Dissolved Oil and Mercury (II) Adsorption under Dynamic Conditions by Thiol-Terminated COF Modified Sponges

Panagiota Bika[a], Nadia Todorova[a], Theopisti Lymperopoulou[b], Lamprini-Areti Tsakanika[b], Maria-Anna Gatou[b], Elias Sakellis[a,c], Nikolaos Zacharopoulos[a], Vasileios Psycharis[a], Apostolos Kalafatis[a], Thomas Stergiopoulos[a], Dimitrios Tsoukleris[d], Evangelia A. Pavlatou[b] and Panagiotis Dallas[a,e]

[a] *Institute of Nanoscience and Nanotechnology, NCSR Demokritos, 15341, Athens, Greece* [b] *Laboratory of General Chemistry, School of Chemical Engineering, National Technical University of Athens, Zografou Campus, 15772, Athens, Greece* [c] *Department of Physics, National and Kapodistrian University of Athens, Athens, Greece* [d] *NanoViis Innovative Nanotechnologies 21 El. Venizelou Str., Melissia, Athens, Greece, 15127* [e] *Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation, 11635, Athens, Greece*

- *pdallas@eie.gr; p.dallas@inn.demokritos.gr Phone: +302107273812*

Highlights. Covalent organic frameworks, melamine sponge, heavy metal adsorption, crude oil, oil-in-water emulsion, mercury removal

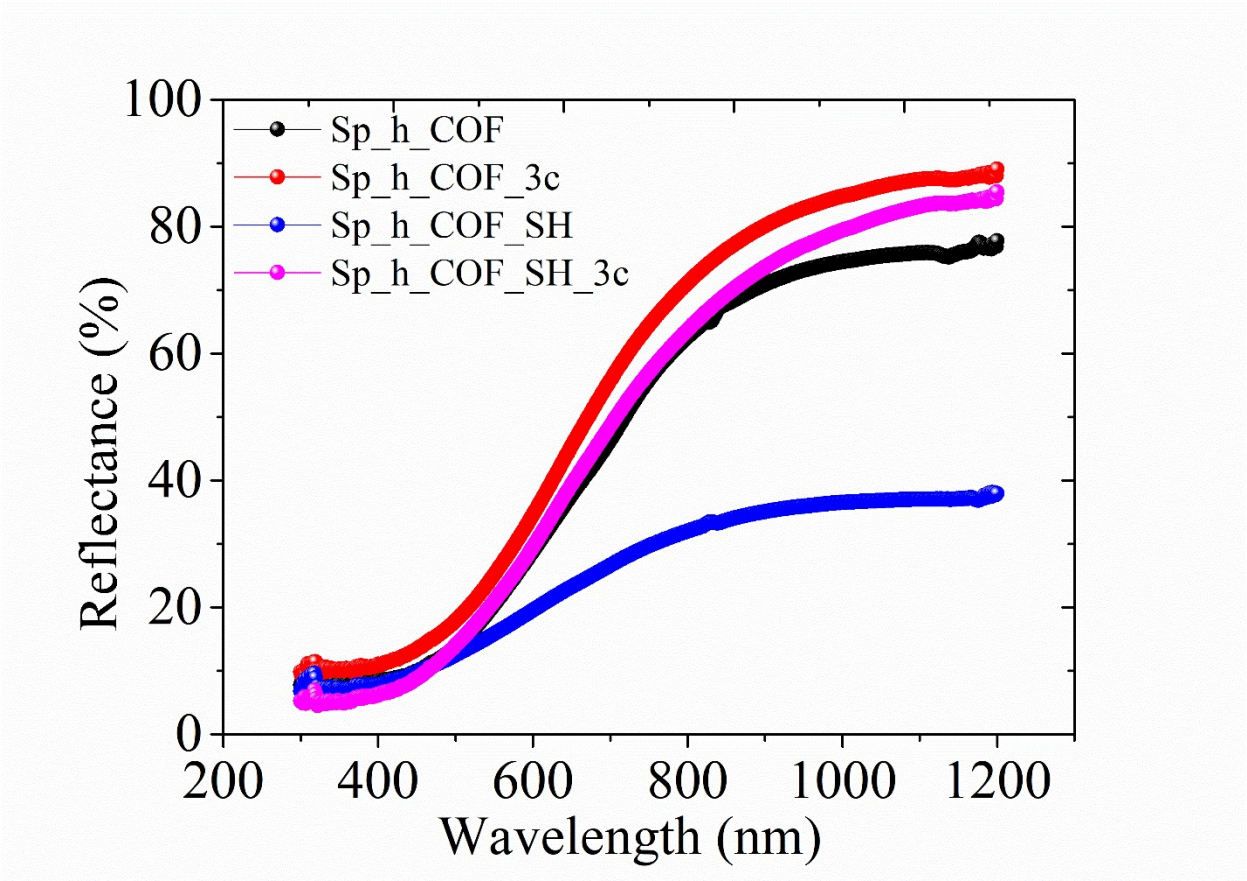


Figure S1. Diffuse reflectance spectra of three samples, Sp_h_COF; Sp_h_COF_3c; Sp_h_COF_SH and Sp_h_COF_SH_3c

Element	Weight %		Atomic %	
	Before	After	Before	After
Carbon	62.69	65.49	75.395	75.33
Nitrogen	10.65	15.355	10.68	15.12
Oxygen	6.18	6.095	5.58	5.25
Silicon	2.7	1.26	1.385	0.62
Gold (coating)	3.145	3.92	0.24	0.285
Sulfur	14.915	7.88	6.725	3.395
Total	99.995	100	100.005	100

Table S1. Quantitative analysis of the EDS spectra of the thiol modified sponges before (Sp_h_COF_SH) and after (Sp_h_COF_SH_3c) the oil removal and subsequent recovery

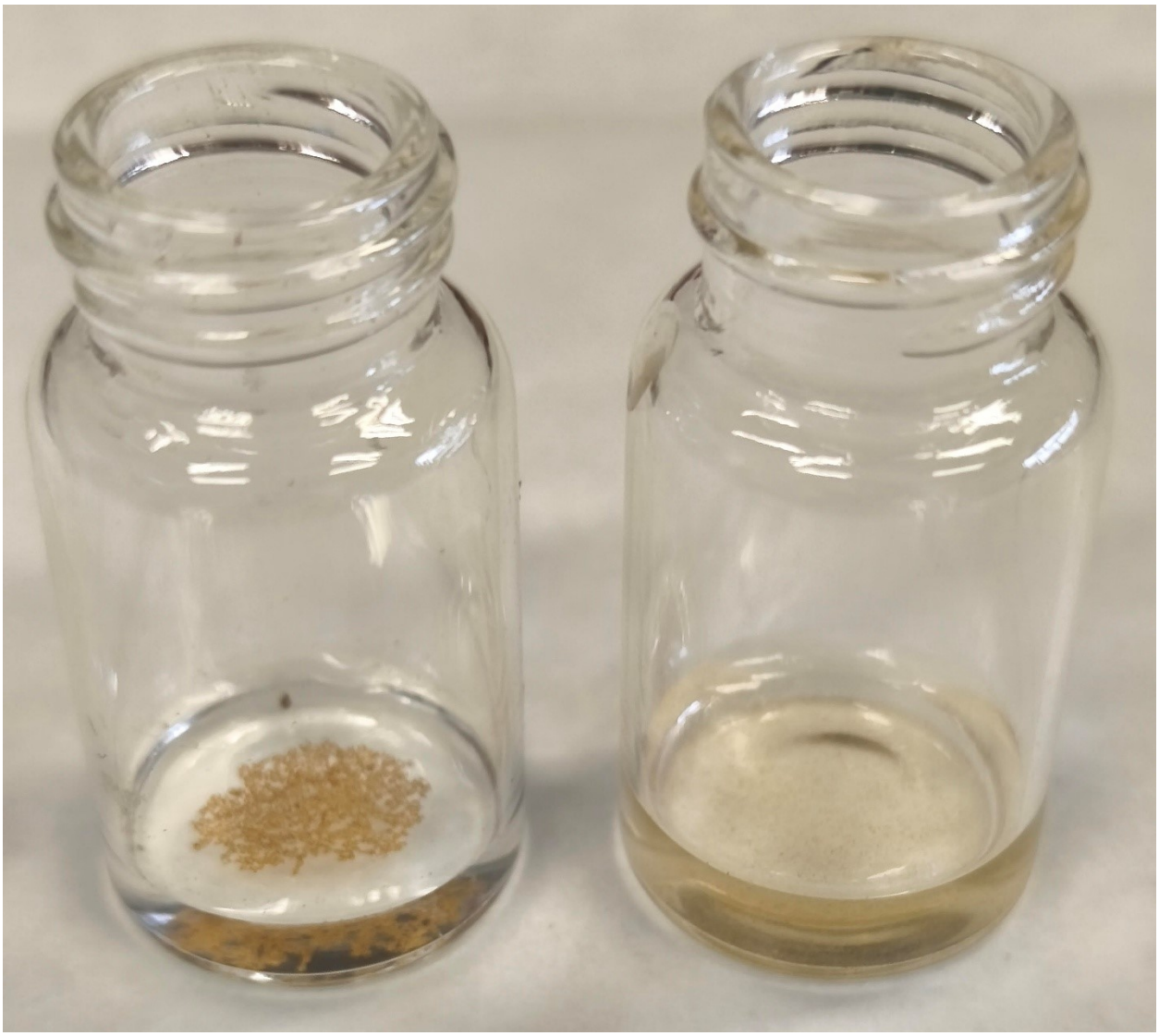
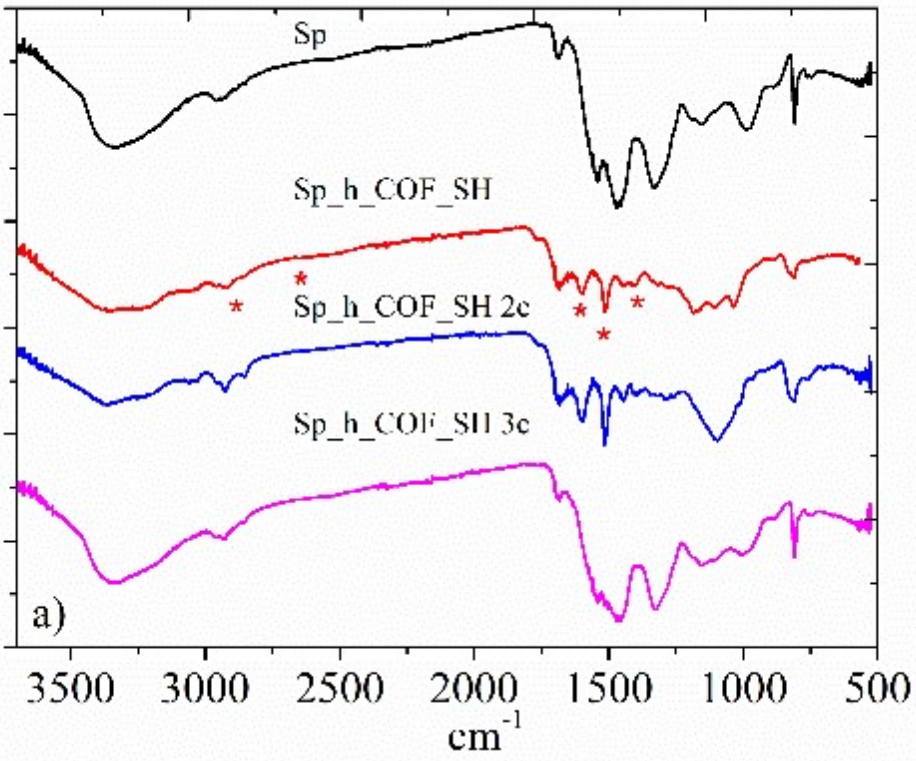
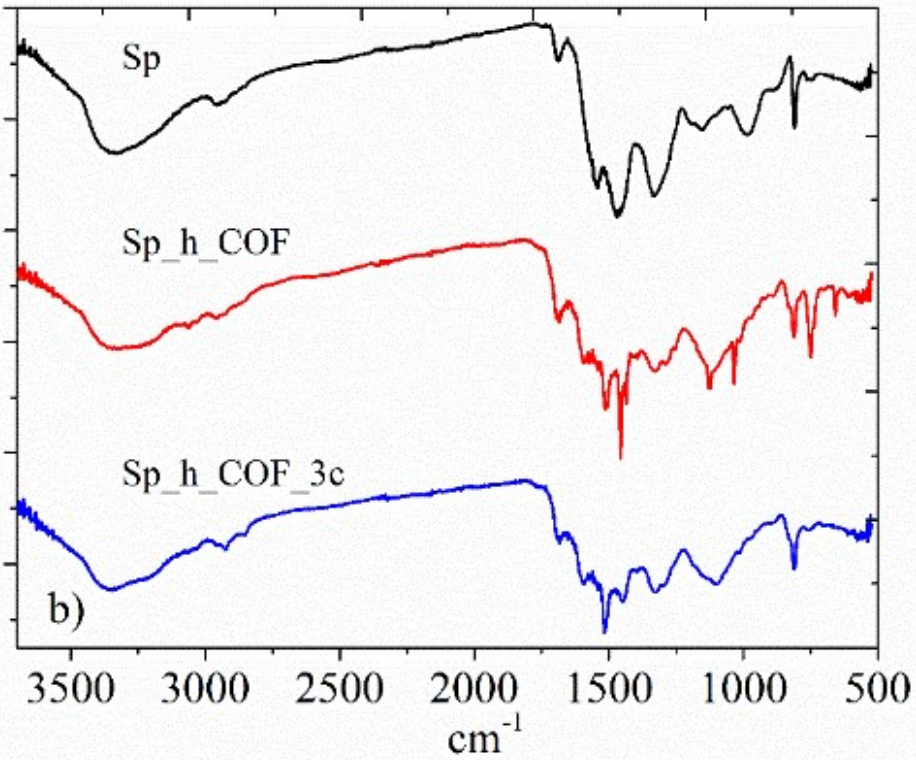


Figure S2. The powders removed from the Sp_h_COF_3c and the Sp_h_COF_SH samples are added in water.


Sp
Sp_h_COF_SH
Sp_h_COF_SH 2c
Sp_h_COF_SH 3c
a)
3500
3000
2500
2000
1500
1000
500
cm-1


Sp
Sp_h_COF
Sp_h_COF_3c
b)
3500
3000
2500
2000
1500
1000
500
cm-1

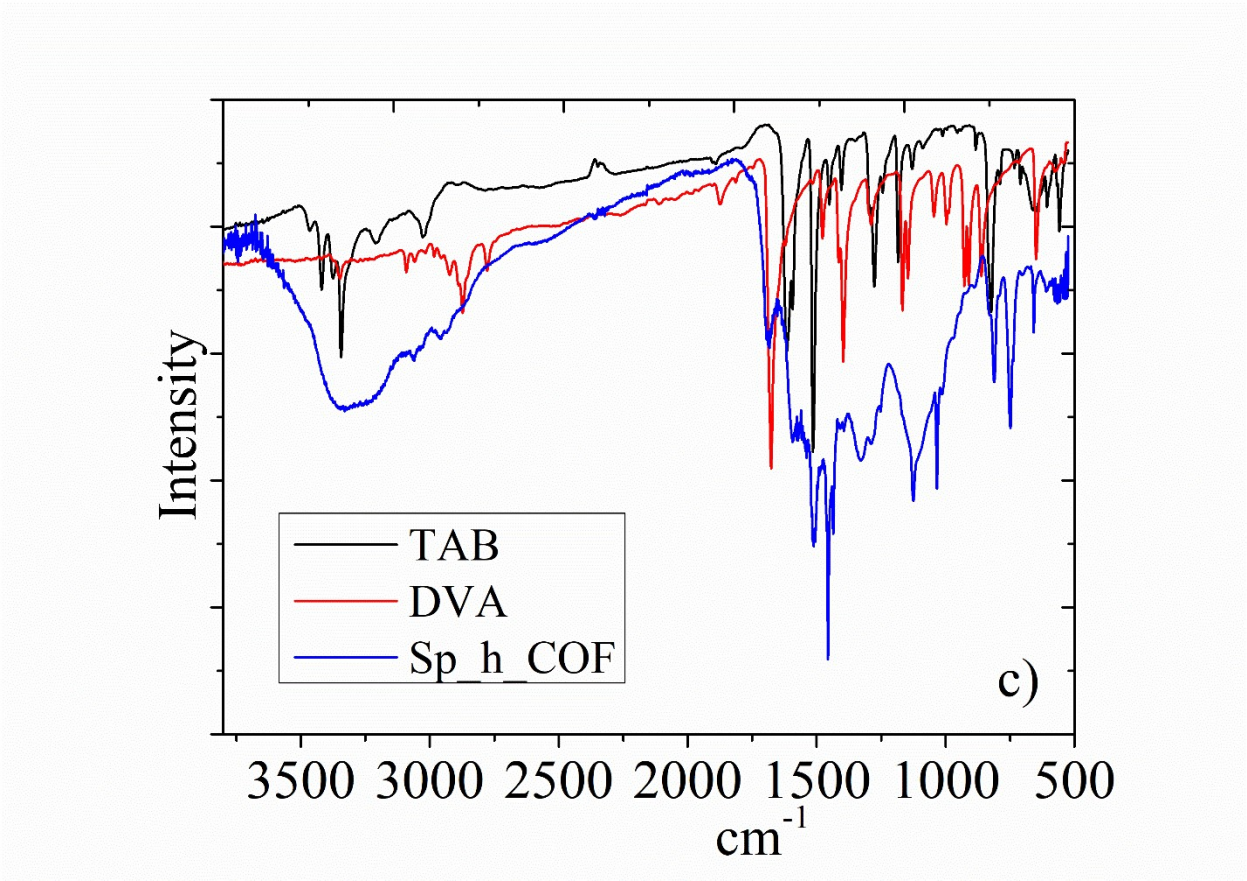


Figure S3. FTIR spectra of a) Sp; Sp_h_COF_SH; Sp_h_COF_SH_2c; Sp_h_COF_SH_3c b) Sp; Sp_h_COF; Sp_h_COF_3c c) The spectra of TAB and DVA precursors in comparison with the Sp_h_COF sample

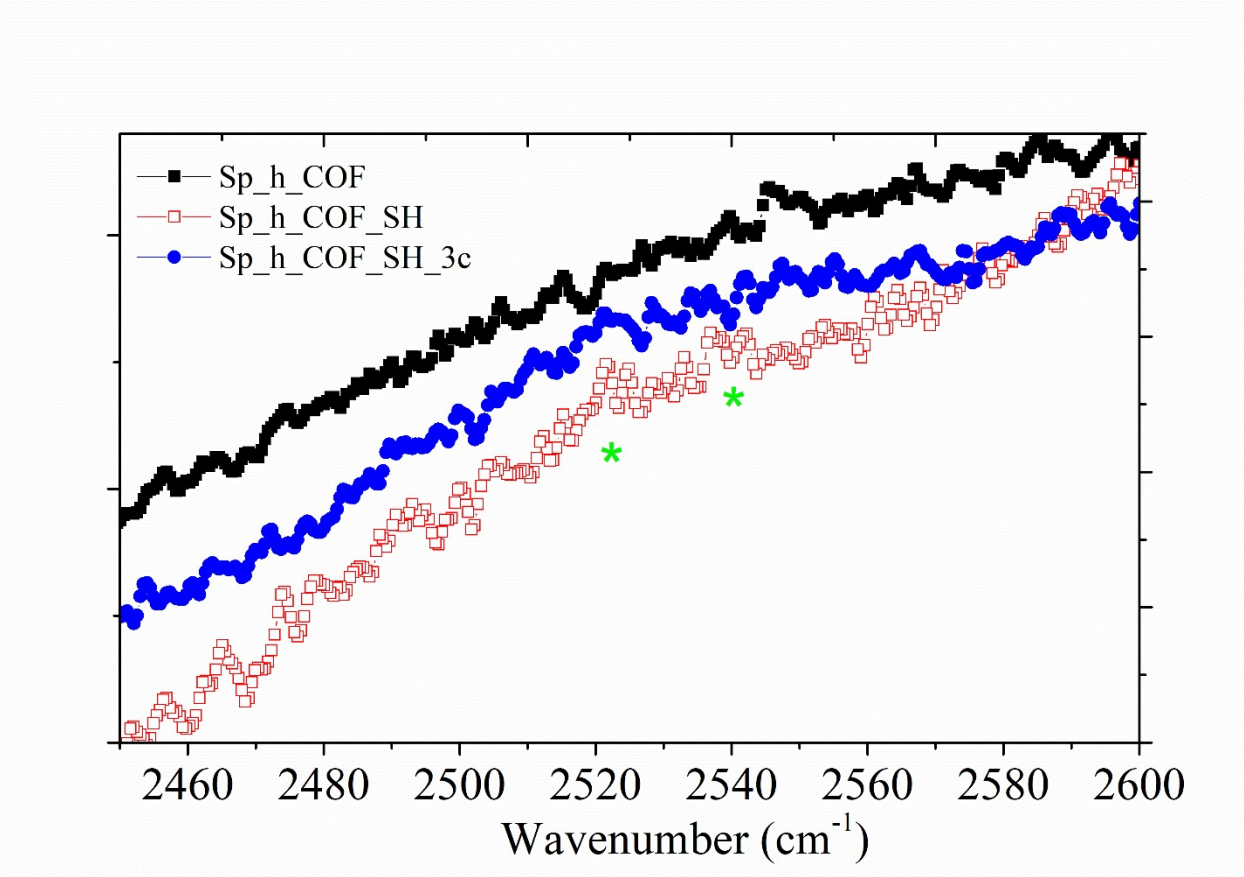


Figure S4. FTIR spectra focusing on the S-H region. The peaks indicating the S-H group are indicated with green stars

VID_20251117_105341.mp4

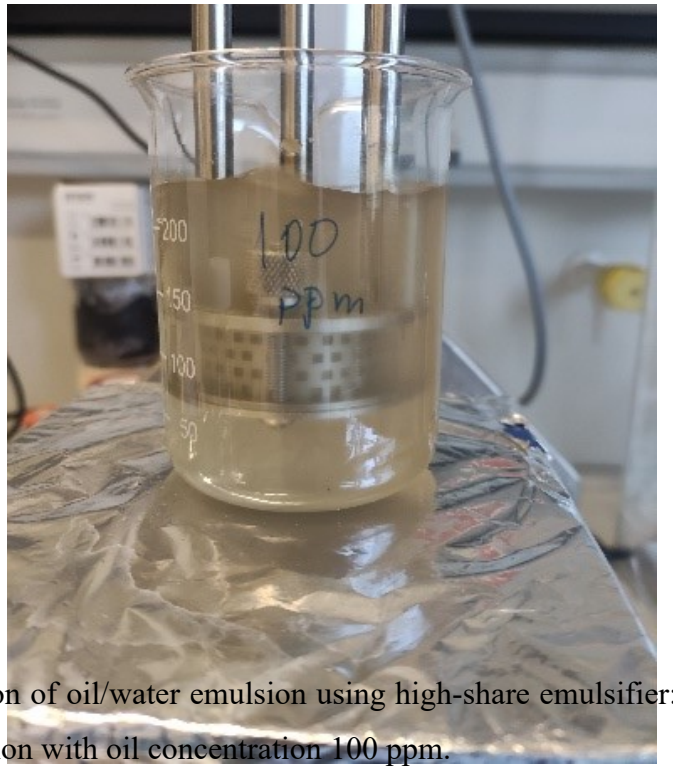
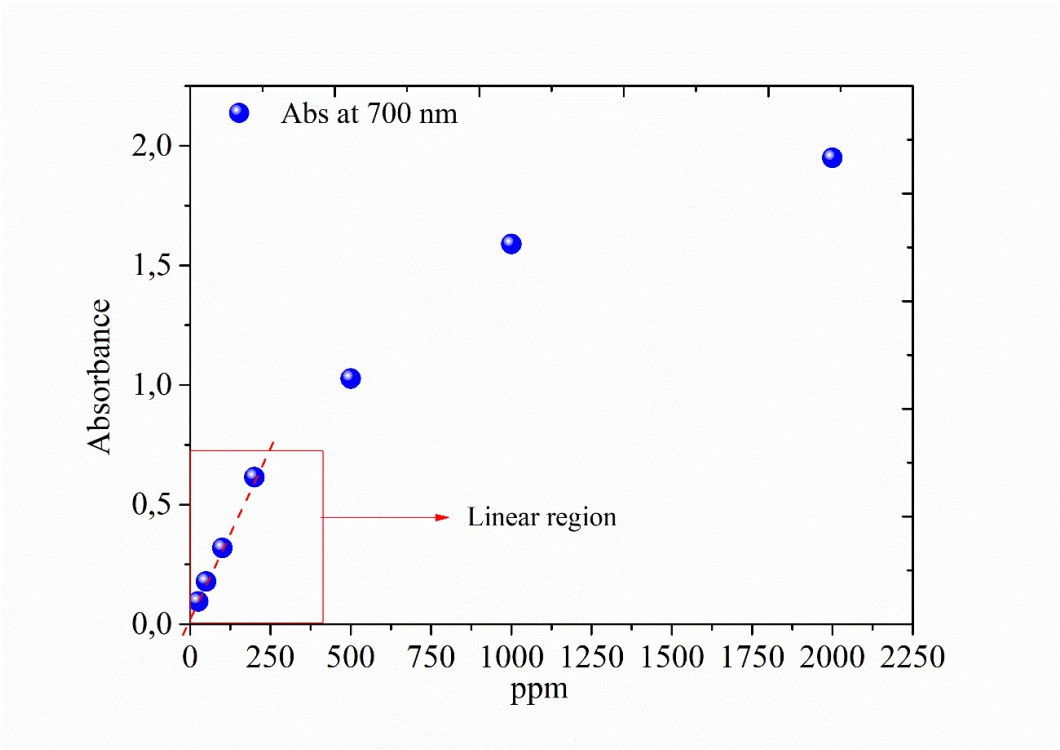


Figure S5. Preparation of oil/water emulsion using high-share emulsifier: video (a) and photo (b) of the final emulsion with oil concentration 100 ppm.



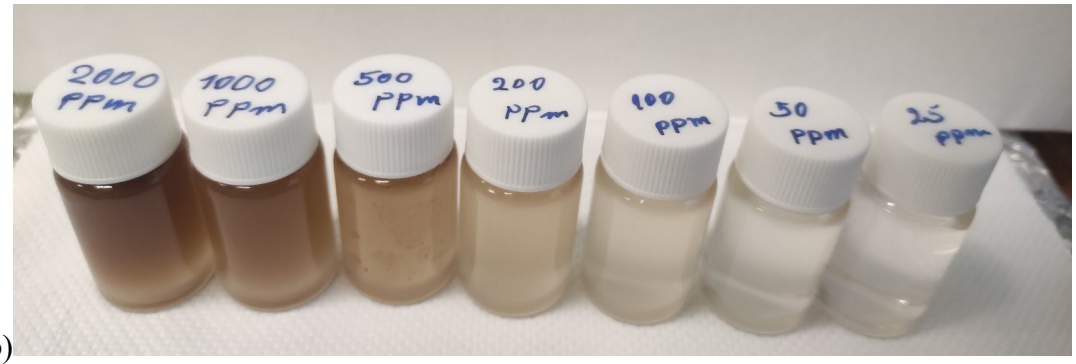
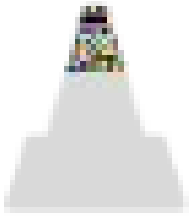
b) 

Figure S6. a) The intensity of the absorbance at 700 nm for different oil concentrations b) Image of the oil-in-water emulsions from 25 to 2000 ppm



Sp_h_COF_SH video.mp4

Figure S7. Video of the Sp_h_COF_SH during the first oil-in-water adsorption cycle

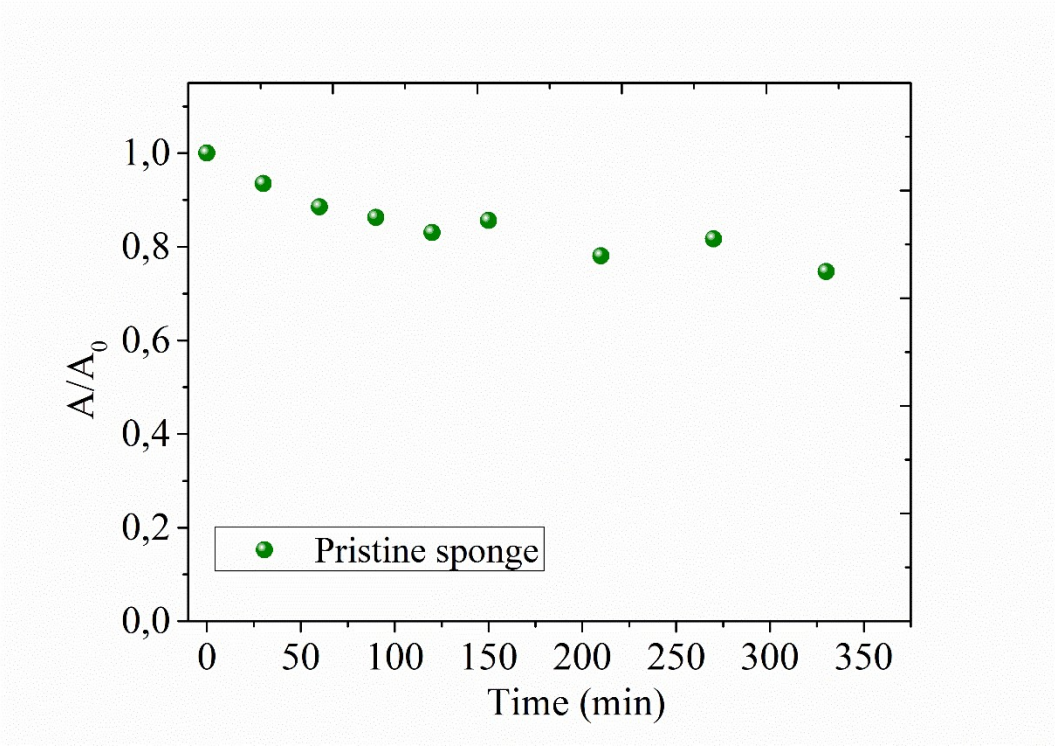


Figure S8. The oil adsorption behavior of the pristine sponge. A is the absorbance of aliquots in different time intervals and A0 the absorbance of the initial emulsion before the addition of the sponge

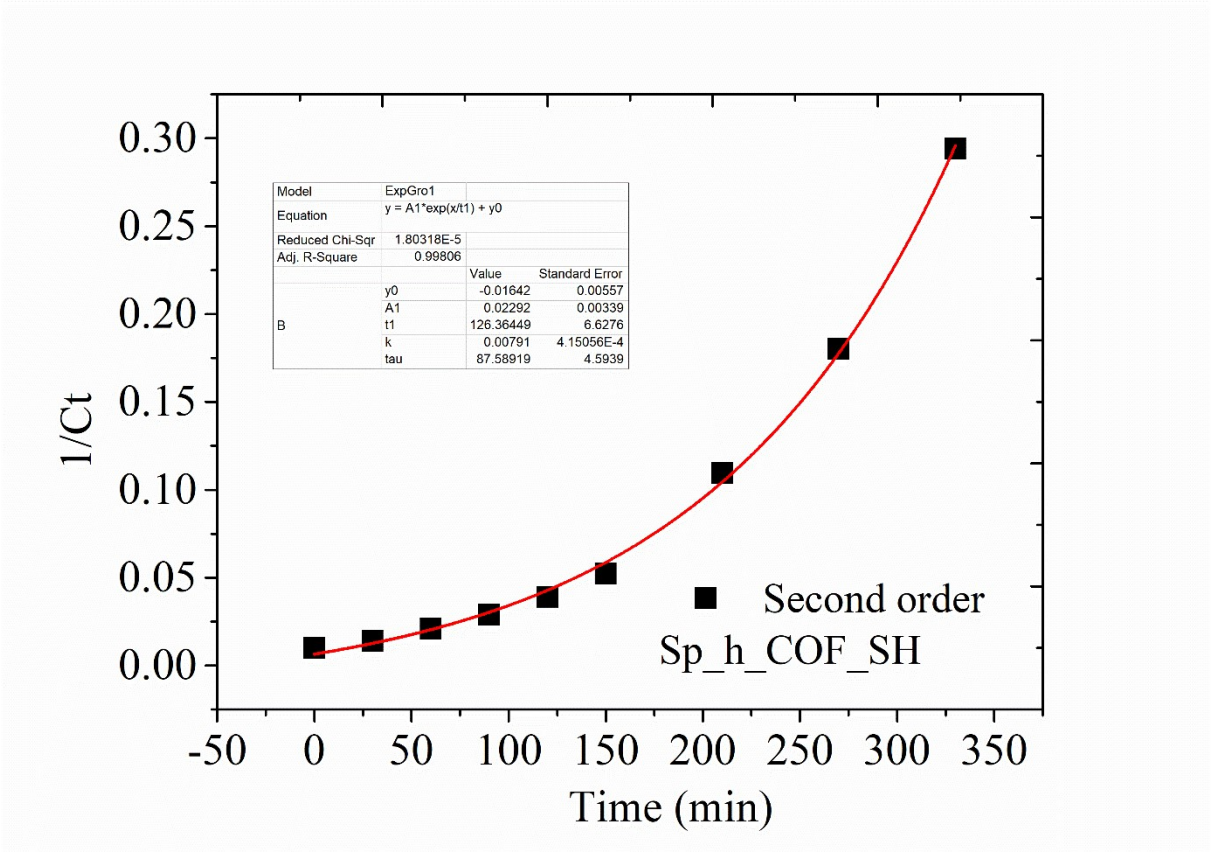


Figure S9. Second order kinetic fitting for the Sp_h_COF_SH oil adsorption

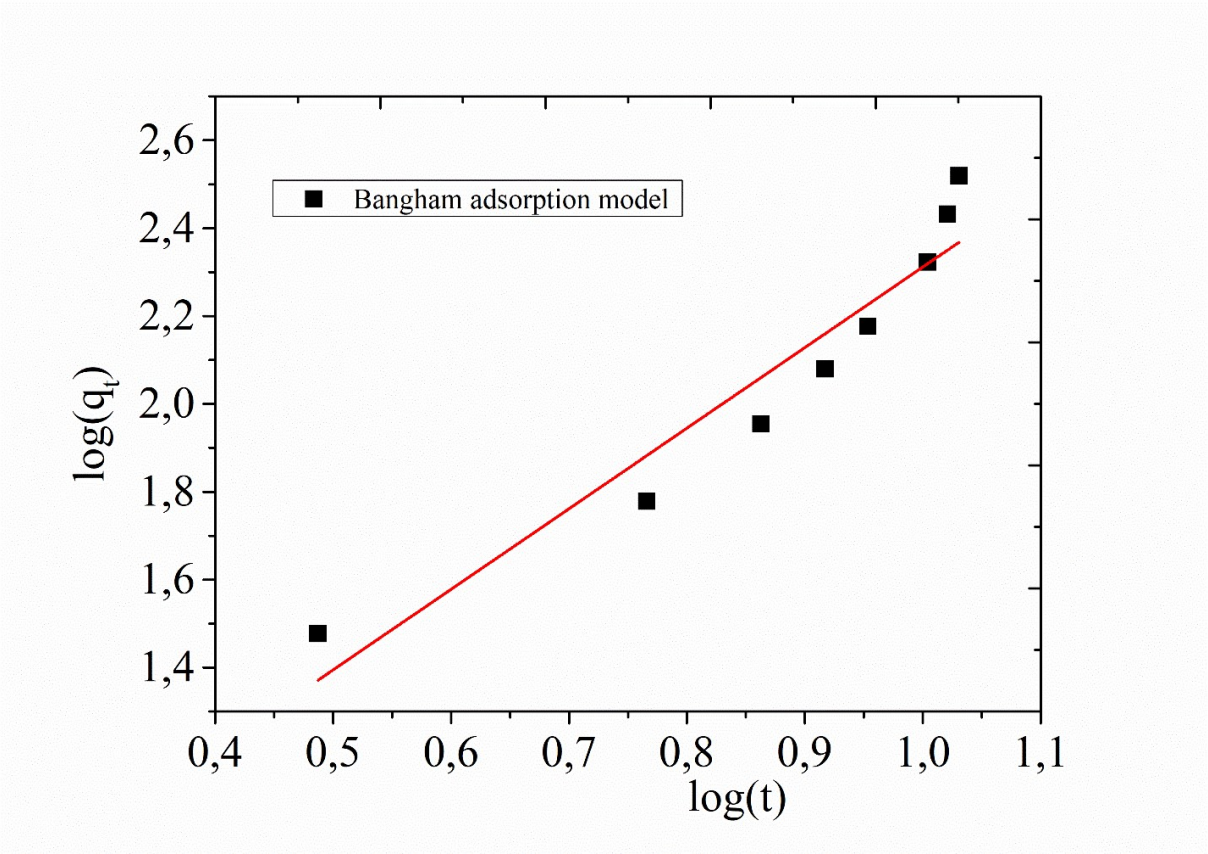


Figure S10. Bangham model fitting curve for the first oil adsorption cycle of the Sp_h_COF_SH sample

Element	%	
	Wt	At
Carbon	44.89	63.53
Nitrogen	5.01	6.08
Oxygen	16.66	17.71
Silicon	9.97	6.04
Sulfur	8.08	4.29
Mercury	15.39	2.36

Table S2. Quantitative analysis of the EDS spectra of the thiol modified sponges before (Sp_h_COF_SH) after the dynamic mercury adsorption