

## Supporting Information

### A supplementary physical model of supercapacitor to reveal the mechanism of voltage recovery phenomenon

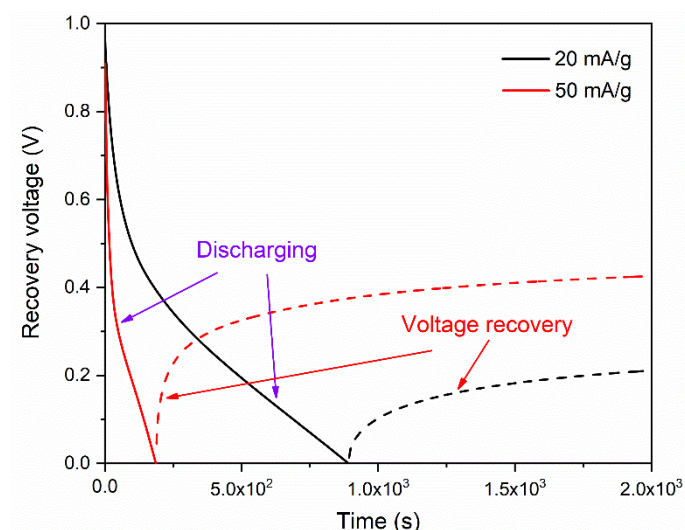
#### EXPERIMENTAL

##### Materials and Method

Potassium hydroxide (KOH, 90%) was purchased from Sigma-Aldrich Co. Ltd. Biochar electrodes were prepared by carbonization (see our before works), then cut to  $2 \times 1.5 \text{ cm}^2$ . Metal plates were stainless steel with  $4 \times 4 \text{ cm}^2$ . The cells were made with two electrodes, one separator and electrolytes.

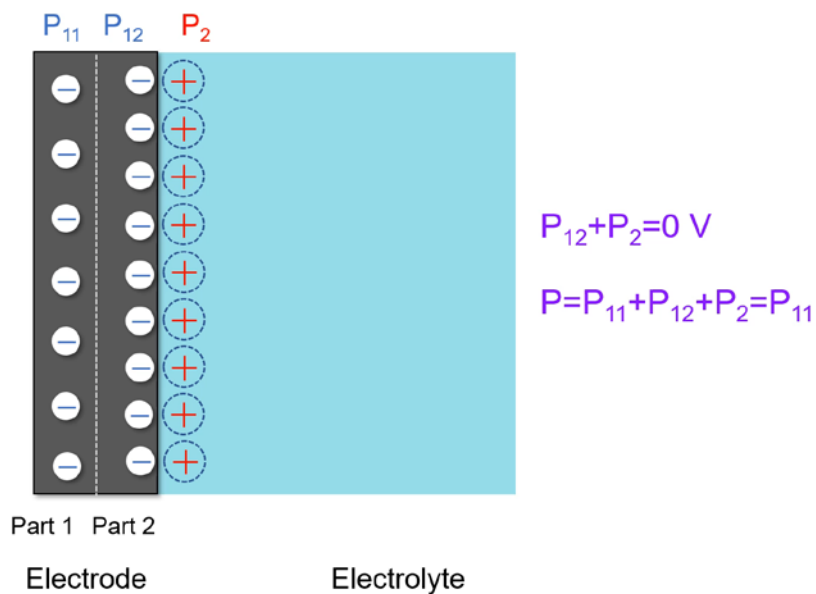
##### Characterization

All of experiments were carried out using electrochemical measurement unit (Autolab PGSTAT302N) with two electrodes system.



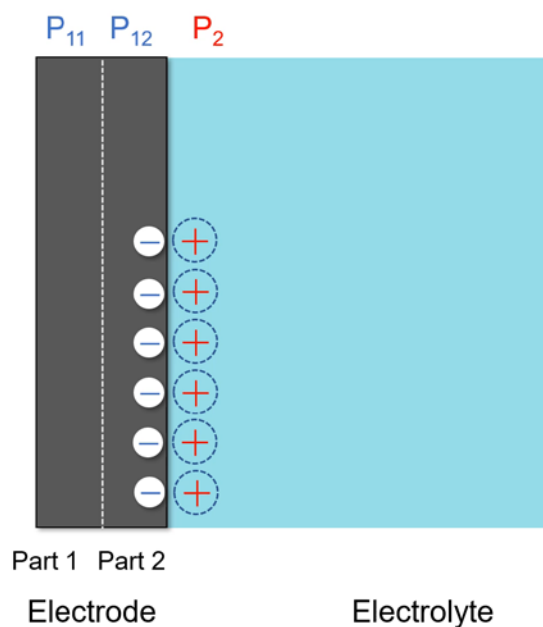
**Fig. S1** The plots of voltage recovery, cell made by pine biochar ( $20 \times 15 \times 2 \text{ mm}^3$ ), electrolyte is 4 M KOH

Discharge process

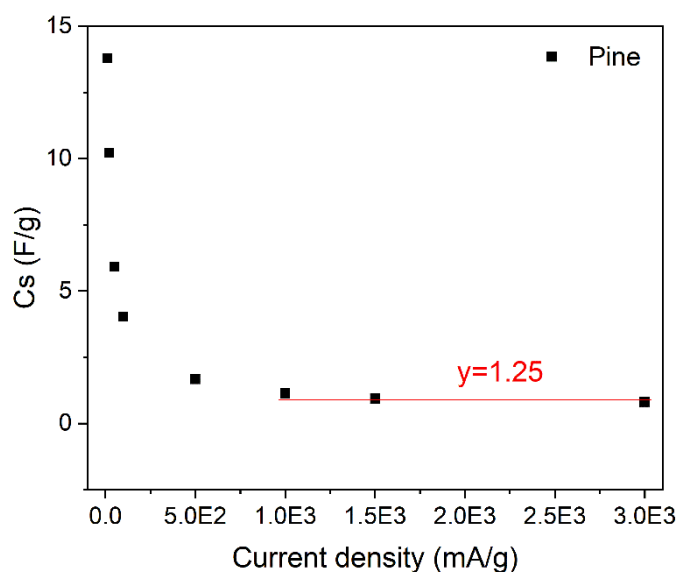


**Video S1** Schematic animation of discharge process (double click to watch the video)

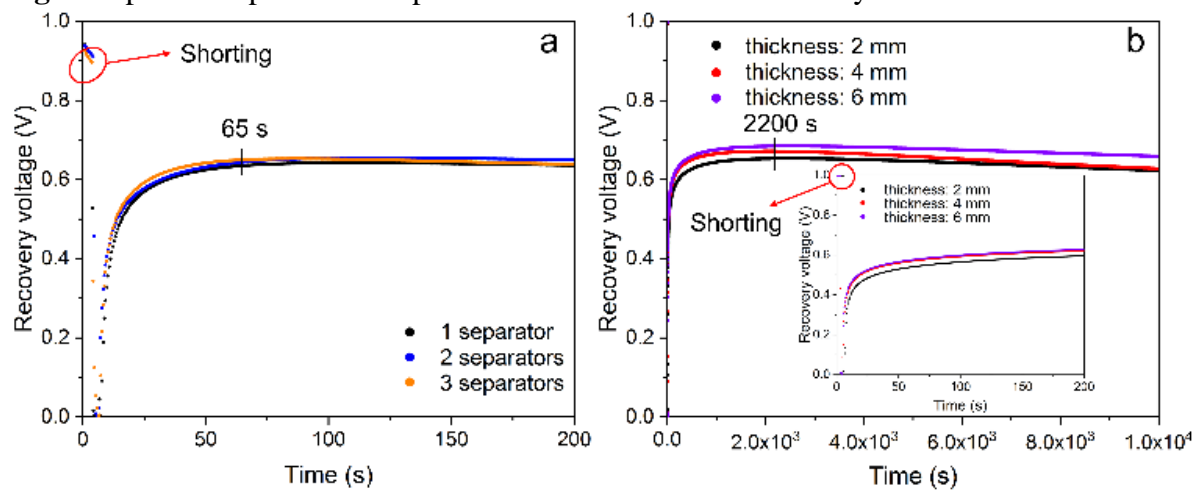
Voltage recovery



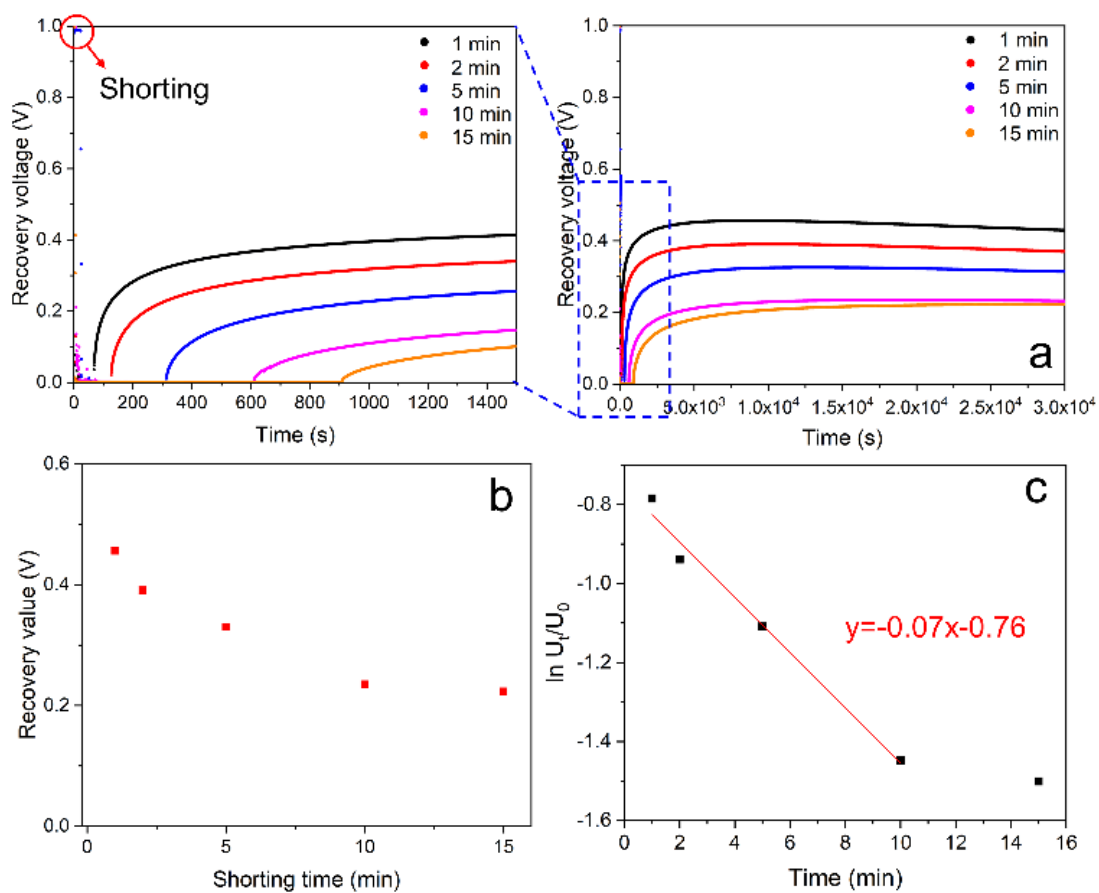
**Video S2** Schematic animation of voltage recovery (double click to watch the video)



**Fig. S2** Specific capacitance of pine cell at different current density



**Fig. S3** The voltage recovery of a) metal cells with different separators b) cells made by different thickness of pine biochar



**Fig. S4** a) voltage recovery, b) recovery value after different shorting time and c)  $\ln \frac{U_t}{U_0}$  vs.  $t$