Electronic Supplementary Information for:

Sustainable Electrode Material for High-Energy Supercapacitor: Biomass-Derived Graphene-Like Porous Carbon with Three Dimensional Hierarchically Ordered Ion Highways

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Assessment of Electrochemical Performance

The specific capacitance, C_{cv} (F.g^{-1}) value for samples from CV curves was calculated by using the Eq. 1:

$$C_{cv} = \frac{q_a + |q_c|}{m.\Delta V} \quad (1)$$

where, q_a, q_c, m and ΔV are the anodic and cathodic voltammetric charges on positive and negative sweeps, the weight of active material and the potential range of cyclic voltammetry, respectively [1].

The specific capacitance C_{GCD} (F.g^{-1}) of the symmetrical supercapacitor cell was calculated from GCD curve by Eq.2:

$$C_{GCD} = \frac{I\, t_d}{m\, \Delta V} \quad (2)$$

where I is the constant current (A), m is the total mass of active material (g), t_d is the discharge time and ΔV is the potential range excluding the voltage drop (V_{drop}) at the beginning of the discharge [1].

Coloumbic efficiency (η)was calculated from GCD curve by Eq.3:

$$\eta = \frac{t_d}{t_c} \times 100 \quad (3)$$

where t_d and t_c are the discharge and charge time (s), respectively.

The energy density, E (W.h.kg^{-1}), was calculated using the Eq. (4);

$$E = \frac{1}{7.2} C_{GCD} \Delta V^2 \quad (4)$$

The power density, P(W.kg^{-1}), was estimated using the Eq. (5);

$$P = \frac{E}{t_d} \tag{5}$$

where t_d (h) is the discharge time at a constant current density.

The capacitance retention was calculated according to Eq. (6);

$$Capacitance\ Retention\ (\%) = \frac{C_i}{C_1} \times 100 \tag{6}$$

where C_i and C_1 are the specific capacitances of the i^{th} and 1^{st} GCD cycles, respectively [1,2].

Supplementary Tables

Table S1. Elemental analysis results of DOP sample

Sample	*C (%)*	*H (%)*	*N (%)*	*S (%)*	*(O +ash)* (%)*
DOP	50.40	6.88	0.08	0.02	40.64

** The oxygen content is calculated by difference*

Table S2. The performance parameters of GPC-3.0 based symmetric supercapacitor cell in SIW and WIS electrolytes

Sample	**Current Density (A/g)**	**Specific Capacitance (F/g)**	**E (W.h/kg)**	**P (W/kg)**	**Coulombic Efficiency**
12.0 m $NaNO_3$	0.5	70.0	51.43	575.00	99.39
	1.0	64.0	47.02	1150.00	93.75
	2.0	59.0	43.35	1776.38	88.24
	5.0	54.0	39.68	5750.00	82.50
	10.0	49.9	36.66	11507.02	81.17
1.0 M Na_2SO_4	0.5	59.0	36.14	445.06	97.49
	1.0	49.0	30.01	899.91	91.53
	2.0	44.0	26.95	1796.87	88.89
	5.0	41.0	25.11	4677.25	82.86
	10.0	38.0	23.28	9146.56	80.00

Supplementary Figures and Captions

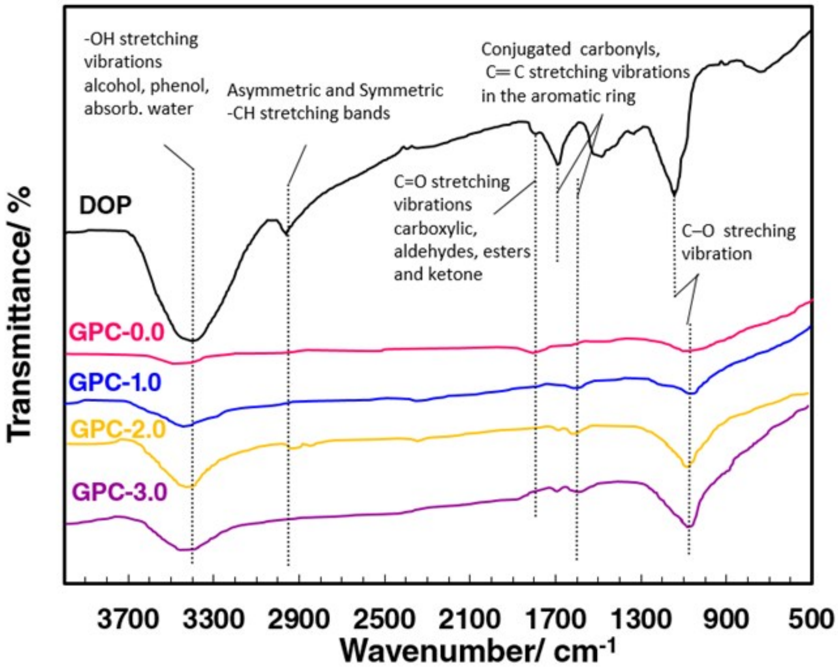

Fig S1. FTIR spectra of DOP and GPC-*x* samples

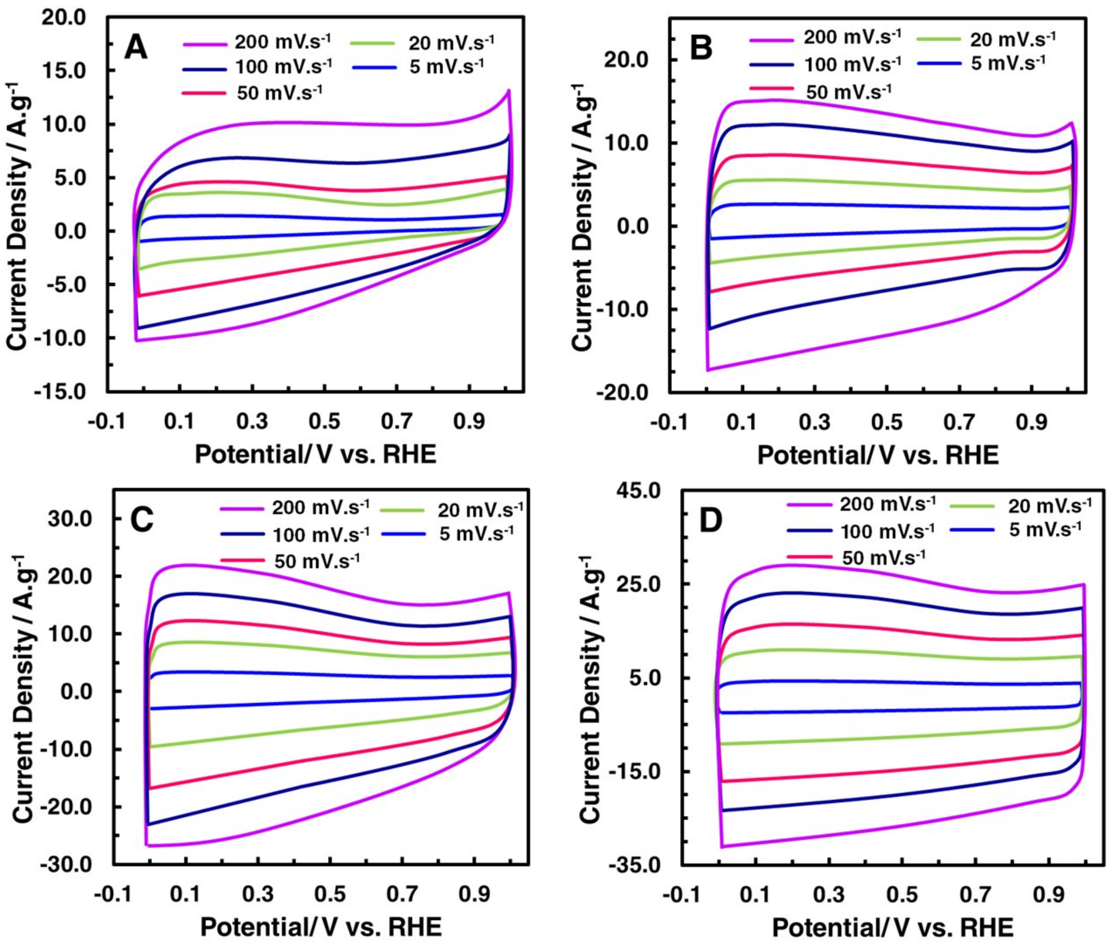

Fig. S2 Cyclic voltammograms of **(A)** GPC-0.0, **(B)** GPC-1.0, **(C)** GPC-2.0, and **(D)** GPC-3.0 at various potential scan rates in 6.0 M KOH electrolyte performed in a three-electrode electrochemical cell

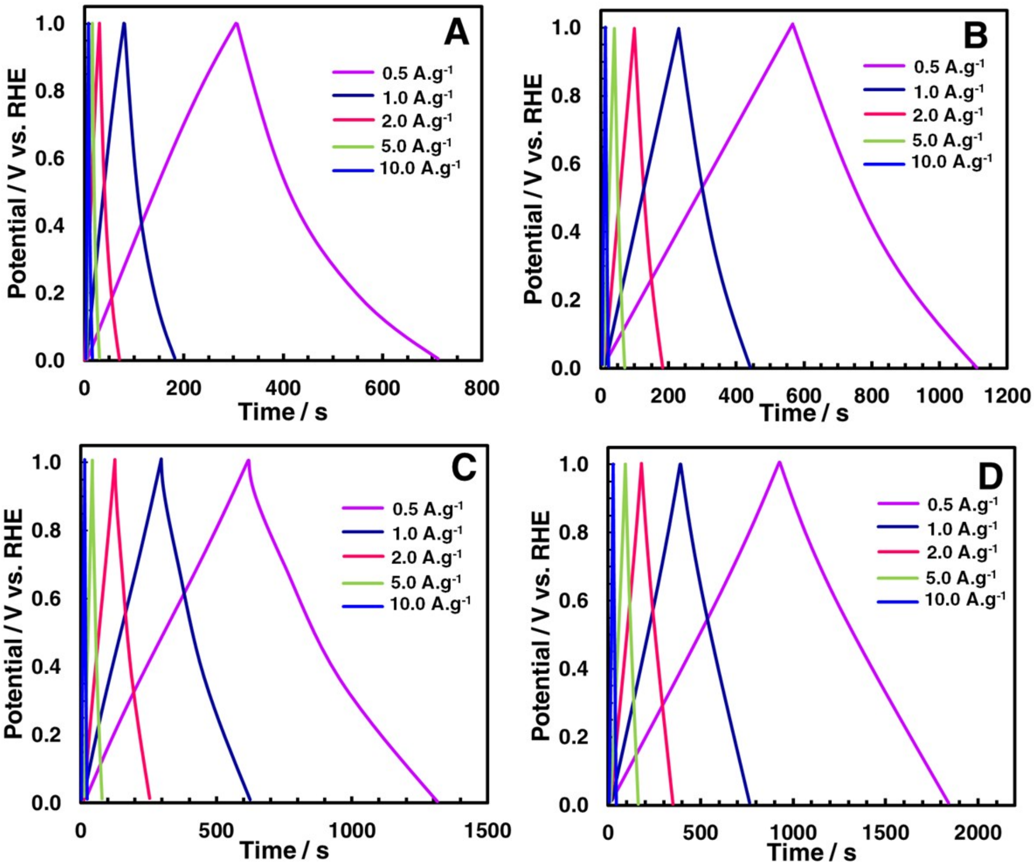

Fig. S3 Galvanostatic charge/discharge curves of **(A)** GPC-0.0, **(B)** GPC-1.0, **(C)** GPC-2.0, and **(D)** GPC-3.0 at various current densities in 6.0 M KOH electrolyte performed in a three-electrode electrochemical cell

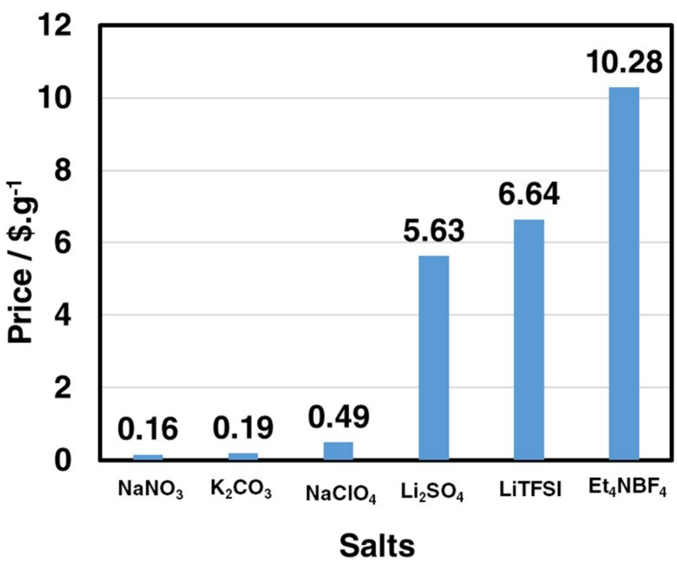

Fig S4. The prices of salts and solvents to prepeare various water-in-salt electrolytes [3]

References

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