Electronic Supplementary Information

Environmentally-Friendly Synthesis of Flexible MOFs $M(NA)_2$ (M = Zn, Co, Cu, Cd) with Large and Regenerable Ammonia Capacity

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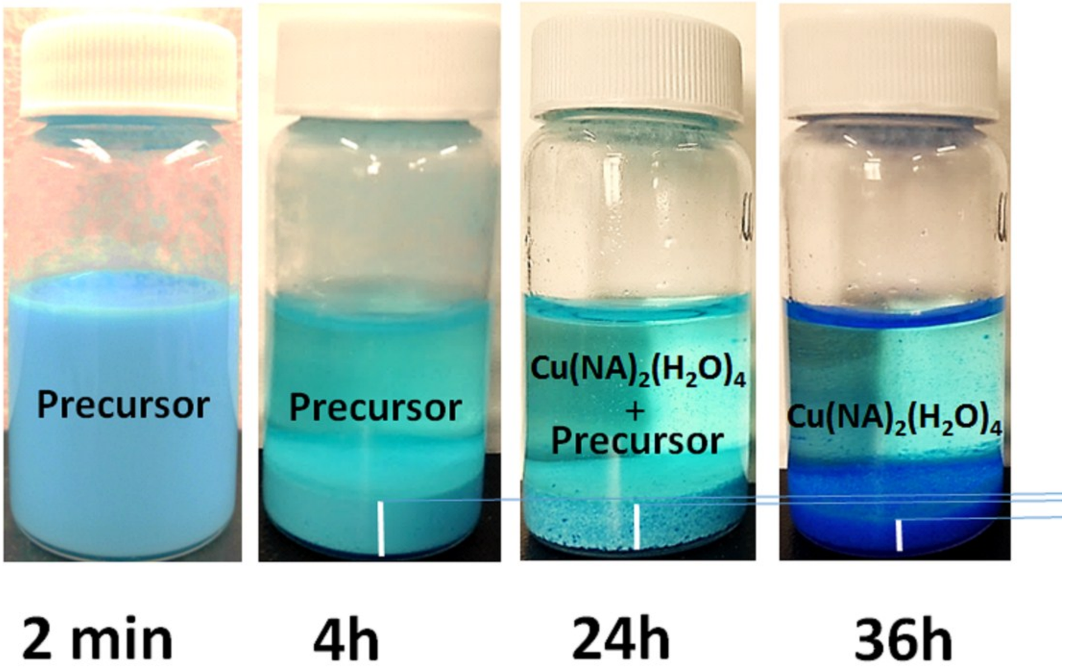

Fig. S1 Evolution of the precursor transformed to crystals in the synthesis of $Cu(NA)_2(H_2O)_4$.

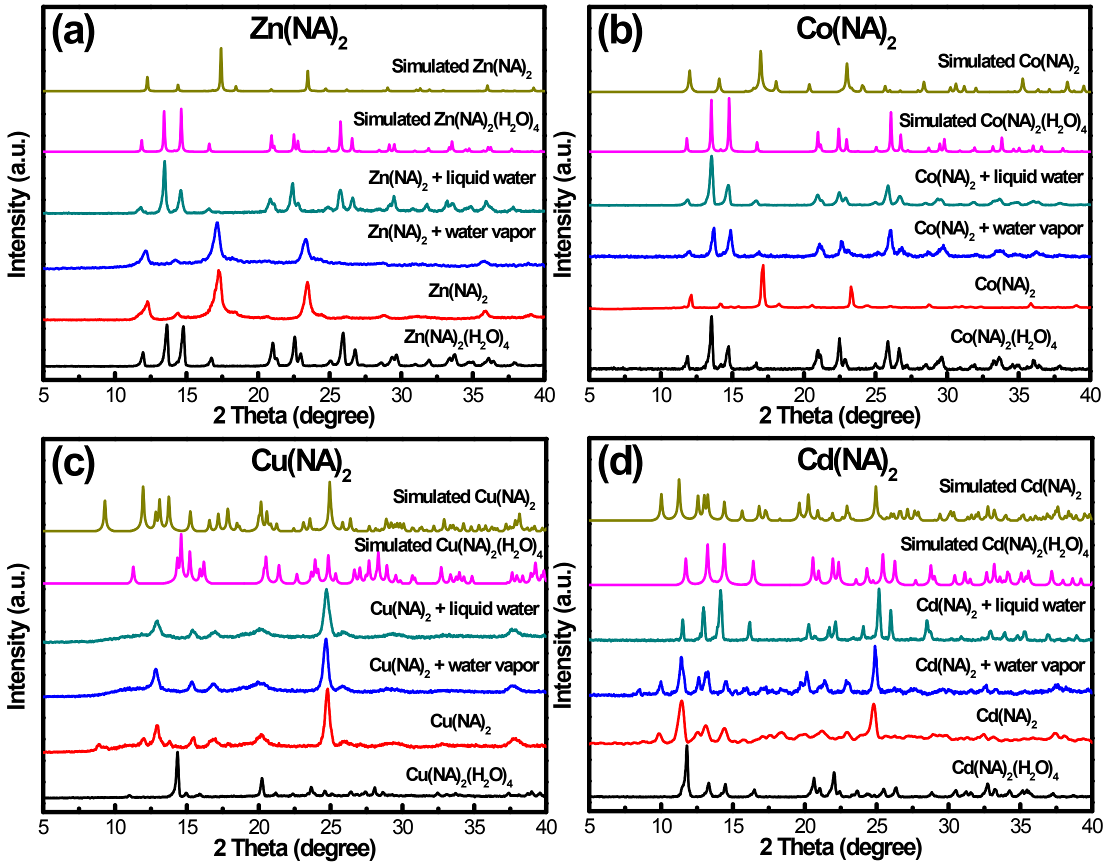

Fig. S2 The compared PXRD patterns of $M(NA)_2$ (M = Zn, Co, Cu, Cd) adsorbed H_2O in liquid or steam condition.

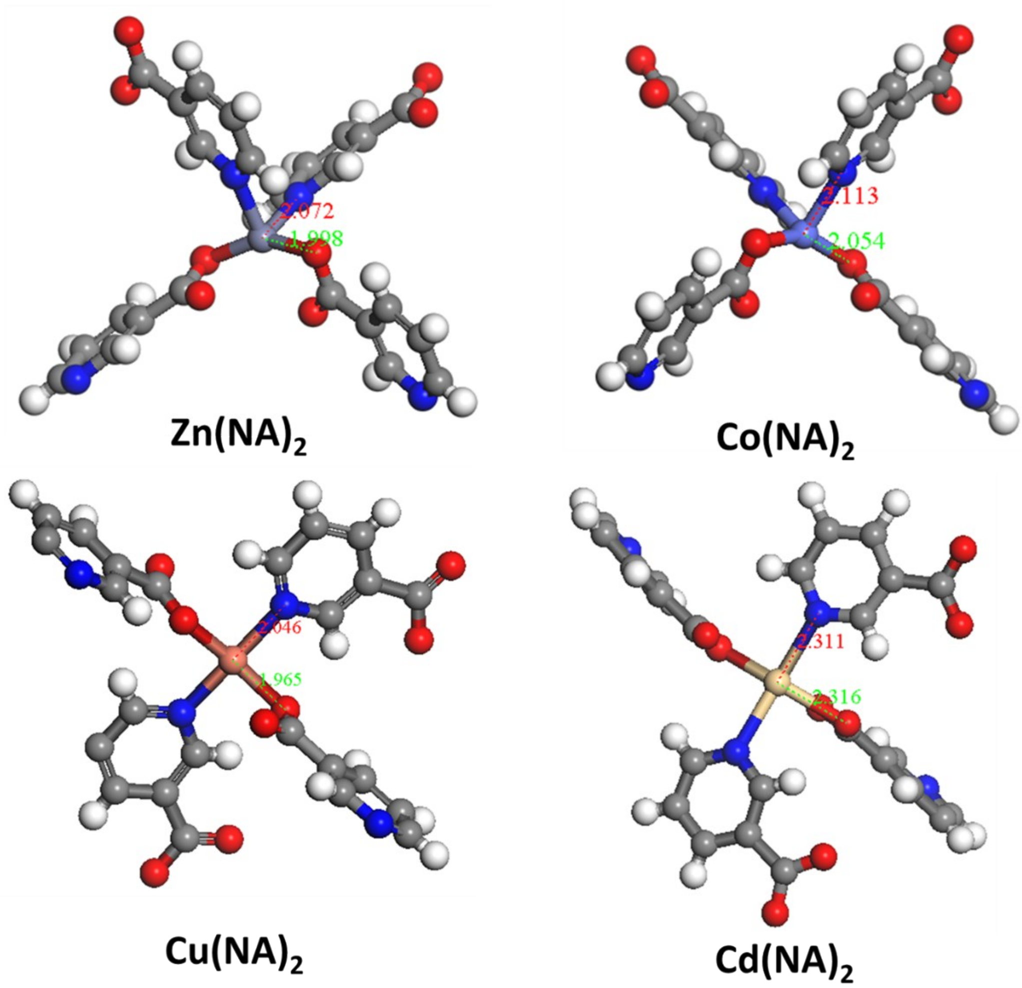

Fig. S3 M-O and M-N bond length in structures of M(NA)$_2$ (M = Zn, Co, Cu, Cd).

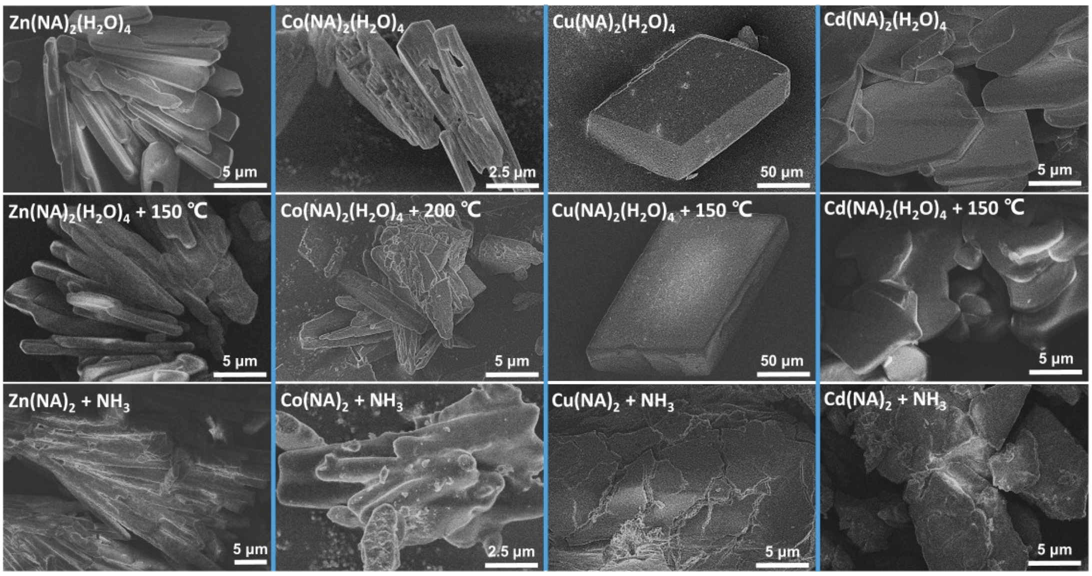

Fig. S4 The SEM images of the as-synthesized $M(NA)_2(H_2O)_4$ (M = Zn, Co, Cu, Cd) samples, and their SEM images after activated or adsorbing NH_3.

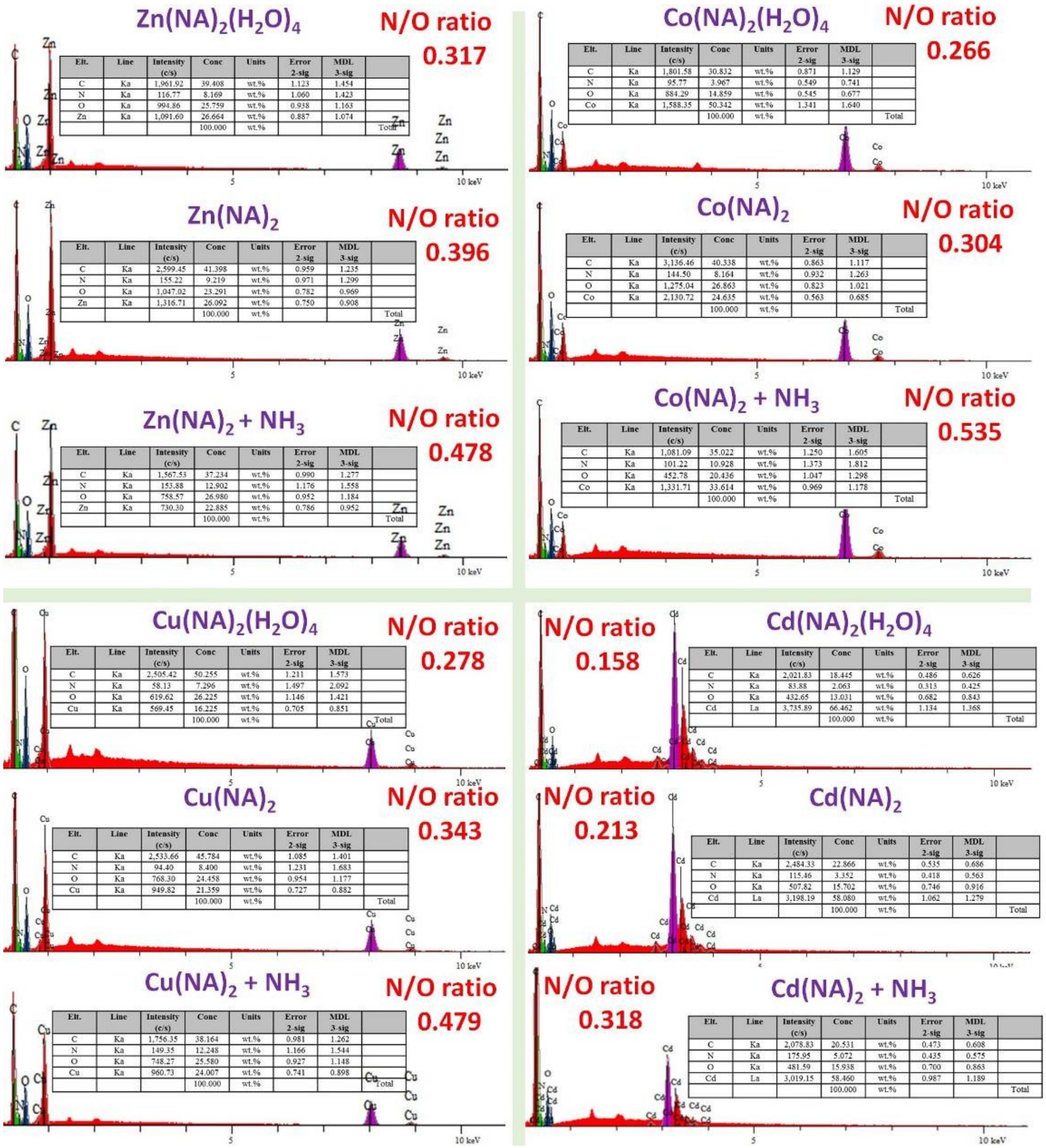

Fig. S5 EDS spectrums of $M(NA)_2(H_2O)_4$ (M = Zn, Co, Cu, Cd) that as-synthesized, activated and adsorbed NH_3.

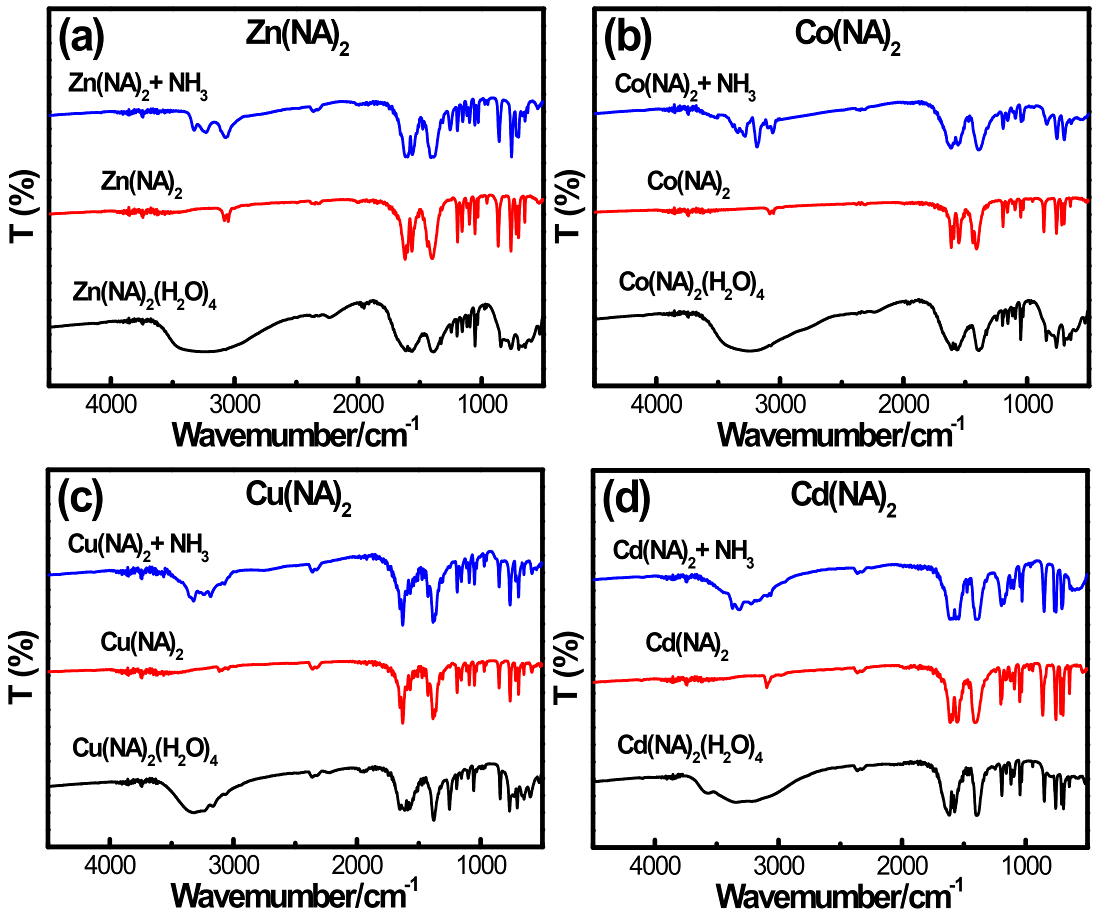

Fig. S6 IR spectra of $M(NA)_2(H_2O)_4$ (M = Zn, Co, Cu, Cd) that as-synthesized, activated and adsorbed NH_3.

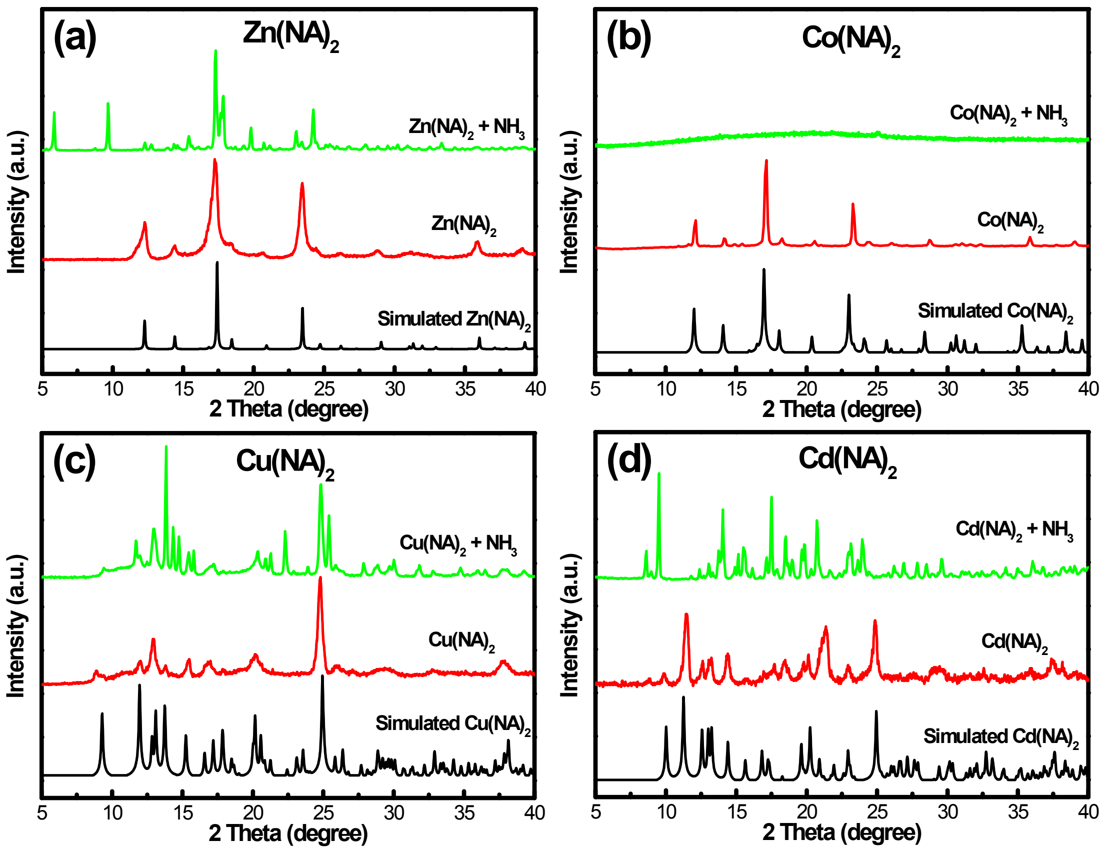

Fig. S7 Compared PXRD patterns for M(NA)$_2$ (M = Zn, Co, Cu, Cd) and they were adsorbed NH_3.

Table S1. The ammonia adsorption and regeneration properties under specific conditions for various porous materials.

Porous materials	Surface area/m^2 g^{-1}		Ammonia uptake /mmol g^{-1}	Adsorption conditions		Regeneration conditions		Adsorption loss	Ref.
	BET	Lang.		P/bar	T/°C	P	T/°C		
CoHCC	848		21.9	1	25	Vacuum	150	No loss (4 cycle)	1
CuHCF	547		20.2	1	25				1
Co_2Cl_2(BBTA)	1161		17.95	1	25	Vacuum	200	~4% (3 cycle)	2
Mn_2Cl_2(BTDD)	1917		17.86	1	20	Vacuum	200	No loss (3 cycle)	3
$Zn_2(L1)_2$(bipy)[a]	47		17.79	1	20				4
$Co(NA)_2$	55		17.5	1	25	Vacuum	150	No loss (3 cycle)	This work
BPP-7	705		16.1	1	25				5
COF-10	1148		15	1	25	0.1 torr	200	4.5% (3 cycle)	6
$Zn_2(L1)_2$(bpe)			14.31	1	20				4
$Cu(NA)_2$	74		13.4	1	25	Vacuum	150	No loss (3 cycle)	This work
$Cu(INA)_2$	164		12.5	1	25	Vacuum	150	No loss (3 cycle)	7
Ni_2Cl_2(BTDD)	1762		12.37	1	20	Vacuum	200	No loss (3 cycle)	3
Co_2Cl_2(BTDD)	1912		12.36	1	20	Vacuum	200	No loss (3 cycle)	3
MOF-5	2449	3917	12.2	1.066	25			Structural collapse	8
MOF-177	3275	5994	12.2	1.066	25			Structural collapse	8
PPN-6-SO_3H	1200		12.1	1	25				9
ZSA-1	1112	1549	11.5	1	25	Vacuum	25	No loss (5 cycle)	10
BPP-2	965		11.2	1	25				9
$Zn(NA)_2$	104		10.2	1	25	Vacuum	150	No loss (3 cycle)	This work
Cr-MIL-101	3740		10	1	25	Vacuum	25	No loss (3 cycle)	11
UiO-66-NH_2			9.84	1	25			50% (3 cycle)	3
13X zeolite	462		9.03	0.967	25.15				12
$Cu_3(BTC)_2$	1460		8.8	BC[b]	25			Structural collapse	13
Al-MIL-100	1220		8	1	25	Vacuum	25	No loss (3 cycle)	11
Mg-MOF-74	1206		7.6	BC	20				14
5A zeolite	368		7.43	0.987	25.15				12
Co-MOF-74	835		6.7	BC	20				14
IRMOF-3	1568		6.2	BC	25				15
ELM-12			6.1	1		Vacuum	60	No loss (2 cycle)	16
$Zn(INA)_2$			6	1	25	Vacuum	120	No loss (3 cycle)	17
$Cd(NA)_2$	41		6	1	25	Vacuum	150	No loss (3 cycle)	This work
UiO-66-OH	946		5.69	BC	20				18
Al-NH_2-MIL-53			5.4	1	25	Vacuum	150		11
MOF-199	1264		5.1	BC	25				15

Al-MIL-53	945	4.4	1	25	Vacuum	25	No loss (3 cycle)	11
Ni-MOF-74	937	3.76	BC	25			No loss (5 cycle)	19
Zn-MOF-74	496	3.7	BC	20				14
Fe-MIL-100	1212	2.76	BC	25			6.4% (5 cycle)	19
Cu-MOF-74	1170	2.6	BC					20
12NN-AC[c]	926	2.45	BC		Acid-modified			21
Ni-MOF-74	599	2.3	BC	20				14
IRMOF-62	1814	1.4	BC	25				15
AC	1073	0.13	BC					21

[a] L1 is 6-oxo-6,7-dihydro-5H-dibenzo[d,f][1,3]-diazepine-3,9-dicarboxylate

[b] BC is the abbreviation of breakthrough capacity

[c] AC is the abbreviation of activated carbon; 12NN-AC is acid-modified activated carbon

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