Supporting Information

Inspired by Bread Leavening: One-pot Synthesis of Hierarchically Porous Carbon for Supercapacitors

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1. Tables

Table S1. Textural properties of the as-synthesized products calcined at 900 ^{o}C with different mass ratio of $KHCO_3$ to cellulose.

Mass ratio of $KHCO_3$ to cellulose	S_{BET} ($m^2\ g^{-1}$)	Total pore volume ($m^2\ g^{-1}$)	V_{mic}/V_{total}
0*	506.2	0.28	0.68
2	1689.8	0.98	0.35
4	1893.0	1.37	0.18
8	1709.0	1.19	0.23

[*] 0 represented cellulose was calcined without $KHCO_3$

Table S2. Textural properties of the as-synthesized products* calcined at different temperature.

Temperature (^{o}C)	SBET ($m^2\ g^{-1}$)	Total pore volume ($m^2\ g^{-1}$)	V_{mic}/V_{total}
400	52.7	0.084	0.03
600	593.3	0.33	0.81
800	1062.6	0.61	0.67
900	1893.0	1.37	0.18

[*] Mass ratio of $KHCO_3$ to cellulose is 4.

Table S3. The yield and EA results of the as-synthesized products[*] calcined at different temperature.

Temperature (^oC)	Yield (%)	C (%)	H (%)	O (%)
600	15.9	79.38	2.62	18
800	9.5	80.27	2.27	17.47

[*] Mass ratio of KHCO3 to cellulose is 4.

Table S4. The yield and EA results of the as-synthesized products calcined at 900 ^oC with different mass ratio of $KHCO_3$ to cellulose.

Mass ratio of $KHCO_3$ to cellulose	Yield (%)	C (%)	H (%)	O (%)
0*	13.4	73.5	2.70	23.81
2	5.5	84.84	1.47	13.7
4	7.3	88.84	1.44	9.73
8	4.3	88.1	1.27	10.64

[*] 0 represented cellulose was calcined without $KHCO_3$

Table S5. The yield and textural properties of $C_{x\text{-}LE}$ and C_x (x represents the resource)

	Yield (%)	S_{BET} ($m^2\ g^{-1}$)	Total pore volume ($m^2\ g^{-1}$)	V_{mic}/V_{total}
C_{chi}	21.3	371.8	0.26	0.42
$C_{chi\text{-}LE}$	8.0	1762.1	1.05	0.26
C_{sta}	9.1	829.7	0.44	0.86
$C_{sta\text{-}LE}$	5.6	1962.7	1.21	0.28
C_{bam}	20.2	524.9	0.28	0.79
$C_{bam\text{-}LE}$	16.1	1425.2	0.83	0.56
C_{suc}	18.4	391.9	0.20	0.91
$C_{suc\text{-}LE}$	6.9	1750.7	1.06	0.32
C_{xyl}	12.5	645.4	0.35	0.81
$C_{xyl\text{-}LE}$	10.1	1600.1	1.01	0.36
C_{glu}	9.8	767.1	0.40	0.86
$C_{glu\text{-}LE}$	7.4	1829.0	1.14	0.25

2. Figures

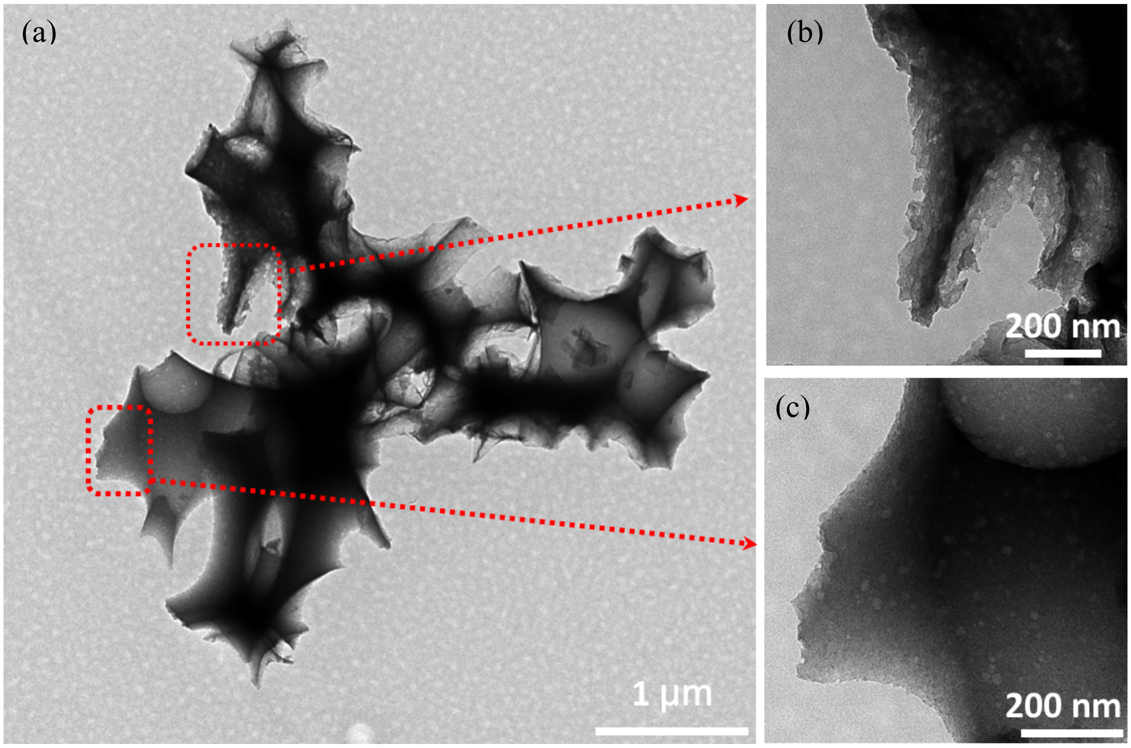

Fig. S1 TME images of Ccel-LE. (cel stands for cellulose)

The macropores can been seen from the TEM image (Figure S1 a). The mesopores can be disclosed from the enlarged TEM images (Figure S1 b and c).

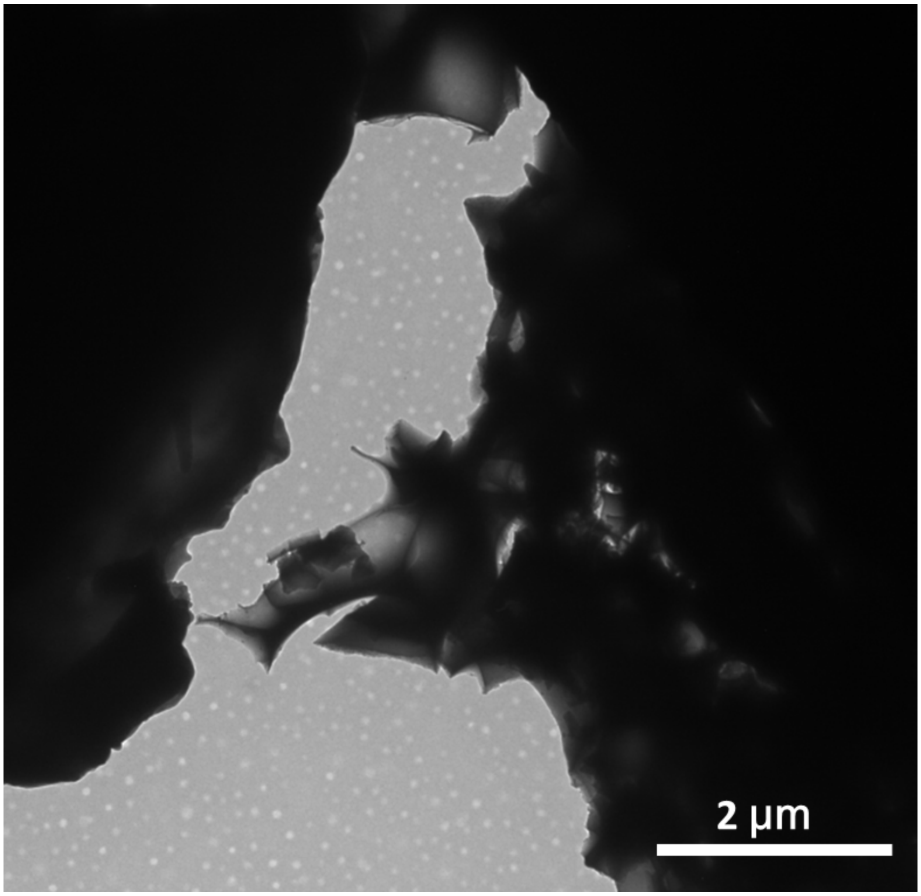

Fig. S2 TEM image of C_{cel}. (cel stands for cellulose)

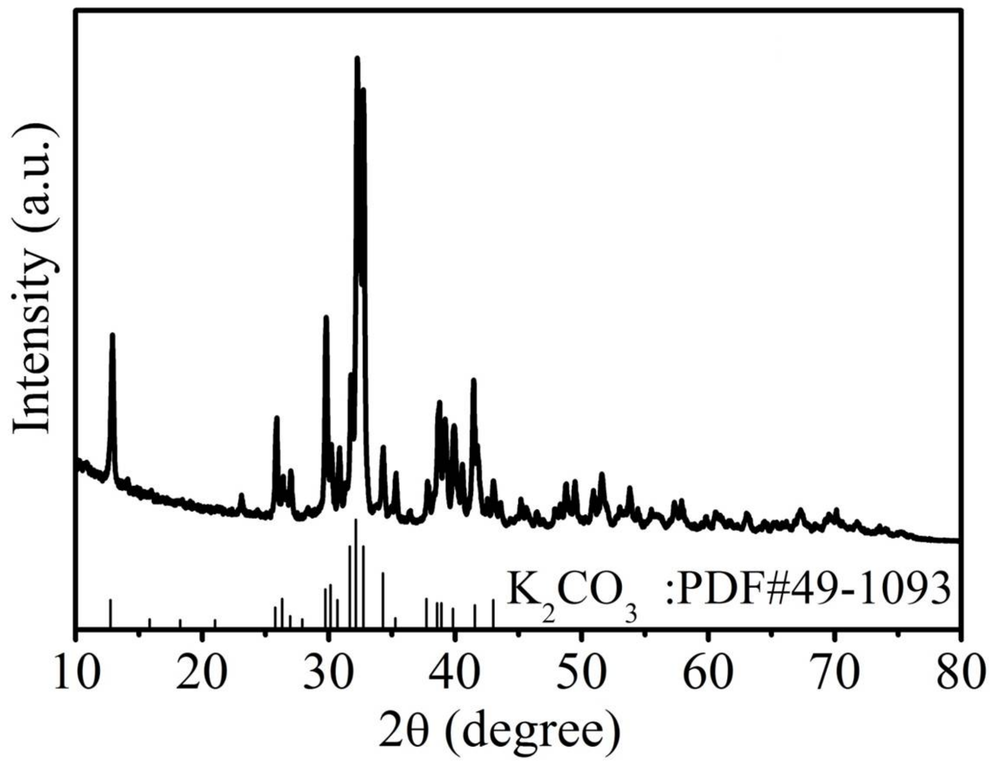

Fig. S3 the XRD spectrum of $C_{cel\text{-}LE}$ before washing with HCl.

The XRD spectrum of $C_{cel\text{-}LE}$ before washing with HCl solutions demonstrate that $KHCO_3$ decomposed into K_2CO_3 during the pyrolysis.

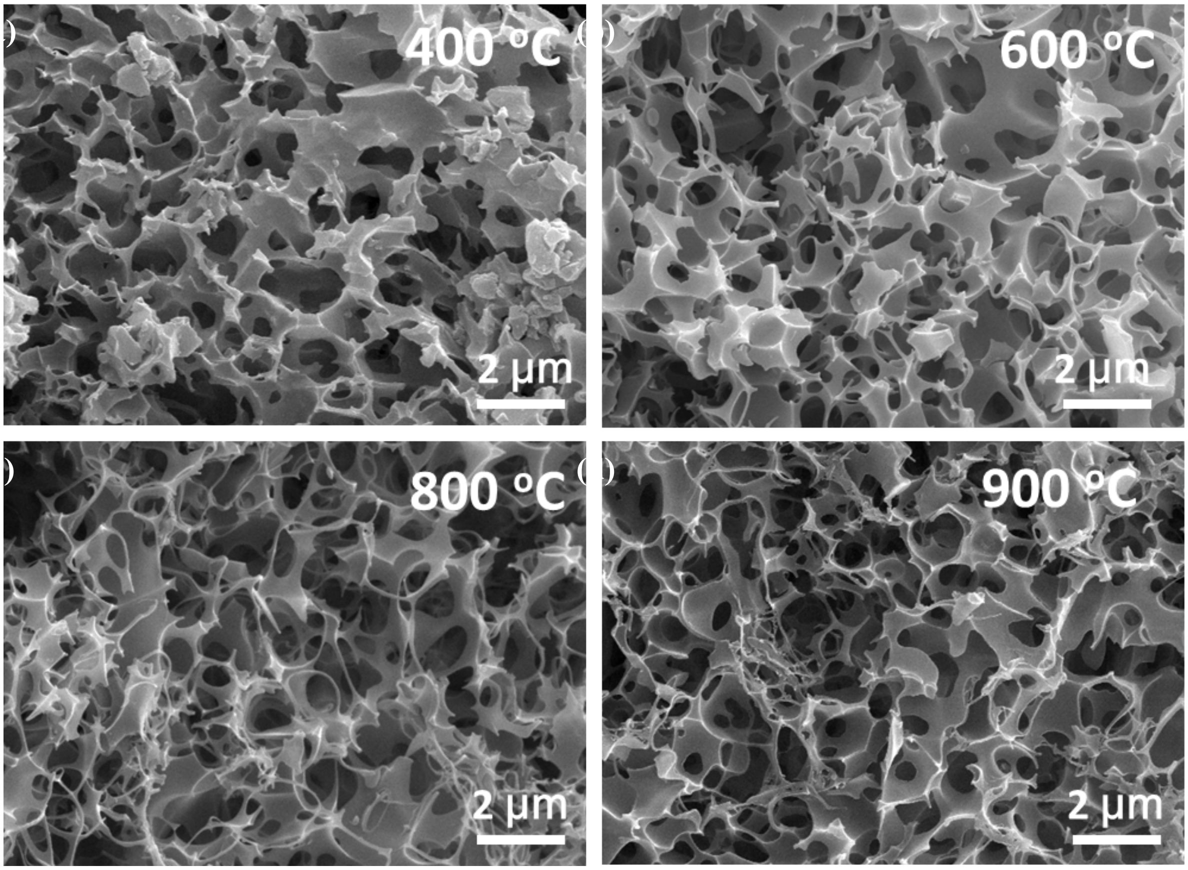

Fig. S4 SEM images of $C_{cel\text{-}LE}$ of different temperature (a) 400 ^{o}C, (b) 600 ^{o}C, (c) 800 ^{o}C, (d) 900 ^{o}C.

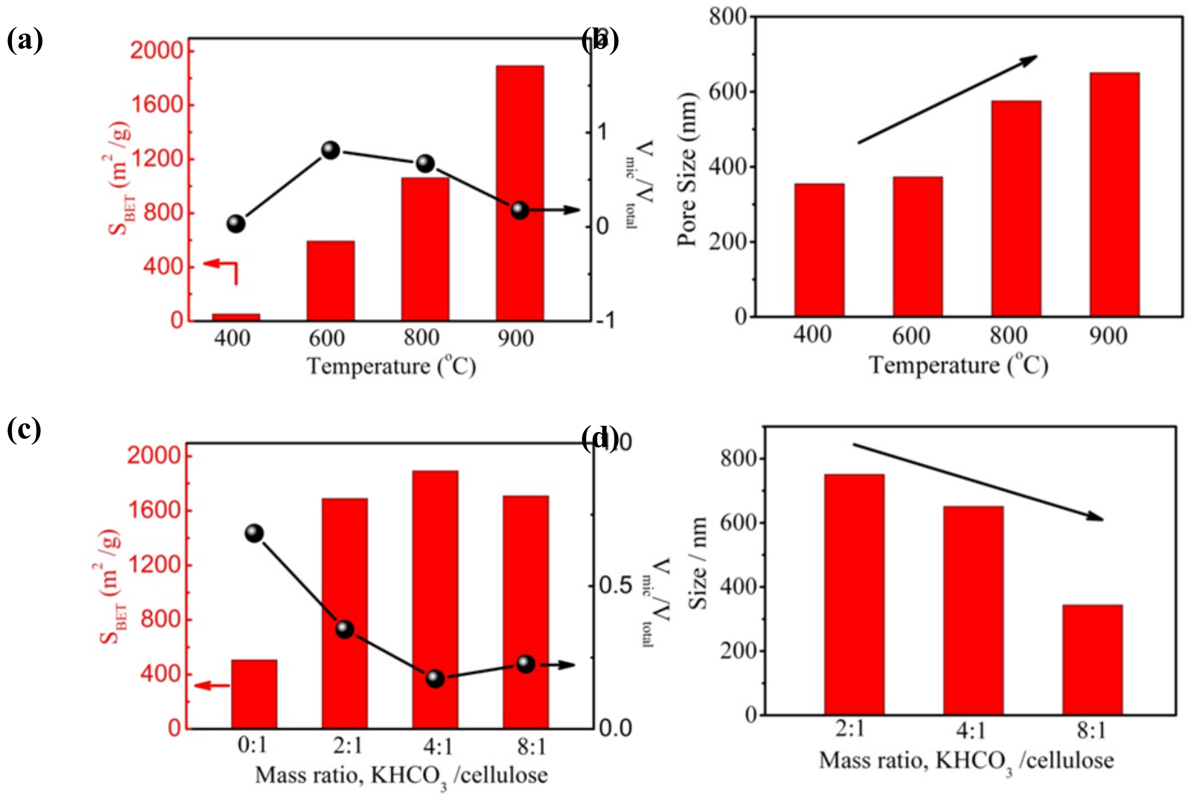

Fig. S5 (a) SSA calculated by the Brunauer–Emmett–Teller (BET) model, V_{mic}/V_{total} and (b) the average size of macropores of the as-prepared porous carbon materials with different temperature, the mass ratio of $KHCO_3$ to cellulose is 4, (c) SSA calculated by the Brunauer–Emmett–Teller (BET) model, V_{mic}/V_{total} and (d) the average size of macropores of the as-prepared porous carbon materials with different mass ratio, the annealing temperature is 900 ^{o}C. (the average size of macropores was calculated by measuring SEM images)

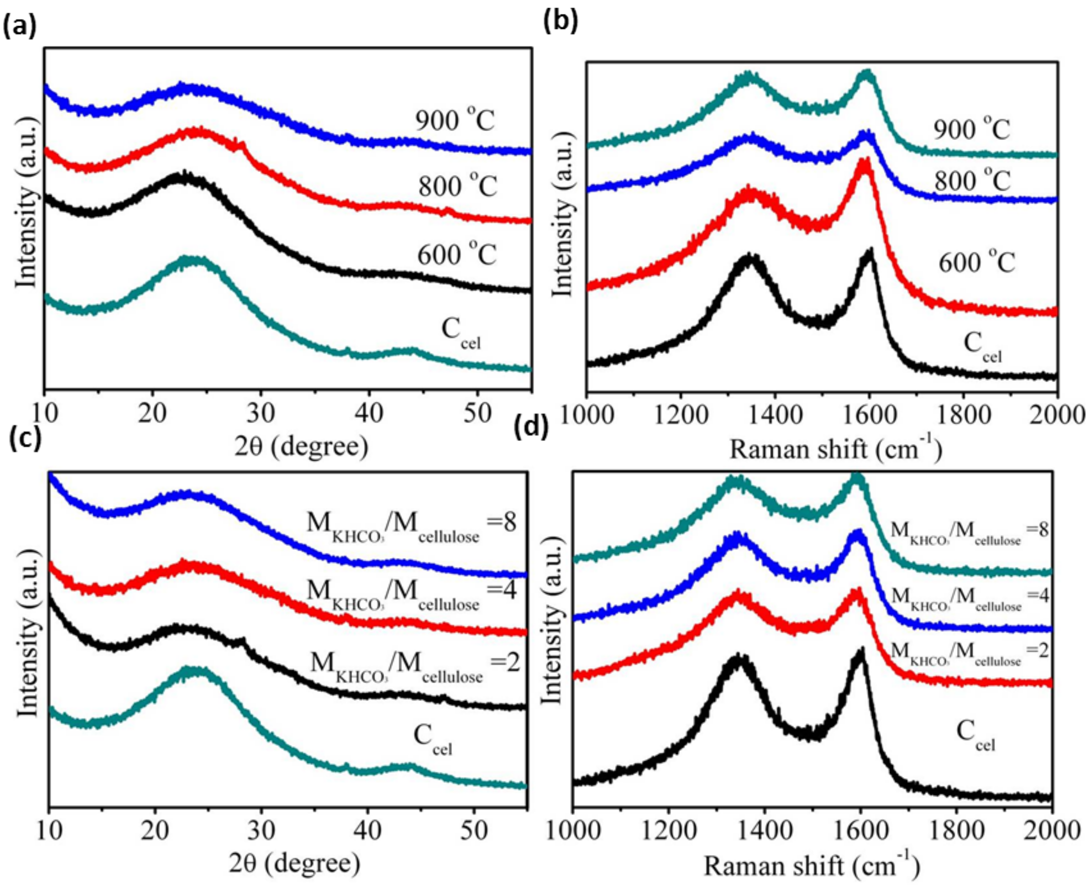

Fig. S6 (a) XRD results and (b) Raman spectras using 514 nm excitation of $C_{cel\text{-}LE}$ with different temperature and C_{cel}; (c) XRD results and (d) Raman spectras using 514 nm excitation of simples calcined at 900 ^{o}C with different mass ratio of $KHCO_3$ to cellulose.

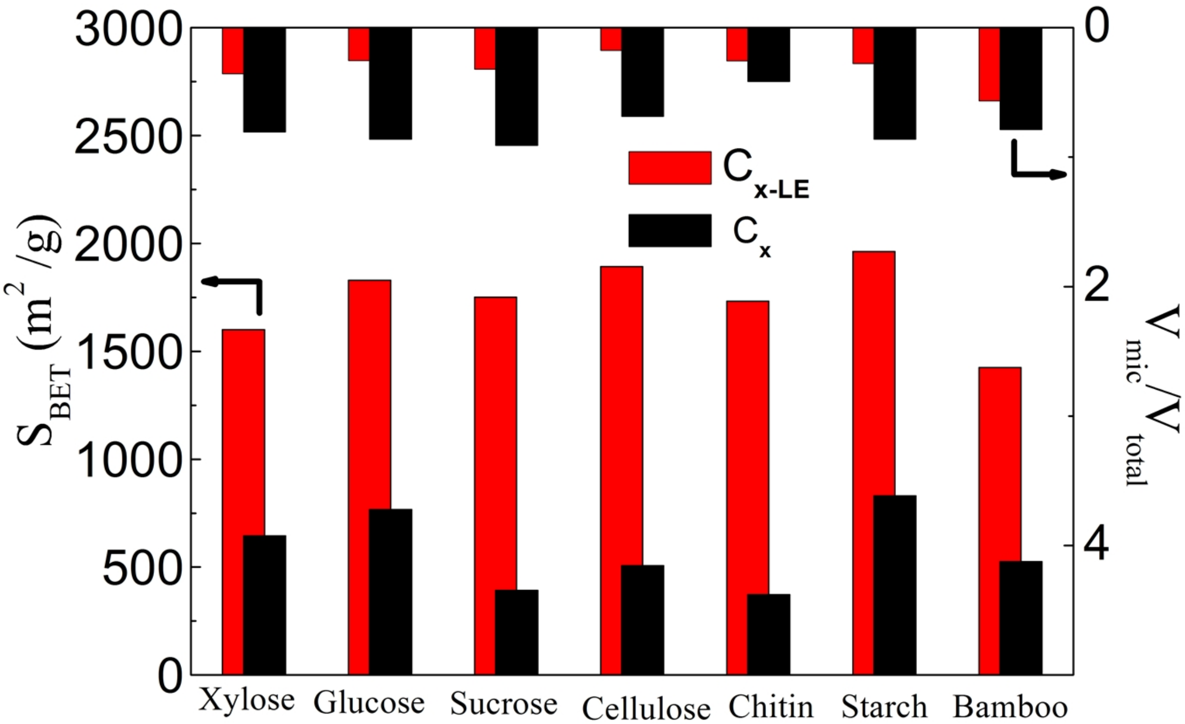

Fig. S7 The specific surface areas and V_{mic}/V_{total} of the C_x and C_{x-LE} where x stands for the carbon precursor.

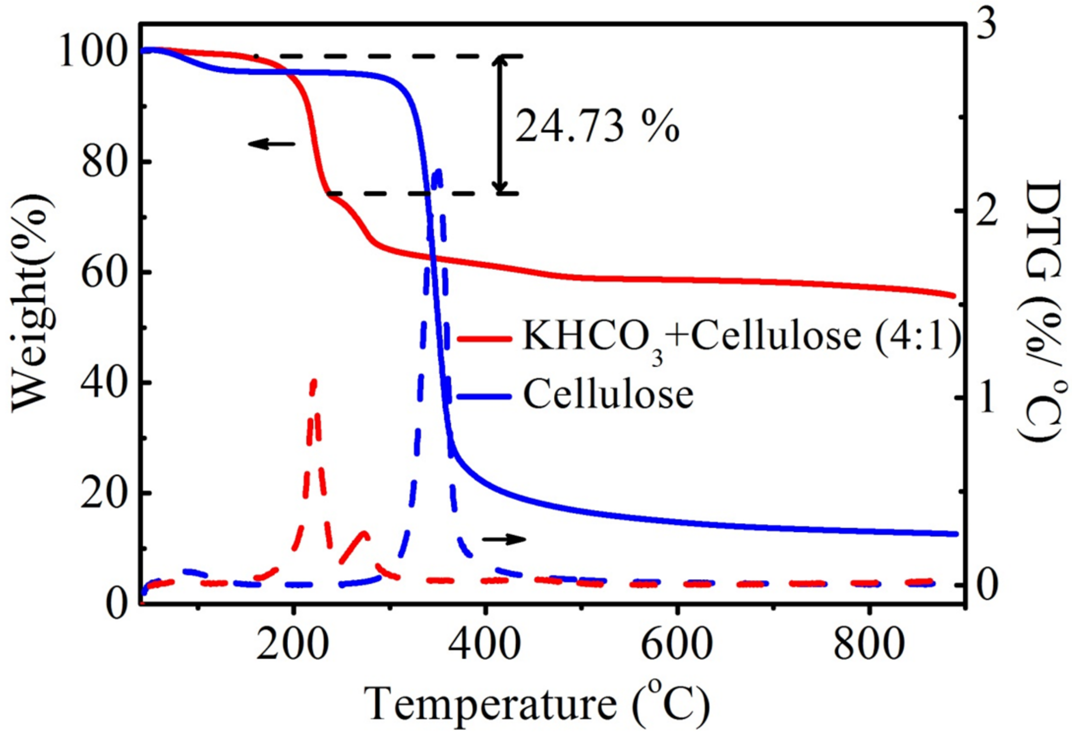

Fig. S8 TGA results for the mixture of $KHCO_3$ and cellulose (4:1) (red) and cellulose (blue). $KHCO_3$ decompose through reaction 1. The TGA was measured at 15 ^{o}C / min under the atmosphere of N_2.

$$2KHCO_3 \longrightarrow K_2CO_3 + CO_2 + H_2O \qquad (1)$$

Molecular weight 100.12×2 138.21 44.01 + 18.02=62.03

CO_2 and H_2O is gas when temperature is above 200 ^{o}C.

So the weight loss of the mixture of $KHCO_3$ and cellulose ($mass_{KHCO3}/mass_{cellulose}$=4)

$$\text{Weight loss (\%)} = \frac{M_{(co_2+H_2O)}}{M_{KHCO_3}+M_{cellulose}} \times 100\%$$

$$= \frac{M_{KHCO_3}}{M_{KHCO_3}+M_{cellulose}} \times \frac{62.03}{100.12\times 2} \times 100\% \qquad = \frac{4}{4+1} \times \frac{62.03}{100.12\times 2} \times 100\% \qquad = 24.78\%$$

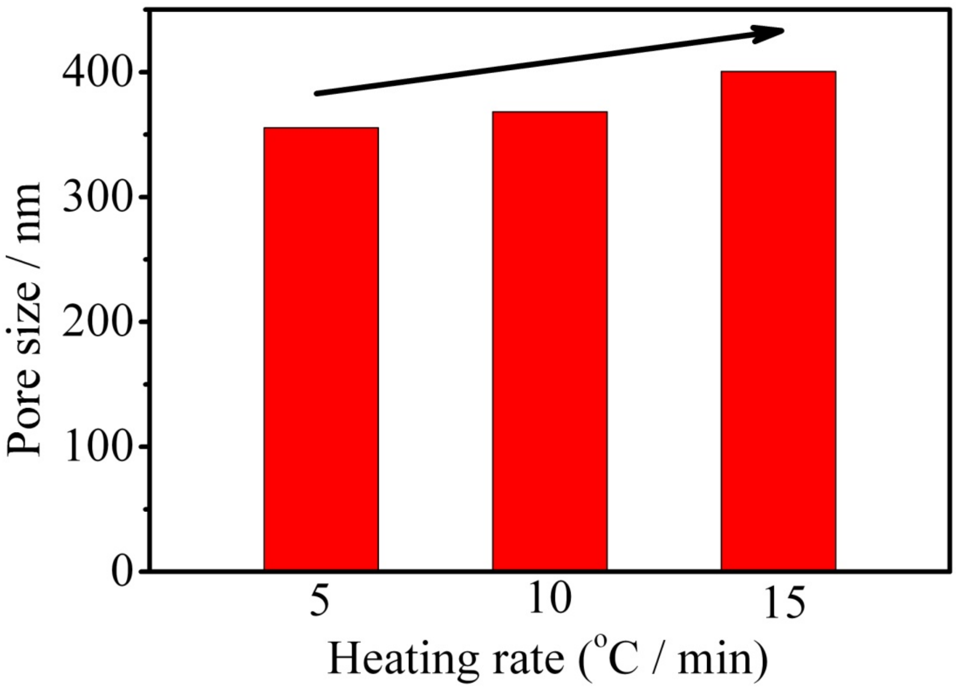

Fig. S9 The average size of macropore of the as-prepared porous carbon material calcined at 400 °C with different heat rate.

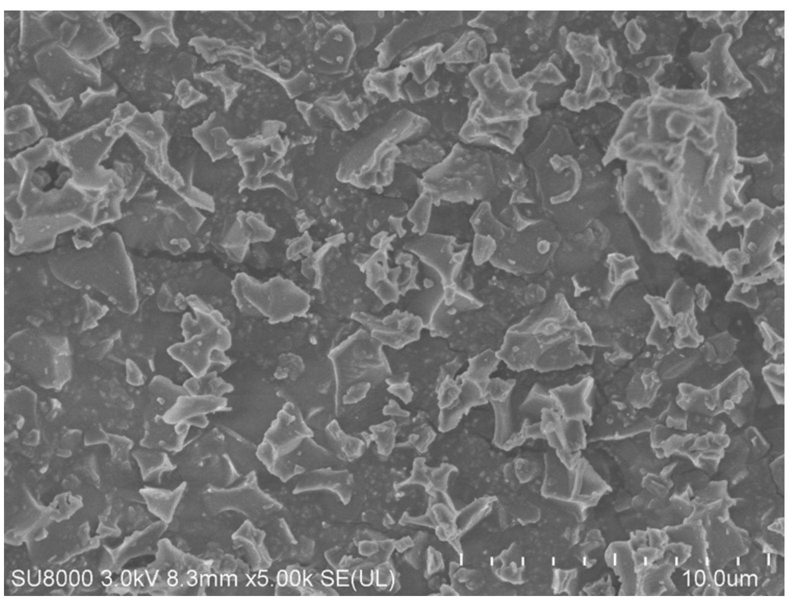

Fig. S10 SEM image of the product derived from mixture of K_2CO_3 and cellulose undergoing pyrolysis at 400 °C.

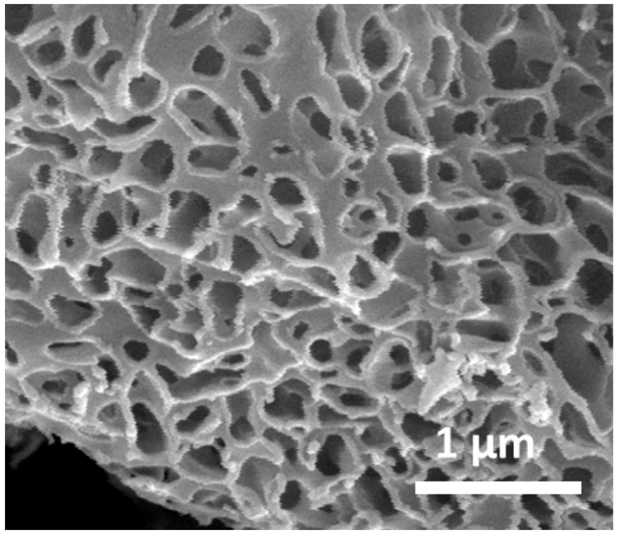

Fig. S11 SEM image of product synthesized by pyrolysized the mixture of $NaHCO_3$ and cellulose as the same procedure as $C_{cel\text{-}LE}$.

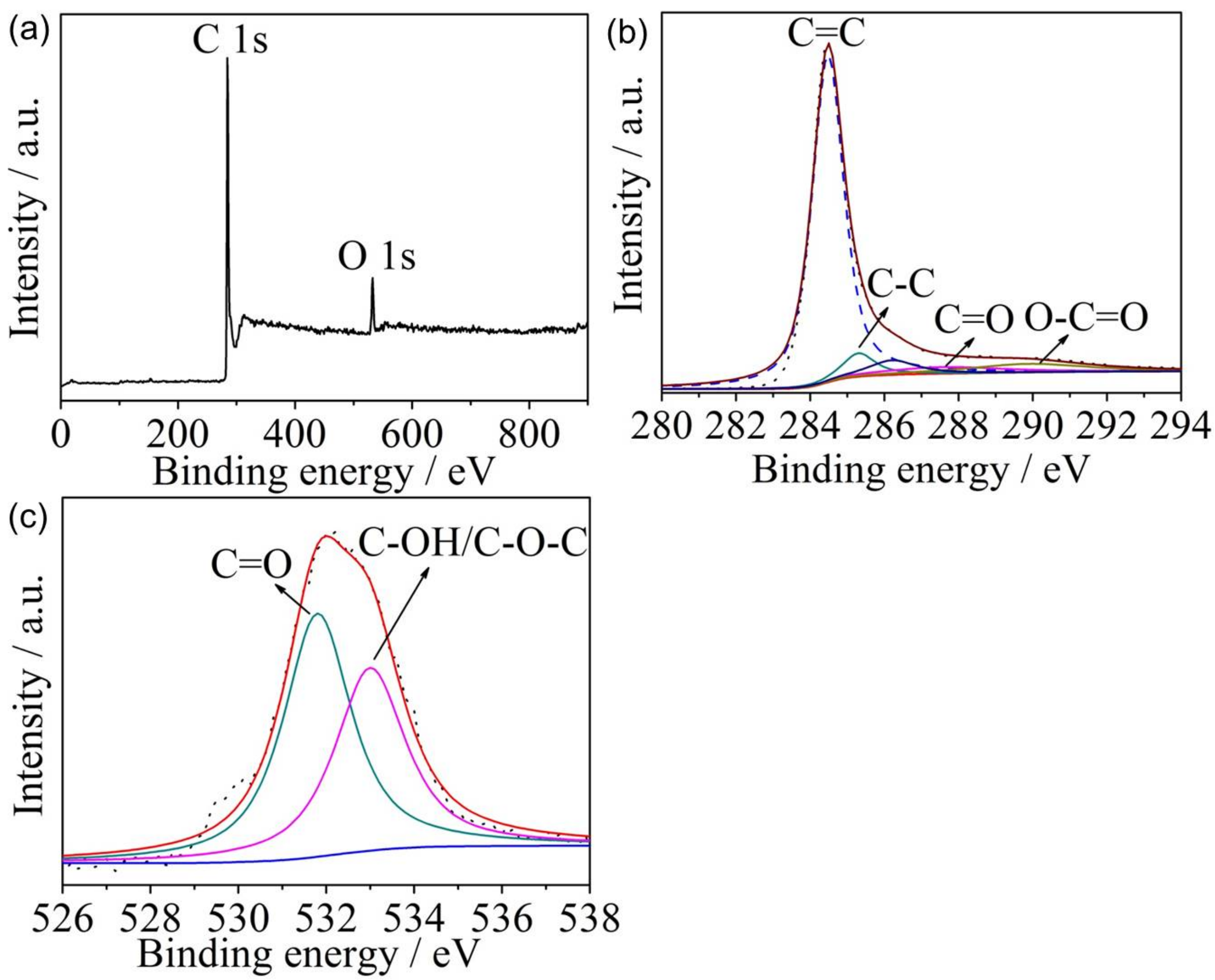

Fig. S12 (a) XPS, (b) C 1s, (c) O 1s spectra of $C_{cel\text{-}LE}$.

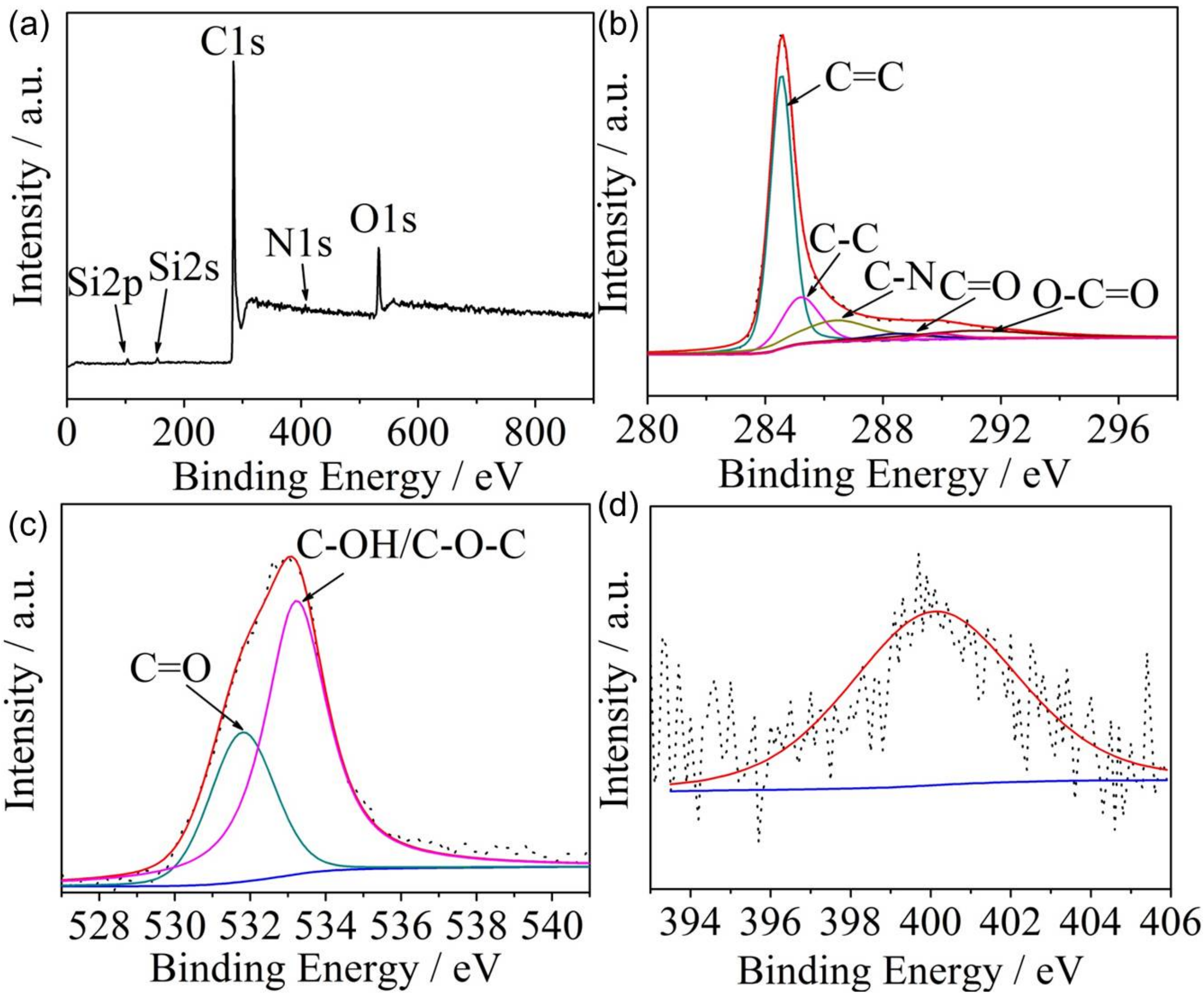

Fig. S13 (a) XPS, (b) C 1s, (c) O 1s, (d) N 1s of $C_{bam\text{-}LE}$.

The XPS spectrum (Fig. S12a) of $C_{cel\text{-}LE}$ possess only two peaks at 284.4 eV and 532 eV, corresponding to C 1s and O 1s, respectively. This results also demonstrate that activators or the by-products have been removed thoroughly. The XPS spectrum of the C 1s (Fig. S12b) can be divided into four peaks, which are associated with C=C (sp2), C-C (sp3), C=O, and O=C-O. Accordingly, two peaks of the XPS spectrum of O 1s can be associated with C=O and C-OH/C-O-C, respectively. As for the XPS spectrum of $C_{bam\text{-}LE}$ whose carbon resourse come from the crude biomass – bamboo and contain plenty of heteroatoms, the peak of N 1s, Si 2s, and Si 2p are also included beside the peak of C 1s and O 1s. Accordingly, the divided peak of C 1s and N 1s also reflect the existance of C-N.[1]

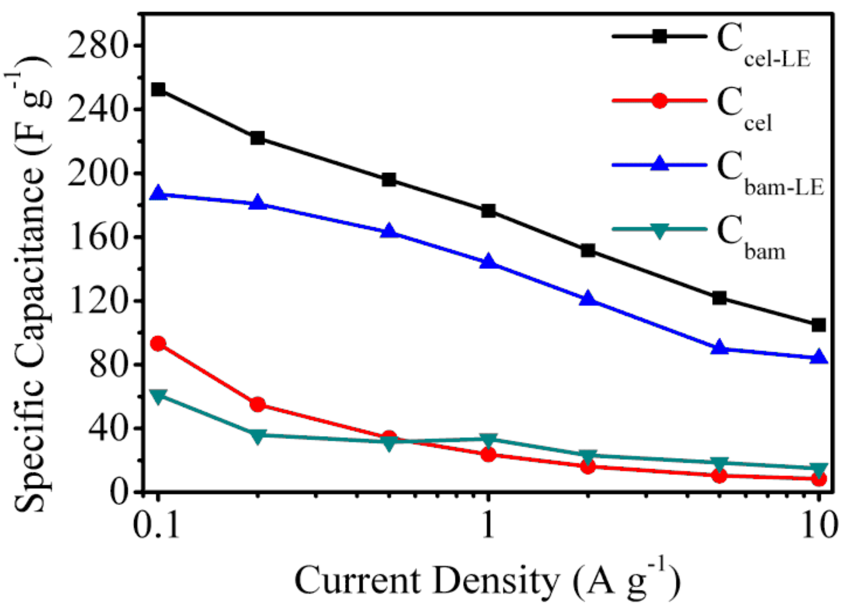

Fig. S14 The specific capacitance of C_{cel-LE}, C_{cel}, C_{bam-LE} and C_{bam} as a function of current density ranging from 0.1 to 10 A g^{-1}

Reference

1. D. Wei, Y. Liu, Y. Wang, H. Zhang, L. Huang and G. Yu, *Nano Lett.*, 2009, **9**, 1752-1758.