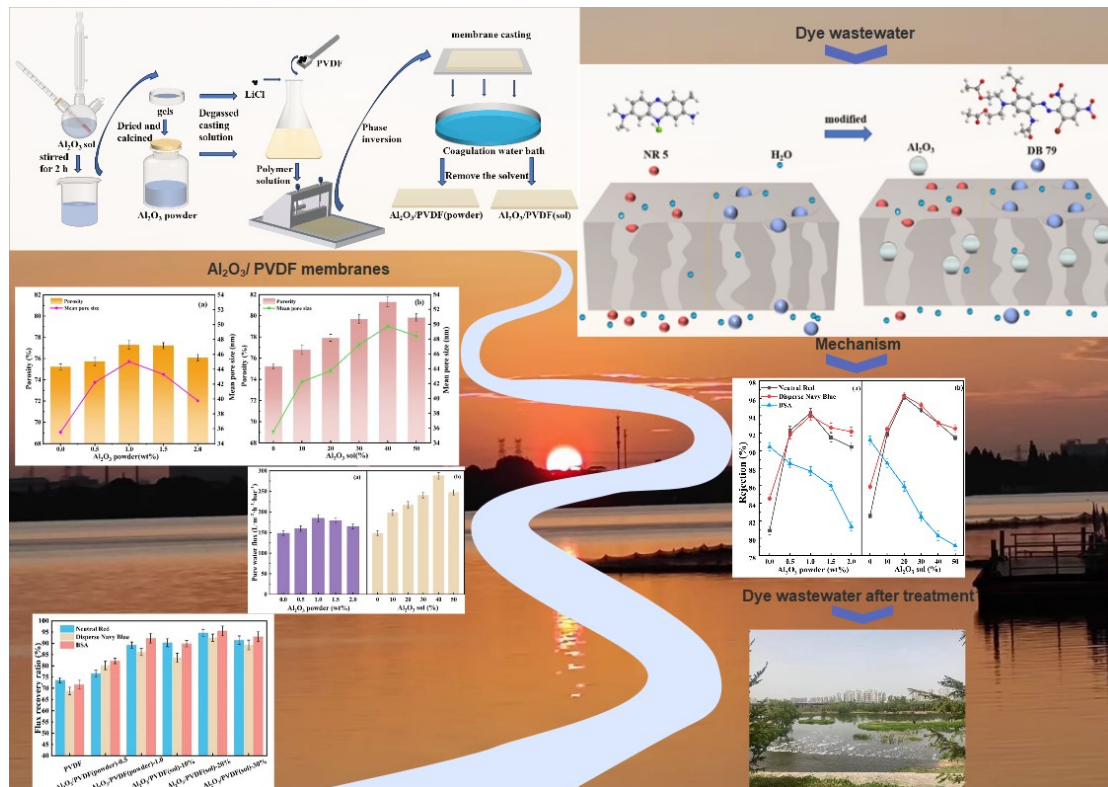


Appendix Fig. 1 TEM images of Al₂O₃ sol (a) and Al₂O₃ powder (b).

Appendix Table.1 Comparisons of the performance of Al₂O₃ membrane with that of commercially available and literature-reported separation membranes.

Membrane type	particle size (nm)	Pore size (nm)	Water contact angle (°)	Pure water flux (L·m ⁻² ·h ⁻¹) (0.1MPa)	Rejection (%)	FRR (%)	Ref.
PES-N ₅ / Al ₂ O ₃ particle	13-28	80	60.46±0.04	30.4	96.92% (Rhodamine B)	42.76%	[15]
PVDF-4/ Al ₂ O ₃ particle	10	55.82	58.97	≈120	96.45% (BSA)	72.6%	[16]
γ- ultrafiltration membrane/ Al ₂ O ₃ sol	30	6.8	58.4	30.4	96.8%(Methyl Blue) 96.2%(BSA)	/	[17]
PVDF-M ₁ / Al ₂ O ₃ particle	<50	/	62.45±2.5	598	≈88%(Congo red)	/	[18]
Pure PVDF*	/	43.2	69±1.66	148.8±8.6	82.58% (NR 5), 85.88% (DB 79), 83.00% (BSA)	73.56% (NR 5), 68.82%(DB79),71.67%(BSA)	This work
Al ₂ O ₃ /PVDF(powder)-1.0	77.02±1.53	45.0	65±1.18	184.8±9.7	94.69% (NR 5), 94.39% (DB 79), 91.20% (BSA)	89.21% (NR 5), 86.18%(DB79) , 92.27%(BSA)	This work
Al ₂ O ₃ /PVDF(sol)-20 %	9.81±0.05	47.1	64±1.07	217.00±10.17	96.13% (NR 5), 96.29% (DB 79), 96.93% (BSA)	94.67% (NR 5), 92.54%(DB79), 95.55%(BSA)	This work



Appendix Fig. 2 Graphical abstract