Electronic Supplementary Information

Heterostructured PPy/ZnO layer assembled PAN nanofibrous membrane with robust visible-light-induced self-cleaning for high efficient water purification with fast separation flux

Liyun Zhang,[ab] Pingya Luo,[*ab] Yi He,[*ab] Lan Ma,[*a] Yi Fan,[c] Heng Shi,[ab] Shihong Zhang,[ab] and Shuangshuang Li [ab] and Yiling Nie[a,b]

a. State Key Lab of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu, 610500, P. R. China.

b. College of Chemistry and Chemical Engineering, Southwest Petroleum University, Chengdu, 610500, P. R. China.

c. Chengdu Graphene Application Institute of Industrial Technology, Chengdu, 611130, P. R. China

Email: luopy@swpu.edu.cn, chemheyi@swpu.edu.cn &1220180024@mail.xhu.edu.cn and Fax: +86 02883037315

Table of Contents

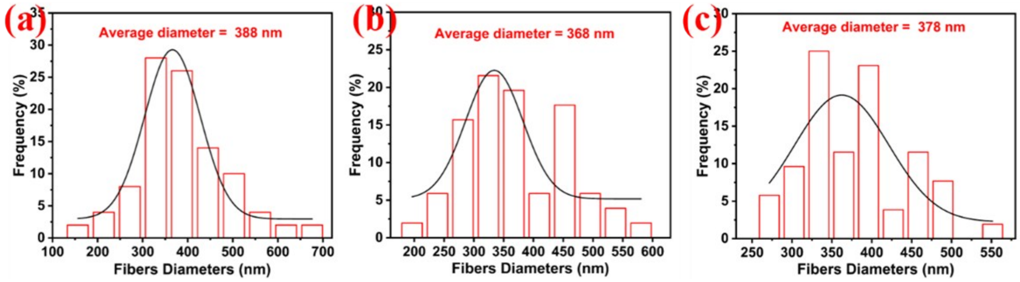

Figure S1. Corresponding diameter distribution curves of (a) PAN, (b)SPAN and (c) SPAN-PPy NFMs, respectively.

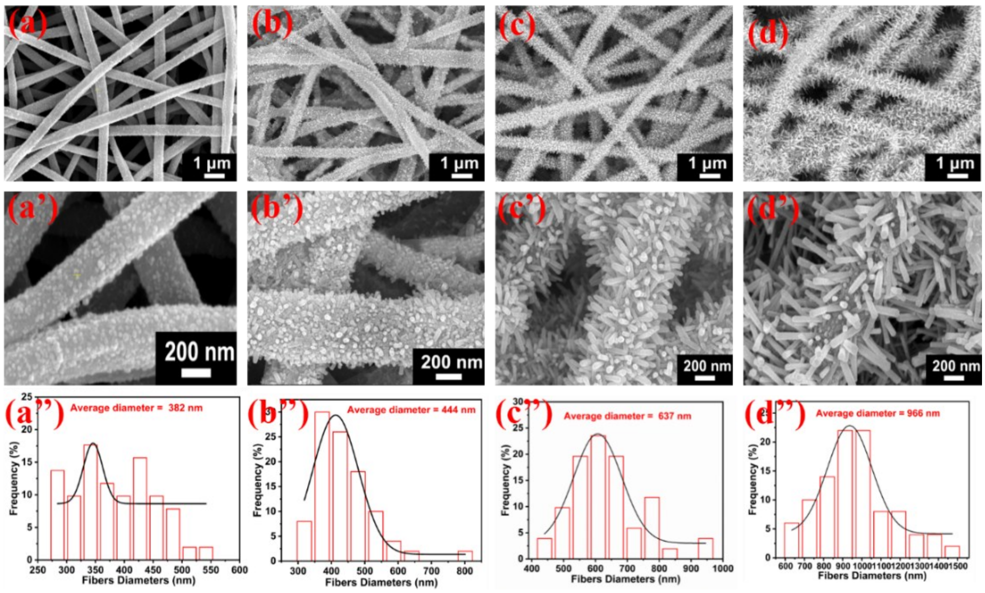

Figure S2. SEM images and corresponding diameter distribution curves of the SPAN-PPy-ZnO nanofibrous membranes through different hydrothermal reaction time: (a) - (a'') 1 h, (b) - (b'') 4 h, (c) - (c'') 8 h and (d) - (d'') 16 h, respectively.

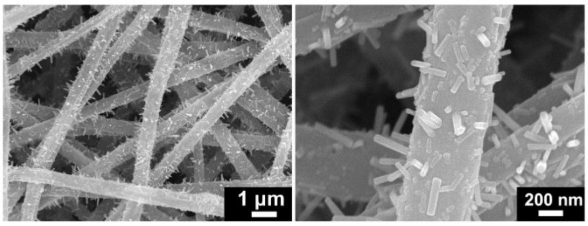

Figure S3. SEM images of the SPAN-ZnO16 nanofibrous membranes, right is the high-magnification SEM image of nanofibers. The time of hydrothermal reaction is 16 hours.

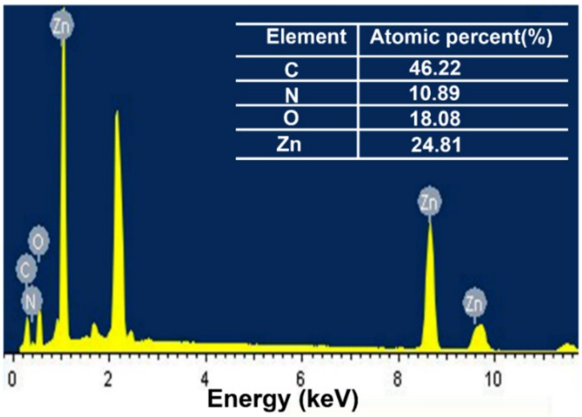

Figure S4. EDX scan images and elementary composition of SPAN-PPy-ZnO8 NFM.

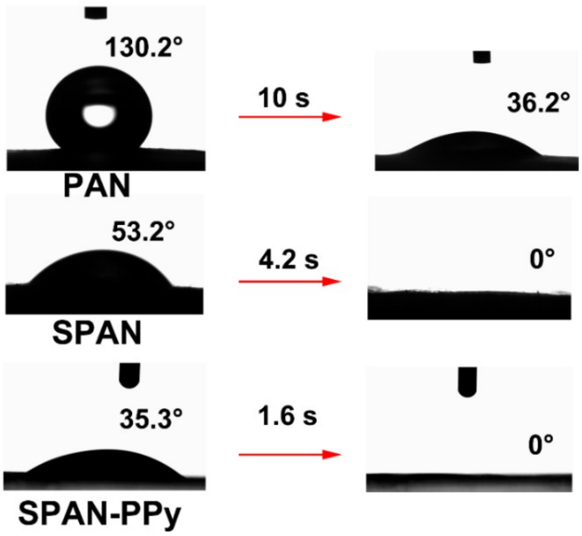

Figure S5. Photographs of dynamic measurements of water permeation on the surface of PAN, SPAN and SPAN-PPy NFMs

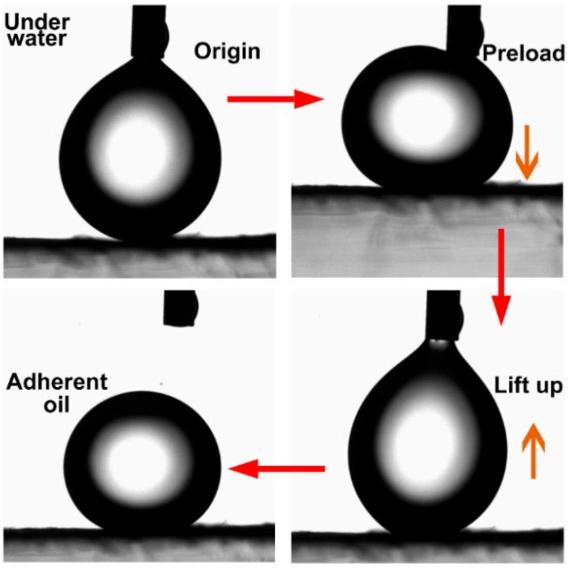

Figure S6. Underwater oil-adhesion property on the surface of the SPAN-PPy NFM.

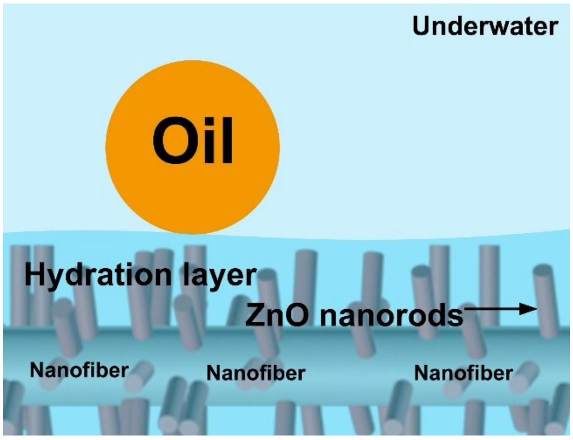

Figure S7. Schematic of the underwater oleophobic "Cassie– Baxter" model for SPAN-PPy-ZnO8 NFM.

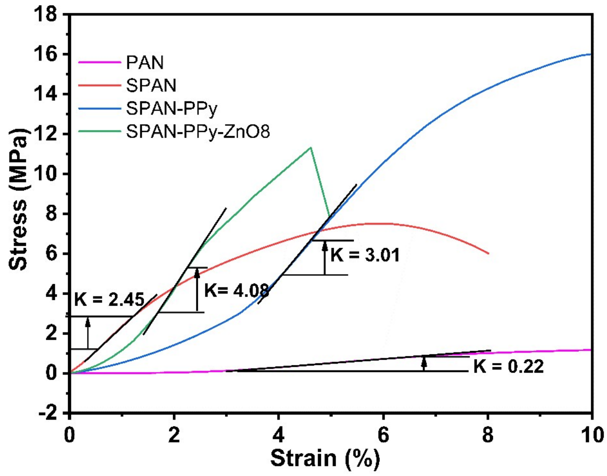

Figure S8. Young's modulus calculation of relevant fibrous membranes.

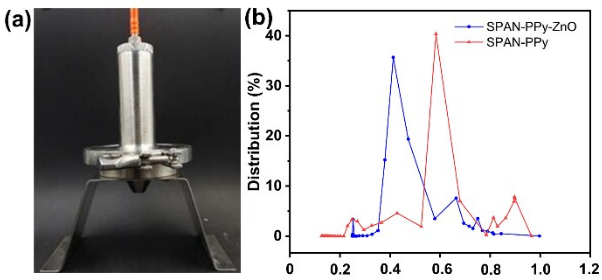

Figure S9. (a) Ultrafiltration device for measuring the oil intrusion pressure of as-obtained membranes. (b) The pore size distribution curve of the SPAN-PPy, SPAN-PPy/ZnO composite membrane, the mean pore size is 0.65 μm and 0.43 μm, respectively.

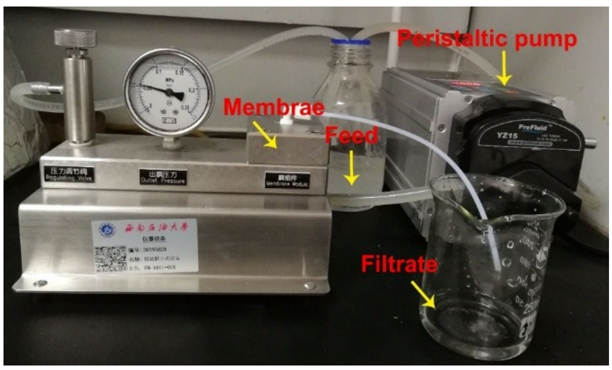

Figure S10. Photographs of Lab-scale cross-flow equipment.

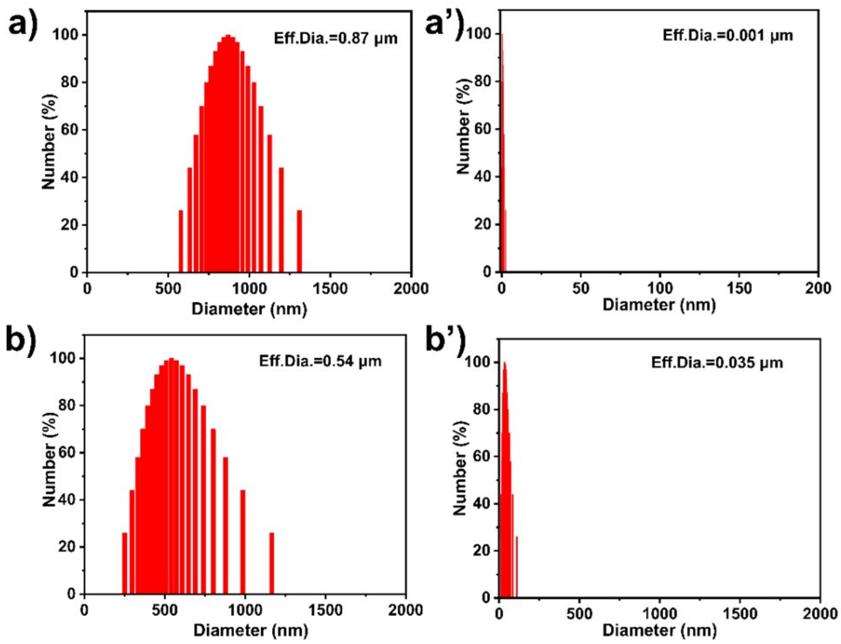

Figure S11. DLS size distribution curves of (a) the surfactant-free and (b) surfactant stabilized diesel emulsions, and their corresponding filtrates (a′ and b′) after separation.

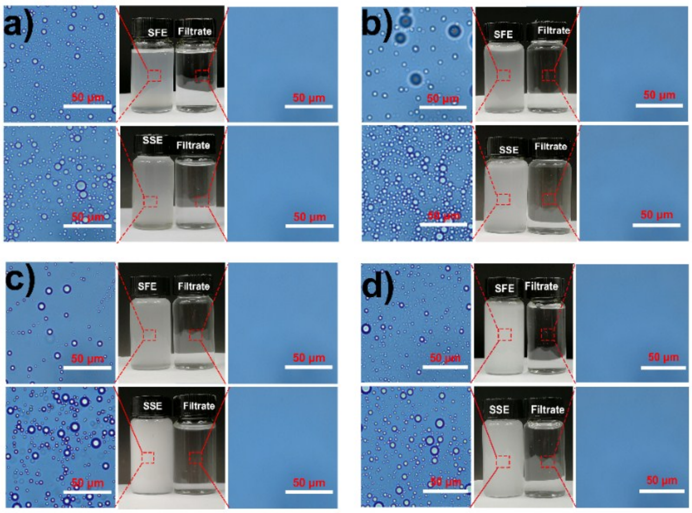

Figure S12. Optical microscopy images of the corresponding emulsions derived from different oils with or without surfactant. (a) n-hexane, (b) petroleum ether, (c) xylene and (d) hexadecane.

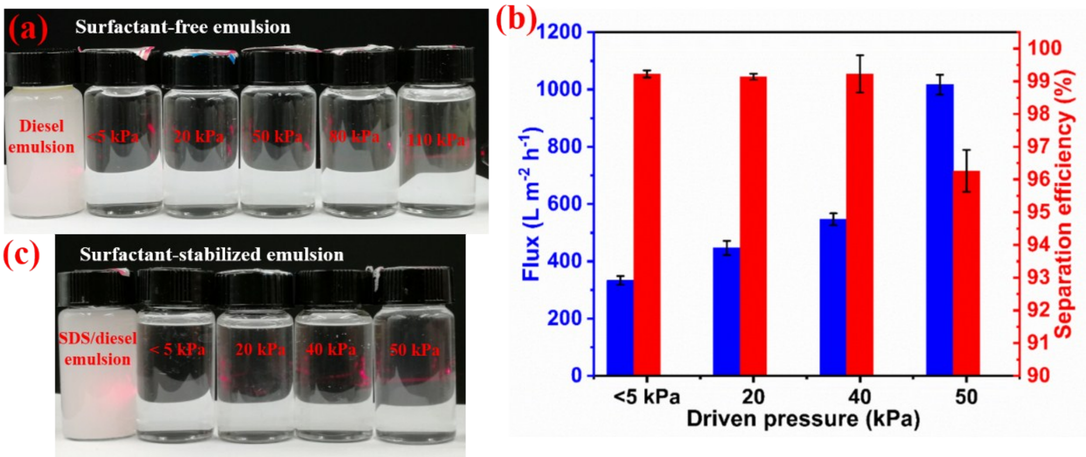

Figure S13. Photographs of (a) surfactant-free emulsion and correlative filtrate under different driving pressure. (b) Permeation fluxes and corresponding efficiency of surfactant-stabilized diesel-in-water emulsion under different driving pressure. (c) surfactant-stabilized emulsion and correlative filtrate under different driving pressure. The experiment oil is diesel.

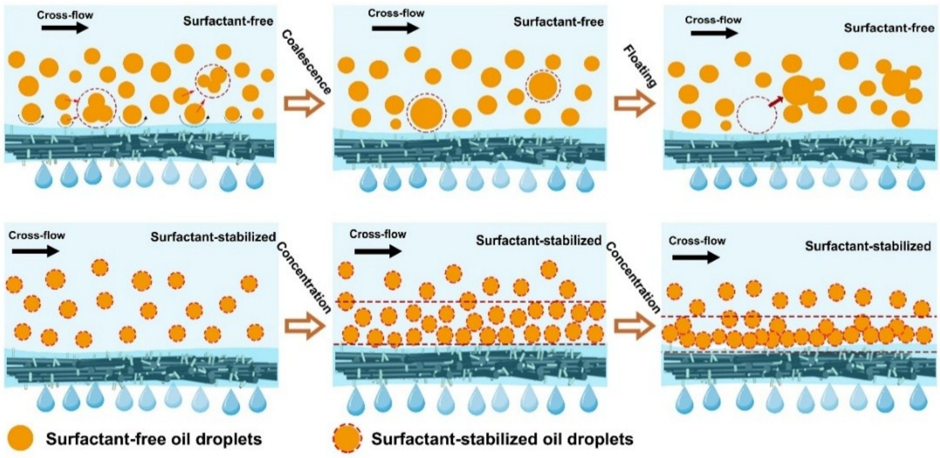

Figure S14. Behavior of oil droplets during permeating in the cases of (a) surfactant-free oil-in-water emulsion and (b) surfactant-stabilized oil-in-water emulsion

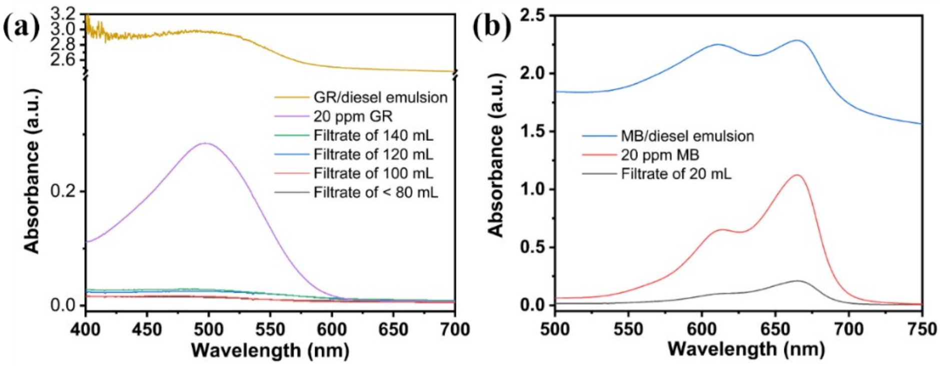

Figure S15. UV-vis spectra of (a) CR and (b) MB emulsions and corresponding filtrate for the SPAN-PPy-ZnO NFM.

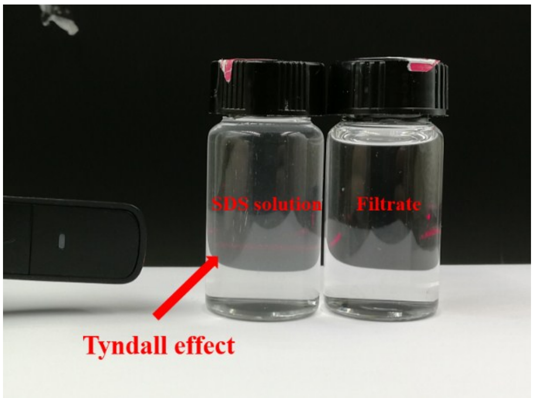

Figure S16. The 50 ppm anionic surfactant (SDS) solution (left) and (right) corresponding filtrate.

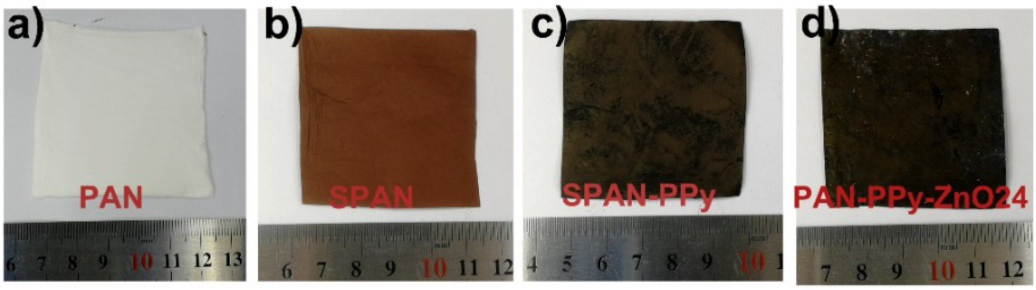

Figure S17. Photographs of (a) PAN, (b) SPAN, (c) SPAN-PPy, (d) SPAN-PPy-ZnO8 NFMs, respectively.

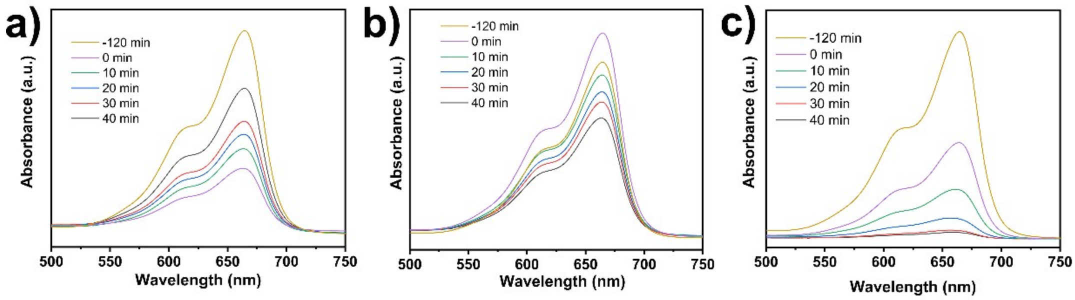

Figure S18. UV-vis spectra of MB solution within 40 min under visible light irradiate for (a) SPAN, (b) SPAN-PPy and SPAN-PPy/ZnO8 NFMs.

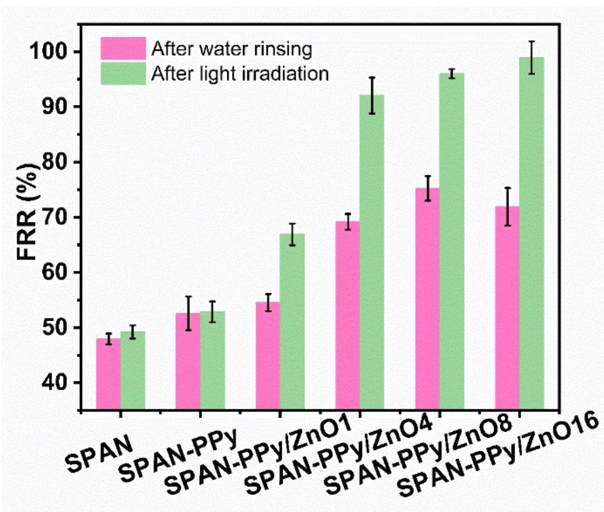

Figure S19. Flux recovery ratio (FRR) of fouled as-prepared membranes after water rinsing and light irradiation.

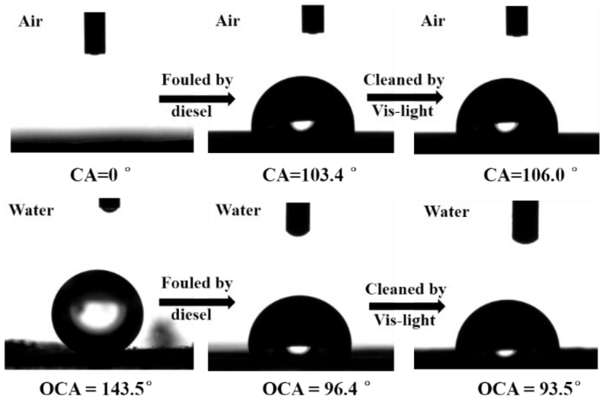

Figure 20. The change of WCA and UWOCA for SPAN-PPy NFM after encountering fouling from diesel oil and after vis-light irradiation.

Table S1. Summary of the oils properties and the related TOC values of 1% oil/water emulsions. The filtrate is collected under 10 kPa of driving pressure.

Oils	Viscosity (mPa. s)	Density (g cm^{-3})	Surface tension (mN m^{-1})	TOC of filtrate/SFE (mg L^{-1})	TOC of filtrate/SSE (mg L^{-1})
Petroleum ether	0.3	0.67	18.8	2.7/1223	28.9/3140
n-hexane	0.3	0.66	18.4	2.6/856	25.1/1630
Xylene	0.75	0.86	31.2	2.0/1360	28.3/2520
Hexadecane	3.28	0.77	27.2	9.7/2360	32.3/4580
Diesel	2.87	0.84	26.8	11.6/3250	35.3/5018