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Electronic Supplementary Information

Graphene Oxide Enables Self-assemble of Silver Trimolybdate Nanowires into Robust Membranes for Nanosolid Capture and Molecular Separation

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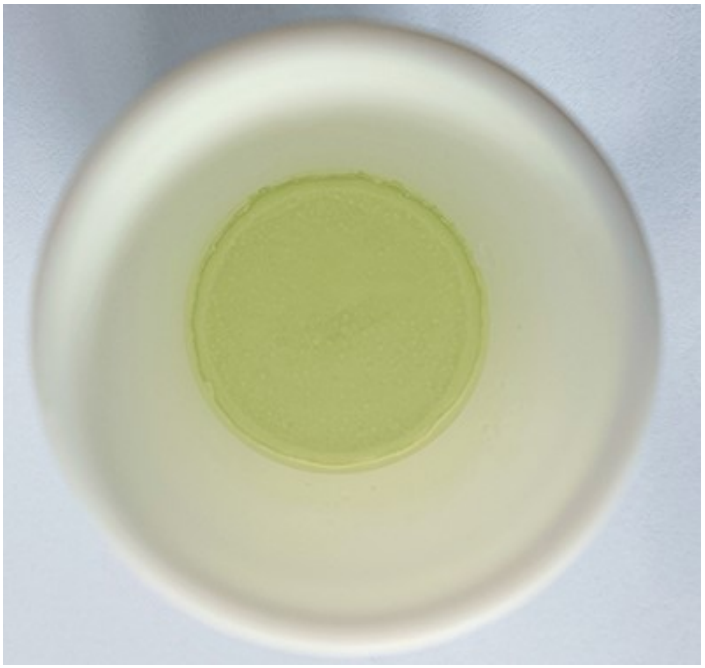

Fig. S1 The photograph of the product obtained with GO. When the reaction was finished, a regular shaped disk-like membrane was successfully obtained at the bottom of the Teflon reactor.

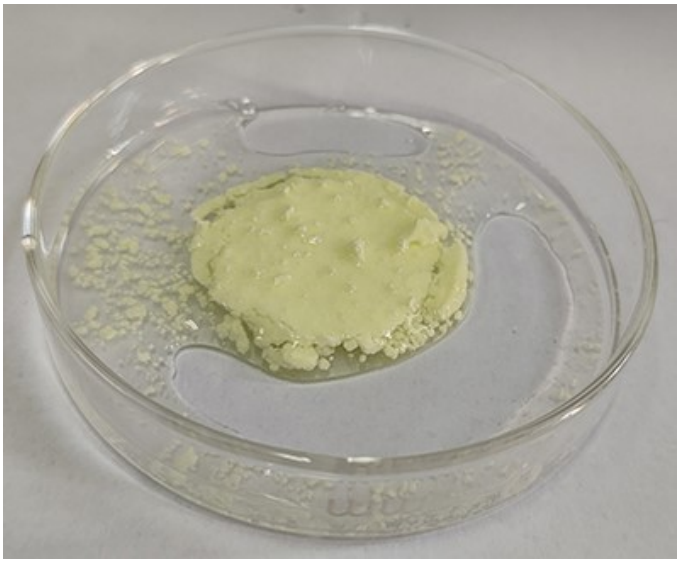

Fig. S2 The photograph of the product obtained without GO. In parallel experiments, GO solution was not added into the reaction system while keeping other conditions unchanged. Only scattered yellow precipitates were obtained in the Teflon reactor.

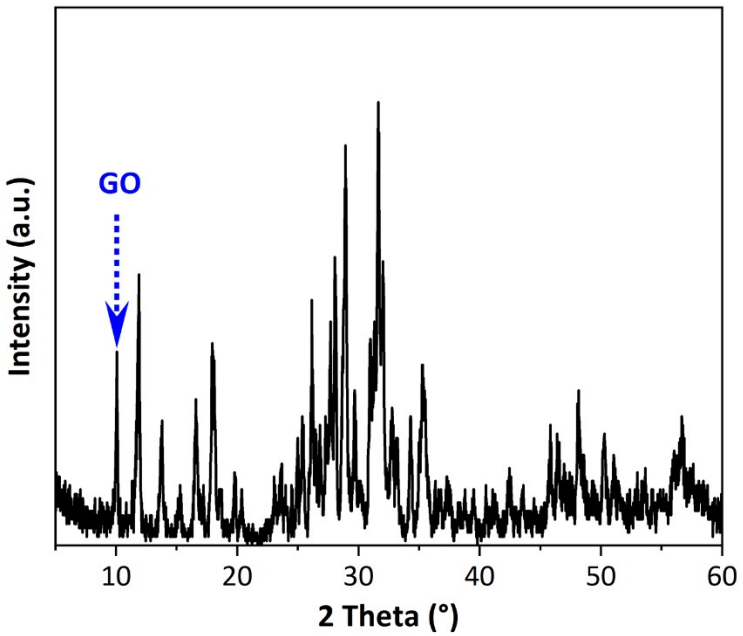

Fig. S3 XRD pattern of STNMs membrane containing more GO. The strong characteristic peak of GO located around 10° indicates the existence of GO in membrane.

Fig. S4 The photograph of the STNMs membrane containing different amount GO: left: 0.4 mg GO; right: 4 mg GO.

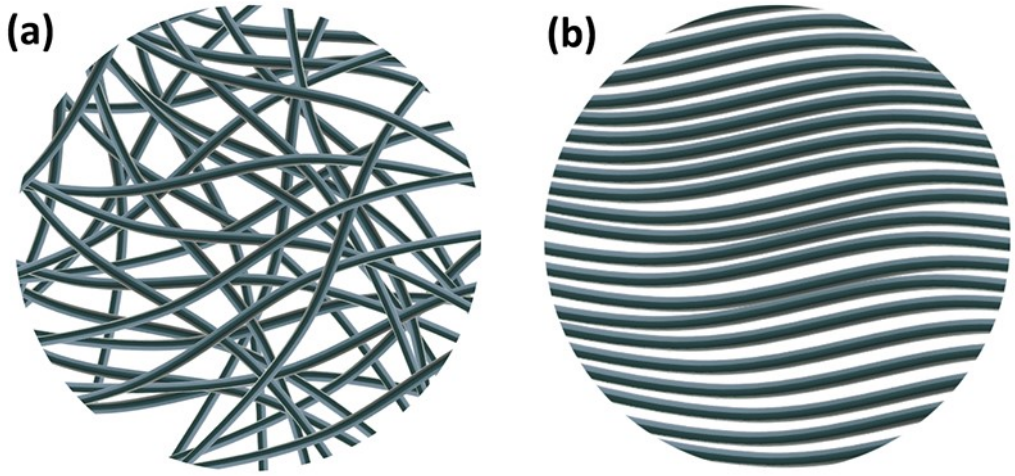

Fig. S5 (a) Membrane consisted of disordered nanowire exhibits large pore structures; (b) Membrane consisted of parallelly aligned nanowires exhibits small pore structures.

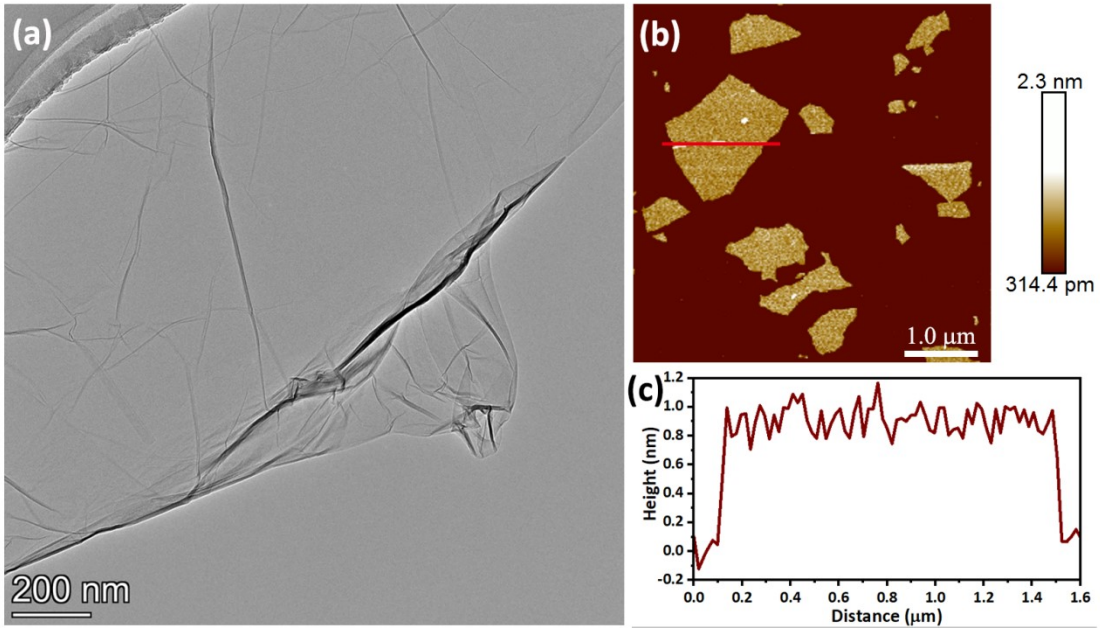

Fig. S6 Graphene oxide: (a) TEM image; (b) AFM image and corresponding height profile (c).

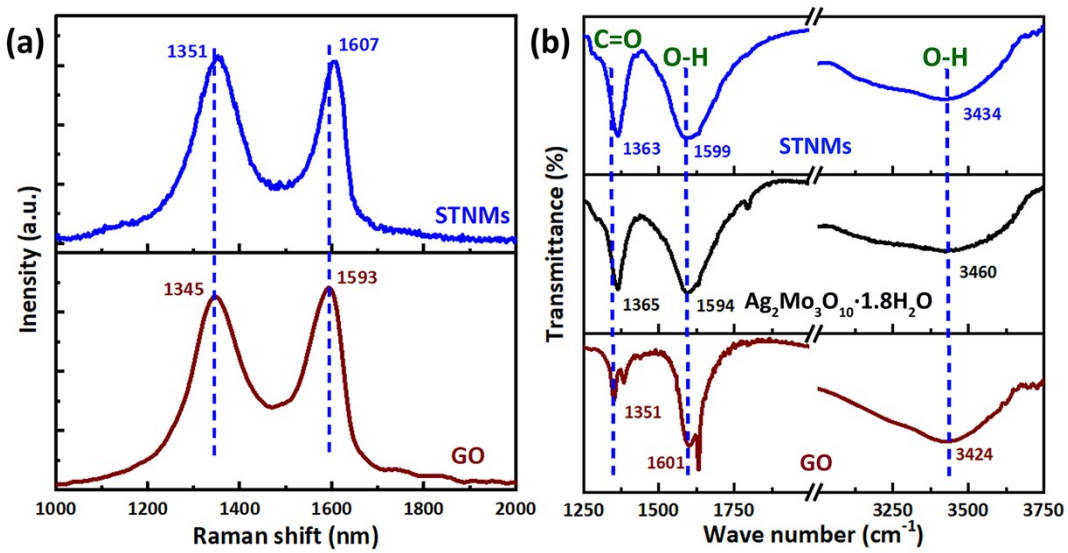

Fig. S7 (a) Raman spectra of GO and STNMs membrane; (b) IR spectra of GO, $Ag_2Mo_3O_{10}·1.8H_2O$ nanowire and STNMs membrane. Comparing to pure GO, the characteristic bands of GO in STNMs exhibit obvious shifts. For instance, the D Raman band of GO located at 1345 cm^{-1} moved to 1351 cm^{-1}, while G Raman band of GO shifted from 1593 cm^{-1} to 1607 cm^{-1}, confirming the direct interaction between the GO and $Ag_2Mo_3O_{10}·1.8H_2O$ nanowires. Furthermore, when coupled with $Ag_2Mo_3O_{10}·1.8H_2O$ nanowires, the epoxide and hydroxyl functional groups of GO show obvious shifts in IR spectra, indicating the direct interaction between the GO and $Ag_2Mo_3O_{10}·1.8H_2O$ nanowires.

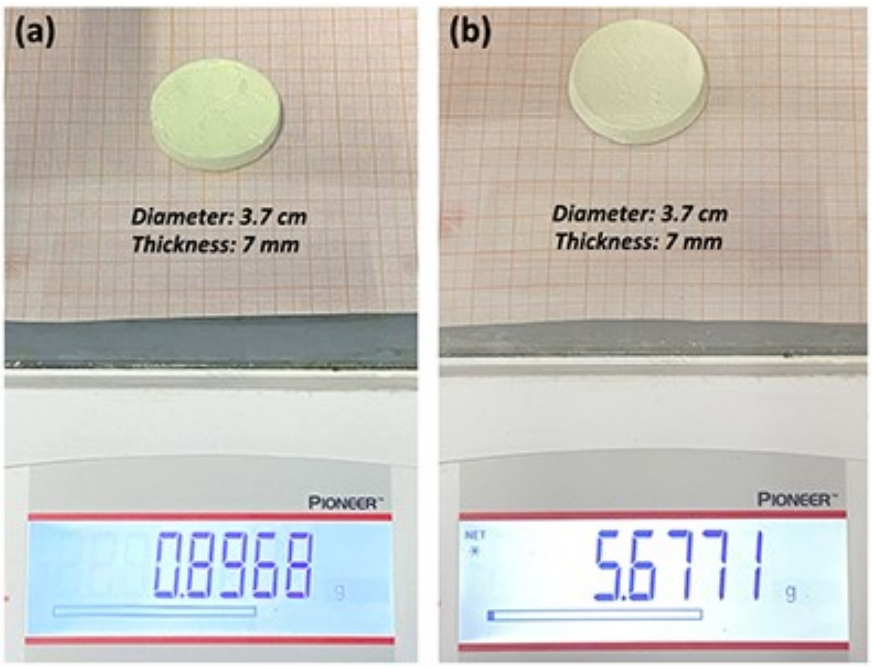

Fig. S8 (a) Membrane prepared by GO assisted self-assembly method; (b) Membrane prepared by vacuum filtration method. An artificially assembled membrane with similar volume is 5 times heavier than the self-assembled ones, indicative of the material saving merit of GO assisted self-assembly method.

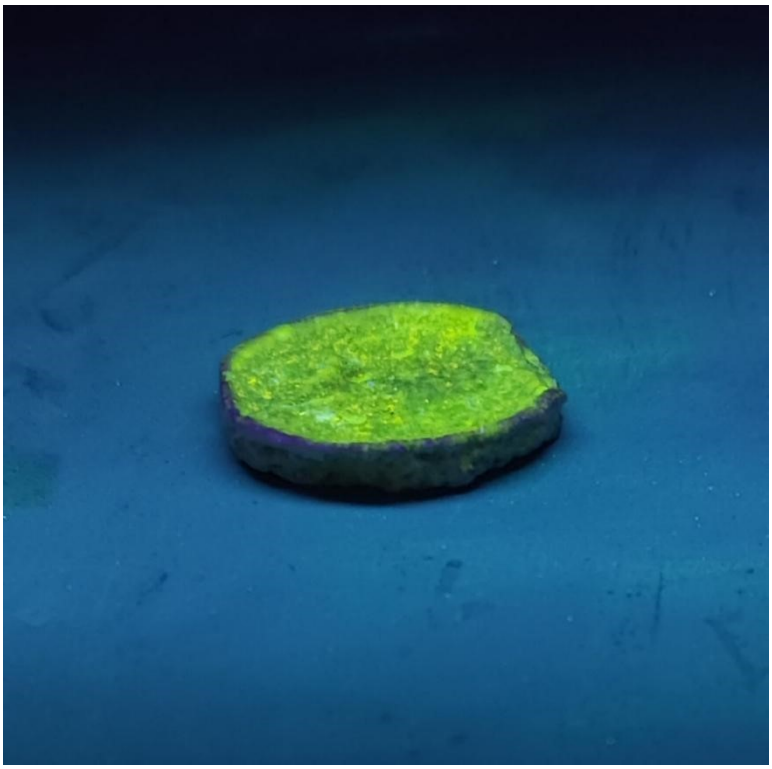

Fig. S9 Photography of the green-emitting STNMs membrane after capturing CdTe QDs (excited by a hand-held UV lamp).

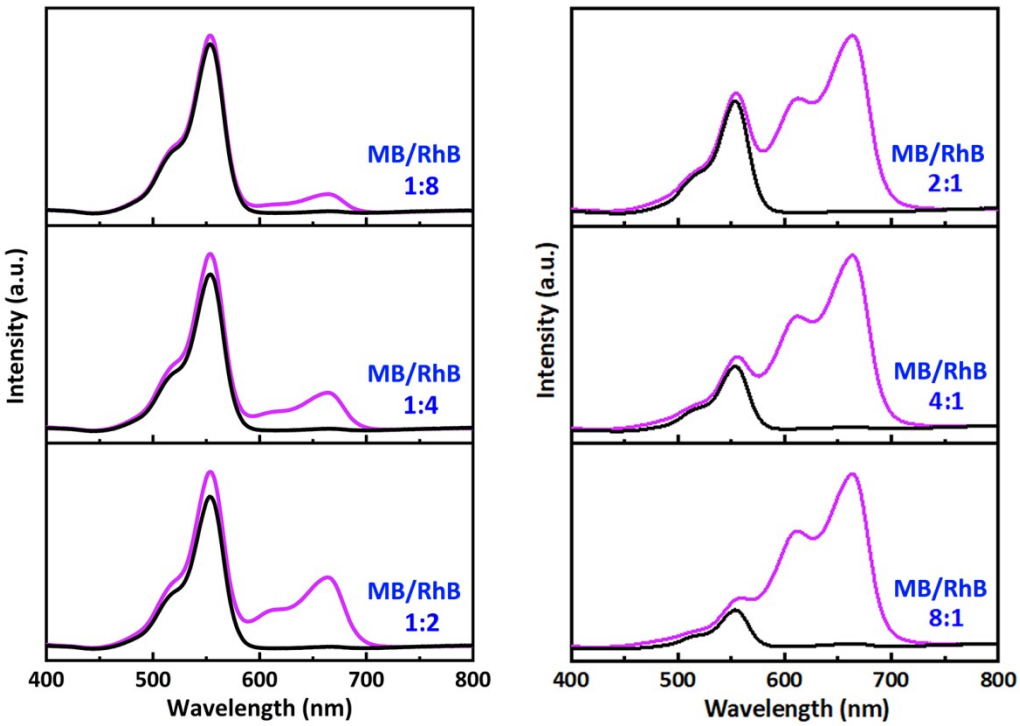

Fig. S10 UV-vis absorption spectra of mixed-dye aqueous solution with different MB/RhB ratios ranging from 1:8 to 8:1 before and after filtration. For all the mixed-dye aqueous solution with different MB/RhB ratios, the absorption peak of MB disappeared, while the absorption peak of RhB only exhibited a slight decrease after filtration, revealing that the STNMs membrane can efficiently extract MB from mixed-dye solution with different MB/RhB ratios.

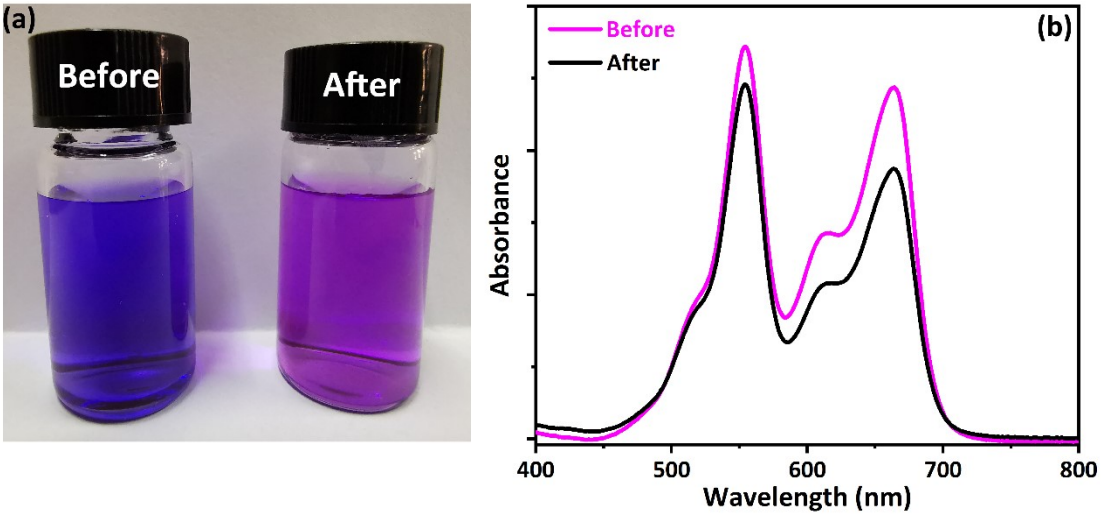

Fig. S11 Photography (a) and UV-vis absorption spectra (b) of MB/RhB dye solution before and after passing through the microporous cellulose filter.

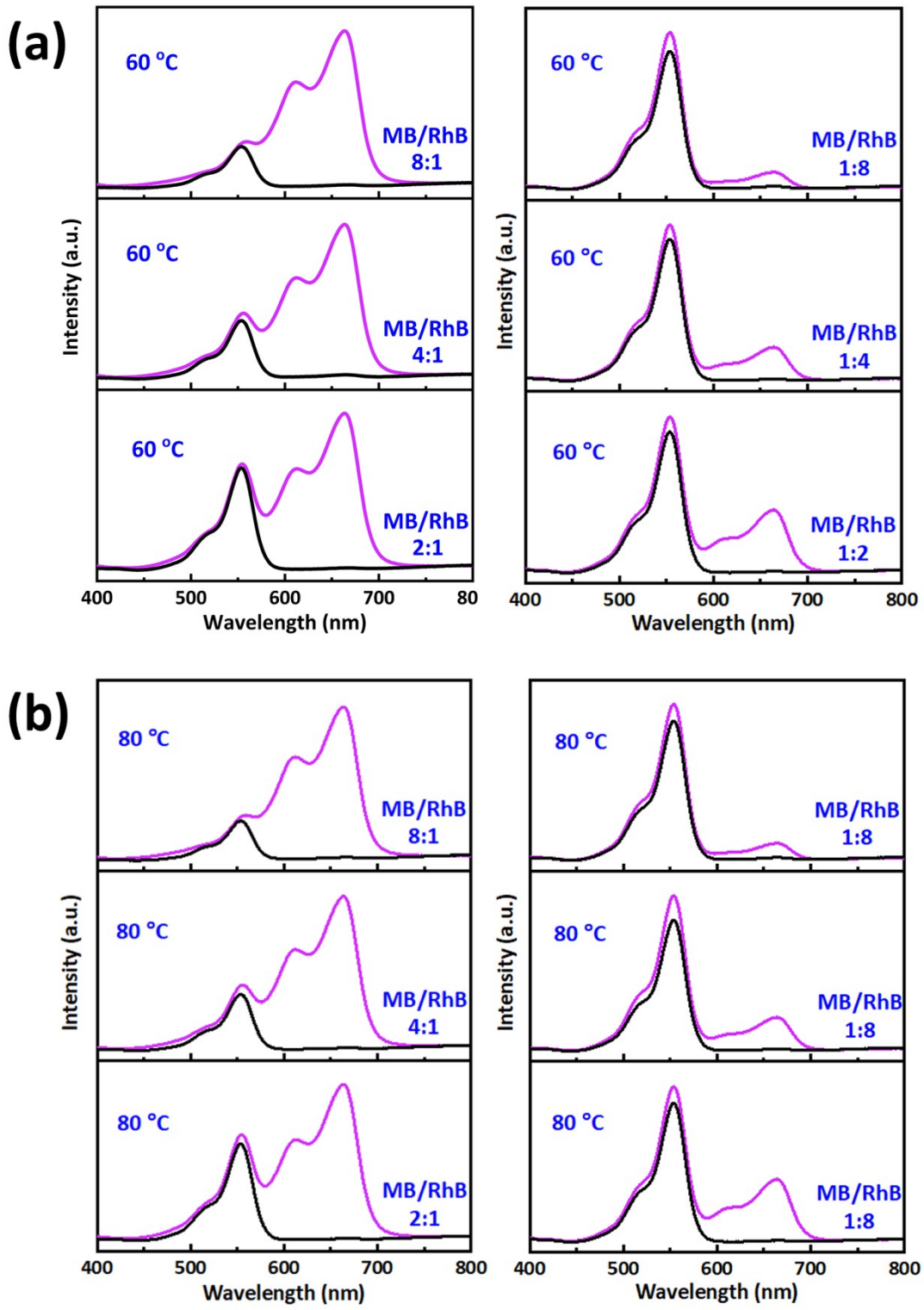

Fig. S12 UV-vis absorption spectra of mixed-dye aqueous solution with different MB/RhB ratios before and after filtration at 60 °C (a) and 80 °C (b). Owing to the high thermostability, the STNMs membranes maintain nearly 100% MB extraction efficiency at different temperature.

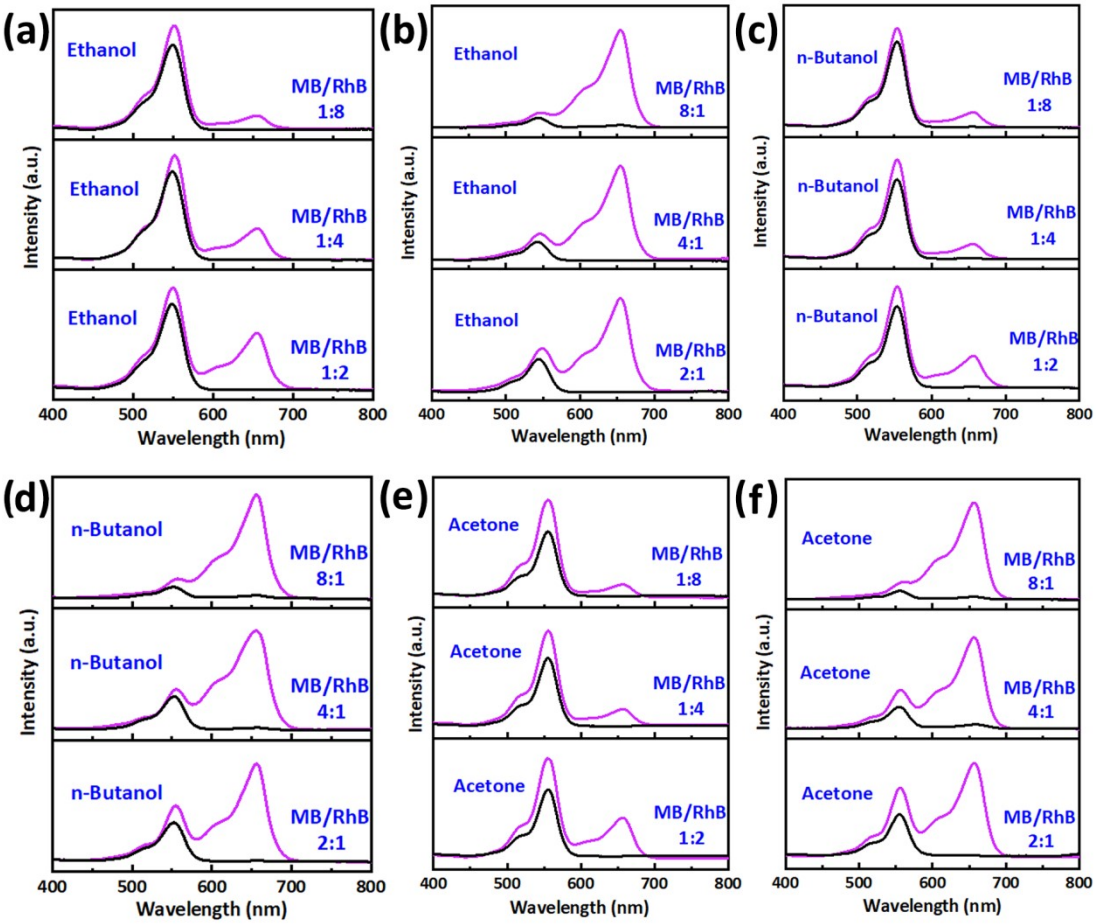

Fig. S13 UV-vis absorption spectra of mixed-dye organic solution with different MB/RhB ratios before and after filtration: (a, b) Ethanol; (c, d) n-Butanol; (e, f) Acetone. Owing to the excellent organic solvents tolerance, the STNMs membranes maintain nearly 100% MB extraction efficiency under different organic environment.

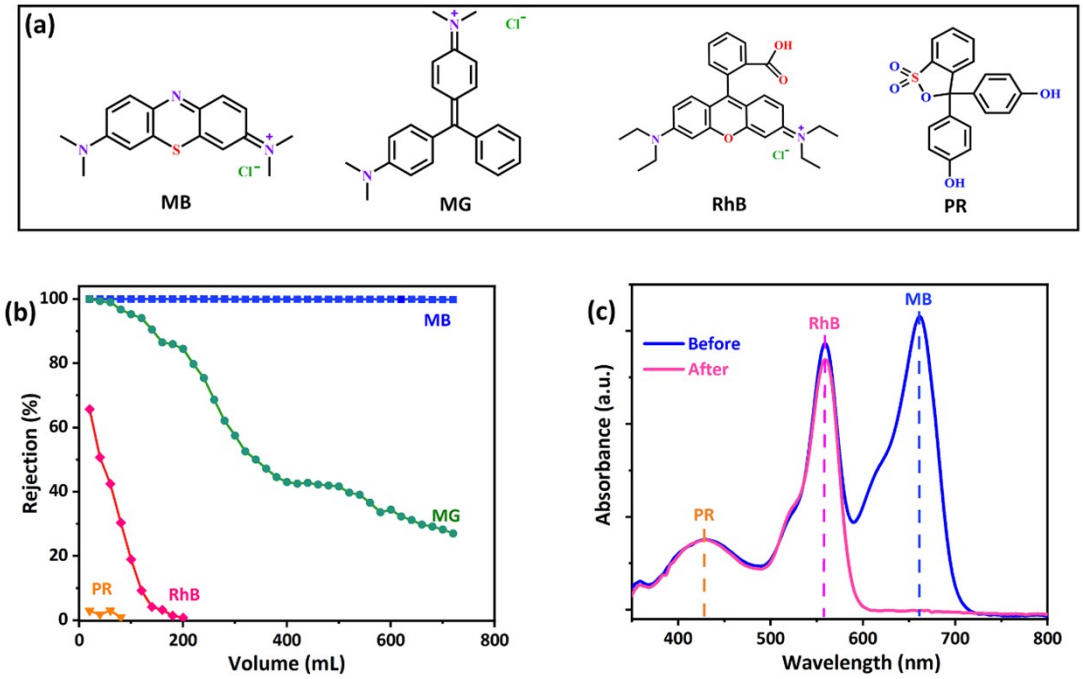

Fig. S14 (a) Molecular structure of various dyes; (b) Rejection ratio of various dyes; (c) UV-vis absorption spectra of PR/RhB/MB mixed dye solution before and after passing through STNMs membrane.

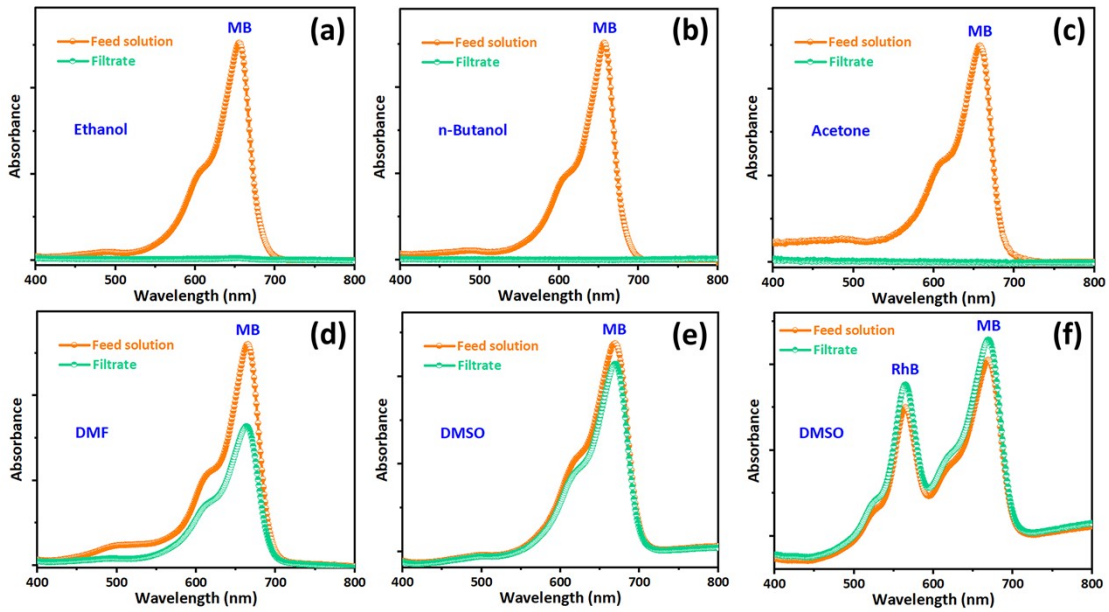

Fig. S15 UV-vis absorption spectra of dye organic solution before and after filtration: (a) MB ethanol solution; (b) MB n-butanol solution; (c) MB acetone solution. (d) MB DMF solution; (e) MB DMSO solution; (f) RhB/MB DMSO solution. The UV-vis absorption spectra of the filtrates indicates that the MB capture efficiency of STNMs membrane from MB ethanol solution, MB n-butanol solution and MB acetone solution are nearly 100% , while that for MB DMF solution and MB DMSO solution are only 65% and 11% respectively, which are both lower than that of other organic system without coordination ability, such as ethanol, n-butanol, and acetone. The reason is that the N atom in DMF molecule and S atom in DMSO molecule can from Ag-N bond and Ag-S bond with STNMs membrane, which reduce the chance of Ag-S bond formation between MB and STNMs membrane, thus leading to much lower MB extraction efficiency. When DMSO was used as solvent for RhB/MB mixed dye, both absorption peaks of RhB and MB decreased simultaneously, indicating that the STNMs membrane lost its selective permeability towards MB as all the active sites of STNMs have been occupied by DMSO molecules.