Supplementary information

Design and Fabrication of Hierarchically Porous Carbon with a Template-free Method

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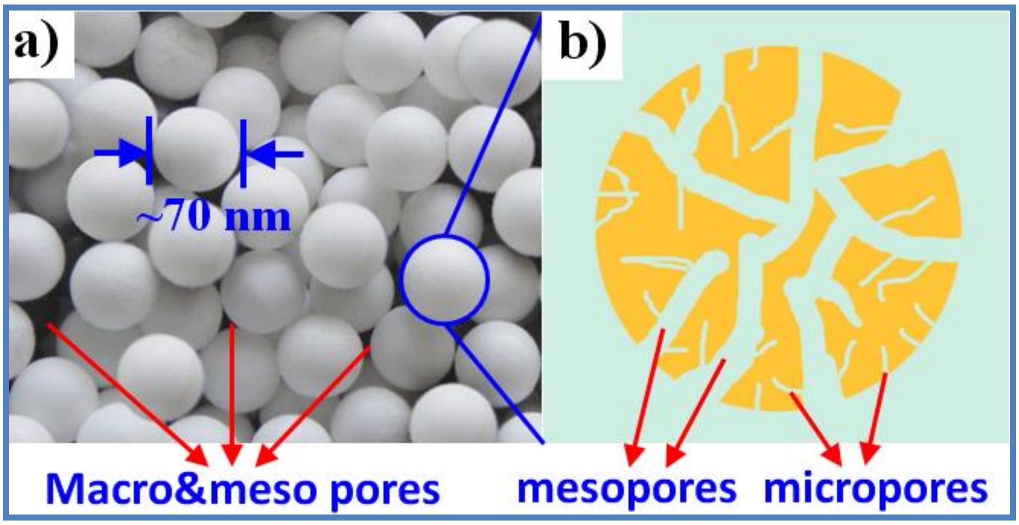


Figure S1. The sketch map of the designed hierarchically porous structure

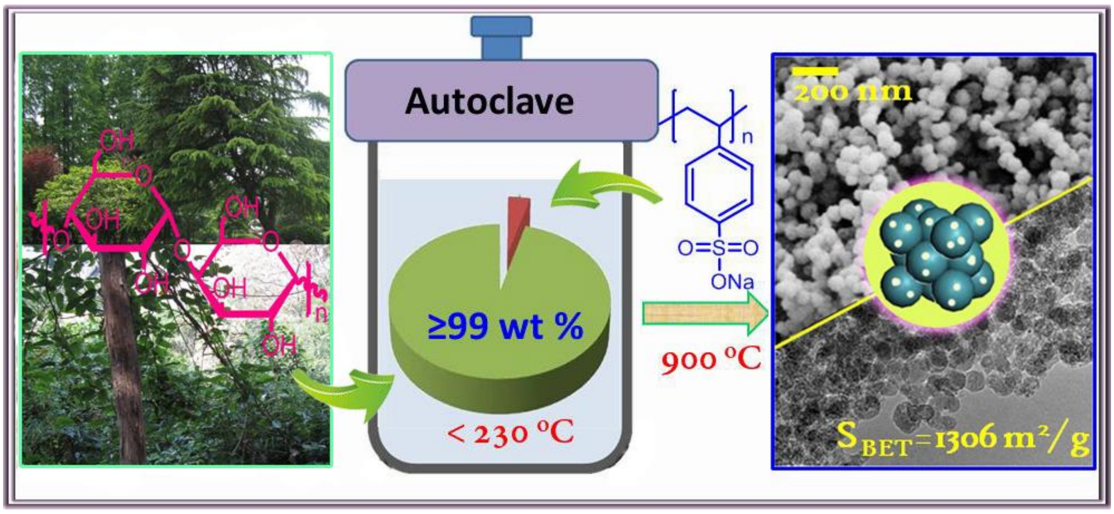


Figure S2. The synthetic scheme of the HPCs (The included photographs of plants were taken by the author).

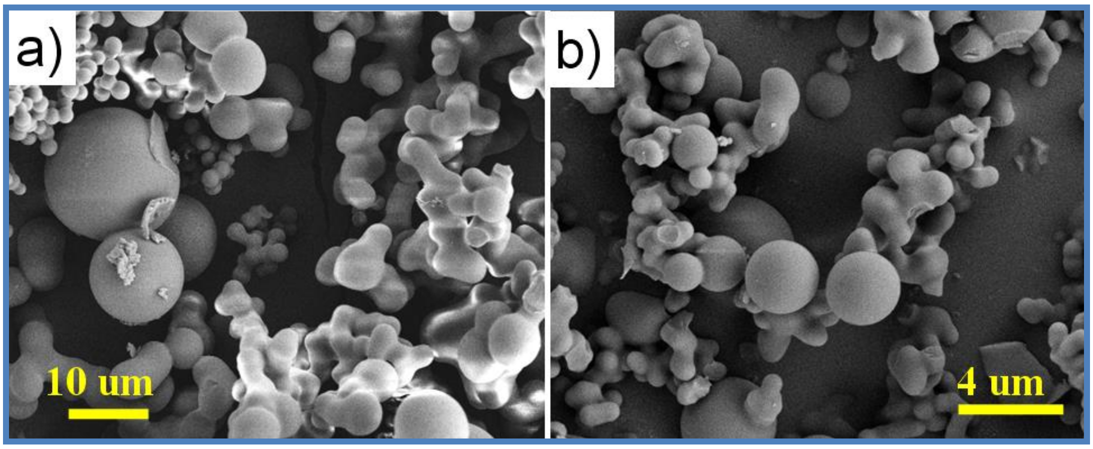


Figure S3. SEM images of classical HTC products from fructose (a) and glucose (b).

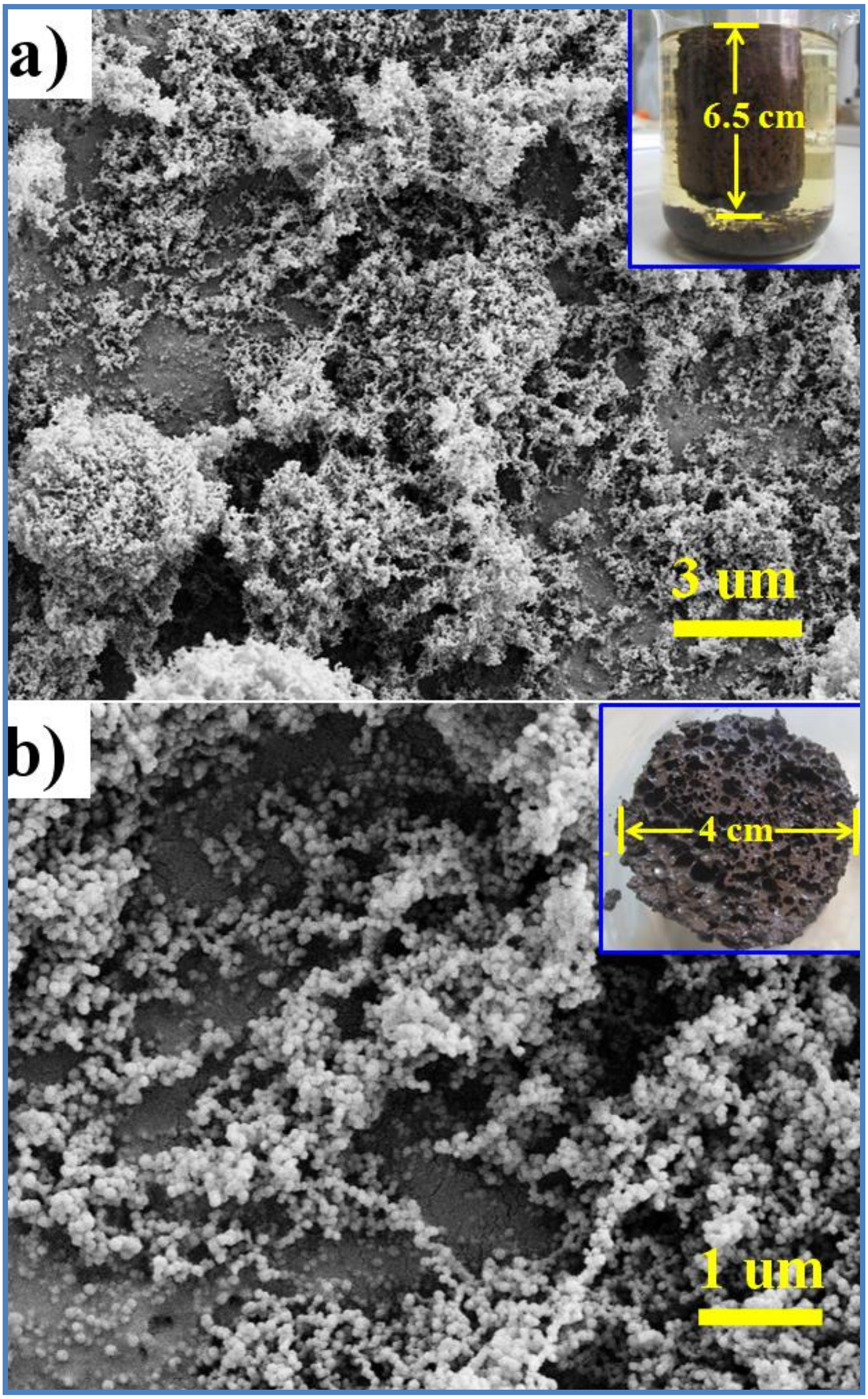
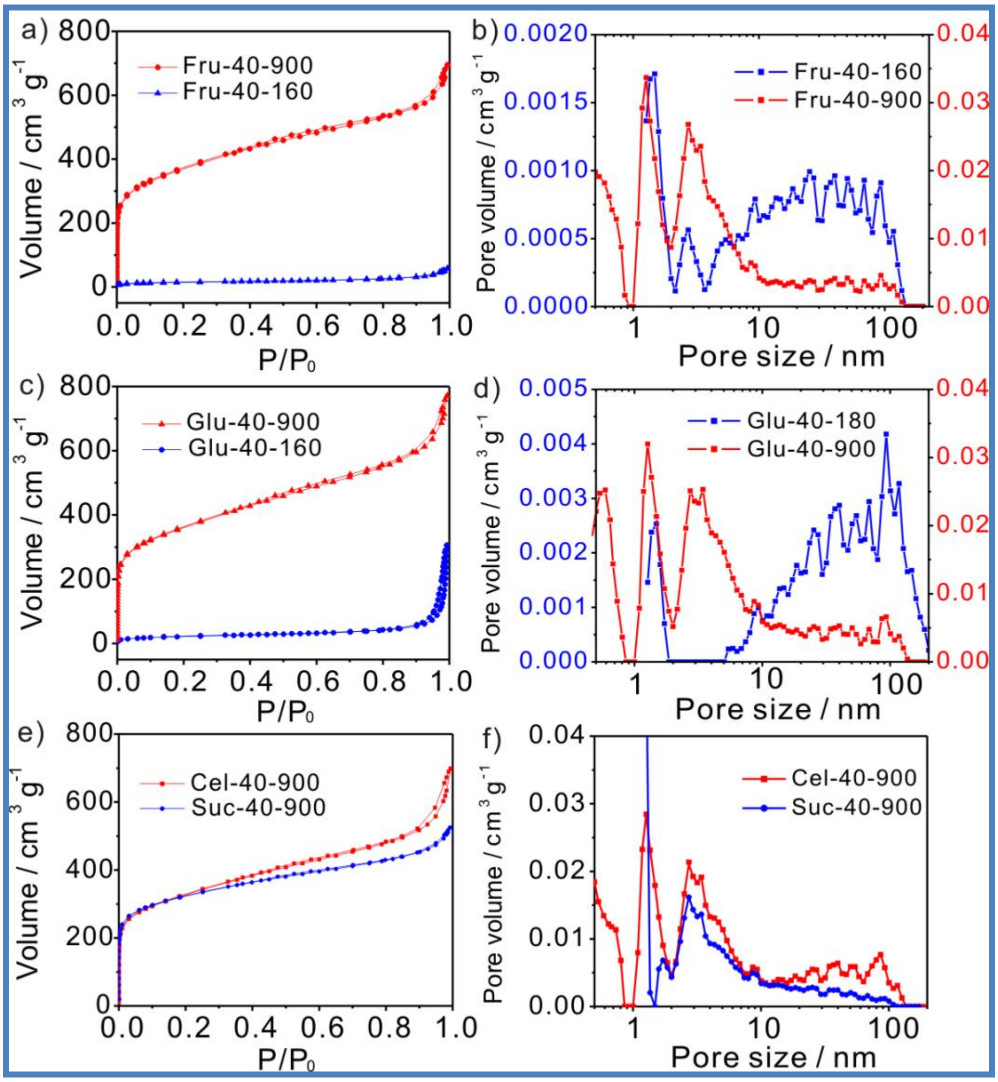
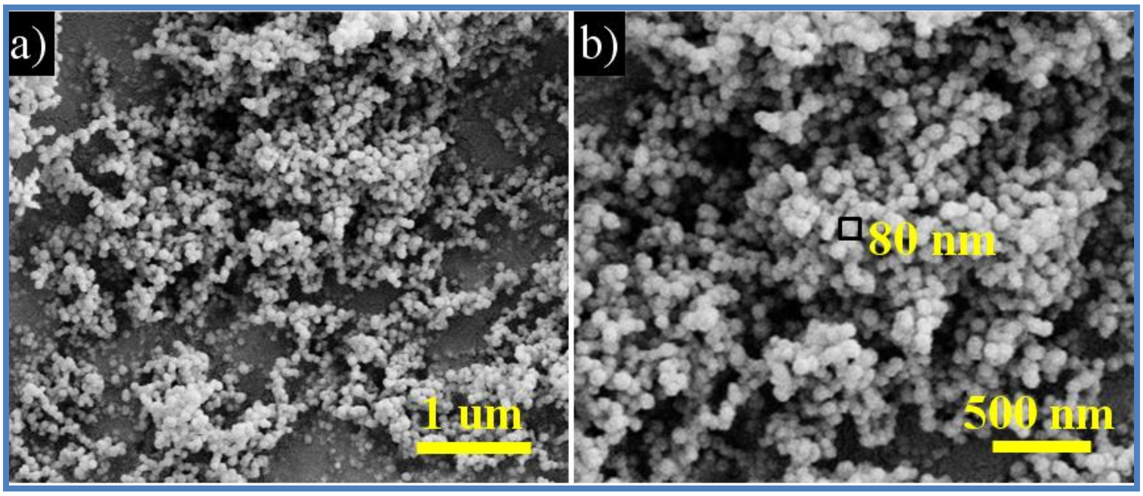


Figure S4. SEM images of Fru-40-160 with different magnifications (Insets are the photographs of the KAHTC monolith).



Nitrogen sorption isotherms were performed to quantify the interstitial porous system. The Fru-40-160 and Glu-40-180 show a little mesopores and macropores. After thermal treatment under 900 ^{o}C in the air, the surface area was highly enhanced. Abundant mesopores and micropores appeared, in line with the presence of the hysteresis loop.

Figure S5. N_2 adsorption-desorption isotherm and corresponding DFT pore size distributions of Fru-40-160, Fru-40-900, Glu-40-180, Glu-40-900, Suc-40-900 and Cel-40-900.



In order to test if KAHTC method is effective at higher sugar concentration, 12 g fructose with 24 mg kayexalate was dissolved in 50 ml water and treated in 160 ^{o}C for 8 h under hydrothermal conditions.

Figure S6. SEM images of the KAHTC material from fructose at the concentration of 240 g/L (0.2 % kayexalate) with different magnifications.

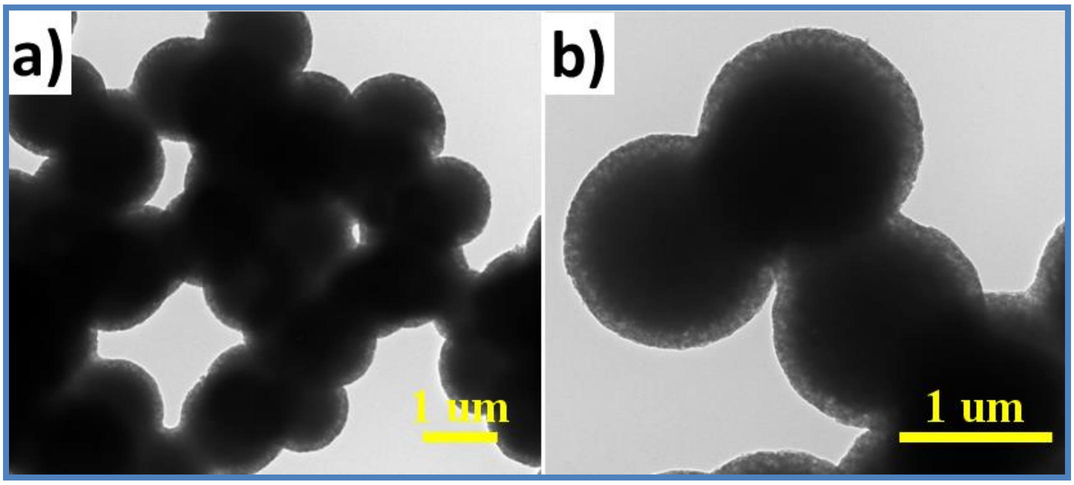


Figure S7. TEM images of Fru-900 (selected from the relatively dispersed area)

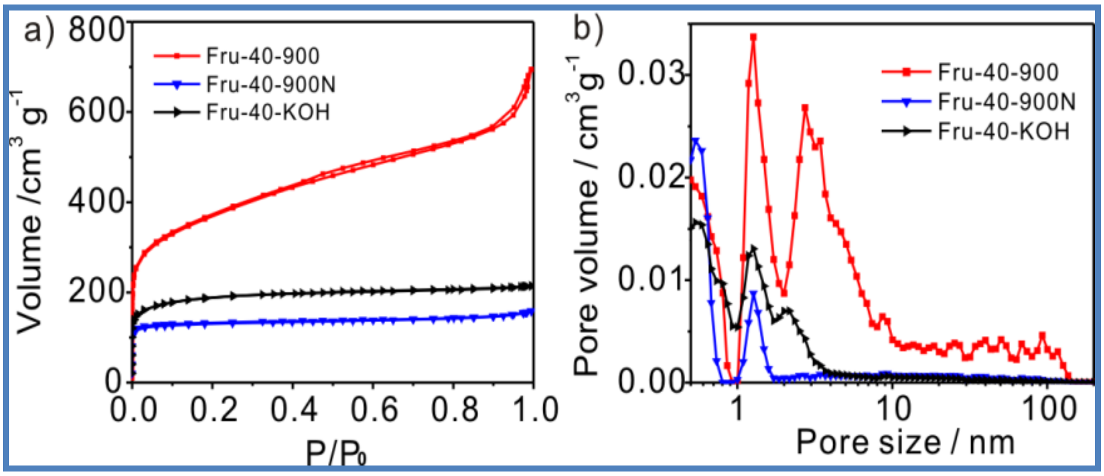


Figure S8. N_2 adsorption-desorption isotherms and corresponding DFT pore size distributions of Fru-40-900, Fru-40-900N, Fru-40-KOH.

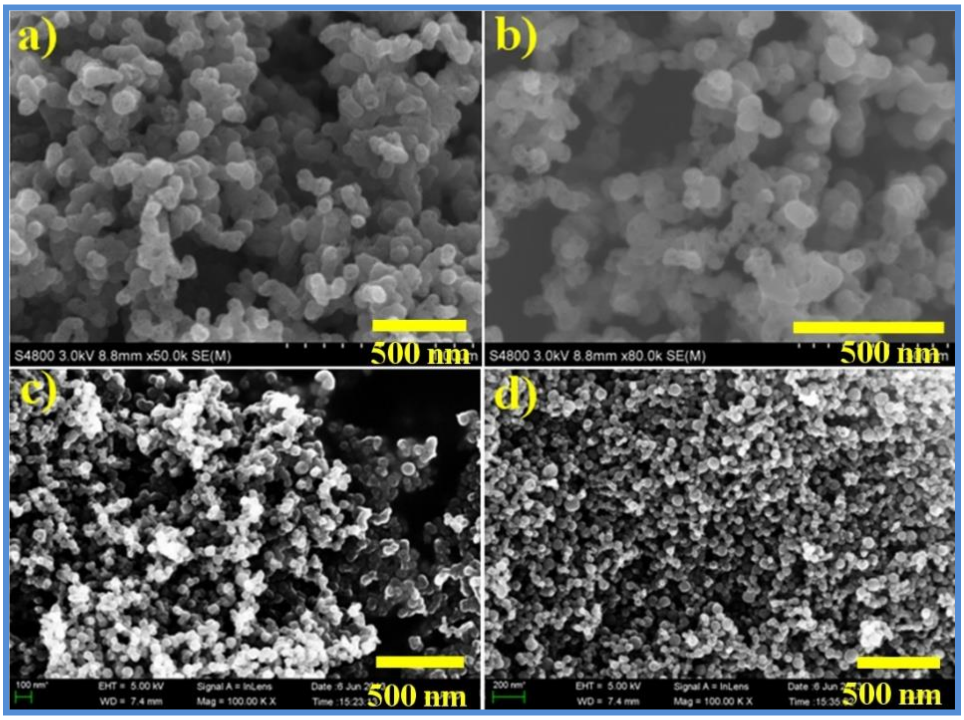


Figure S9. SEM images of Fru-8-900 (a) , Fru-16-900 (b), Fru-40-900 (c) and Fru-80-900 (d).

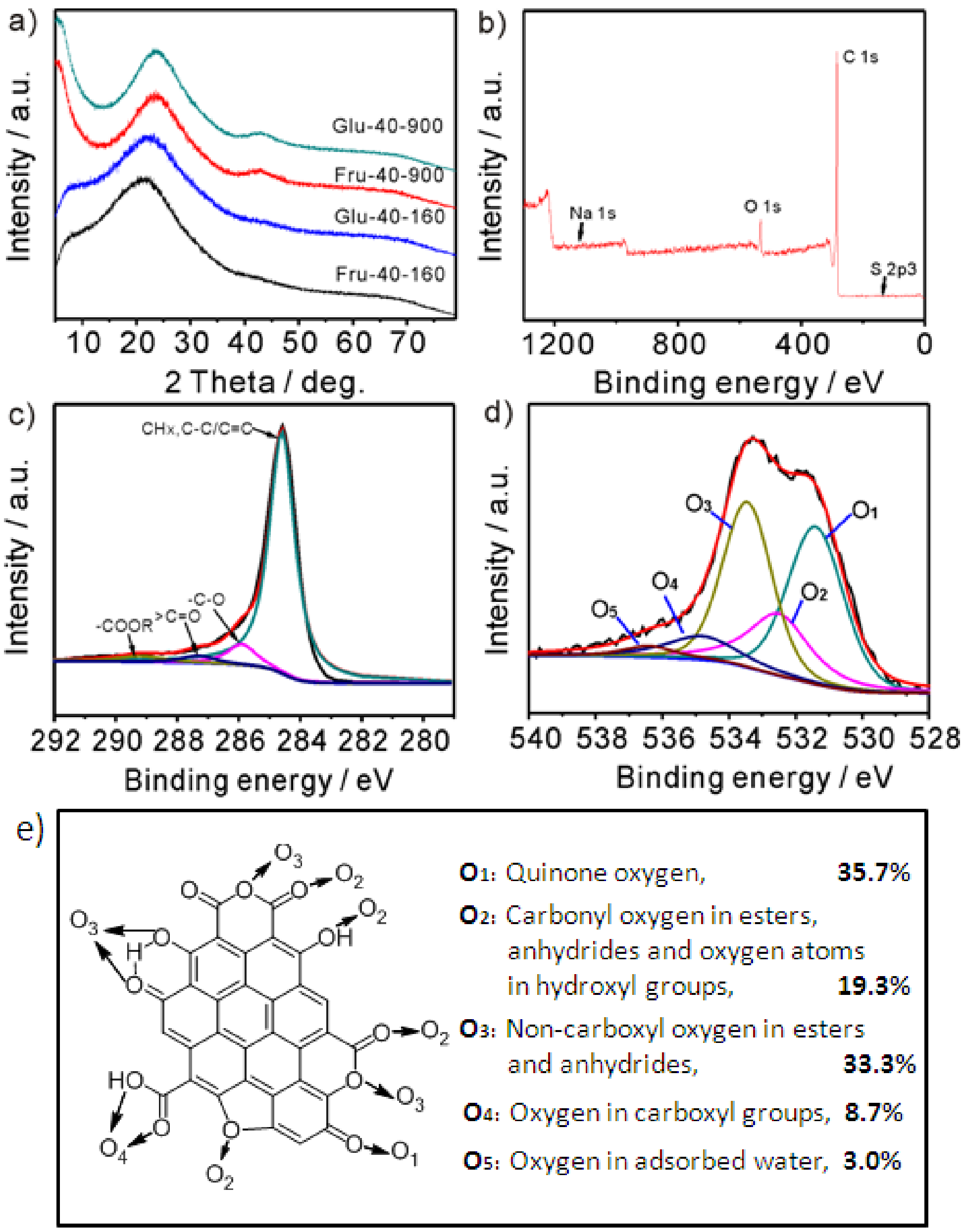


Figure S10. XRD analysis of Fru-40-160, Fru-40-900, Glu-40-180, and Glu-40-900 (a). XPS analysis of Fru-40-900 (b), corresponding C (1s) (c) and O (1s) envelopes (d) and structure showing the peak lable (e)

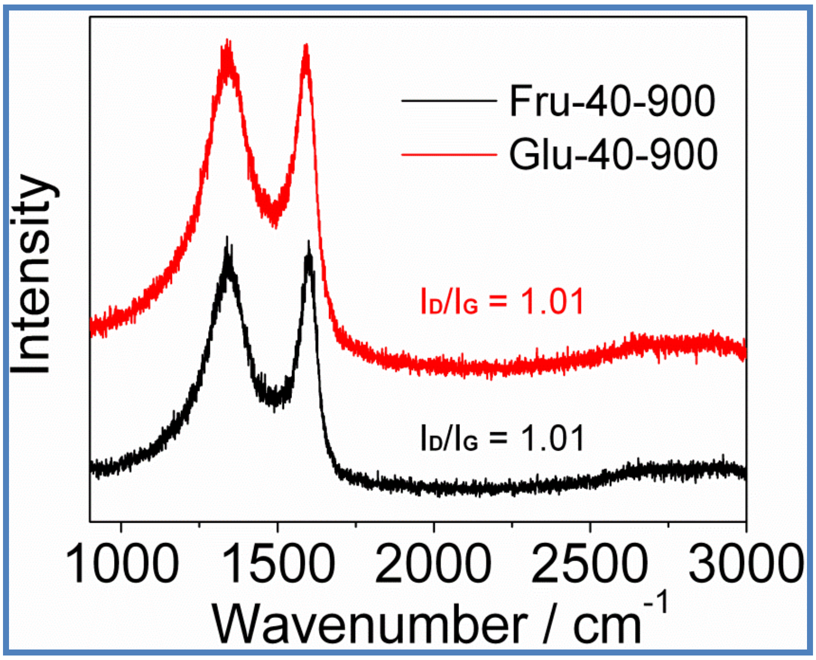


Figure S11. Raman spectra of Fru-40-900 and Glu-40-900.

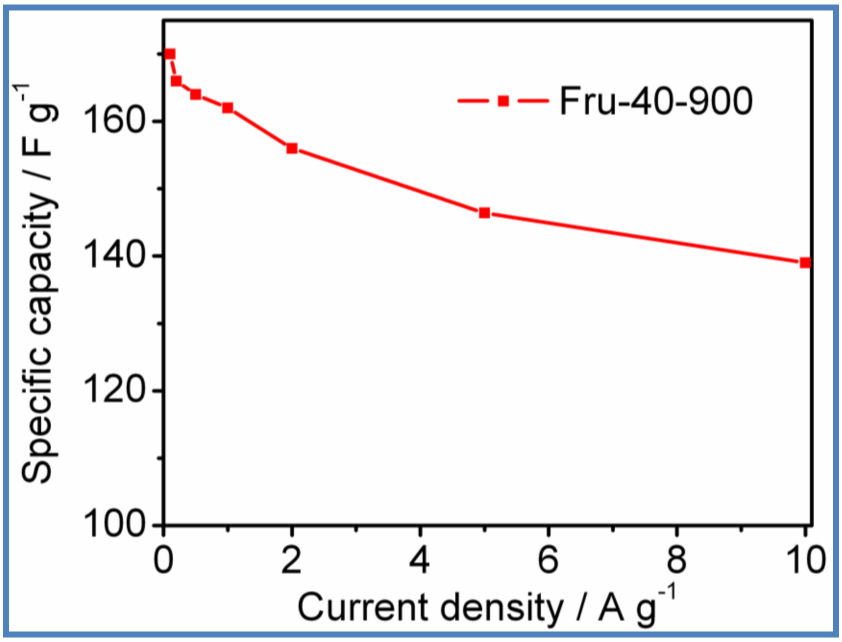


Figure S12. Capacitance as a function of current density.

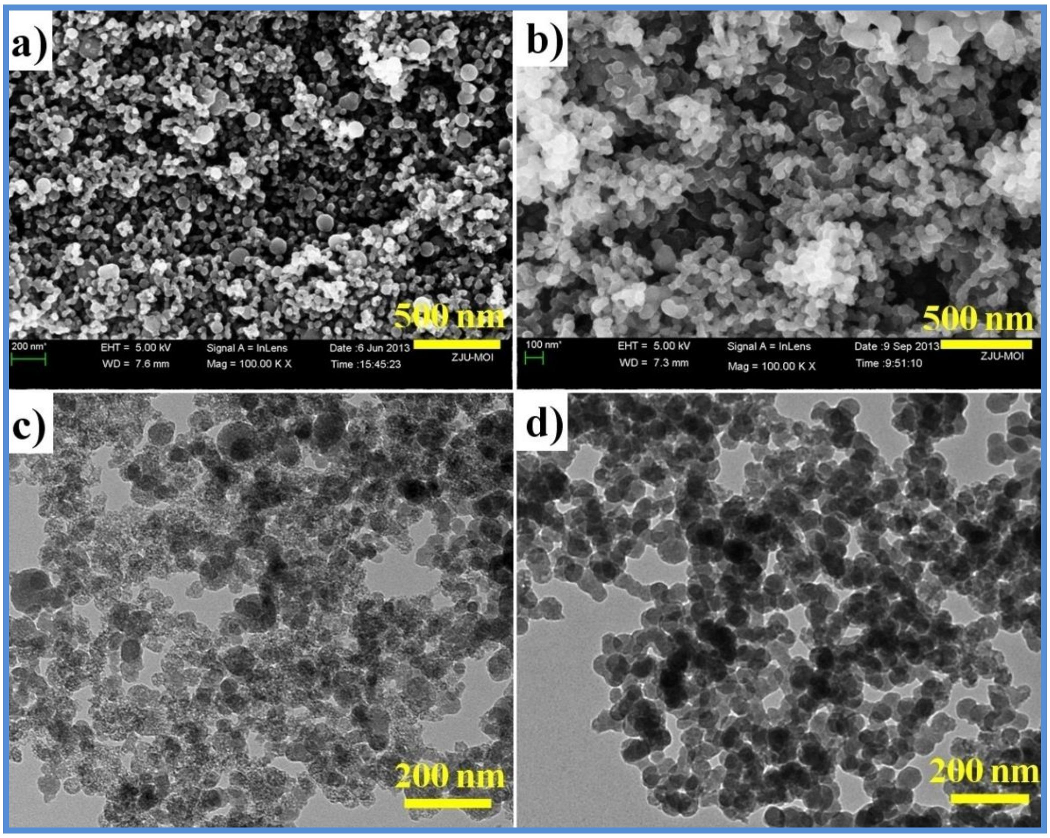
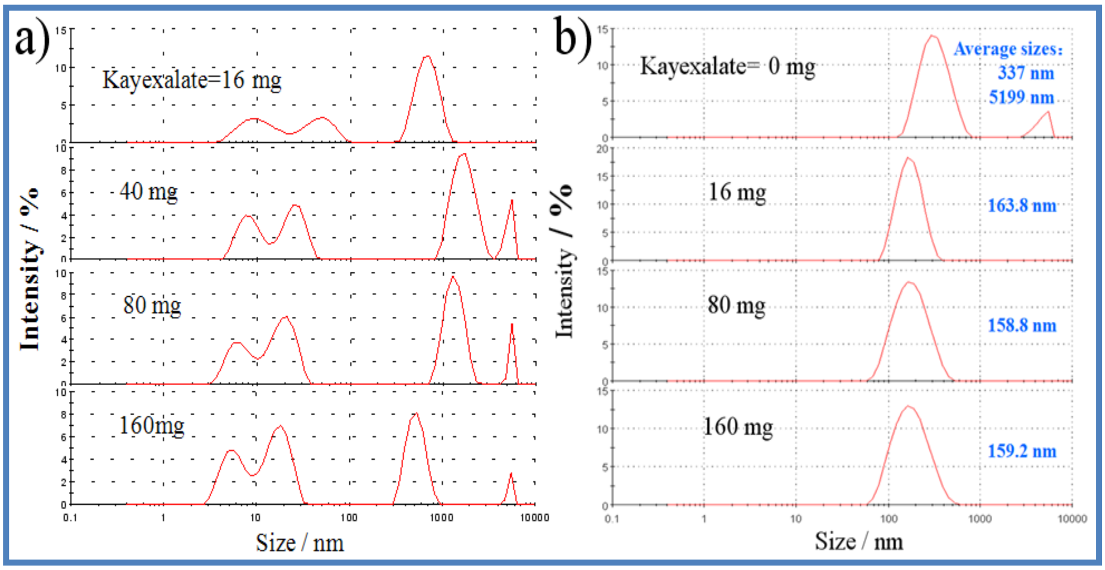


Figure S13. SEM images of Cel-40-900 (a) and Suc-40-900 (b). TEM images of Cel-40-900 (c) and Suc-40-900 (d).



A dynamic light scattering (DLS) test was applied to measure the sizes of kayexalate micelle and the carbon particle sizes.

0, 16, 80 and 160 mg of kayexalate were dissolved in 50 mL water for the kayexalate micelle sizes.

For carbon spheres size measurement, 8 g of fructose, 50 mL of water, 0, 16, 80 or 160 mg of kayexalate were mixed and stirred to a clear solution. And the mixtures were sealed in 100 ml autoclaves. Then they were treated at 160 ^{o}C for 2 h. After cooling off, the obtained carbon colloids were centrifuged. The supernatants were taken for zeta potential and particle size measurement.

Figure S14. Size distribution of kayexalate micelles (a) and carbon nanoparticles formed during the KAHTC process (b).

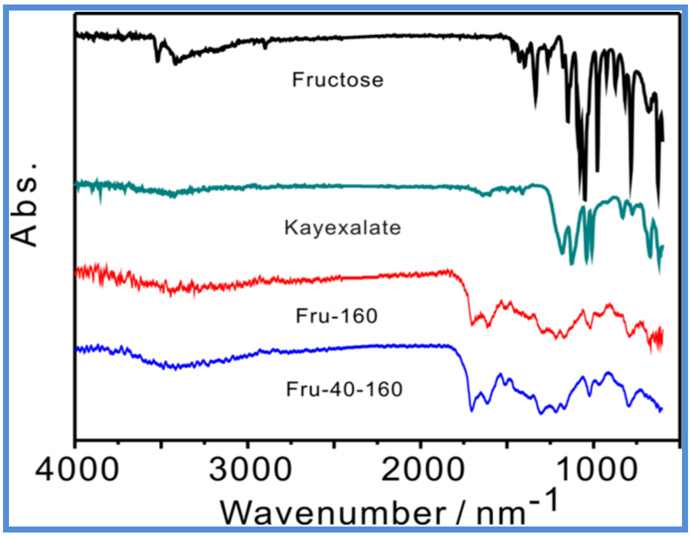


Figure S15. FTIR spectra of fructose, kayexalate, Fru-160 and Fru-40-160.

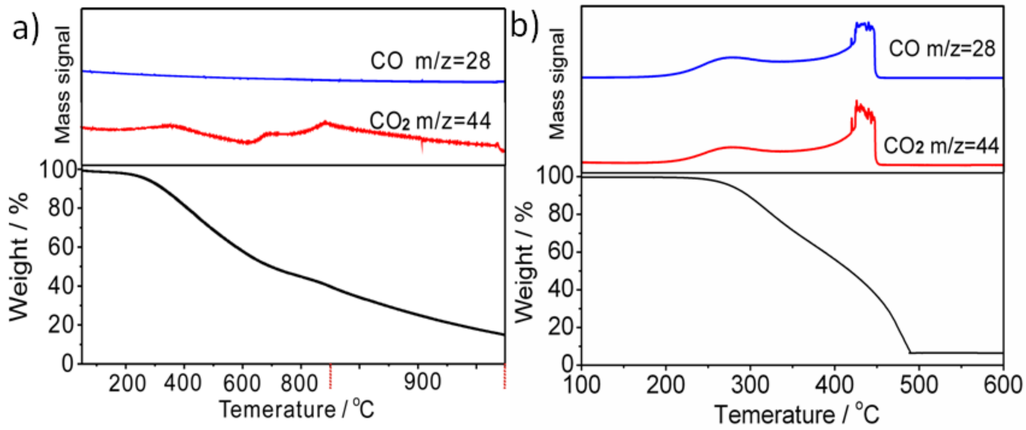
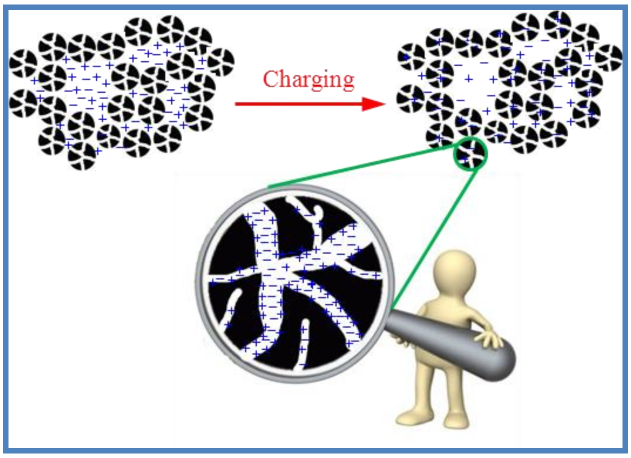
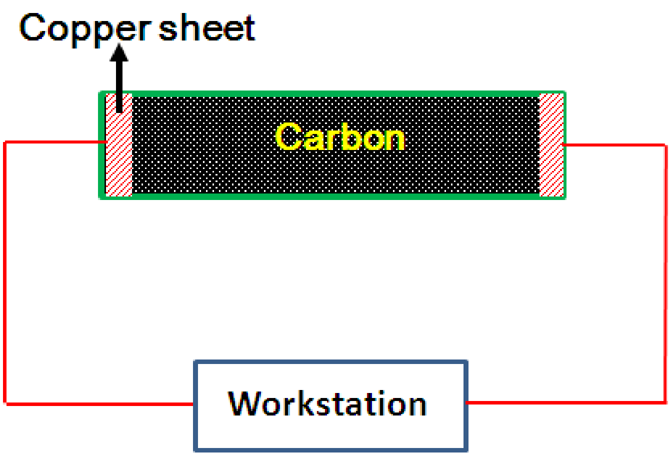


Figure S16. TGA-MS analysis of KAHTC material in Ar (a) and air (Ar replaces N_2 to avoid disruption to CO signal) (b)



Scheme S1. The ion transfer during the charging process



The conductivity of Fru-40-900 was evaluated using an insulting mould filled with carbon materials. For comparison, the conductivities of graphite and conductive acetylene black was also measured and summarized in Table S4.

Scheme S2. The devices applied to evaluate electronic conductivity.

Table S1. Effect of time on hydrothermal yield

Entry	Time / h	Yield [a] / g	Yield [b] / g
1	0	0	0
2	4	1.3	1.4
3	8	2.58	2.35
4	12	2.66	2.48

Reaction conditions: 8 g fructose, 50 mL water, 160 ^{o}C
a.40 mg of kayexalate as additive
b. without additives

Table S2. Activation yield of different methods [a]

Entry	Methods	Atmosphere	Yield / %
1	This work	Air	23
2[b]	This work	Air	28
3	KOH，600 ^{o}C	N_2	27
4	KOH，900 ^{o}C	N_2	0
5	N_2	N_2	55

a. Fru-40-160 was applied as the activation precursor
b. 3 g Fru-40-160 was used

Table S3. Elemental analysis

Entry	Samples	C (w %)	H (w %)	N (w %)	O (w %)[a]
1	Fru-40-160	64.9	4.0	0	31.1
2	Glu-40-180	65.2	3.9	0	30.9
3	Fru-40-900	81.8	1.18	0.27	16.75
4	Glu-40-900	79.9	0.97	0.26	18.87

a． Calculated

Table S4. Electronic conductivity

Entry	Sample	Conductivity S/m
1	Fru-40-900	11.7
2	Acetylene black	141.6