

Supplementary information

Nomenclature

$X_1 (x_1)$ first factor or input variable, the mass ratio of ZnCl_2 to JAS

$X_2 (x_2)$ second factor or input variable, activation temperature ($^{\circ}\text{C}$)

$X_3 (x_3)$ third factor or input variable, activation time (h)

Cor total totals of all information corrected for the mean

SD standard deviation

CV coefficient of variation

DF degree of freedom

$\text{prob} > F$ proportion of time or probability expected to obtain the stated F value

PRESS predicted residual error sum of squares

R^2 determination coefficient

Adj R^2 adjusted R^2

Pred R^2 predicted R^2

Adeq Precisor adequate precision

Table S1 ANOVA for response Surface Quadratic model^{a)}

source	sum of square	DF	mean square	F value	prob>F
model	10693.57	9	1188.17	9.47	0.0117 ^{b)}
A	6745.41	1	6745.41	53.74	0.0007
B	110.26	1	110.26	0.88	0.3917
C	273.78	1	273.78	2.18	0.1998
AB	142.80	1	142.80	1.14	0.3349
AC	585.64	1	585.64	4.67	0.0832
BC	70.56	1	70.56	0.56	0.4872
A ²	1726.01	1	1726.01	13.75	0.0139
B ²	1205.74	1	1205.74	9.61	0.0269
C ²	0.60	1	0.60	<0.001	0.9474
residual	627.63	5	125.53		
lack of fit	627.30	3	209.10	1280.21	0.0008
pure error	0.33	2	0.16		
Cor total	11321.20				
SD	11.20		R ²	0.9446	
mean	69.01		Adj R ²	0.8448	
C.V.%	16.23		Pred R ²	0.1134	
PRESS	10037.57		Adeq Precisor	9.299	

Notes: a) response: mesoporosity; b) significant

Table S2 ANOVA for response Surface Quadratic model^{a)}

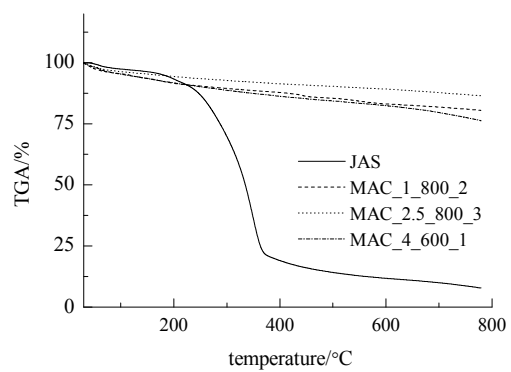
source	sum of square	DF	mean square	<i>F</i> value	prob> <i>F</i>
model	2.470	9	0.270	13.21	0.0055 ^{b)}
A	1.750	1	1.750	84.30	0.0003
B	0.061	1	0.061	2.96	0.1459
C	0.050	1	0.050	2.41	0.1809
AB	0.092	1	0.092	4.41	0.0897
AC	0.018	1	0.018	0.87	0.3932
BC	0.034	1	0.034	1.65	0.2552
A ²	0.020	1	0.020	0.96	0.3718
B ²	0.440	1	0.440	21.10	0.0059
C ²	<0.001	1	<0.001	0.22	0.6579
residual	0.100	5	0.021		
lack of fit	0.100	3	0.035	379.22	0.0026
pure error	<0.001	2	<0.001		
Cor total	2.570				
SD	0.14		<i>R</i> ²	0.9596	
mean	0.74		Adj <i>R</i> ²	0.8870	
C.V. %	19.51		Pred <i>R</i> ²	0.3551	
PRESS	1.66		Adeq Precision	10.47	

Notes: a) response:mesopore volume; b) significant

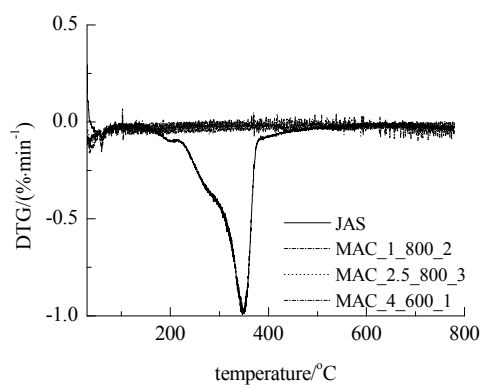
Table S3 ANOVA for response Surface Quadratic model^{a)}

source	sum of square	DF	mean square	<i>F</i> value	prob> <i>F</i>
model	183.90	9	20.43	7.00	0.0227 ^{b)}
A	34.030	1	34.03	11.65	0.0190
B	101.53	1	101.53	34.76	0.0020
C	10.12	1	10.12	3.47	0.1217
AB	27.56	1	27.56	9.44	0.0277
AC	0.25	1	0.25	0.09	0.7816
BC	4.00	1	4.00	1.37	0.2946
A ²	0.85	1	0.85	0.29	0.6132
B ²	5.58	1	5.58	1.91	0.2255
C ²	0.08	1	0.08	0.03	0.8762
residual	14.60	5	2.92		
lack of fit	12.44	3	4.15	3.83	2.2141
pure error	2.17	2	1.08		
Cor total	198.50				
SD	1.71		<i>R</i> ²	0.9264	
mean	36.00		Adj <i>R</i> ²	0.7940	
C.V. %	4.75		Pred <i>R</i> ²	-0.0271	
PRESS	203.88		Adeq Precision	9.003	

Notes: a) response: yield; b) significant

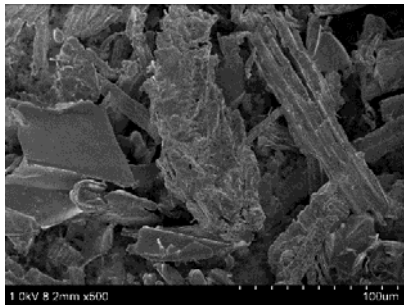


(a)

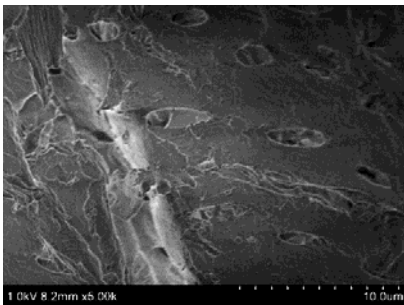


(b)

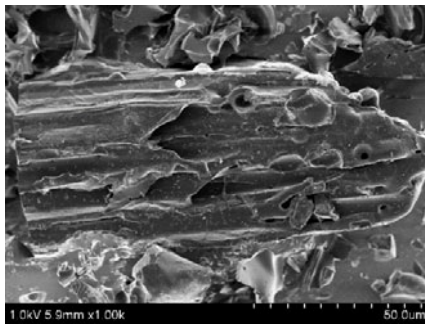
Fig. S1 Thermogravimetric analysis curves of: (a) TGA; (b) DTG



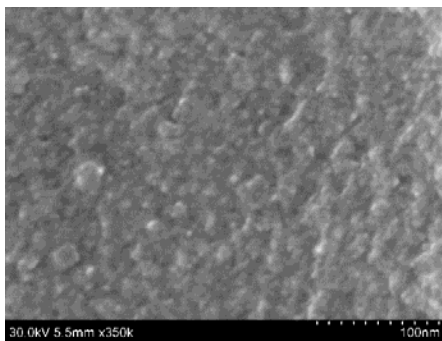
(a)



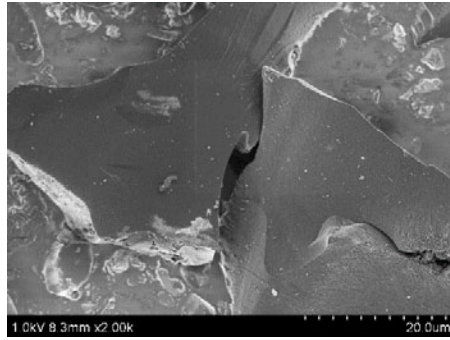
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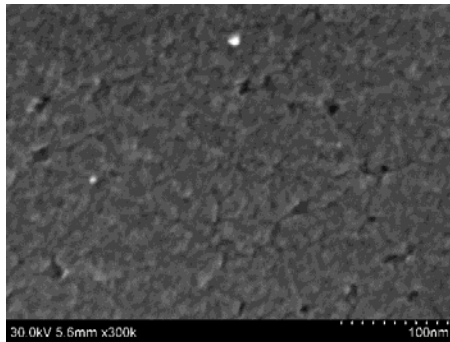
(c)



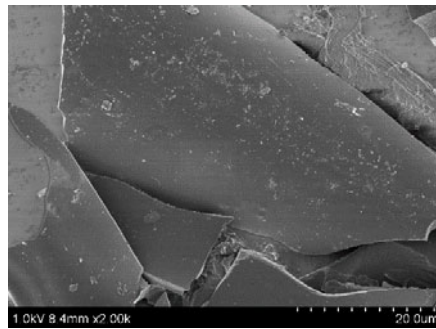
(d)



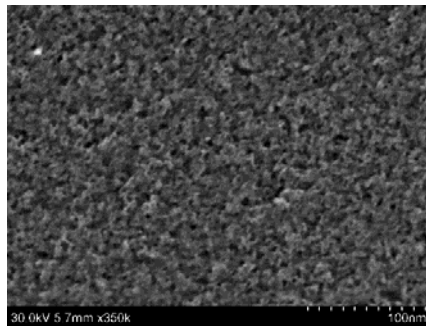
(e)



(f)

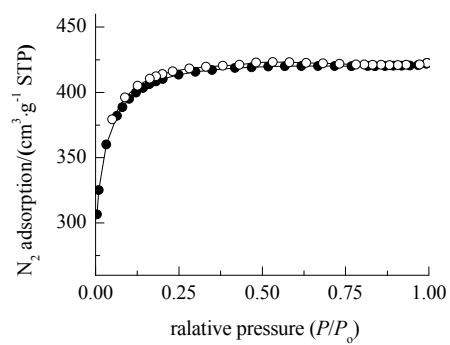


(g)

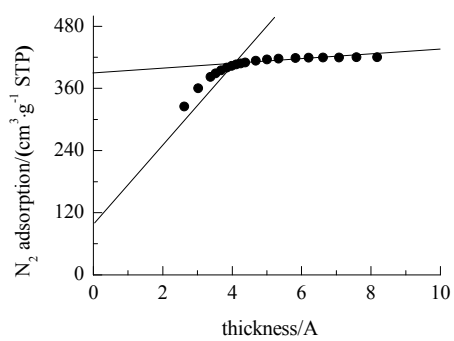


(h)

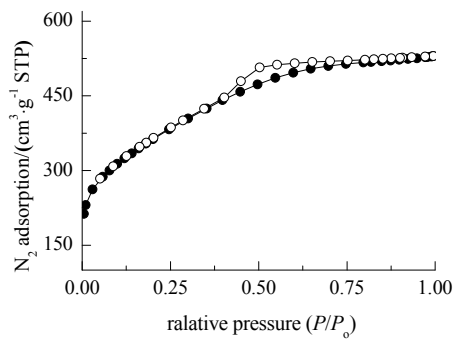
Fig. S2 High resolution scanning electron microscope images of the JAS and resulting carbons: (a) and (b) for raw materials, (c) and (d) for MAC_1_800_2, (e) and (f) for MAC_2.5_800_3, (g) and (h) for MAC_4_600_1



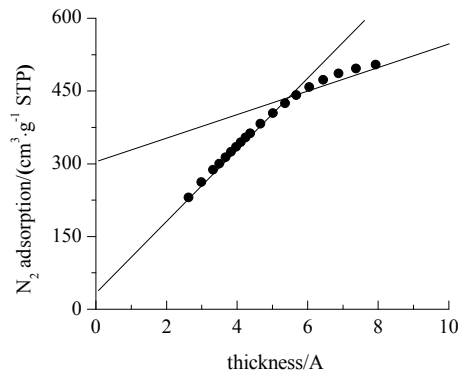
(a)



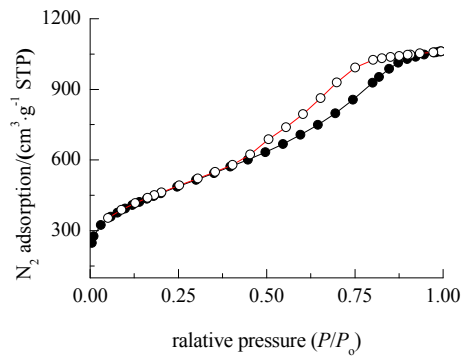
(b)



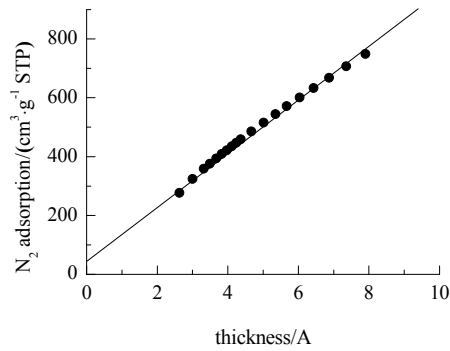
(c)



(d)

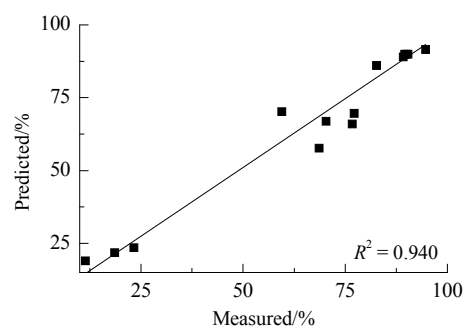


(e)

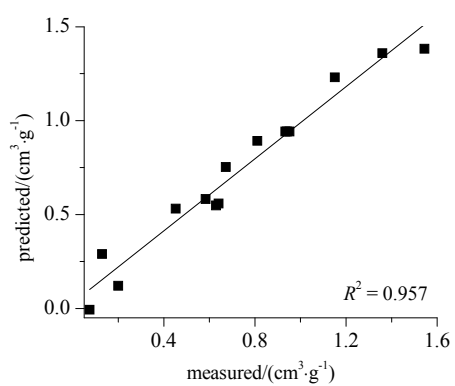


(f)

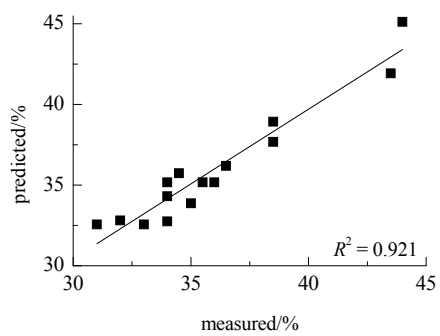
Fig. S3 Nitrogen adsorption isotherms and t-plots for (a) MAC_1_800_2 and (b) MAC_1_800_2, (c) MAC_2.5-800_3 and (d) MAC_2.5-800_3 (e) MAC_4_600_1 and (f) MAC_4_600_1, respectively.



(a)

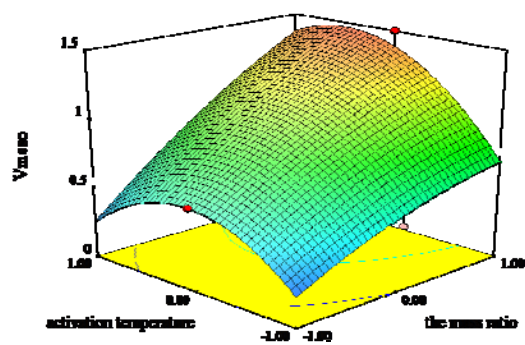


(b)

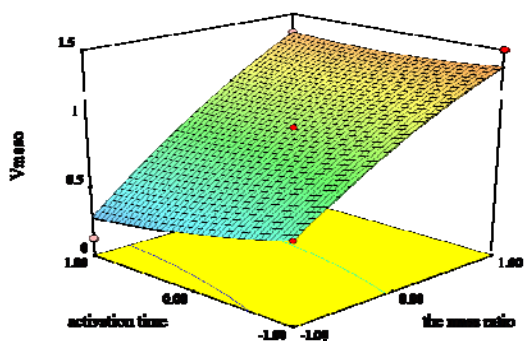


(c)

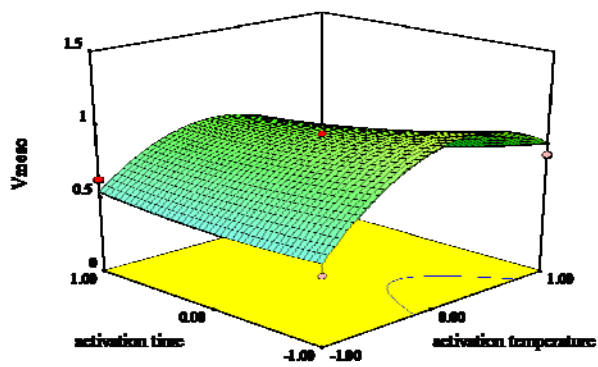
Fig. S4 Predicted vs actual data for: (a) mesopore volume, (b) mesopore ratio, and (c) carbonization yield



(a)

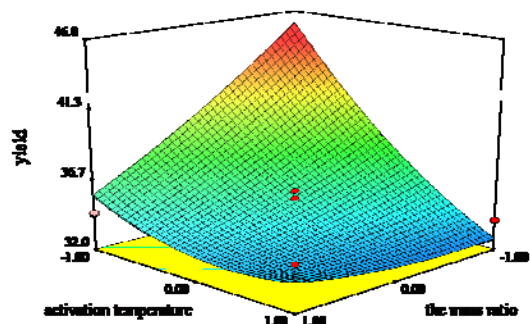


(b)

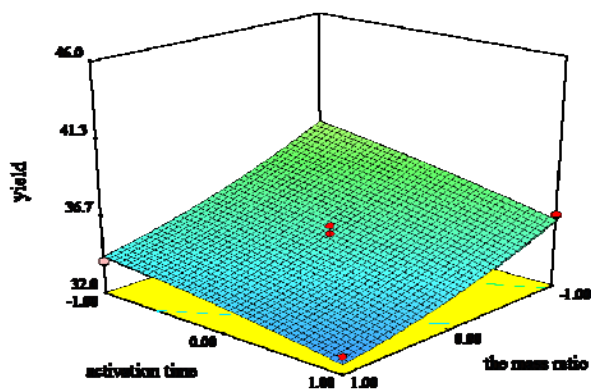


(c)

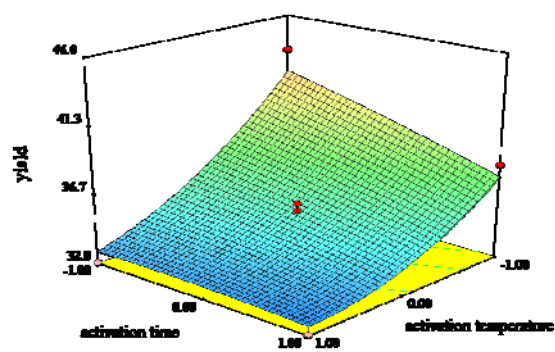
Fig. S5 3D surface graphs and contour plots of mesopore volume showing the effect of (a) x_1 - x_2 , (b) x_1 - x_3 , (c) x_2 - x_3



(a)



(b)



(c)

Fig. S6 3D surface graphs and contour plots of total yield showing the effect of (a) x_1 - x_2 , (b) x_1 - x_3 , (c) x_2 - x_3