PVA Based Mixed Matrix Membranes for Ethanol Dehydration via Pervaporation: A Comparison Study between Graphene and Graphene Oxide

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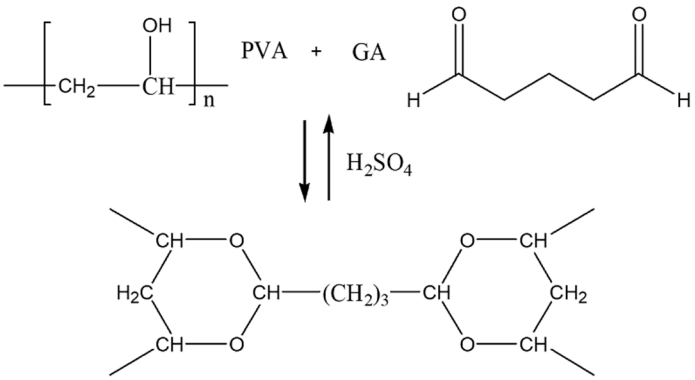


Figure S1. Chemical cross-linking of PVA with GA.



Figure S2. The photograph image of pervaporation apparatus.

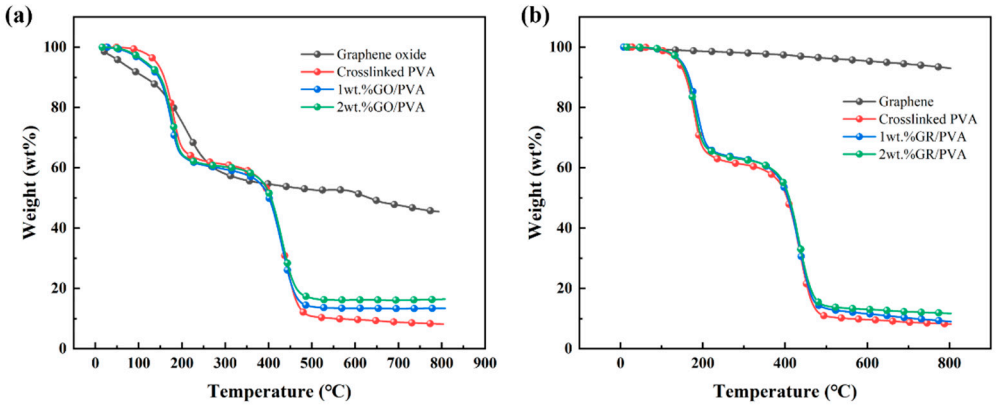


Figure S3. The TG curves for GR/PVA MMMs(a) and GO/PVA MMMs(b)

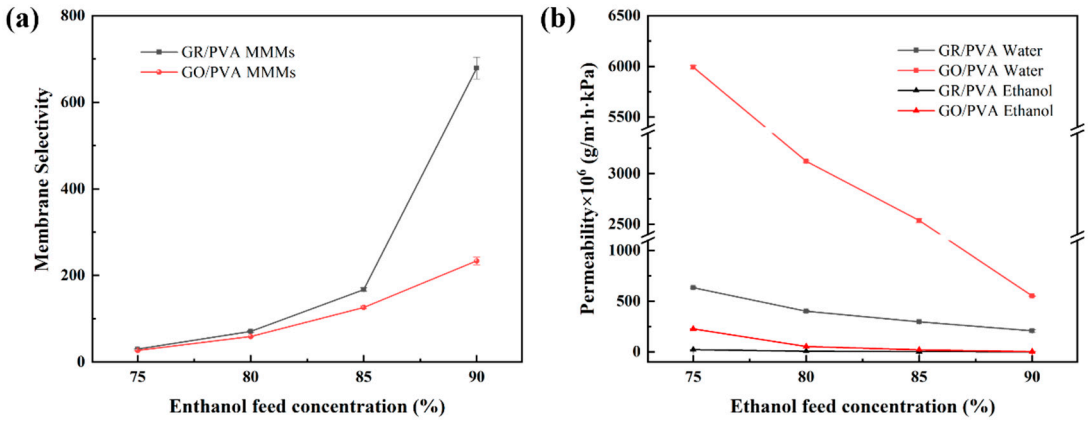


Figure S4. Effect of ethanol feed concentration on PV performance of GR/PVA and GO/PVA MMMs (a) Membrane selectivity; (b) Permeability

Table S1 Effect of feed concentration on activity coefficient, saturated vapor pressure and feed fugacity at 40℃.

Ethanol/water mixture (wt %)	Mole fraction (mol %)		Activity coefficient		Saturated vapor pressure (kPa)		Feed fugacity (kPa)	
	Ethanol	Water	Ethanol	Water	Ethanol	Water	Ethanol	Water
90/10	0.54	0.46	1.21	1.53	17.90	7.36	11.67	5.16
85/15	0.61	0.39	1.14	1.65			12.43	4.74
80/20	0.69	0.31	1.08	1.82			13.35	4.14
75/25	0.78	0.22	1.04	2.03			14.49	3.29

Table S2 Effect of feed temperature on activity coefficient, saturated vapor pressure and feed fugacity of ethanol/water(90wt%) mixture

Temperature (℃)	Activity coefficient		Saturated vapor pressure(kPa)		Feed fugacity(kPa)	
	Ethanol	Water	Ethanol	Water	Ethanol	Water
40	2.03	1.04	17.90	7.36	14.49	3.29
50			29.46	12.33	23.85	5.51
60			46.84	19.92	37.93	8.91
70			72.21	31.17	58.47	13.93