Supporting Information For

Covalent organic framework assisted interlocked graphene oxide based thinfilm composite membrane for effective water remediation

Subhasish Maiti, Sk Safikul Islam, Suryasarathi Bose*

Department of Materials Engineering, Indian Institute of Science, Bangalore, Karnataka, India-560012

*corresponding author: sbose@iisc.ac.in



Figure S1: Spectrum showing proton NMR of 1,3,5-triformylphloroglucinol.

Pretreatment of PVDF membrane:

To make it an active surface the membrane (50/50 composition) was initially treated with NaOH solution (1 M) for 24 h under the magnetic stirred condition on mild heating condition (40 °C). Then it was nicely washed with distilled water and kept for vacuum drying for 24 hat 50 °C. The FTIR Spectrum of the treated membrane was shown in figure S2.



Figure S2: FTIR Spectrum of PVDF membrane and NaOH treated PVDF membrane.



Figure S3:Micrograph showing surface morphology of GO@COF membrane at different compositions (a) $GO@COF_{0.05}$ (b) $GO@COF_{0.10}$ (c) $GO@COF_{0.15}$ (d) $GO@COF_{0.20}$ respectively.



Figure S4: Micrograph showing the SEM-EDS mapping of GO membrane (a1, a2) and GO@COF membrane for different compositions such as $GO@COF_{0.05}$ (b1, b2, and b3),

 $GO@COF_{0.10}$ (c1, c2, and c3), $GO@COF_{0.15}$ (d1, d2, and d3), and GO@COF0.20 (e1, e2, and e3) membranes respectively.



Figure S5: XRD Spectrum of GO, COF and GO@COF membranes at different compositions.



Figure S6: Stability of $GO@COF_{0.15}$ membrane after keeping 30 days under water (a) unfold membrane (b) & (c) showing the stability of membrane even in folding condition.



Figure S7: SEM micrograph of (a) $PA-COF_0-GO@COF_{0.15}$, (b) $PA-COF_1-GO@COF_{0.15}$, (c) $PA-COF_2-GO@COF_{0.15}$, (d) $PA-COF_3-GO@COF_{0.15}$, (e) $PA-COF_4-GO@COF_{0.15}$, and (f) $PA-COF_5-GO@COF_{0.15}$ modified membrane.



Figure S8: Cross-sectional SEM micrograph of (a) $PA-COF_0-GO@COF_{0.15}$, (b) $PA-COF_1-GO@COF_{0.15}$, (c) $PA-COF_2-GO@COF_{0.15}$, (d) $PA-COF_3-GO@COF_{0.15}$, (e) $PA-COF_4-GO@COF_{0.15}$, and (f) $PA-COF_5-GO@COF_{0.15}$ modified membrane.



Figure S9: Micrograph showing the SEM-EDS mapping on PA-COF₀-GO@COF_{0.15} (a, b, c) and PA-COF₄-GO@COF_{0.15} modified membrane (d, e, f).



Figure S10: XPS Spectra: (a1) C 1s (b1) N 1s (c) O 1s of PA-COF₀-GO@COF_{0.15} and (a2) C 1s (b2) N 1s (c2) O 1s of PA-COF₄-GO@COF_{0.15} modified membrane.



Figure S11: Zeta potential of GO, $GO@COF_{0.15}$, PA-COF₀-GO@COF_{0.15}, PA-COF₁-GO@COF_{0.15}, PA-COF₂-GO@COF_{0.15}, PA-COF₃-GO@COF_{0.15} and PA-COF₄-GO@COF_{0.15} modified membrane.



Figure S12: Surface SEM image of GO-COF dispersion (a) lower magnification image (20.95 K X) (b) magnified image of the selected area (200 K X). White dot represents the COF particle in GO-COF dispersion.



Figure S13: Digital images of fabricated membranes (a) $GO@COF_{0.15}$ modified membrane (b) PA-COF₄-GO@COF_{0.15} modified membrane.



Figure S14: (a) UV-VIS Spectroscopy of water in which $GO@COF_{0.15}$ membrane was immersed for 30 days (b) XRD of $GO@COF_{0.15}$ membrane after immersing in water for 30 days.



Figure S15: SEM images of $GO@COF_{0.15}$ modified membrane (a) surface (b) cross-section after thoroughly washing with water after long term performance.



Figure S16: Digital image of $GO@COF0_{0.20}$ membrane showing brittle structure of membrane.



Figure S17: Graph shows the rejection performance of freestanding GO membrane.



Figure S18: Graph shows long term performance of PVDF membrane.

Table 1: Contact angle of COF, GO and different GO@COF membranes.

Sample	Figure	Contact angle (°)
COF		0
GO		38±3
GO@COF _{0.05}		35±1.5
GO@COF _{0.10}		27±2.5

GO@COF _{0.15}	22±1
GO@COF _{0.20}	15±3

 Table 2: Contact angle of various TFC membranes.

Sample	Figure	Contact angle (°)
PA-COF ₀ -GO@COF _{0.15}		63±2.5
PA-COF ₁ -GO@COF _{0.15}		57±1
PA-COF ₂ -GO@COF _{0.15}		53±2
PA-COF ₃ -GO@COF _{0.15}		46±1.2
PA-COF ₄ -GO@COF _{0.15}		24±1
PA-COF ₅ -GO@COF _{0.15}		20±2