Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Supporting Information

A hollow microshuttle-shaped capsule covalent organic framework for protein adsorption

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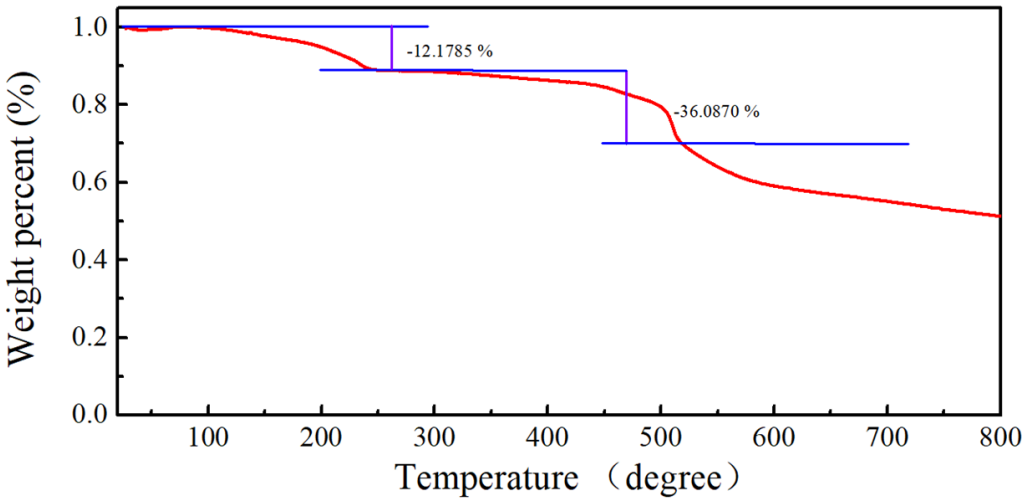


Fig. S1 Thermogravimetric analysis (TGA) of TPE-TAP-COF under N_2 atmosphere.

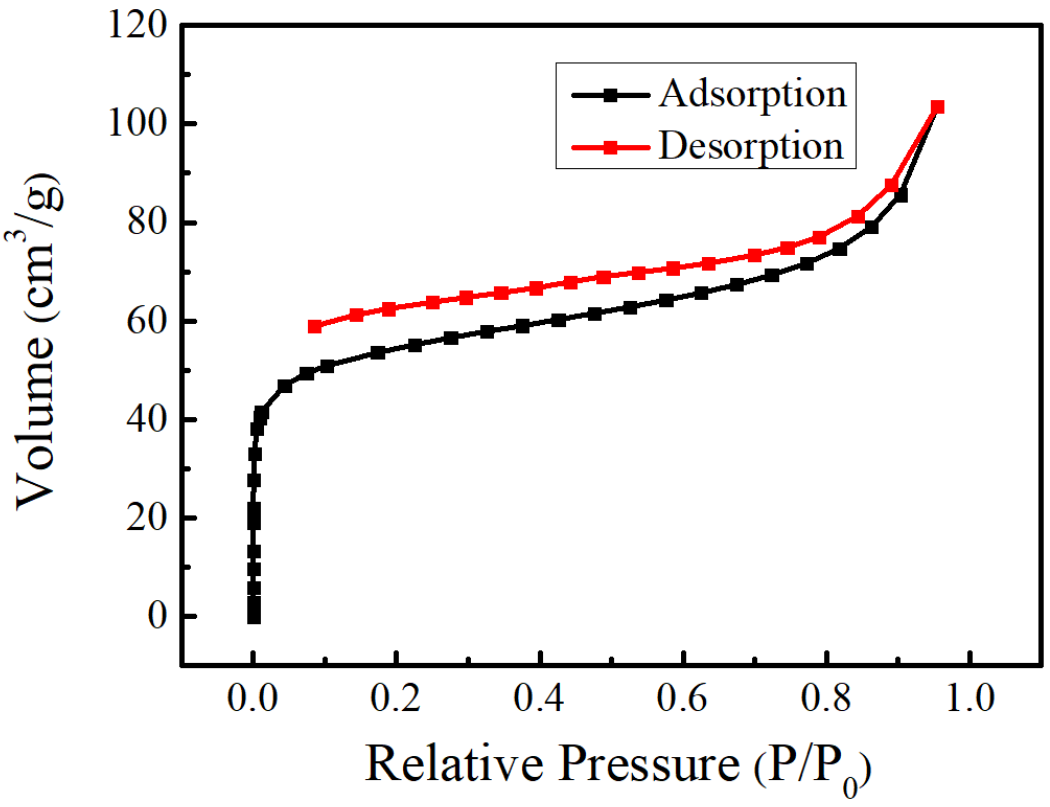


Fig. S2 N_2 adsorption (black)/desorption (red) isotherm of TPE-TAP-COF at 77 K.

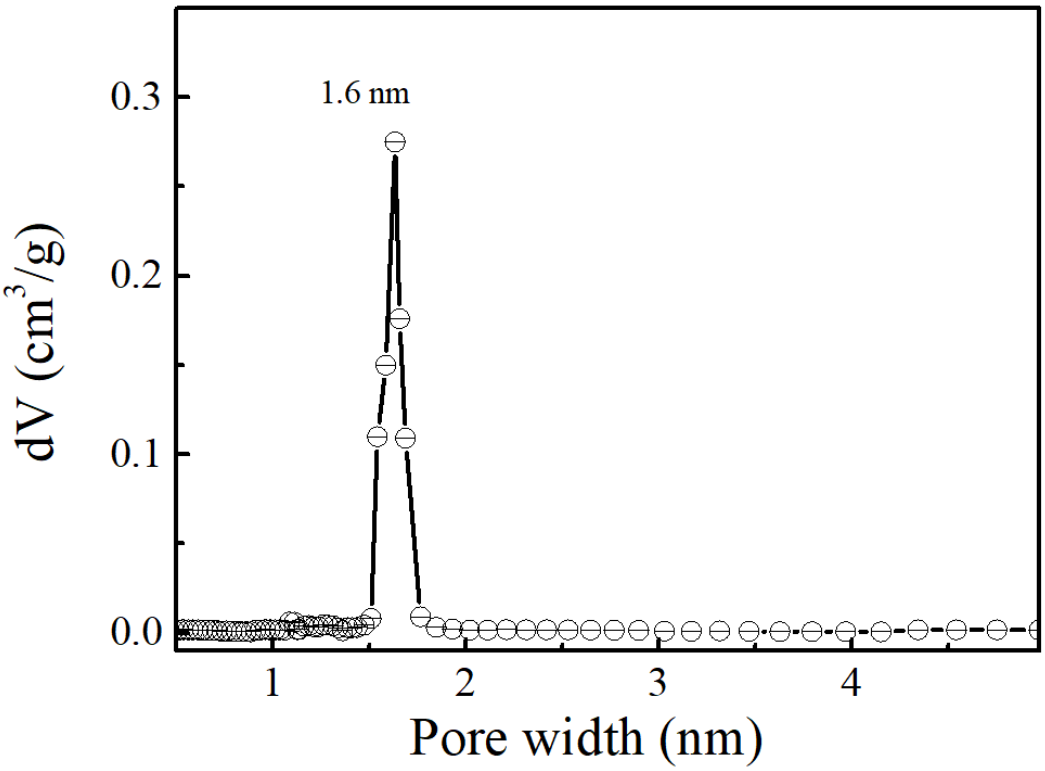
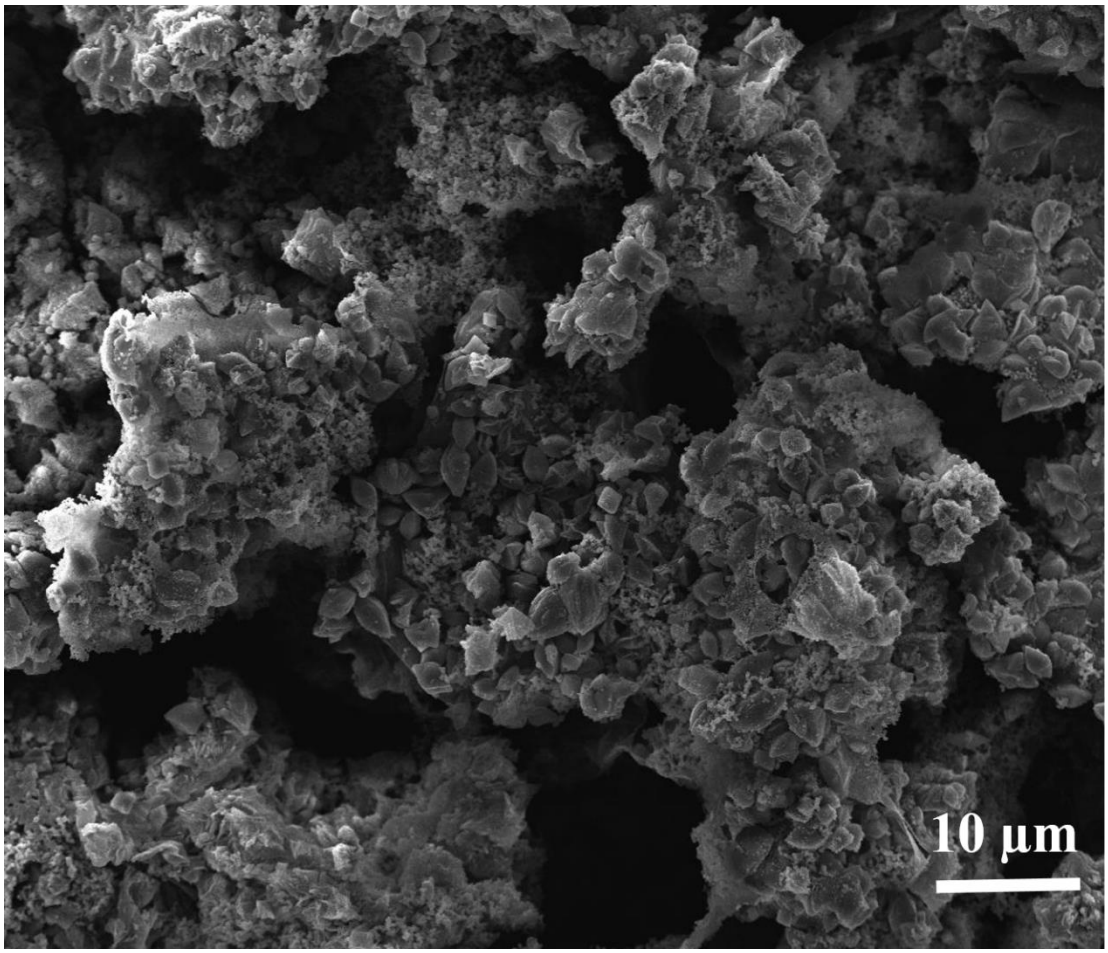
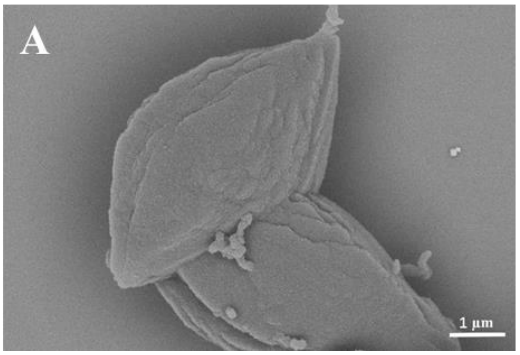


Fig. S3 Pore size distribution (black empty circle).





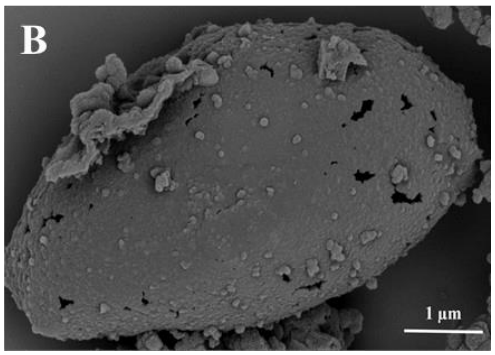


Fig. S4 SEM images of TPE-TAP-COF

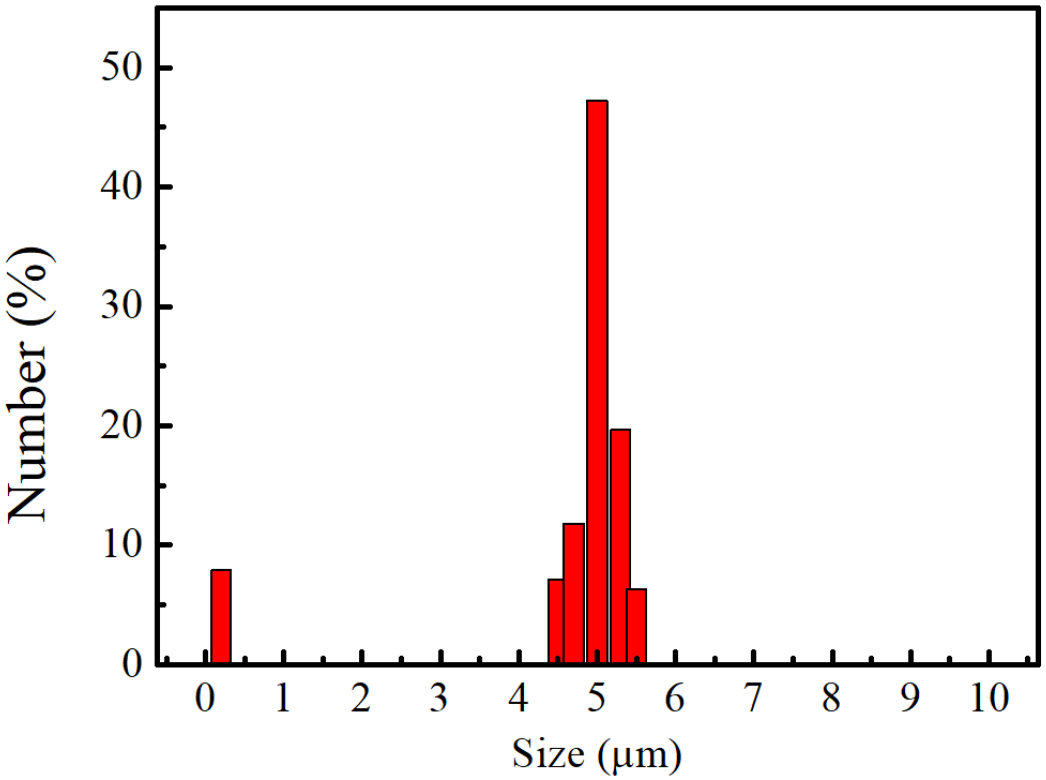


Fig. S5 About the particle size distribution of microcapsule.

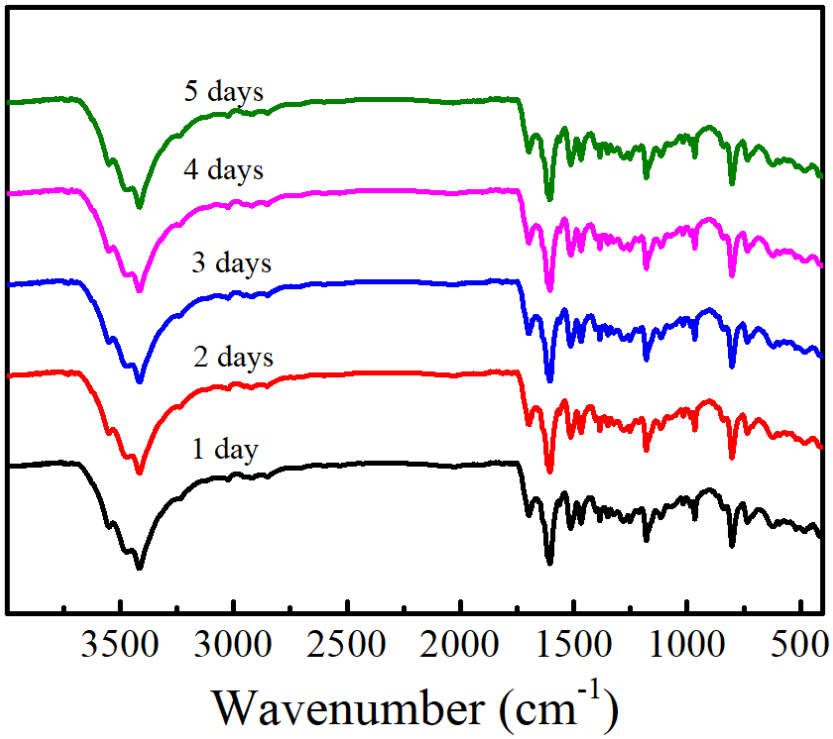


Fig. S6 FTIR spectra of TPE-TAP-COF synthesized at different intervals of time.

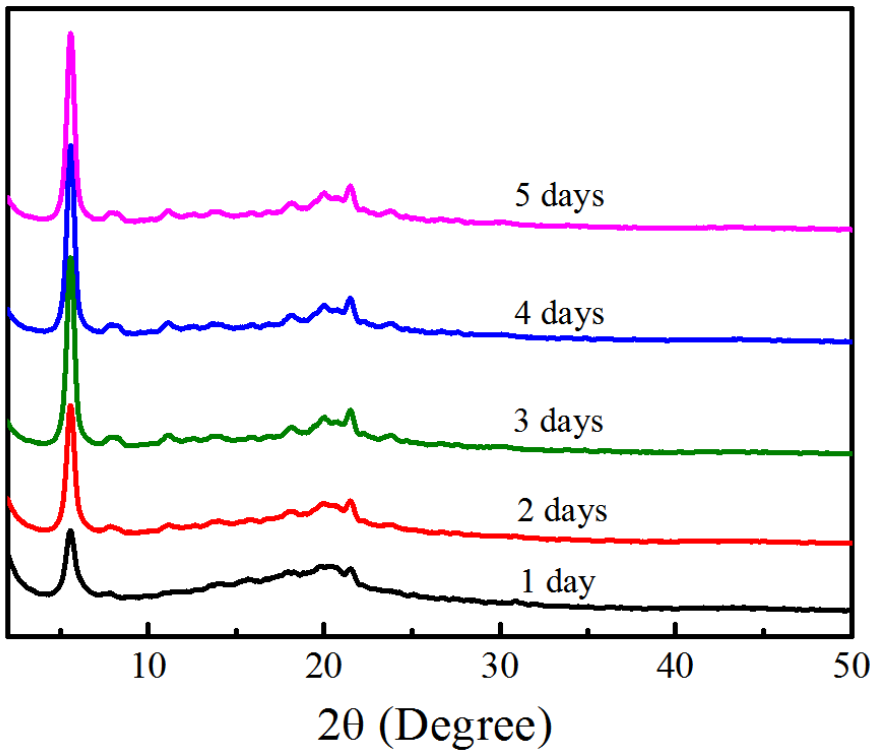


Fig. S7 PXRD of TPE-TAP-COF synthesized at different intervals of time.

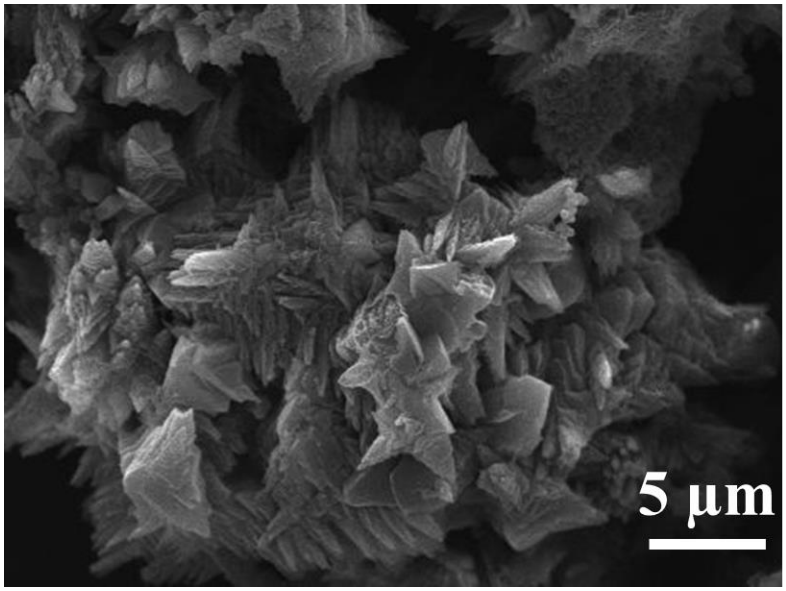


Fig. S8 SEM image of TPE-TAP-COF recorded at 3 days.

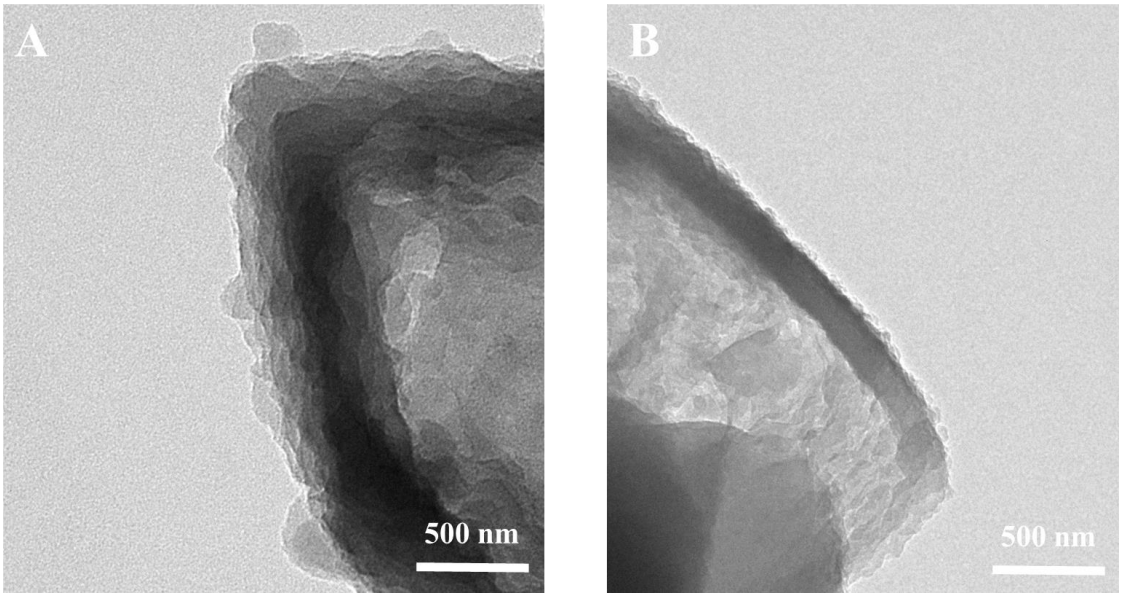


Fig. S9 TEM images of TPE-TAP-COF recorded at 4 days and 5 days, respectively.

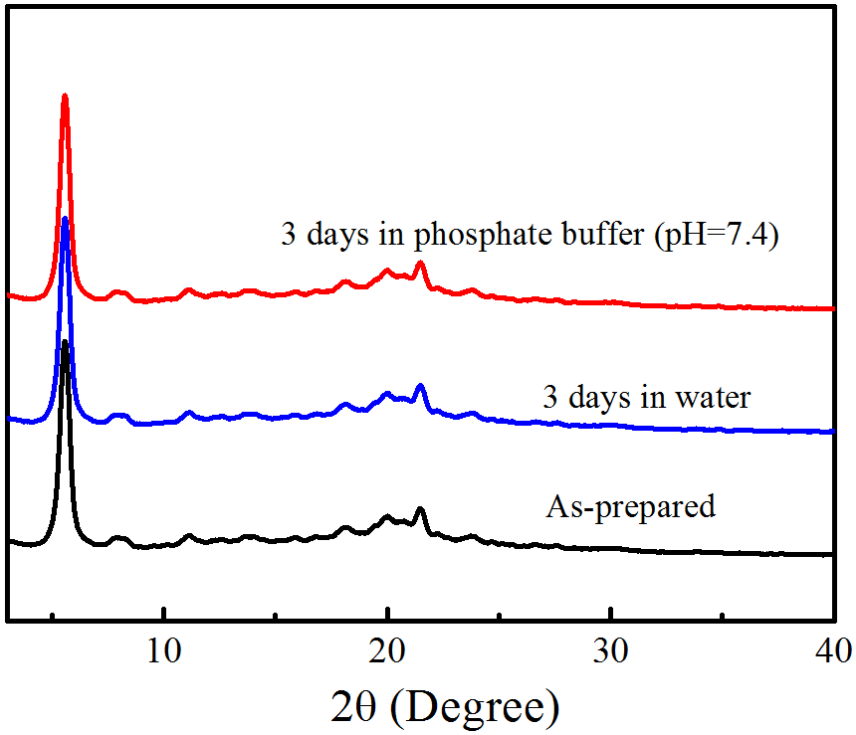


Fig. S10 PXRD of stability of TPE-TAP-COF in water, phosphate buffer.

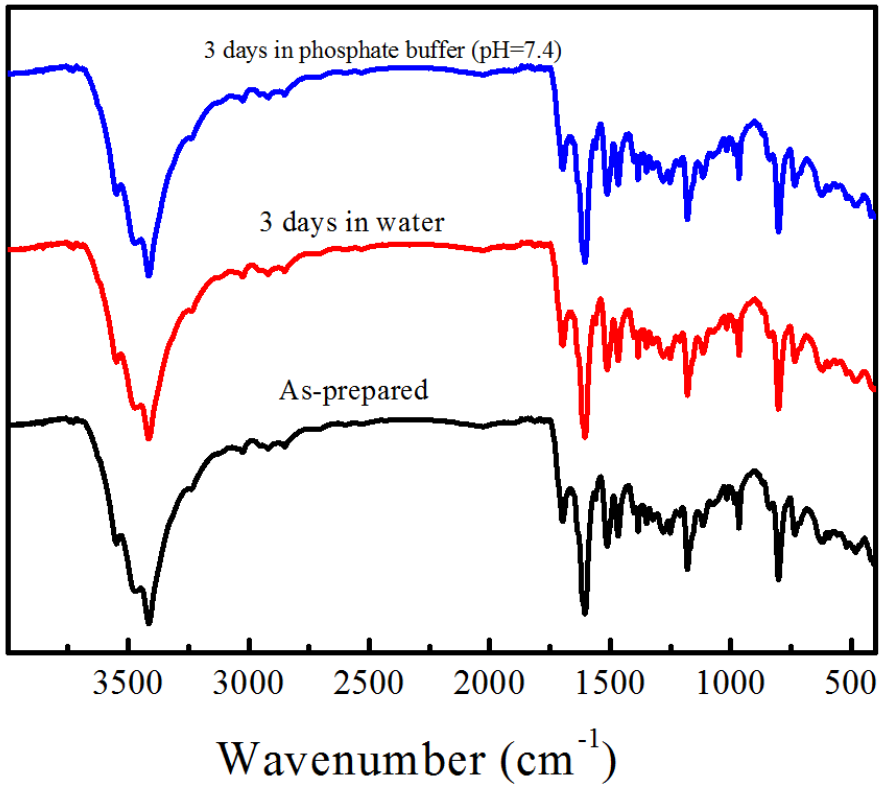


Fig. S11 FTIR spectra of stability of TPE-TAP-COF in water, phosphate buffer.

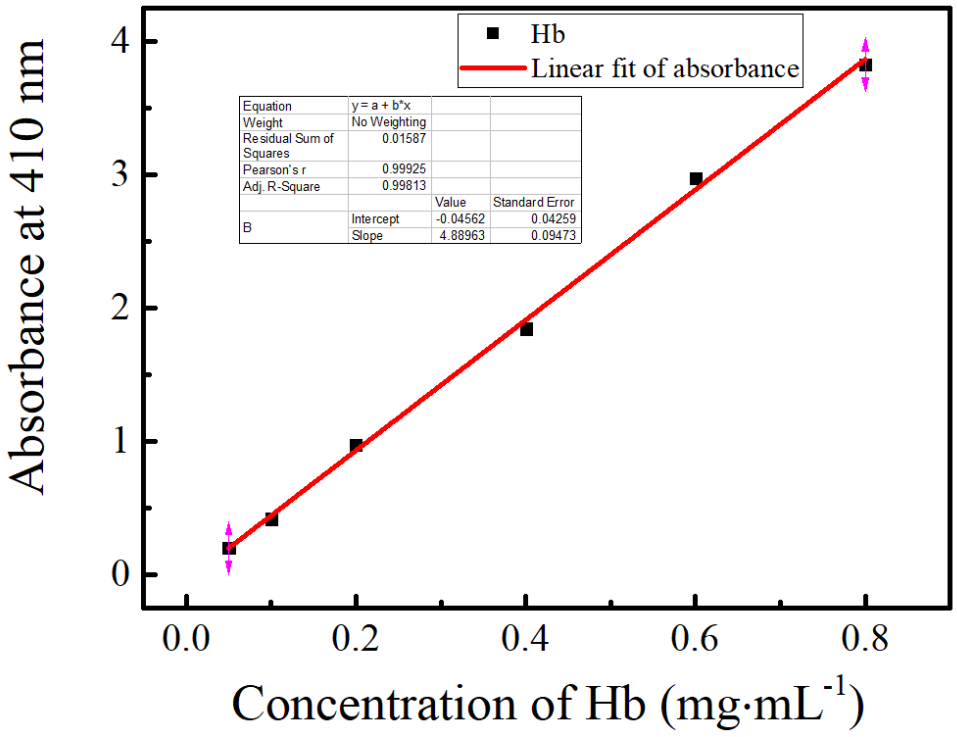


Fig. S12 Calibration curve for Hb in phosphate buffer (pH=7.4).

Table S1. COFs with different shapes on the adsorption behaviors

Morphology	The adsorption capacity ($mg \cdot g^{-1}$)	The adsorption time (h)
NS	50.25	16
NR	166.12	14
DMS	488.16	10
HMS	550.82	8

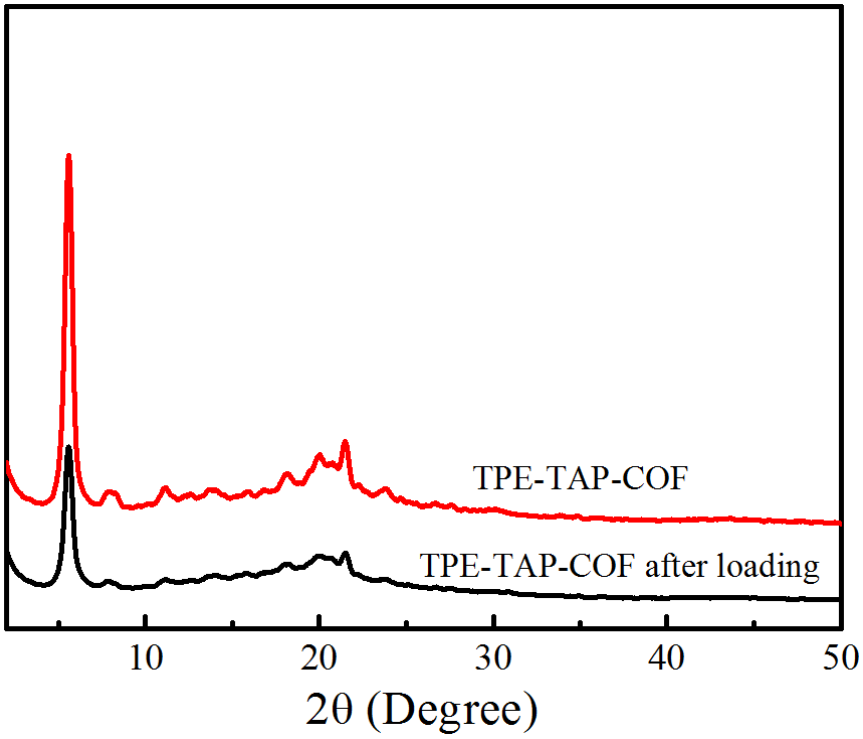


Fig. S13 PXRD patterns of TPE-TAP-COF after the adsorption of Hb.

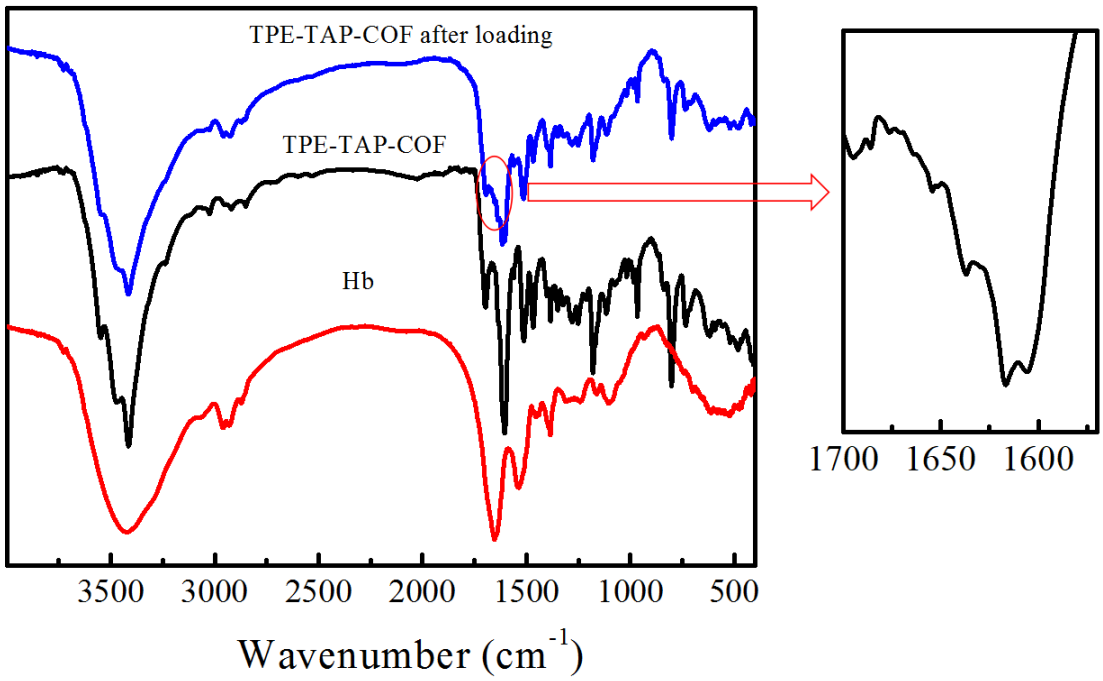


Fig. S14 FTIR spectra of Hb, TPE-TAP-COF and loading-TPE-TAP-COF.

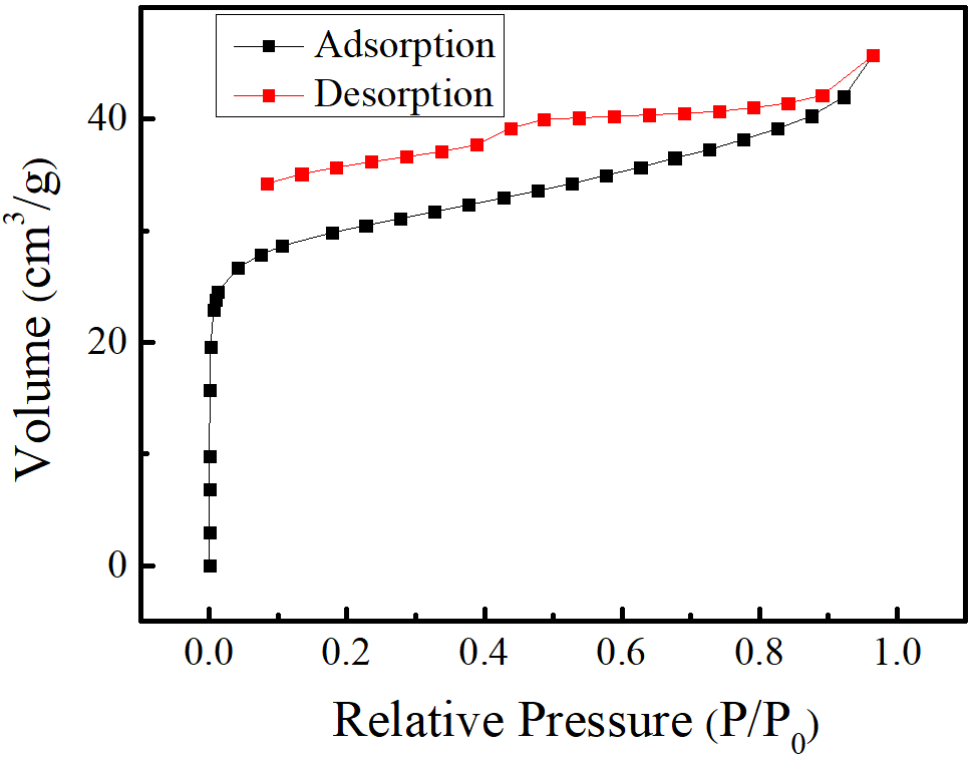


Fig. S15 N_2 adsorption (black)/desorption (red) isotherm of loading-TPE-TAP-COF at 77 K.

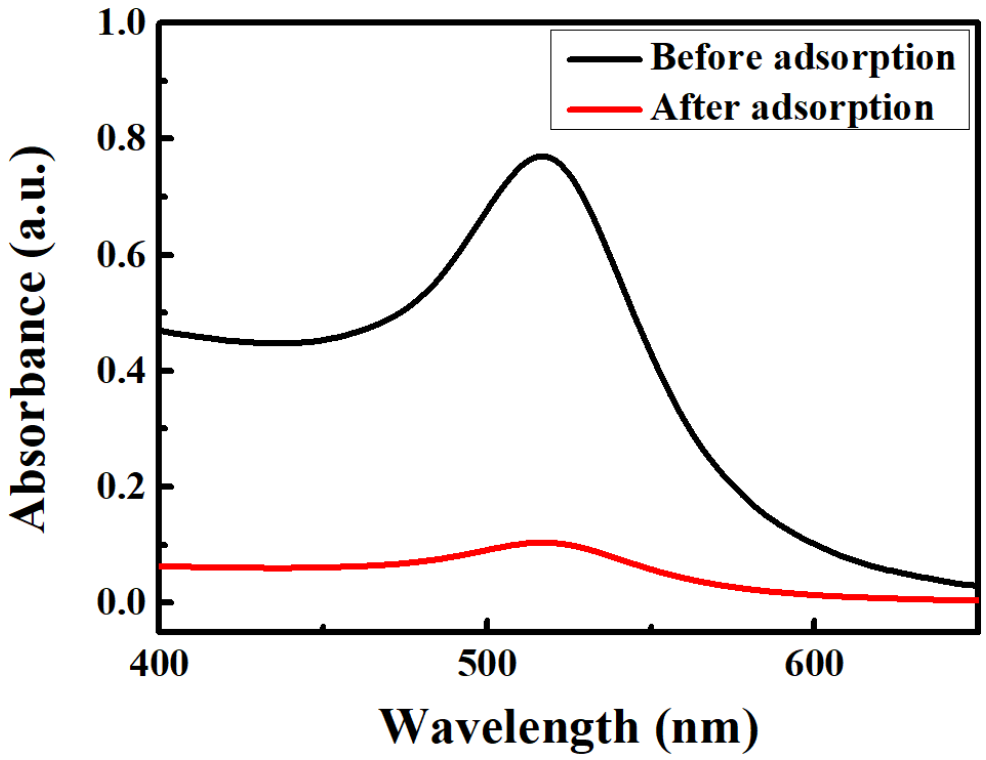


Fig. S16 UV absorption spectra of TPE-TAP-COF before and after adsorption of Au NPs.

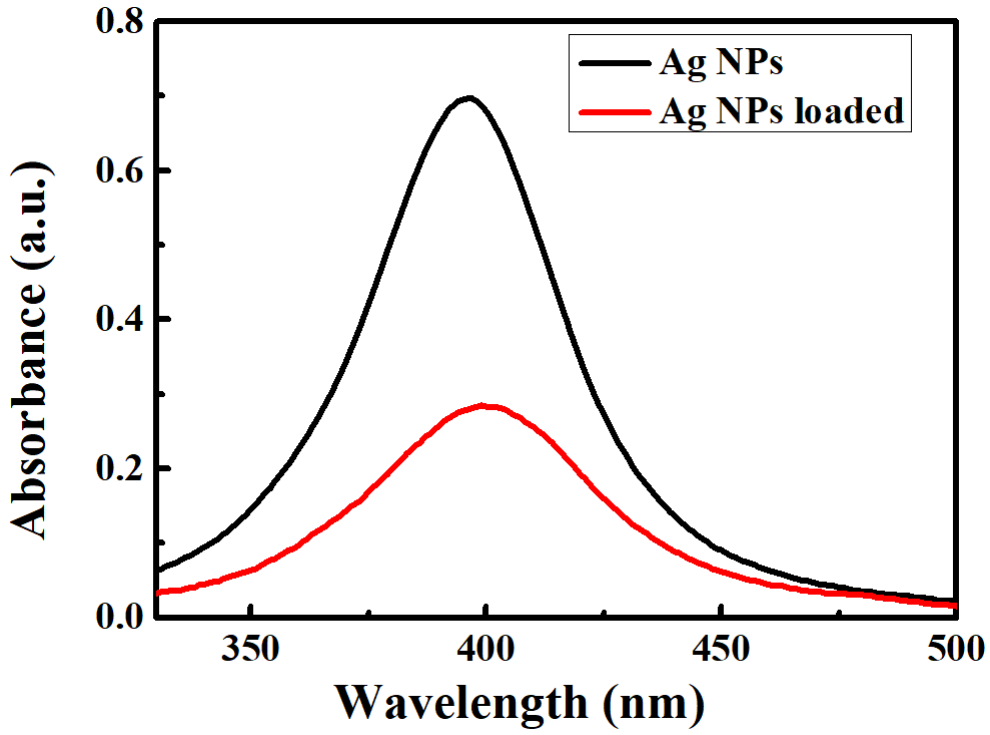


Fig. S17 UV absorption spectra of TPE-TAP-COF before and after adsorption of Ag NPs.

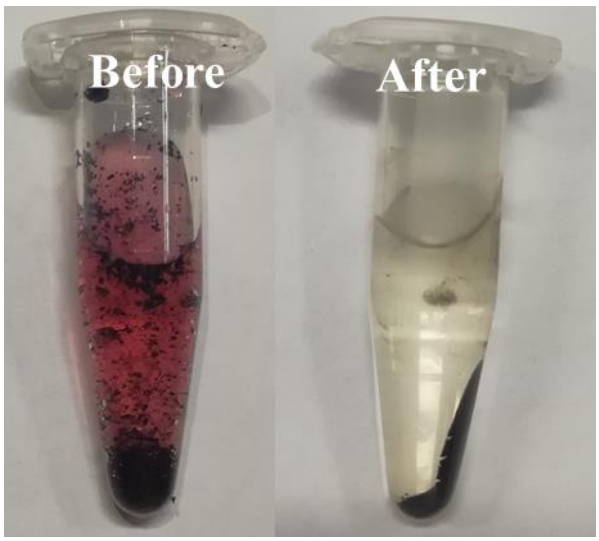


Fig. S18 Images of TPE-TAP-COF before and after adsorption of Au NPs. daily light.

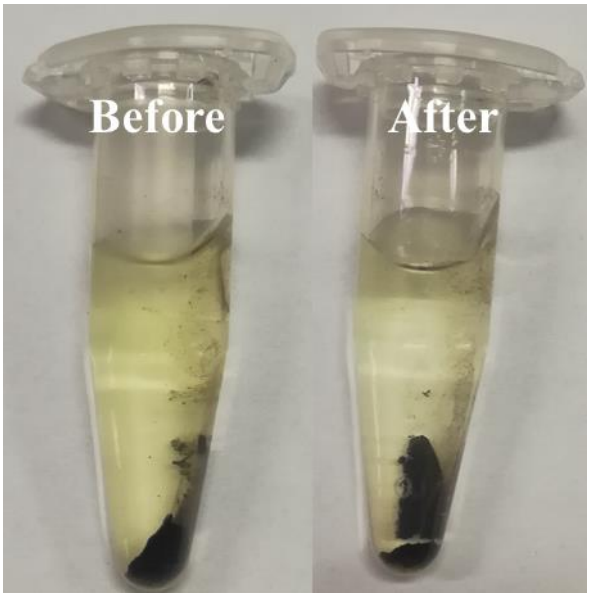


Fig. S19 Images of TPE-TAP-COF before and after adsorption of Ag NPs. daily light.

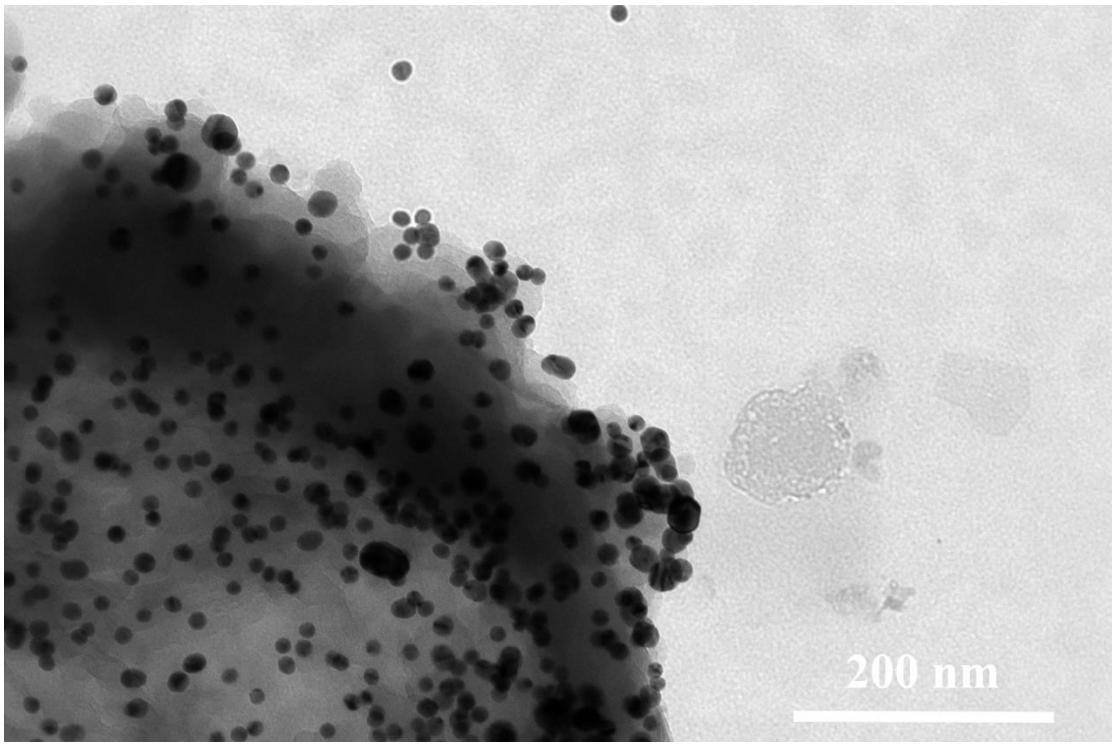


Fig. S20 TEM image of TPE-TAP-COF after adsorption of Au NPs.

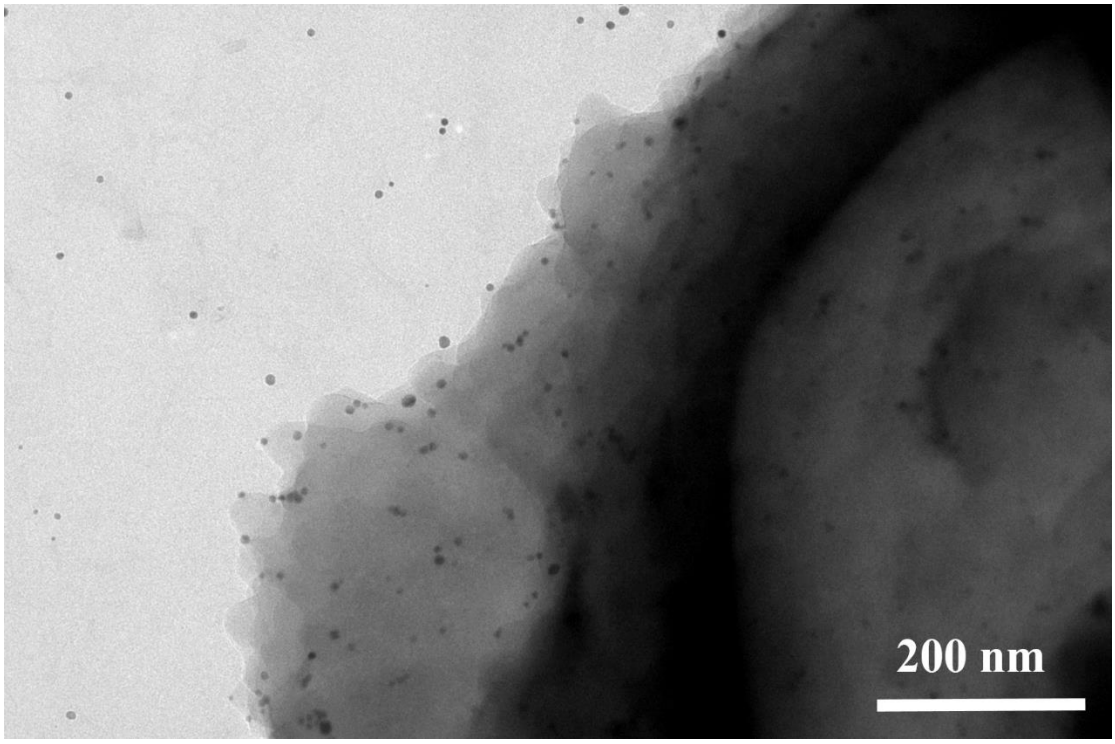


Fig. S21 TEM image of TPE-TAP-COF after adsorption of Ag NPs.

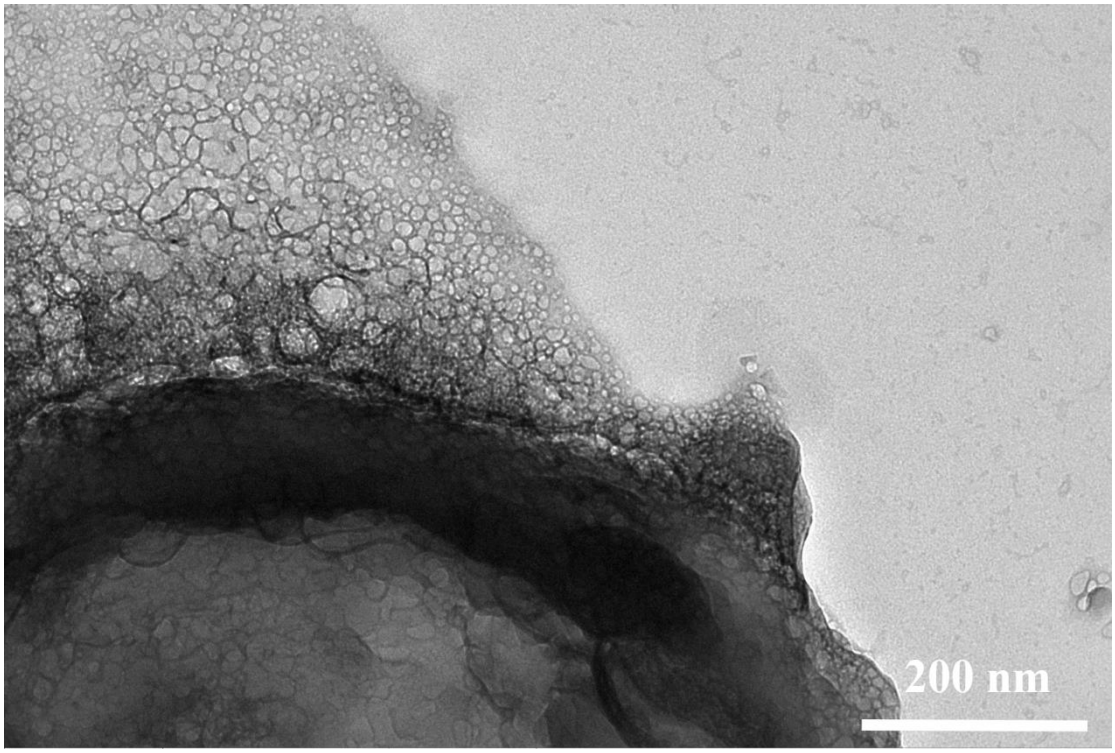


Fig. S22 TEM image of TPE-TAP-COF after adsorption of Hb.

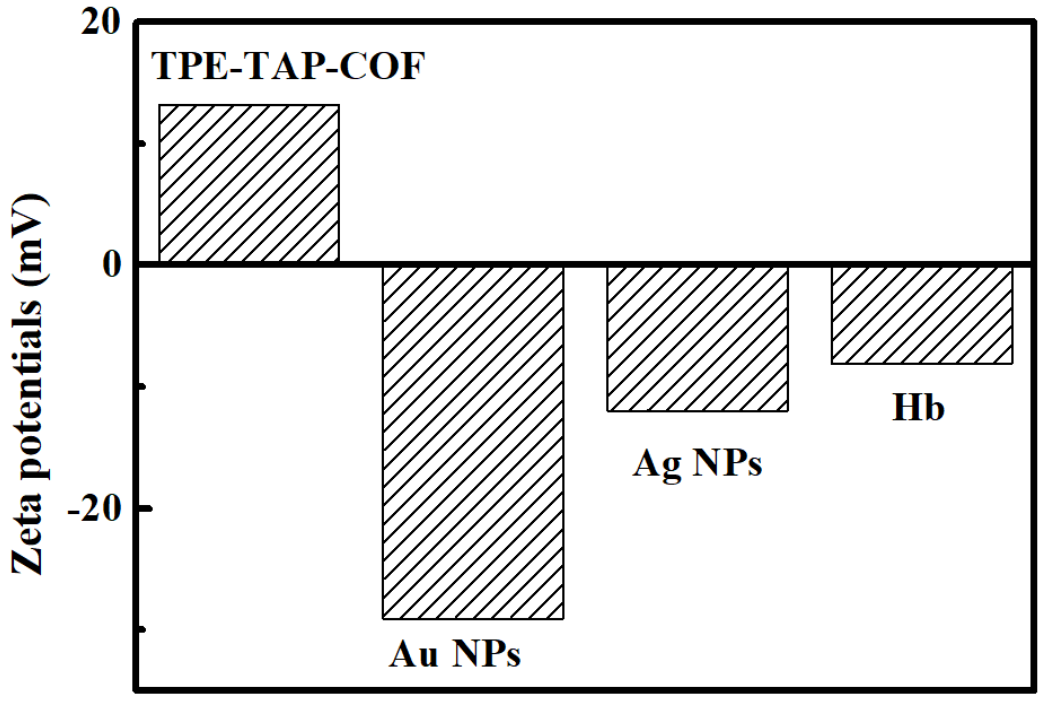
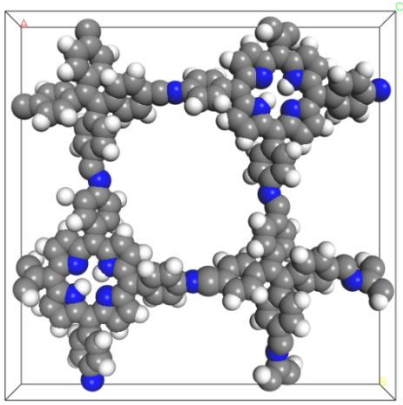


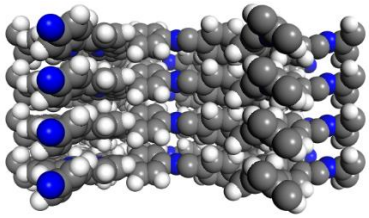
Fig. S23 Zeta potentials of TPE-TAP-COF and pure Hb in phosphate buffer (pH=7.4), Au NPs and Ag NPs in solution.

Table S2. Unit cell structure and parameters

Lattice type-3D triclinic
Space group- P1

Length A = 31.9982
Length B = 31.5291
Length C = 4.28402
Angle α = 90.4039
Angle β = 89.9188
Angle λ = 92.4525





	X	Y	Z
H1	0.15384	0.281966	0.018234
H2	0.144269	0.112508	0.041106
H3	0.198351	0.054181	0.070474
H4	0.422098	0.09479	0.070917
H5	0.431761	0.264	0.05466
H6	0.377569	0.3223	0.049194
H7	0.261373	0.168349	0.04157
H8	0.314827	0.207911	0.028601
H9	0.13546	0.149622	0.503522
H10	0.062015	0.138303	0.500194
H11	0.444118	0.226361	0.500194
H12	0.518254	0.232781	0.487245
H13	0.249439	0.350218	0.328225
H14	0.327929	0.033065	0.415843

H15	0.332781	0.959025	0.373769
H16	0.213892	0.330946	-0.104451
H17	0.362601	0.045096	-0.043901
H18	0.120928	0.243363	-0.240335
H19	0.047286	0.238192	-0.185675
H20	0.450956	0.131953	-0.24447
H21	0.525041	0.131884	-0.195538
H22	0.344757	0.339115	-0.399375
H23	0.352636	0.413707	-0.402441
H24	0.233367	0.029782	-0.326199
H25	0.232287	0.955212	-0.311313
H26	0.251606	0.42481	0.268946
H27	0.344302	0.543055	0.280129
H28	0.350136	0.617129	0.363955
H29	0.343503	0.740278	0.449849
H30	0.415619	0.757568	0.448982
H31	0.230207	0.754513	0.474062
H32	0.234987	0.63408	0.441249
H33	0.230521	0.829418	0.46436
H34	0.161488	0.621761	0.4307
H35	0.23946	0.562207	-0.340168
H36	0.248443	0.636192	-0.295895
H37	0.366964	0.6429	-0.247658
H38	0.439541	0.656005	-0.199673
H39	0.331788	0.753178	-0.202892
H40	0.21872	0.736216	-0.22574
H41	0.335509	0.828027	-0.169873
H42	0.145052	0.726847	-0.199056
H43	0.936142	0.614339	0.018234
H44	0.94584	0.78379	0.041106
H45	0.8918	0.842158	0.070474
H46	0.668024	0.801717	0.070917
H47	0.658234	0.632514	0.05466
H48	0.712384	0.574173	0.049194
H49	0.828693	0.728037	0.04157
H50	0.77521	0.688515	0.028601
H51	0.954621	0.746669	0.503522
H52	0.02397	0.756695	0.500194
H53	0.645905	0.670162	0.500194
H54	0.571765	0.663798	0.487245
H55	0.840492	0.546159	0.328225
H56	0.762238	0.863371	0.415843
H57	0.754764	0.937809	0.373769
H58	0.876054	0.565404	-0.104451

H59	0.727557	0.851367	-0.043901
H60	0.969083	0.652917	-0.240335
H61	0.038624	0.656795	-0.185675
H62	0.639138	0.764576	-0.24447
H63	0.565053	0.764701	-0.195538
H64	0.745182	0.557333	-0.399375
H65	0.737248	0.482748	-0.402441
H66	0.856802	0.866583	-0.326199
H67	0.85526	0.941546	-0.311313
H68	0.745484	0.353417	0.280129
H69	0.739594	0.279346	0.363955
H70	0.746136	0.156192	0.449849
H71	0.674007	0.138956	0.448982
H72	0.859421	0.141872	0.474062
H73	0.854731	0.262309	0.441249
H74	0.859051	0.066967	0.46436
H75	0.928239	0.274573	0.4307
H76	0.850311	0.334185	-0.340168
H77	0.841273	0.260207	-0.295895
H78	0.722747	0.253588	-0.247658
H79	0.65016	0.240538	-0.199673
H80	0.757841	0.143283	-0.202892
H81	0.870922	0.160161	-0.22574
H82	0.754065	0.068438	-0.169873
H83	0.944596	0.169474	-0.199056
C84	0.185718	0.272825	0.005204
C85	0.203104	0.232051	0.041691
C86	0.180159	0.195471	0.072652
C87	0.198016	0.155784	0.057948
C88	0.177034	0.117444	0.053329
C89	0.20544	0.086696	0.057686
C90	0.244921	0.104886	0.044132
C91	0.390247	0.103821	0.048489
C92	0.321619	0.101586	0.013413
C93	0.395734	0.181199	0.083261
C94	0.378023	0.220816	0.060207
C95	0.398955	0.259115	0.054297
C96	0.370474	0.28975	0.041227
C97	0.331058	0.271422	0.019464
C98	0.282423	0.083471	0.024466
C99	0.372702	0.144675	0.066238
C100	0.135199	0.196172	0.112488
C101	0.116724	0.167834	0.331533
C102	0.07492	0.161857	0.336091

C103	0.049267	0.186765	0.140766
C104	0.440745	0.179497	0.112992
C105	0.4613	0.20693	0.326733
C106	0.503431	0.21003	0.32643
C107	0.526958	0.183119	0.132073
C108	0.27068	0.363528	0.146656
C109	0.272393	0.405905	0.11985
C110	0.281219	0.038049	0.030275
C111	0.308929	0.016506	0.235383
C112	0.310068	0.974675	0.217795
C113	0.283547	0.951943	0.013837
C114	0.254366	0.274757	-0.007938
C115	0.217044	0.2986	-0.040431
C116	0.359063	0.077681	0.009429
C117	0.293637	0.292747	-0.003177
C118	0.10883	0.221737	-0.05576
C119	0.066712	0.218469	-0.03079
C120	0.464944	0.152489	-0.060379
C121	0.507195	0.152806	-0.039161
C122	0.296444	0.338069	-0.026413
C123	0.325432	0.357402	-0.233034
C124	0.329713	0.399682	-0.23971
C125	0.254534	0.014705	-0.152455
C126	0.252974	0.972534	-0.149268
C127	0.30235	0.424561	-0.062174
C128	0.1033	0.671106	0.123613
C129	0.363682	0.722966	0.283387
C130	0.404984	0.732256	0.291334
C131	0.433257	0.708223	0.11523
C132	0.28175	0.747411	0.135833
C133	0.252983	0.770176	0.31948
C134	0.215865	0.653592	0.281604
C135	0.253354	0.812655	0.317927
C136	0.174045	0.646994	0.282109
C137	0.283594	0.834175	0.143033
C138	0.290712	0.547015	-0.018982
C139	0.26381	0.574201	-0.179373
C140	0.322672	0.56361	0.171685
C141	0.268363	0.616254	-0.147384
C142	0.326157	0.605606	0.214384
C143	0.298637	0.633028	0.061375
C144	0.307496	0.676741	0.103029
C145	0.348325	0.690877	0.100697
C146	0.273467	0.704319	0.123844

C147	0.376958	0.667472	-0.079703
C148	0.418294	0.675259	-0.057475
C149	0.233154	0.68604	0.115212
C150	0.310822	0.769268	-0.034654
C151	0.206613	0.711554	-0.068173
C152	0.312351	0.811702	-0.024307
C153	0.164883	0.705989	-0.057241
C154	0.147694	0.673664	0.126931
C155	0.284709	0.502719	-0.04609
C156	0.477937	0.709527	0.102529
C157	0.278854	0.878488	0.124181
C158	0.904271	0.623504	0.005204
C159	0.886915	0.664291	0.041691
C160	0.909887	0.700854	0.072652
C161	0.892059	0.740554	0.057948
C162	0.91307	0.778878	0.053329
C163	0.884688	0.809648	0.057686
C164	0.845193	0.791487	0.044132
C165	0.699867	0.792662	0.048489
C166	0.768498	0.794845	0.013413
C167	0.694323	0.715288	0.083261
C168	0.712005	0.675658	0.060207
C169	0.691045	0.637375	0.054297
C170	0.719503	0.606718	0.041227
C171	0.758932	0.625017	0.019464
C172	0.807707	0.812931	0.024466
C173	0.717382	0.751795	0.066238
C174	0.954847	0.700119	0.112488
C175	0.973343	0.728443	0.331533
C176	0.011047	0.733151	0.336091
C177	0.036681	0.708223	0.140766
C178	0.649314	0.717024	0.112992
C179	0.628738	0.689606	0.326733
C180	0.586605	0.686538	0.32643
C181	0.563097	0.713467	0.132073
C182	0.819241	0.532866	0.146656
C183	0.817497	0.490489	0.11985
C184	0.808945	0.858352	0.030275
C185	0.781251	0.879916	0.235383
C186	0.777465	0.922142	0.217795
C187	0.804002	0.944854	0.013837
C188	0.835621	0.621624	-0.007938
C189	0.872926	0.597752	-0.040431
C190	0.731071	0.818779	0.009429

C191	0.796337	0.603664	-0.003177
C192	0.981197	0.674534	-0.05576
C193	0.019213	0.676532	-0.03079
C194	0.625134	0.744051	-0.060379
C195	0.582884	0.743765	-0.039161
C196	0.793496	0.558344	-0.026413
C197	0.764494	0.539033	-0.233034
C198	0.760182	0.496756	-0.23971
C199	0.835647	0.881676	-0.152455
C200	0.83456	0.92424	-0.149268
C201	0.787526	0.471856	-0.062174
C202	0.98639	0.225184	0.123613
C203	0.72597	0.17352	0.283387
C204	0.68466	0.164261	0.291334
C205	0.656405	0.188315	0.11523
C206	0.807883	0.149013	0.135833
C207	0.836634	0.126226	0.31948
C208	0.873838	0.242783	0.281604
C209	0.836231	0.083747	0.317927
C210	0.915663	0.249349	0.282109
C211	0.805975	0.06225	0.143033
C212	0.799071	0.349416	-0.018982
C213	0.825952	0.322209	-0.179373
C214	0.767098	0.332845	0.171685
C215	0.821368	0.28016	-0.147384
C216	0.763582	0.290851	0.214384
C217	0.791081	0.263409	0.061375
C218	0.782189	0.219703	0.103029
C219	0.74135	0.205597	0.100697
C220	0.816198	0.192098	0.123844
C221	0.712735	0.229024	-0.079703
C222	0.671393	0.221268	-0.057475
C223	0.856524	0.210347	0.115212
C224	0.778795	0.127178	-0.034654
C225	0.883047	0.184813	-0.068173
C226	0.777235	0.084745	-0.024307
C227	0.924781	0.190347	-0.057241
C228	0.941994	0.222659	0.126931
C229	0.805107	0.393708	-0.04609
C230	0.611725	0.187044	0.102529
C231	0.810682	0.017934	0.124181
N232	0.244604	0.234551	0.024184
N233	0.238758	0.146503	0.045645
N234	0.331215	0.142007	0.046835

N235	0.3373	0.229885	0.035701
N236	0.286267	0.909212	0.004094
N237	0.569616	0.186588	0.124469
N238	0.007	0.179963	0.134433
N239	0.306869	0.467169	-0.064776
N240	0.845414	0.661823	0.024184
N241	0.851324	0.749866	0.045645
N242	0.758871	0.754432	0.046835
N243	0.752721	0.666559	0.035701
N244	0.801314	0.987588	0.004094
N245	0.520437	0.71003	0.124469
N246	0.079883	0.704648	0.134433
N247	0.782976	0.429251	-0.064776
C248	0.308929	1.016506	0.235383
C249	0.310068	-0.025325	0.217795
C250	0.254534	1.014705	-0.152455
C251	0.252974	-0.027466	-0.149268
C252	-0.026657	0.728443	0.331533
C253	1.011047	0.733151	0.336091
C254	-0.018803	0.674534	-0.05576
C255	1.019213	0.676532	-0.03079
C256	-0.01361	0.225184	0.123613
C257	0.810682	1.017934	0.124181
N258	1.007	0.179963	0.134433
N259	0.801314	-0.012412	0.004094
H260	0.868079	0.475167	0.268946

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