Electronic Supplementary Information (ESI) for

Multi-hydroxyl-containing porous organic polymers based on phenol formaldehyde resin chemistry with high carbon dioxide capture capacity

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A. Elemental analysis data

Table S1 Elemental analysis data of **PFPOP-1–3**.

PFPOPs		C	N	H
PFPOP-1	Exp. (%)	68.13	0	3.62
($C_{45}H_{30}O_{12}$)	Cal. (%)	70.86	0	3.96
PFPOP-2	Exp. (%)	72.53	0	4.04
($C_{63}H_{42}O_{12}$)	Cal. (%)	76.36	0	4.27
PFOPO-3	Exp. (%)	68.09	1.24	4.25
($C_{57}H_{39}O_{12}N$)	Cal. (%)	73.62	1.51	4.23

B. Solid-state ^{13}C NMR spectra

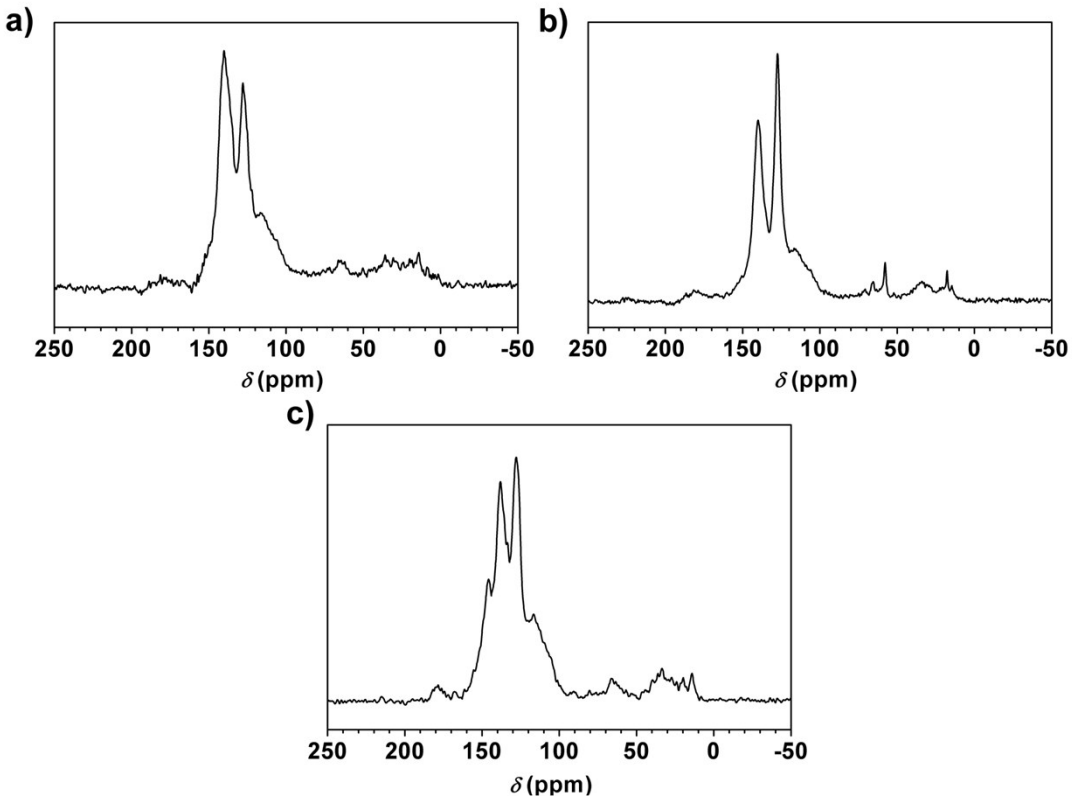

Fig. S1 Solid-state ^{13}C NMR spectra of (a) **PFPOP-1**, (b) **PFPOP-2** and (c) **PFPOP-3**.

C. TEM images

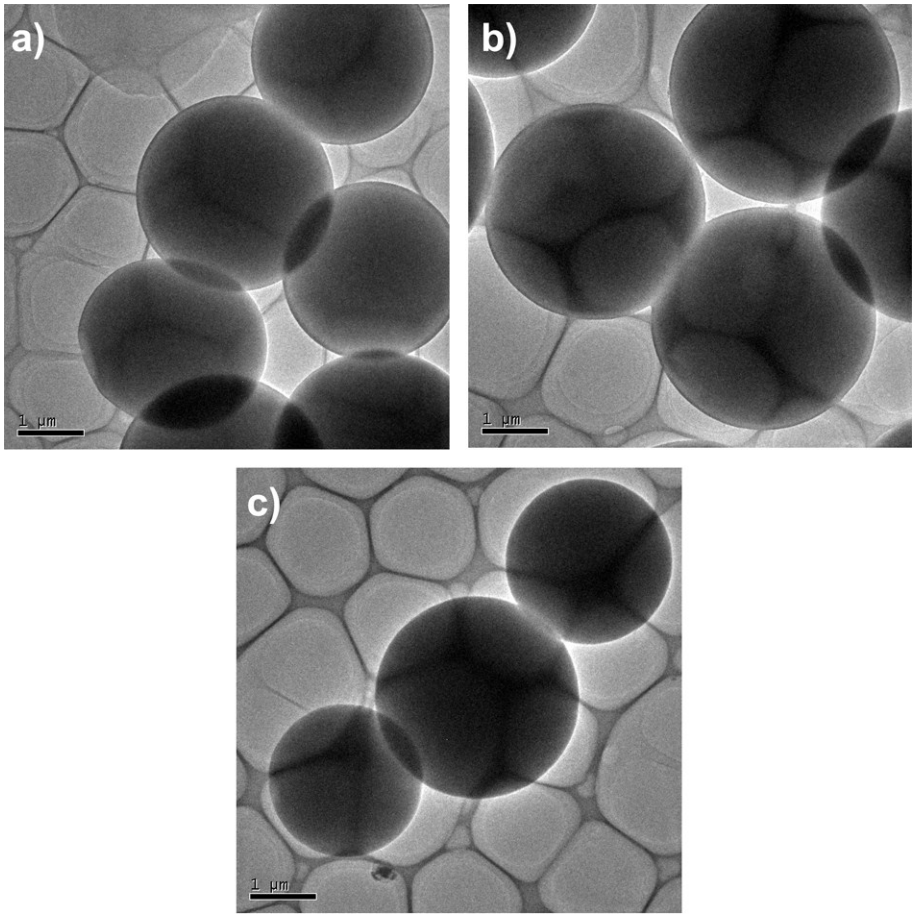

Fig. S2 TEM images of (a) **PFPOP-1**, (b) **PFPOP-2**, and (c) **PFPOP-3**.

D. Corresponding data of porosity properties

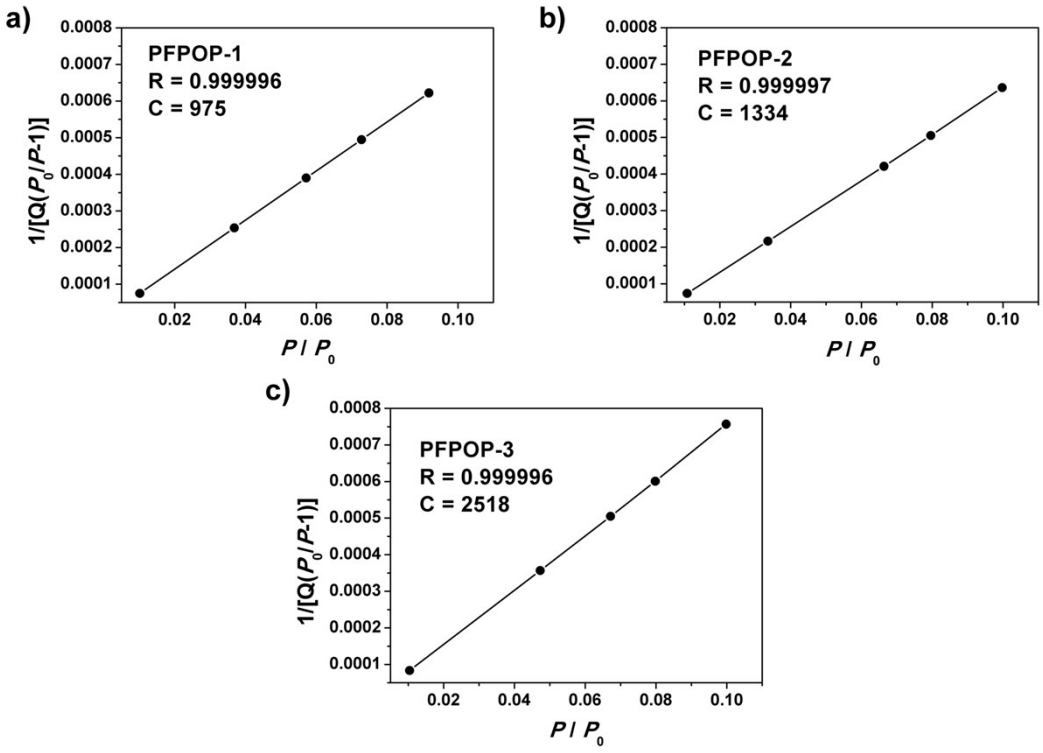

Fig. S3 BET plots of **PFPOP-1** (a), **PFPOP-2** (b), and **PFPOP-3** (c) from nitrogen adsorption data.

E. Corresponding data of gas adsorption and selectivities

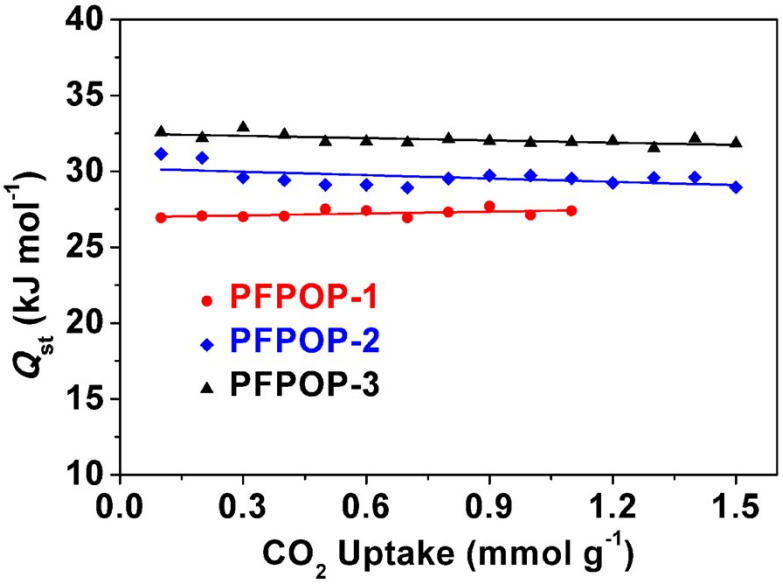

Fig. S4 The isosteric heats of adsorption of CO_2 for **PFPOP-1–3**.

Ideal adsorbed solution theory (IAST) selectivity studies

In order to evaluate the efficiency of PFPOPs for CO_2 over N_2 separation, we used the Ideal Adsorbed Solution Theory (IAST) of Myers and Prausnitz along with the pure component isotherm fits to determine the molar loadings in the mixture for specified partial pressures in the bulk gas phase.

The pure component isotherms of CO_2 measured at 273 K were fitted with the dual-site Langmuir (DSL) model:

$$q = q_A + q_B = q_{sat,A} \frac{b_A p}{1 + b_A p} + q_{sat,B} \frac{b_B p}{1 + b_B p}$$

The pure component isotherms of N_2 measured at 273 K were fitted with the single-site Langmuir (SSL) model:

$$q = q_{sat,A} \frac{b_A p}{1 + b_A p}$$

where, q is molar loading of adsorbate (mmol g^{-1}), q_{sat} is saturation loading (mmol g^{-1}), b is parameter in the pure component Langmuir isotherm (bar^{-1}), p is bulk gas phase pressure (bar).

Pure-component isotherm fitting parameters were then used for calculating IAST binary-gas adsorption selectivities (S_{ads}). S_{ads} is defined as:

$$S_{ads} = \frac{q_1/q_2}{p_1/p_2}$$

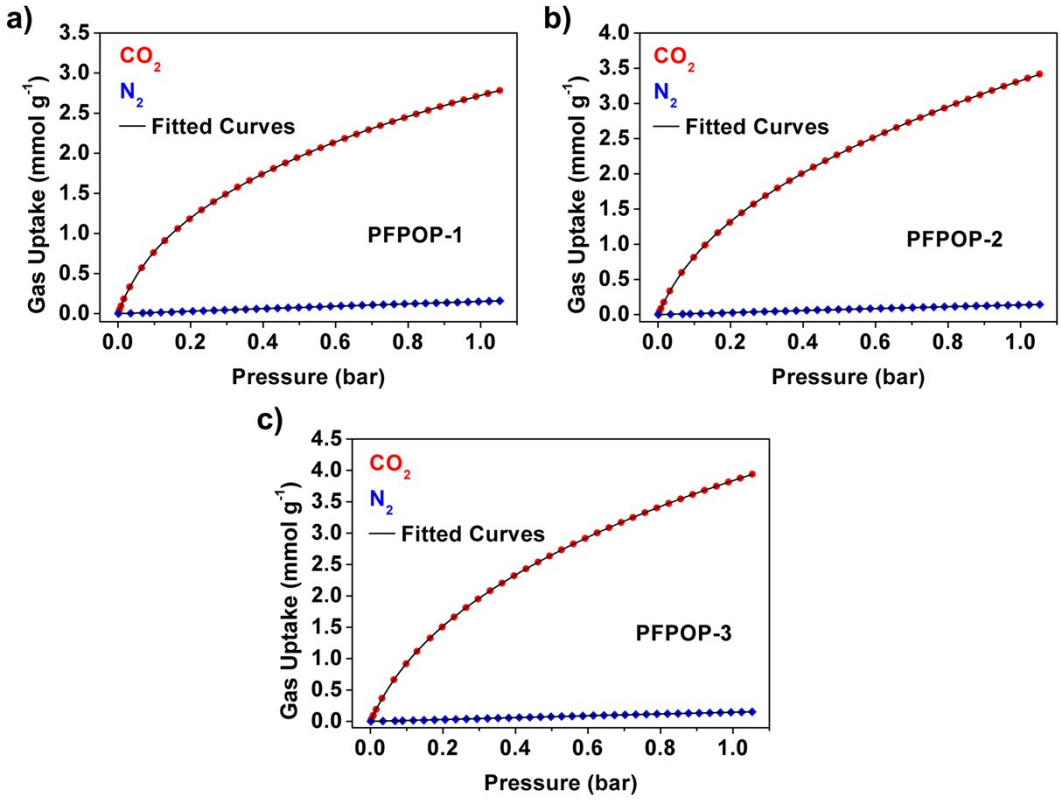

Fig. S5 The corresponding isotherm fits (solid black lines) dual-site Langmuir model fits for CO_2 and single-site Langmuir model for N_2 of **PFPOP-1** (a), **PFPOP-2** (b), and **PFPOP-3** (c) based on experimental pure component isotherms for CO_2 (red) and N_2 (blue) at 273 K.

Table S2 Langmuir fitting parameters of CO_2 and N_2 adsorption isotherms of **PFPOP-1–3** at 273 K.

PFPOPs	Gas	$q_{sat,A}$ (mmol g^{-1})	b_A (bar^{-1})	$q_{sat,B}$ (mmol g^{-1})	b_B (bar^{-1})
PFPOP-1	CO_2	4.78740	0.55962	1.11936	8.68132
	N_2	6.12831	0.02553		
PFPOP-2	CO_2	8.12292	0.34526	1.43774	6.22190
	N_2	1.62911	0.09268		
PFPOP-3	CO_2	7.99534	0.44457	1.61727	5.72241
	N_2	3.14180	0.04877		