Supplementary Figure 1 - Higher magnification scanning electron microscopy (SEM) longitudinal image showing interconnecting pores in tubular structures (i.e. - red circle) of carbonized aerenchyma tissue which enables radial water transport in carbonized red mangrove root (RMR).
Supplementary Figure 2 – Raman spectra for three independently prepared carbonized RMRs. The units for the y-axis are arbitrary units (a.u.).

Supplementary Table 1 – Raman shift for D-band (disorder) and G-band (graphitic) at five separate locations on three independently prepared samples. Calculated $I_d/I_g$ ratio was from peak intensity values.

| Measurement | Sample 1 | Sample 2 | Sample 3 |
|-------------|----------|----------|----------|
|             | D-band   | G-band   | $I_d/I_g$| D-band | G-band | $I_d/I_g$| D-band | G-band | $I_d/I_g$|        |
| 1           | 1336     | 1588     | 1.12     | 1336  | 1586   | 1.12     | 1346   | 1593   | 1.14     |        |
| 2           | 1333     | 1588     | 1.06     | 1341  | 1591   | 1.12     | 1336   | 1580   | 1.15     |        |
| 3           | 1331     | 1583     | 1.14     | 1336  | 1581   | 1.09     | 1336   | 1586   | 1.14     |        |
| 4           | 1331     | 1578     | 1.05     | 1338  | 1591   | 1.12     | 1333   | 1579   | 1.13     |        |
| 5           | 1338     | 1583     | 1.09     | 1336  | 1583   | 1.10     | 1336   | 1579   | 1.09     |        |
**Supplementary Figure 3** – Representative sample of element identification by energy dispersive X-ray (EDX) spectroscopy in carbonized RMR aerenchyma.Outlined purple box indicates region of interest in elemental identification.

**Supplementary Table 2 - EDX analysis at three locations on four independently prepared carbonized RMRs.** Each sample exhibits high C content accompanied by the presence of Mg in at least two locations (ND = no detection).

| Element (wt%) | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|--------------|----------|----------|----------|----------|
|              | #1       | #2       | #3       | #1       | #2       | #3       | #1       | #2       | #3       | #1       | #2       | #3       |
| C            | 93.90    | 95.26    | 95.26    | 75.49    | 83.64    | 78.90    | 93.47    | 93.07    | 95.50    | 93.47    | 93.07    | 95.50    |
| Mg           | 6.10     | 4.74     | 4.74     | 2.88     | 2.70     | 2.89     | 2.34     | 1.09     | ND       | 2.34     | 2.12     | ND       |
| O            | ND       | ND       | ND       | 17.50    | 11.04    | 15.25    | ND       | ND       | ND       | ND       | ND       | ND       |
| Cl           | ND       | ND       | ND       | 2.47     | 2.62     | 2.97     | 4.19     | 4.81     | 4.50     | 4.19     | 4.81     | 4.50     |
| Ca           | ND       | ND       | ND       | 1.67     | ND       | ND       | ND       | ND       | ND       | ND       | ND       | ND       |
Supplementary Figure 4 – Nitrogen adsorption isotherm for carbonized RMRs. Mean +/- s.e.m., n=4 independent experiments.
Supplementary Figure 5 - Cross-sectional area distribution of tube-like structures in (a) the aerenchyma of carbonized RMR and (b) the secondary xylem of carbonized common woody biomass. The average cross-sectional area of the tube-like structures in the carbonized RMR is approximately 10 times larger than that in the carbonized common woody biomass. Mean +/- s.e.m., n=5 (carbonized RMR) and n=3 (carbonized common woody biomass) independent experiments.
**Supplementary Figure 6** – Mangrove-based FT-CDI cell. Two carbonized RMRs arranged in series in a custom-fabricated silicone coupling and connected to a power supply via 0.3 mm graphite rods.

**Supplementary Figure 7** – Charge efficiency and average salt adsorption rate (ASAR) for each cycle during cyclic operation. Charge efficiency (black diamonds) and ASAR (red diamonds) trended upward after first cycle.
Supplementary Figure 8 - Charge/discharge current response from cyclic operation of bioinspired FT-CDI system. Initial capacitive current response for first 15 minutes corresponds to stopped-flow charging phase. Current response from 15 to 30 minutes corresponds to charging phase when flow is initiated (0.475 mL/min) while maintaining a potential of 1.5 V. Current response from 30 to 60 minutes corresponds to discharging phase at a flow rate of 0.475 mL/min and 0 V. (cycle 1 = orange; cycle 2 = pink; cycle 3 = purple, cycle 4 = light blue; cycle 5 = green)
Supplementary Figure 9 – Representative cross-sectional image of (a) carbonized RMR and (b) carbonized common woody biomass with epoxy filled pith.
Supplementary Figure 10 – Schematic of experimental setup for constant pressure hydraulic permeability experiments.
Supplementary Figure 11 – Schematic of FT-CDI experimental setup utilizing carbonized RMRs as highly permeable electrodes.
Supplementary Figure 12 - NaCl adsorption and concentration reduction control experiment examining the accuracy of the adsorption calculation method and conductivity meter. A 1200 mg/L NaCl solution was delivered through the flow-through capacitive deionization system in the absence of the carbonized red mangrove roots at a flow rate of 0.475 mL/min using a peristaltic pump. The inlet of the peristaltic pump was briefly inserted into a reservoir containing a NaCl solution of 1100, 1050, 1000, or 950 mg/L for approximately 3.7 minutes and then inserted back into the stock reservoir of 1200 mg/L. The reduction in NaCl concentration, which is similar to the concentration curves in Figure 4a, is indirectly measured using a flow-through conductivity meter and calculated from a calibration curve performed both before (Pre-run Calibration = black line) and after (Post-run Calibration = red line) the experiment shown above.
**Supplementary Table 3 – NaCl adsorption control calculation from Supplementary Figure 12.**

| NaCl (mg) | 1100 mg/L (1.745 mL) | 1050 mg/L (1.675 mL) | 1000 mg/L (1.720 mL) | 950 mg/L (1.750 mL) |
|-----------|----------------------|----------------------|----------------------|----------------------|
| Actual    | 0.175                | 0.251                | 0.344                | 0.438                |
| Pre-run Cal. | 0.158              | 0.234                | 0.320                | 0.431                |
| Post-run Cal. | 0.168              | 0.246                | 0.340                | 0.451                |
| Error (%) |                      |                      |                      |                      |
| Pre-run Cal. | -9.3%              | -6.9%                | -6.9%                | -1.6%                |
| Post-run Cal. | -4.0%              | -2.2%                | -1.2%                | 3.0%                 |

**Supplementary Table 4 – NaCl concentration reduction control from Supplementary Figure 12.**

| NaCl (mg/L) | 1100 mg/L (1.745 mL) | 1050 mg/L (1.675 mL) | 1000 mg/L (1.720 mL) | 950 mg/L (1.750 mL) |
|-------------|----------------------|----------------------|----------------------|----------------------|
| Actual      | 100                  | 150                  | 200                  | 250                  |
| Pre-run Cal. | 90                  | 139                  | 181                  | 235                  |
| Post-run Cal. | 95                  | 146                  | 192                  | 249                  |
| Error (%)   |                      |                      |                      |                      |
| Pre-run Cal. | -10.0%              | -7.3%                | -9.5%                | -6.0%                |
| Post-run Cal. | -5.0%              | -2.7%                | -4.0%                | -0.4%                |