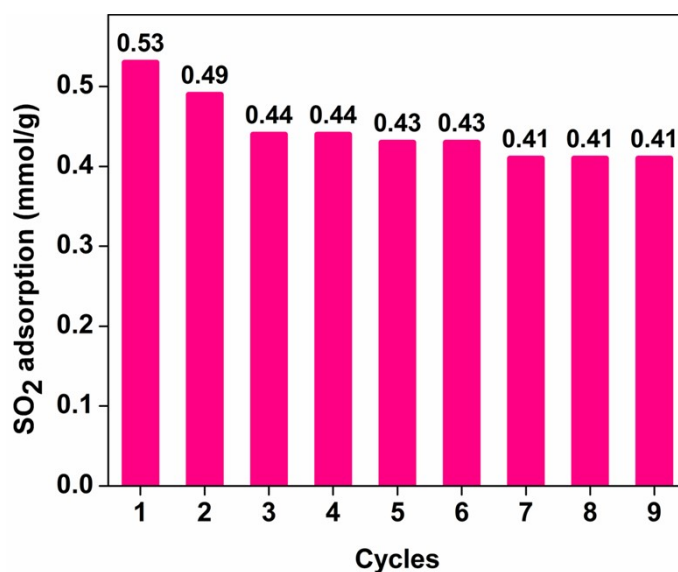


**Figure S4.** SO<sub>2</sub> uptake of GD-PEI/S under different concentrations of SO<sub>2</sub> with and without CO<sub>2</sub>.

## Stability of adsorbent under cyclic conditions

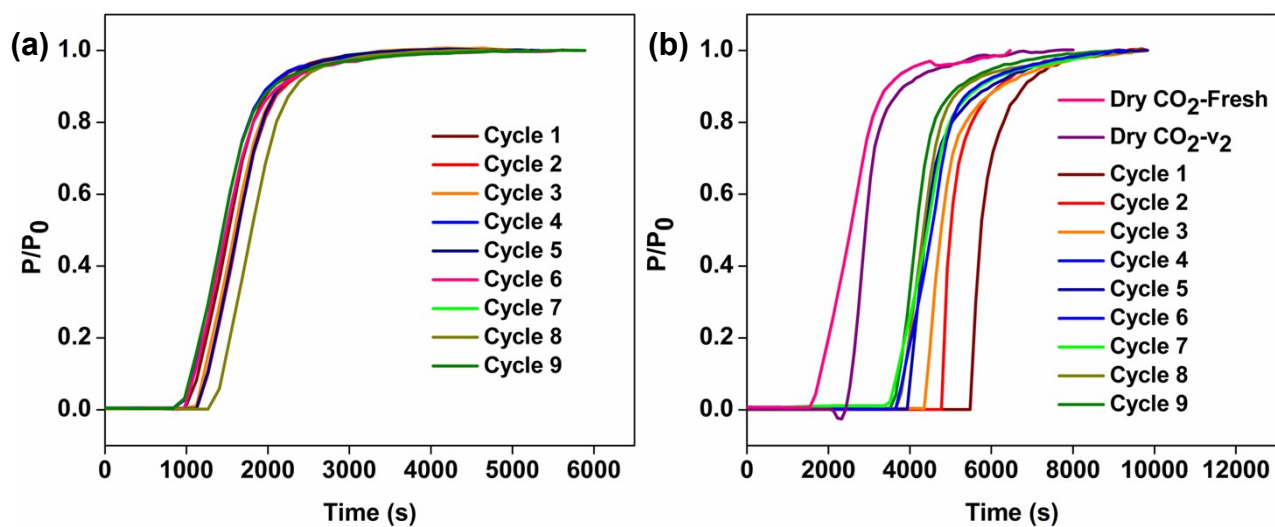


**Figure S5.** Column breakthrough curves of GD-PEI/S for regeneration cycles under dry 100 ppm SO<sub>2</sub> balanced N<sub>2</sub>.



**Figure S6.** Regeneration cycles of GD-PEI/S under dry 500 ppm SO<sub>2</sub> balanced in N<sub>2</sub>.

GD-PEI/S demonstrated good stability even under high partial pressure of SO<sub>2</sub> streams, as evidenced by the 23% SO<sub>2</sub> capacity loss after 9 adsorption-desorption cycles.



**Figure S7.** (a) Column breakthrough curves for regeneration cycles of GD-PEI/S under (a) dry and (b) humid 500 ppm SO<sub>2</sub> balanced in N<sub>2</sub>.