Electronic supplementary information (ESI)

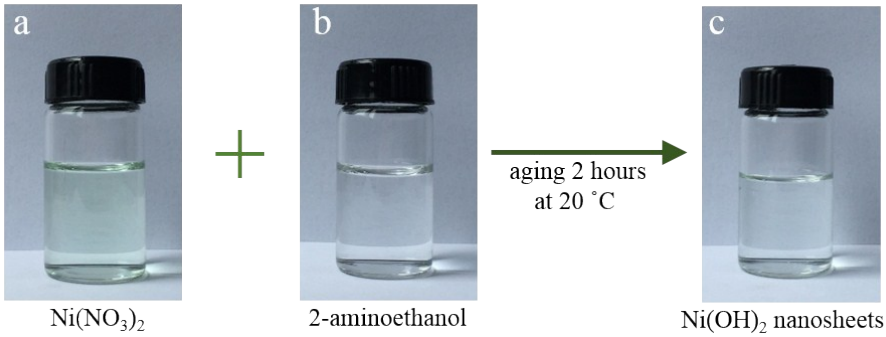


Fig. S1 Preparation process of the nickel hydroxide nanosheets. (a) 2.0 mM nickel nitrate aqueous solution, (b) 3.0 mM 2-aminoethanol aqueous solution, (c) the as-formed nickel hydroxide nanosheets dispersion.

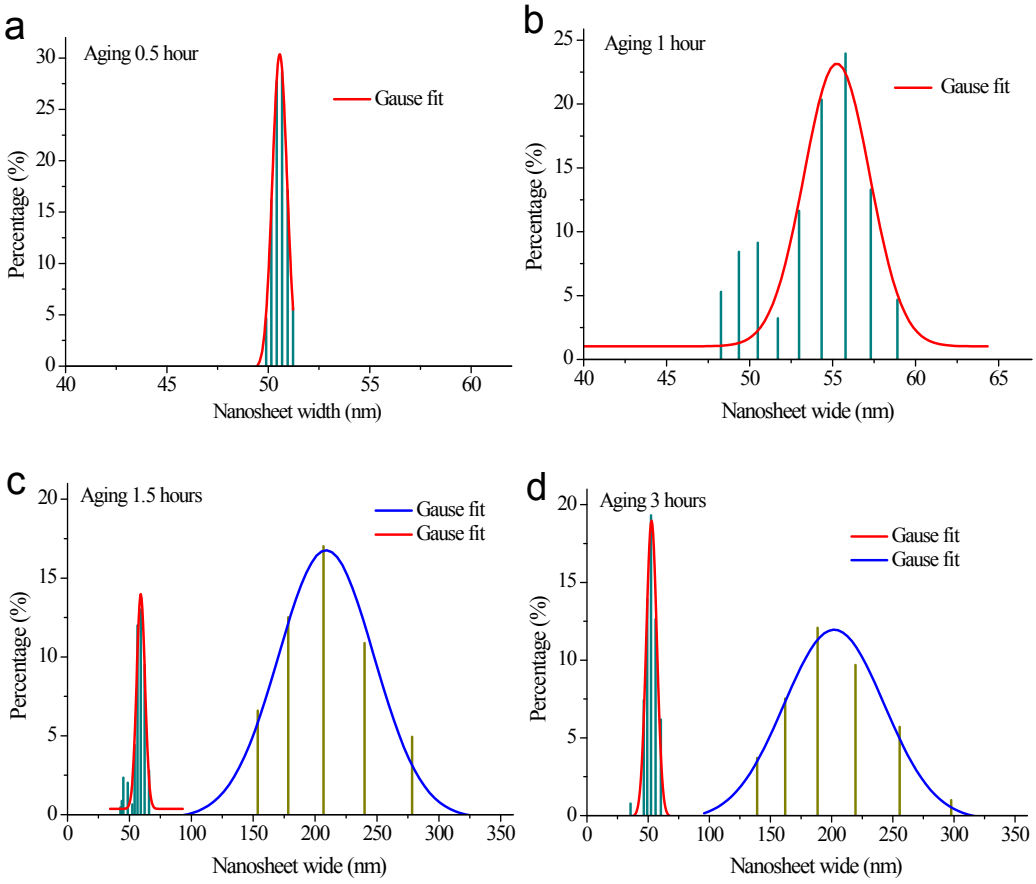


Fig. S2 Width distributions of the nickel hydroxide nanosheets with various aging time. (a) 0.5 hour, (b) 1.0 hours, (c) 1.5 hours and (d) 3.0 hours.

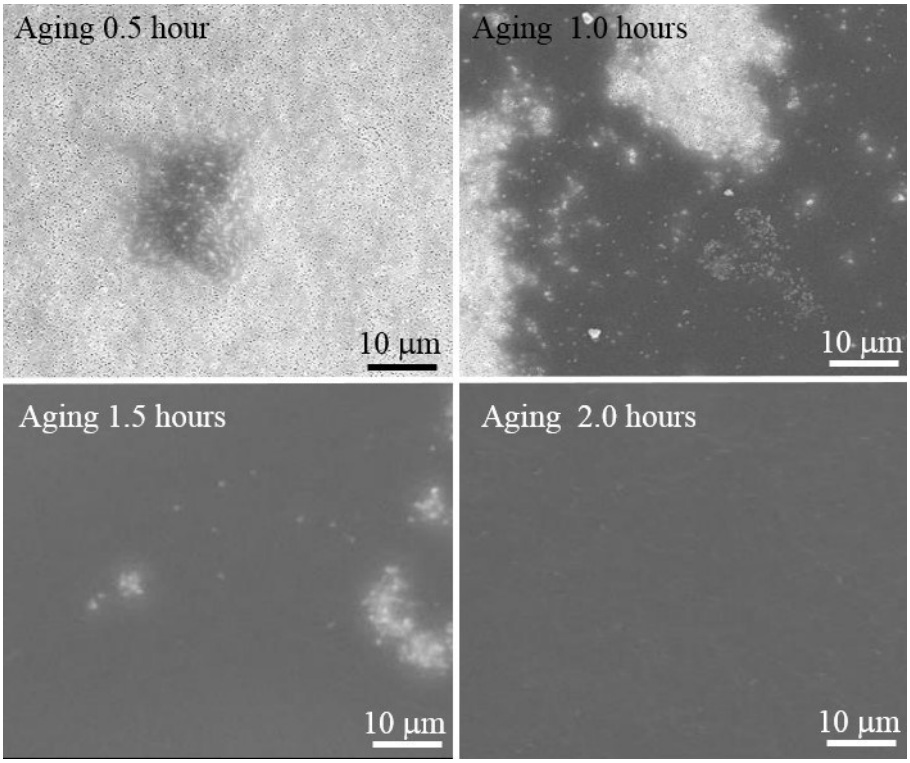


Fig. S3 Effect of aging time on the membrane formation of the nickel hydroxide nanosheets. The membranes were fabricated by filtering the nanosheets dispersion (2.20 mL per cm^2 memrbane) through the 200 nm-pore Anodisc filter.

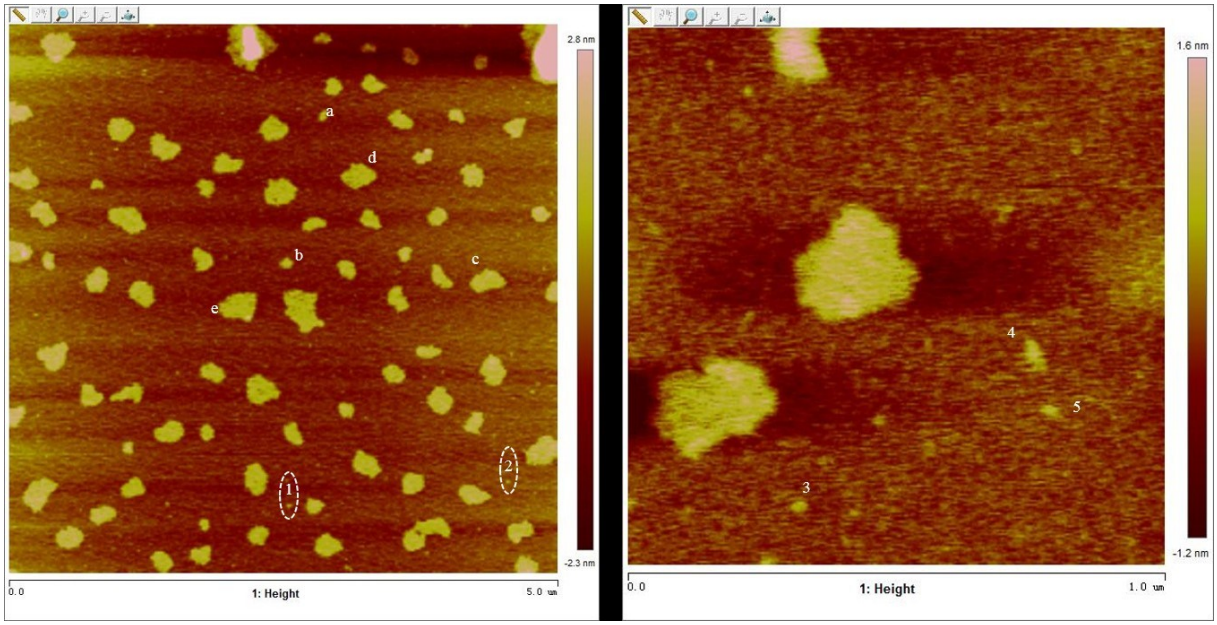


Fig. S4 AFM image of the nickel hydroxide nanosheets. The marked samples were used to measure the nanosheets' thickness.

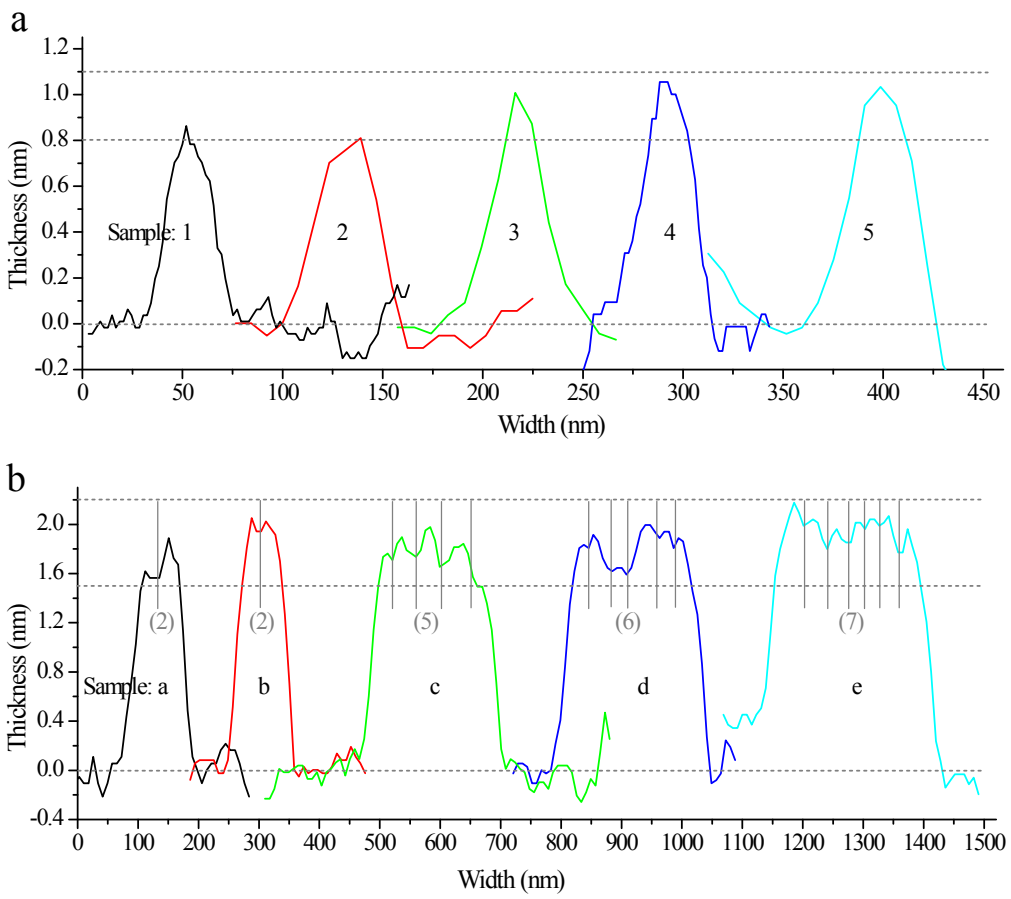


Fig. S5 Thickness of the single nickel hydroxide nanosheets (a) and its clusters (b) respectively. The samples' numbers are shown in Figure S4. Digits in parentheses represent the amount of single nanosheets that composed the clusters (in b).

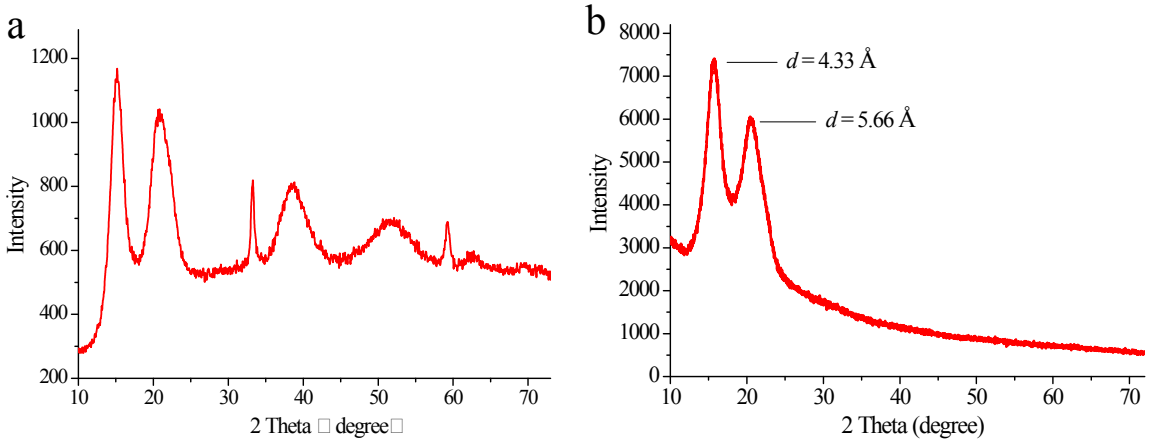


Fig. S6 XRD spectrum of (a) the nickel hydroxide nanosheets and (b) its 3.18 μm-thick membrane. The nanosheet sample was prepared by centrifuging the nanosheets dispersion and then dried in vacuum oven at 40 ˚C. The lamellar spacing (*d*) was estimated on the base of the Bragg's law.

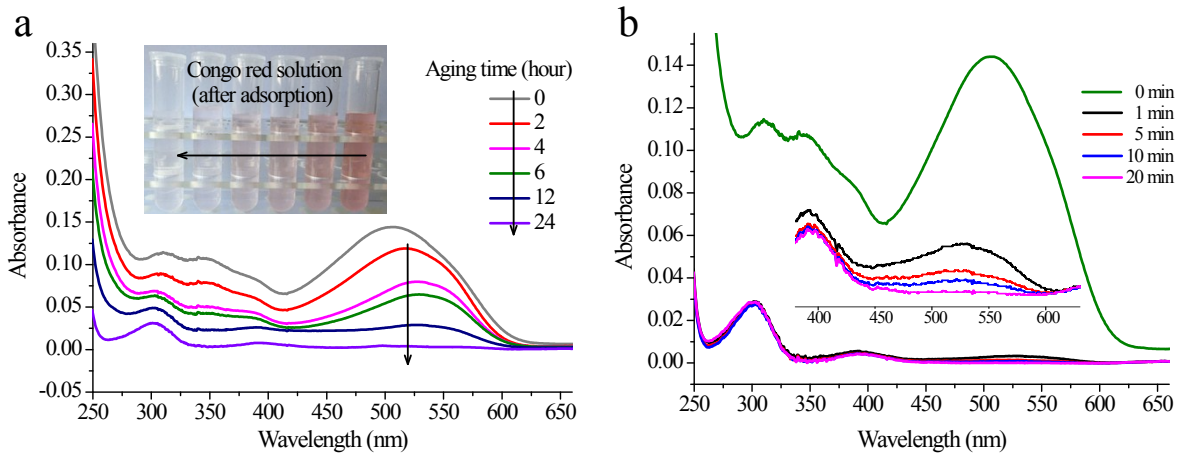


Fig. S7 UV-vis spectra of CR (1.0 mg mL^{-1}, 0.4 mL) solution after adsorption by nickel hydroxide nanosheets (10 mL). a) Adsorbtion for 5 mins using the nanosheets aged at diffrent times. b) Adsorbtion for various times using the 24 h aged nanosheets.

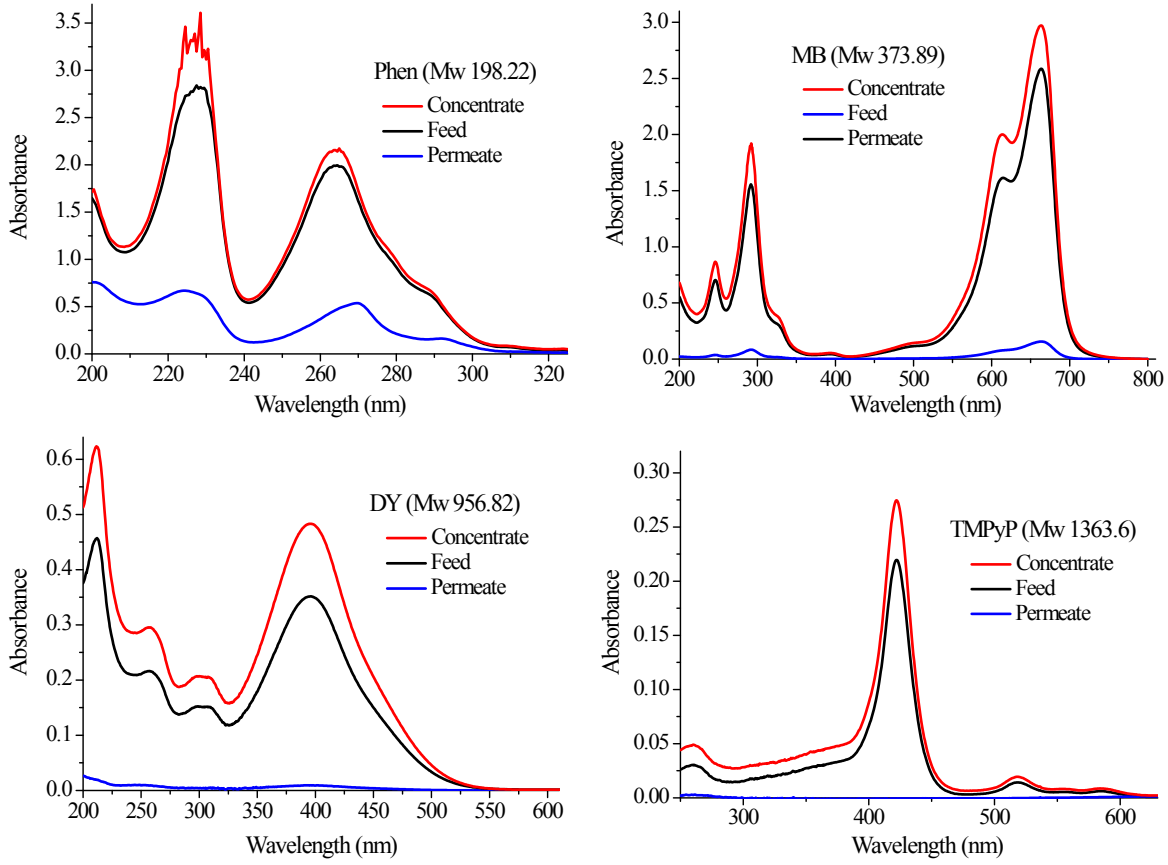


Fig. S8 UV-vis absorption spectra of aqueous dye solutions through the 3.18 μm-thick membrane, including Phen, MB, DY and TMPyP (20 ppm).

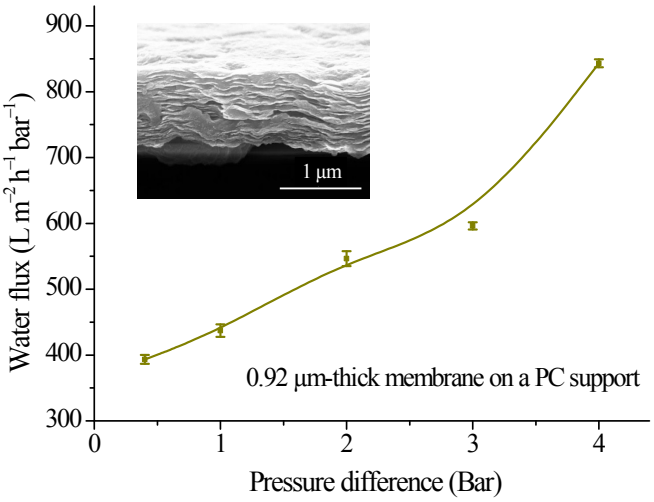


Fig. S9 The pressure dependence of the water flux through the 0.92 μm-thick membrane.

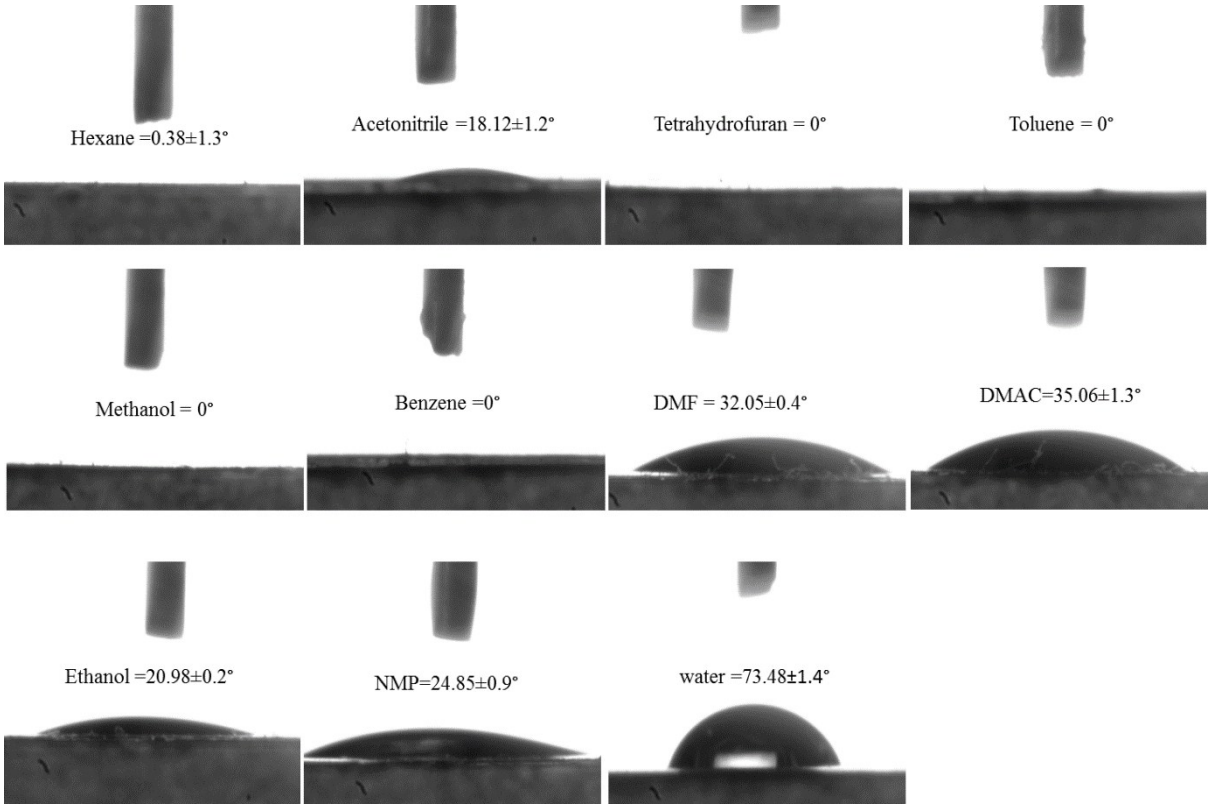


Fig. S10 surface wettability of the nickel hydroxide membrane for water and differnt organic solvents for the 0.92 μm-thick membrane.

Table S1. Properties and rejections of dye molecules separated by the 3.18 μm membrane.

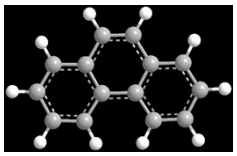
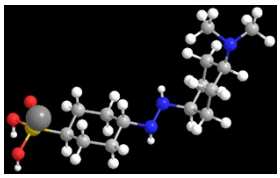
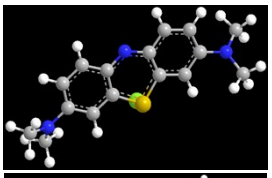
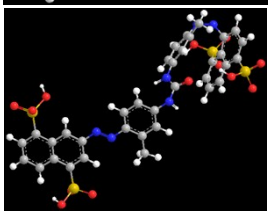
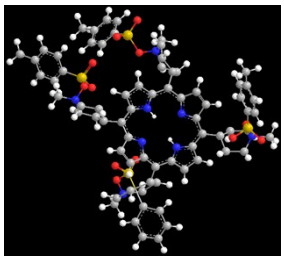
Dye	Structure	MW (g mol^{-1})	Charge	Rejection (%)
1,10-Phenanthroline monohydrate (Phen)		198.22	N	77.4±2.4
Methyl Orange (MO)		328.34	−	89.6±2.6
Methylene Blue (MB)		373.89	+	94.7±1.3
Direct Yellow 50 (DY)		956.82	−	97.3±1.2
α,β,γ,δ-tetrakis(1-methylpyridinium-4-yl)porphyrin p-toluenesulfonate (TMPyP)		1363.6	+	100

Table S2. Separation performances of the nanosheet membranes for water purification.

Membranes	Fabrication method	Feed	Water flux ($L\ m^{-2}h^{-1}\ bar^{-1}$)	Rejection (%)	Ref.
GO	Vacuum filtration	15 μM EB	106	~90	1
GO/TiO_2	Vacuum filtration	10 ppm MO	7	100	2
MoS_2	Vacuum filtration	15 μM EB	245	89	3
Nematic liquid crystals GO	Conventional gravure printing machine	10 mg/L MB	75	99	4
Corrugated CCG	Vacuum filtration	0.01 mM DY	45	67	5
MWCNTs-refluxed GO/PVDF	Vacuum filtration	0.02 mM DY	11.3	99.8	6
Base-refluxed rGO/PVDF	Vacuum filtration	0.02 mM MB	21.8	99.2	7
Ultrathin pristine rGO/PC	Pressure-assisted filtration	0.01 g/L MB	11	95.2	8
Nickel hydroxide	Vacuum filtration	20 ppm DY	127	92.5	present
Nickel hydroxide	Vacuum filtration	20 ppm DY	99	97.3	present
Nickel hydroxide	Vacuum filtration	20 ppm MB	99	94.7	present

GO: graphene oxide; CCG: chemically converted graphene; MWCNTs: Multi-walled carbon nanotubes; PVDF: Polyvinylidene Fluoride; rGO: refluxed graphene oxide; PC: Polycarbonate.

EB: Erythrosine B, Mw 897.88 g mol^{-1}; MO: Methyl Orange, Mw 328.34 g mol^{-1}; MB: Methylene blue, Mw 373.89 g mol^{-1}; DY: Direct yellow 50, Mw 956.82 g mol^{-1}.

References: [1] Y. Ying, L. Sun, Q. Wang, Z. Fan, X. Peng, *RSC Advances* 2014, *4*, 21425-21428; [2] C. Xu, A. Cui, Y. Xu, X. Fu, *Carbon* 2013, *62*, 465-471; [3] L. Sun, H. Huang, X. Peng, *Chem. Commun.* 2013, *49*, 10718-10720; [4] A. Akbari, P. Sheath, S. T. Martin, D. B. Shinde, M. Shaibani, P. C. Banerjee, R. Tkacz, D. Bhattacharyya, M. Majumder, *Nat. commun.* 2016, *7*; [5] L. Qiu, X. Zhang, W. Yang, Y. Wang, G. P. Simon, D. Li, *Chem. Commun.* 2011, *47*, 5810-5812; [6] Y. Han, Y. Jiang, C. Gao, *ACS Appl. Mat. Interfaces* 2015, *7*, 8147-8155; [7] Y. Han, Z. Xu, C. Gao, *Adv. Funct. Mater.* 2013, *23*, 3693-3700; [8] K. Goh, W. Jiang, H. E. Karahan, S. Zhai, L. Wei, D. Yu, A. G. Fane, R. Wang, Y. Chen, *Adv. Funct. Mater.* 2015, *25*, 7348-7359.

Table S3. The thin film composite membranes for organic solvent nanofiltration.

Membranes	Fabrication method	Feed	Flux ($L\ m^{-2}h^{-1}\ bar^{-1}$)	Rejection (%)	Ref.
DuraMem200	polyimide immersion	1 g/L BB	DMF / 3	99.7	1
DLC membranes (monomer is Methane)	plasma deposition technique	0.5 mM PPh-IX	Ethanol / 162.1	81.5	2
DLC membranes (monomer is Acetylene)	plasma deposition technique	0.5 mM PPh-IX	Ethanol / 55.8	100	2
DLC membranes (monomer is ATMS)	plasma deposition technique	0.5 mM PPh-IX	Ethanol / 24.3	100	2
IP membrane (MPD-3%-1min-ACT)	Interface polymerization	20 mg/L MO	Methanol / 52.05	98.9	3
IP membrane (MPD-4%-1min-ACT)	Interface polymerization	20 mg/L MO	Methanol / 31.84	98.8	3
Monoamine modification membrane	phase-inversion process	35 μM MO	DMF / 5.7	85	4
Nickel hydroxide	Vacuum filtration	20 ppm PPh-IX	Methanol / 238	94	present
Nickel hydroxide	Vacuum filtration	—	DMF / 199	—	present

DLC: Diamond-like carbon; BB: Brilliant Blue R, Mw 826 g mol^{-1}; PPh-IX: Protoporphyrin IX, Mw 562.66 g mol^{-1}.

References: [1] I. Sereewatthanawut, F. W. Lim, Y. S. Bhole, D. Ormerod, A. Horvath, A. T. Boam, A. G. Livingston, Org. Process Res. Dev. 2010, 14, 600-611; [2] S. Karan, S. Samitsu, X. Peng, K. Kurashima, I. Ichinose, *Science* 2012, *335*, 444-447; [3] S. Karan, Z. Jiang, A. G. Livingston, *Science* 2015, *348*, 1347-1351; [4] Y. C. Xu, X. Q. Cheng, J. Long, L. Shao, *J. Membr. Sci.* 2016, *497*, 77-89.