**Supplementary Material**

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| a) b) |
| **Figure S1:** (a) 3-electrode system with 0.6 M of HCl (b) Hydrogel supercapacitor schematic diagram (NCH: NCH1, NCH2, NCH3) |

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| --- | --- |
| a) | b) |
| **Figure S2:** (a) Current density of different samples H1, NCH1, NCH2, and NCH3 (b) Cyclic voltammetry of H1, NCH1, NCH2, and NCH3 samples | |

|  |  |
| --- | --- |
| a) | b) |
| **Figure S3:** The cyclic voltammetry curve of the (a) NCHS2 and (b) NCHS3 samples under many cycles | |

**The composition and ratio of the hydrogel nanocomposite used in this study are as follows:**

1. Reduction of GO:

1.0% of GO was first dissolved in deionized water using ultrasonication. Then, 100 mg of ascorbic acid was slowly added to convert GO to RGO.

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| --- | --- | --- |
| Name | % mass | mass |
| Arabic gum (from acacia tree-branched polysaccharide) | 36.601% | 1.2g |
| Acrylic acid | 60.002% | 2g |
| APS (initiator) | 1.5% | 0.05g |

2. Preparation of Arabic gum-polyacrylic acid hydrogel:

1.2 g of AG was completely dissolved in 10 ml of deionized water, then 2 ml of AA solvent was slowly added. After 10 minutes, 0.082 g of FeCl3 and 0.05 g of APS were added to the hydrogel matrix. Then, keep stirring at 40 °C for 2 hours. Table S(1) shows the mass and percentage of each component in the hydrogel.

**Table S1:** Composition of the hydrogel

3. Preparation of RGO-AgNPs-AGPAA hydrogel:

The AgNO3 (1.0%, 0.5%, 0.1%) and 4 ml of solution (1) were slowly added to the hydrogel matrix (2) respectively and then allowed to stir at 90°C for 1 hour. Table S(2) shows the mass and percentage of each component in the nanocomposite hydrogel.

**Table S2:** Composition of the nanocomposite hydrogel

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| --- | --- |
| Name | Amount used |
| Arabic gum | 33.42% |
| Acrylic acid | 58.54% |
| APS | 1.39% |
| GO | 1% |
| Ascorbic acid | 5.57% |
| Ag+ | 0.1% |