

## **SUPPORTING INFORMATION**

### **CO<sub>2</sub> Capture by Temperature Swing Adsorption:**

#### **Use of Hot CO<sub>2</sub>-Rich Gas for Regeneration**

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Table S1: Calculation of theoretical working capacities from isotherm data at different regeneration temperatures

Adsorption/Desorption Temperature	30°C	150°C	200°C	250°C
$q_1$ (mol. CO <sub>2</sub> /kg.ads) = quantity of CO <sub>2</sub> adsorbed at adsorption conditions i.e. 0.15 bar, 30 °C	2.080			
$q_2$ (mol. CO <sub>2</sub> /kg.ads) = quantity of CO <sub>2</sub> adsorbed at regeneration conditions i.e. 1 bar, T <sub>des</sub>		0.740	0.380	0.096
Working capacity (mol. CO <sub>2</sub> /kg.ads) = $q_1 - q_2$		1.34	1.700	1.984

Table S2: Summary of molar flows of CO<sub>2</sub> into and out of the bed: Cycle 2- regeneration by indirect heating followed by hot gas purge

	Regeneration temperature (°C)		
	150	200	250
<i>Adsorption step</i>			
Total feed flow	0.2758	0.3228	0.3420
Flow of CO <sub>2</sub> into bed	0.04137	0.0484	0.0513 mol
Amount of CO <sub>2</sub> in vent stream	0.0023	0.00175	0.00168 mol
<i>Regeneration step</i>			
Amount of CO <sub>2</sub> desorbed	0.1031	0.1167	0.1246 mol
Total Flow of purge gas into bed	0.0816	0.0796	0.0805 mol
CO <sub>2</sub> recovered from bed	0.0215	0.0371	0.0441 mol
<i>Cooling (N<sub>2</sub> purge) step</i>			
Amount of CO <sub>2</sub> in vent stream	0.0175	0.0095	0.00552 mol
<i>Potential improved performance</i>			
*Additional amount of product to recover	0.01024	0.00558	0.00434 mol
*Purity	84.66	87.86	89.24 %CO <sub>2</sub>
*Recovery	76.72	88.18	94.43 %CO <sub>2</sub>

\* New performance figures resulting from recycling the initial effluent of the N<sub>2</sub> purge step up to a CO<sub>2</sub> concentration of 50% directly to the product.

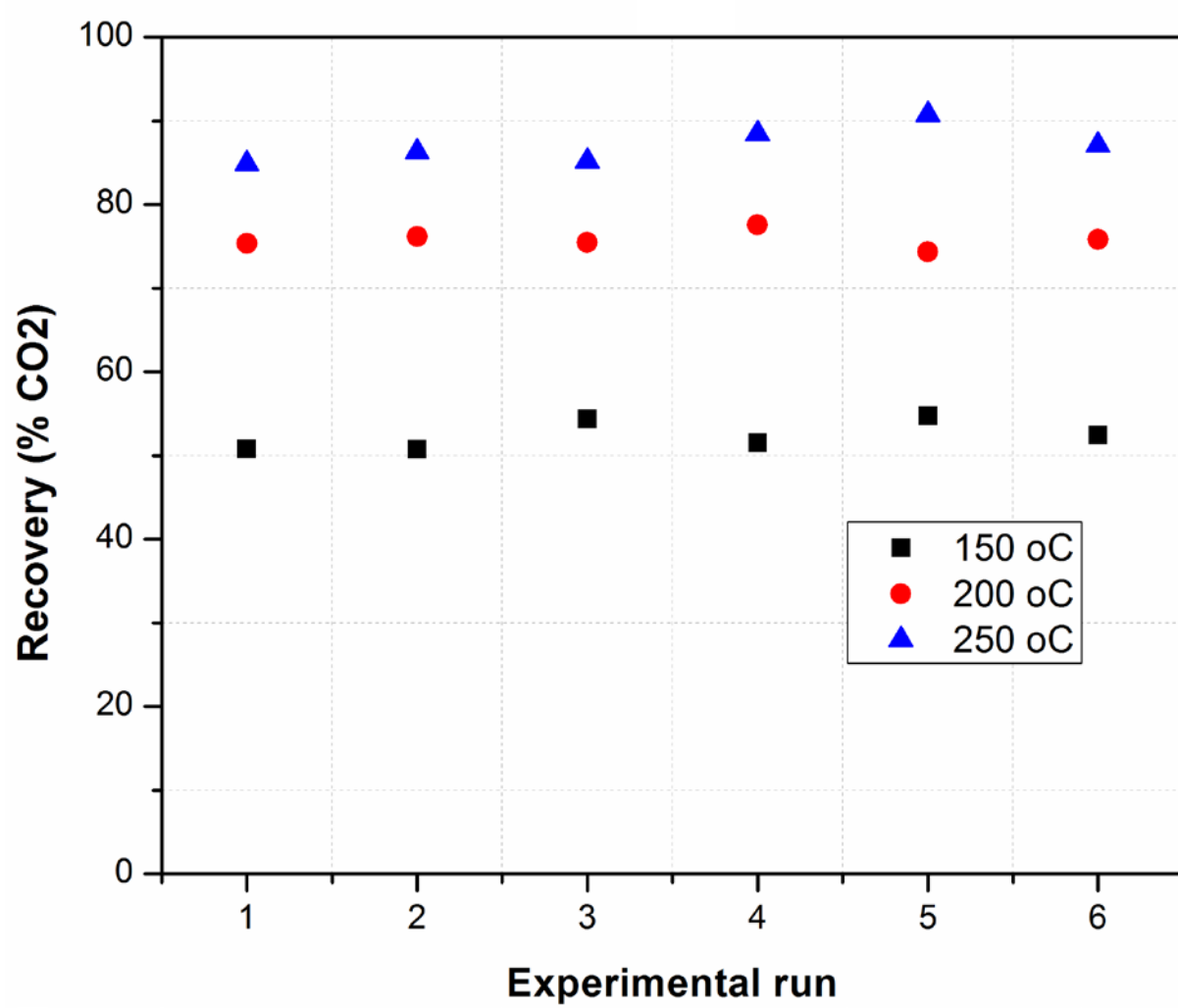


Figure S1. Effect of regeneration temperature on CO<sub>2</sub> recovery

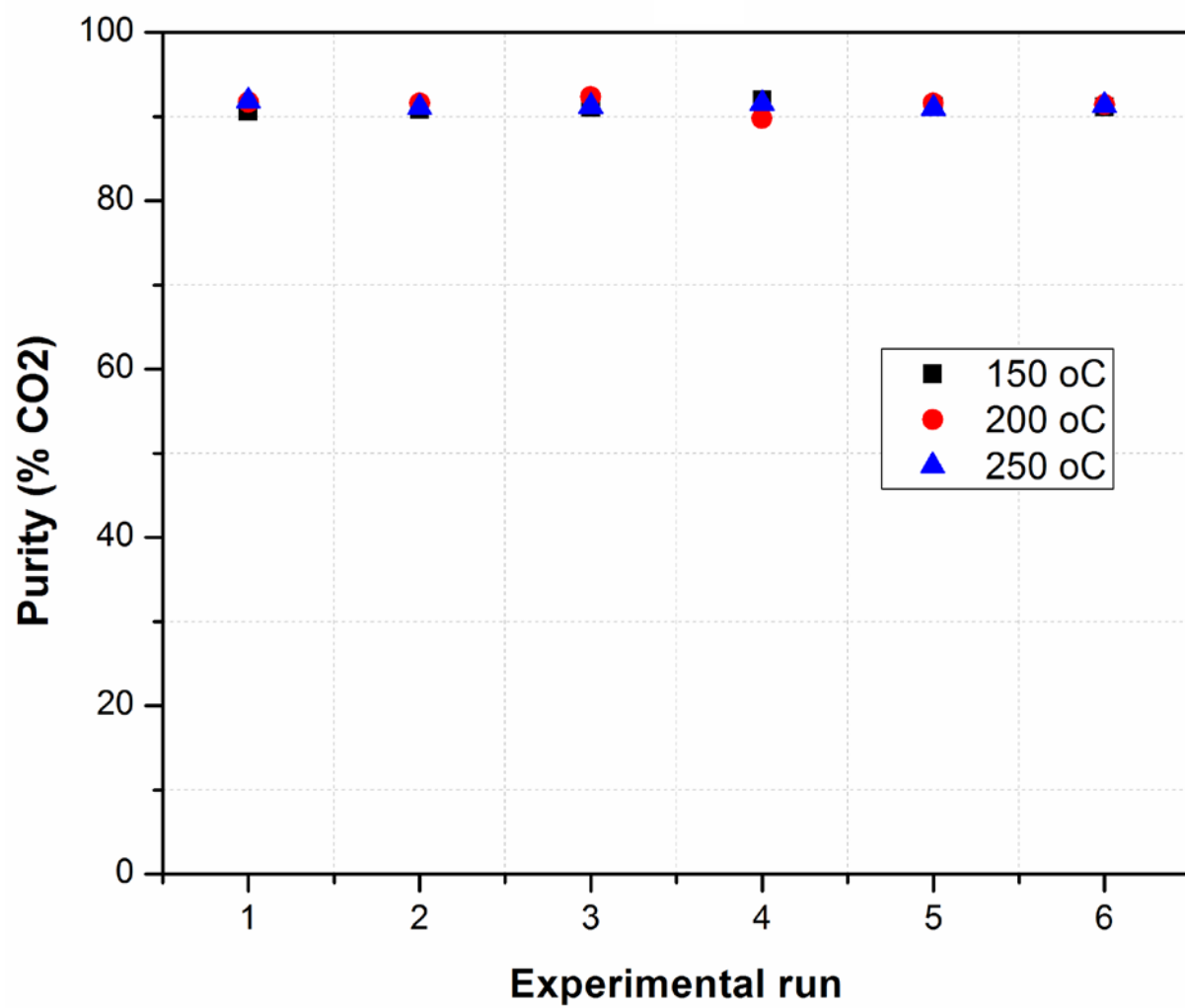


Figure S2. Effect of regeneration temperature on CO<sub>2</sub> purity

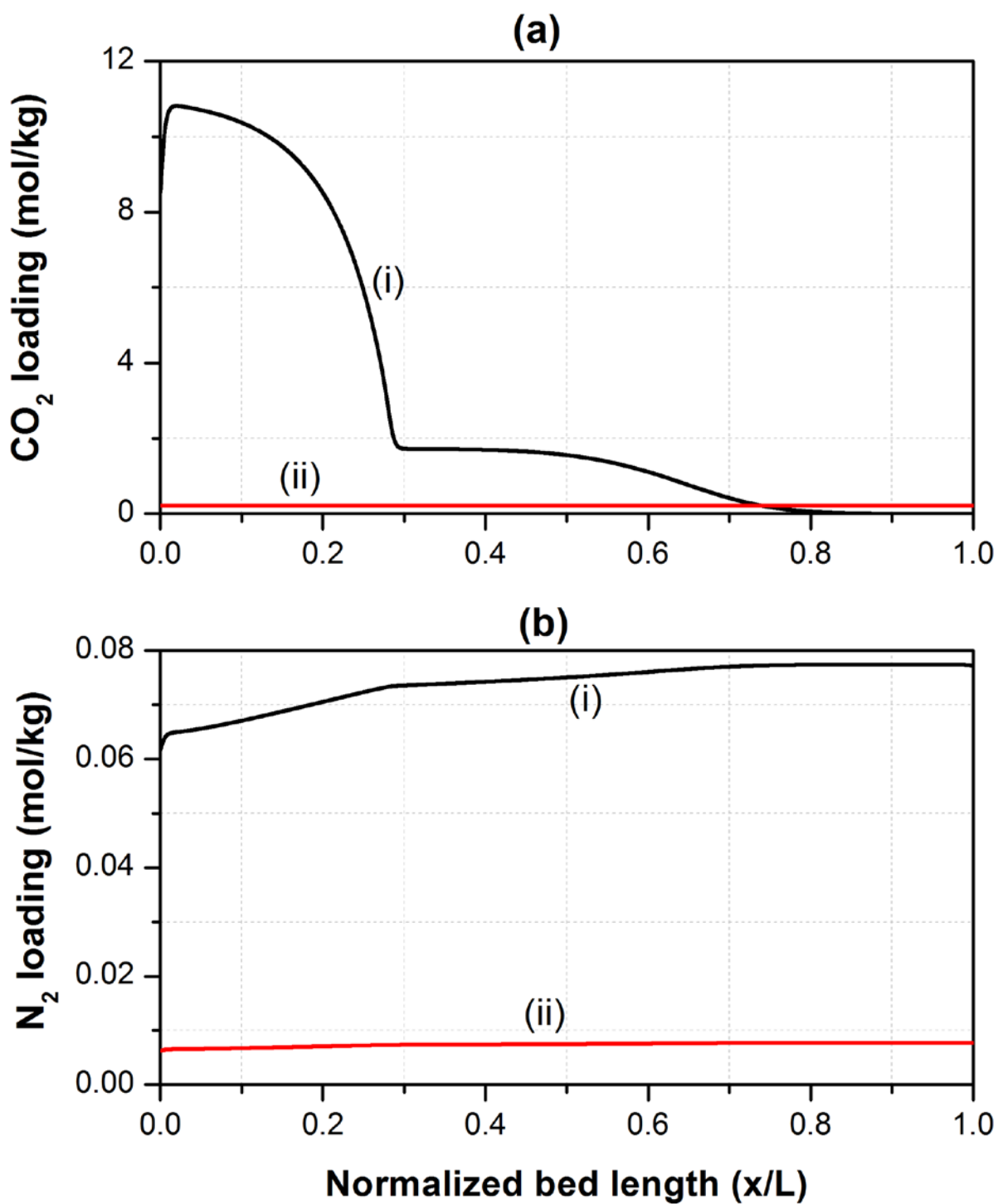


Fig. S3. Cyclic steady state (a) CO<sub>2</sub> loading profiles and (b) N<sub>2</sub> loading profiles on the adsorbent at the ends of product rinse and desorption steps (for regeneration temperature of 250 °C); (i) = profile at end of rinse step, (ii) = profile at end of desorption step.

$$\text{Working Selectivity} = \frac{CO_2 \text{ working capacity}}{N_2 \text{ working capacity}} = \frac{CO_2 \text{ loading}_{(\text{prod rinse})} - CO_2 \text{ loading}_{(\text{des})}}{N_2 \text{ loading}_{(\text{prod rinse})} - N_2 \text{ loading}_{(\text{des})}} \quad \text{Eq. S1}$$