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Supplementary Information

High Performance Concentration Capacitors with Graphene Hydrogel Electrodes for Harvesting Salinity Gradient Energy

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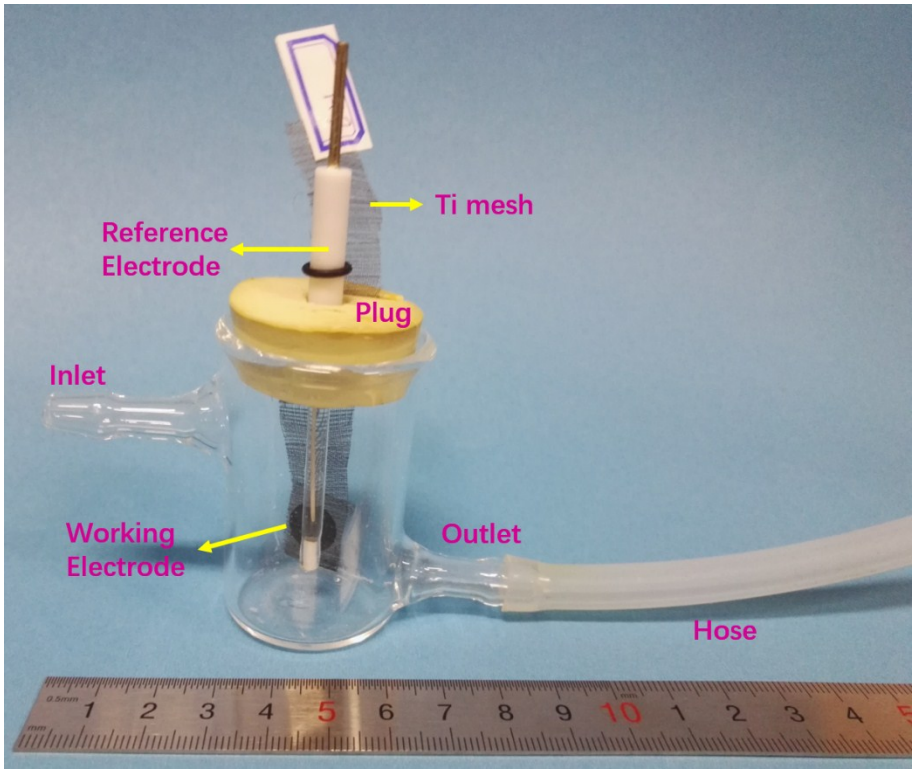

Fig. S1 Photograph of the device for OCP measurements. The HC and LC solutions alternately flow into and out of the tank via the inlet and outlet, respectively. The working electrode and the Ag/AgCl reference electrode are in the tank. The hose connected with the outlet can be used to adjust the height of the liquid level by changing the height of its tail end.

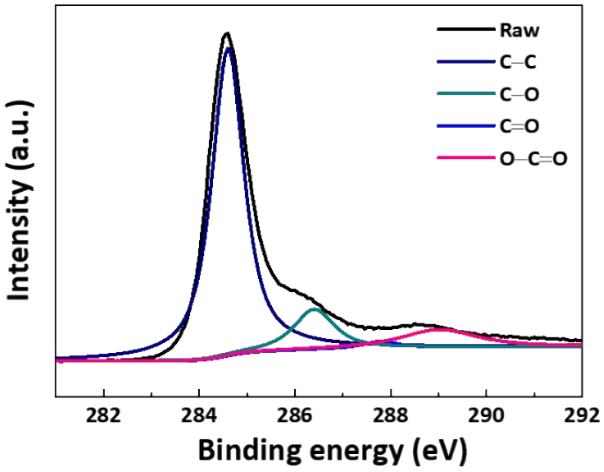

Fig. S2 (a) The C 1s XPS spectra of the freeze-dried graphene hydrogel (GH).

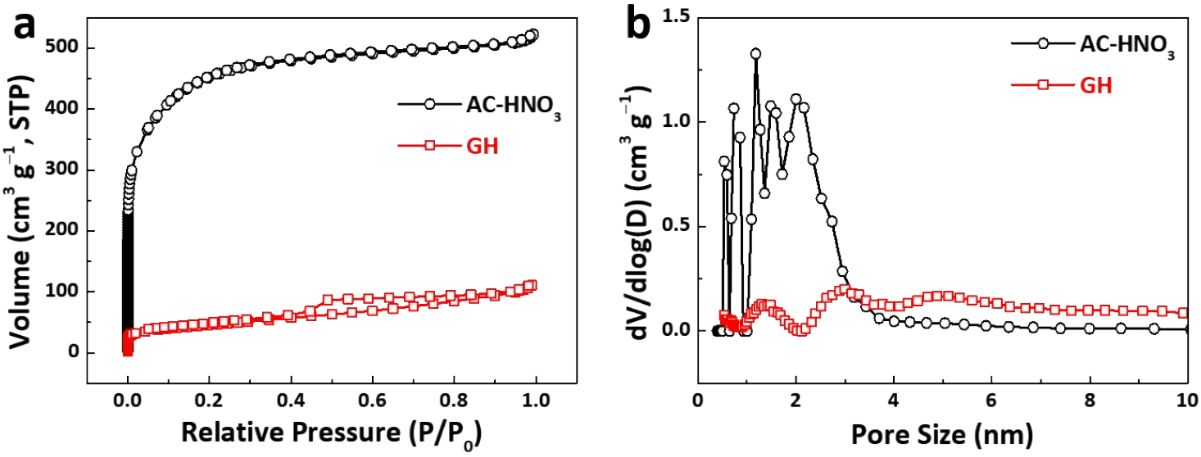

Fig. S3 (a) The N_2 adsorption-desorption isotherms and (b) pore size distribution of nitric acid oxidized activated carbon (AC-HNO_3) reported in our previous work and the freeze-dried graphene hydrogel (GH) in this work.

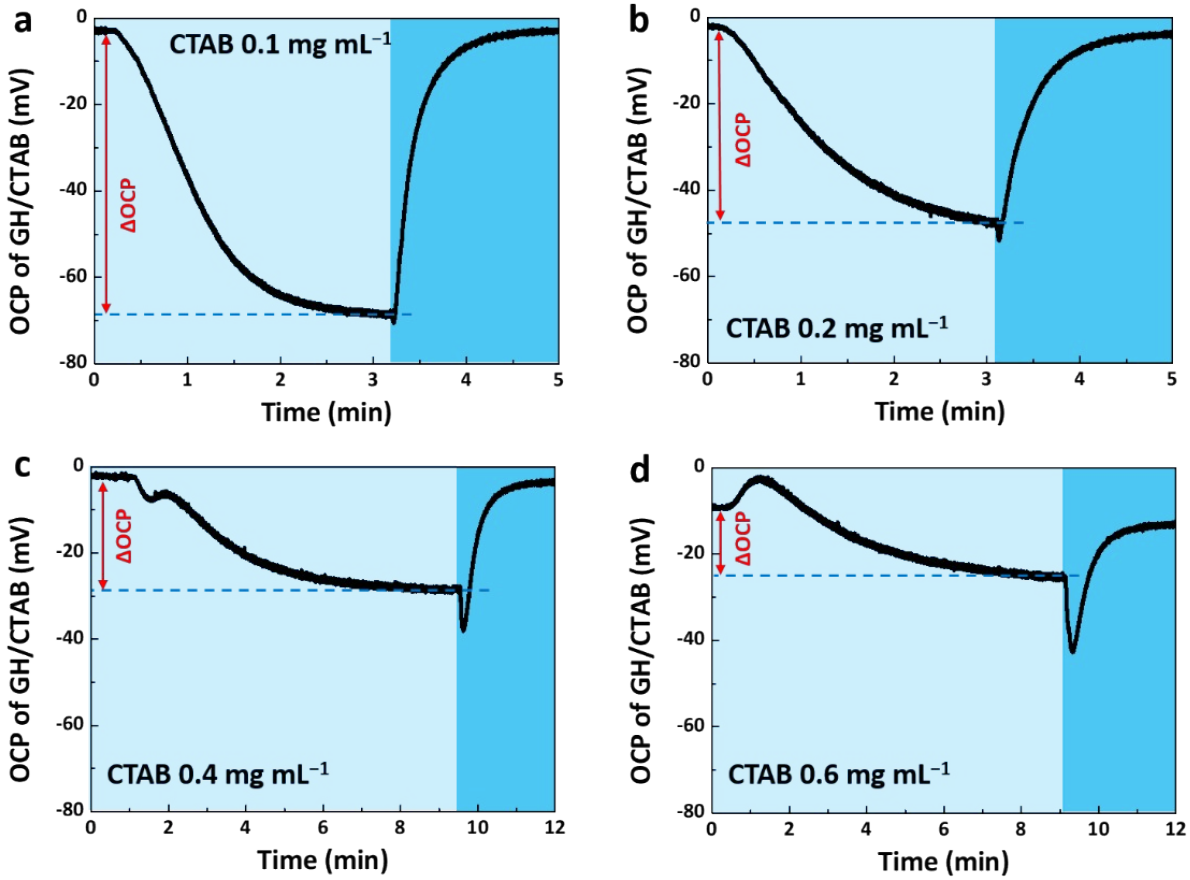

Fig. S4 The open circuit potentials (OCPs) of cetrimonium ammonium bromide (CTAB)-treated GH (GH/CTAB) electrodes at different CTAB concentrations when soaked in the low concentration (LC, light blue background) and high concentration (HC, dark blue background) solutions alternately.

Table S1. Comparison of voltage rise, average power density and peak power density between concentration capacitors and other CapMix techniques.

Electrode 1	Electrode 2	External Power Source	Membrane	Voltage Rise (mV)	Average Power Density (mW m^{-2})	Peak Power Density (mW m^{-2})	Reference
AC	AC	Yes	No	33	6.6	72	1
AC	AC	Yes	No	15.4	1.03	18	2
AC	AC	Yes	No	42.4	0.13	n/a	3
AC	AC	Yes	No	33.4	1.06	n/a	4
AC	AC	Yes	No	29	0.3	n/a	5
AC	AC	Yes	No	29	3.3	n/a	6
AC	AC	No	CEM+AEM	119	12.9	72	7
AC	AC	No	CEM+AEM	93	8.4	132	8
AC	AC	No	CEM+AEM	144	0.4	n/a	9
AC	AC	Yes	CEM+AEM	136	205	n/a	10
AC/p-TSA[a)]	AC/PEI-EN[b)]	Yes	No	83	28	n/a	11
AC/p-TSA	AC/PEI-EN	Yes	No	82	35	n/a	12
AC/PSS[c)]	AC/PDADMAC[d)]	Yes	No	120	50	n/a	13
A-PC-2[e)]	NS30[e)]	No	No	53	50	n/a	14
AC/PSS	AC/PDADMAC	No	No	70	12.1	113	15
AC/PSS	AC/PDADMAC	No	No	72	30	n/a	6
AC-QPVP	AC-HNO_3	No	No	150.0	65.0	1086	16
AC/PEI-EN	AC/PEI-EN	No	FP	61	36.6	n/a	17
AC/p-TSA	AC/p-TSA	No	FP	92	45.2	n/a	17
GH	GH	No	FM	166.7	141.4	1054	this work
GH	GH	No	AEM	288.5	482.4	4164	this work

Notes: [a)]p-toluenesulfonic acid; [b)]polyethyleneimine branched with ethylene diamine; [c)]poly (sodium 4-styrenesulfonate); [d)]poly (diallyldimethylammonium chloride); [e)]different kinds of pristine AC. CEM, AEM, FP and FM denote cation exchange membrane, anion exchange membrane, filter paper and filter membrane, respectively.

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