Design of CO_2 Sorbents using Functionalized Fibrous Nanosilica (KCC-1): Insights into the Effect of the Silica Morphology (KCC-1 vs MCM-41)

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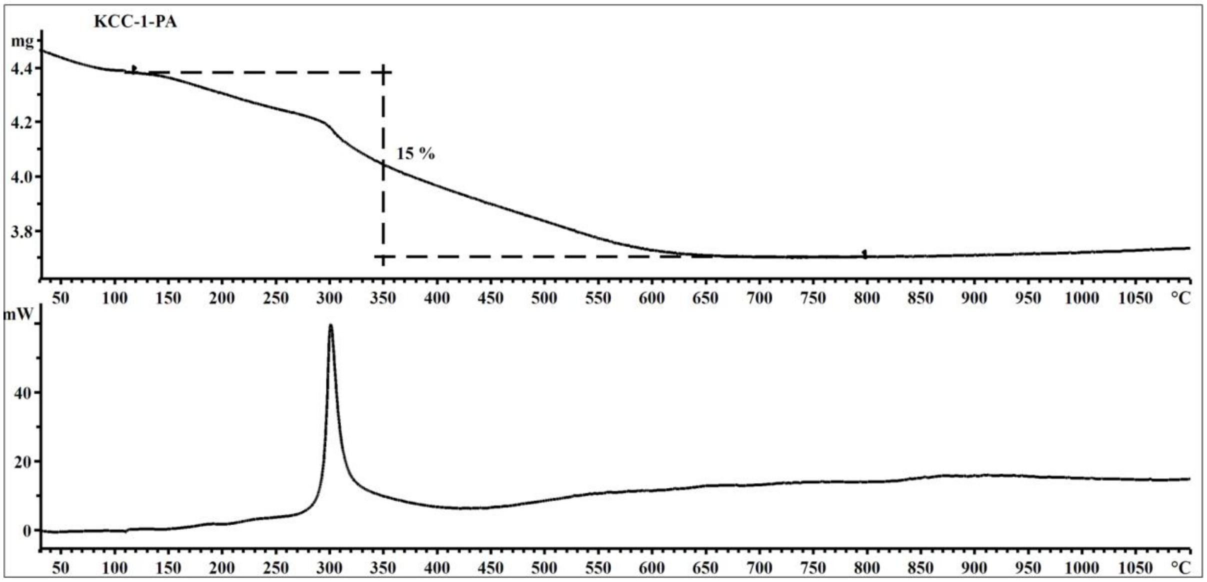

Figure S1. TGA-DTA profile of KCC-1-PA.

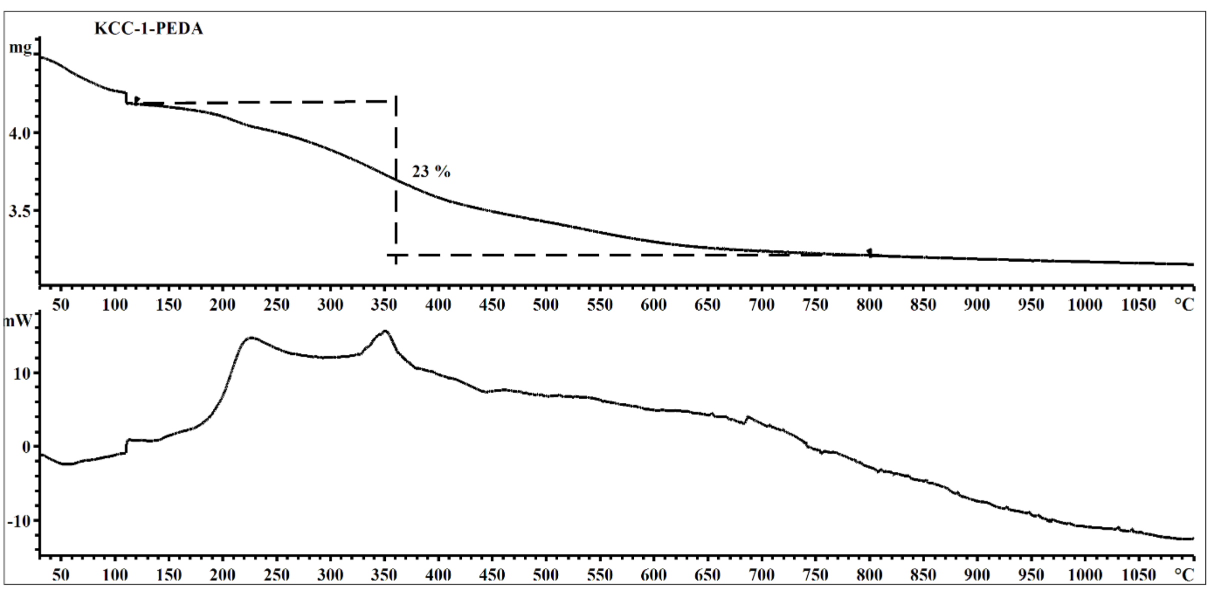

Figure S2. TGA-DTA profile of KCC-1-PEDA.

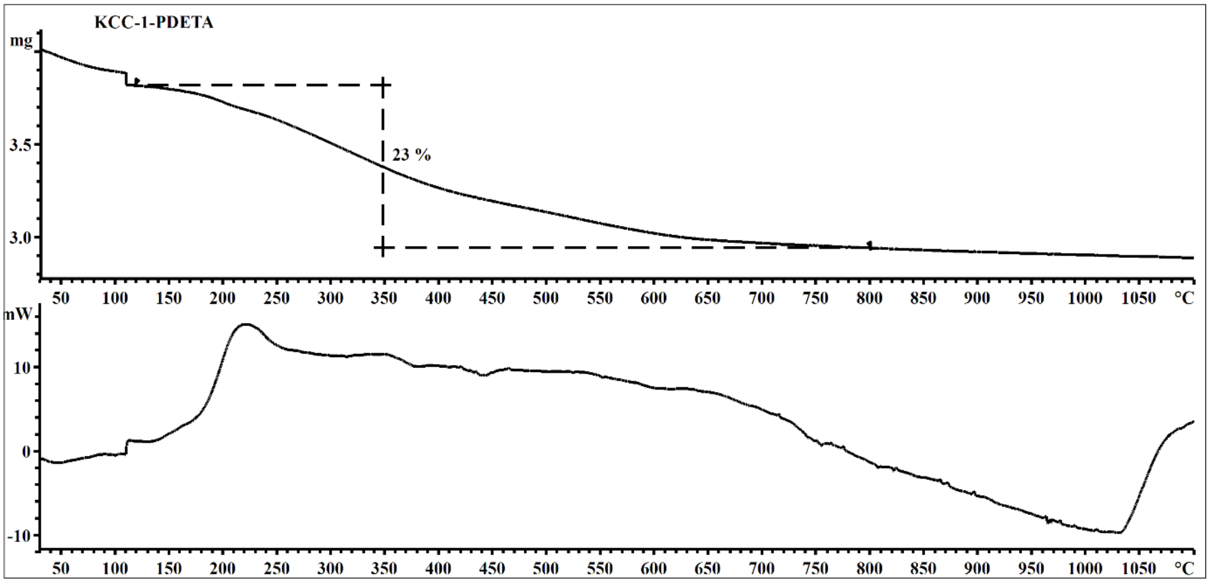

Figure S3. TGA-DTA profile of KCC-1-PDETA.

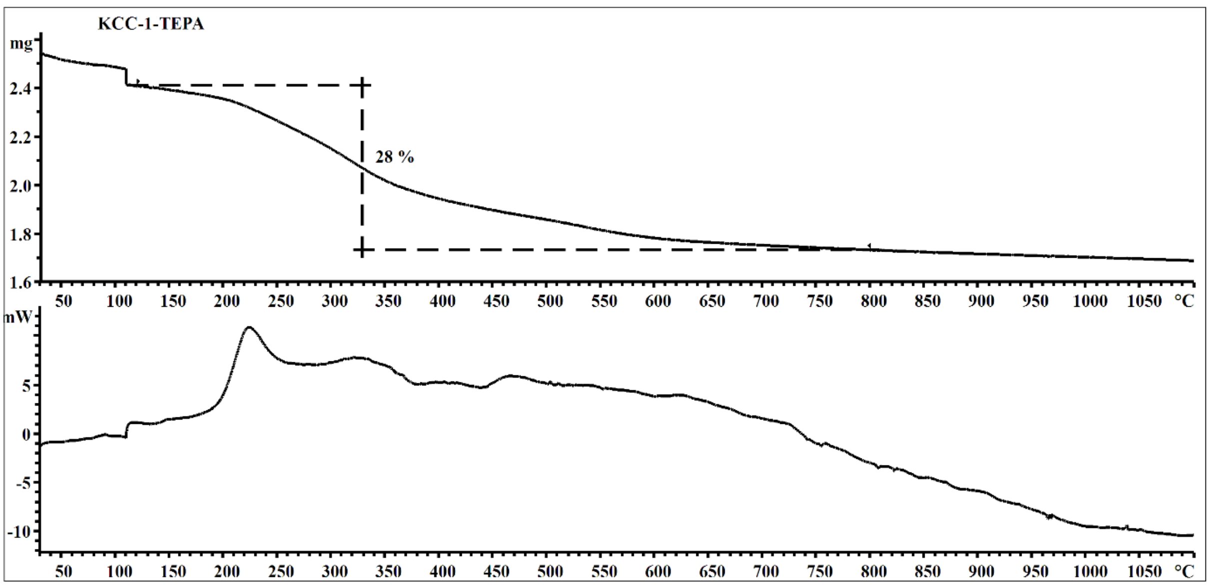

Figure S4. TGA-DTA profile of KCC-1-TEPA.

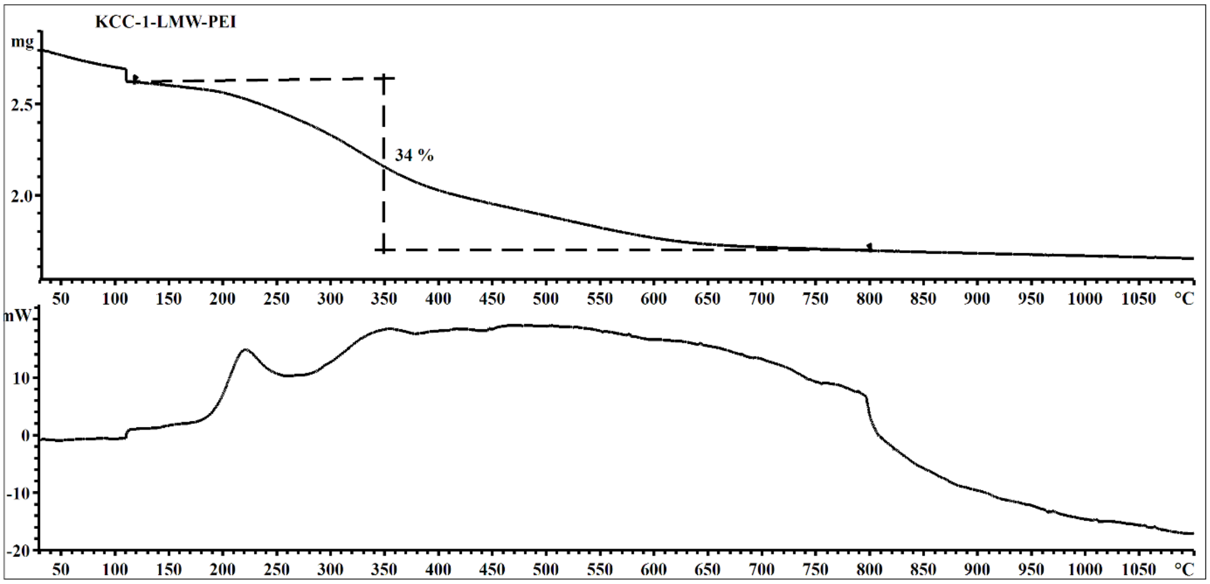

Figure S5. TGA-DTA profile of KCC-1-PEI-LMW.

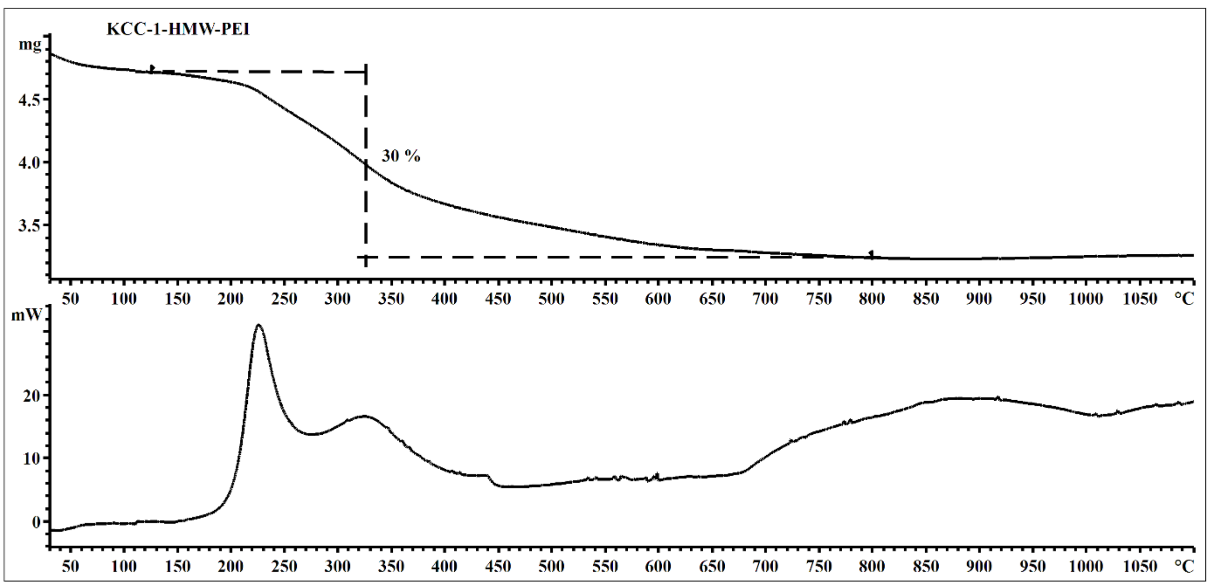

Figure S6. TGA-DTA profile of KCC-1-PEI-HMW.

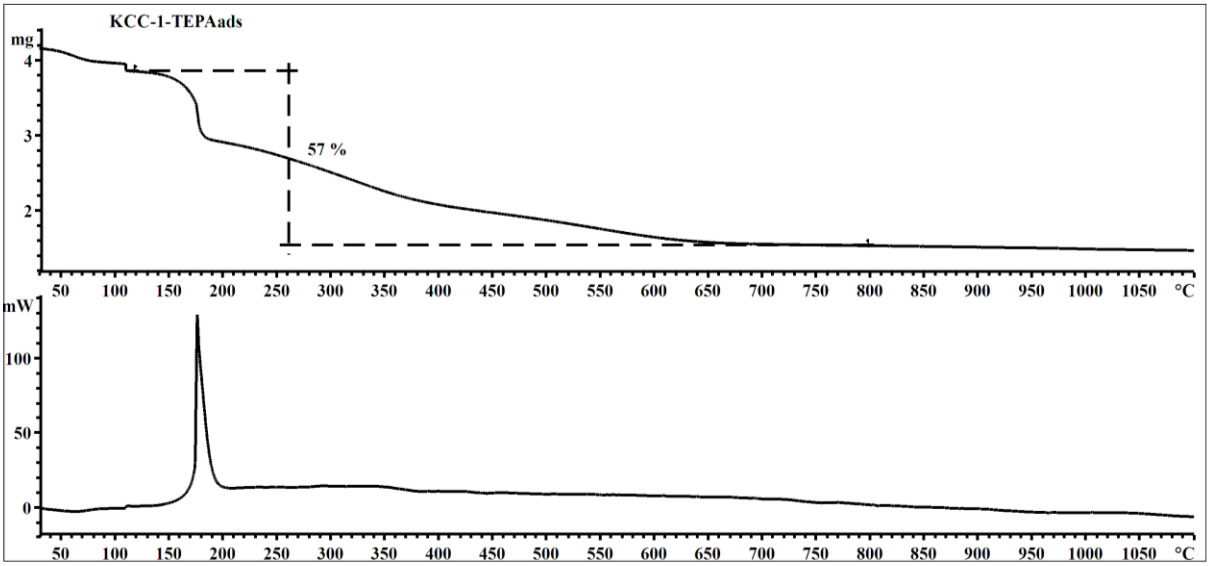

Figure S7. TGA-DTA profile of KCC-1-TEPA$_{ads.}$

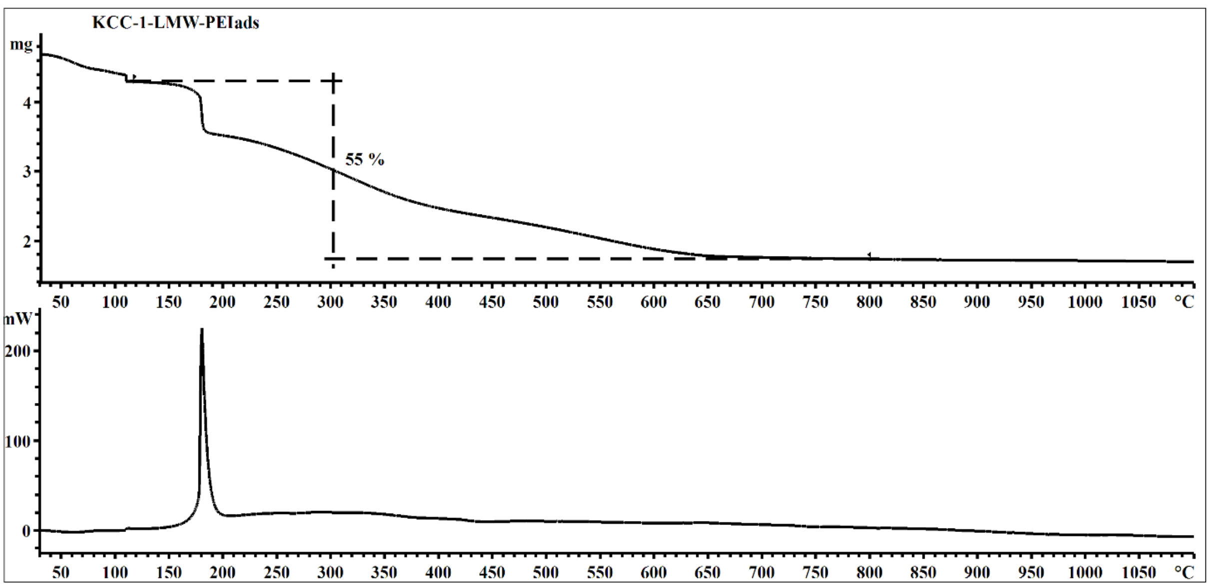

Figure S8. TGA-DTA profile of KCC-1-PEI-LMW$_{ads.}$

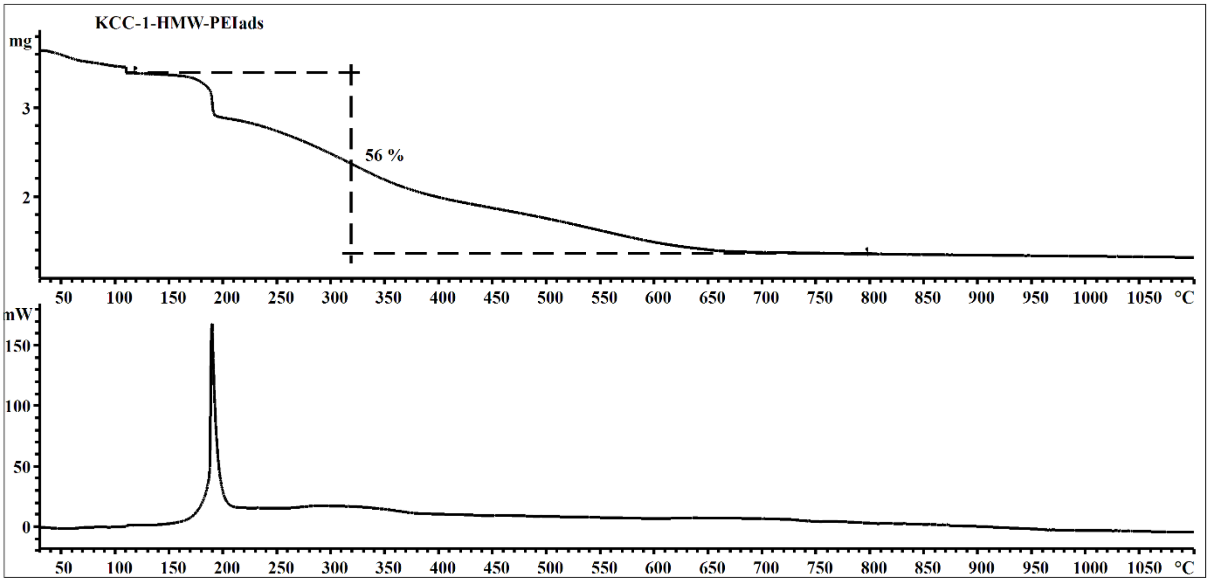

Figure S9. TGA-DTA profile of KCC-1-PEI- $HMW_{ads.}$

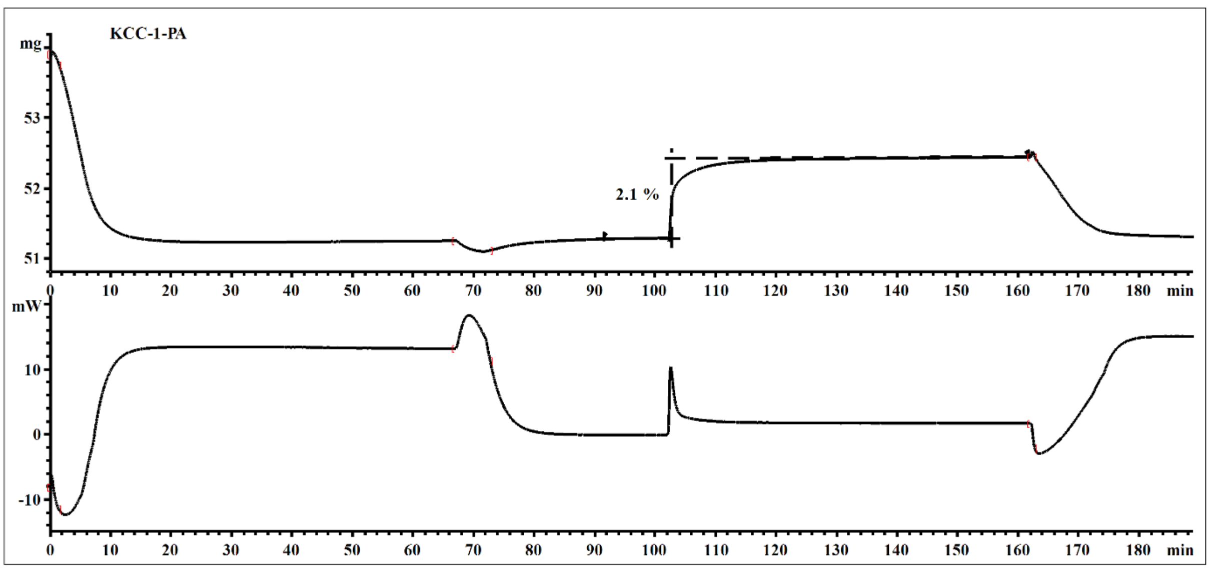

Figure S10. CO_2 adsorption/desorption by KCC-1-PA at 50 °C using 15% CO_2.

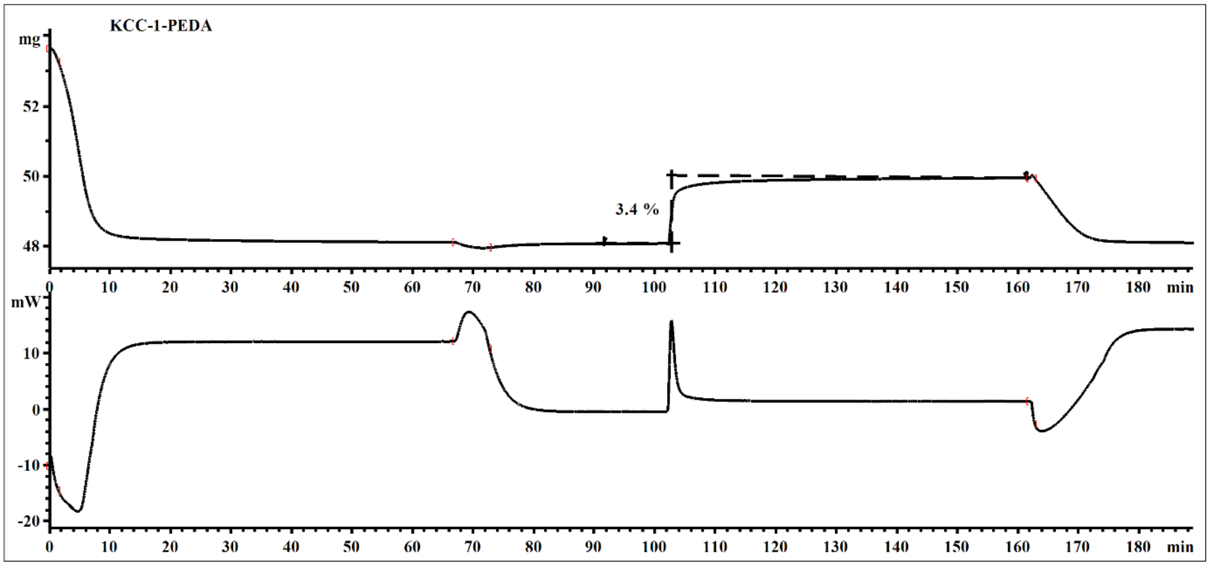

Figure S11. CO_2 adsorption/desorption by KCC-1-PEDA at 50 °C using 15% CO_2.

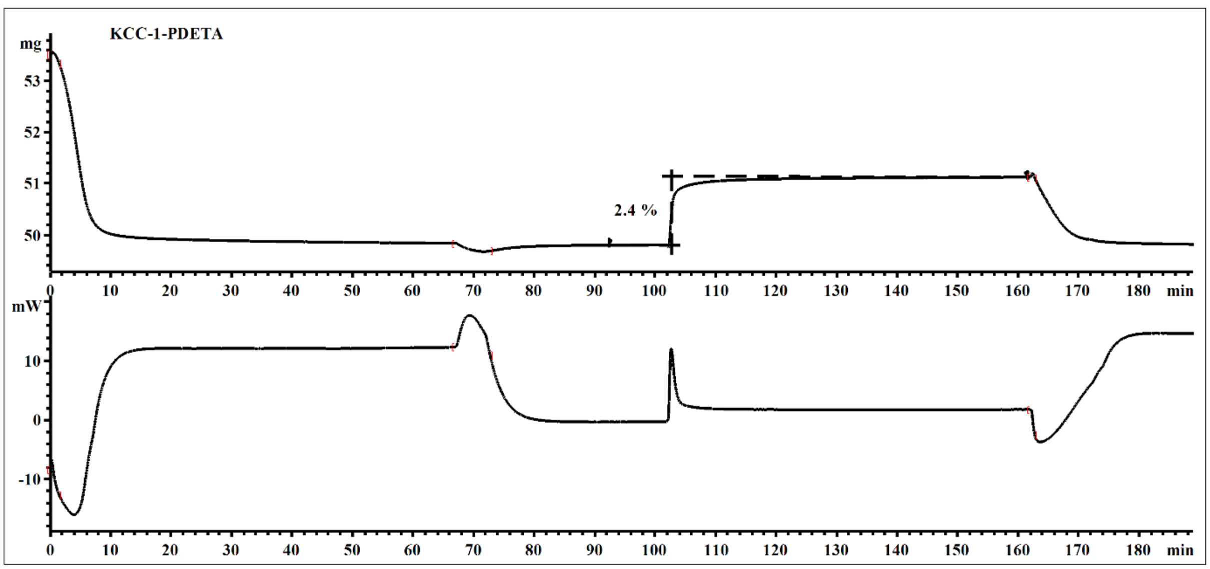

Figure S12. CO_2 adsorption by KCC-1-PDETA at 50 °C using 15% CO_2.

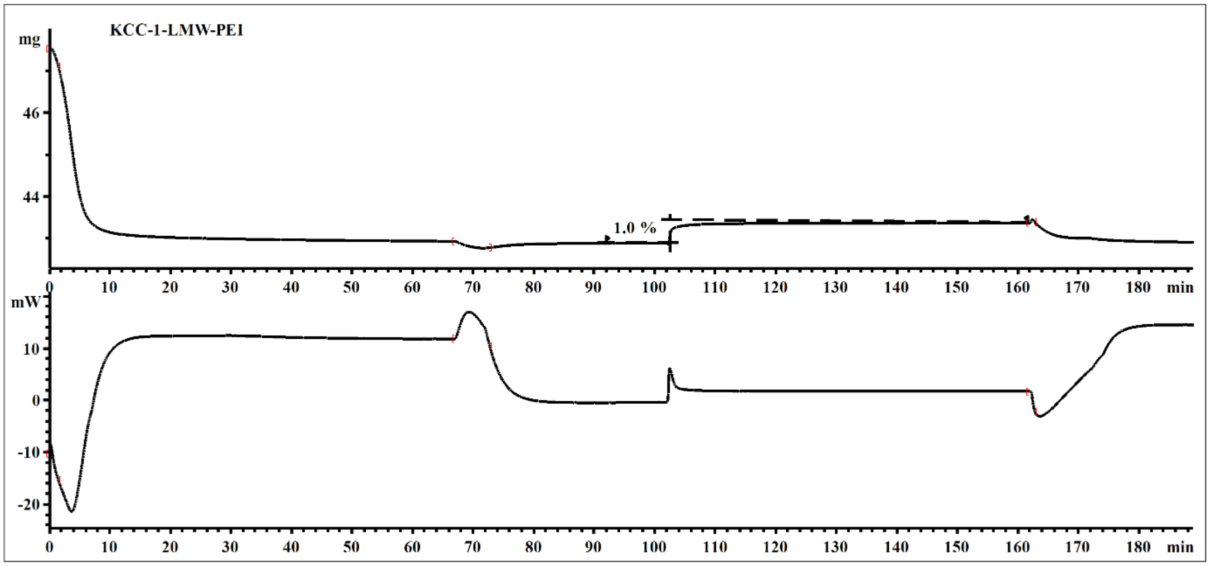

Figure S13. CO_2 adsorption by KCC-1-PEI-LMW at 50 °C using 15 % CO_2.

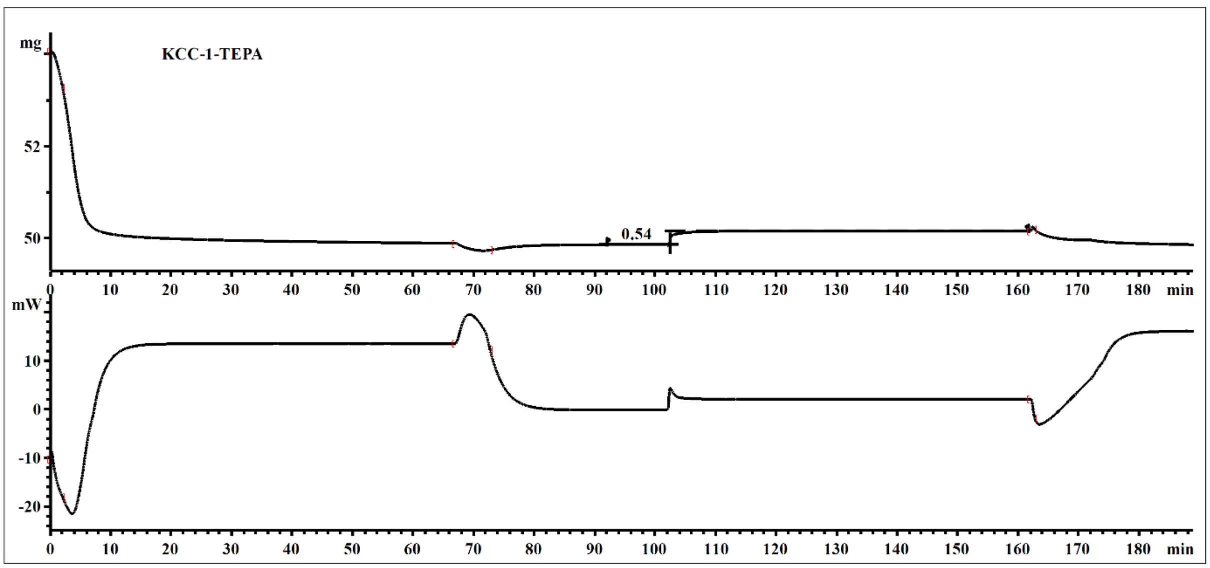

Figure S14. CO_2 adsorption by KCC-1-TEPA at 50 °C using 15 % CO_2.

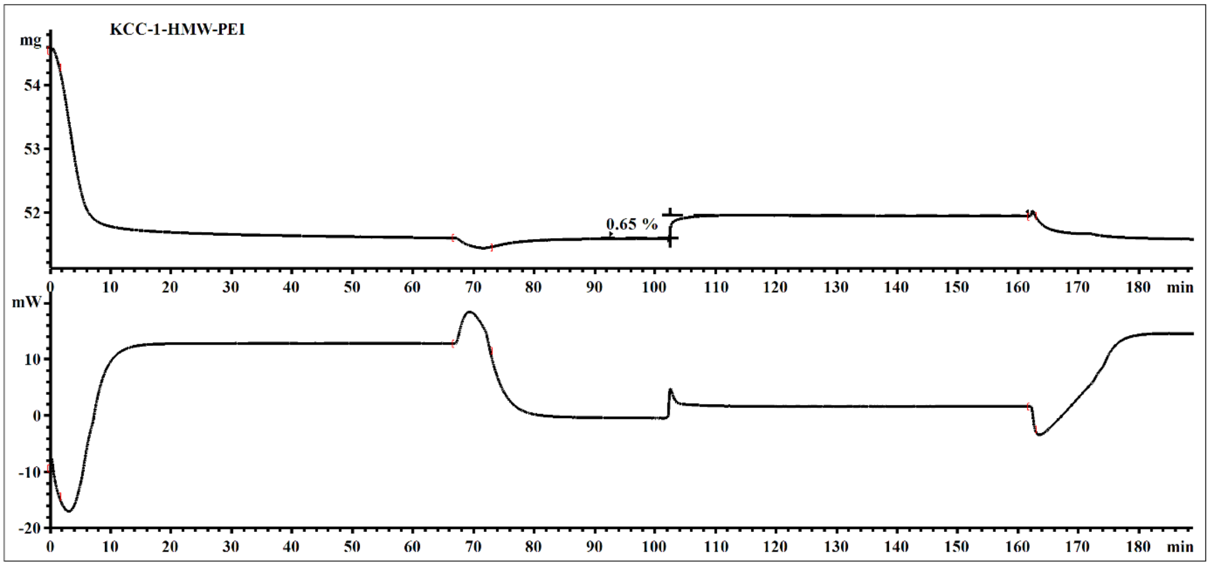

Figure S15. CO_2 adsorption by KCC-1-PEI-HMW at 50 °C using 15 % CO_2.

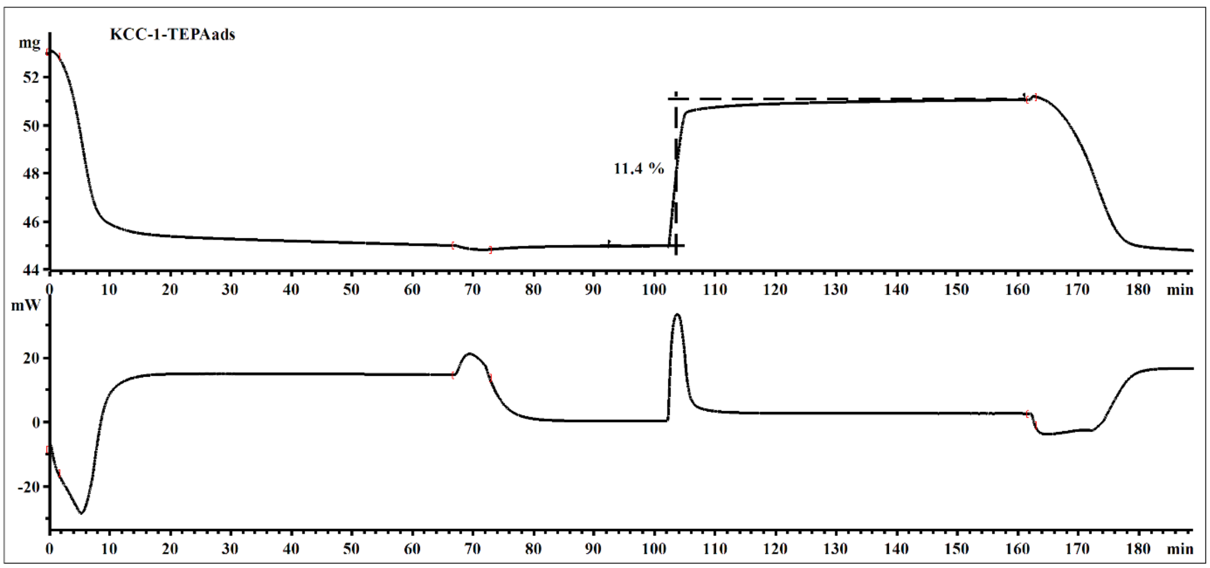

Figure S16. CO_2 adsorption by KCC-1-$TEPA_{ads}$ at 50 °C using 15 % CO_2.

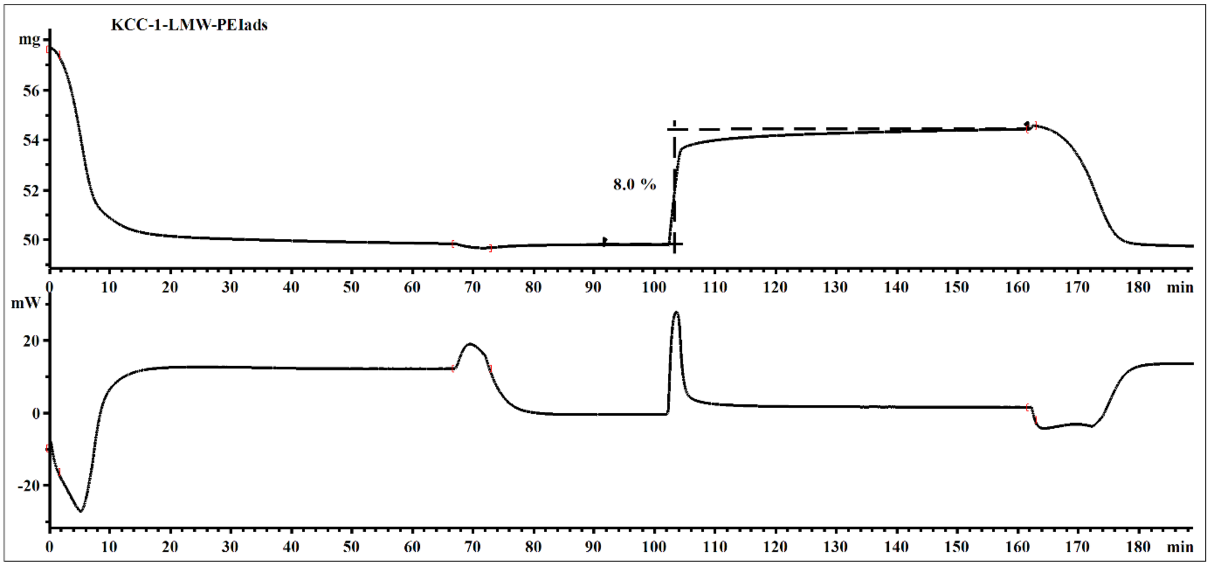

Figure S17. CO_2 adsorption by KCC-1-PEI--LMW$_{ads}$ at 50 °C using 15 % CO_2.

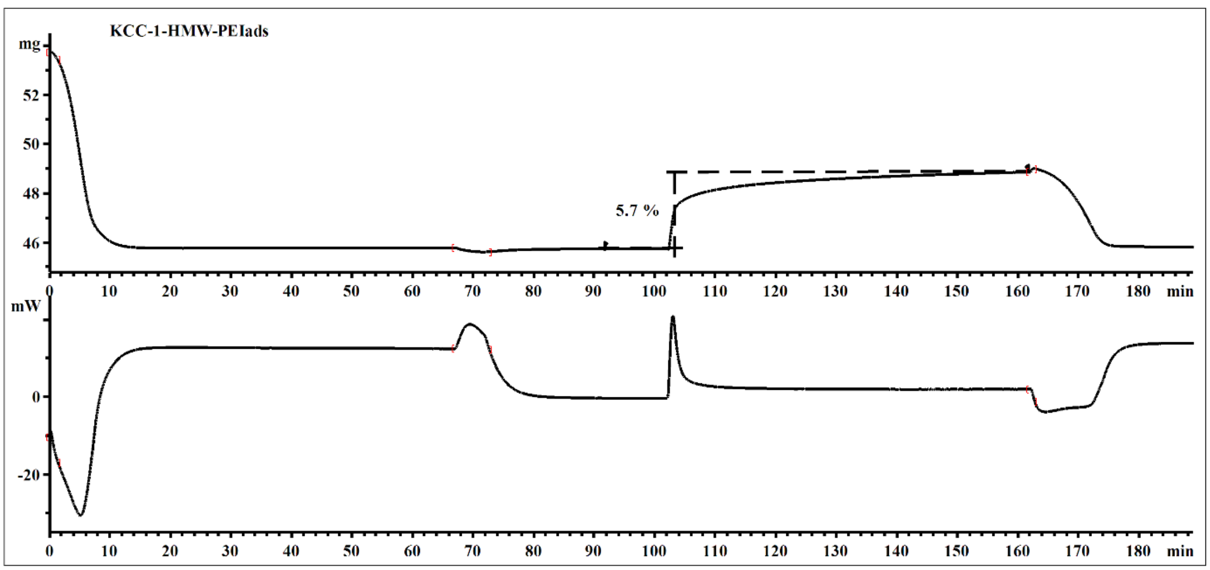

Figure S18. CO_2 adsorption by KCC-1-PEI-HMW$_{ads}$ at 50 °C using 15 % CO_2.

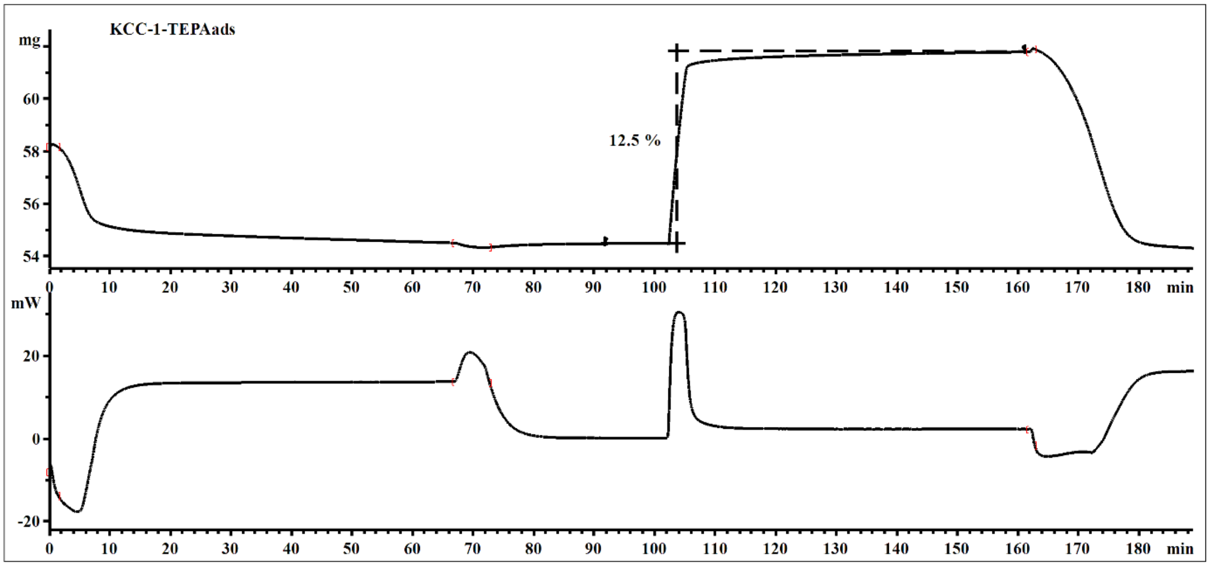

Figure S19. CO_2 adsorption by KCC-1-$TEPA_{ads}$ (toluene as a solvent) at 50 °C using 15 % CO_2.

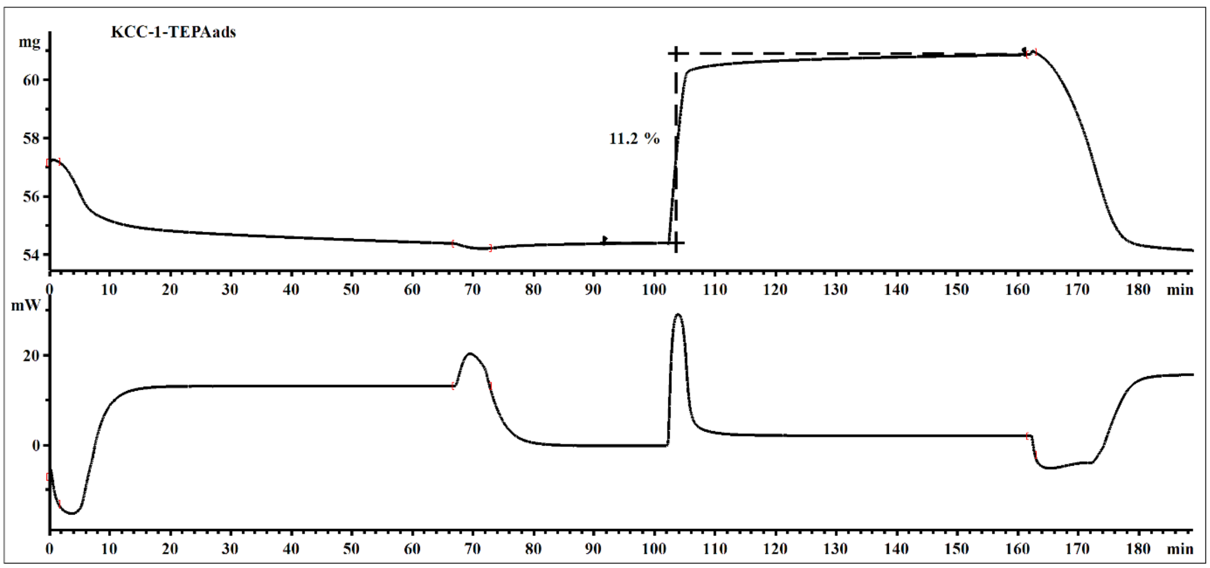

Figure S20. CO_2 adsorption by KCC-1-$TEPA_{ads}$ (THF as a solvent) at 50 °C using 15 % CO_2.

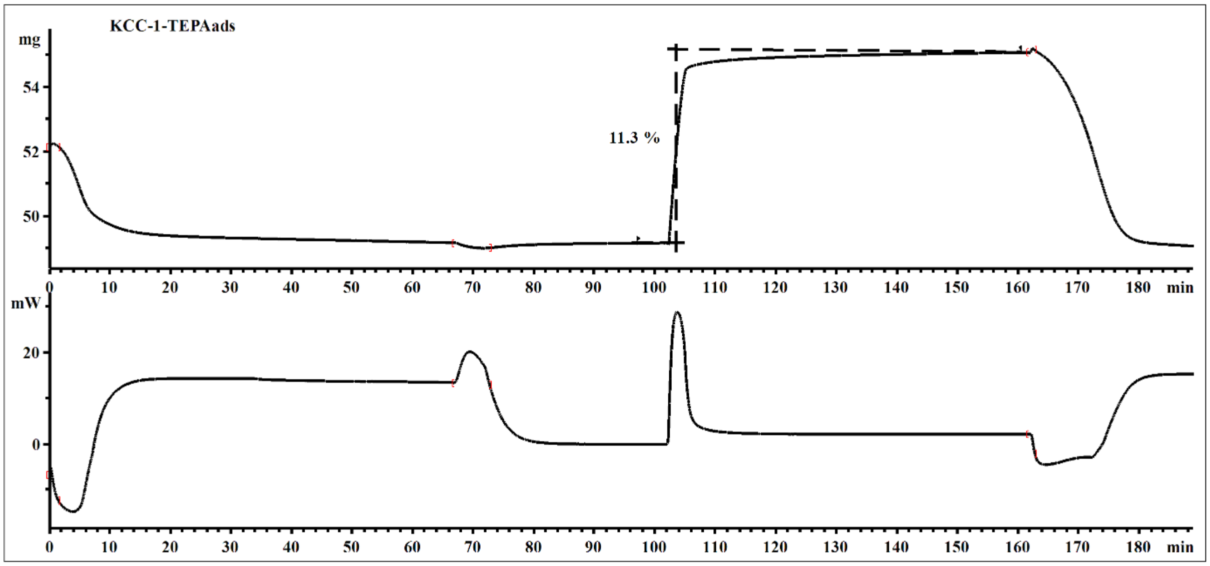

Figure S21. CO_2 adsorption by KCC-1-TEPA$_{ads}$ (Methanol as a solvent) at 50 °C using 15 % CO_2.

Table S1. Synthesis of various TEPA loaded KCC-1 and MCM-41.

Types of support	Amount of support (mg)	TEPA used (mg)	Organic amine loading by TGA (wt. %)
KCC-1	500	1000	63.8
	500	850	61.0
	500	750	58.3
	500	350	44.4
	500	300	39.4
MCM-41	500	1000	67.3
	500	850	64.4
	500	750	57.6
	500	350	39.4
	500	300	36.6

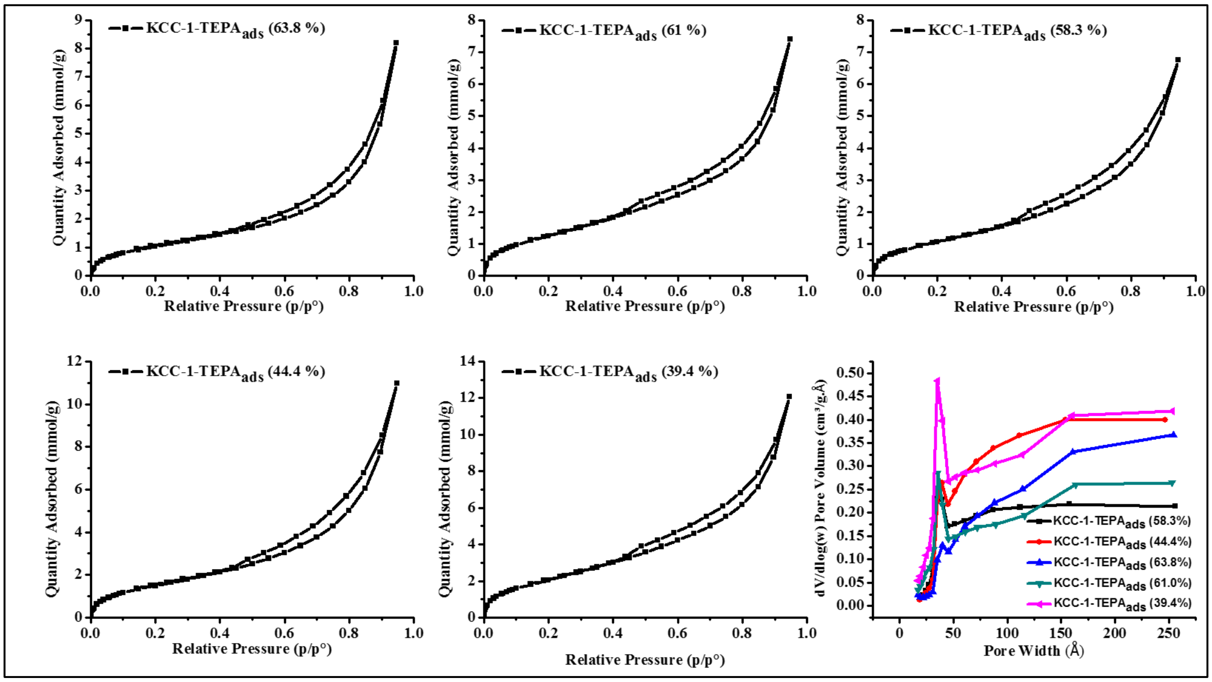

Figure S22. N_2 sorption isotherm of various KCC-1-TEPA$_{ads.}$

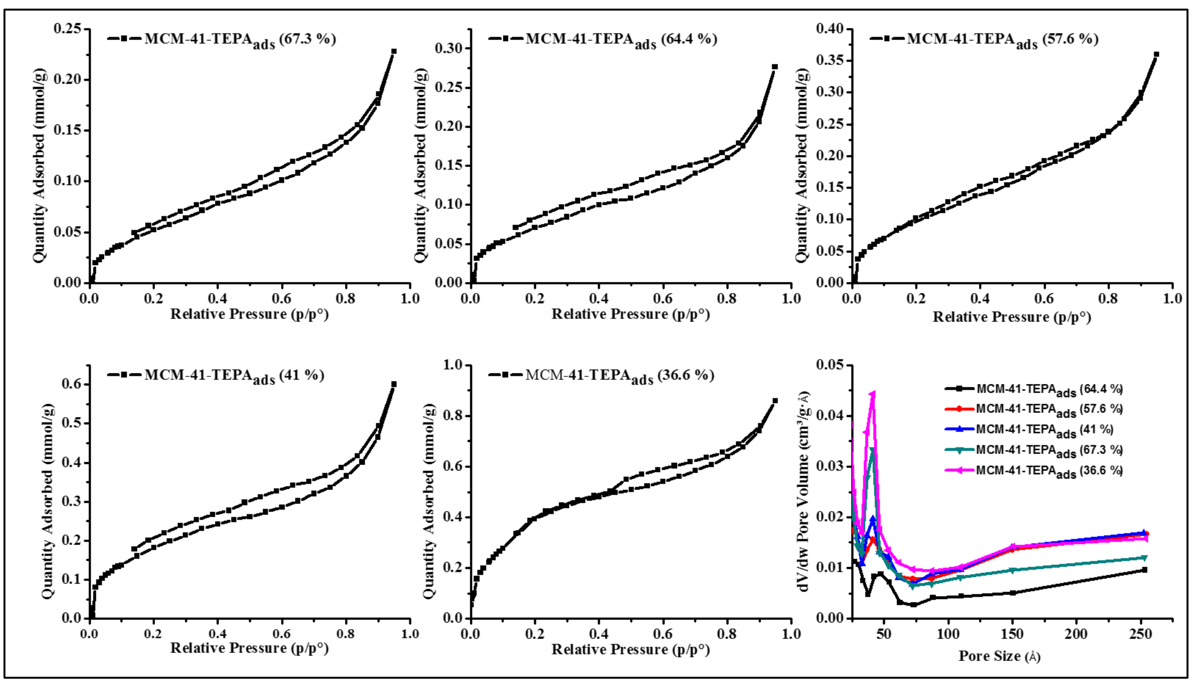

Figure S23. N_2 sorption isotherm of various MCM-41-TEPA$_{ads.}$

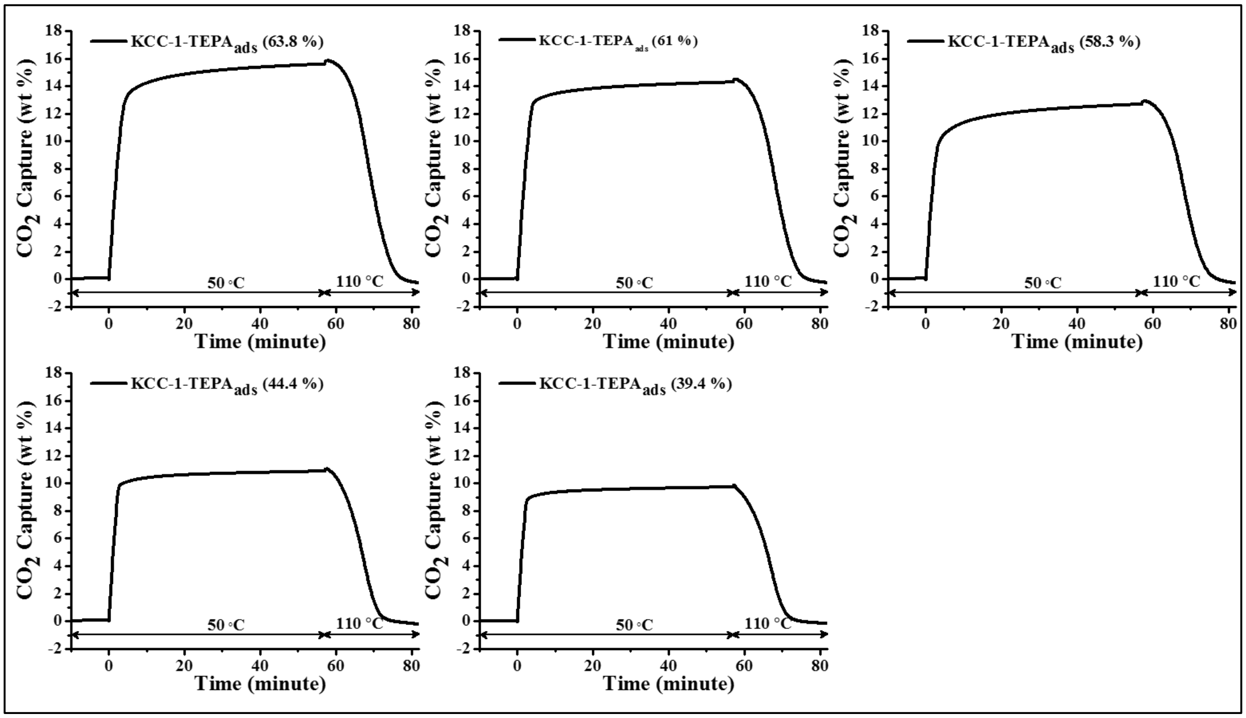

Figure S24. CO_2 adsorption by KCC-1-TEPA$_{ads}$ at different loading (toluene as a solvent) at 50 °C using 15 % CO_2.

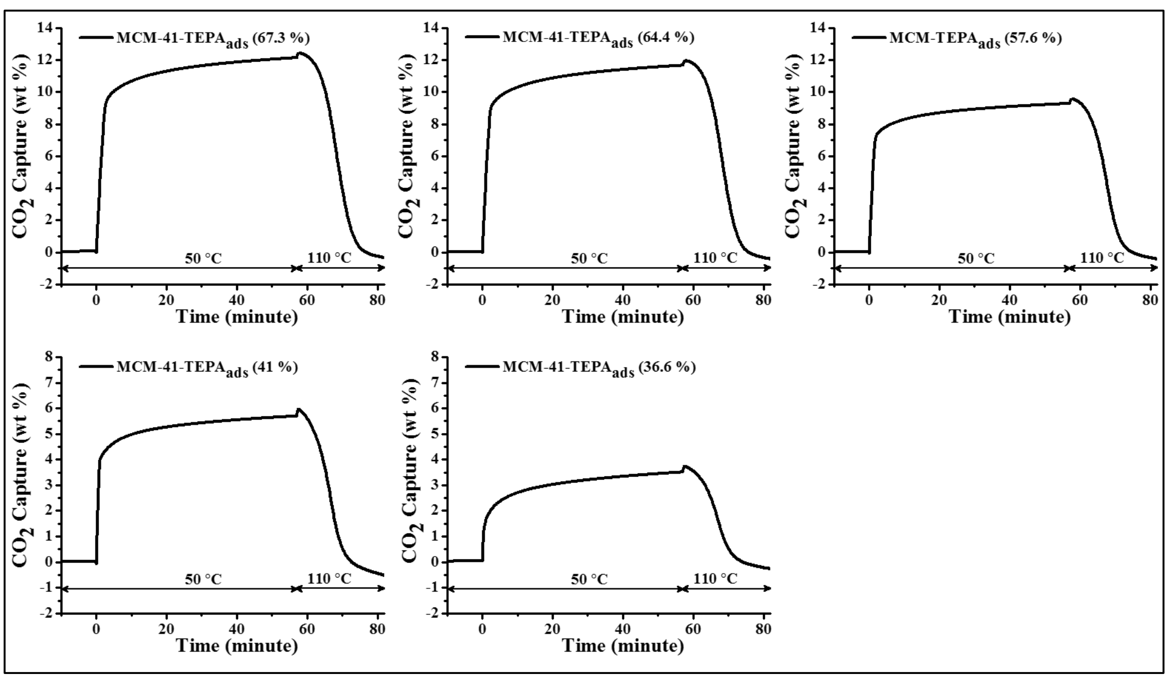

Figure S25. CO_2 adsorption by MCM-41-TEPA$_{ads}$ at different loading (toluene as a solvent) at 50 °C using 15 % CO_2.

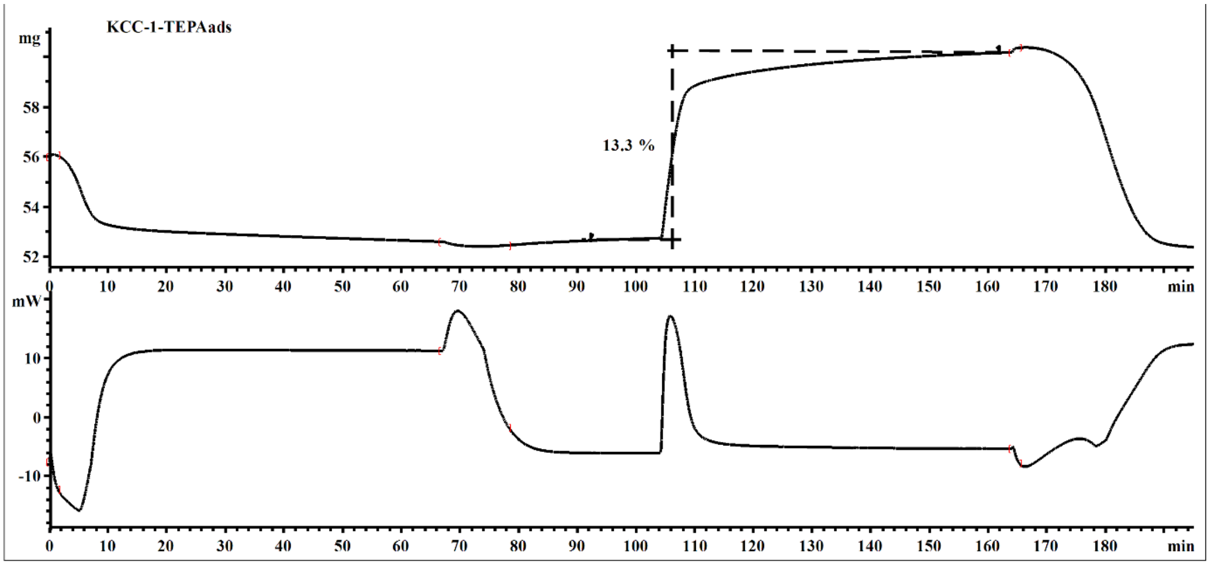

Figure S26. CO_2 adsorption by KCC-1-TEPA$_{ads}$ (63.8 wt. %) at 30 °C using 15 % CO_2.

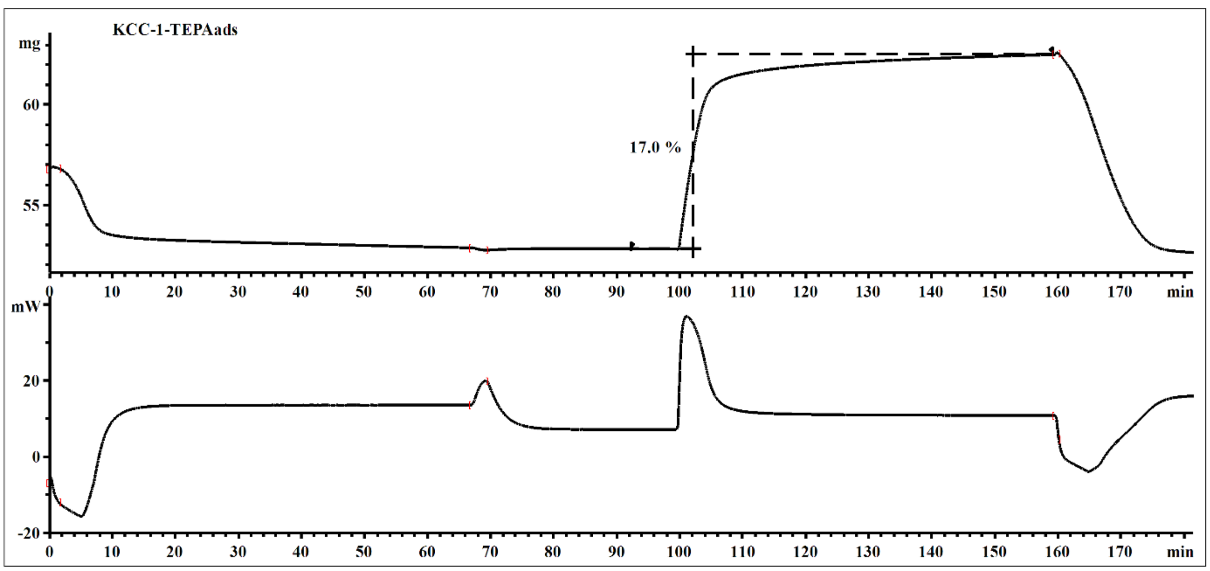

Figure S27. CO_2 adsorption by KCC-1-TEPA$_{ads}$ (63.8 wt. %) at 75 °C using 15 % CO_2.

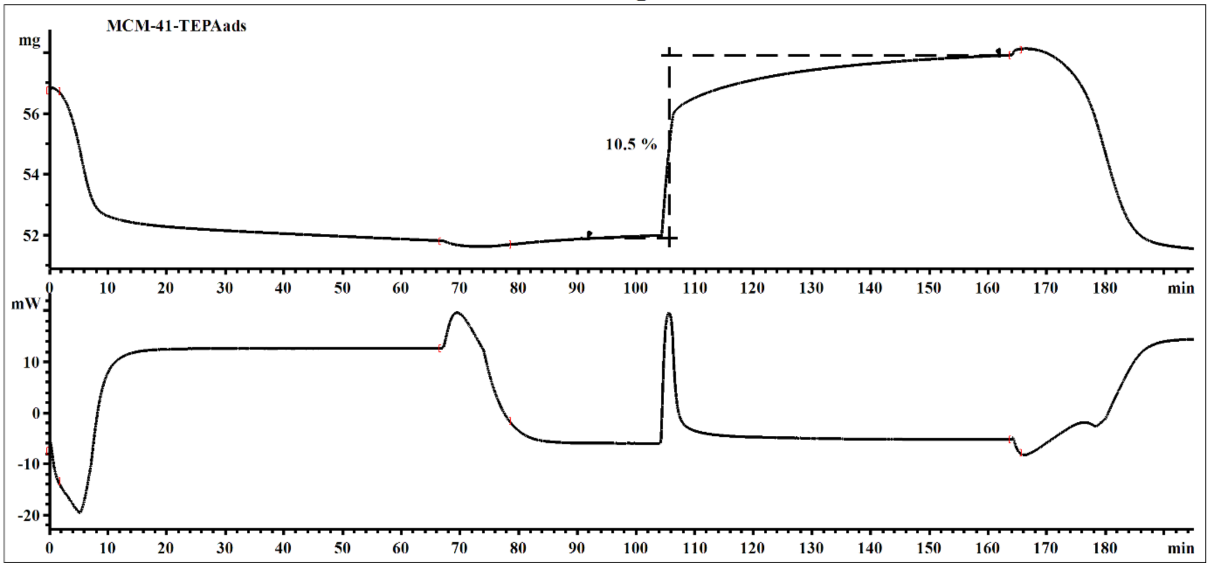

Figure S28. CO_2 adsorption by MCM-41-TEPA$_{ads}$ (67.3 wt. %) at 30 °C using 15 % CO_2.

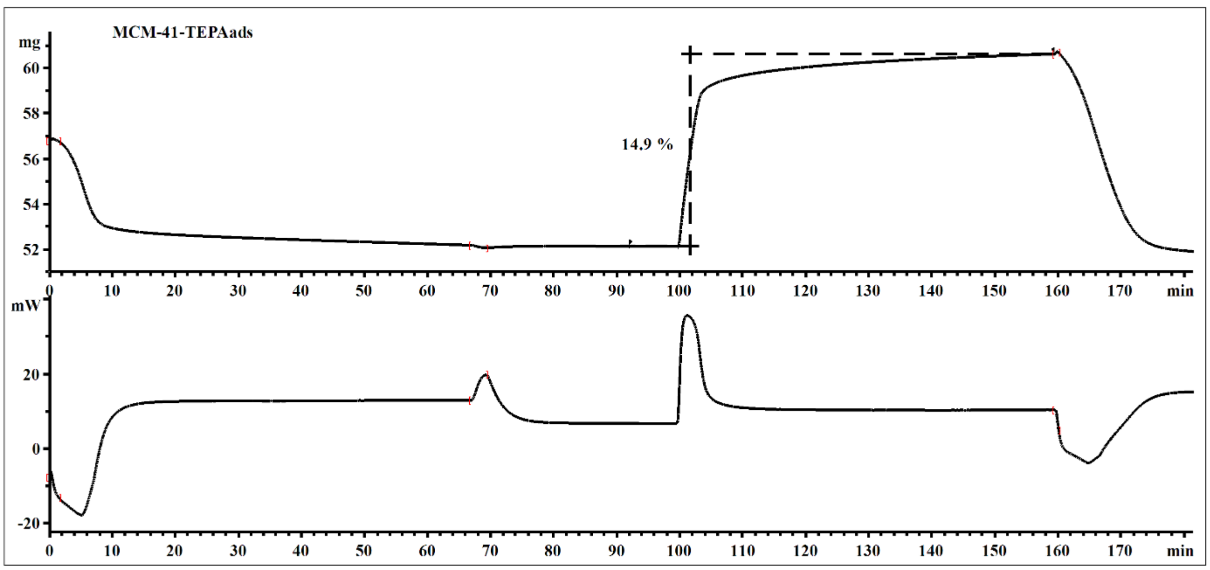

Figure S29. CO_2 adsorption by MCM-41-TEPA$_{ads}$ (67.3 wt. %) at 75 °C using 15 % CO_2.

Table S2. CO_2 capture in each cycle for 21 cycles at 75 °C using 15 % CO_2.

No. of cycles	KCC-1-TEPA$_{ads}$ (63.8 wt. %)		MCM-41-TEPA$_{ads}$ (67.3 wt. %)	
	Under dry condition	Under humid Condition	Under dry condition	Under humid Condition
1	17.0	17.7	15.5	15.4
2	18.3	19.7	16.1	17.6
3	18	19.5	15.7	16.7
4	18.4	20.1	15.9	17.3

5	18.3	19.9	15.4	16.9
6	18.7	20.1	15.6	17
7	18.5	19.8	15.1	16.6
8	18.9	20.1	15	16.7
9	18.5	19.7	14.7	16.3
10	18.8	20	14.9	16.3
11	18.5	19.6	14.4	15.8
12	18.7	19.8	14.5	15.6
13	18.3	19.2	13.9	14.8
14	18.6	19.3	13.9	14.8
15	18.2	18.8	13.7	14.3
16	18.3	18.9	13.2	14.6
17	17.8	18.4	12.6	13.8
18	17.9	18.6	12.5	14
19	17.5	17.9	11.9	12.8
20	17.7	18.1	11.7	12.7
21	17.2	17.4	11.0	11.9
Total	383	402.65	297.2	321.9

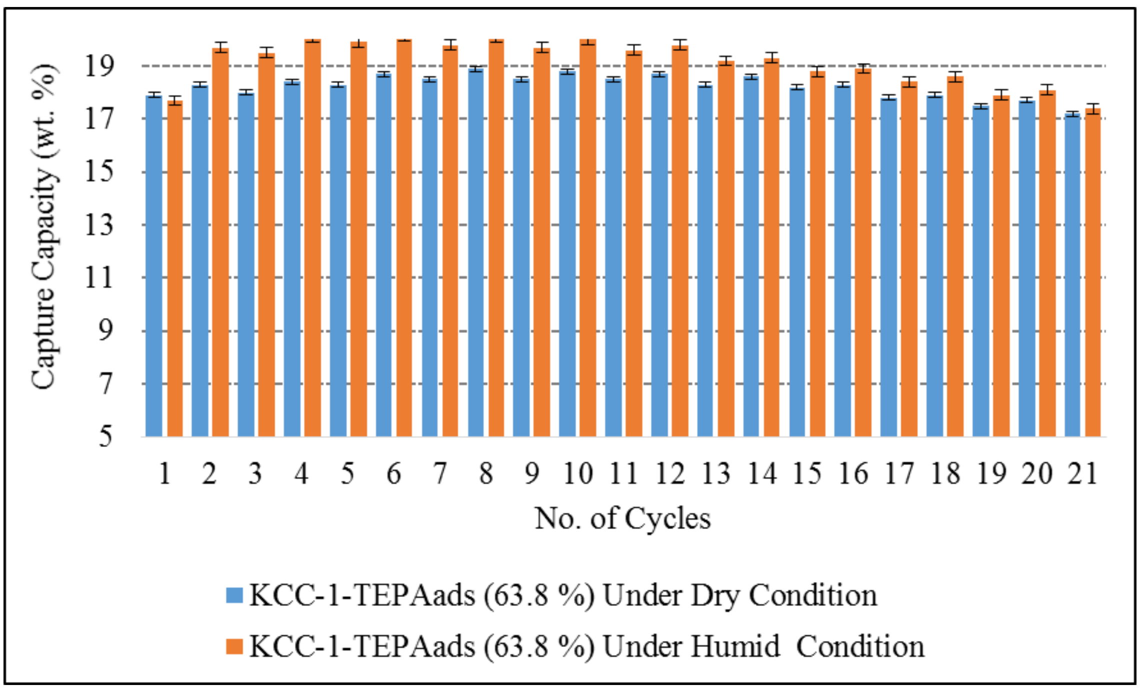

Figure S30. CO_2 adsorption recyclability study under dry and humid condition of KCC-1-TEPA$_{ads}$ (63.8 wt. %) at 75 °C using 15 % CO_2.

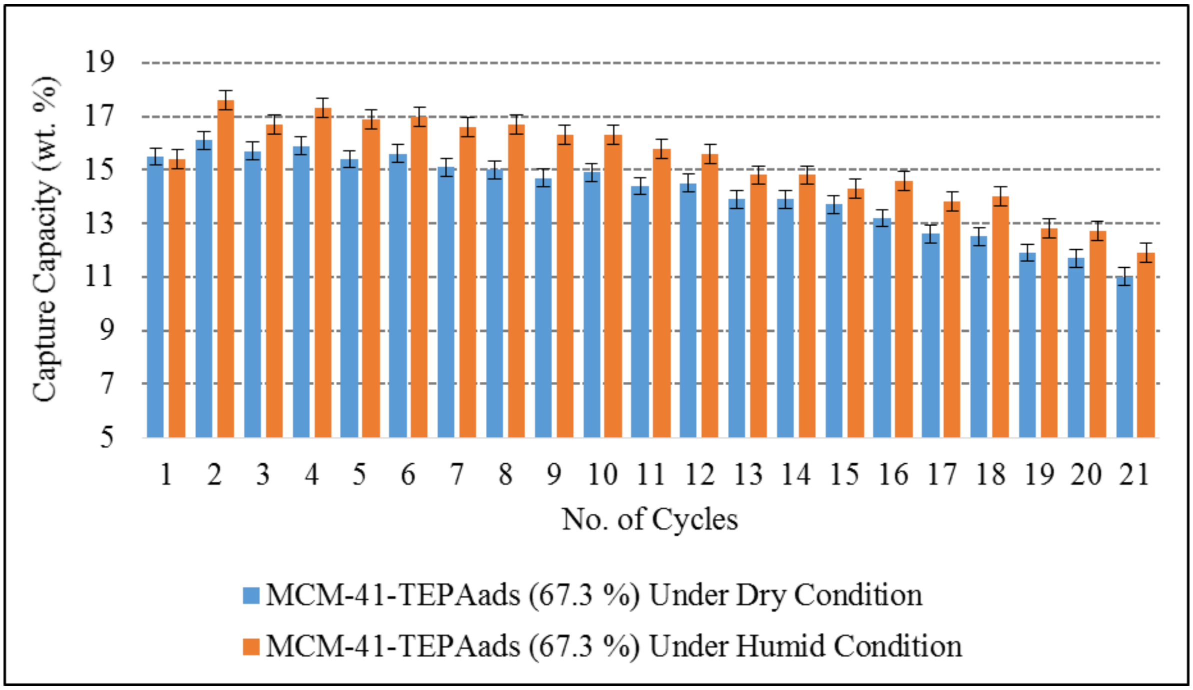

Figure S31. CO_2 adsorption recyclability study under dry and humid condition of MCM-41-TEPA$_{ads}$ (67.3 wt. %) at 75 °C using 15 % CO_2.

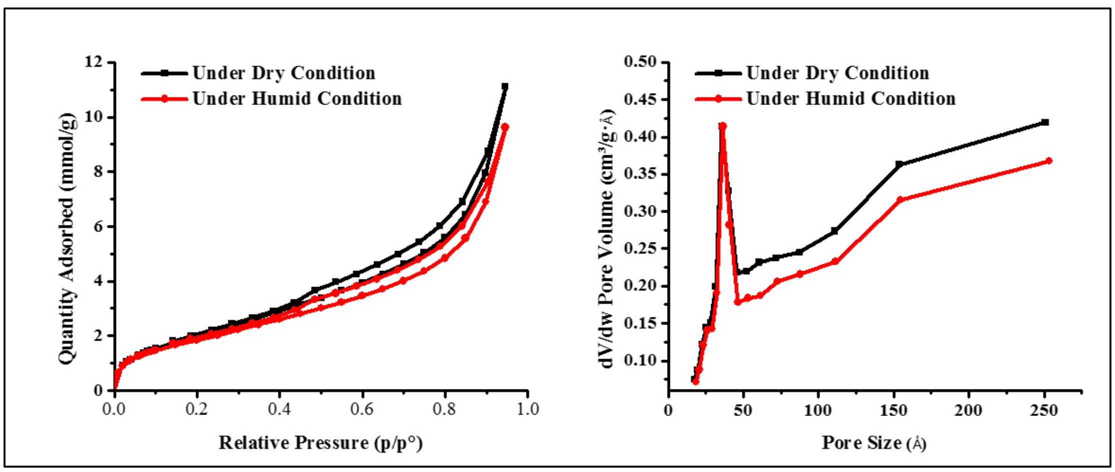

Figure S32. N_2 sorption isotherm and pore size distribution of recycled KCC-1-TEPA$_{ads}$ (63.8 wt. %) after 21 cycles under dry and humid conditions.

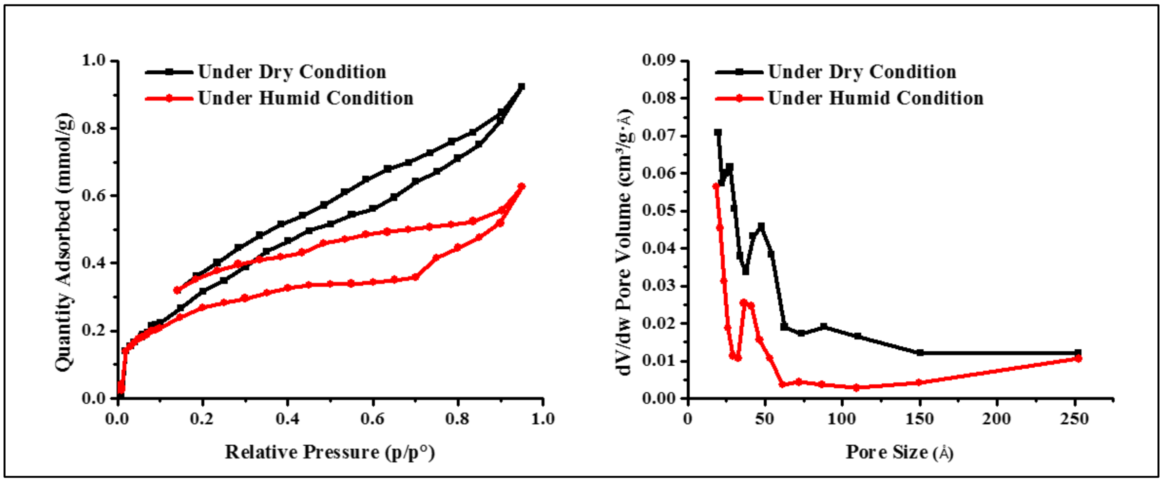

Figure S33. N_2 sorption isotherm and pore size distribution of recycled MCM-41-TEPA$_{ads}$ (67.3 wt. %) after 21 cycles under dry and humid conditions.

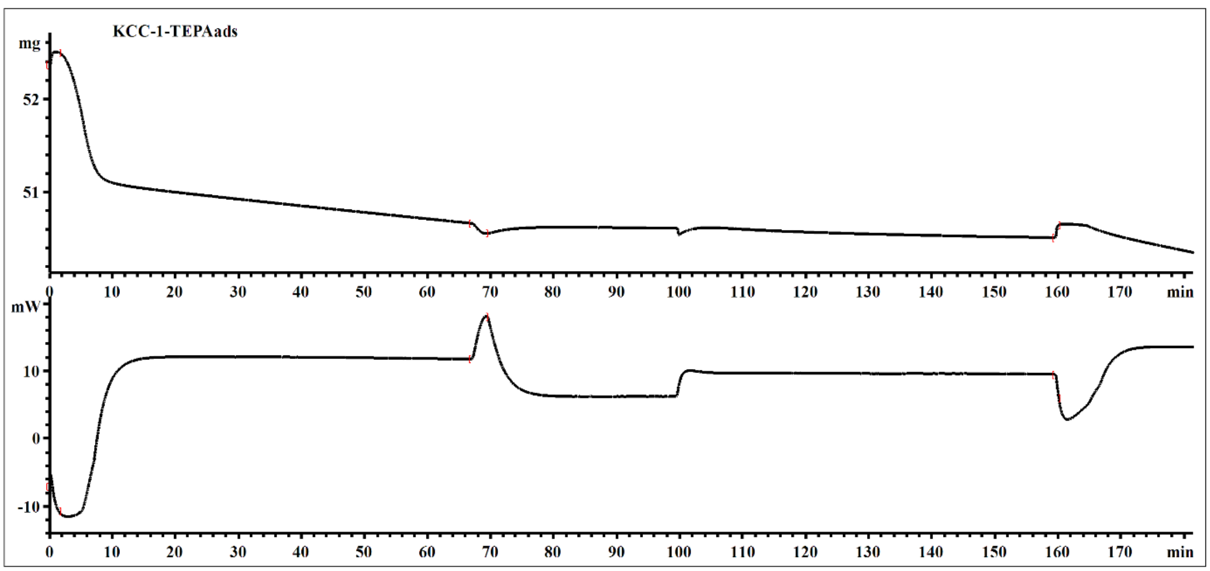

Figure S34. N_2 adsorption of KCC-1-TEPA$_{ads}$ (63.8 wt. %) at 75 °C.

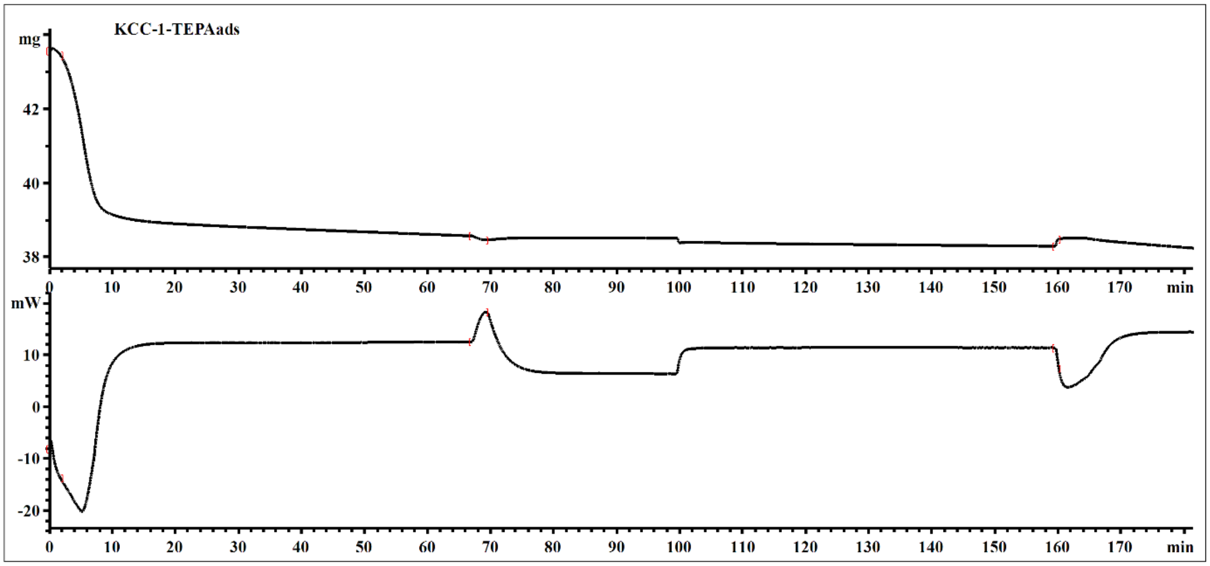

Figure S35. O_2 adsorption of KCC-1-$TEPA_{ads}$ (63.8 wt. %) at 75 °C.

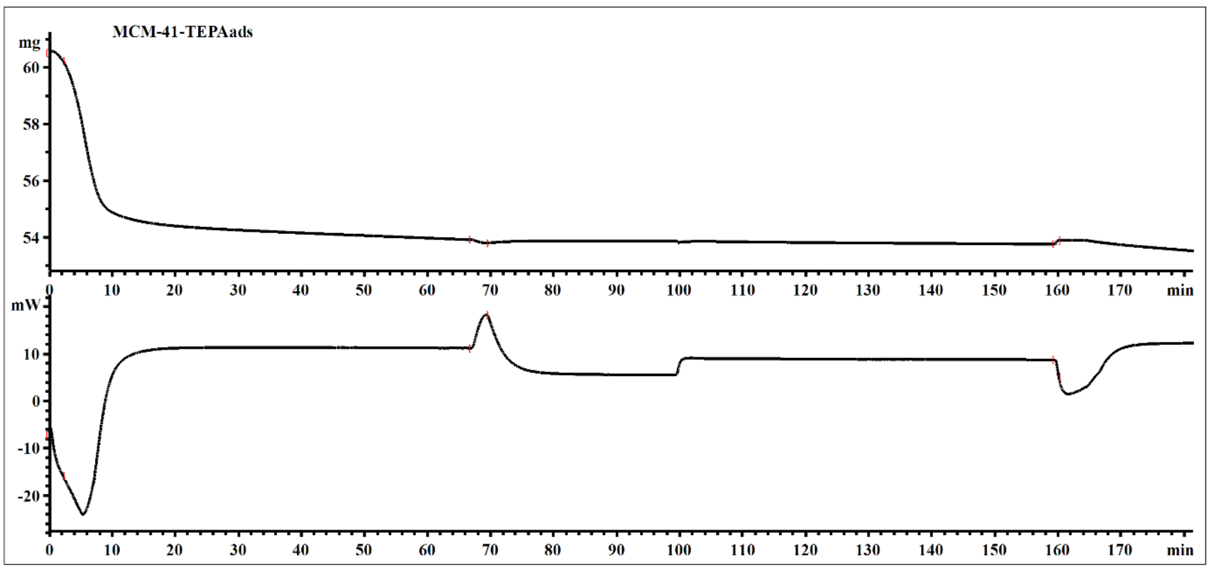

Figure S36. N_2 adsorption of MCM-41-TEPAads (67.3 wt. %) at 75 °C.

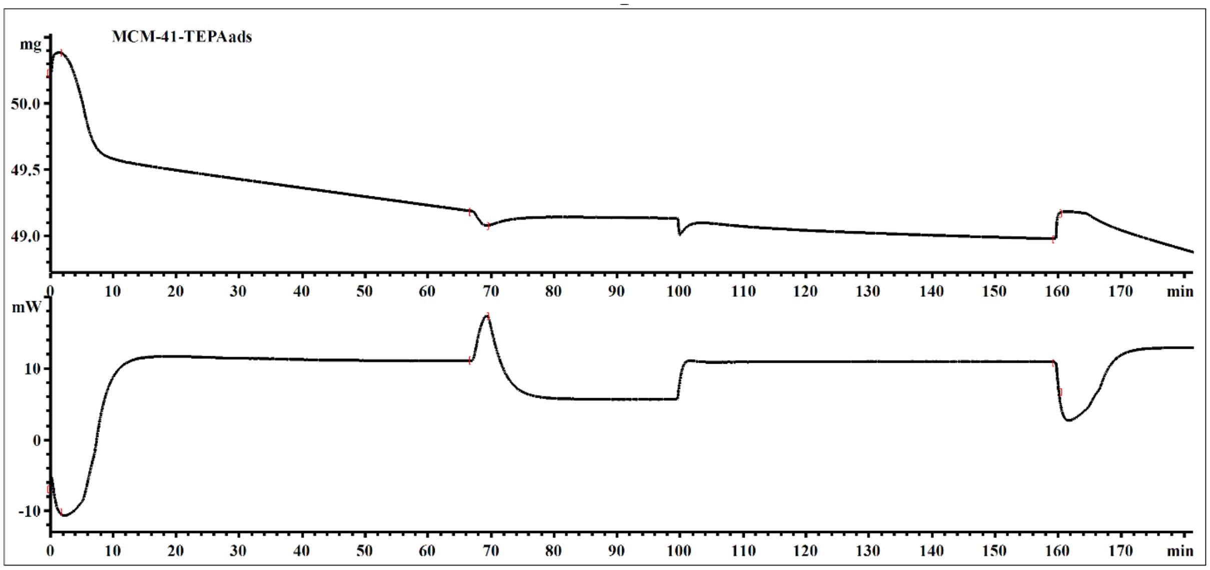

Figure S37. O_2 adsorption of MCM-41-TEPAads (67.3 wt. %) at 75 °C.

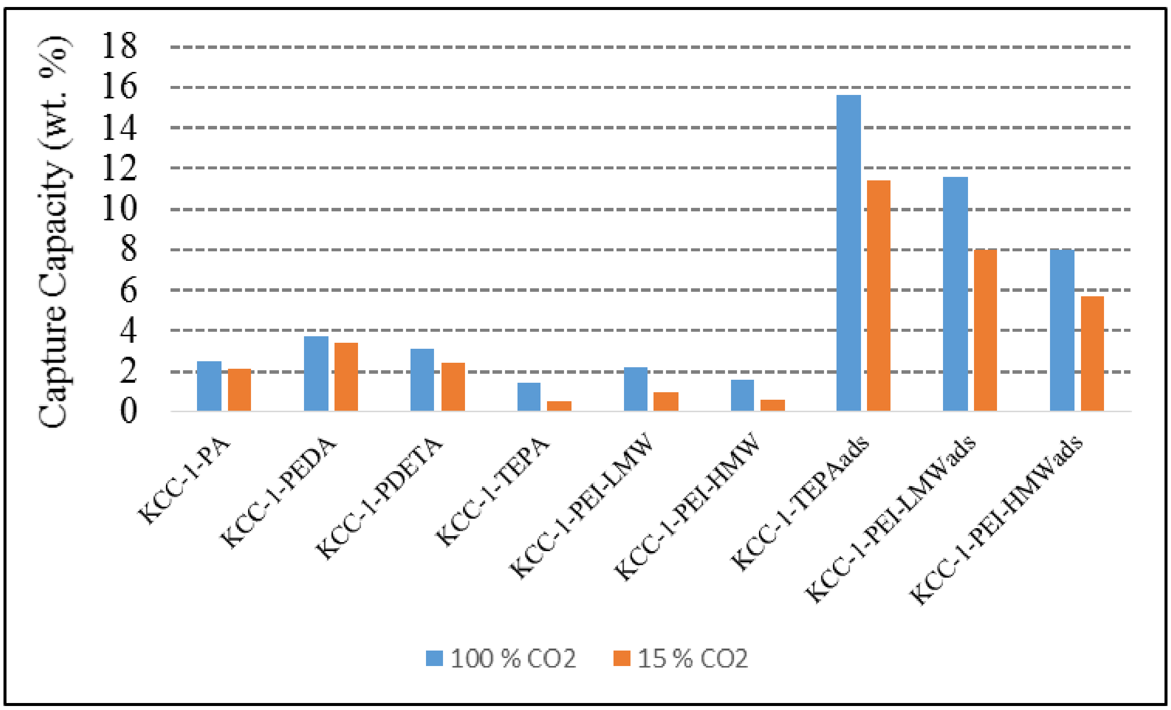

Figure S38. CO_2 adsorption comparison of different KCC-1 sorbent using 15 % CO_2 and 100 % CO_2 at 50 °C