

Supporting information

Biomass porous carbons derived from banana peel waste as sustainable anodes for lithium-ion batteries

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1. Elemental composition of the BPW samples obtained by EDS analysis.

Table S1. Elemental composition of the BPW samples obtained by EDS analysis.

Element ¹	BPW	BPW@H ₃ PO ₄	BPW@ZnCl ₂	BPW@KOH
C	52.98	89.91	87.26	83.01
O	37.57	7.01	6.51	11.57
Si	3.46	1.08	2.44	2.78
P	0.85	2.00	-	-
Zn	0.51	-	3.11	-
Cl	-	-	0.68	-
K	1.52	-	-	2.64
Mg	0.73	-	-	-
Ca	1.32	-	-	-
Na	0.56	-	-	-
Fe	0.24	-	-	-
Cu	0.15	-	-	-
S	0.11	-	-	-

¹ Weight (atomic %).

2. Kinetic parameters for carbon electrodes from fitted EIS and CV measures

Table S2. Kinetic parameters for carbon electrodes from fitted EIS and CV measures.

Sample	R _{e(initial)} (Ω)	R _{e(final)} (Ω)	R _{ct(initial)} (Ω)	R _{ct(final)} (Ω)	A _w (Ω s ^{-1/2})	D _{Li⁺EIS} (cm ² s ⁻¹) ¹	D _{Li⁺CV} (cm ² s ⁻¹) ²
BPW@H ₃ PO ₄	10.77	7.42	114	63.4	50.3570	7.94x10 ⁻¹²	8.23x10 ⁻⁸
BPW@ZnCl ₂	14.93	11.09	172	117	68.9113	4.24x10 ⁻¹²	3.76x10 ⁻⁸
BPW@KOH	19.23	15.69	234	184	107.6097	1.74x10 ⁻¹²	1.99x10 ⁻⁸

¹ Calculated for an area of the electrode of 1.327 cm². ² Calculated for an average particle radius of 25 μm.

3. Specific capacities of BPW electrodes at different cycles for 0.2 C galvanostatic regime and at different current densities for rate capability test

Table S3. Specific capacities (in mAh g⁻¹) of BPW electrodes at different cycles for 0.2 C galvanostatic regime and at different current densities for rate capability test.

<i>Sample</i>	<i>Cycle</i>	<i>1st</i>	<i>2nd</i>	<i>5th</i>	<i>10th</i>	<i>20th</i>	<i>50th</i>	<i>100th</i>	<i>150th</i>	<i>200th</i>
<i>Sample</i>		<i>Rate</i>	<i>0.1 C</i>	<i>0.2 C</i>	<i>0.5 C</i>	<i>0.8 C</i>	<i>1 C</i>	<i>2 C</i>	<i>0.1 C¹</i>	
BPW@H ₃ PO ₄		942	307	277	242	238	212	225	250	272
BPW@ZnCl ₂		831	293	228	207	211	195	226	227	250
BPW@KOH		763	174	157	147	146	158	195	212	224
BPW@H ₃ PO ₄		442	295	220	173	149	131			284
BPW@ZnCl ₂		347	286	214	167	145	129			267
BPW@KOH		280	237	178	136	116	104			230

¹ Return to 0.1 C in the rate capability test.

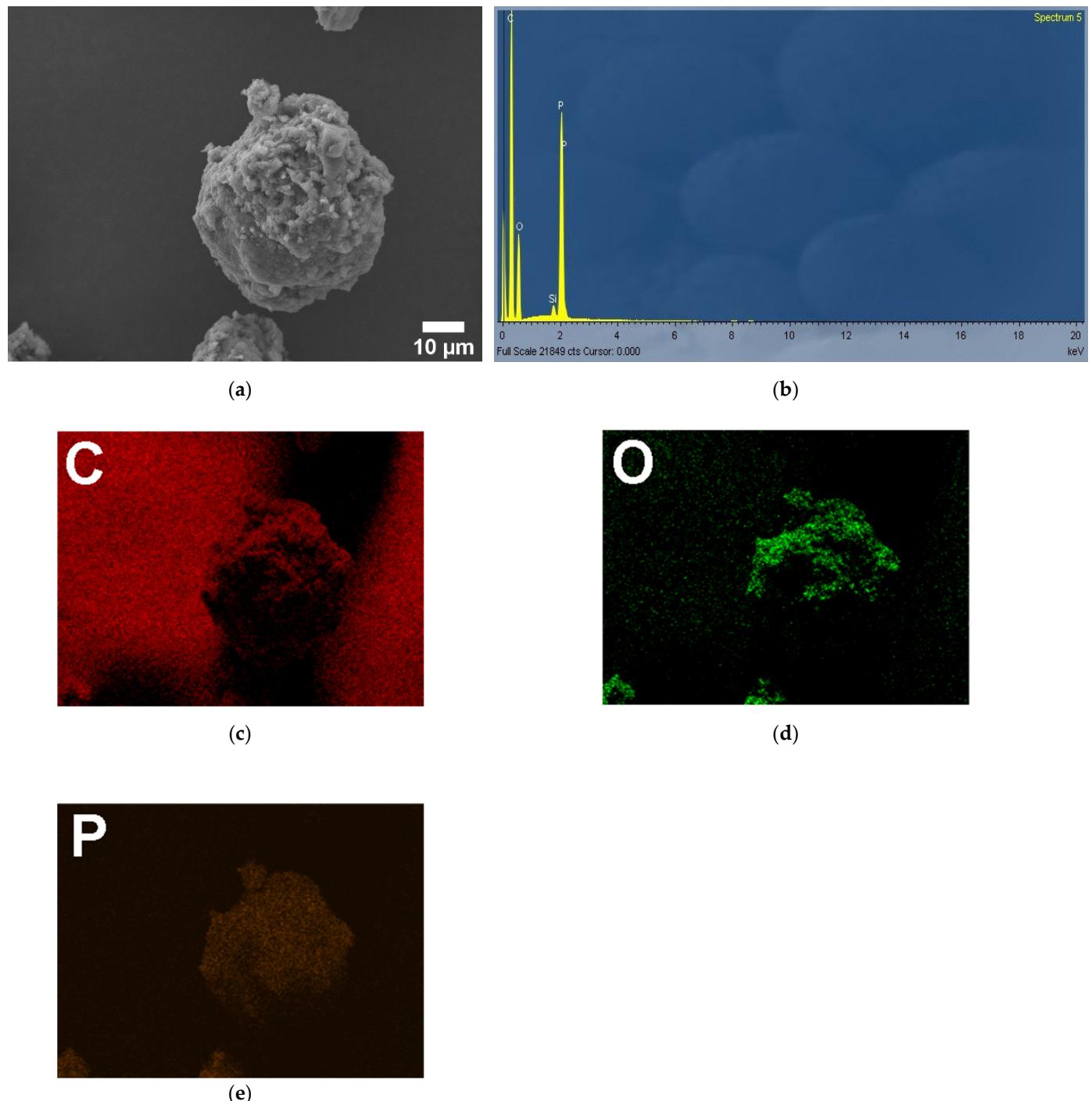
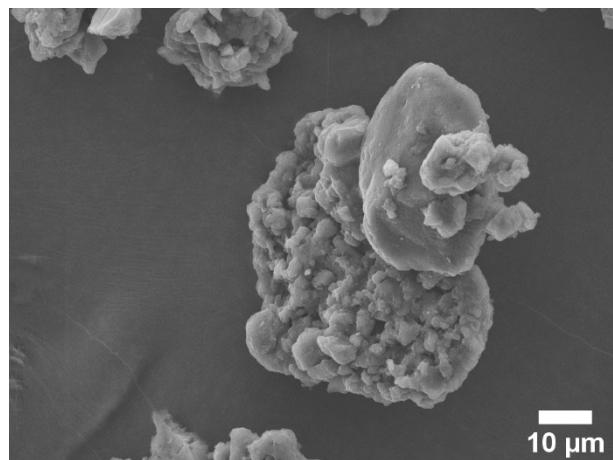
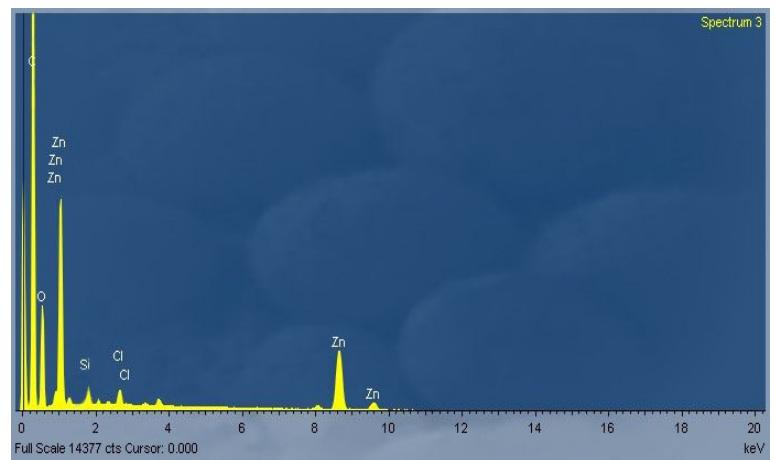
4. EDS spectra and elemental mappings of BPW@H₃PO₄, BPW@ZnCl₂, BPW@KOH

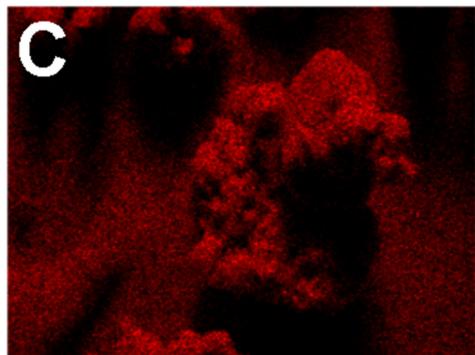
Figure S1. (a) EDS image, (b) EDS spectrum, (c) C, (d) O, and (e) P elemental mapping of BPW@H₃PO₄.



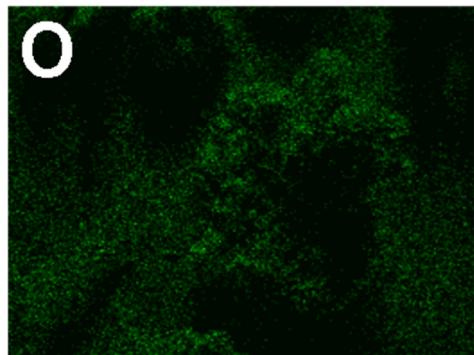
(a)



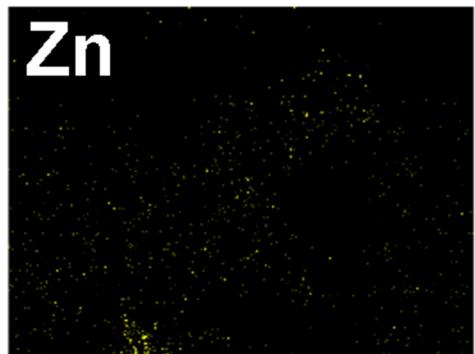
(b)



(c)

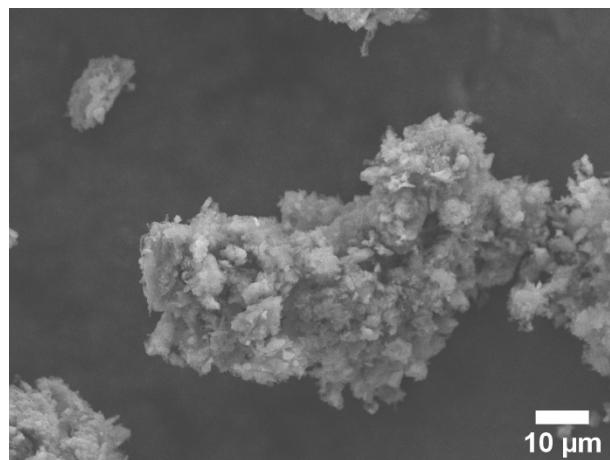


(d)

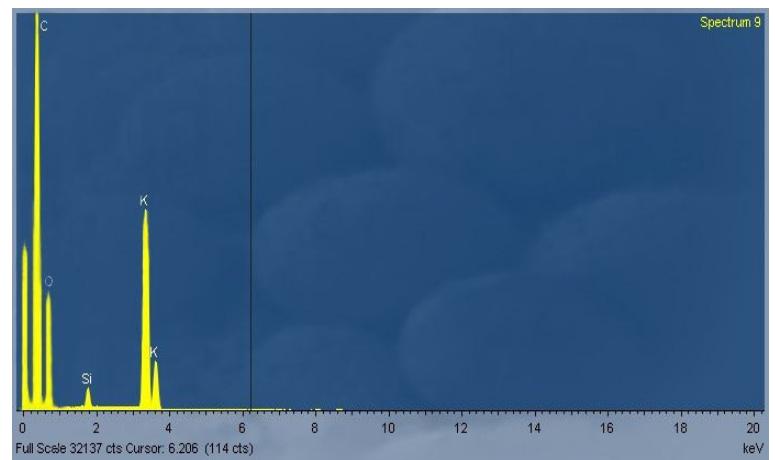


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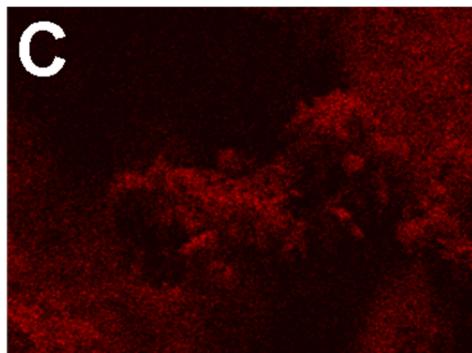
Figure S2. (a) EDS image, (b) EDS spectrum, (c) C, (d) O, and (e) P elemental mapping of BPW@ZnCl₂.



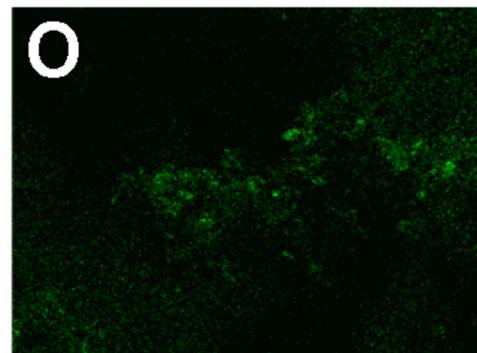
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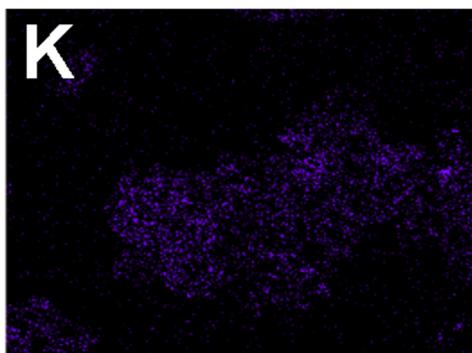
(b)



(c)



(d)



(e)

Figure S3. (a) EDS image, (b) EDS spectrum, (c) C, (d) O, and (e) P elemental mapping of BPW@KOH.

5. CV curves recorded at 0.1 mV s^{-1} of BPW@ZnCl₂ and BPW@KOH

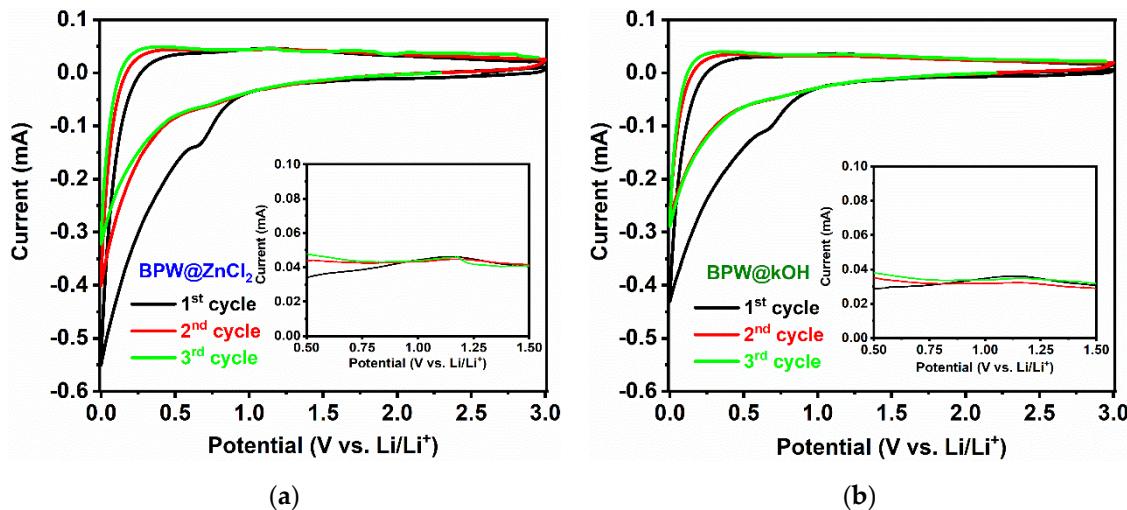


Figure S4. CV curves recorded at 0.1 mV s^{-1} of (a) BPW@ZnCl₂, (b) BPW@KOH. (Insets) Zoom of “hump” regions.

6. Charge-discharge curves of 1st cycle at 0.2C for BPW@H₃PO₄, BPW@ZnCl₂ and BPW@KOH

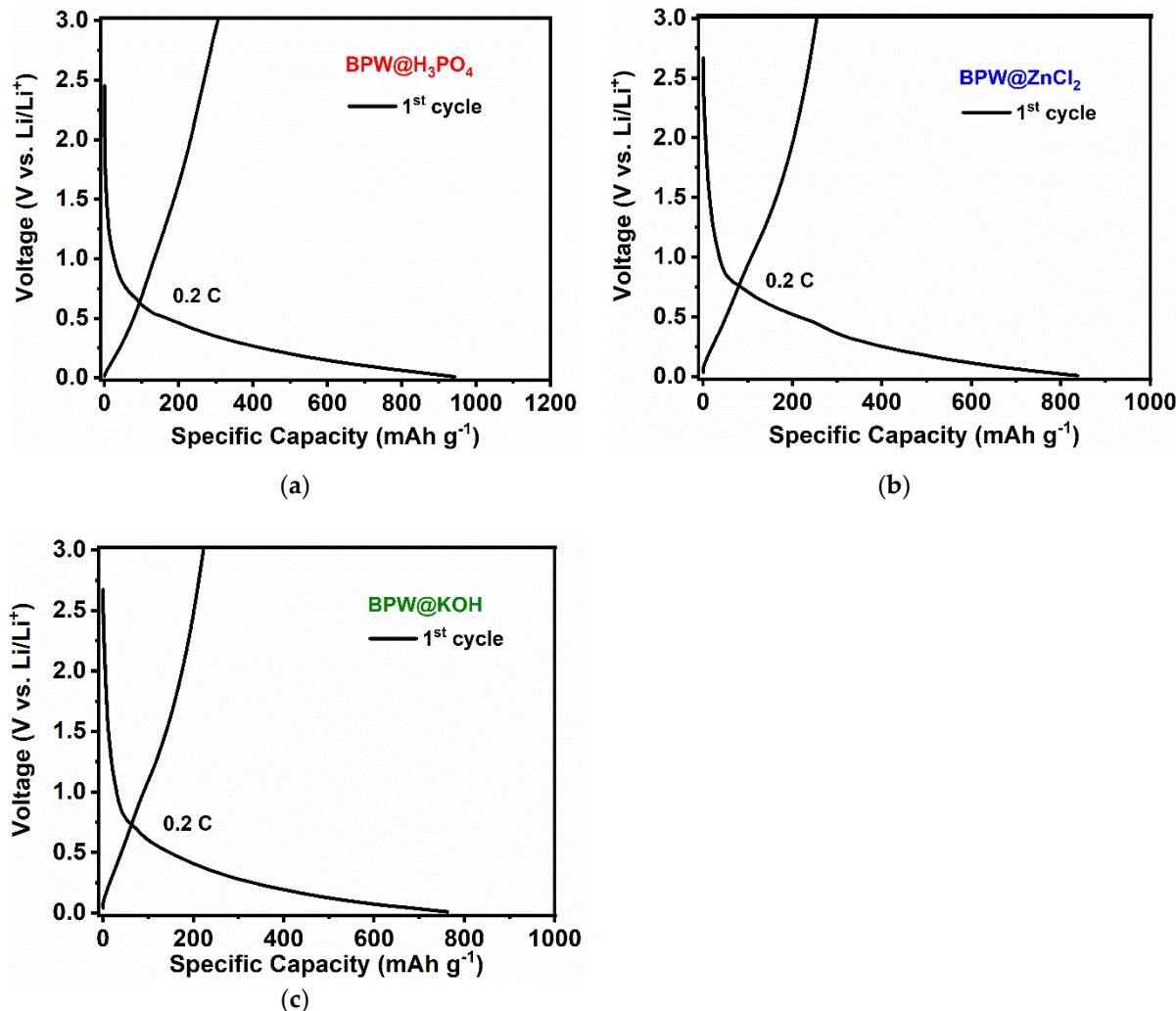
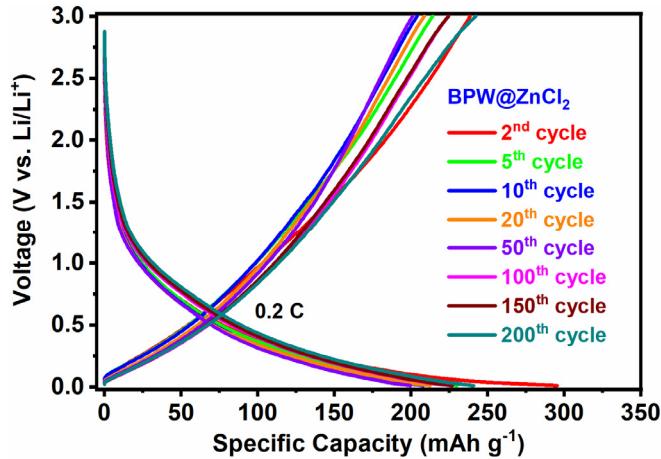
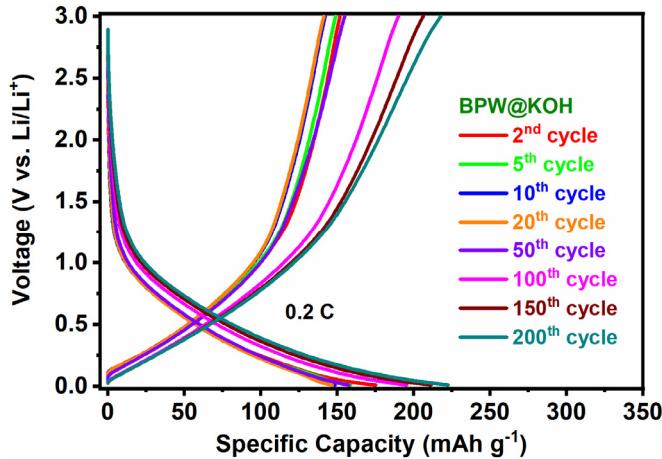


Figure S5. Galvanostatic charge-discharge curves of 1st cycle at 0.2 C for (a) BPW@H₃PO₄, (b) BPW@ZnCl₂, (c) BPW@KOH

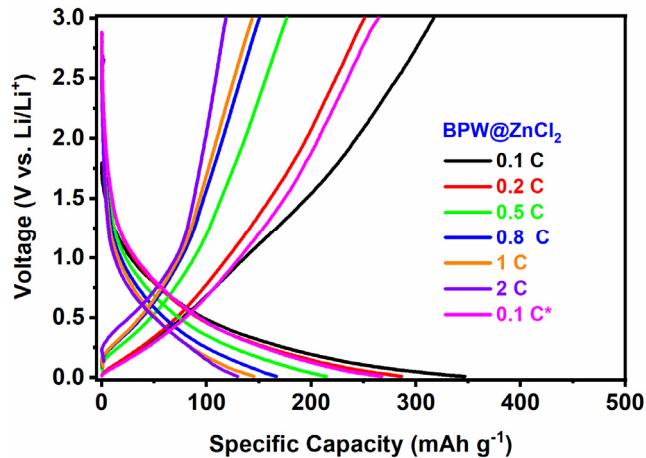
7. Galvanostatic charge-discharge curves from 2nd to 250th cycle at 0.2 C for BPW@ZnCl₂ and BPW@KOH. Rate capability charge-discharge curves for BPW@ZnCl₂ and BPW@KOH



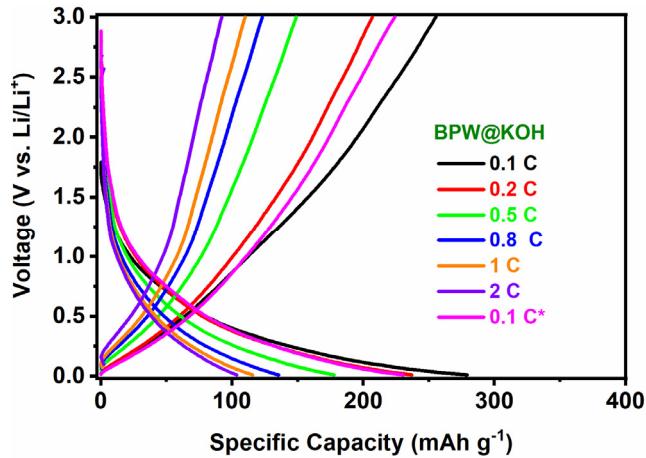
(a)



(b)



(c)



(d)

Figure S6. Galvanostatic charge-discharge curves from 2nd to 250th cycle at 0.2 C for (a) BPW@ZnCl₂, (b) BPW@KOH. Rate capability charge-discharge curves for (c) BPW@ZnCl₂, (d) BPW@KOH.