SUPPORTING MATERIAL

A Biocompatible $ZnNa_2$-based Metal-Organic Framework with high Ibuprofen, Nitric Oxide and Metal Uptake Capacity

Meghan Winterlich,[a,b] Constantinos G. Efthymiou, [b] Wassillios Papawassiliou,[c] Jose P. Carvalho,[c] Andrew J. Pell,[c] Julia Mayans,[d] Albert Escuer,[e] Michael P. Carty,[f] Patrick McArdle,[b] Emmanuel Tylianakis,[g] Liam Morrison, *[h] George Froudakis,*[i] and Constantina Papatriantafyllopoulou* [a,b,j]

[a.] *CÚRAM Centre for Research in Medical Devices, Ireland*
[b.] *School of Chemistry, College of Science and Engineering, National University of Ireland Galway, H91 TK 33 Galway, Ireland; E-mail address: constantina.papatriantafyllopo@nuigalway.ie; Tel: +353 91 493462.*
[c.] *Department of Materials and Environmental Chemistry, Stockholm University, Sweden.*
[d.] *Instituto de Ciencia Molecular (ICMol), Universidad de Valencia, Catedrático José Beltran 2, 46980 Paterna (Valencia), Spain*
[e.] *Departament de Quimica Inorgànica i Orgànica, Secció Inorgànica and Institut de Nanociencia i Nanotecnologia (IN2UB), Universitat de Barcelona, Marti i Franquès 1-11, 08028 Barcelona, Spain*
[f.] *Biochemistry, School of Natural Sciences, National University of Ireland Galway, H91 TK 33 Galway, Ireland.*
[g.] *Department of Materials Science and Technology, University of Crete, Voutes Campus, GR-70013 Heraklion, Crete, Greece.*
[h.] *Earth and Ocean Sciences and Ryan Institute, School of Natural Sciences, National University of Ireland Galway, H91 TK 33 Galway, Ireland.*
[i.] *Department of Chemistry, University of Crete, Voutes Campus, GR-70013 Heraklion, Crete, Greece.*
[j.] *SSPC, Synthesis and Solid State Pharmaceutical Centre, Ireland*

Table S1: Crystallographic data for **NUIG1**

	NUIG1
Formula	$C_{33}H_{22}NNaO_{11}Zn$
Mw	696.87
Crystal System	Monolinic
Space group	C 2/c
a/ Å	17.1793(16)
b/ Å	21.2560(13)
c/ Å	24.5546(16)
β/°	106.191(8)
V/ Å ^{3}	8610.8(12)
Z	8
T/ K	298(2)
λ/ Å	0.71073
D_c/g cm^{-3}	1.075
μ(Mo Ka)/mm^{-1}	0.627
Reflections collected	16960
Independent reflections	7571
R_1[a]	0.0882
wR_2[b]	0.1093
Goodness of fit on F^2	1.044
Δρmax/min/e Å $^{-3}$	2.707 /-0.901

[a] $R_1 = \Sigma(|F_o| - |F_c|)/\Sigma|F_o|$; [b] $wR_2 = [\Sigma[w(Fo^2 - Fc^2)^2]/\Sigma[wFo^2)^2]]^{1/2}$

Table S2: Extracted experimental shift and quadrupolar interaction parameters ($P_q=C_q\sqrt{1+\eta\text{^}2/3}$, with Cq being the quadrupolar coupling and η the asymmetry parameter). C_q range was determined considering the asymmetry parameter η varies between 0 and 1.

	δ_{iso}	P_q [MHz]	C_q [MHz]
MOF Na 1	0+/-1	2.4+/-0.2	2.1-2.4
MOF Na 2	3+/-2	3.6+/-0.2	3.1-3.6
MOF+ibu Na 1	-1+/-3	2.7+/-0.4	2.4-2.7
MOF+ibu Na 2	2+/-1	3.6+/-0.1	3.1-3.6

Table S3: Fitting parameters of the metal adsorption data to the pseudo-second order kinetic model.

Metal ion	q_e (mg g^{-1})	k_2 (mg g^{-1} h^{-1})	R^2
Co^{2+}	74.07	0.6075	0.9887
Cu^{2+}	52.63	0.7220	0.9880
Ni^{2+}	20.283	2.2124	0.9796

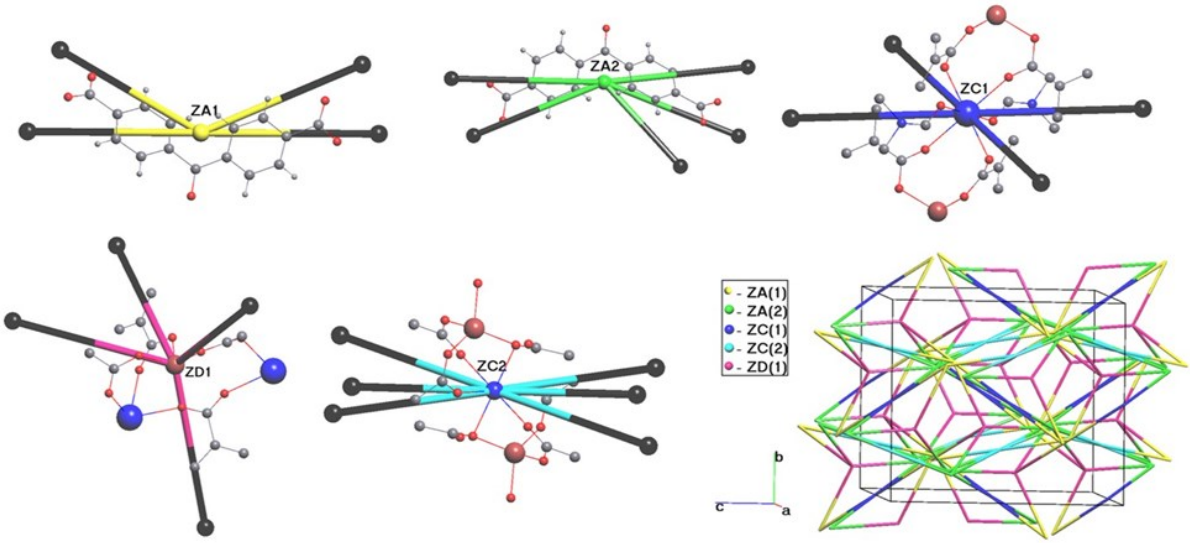
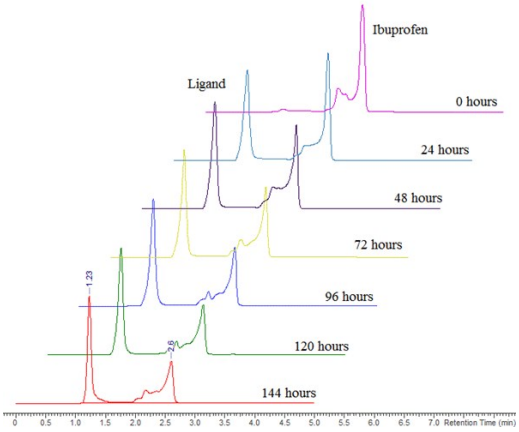
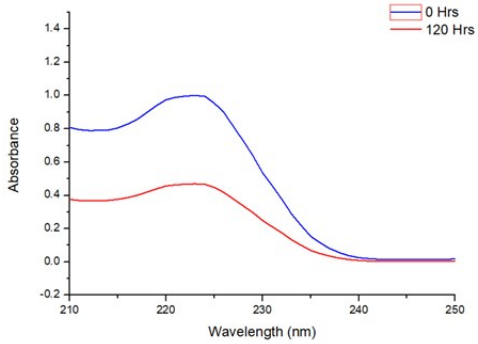


Figure S1: Simplified 5-nodal net of the **NUIG1** crystal structure in the standard representation of valence-bonded MOFs with new topology; nodes ZA1 and ZA2 correspond to benzophenone-4,4'-dicarboxylate ligands, ZC1 and ZC2 correspond to Na1 and Na2 atoms, and ZD1 correspond to Zn atoms, respectively.





MOF: Ibu	mg Ibu / L solution	mg Ibu / g MOF
1:2	9200	1640
1:3	13000	2280
1:4	18000	2650
1:5	23000	2700
1:6	27000	2800

Figure S2: HPLC data showing the uptake and amount of Ibu after 144 hours (top). UV Vis data showing the uptake and the amount of Ibu after 120 hours (bottom).

MOF: Ibu	mg Ibu / L solution	mg Ibu / g MOF
1:2	9200	1760
1:3	13000	2200
1:4	18000	2600
1:5	23000	2700
1:6	27000	2800

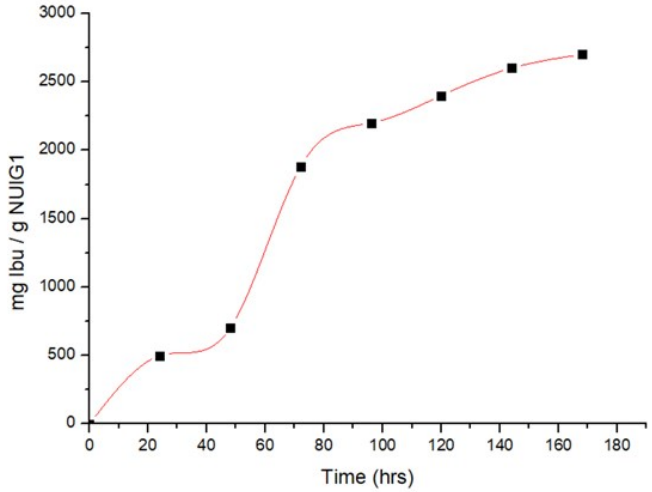


Figure S3: The uptake kinetics of **NUIG1** and Ibu where the drug was absorbed within 144 hours.

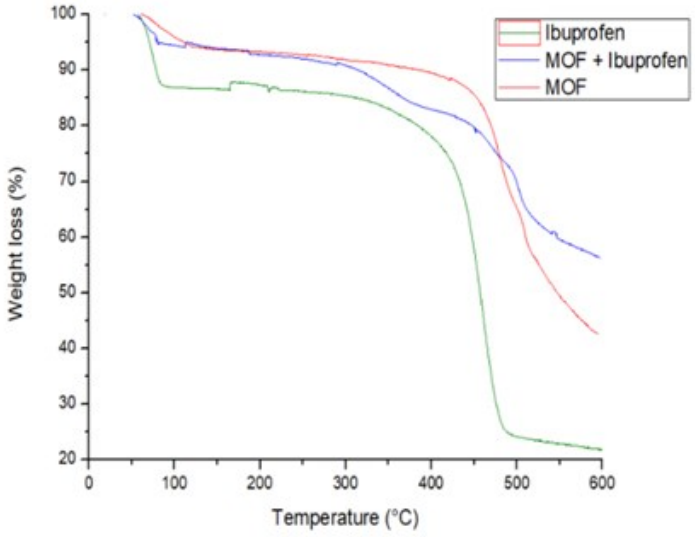


Figure S4: TGA showing the encapsulation of Ibu (in green), Ibu@**NUIG1** (in blue) and **NUIG1** (in red). The TGA plot of Ibu@**NUIG1** reveals an additional two-step mass loss between ca. 300 and 400^{o}C, attributed to the decomposition of the drug. The drug uptake based on the TGA is

approximately 1300 mg Ibu/gMOF, which is in close agreement with the value of 1600mg Ibu/g NUIG1 expected for an 1:2 MOF:Ibu ratio.

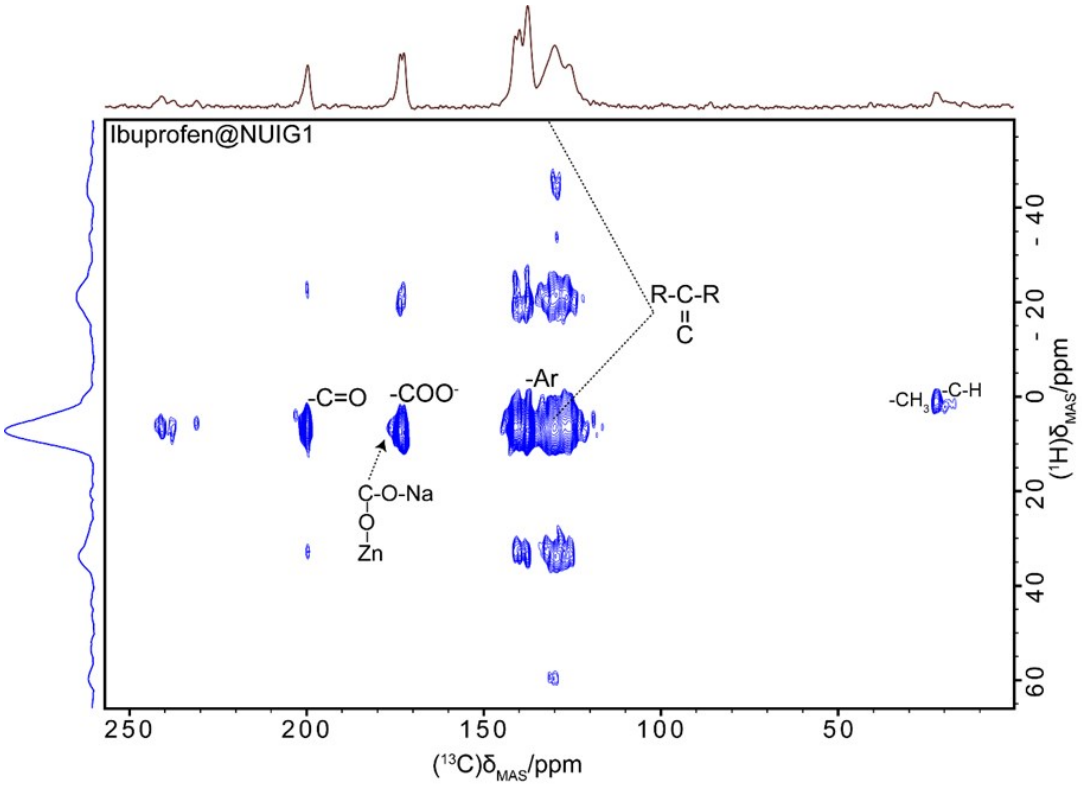


Figure S5: The 2-D $^{1}H \rightarrow {}^{13}C$ HETCOR spectrum for the Ibuprofen loaded **NUIG1** sample, correlating carbon shifts in the direct dimension to proton shifts in the indirect dimension. Not marked peaks are attributed to the spinning sideband manifold.

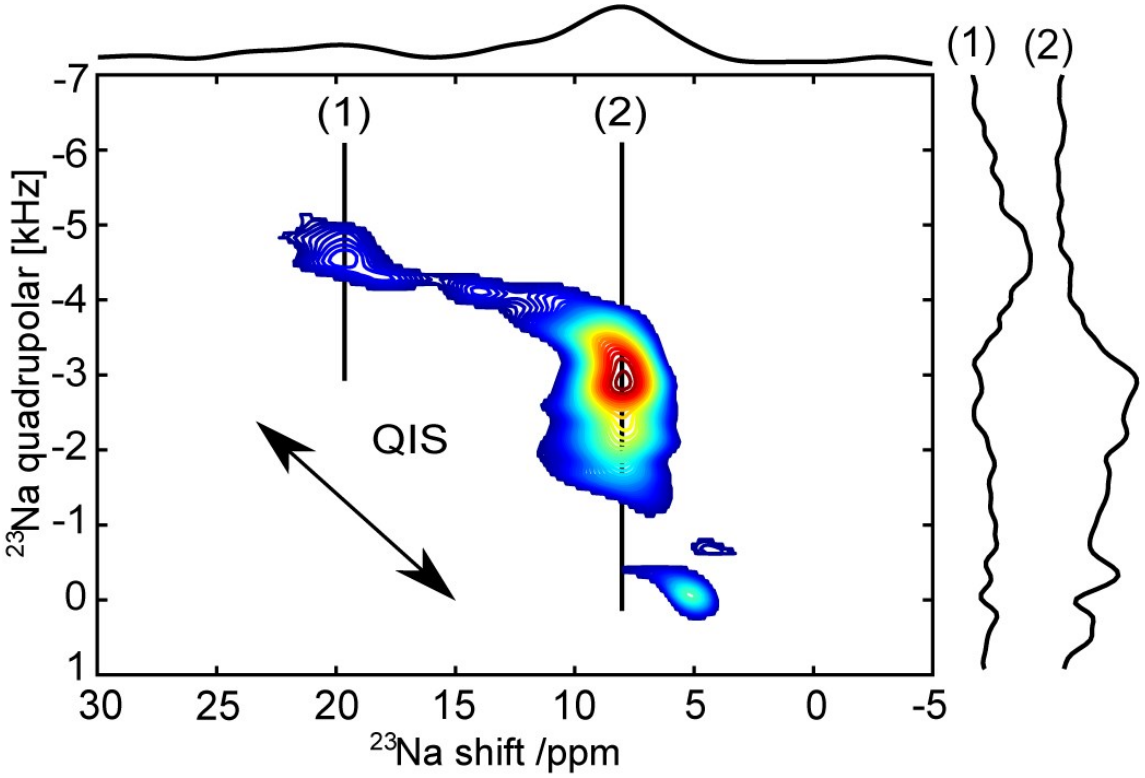


Figure S6: DQF-TOP-STMAS ^{23}Na spectra of unloaded MOF. Similarly, to the loaded MOF, two separate resonances (1) and (2) can be identified. It is also possible to identify the sharp peak arising from the impurity signal which is not shifted by the QIS. The horizontal extracted slices of resonances (1) and (2) are also represented. The arrow indicates the direction of the QIS.

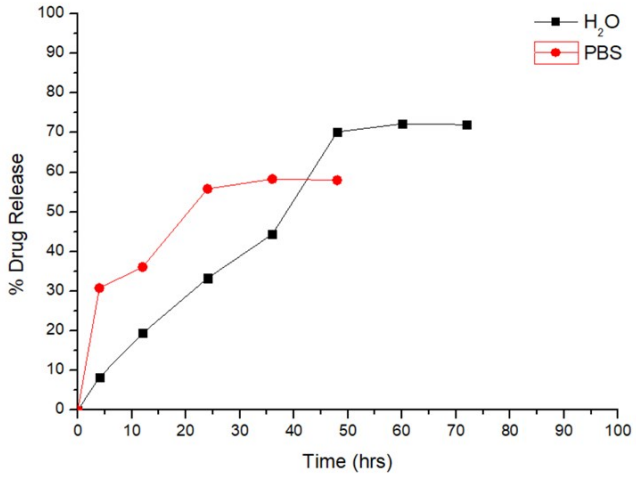


Figure S7: Release kinetics of Ibu@**NUIG1** in water (black) and phosphate buffer solution (red).

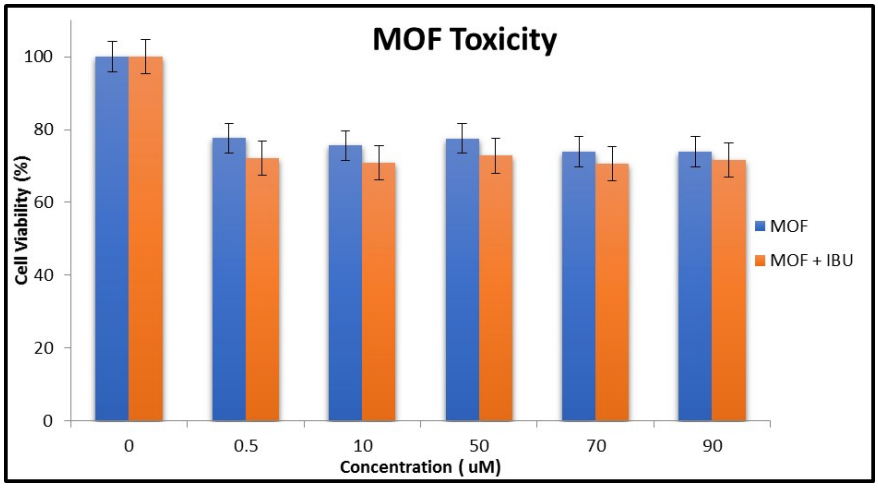


Figure S8: Biological toxicity of **NUIG1** (blue) and Ibu@**NUIG1** (orange) usingMCF-7 cells and MTT assay showing the framework is not toxic.

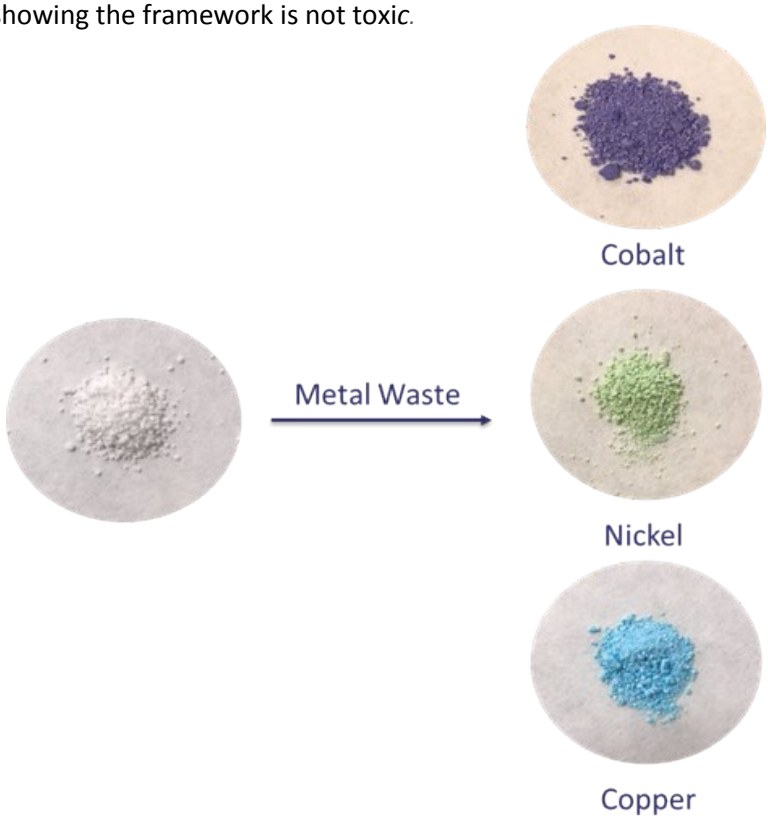
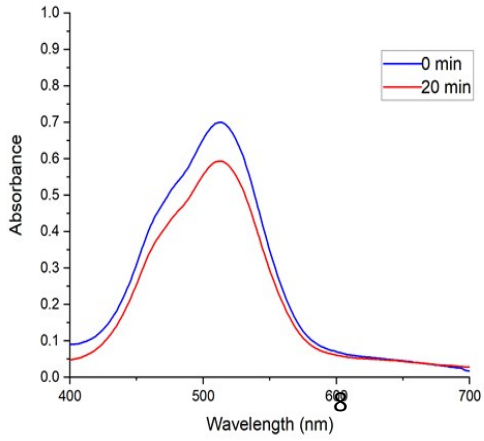
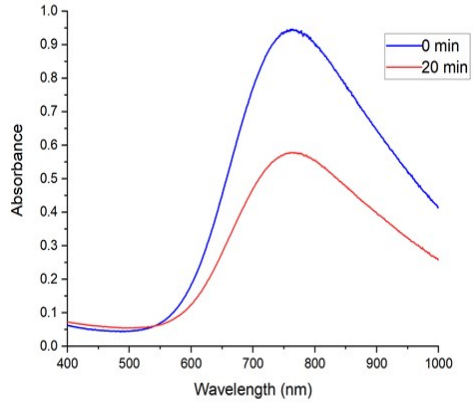


Figure S9: Picture showing the colour change of **NU**IG1 (white) upon metal encapsulation.

Co@**NUIG1**



Cu@**NUIG1**



Ni@**NUIG1**

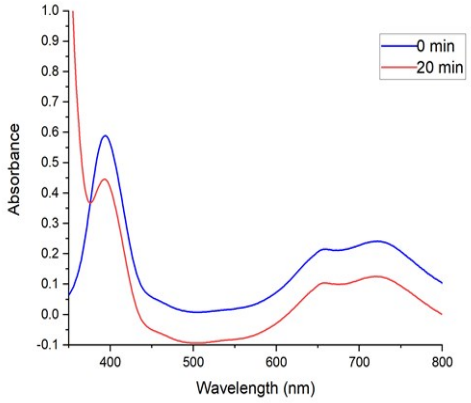


Figure S10: UV Vis data for the metal encapsulation by **NUIG1**.

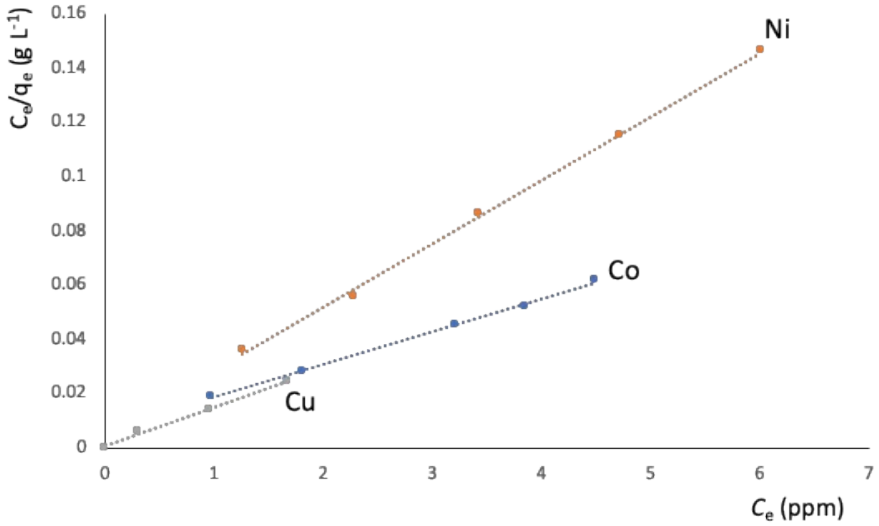


Figure S11: Fitting of the metal adsorption data to the Langmuir model.

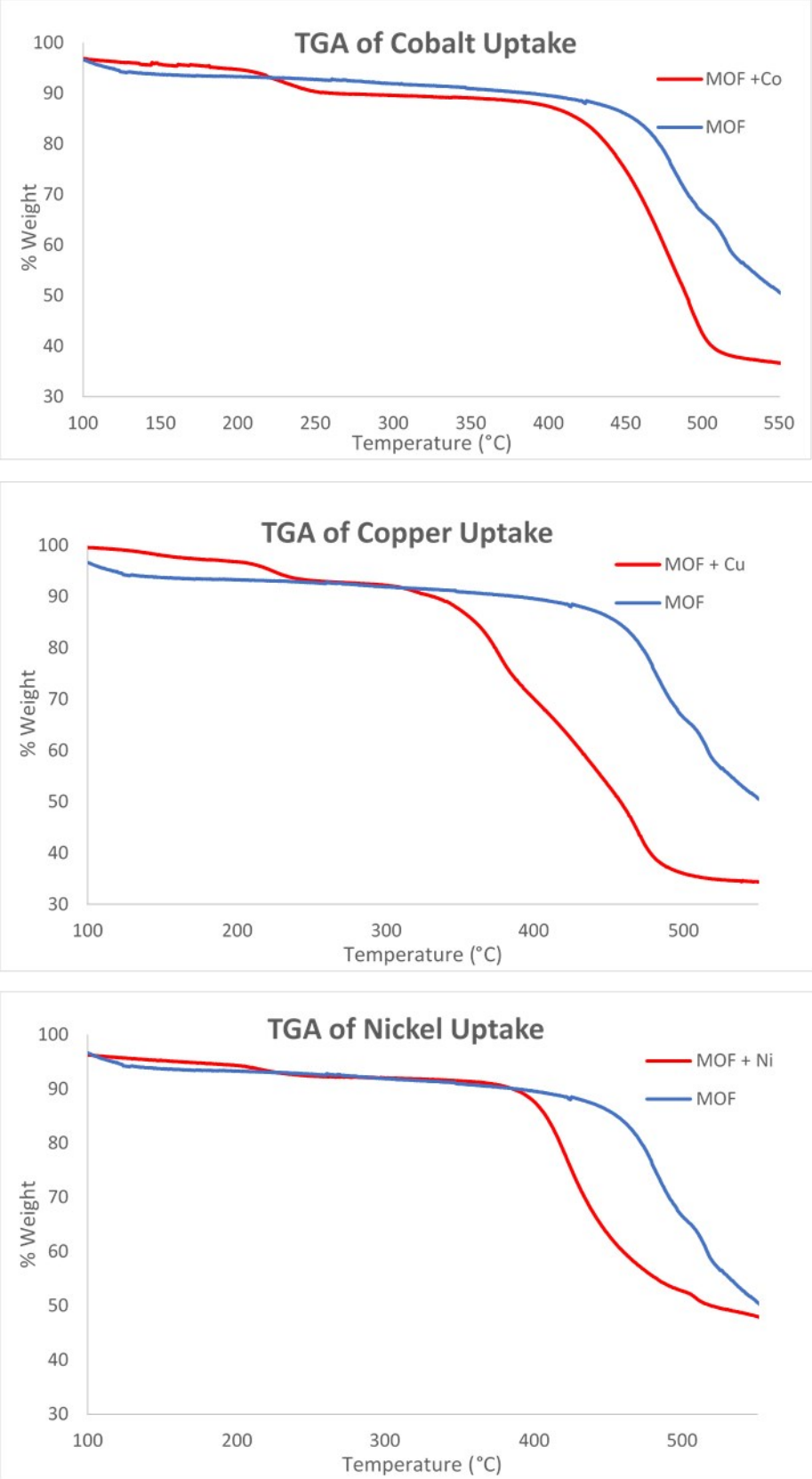


Figure S12: TGA plots for the three M@**NUIG1** samples.

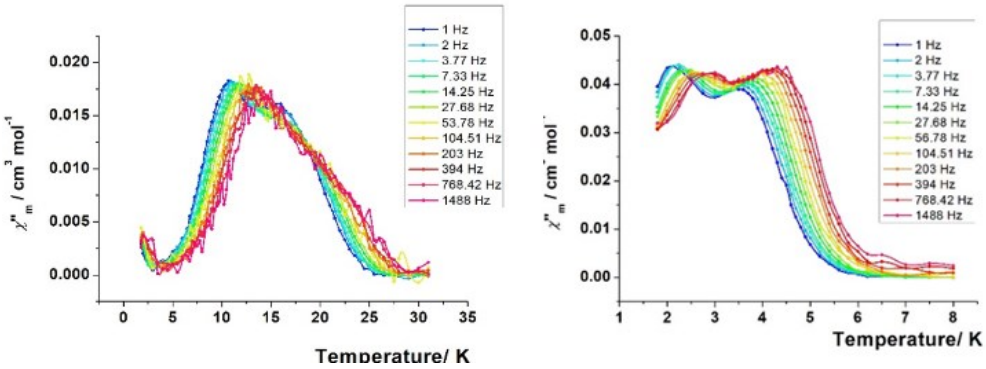


Figure S13: Representation of the χ_M'' for Co@**NUIG1** (left), and Ni@**NUIG1** (right) under 0 dc applied magnetic field.

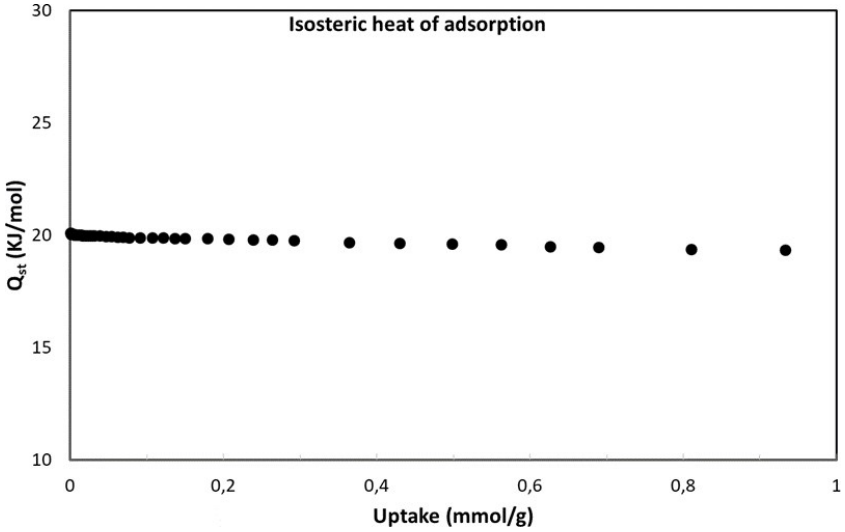


Figure S14: Isosteric heat of adsorption of NO at the MOF of this study at 298 K

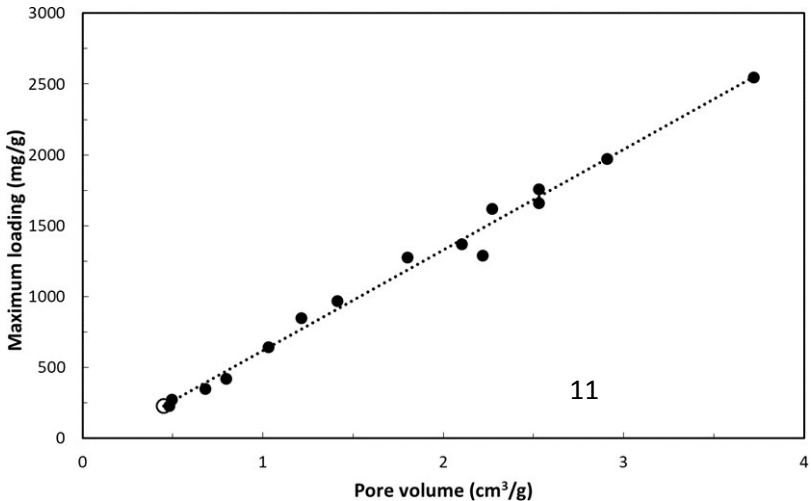


Figure S15: Maximum loading capacity of ibuprofen at different MOF structures as a function of Pore volume of the MOF.