Supporting Information

A Combined Experimental and Computational Study of Novel Nanocage-based Metal-Organic Frameworks for Drug Delivery

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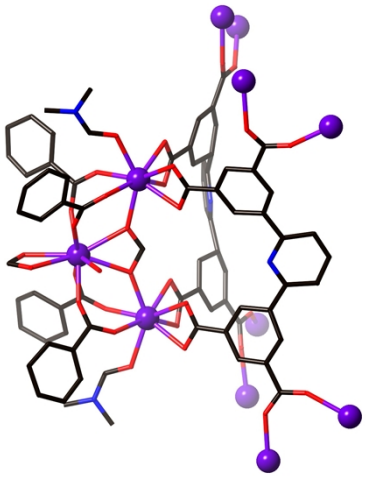


Figure S1. Sm_3 cluster geometries in the structure of **1**.

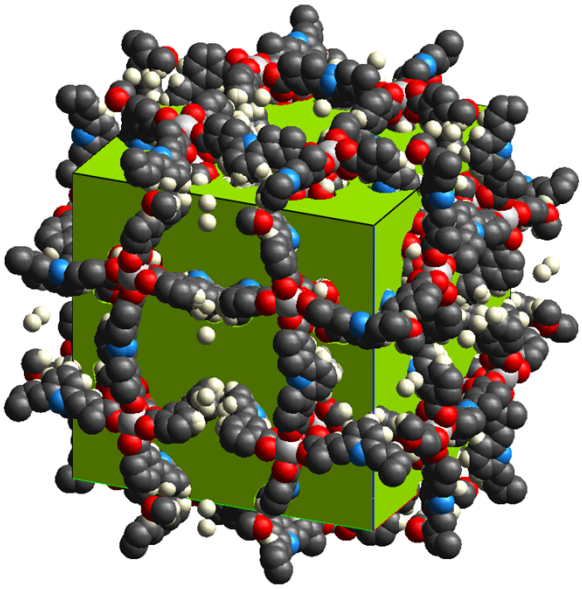


Figure S2. Space-filling plot of **1** network; the uncoordinated water and DMF molecules are presumed to occupy the shaded (green) regions of the unit cell.

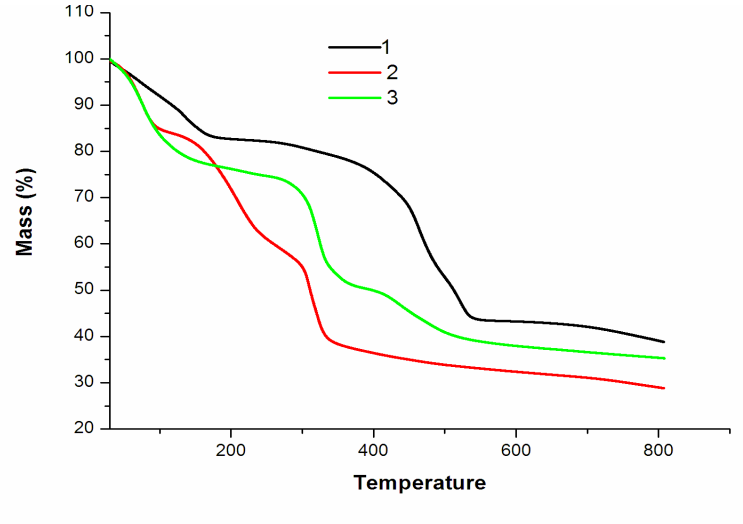


Figure S3. TGA curves of compounds **1-3**.

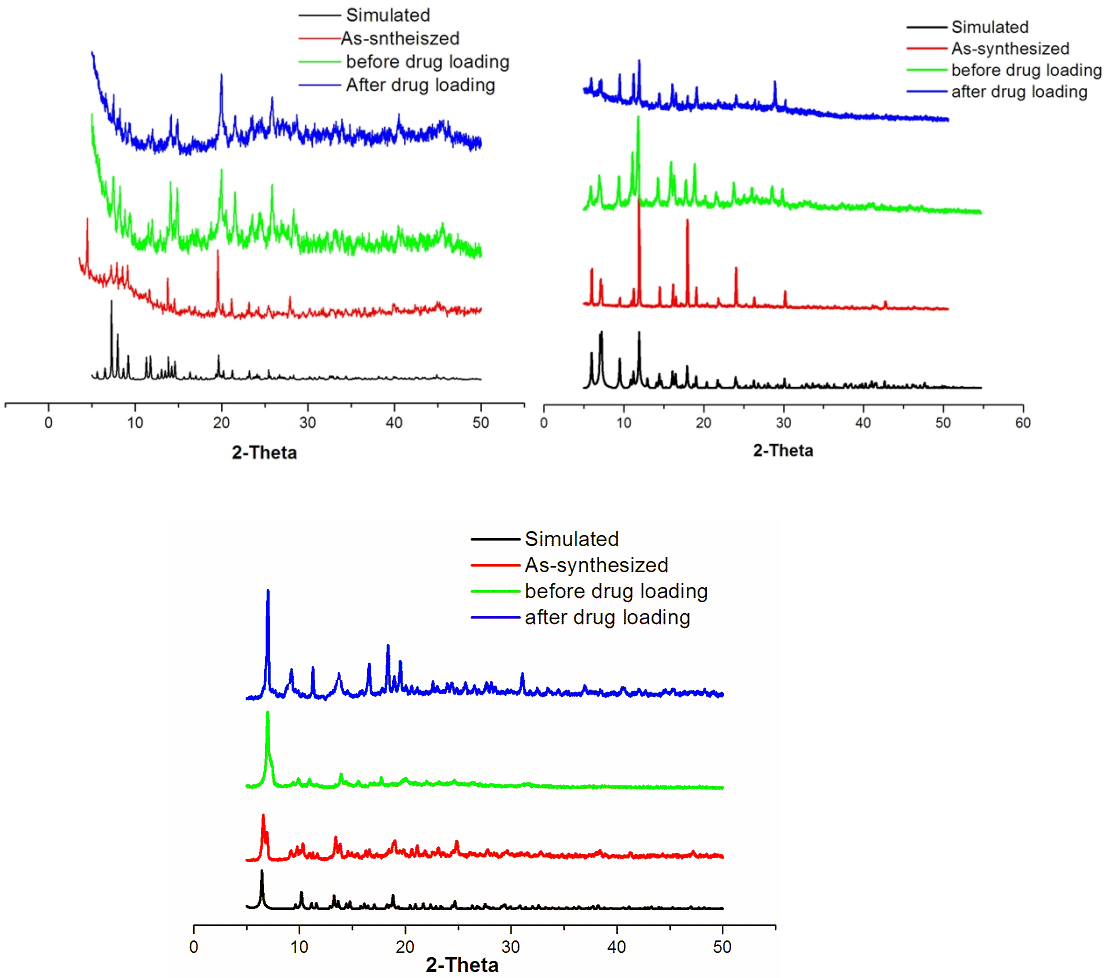


Figure S4. XRPD patterns for **1-3** (black, simulated; red, as-synthesized; green, 5-FU-loaded; blue, after 5-FU released) (a, b and c represent the compounds **1, 2** and **3**, respectively).

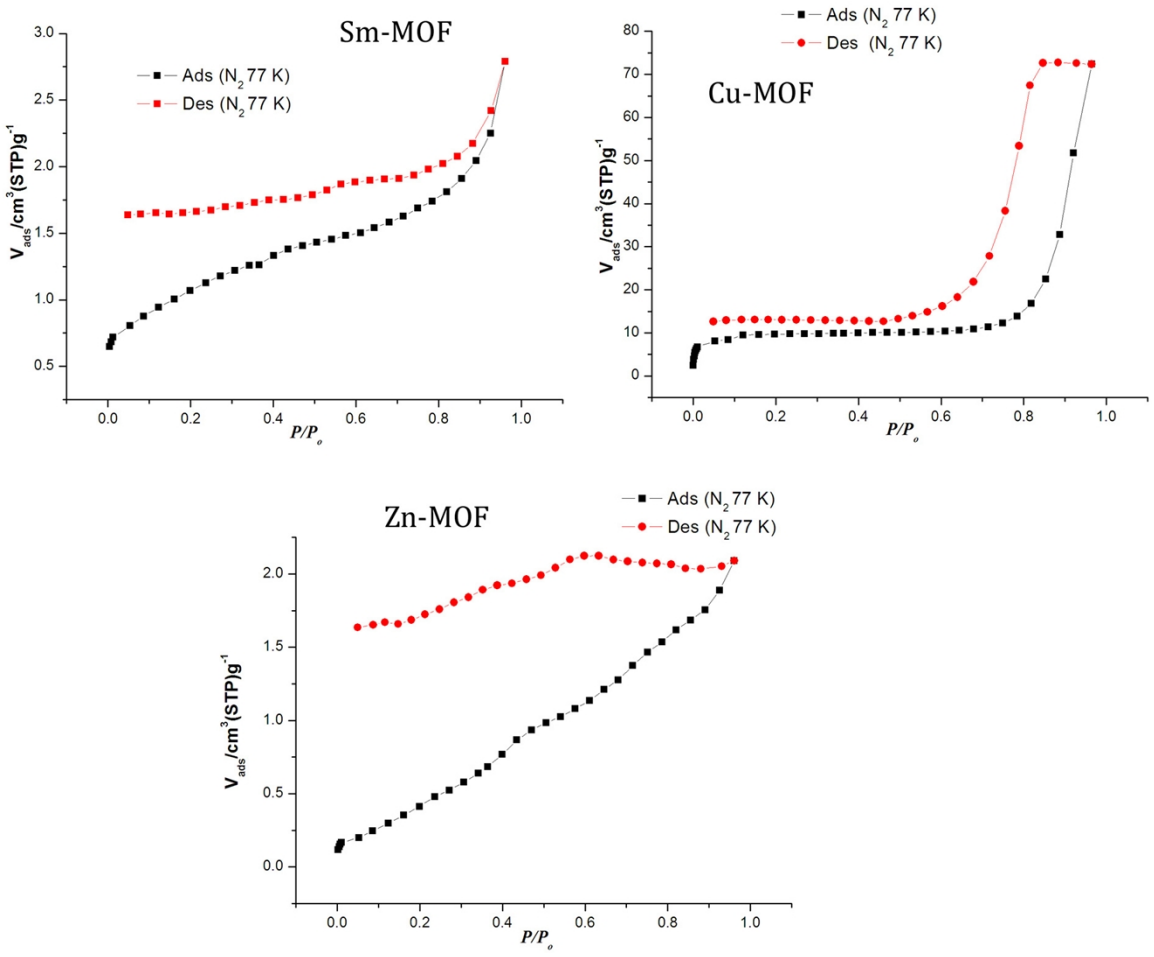


Figure S5. N_2 isotherms measure for compounds **1-3** (5-FU@MOFs materials) (Sm-MOF is **1**; Cu-MOF is **2** and Zn-MOF is **3**)

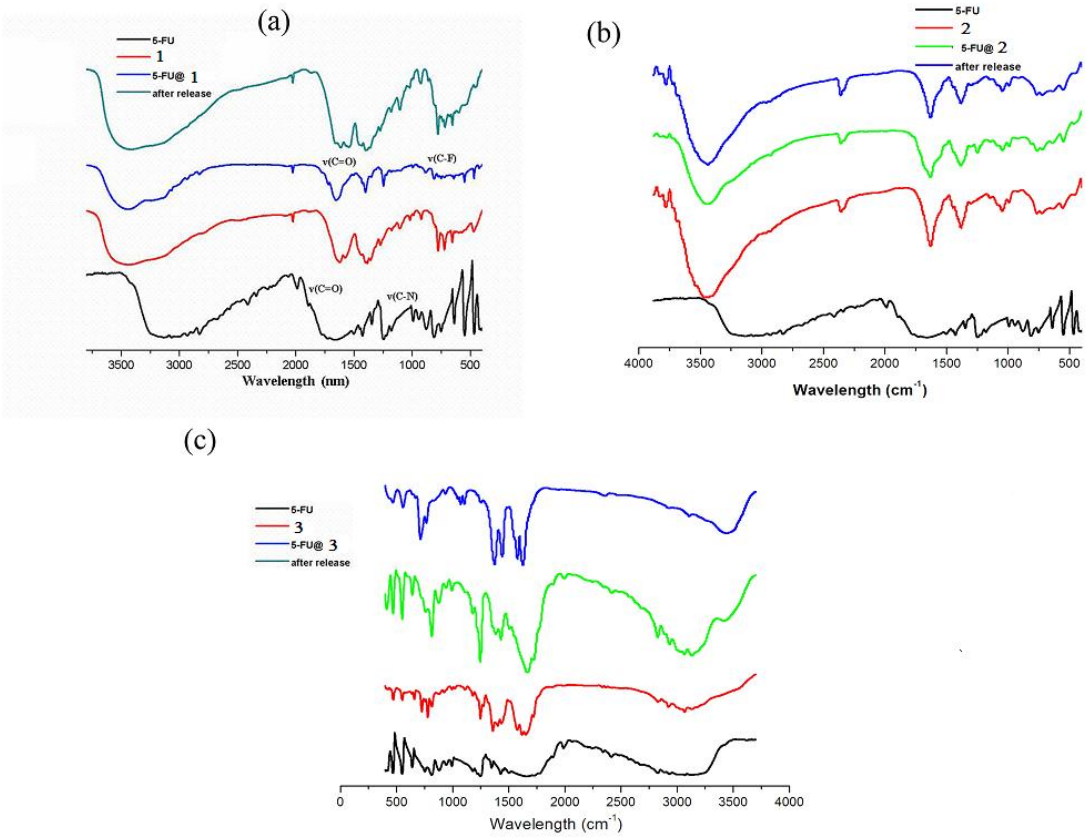


Figure S6. IR spectra measured for compounds **1 (a), 2 (b) and 3 (c)**. Each spectrum displays measurements for 5-FU, MOF, 5-FU@MOF and upont drug release from the respective porous material).

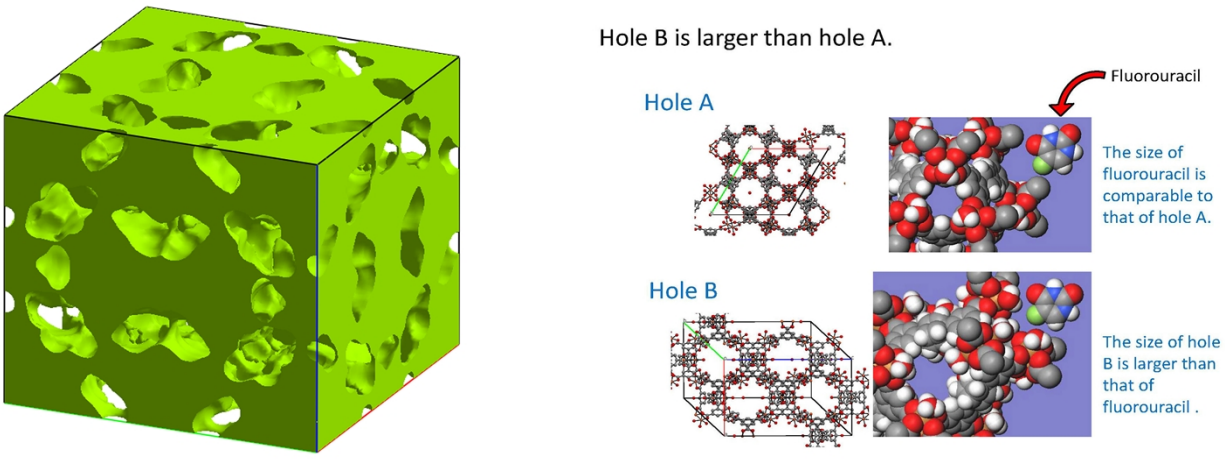
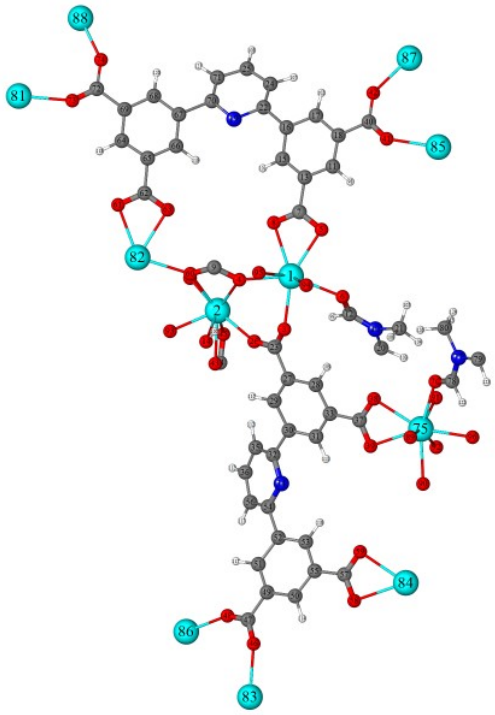


Figure S7. Representation of the two windows from channels of compounds **1-2**.

Table S1: UFF atomic pair Lennard-Jones parameters used for GCMC simulations.

Atomic Pair	σ_{ij}	ε_{ij}
C---C	3.431	52.842
C---O	3.274	39.946
C---N	3.346	42.837
C---H	3.001	34.207
C---F	3.214	36.465
F---F	2.997	25.163
F---O	3.057	27.565
F---H	2.784	23.605
F---N	3.129	29.560
O---O	3.118	30.196
O---H	2.844	25.858
O---N	3.189	32.382
N---H	2.916	27.730
H---H	2.571	22.144
N---N	3.260	34.726
Zn---C	2.946	57.426
Zn---F	2.729	39.627
Zn---O	2.790	43.410
Zn---H	2.516	37.174
Zn---N	2.861	46.552
Cu---C	3.272	11.531
Cu---F	3.055	7.957
Cu---O	3.115	8.717
Cu---H	2.842	7.464
Cu---N	3.187	9.348
Sm---C	3.283	14.586
Sm---F	3.066	10.065
Sm---O	3.127	11.026
Sm---H	2.853	9.442
Sm---N	3.198	11.824

Table S2: EQeq calculated atomic charges for SmMOF (**1**), CuMOF (**2**) and ZnMOF (**3**) MOFs.



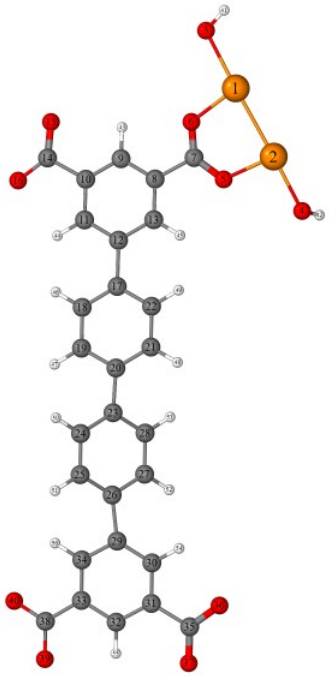
SmMOF (1)

Atom	Atomic Charge (a.u.)
Sm	0.120
Sm	0.270
O	-0.190
O	-0.140
O	-0.170
O	-0.150
C	0.280
O	-0.180
C	0.280
N	-0.120
C	0.020
C	0.180
C	-0.050
O	-0.160
C	-0.010
C	0.010

C	-0.010
C	-0.050
N	-0.110
C	0.030
C	-0.130
C	0.070
C	0.320
C	-0.080
C	0.030
O	-0.180
C	-0.070
C	0.040
C	0.010
C	-0.020
C	0.020
C	0.090
C	-0.080
N	-0.130
C	-0.090
C	0.030
C	0.310
O	-0.190
O	-0.180
C	0.290
O	-0.210
O	-0.200
O	-0.150
C	0.230
O	-0.140
O	-0.230
C	0.340
O	-0.230
C	-0.090
C	0.050
C	0.020
C	-0.030
C	0.020
C	0.100
C	-0.090
C	-0.090
C	0.320
O	-0.200
O	-0.200

O	-0.150
O	-0.190
C	0.280
O	-0.190
C	0.020
C	-0.050
C	-0.010
C	0.010
C	-0.010
C	-0.050
C	0.070
C	-0.080
C	0.290
O	-0.210
O	-0.200
Sm	0.010
O	-0.160
N	-0.120
C	0.180
C	0.020
C	-0.120
Sm	-0.030
Sm	0.410
Sm	0.010
Sm	0.180
Sm	0.000
Sm	0.020
Sm	0.000
Sm	0.010
O	-0.060
O	-0.040
O	-0.070
O	-0.050
O	-0.030
O	-0.050
O	-0.060
O	-0.070
O	-0.040
H	0.070
H	0.030
H	0.180
H	0.070
H	0.060

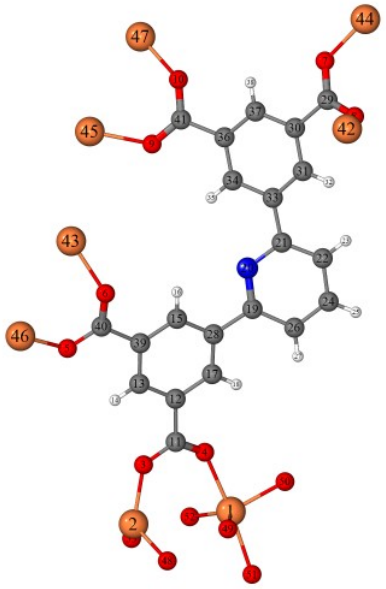
H	0.060
H	0.090
H	0.090
H	0.100
H	0.060
H	0.030
H	0.060
H	0.070
H	0.060
H	0.070
H	0.040
H	0.060
H	0.050
H	0.060
H	0.070
H	0.070
H	0.070
H	0.060
H	0.060
H	0.030
H	0.050
H	0.080
H	0.080
H	0.090



CuMOF (2)

Atom	Atomic Charge (a.u.)
Cu	0.45
Cu	0.45
O	-0.16
O	-0.16
O	-0.46
O	-0.47
C	0.64
C	0.35
C	0.53
C	0.36
C	0.52
C	0.33
C	0.52
C	0.65
O	-0.41
O	-0.4
C	0.33
C	0.54
C	0.54
C	0.33
C	0.55
C	0.54

C	0.33
C	0.55
C	0.55
C	0.34
C	0.55
C	0.55
C	0.33
C	0.53
C	0.36
C	0.53
C	0.35
C	0.52
C	0.65
O	-0.4
O	-0.4
C	0.64
O	-0.39
O	-0.39
H	-0.29
H	-0.28
H	-0.74
H	-0.73
H	-0.73
H	-0.7
H	-0.73
H	-0.71
H	-0.69
H	-0.71
H	-0.71
H	-0.74
H	-0.73
H	-0.75
H	-0.75
H	-0.77

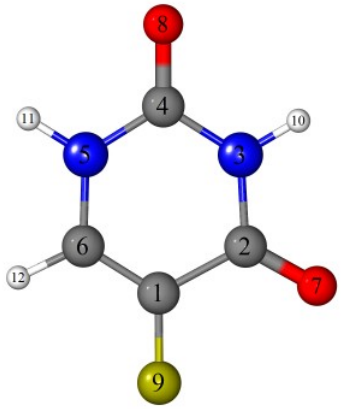


CuZn (3)

Atom	Atomic Charge (a.u.)
Zn	0.840
Zn	0.790
O	-0.340
O	-0.570
O	-0.410
O	-0.590
O	-0.510
O	-0.500
O	-0.440
O	-0.600
C	0.480
C	0.360
C	0.380
H	-0.550
C	0.500
H	-0.810
C	0.500
H	-0.770
C	0.520
N	-0.410
C	0.280
C	0.410
H	-0.550
C	0.420
H	-0.680

C	0.600
H	-0.850
C	0.500
C	0.550
C	0.420
C	0.420
H	-0.660
C	0.260
C	0.350
H	-0.660
C	0.330
C	0.600
H	-0.960
C	0.350
C	0.430
C	0.490
Zn	0.280
Zn	0.290
Zn	0.260
Zn	0.260
Zn	0.660
Zn	0.660
O	-0.380
O	-0.430
O	-0.350
O	-0.410
O	-0.340
O	-0.400

Table S3: 5-FU ChelpG atomic charges calculated at B3LYP/6-311**G level of theory.



5-FU

Atom	Atomic Charge (a.u.)
C	0.021293
C	0.640295
N	-0.570022
C	0.713896
N	-0.456927
C	-0.018921
O	-0.510793
O	-0.557068
F	-0.133259
H	0.361690
H	0.348083
H	0.161733

Table S4: Average interaction energies (U_{av}), electrostatic contribution (U^{elec}), van der Waals contribution (U^{vdw}) and isosteric heat of adosorption (Qst) calculated for interaction of 5-FU with ZnMOF, CuMOF and SmMOF porous materials.

Interaction	U^{elec}(kJ mol^{-1})	U^{vdW}(kJ mol^{-1})	U_{av}(kJ mol^{-1})	Q_{st}(kcal mol^{-1})
5-FU--5-FU	-1.16	-11.2	-175.2	33.4
5-FU--ZnMOF	-127.1	-35.7		
5-FU--5-FU	-1.4	-4.6	-171.1	33.0
5-FU--CuMOF	-135.6	-29.5		
5-FU--5-FU	-12.2	-13.7	-106.1	26.2
5-FU--SmMOF	-14.0	-66.2		

The data in table S1 show that the adsorption process of 5-FU to zinc and copper frameworks is chiefly dominated by electrostatic interactions. For the Samarium MOF, the adsorption of 5-FU is driven mostly by van der Waals interactions. The calculated isosteric heat of adsorption provides a thermodynamic estimation of 5-FU binding to the three porous materials. In this context, our results indicate that 5-FU binds more strongly to ZnMOF and CuMOF frameworks. The isosteric heat was calculated using the usual expression

$$Q_{st} = RT - \frac{\langle NU \rangle - \langle N \rangle \langle U \rangle}{\langle N^2 \rangle - \langle N \rangle^2}$$

where N is the number of molecules, U is the potential energy and the values between $\langle\ \rangle$ refers to averages obtained over the simulations runs.