Electronic Supplementary Information （ESI）

In-situ Confined Encapsulation of Ultrafine Fe_2O_3 Nanoclusters in N/S Co-doped Graphene-based Membranes for Continuous Chemical Conversion

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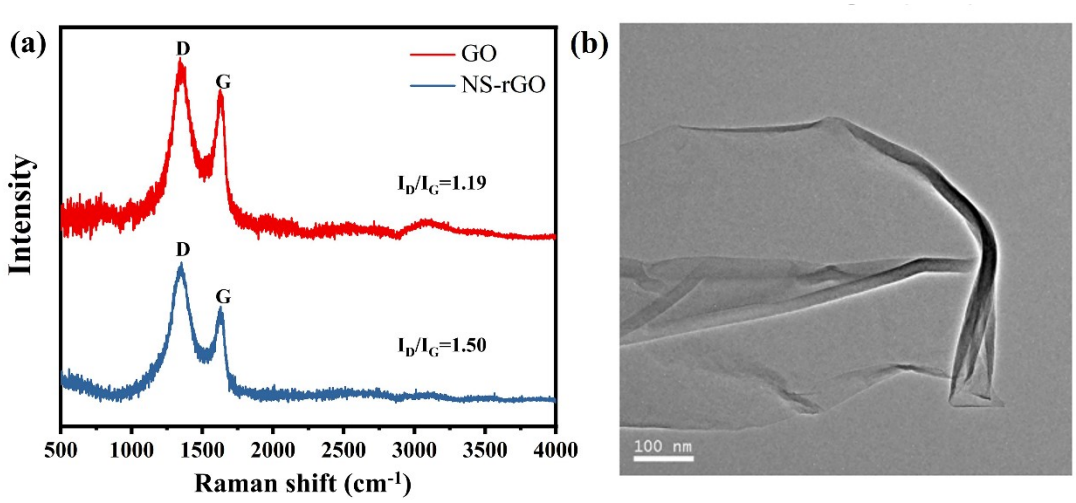

Fig. S1. (a) Raman spectra of GO and NS-rGO. (b) TEM image of NS-rGO.

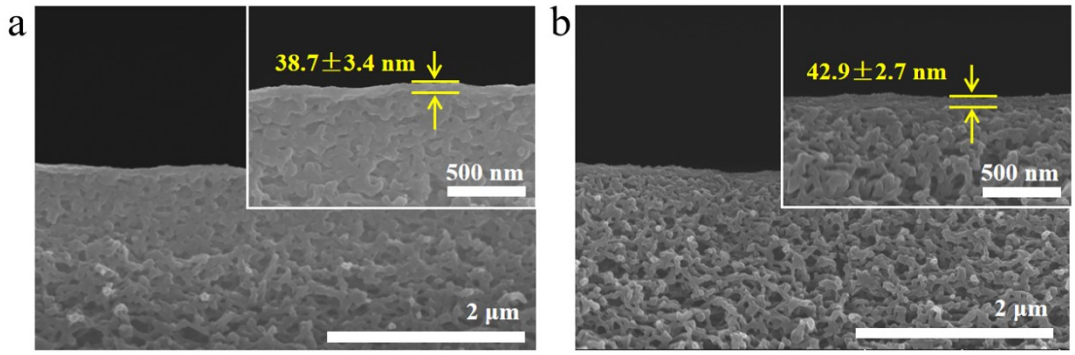

Fig. S2. Cross-section SEM images of Fe/NS-rGO catalytic membranes by using 0.0125M (a) and 0.05M (b) ferric chloride.

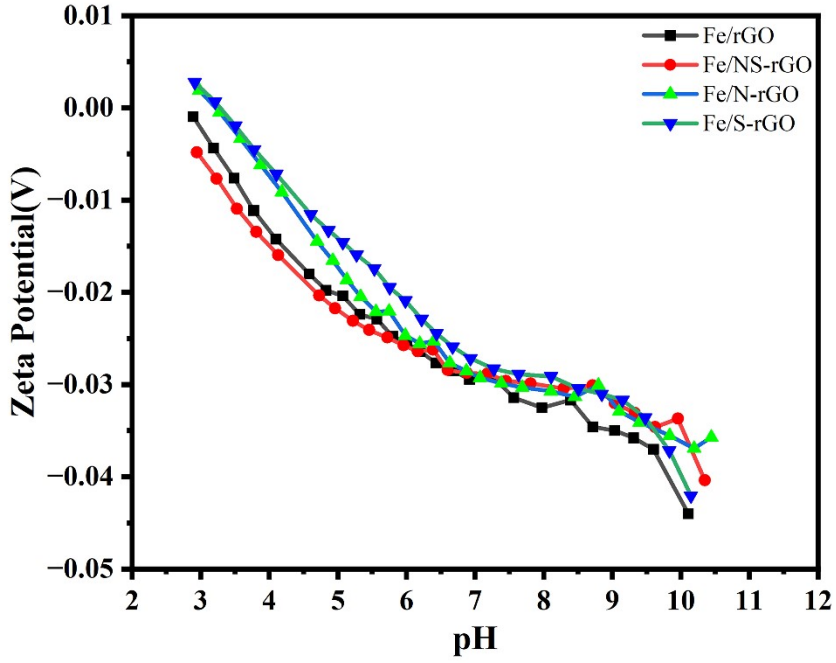

Fig. S3. Zeta potential of Fe/rGO, Fe/N-rGO, Fe/S-rGO, and Fe/NS-rGO samples.

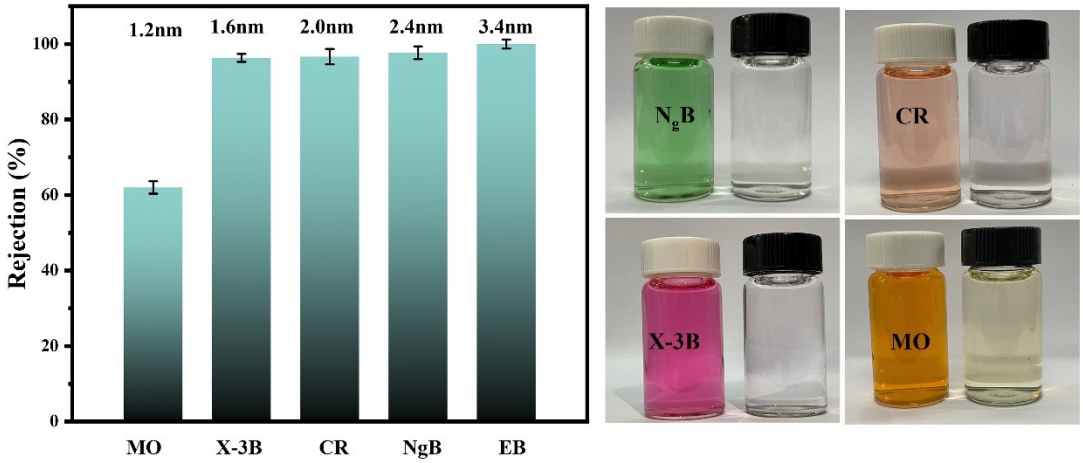

Fig. S4. The rejection rate of Fe/NS-rGO membranes for different dyes in cross-flow filtration and part of the comparison pictures.

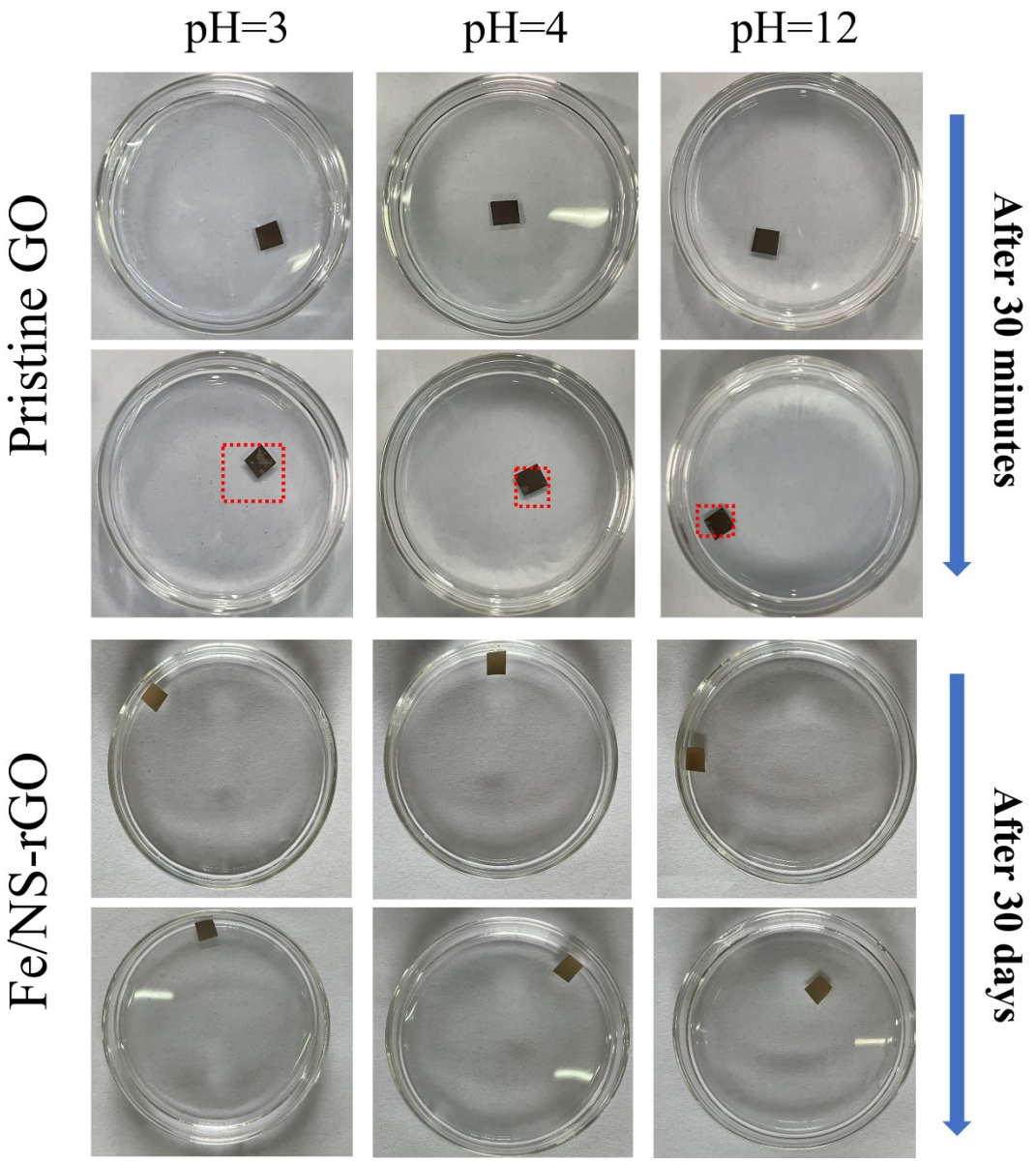

Fig. S5. Photographs of the GO and Fe/NS-rGO catalytic membranes before and after soaking in water at different pH for a period of time.

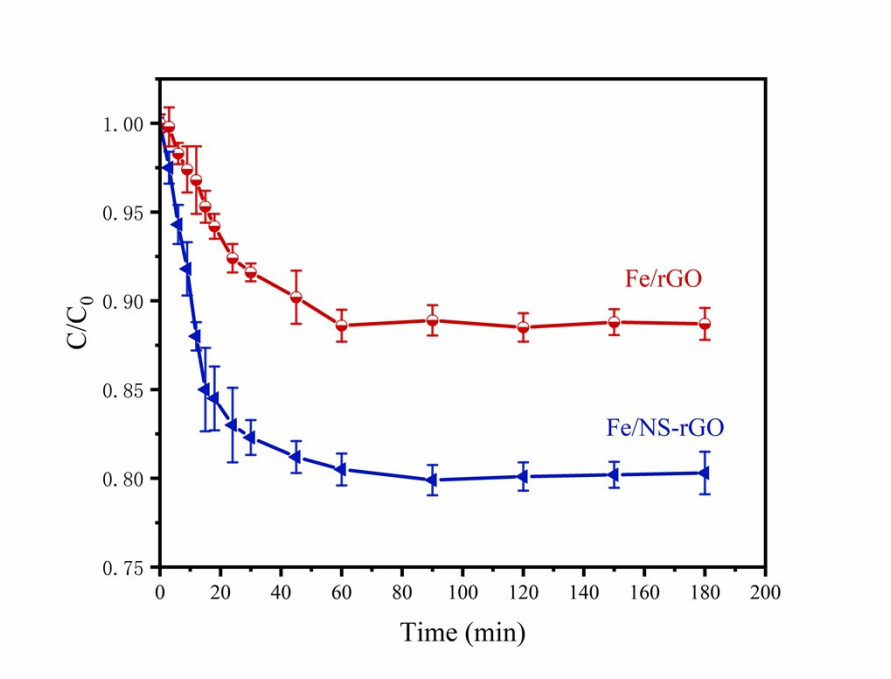

Fig. S6. Time-dependent adsorption of 4-NP on Fe/NS-rGO and Fe/rGO Membrane.

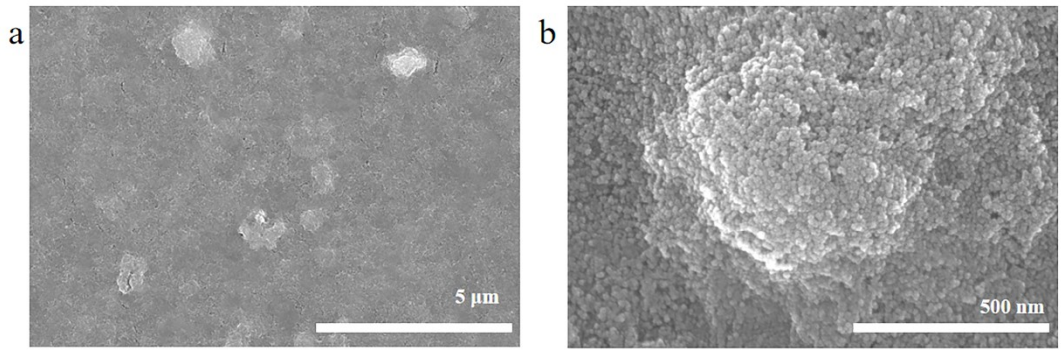

Fig. S7. (a, b) Surface SEM images of Fe/NS-rGO catalytic membranes by using 0.0125M and 0.05M ferric chloride.

Table S1. Comparison of rate constants and TOF values for the catalytic reduction of 4-NP by different membranes

Catalyst	Concentration of 4-NP (mM)	TOF [h^{-1}]	k [min^{-1}]	Ref
Pd/PDMS/PAIHF membrane	1.00	183.4	0.024	40
Ni/Au-CW membrane	0.10	25.5	0.31	41
Cu−Ag/PES membrane	0.25	/	0.0507	42
Ag-PES/PNM membrane	0.22	170.9	67.2	43
Pd-immobilized membrane	1.20	106.48	/	44
CuO/PES membrane	5.0	115	/	45
Fe/NS-rGO membrane	0.30	1596.0	0.5657	This work
Fe/N-rGO membrane	0.30	957.1	0.2411	This work
Fe/S-rGO membrane	0.30	1198.8	0.5025	This work
Fe/rGO membrane	0.30	12.45	0.1409	This work

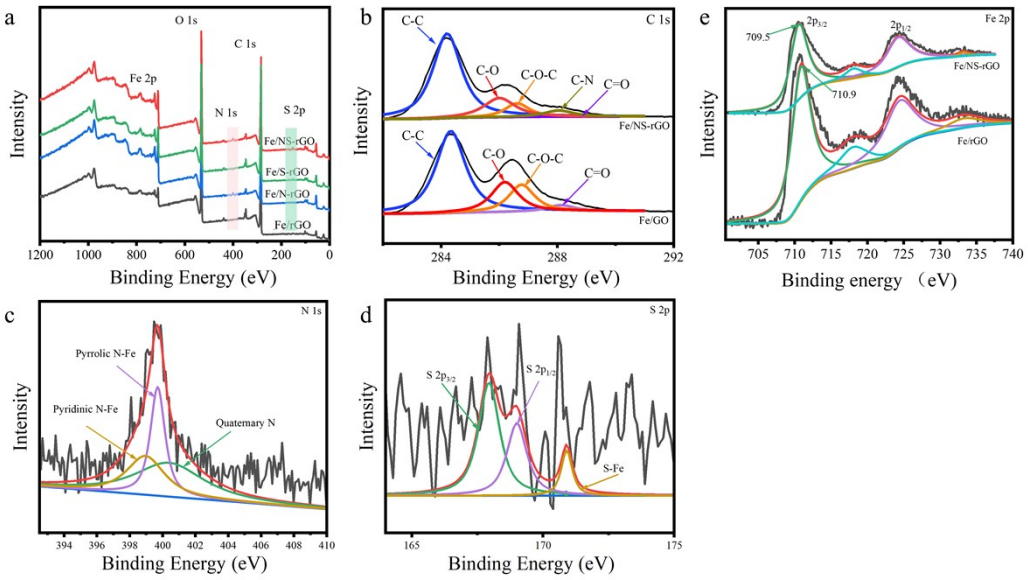

Fig. S8. XPS spectra. (a) Full spectra of Fe/rGO, Fe/N-rGO, Fe/S-rGO and Fe/NS-rGO samples. (b) C 1s spectra of Fe/rGO and Fe/NS-rGO composites. (c,d) N 1s and S 2p spectra of Fe/NS-rGO composites. (e) Fe 2p spectra of Fe/rGO and Fe/NS-rGO composites.