Design of an efficient, tunable and scalable freestanding flexible membrane for filter application

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• Spray pyrolysis assisted CVD synthesis of MWCNTs



Figure S1: Schematic diagram of spray pyrolysis assisted CVD setup used for the growth of MWCNTs.

• Preparation of FMWCNTs membrane



Figure S2: (a) Comparative Raman spectrum of MWCNTs before and after acid treatment stirred for various time intervals 4h, 8h, 12h, and 16h, respectively (b-c) digital images of designed

membranes via acid-treated MWCNTs stirred for 8h or more, indicating that the formation of uneven, leaky, rough, and brittle membranes.

• Reusability process of designed FMWCNTs membrane and organic contaminants (e.g., rhodamine B)



Figure S3: Schematic diagram for the reusability process of freestanding and flexible FMWCNTs membrane and the organic contaminants (e.g., rhodamine B) separately.



• The separation performance of the designed membrane for salts

Figure S4: (a) UV-Vis absorption spectrum of various salts (a) feed solution (b) permeates, respectively.

• Separation and recovery performance of the designed FMWCNTs membrane with varying concentrations (10 mg/L to 100 mg/L) of rhodamine B



Figure S5: (a) UV-Vis absorption spectrum of feed solution with varying concentrations of rhodamine B (b) corresponding digital images (c) UV-Vis absorption spectrum of permeates with these varying concentrations of rhodamine B (d) corresponding digital images (e) UV-Vis absorption spectrum of the recovered solution for these varying concentrations of rhodamine B (f) corresponding digital images.



• Relative comparison of permeance and filtration efficiency

Figure S6: Shows the relative comparison of permeance and filtration efficiency.

• Relative comparison of normalized permeance and filtration efficiency



Figure S7: Shows the relative comparison of normalized permeance and filtration efficiency.

• Table S1: The table shows how the pore size of the designed membrane has been tuned by selecting the appropriate filtration volume and concentration of FMWCNTs

Fig. No.	Filtration volume of FMWCNTs in	Average Pore Size
	100 mL of Acetone	(nm)
6(a)	0.3 g	~27.4
6(b)	0.4 g	~16.3
6(c)	0.5 g	~1.7

• Movie S1: Movie (.avi) of the filtering of organic contaminant (e.g., rhodamine B) using designed membrane.

• Movie S2: Movie (.avi) of the the extrusion of waterborne contaminant (e.g., rhodamine B) from designed membrane indicating the reusability of both designed membrane and contaminant separately.