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Electronic Supplementary Information (ESI)**

**Facile Synthesis Tool of Nanoporous Carbon for Promising H₂, CO₂,
and CH₄ Sorption Capacity and Selective Gas Separation**

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Keywords: Nanoporous carbon; Hydrogen storage; CO₂ Uptake; Methane storage, polymer nanoparticles; Renewable biomass.

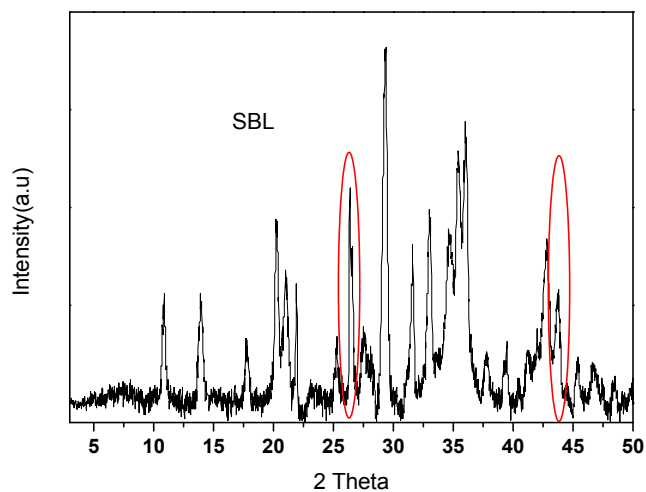


Fig. S1 XRD pattern of SBL

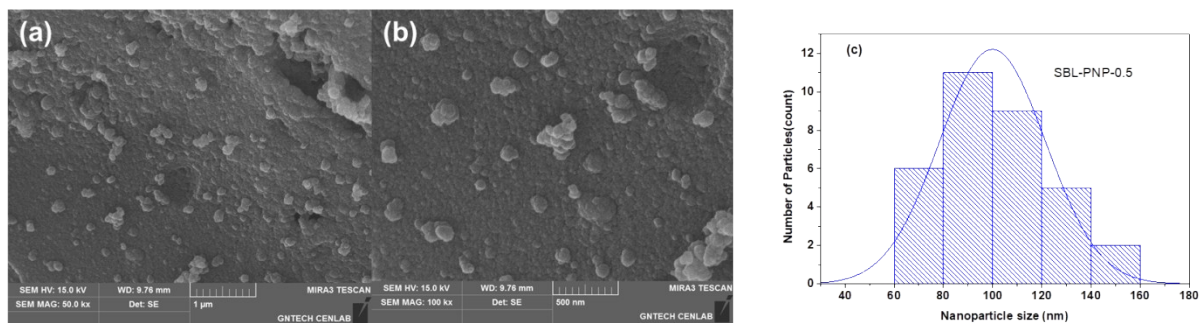


Fig. S2 SEM images of (a) SBL-PNP-0.5, (b) a high-magnification image of SBL-PNP-0.5 and (c) histogram representing the average particle size of PNP.

Table S1 EDS data of SBL carbon

Sample	C [At.%]	O [At.%]	N [At.%]	Si [At.%]	Fe [At.%]	Zn [At.%]	Cl [At.%]	Na [At.%]	Ca [At.%]	Mg [At.%]	Al [At.%]	S [At.%]	Al [At.%]	K [At.%]	Total [At.%]
SBL	69.13	22.75	0	0.32	0.11	0	1.72	3.69	0.4	0.69	0.13	0.25	0.13	0.81	100

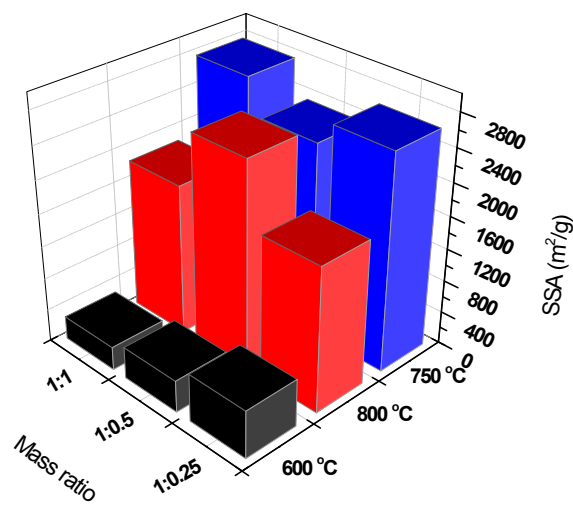


Fig. S3 Correlation diagram of PNP mass loadings versus activation temperatures and resulting SSA.

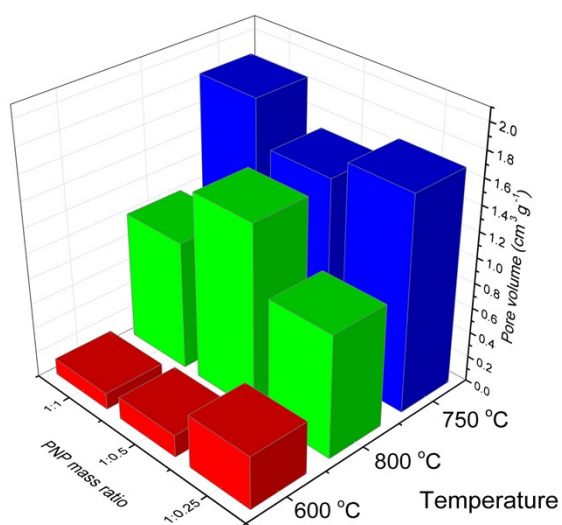


Fig. S4 Correlation diagram of PNP mass loadings versus activation temperatures and resulting TPV.

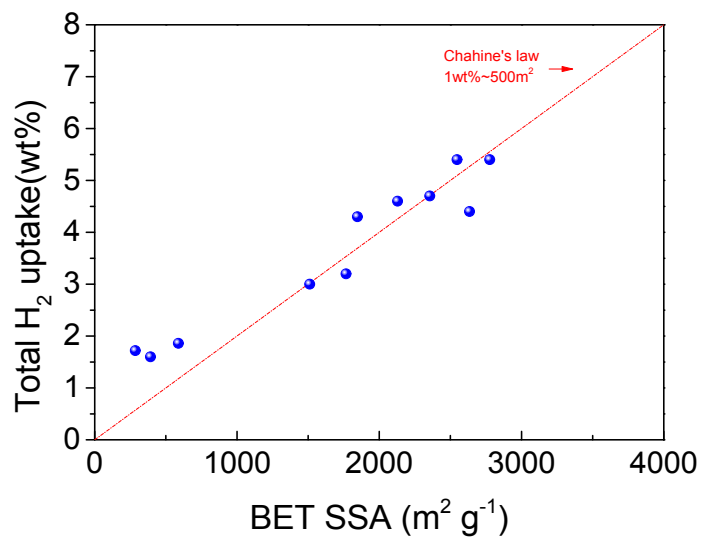
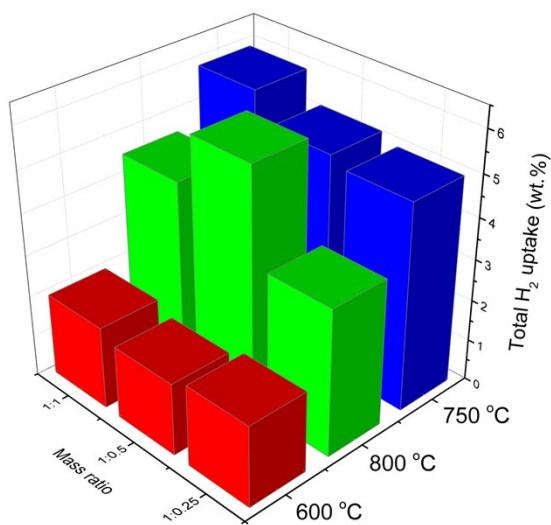
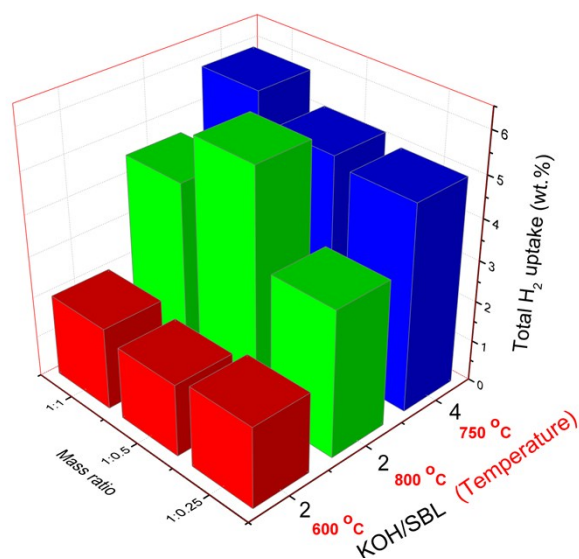


Fig. S5 Total H₂ uptake (in wt%) at 77 K versus BET specific surface area for developed porous carbon. The red dotted line indicates the linear correlation between surface area and uptake with a slope of 1 wt% H₂ per 500 m² g⁻¹.



total H₂ uptake.



resulting total H₂ uptake.

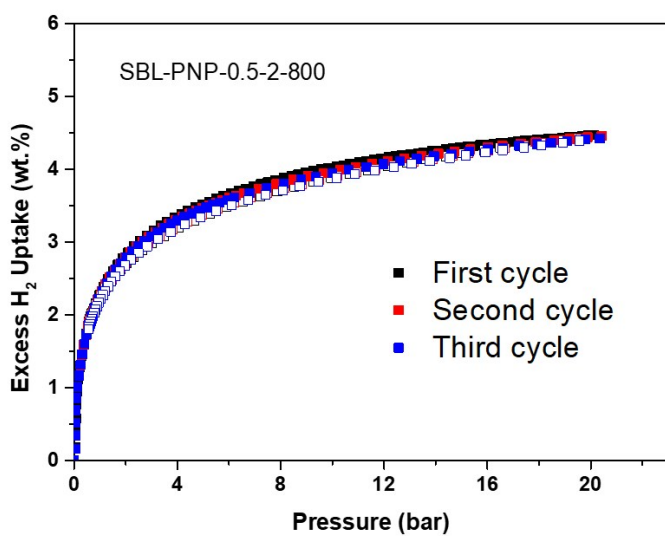


Fig. S8 Cycles of H₂ adsorption isotherm of SBL-PNP-0.5-2-800 reflecting the reproducibility of results.

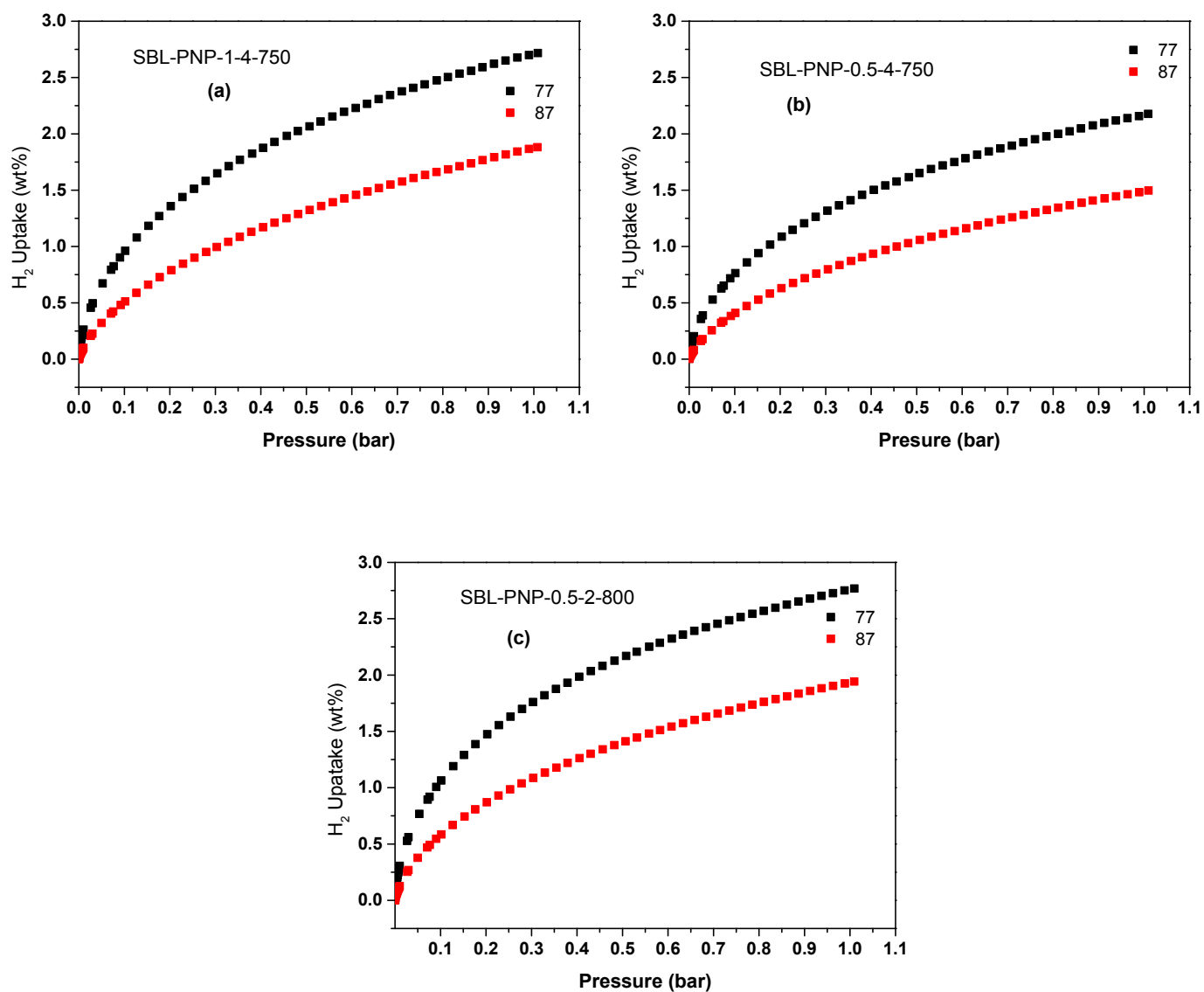


Fig. S9 The H_2 adsorption isotherms at 77 and 87 k and 1 bar for SBL-PNP-1-4-750(a), SBL-PNP-0.5-4-750 (b) SBL-PNP-0.5-2-800.

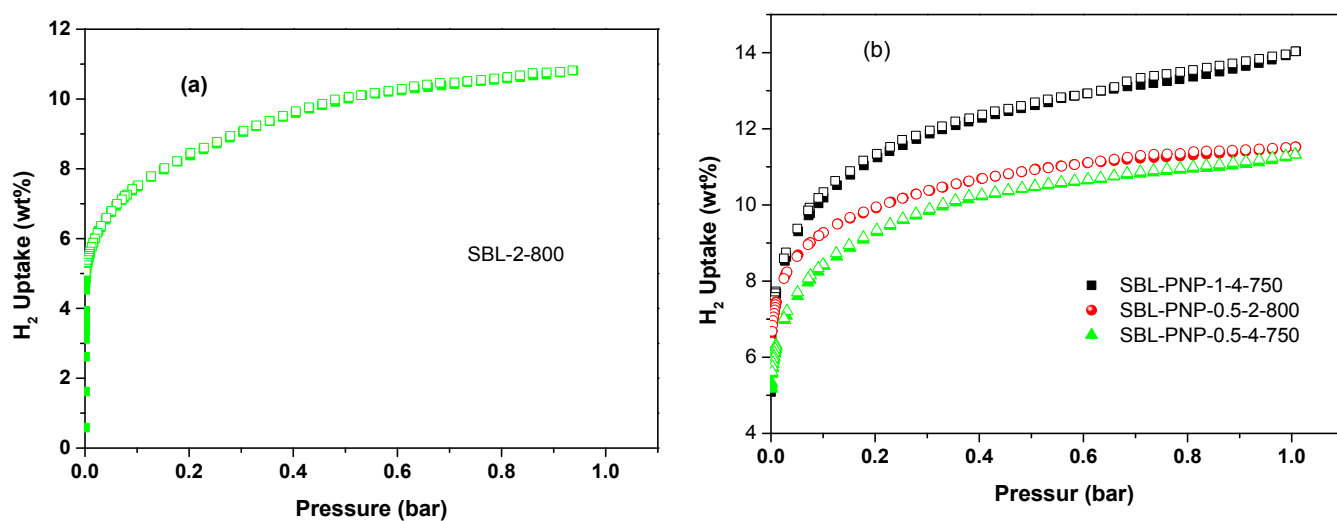


Fig. S10 The H_2 adsorption isotherms at 20 k and 1 bar for SBL- 2-800(a), SBL-PNP-0.5-2-800, SBL-PNP-0.5-4-750 and SBL-PNP-1-4-750 (b) .

S8 Fitting curves and parameters for Ideal adsorbed solution theory (IAST)

Fitting for Ideal adsorbed solution theory (IAST)

Single-Site Langmuir-Freundlich Model: For Activated carbon, there are no discernible isotherm inflections, and therefore the single-site Langmuir Model is used.

$$q = \frac{q_m b p^{\frac{1}{n}}}{1 + b p^{\frac{1}{n}}}$$

where q is the adsorbed amount per mass of adsorbent, q_m is the saturation capacity of the site, b is the affinity coefficient of the site, p is the pressure of the bulk gas at equilibrium with the adsorbed phase, n represents the deviation from an ideal homogeneous surface

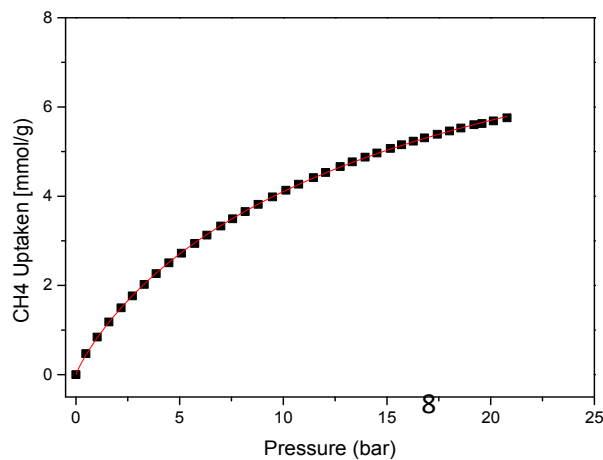
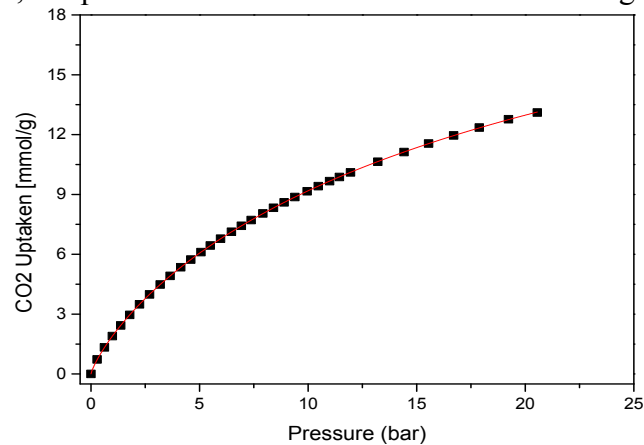


Fig. S11. (Upper) CO₂ and CH₄ (bottom) adsorption isotherms for SBL-PNP-0.5-4-800 Curves are fits to the Single-site Langmuir-Freundlich model. The parameters are listed in Table S1~2.

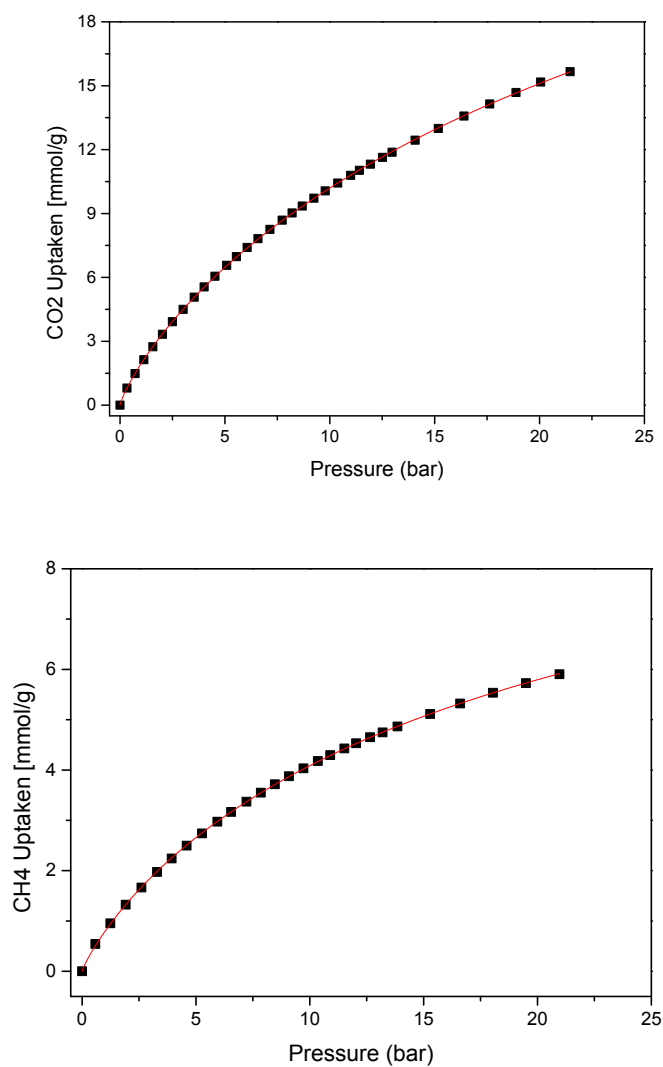


Fig. S12. (Upper) CO₂ and CH₄ (bottom) adsorption isotherms for SBL-PNP-0.5-4-750. Curves are fits to the Single-site Langmuir-Freundlich model. The parameters are listed in Table S1~2.

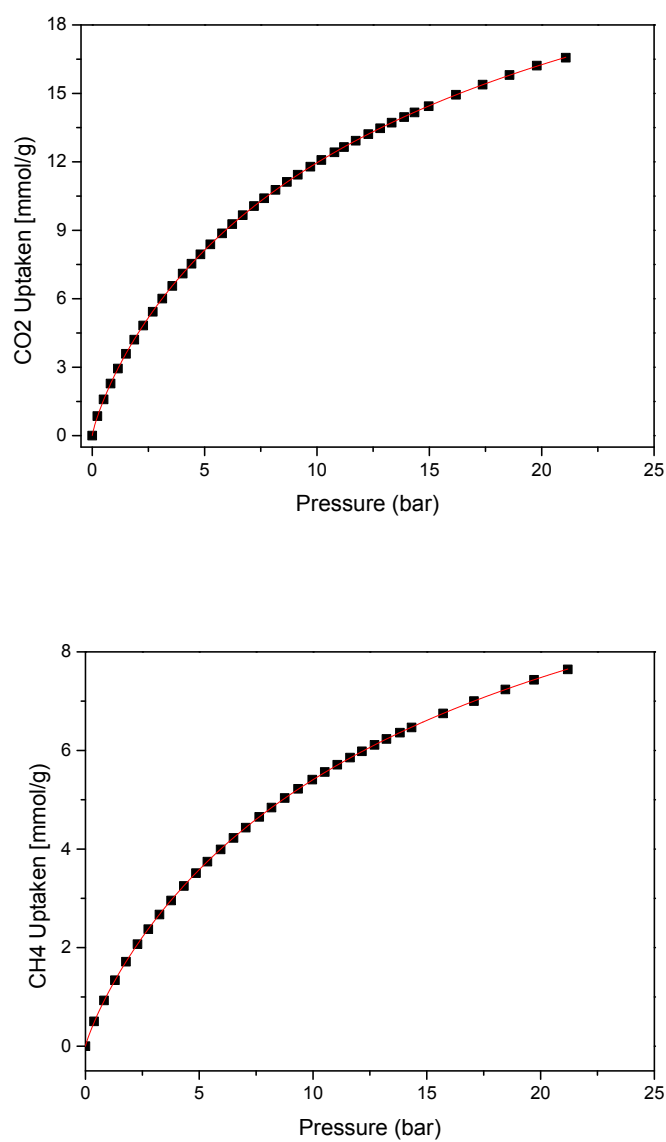


Fig. S13. (Upper) CO₂ and CH₄ (bottom) adsorption isotherms for SBL-PNP-0.5-2-800. Curves are fit to the Single-site Langmuir-Freundlich model. The parameters are listed in Table S1~2.

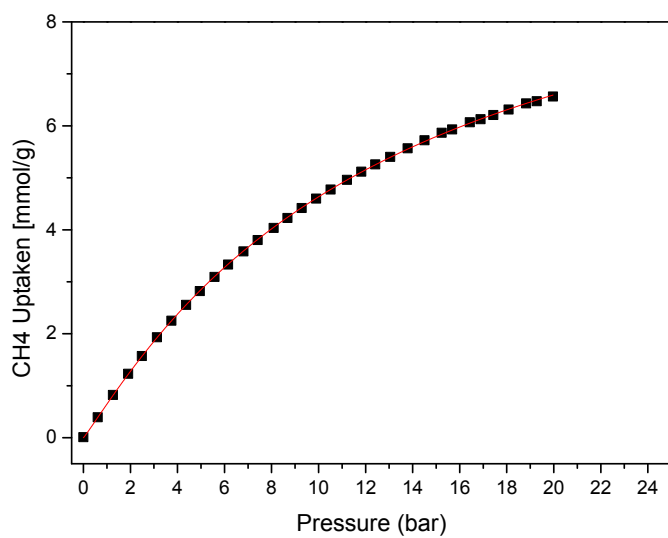
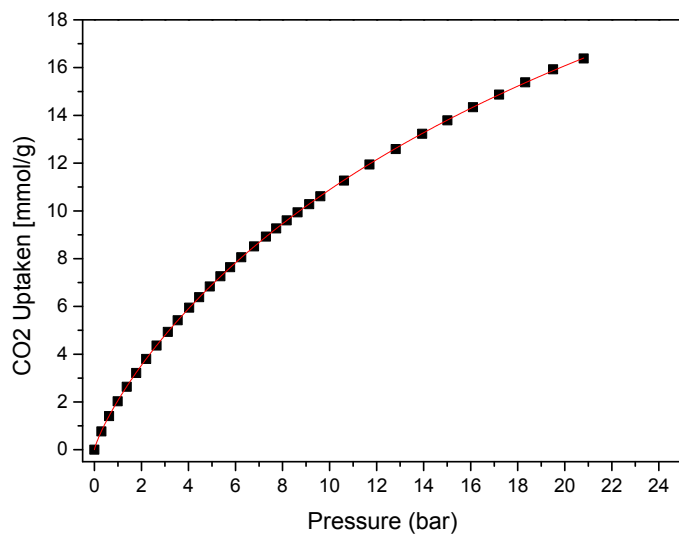


Fig. S14. (Upper) CO₂ and CH₄ (bottom) adsorption isotherms for SBL-PNP-1-4-750 Curves are fit to the Single-site Langmuir-Freundlich model. The parameters are listed in Table S4.

Table S2. Fitting parameters of Langmuir-Freundlich model for CO₂ adsorption isotherm in SBL-PNP-0.5-4-750, SBL-PNP-0.5-2-800 and SBL-PNP-0.5-4-800

CO ₂				
	R ²	q _m	b	n
SBL-PNP-0.5-4-750	0.99997	40.10372	0.05098	1.21176
SBL-PNP-0.5-2-800	0.99999	30.07405	0.09684	1.19948
SBL-PNP-0.5-4-800	0.99999	28.13433	0.07325	1.21856

Table S3. Fitting parameters of Langmuir-Freundlich model for CH₄ adsorption isotherm in SBL-PNP-0.5-4-750, SBL-PNP-0.5-2-800 and SBL-PNP-0.5-4-800

CH ₄				
	R ²	q _m	b	n
SBL-PNP-0.5-4-750	0.99996	11.70571	0.0725	1.15028
SBL-PNP-0.5-2-800	0.99999	13.75869	0.08558	1.13782
SBL-PNP-0.5-4-800	0.99992	10.5485	0.08305	1.13036

Table S4. Fitting parameters of Langmuir-Freundlich model for CO₂ and CH₄ adsorption isotherm in SBL-PNP-1-4-750.

SBL-PNP-1-4-750				
	R ²	q _m	b	n
CO ₂	0.99999	41.11043	0.05276	1.19872
CH ₄	0.99996	10.68233	0.06447	0.93011