P/N/O co-doped carbonaceous materials based supercapacitor with voltage up to 1.9 V in the aqueous electrolyte

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**Experimental**

**Materials**

Aniline, ammonium persulfate (AR grade), hydrochloric acid and 70wt% phytic acid solution were purchased from Sinopharm Chemical Reagent Co., Ltd. Aniline monomer was distilled under reduced pressure. Ammonium persulfate and phytic acid solution were used as received without further treatment.

**Calculations**

In the three electrode system, the specific capacitance \( C \) is calculated from the galvanostatic discharge curve by the equation

\[
C = \frac{i t}{m \Delta V},
\]

where \( i \) = discharge current (A), \( t \) = discharge time (s), \( m \) = mass of the active material (g), \( \Delta V \) = the potential range (V).

In the two electrode system, the specific capacitance \( C \), energy density \( E \) and power density \( P \) are respectively calculated from the galvanostatic discharge curve by the equations:

\[
C = \frac{i t}{m \Delta V}, \quad E = \frac{1}{2} C \Delta V^2, \quad P = \frac{E}{\Delta t}
\]

where \( C_s \) = specific capacitance of a single electrode (F/g), \( E \) = energy density (J/g), \( P \) = power density (W/g).
Figure S1. Overall surveys of XPS spectra of all carbon samples.
Figure S2. SEM images of (a-b) HCl-PANI, (c-d) PA-PANI1 and (e-f) PA-PANI2.
Figure S3. N₂ sorption isotherms and PSD by NLDFT of NODC, PNODC1 and PNODC2.
Figure S4. (a) CV curves at 100 mV/s; (b) galvanostatic charge and discharge curves; (c) specific capacitance vs. current density plots from 0.5 A/g to 10 A/g; (d) Nyquist plots, the inset is the magnified view of the high-frequency zone, of all carbon samples in three electrode system in the 1 M H$_2$SO$_4$ solution.

Figure S5. (a) CV from 5 mV/s to 200 mV/s and (b) galvanostatic charge and discharge curve of PNODC2 in three electrode system in 1 M H$_2$SO$_4$ electrolyte.
Figure S6. O spectrum of carbon materials after cycling at 10 A/g for 10000 cycles.
### Table S1. Elemental compositions of all carbon samples by XPS (at%).

<table>
<thead>
<tr>
<th>Sample</th>
<th>C</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>N+P+O</th>
</tr>
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<tbody>
<tr>
<td>NODC</td>
<td>89.09</td>
<td>7.65</td>
<td>3.26</td>
<td>0</td>
<td>10.91</td>
</tr>
<tr>
<td>PNODC1</td>
<td>83.89</td>
<td>5.32</td>
<td>7.82</td>
<td>2.96</td>
<td>16.11</td>
</tr>
<tr>
<td>PNODC2</td>
<td>82.24</td>
<td>4.74</td>
<td>9.76</td>
<td>3.26</td>
<td>17.76</td>
</tr>
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