Supporting Information

# Assembly of electric double-layer capacitors with hardwood kraft lignin-based electrodes and separator together with ionic liquid electrolyte

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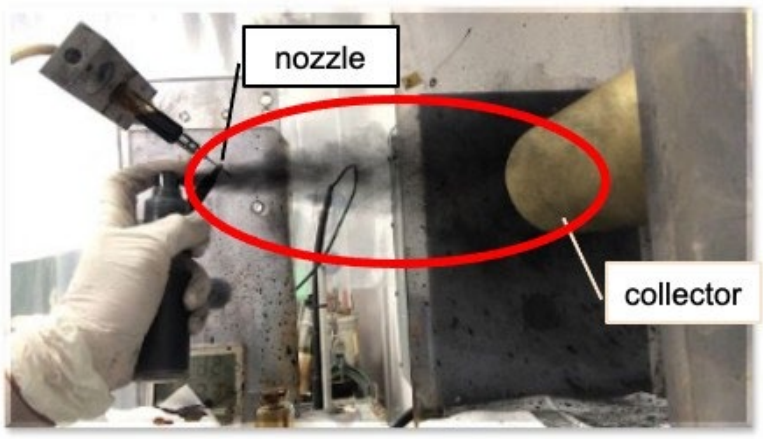
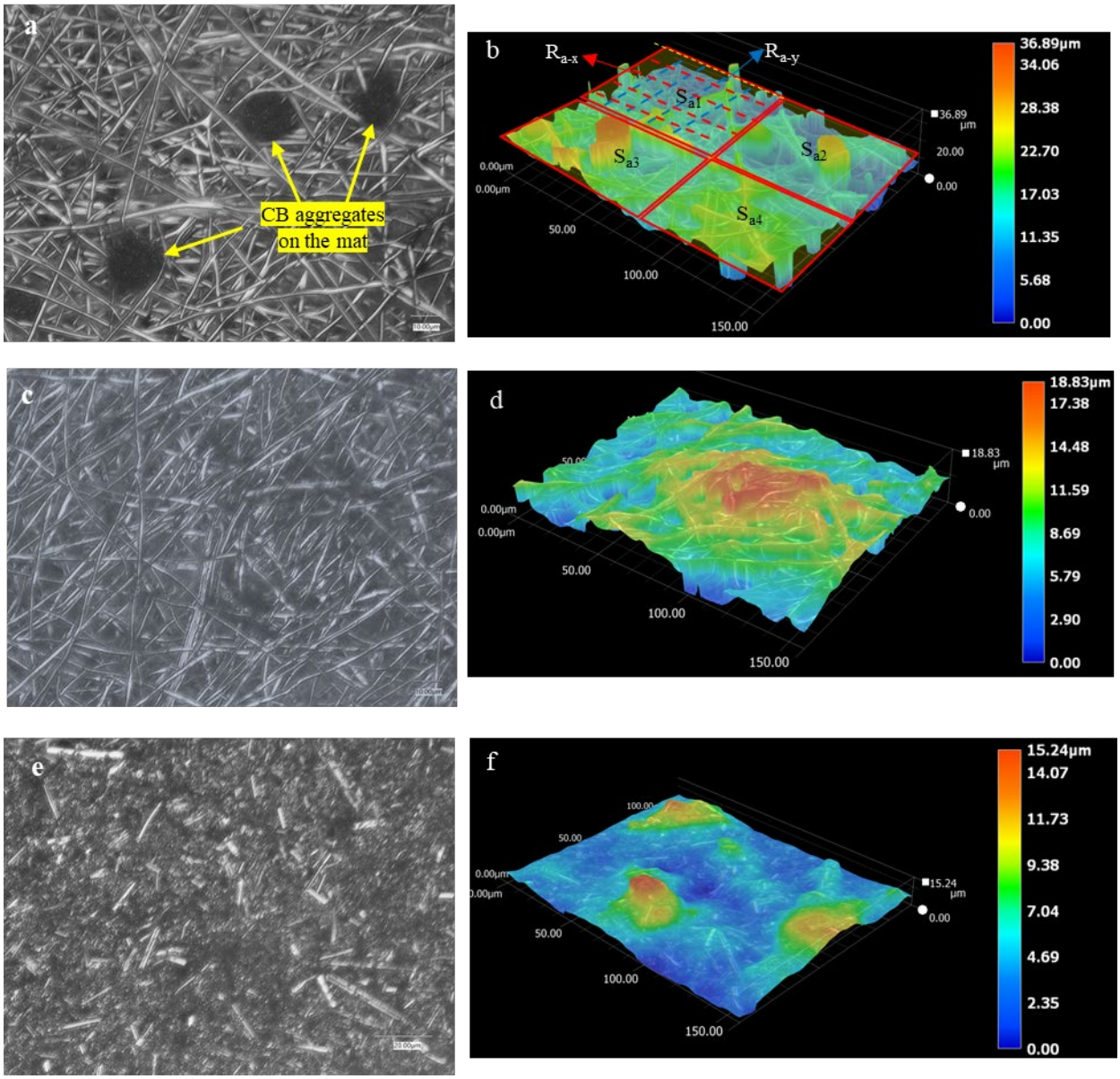
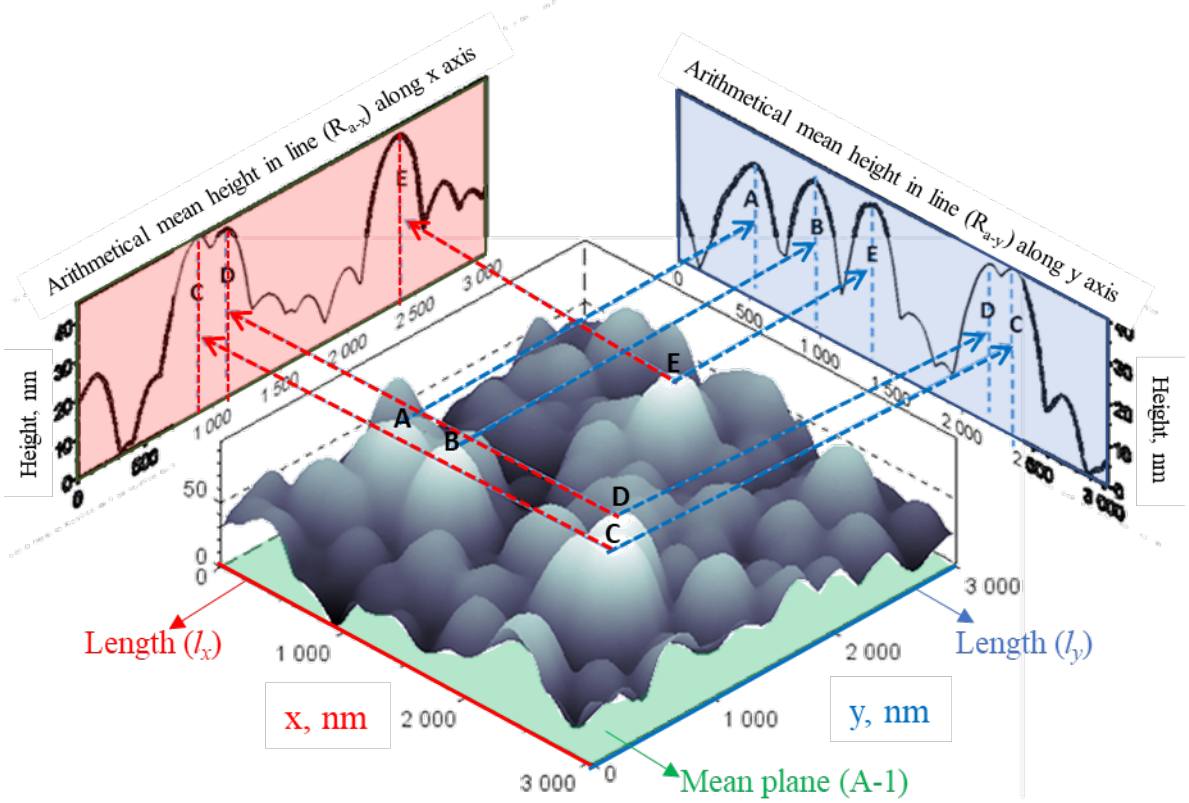



**Supplementary Figure S1:** A picture of spraying a 1 wt.% conductive carbon black (CB) suspension in acetone over an electrospun fiber mat during the electrospinning of the HKL-containing dope. The CB suspension was simply prepared by mixing a predetermined amount of CB powder and acetone with stirring at RT.




**Supplementary Figure S2:** 2D and 3D surface images of the HKL-based electrodes: (a, b) E-S-CB-mat, (c, d) E-MS-CB-mat, and (e, f) E-S-CB-powder at a magnification ×2000.

# How to calculate surface roughness (Sa)



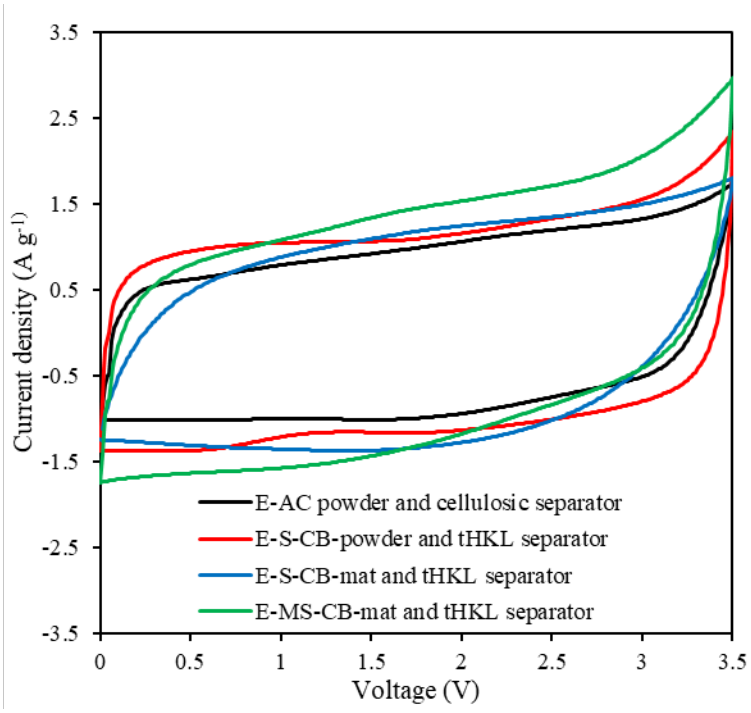

**Arithmetical mean height in line ($R_a$)**

along x axis: $R_{a\text{-}x} = \frac{1}{l_x}\int_0^{l_x} |z(x)|dx$

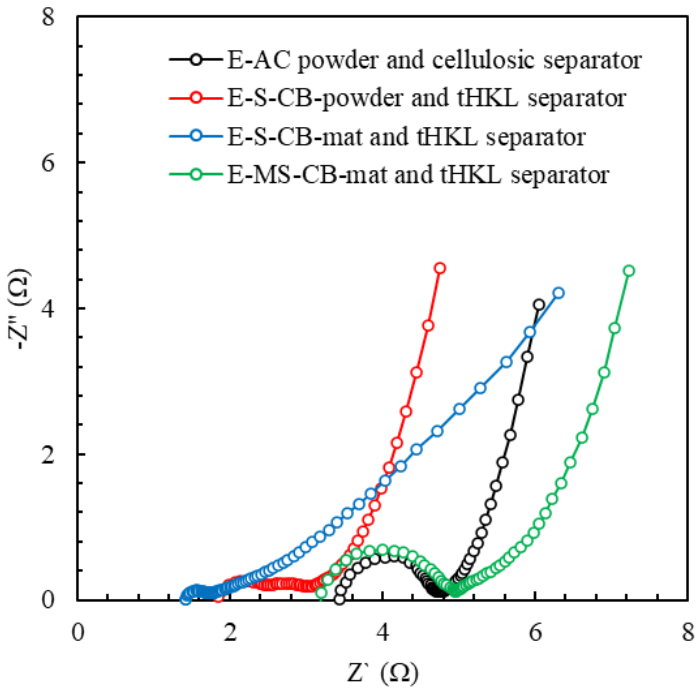
along y axis: $R_{a\text{-}y} = \frac{1}{l_y}\int_0^{l_y} |z(y)|dy$

**Arithmetical mean height of the surface ($S_a$)**

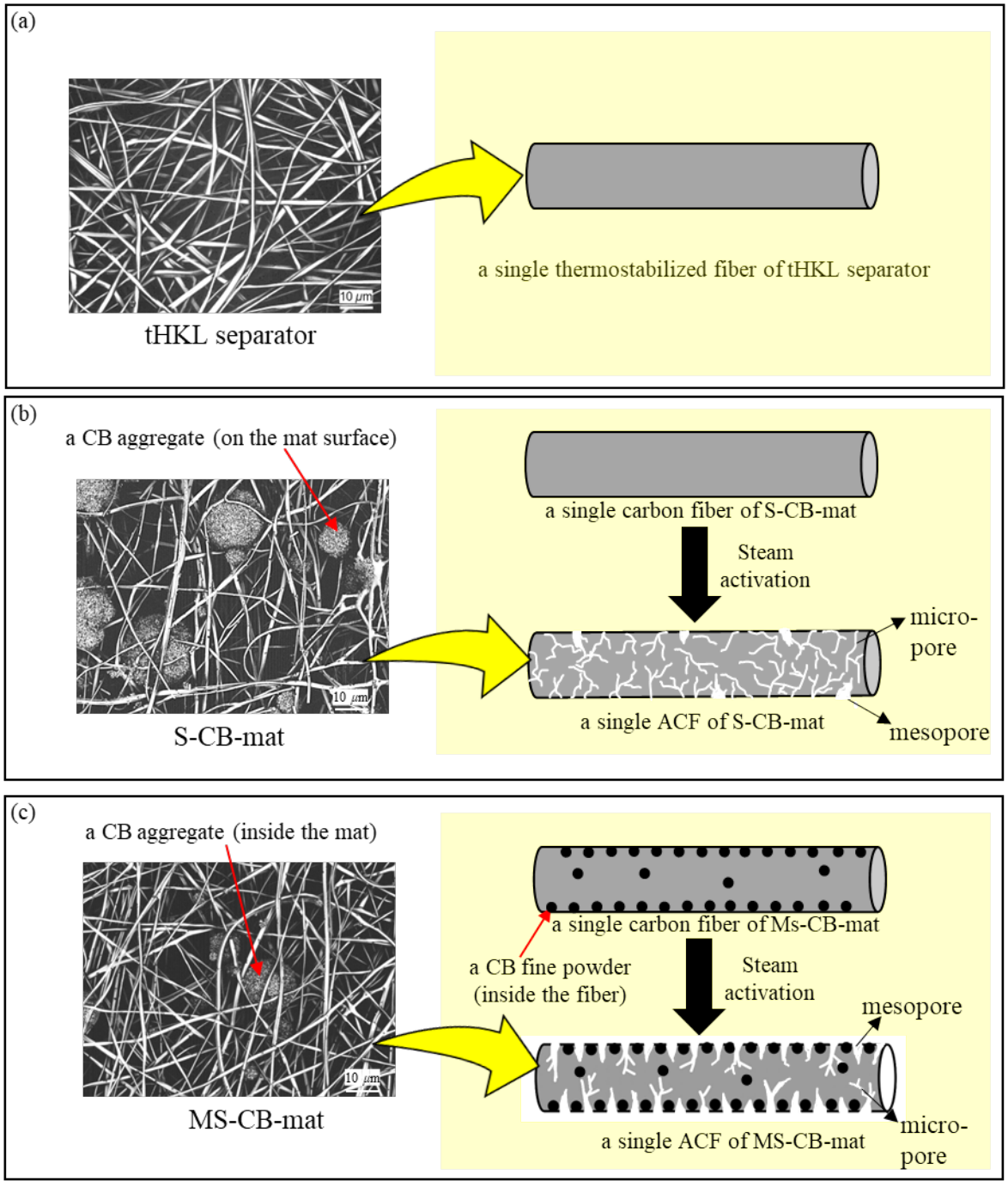
Mean plane: $S_{a1} = \frac{1}{A_1}\iint_{A_1} |z(x,y)|\,dx\,dy$



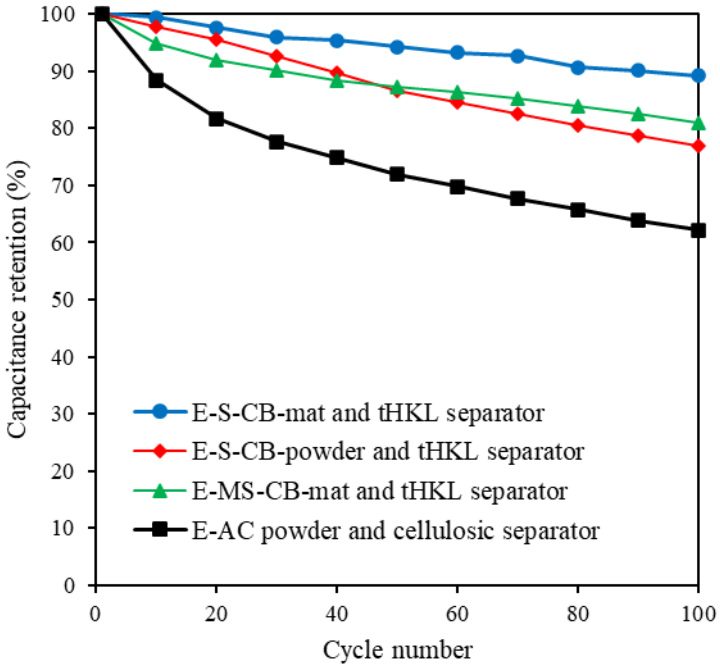

**Supplementary Figure S3:** Average cyclic voltammograms (CVs) of HKL-based EDLCs and a reference EDLC at scan rate of 0.05 V $s^{-1}$.



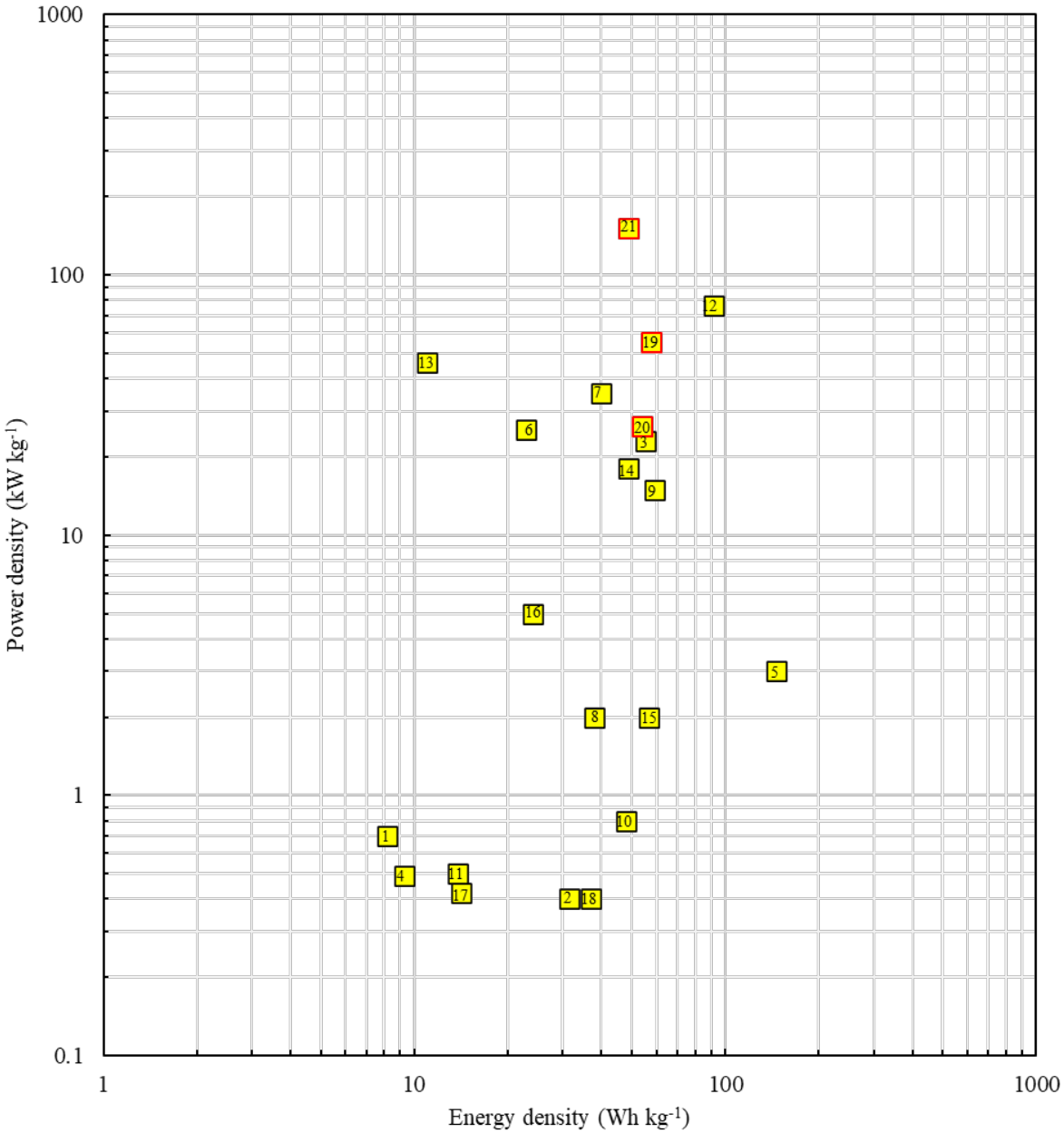

**Supplementary Figure S4:** Nyquist plots of HKL-based EDLCs and a reference EDLC.




**Supplementary Figure S5:** 2D surface images of ACF mats and schematic illustrations of (a) a single thermostabilized fiber of tHKL separator and single carbon fibers of (b) S-CB-mat and (c) MS-CB-mat. These carbon fibers were activated by steam to develop micro- and mesopores in the fibers. CB aggregates are located both on the surface and inside of the S-CB-mat, while the aggregates positions only inside the MS-CB-mat in which CB fine powders would be dispersed in each single fiber.




**Supplementary Figure S6:** Cyclic stability of HKL-based EDLCs and a reference EDLC as shown by capacitance retention from GCD at current density of 1 A $g^{-1}$.




**Supplementary Figure S7:** Comparison of energy and power densities of lignin-based EDLCs.

# References in Figure S7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19. This work (**E-MS-CB-mat**)
20. This work (**E-S-CB-mat**)
21. This work (**E-S-CB-powder**)