Electronic supplementary information for

Depolymerization of cellulose to glucose by oxidation-hydrolysis

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Table S1

The DP and acid amount of α-cellulose after oxidation treatment by air[a]

Sample	Acid amount (mmol/g)	DP	Conversion (%)	TRS yield (%)	Glucose yield (%)
α-cellulose-150-24	0.04	945	12.9	4.8	0.3
α-cellulose-180-24	0.07	375	18.6	8.3	0.7
α-cellulose-210-3	0.10	470	15.8	6.3	1.3
α-cellulose-210-6	0.15	318	19.9	9.1	2.0
α-cellulose-210-12	0.20	180	29.3	12.4	4.1
α-cellulose-210-24	0.28	137	36.9	20.6	7.6
α-cellulose-210-36	0.52	96	43.0	26.2	13.4
α-cellulose-210-48	0.54	74	47.7	30.7	16.3

[a] Hydrolysis reaction conditions: cellulose (0.3 g), H_2O (30 mL), 1.0 MPa N_2, 150 ^oC, 8 h.

Table S2

Influence of the weight ratio of cellulose/water on the hydrolysis of α-cellulose[a]

Cellulose/water (w/w)	Conversion (%)	TRS yield (%)	Glucose yield (%)
0.01	47.7	30.7	16.3
0.05	42.4	36.8	21.2
0.10	40.6	33.0	22.2
0.20	40.7	34.9	23.3
0.30	39.1	38.2	17.7
0.40	40.7	30.9	17.9

[a] Reaction conditions: H_2O (30 mL), 150 ^oC, 8 h, 1.0 MPa N_2, α-cellulose oxidized by air at 210 ^oC for 48 h was used as the substrate.

Table S3

The results of three preoxidation-hydrolysis runs for MCC[a]

Reaction runs	Mass of cellulose for hydrolysis (g)	Conversion (%)	TRS yield (%)	Glucose yield (%)
1st	3.0023	38.5	36.7	25.2
2nd	1.2653	48.8	45.0	38.2
3rd	0.2915	38.2	30.8	24.4
Total[b]	-	94.0	58.6	43.4

[a]After hydrolysis reaction, the residue was washed twice with water and ethanol separately. After drying at 110 ^{o}C for 8 h, the obtained solid was oxidized by air at 210 ^{o}C for 48 h. Hydrolysis reaction conditions: cellulose/water = 0.1 g/mL, 1.0 MPa N_2, 170 ^{o}C, 8 h.

[b] Total conversion = the weight of the solid residue after the 3rd run/ the initial cellulose weight.

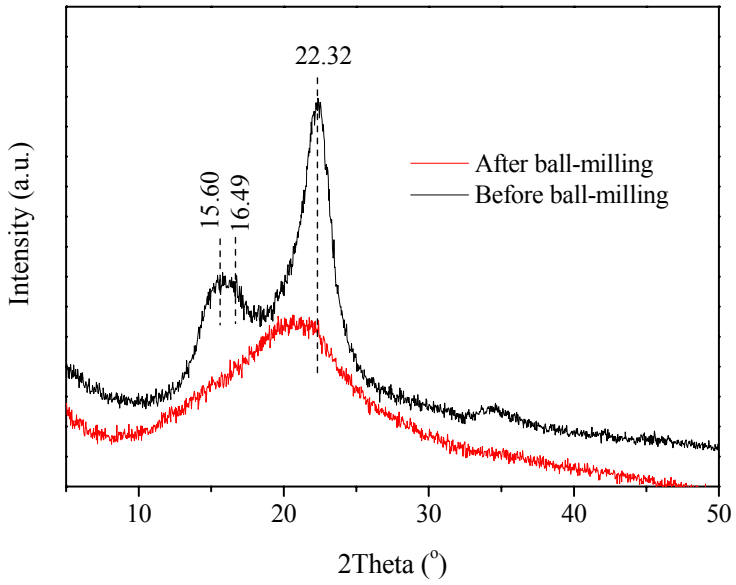
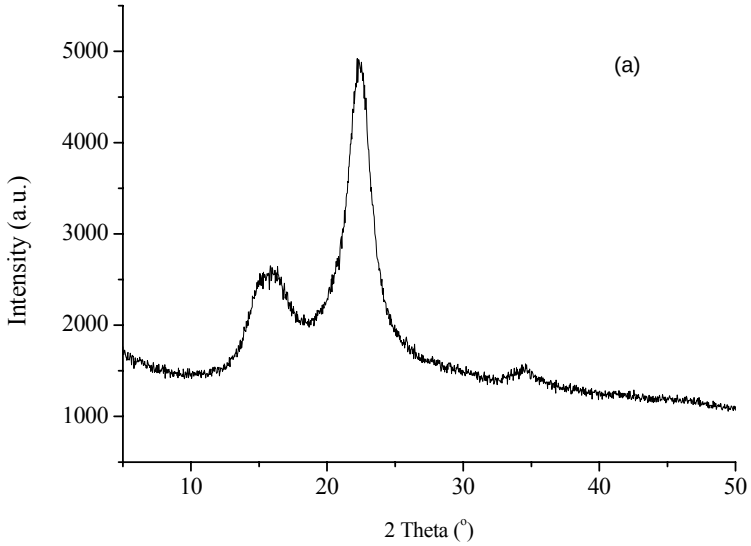


Fig. S1 XRD patterns of α-cellulose before and after ball-milling.



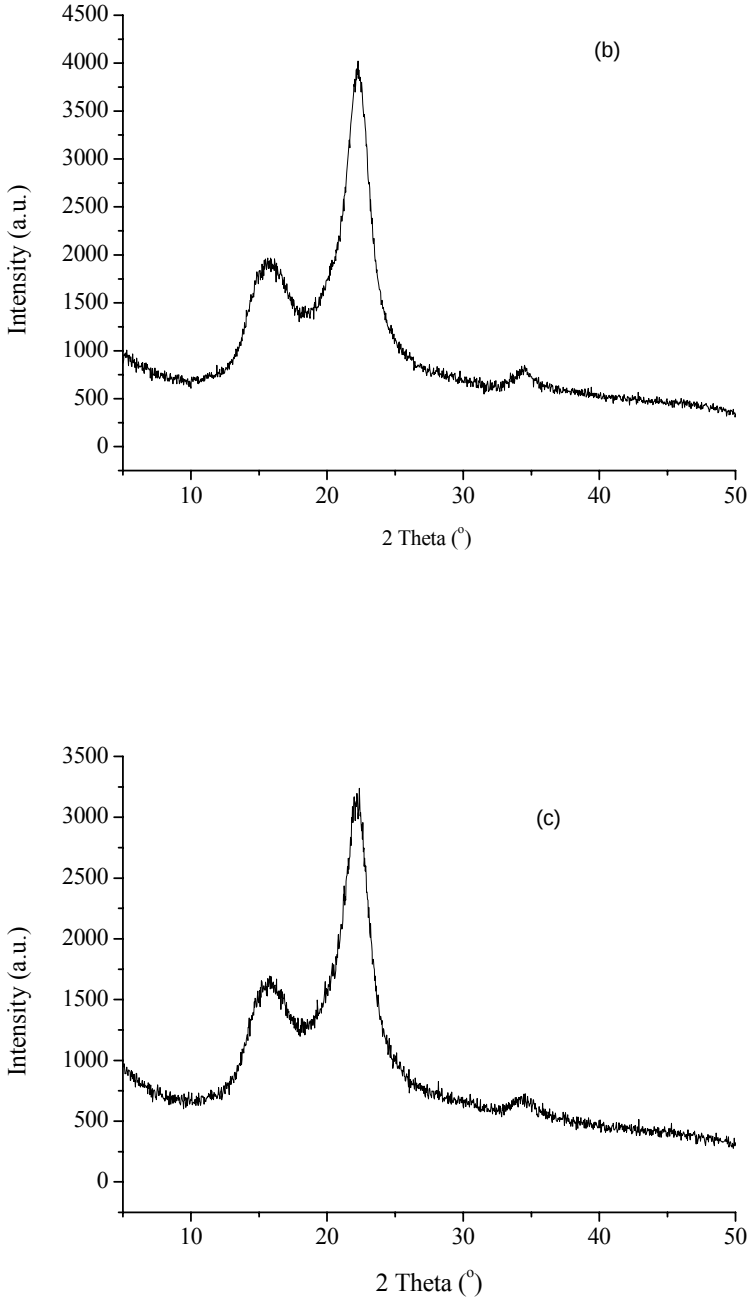


Fig. S2 XRD patterns of α-cellulose after oxidation in a tube furnace with a quartz tube reactor by NO_2 (a), O_2 (b) and air (c).

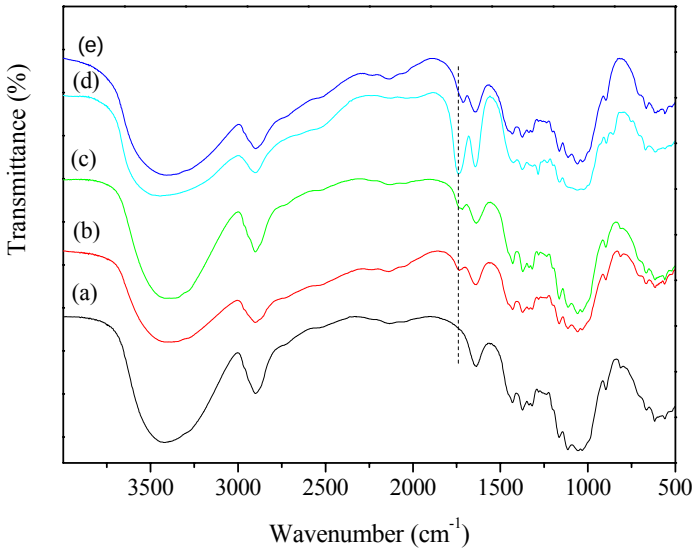


Fig. S3 FTIR spectra of α-cellulose without pretreatment (a), α-cellulose-H_2O_2 (b), α-cellulose-$KMnO_4$ (c), α-cellulose-HNO_3-$NaNO_2$ (d), and α-cellulose-TEMPO-NaClO (e).

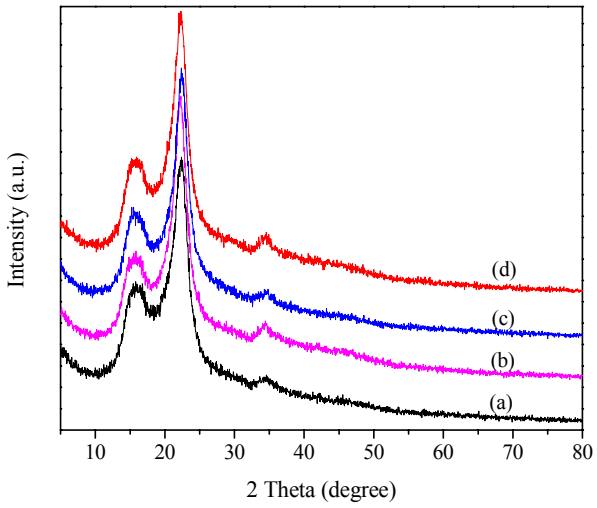
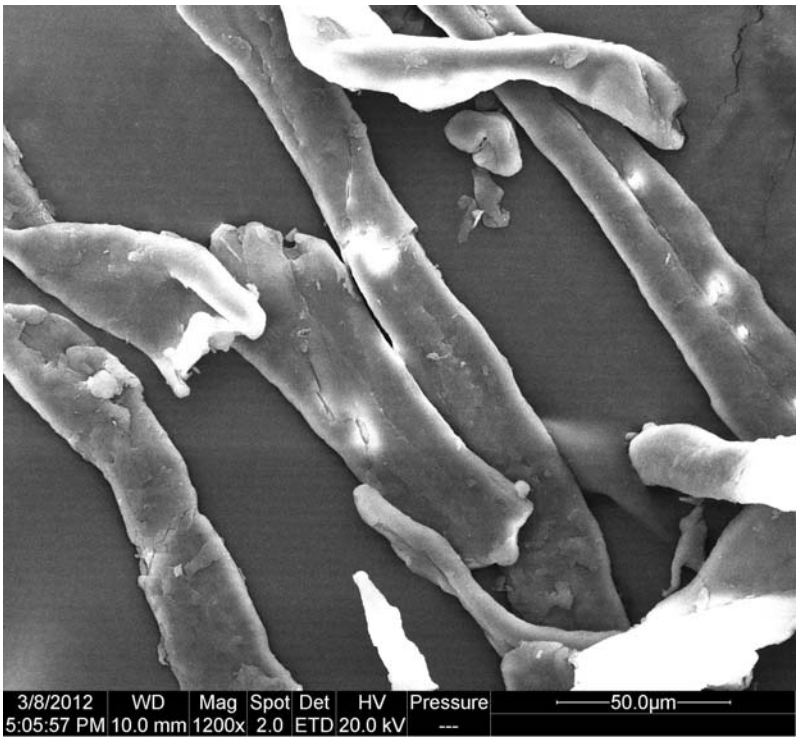
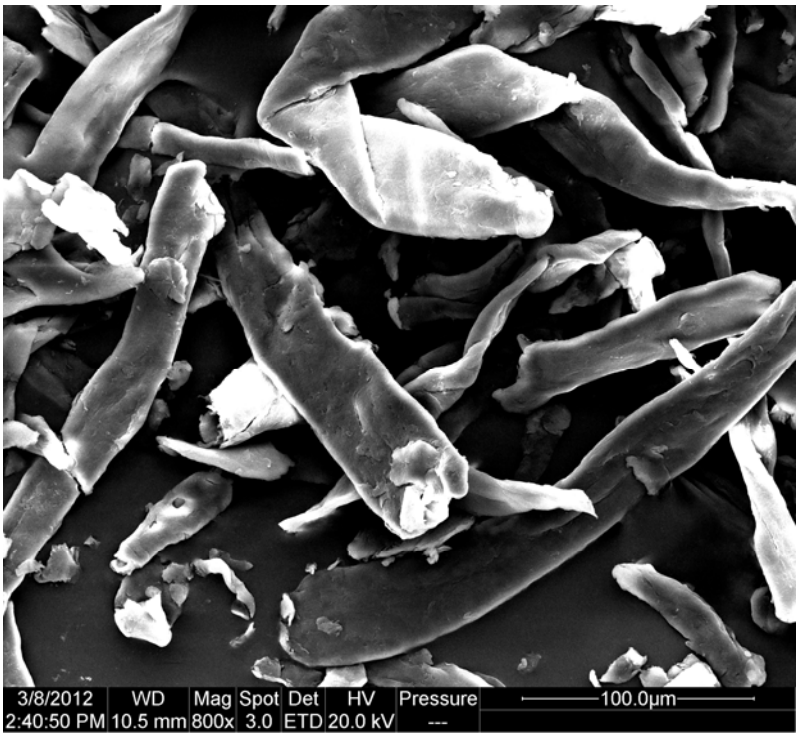


Fig. S4 XRD patterns of α-cellulose (a) and α-cellulose oxidized by air: α-cellulose-210-12 (b) and α-cellulose-210-24 (c) and α-cellulose-210-48 (d)



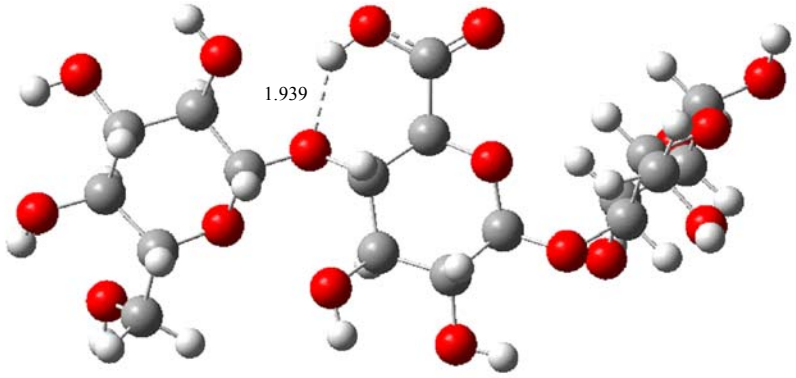
(a)



(b)

Fig. S5 SEM images of α-cellulose before (a) and after oxidation in air (b).

(a)



(b)

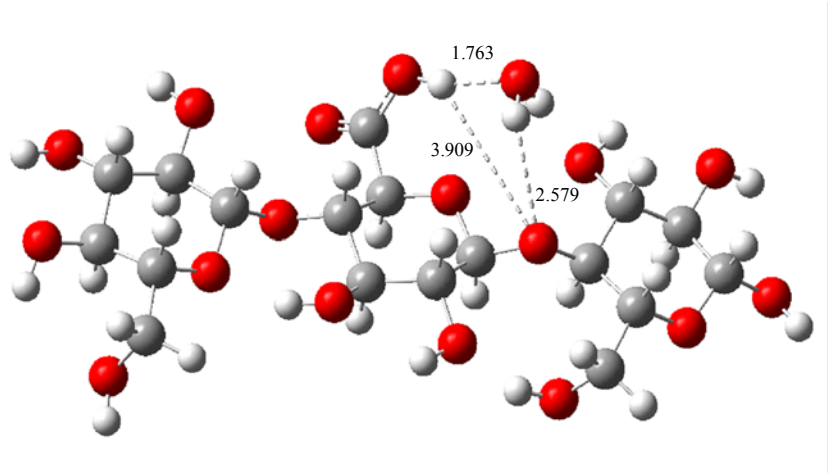


Fig. S6 Theoretical calculations of the structure for hydrolysis of glycosidic bond located on both sides of –COOH.

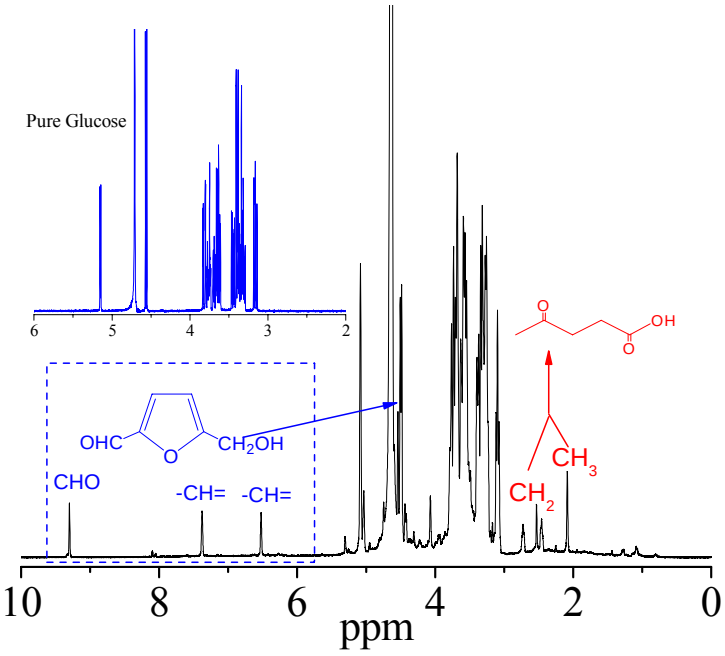


Fig. S7 ^{1}H NMR spectra of the aqueous phase recovered after the catalytic hydrolysis of α-cellulose.

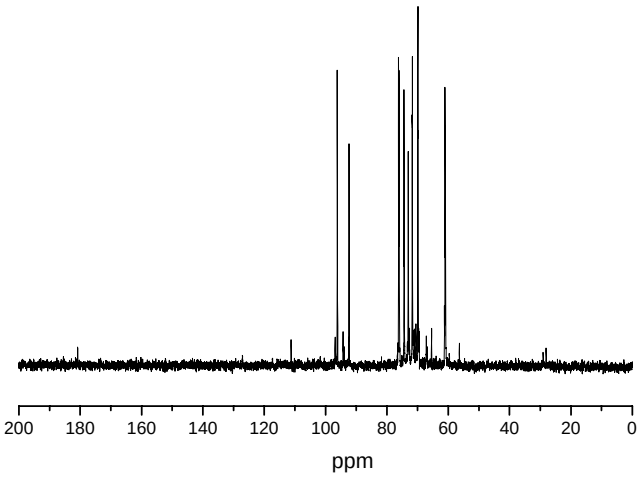


Fig. S8 ^{13}C NMR spectra of the aqueous phase recovered after the catalytic hydrolysis of α-cellulose.

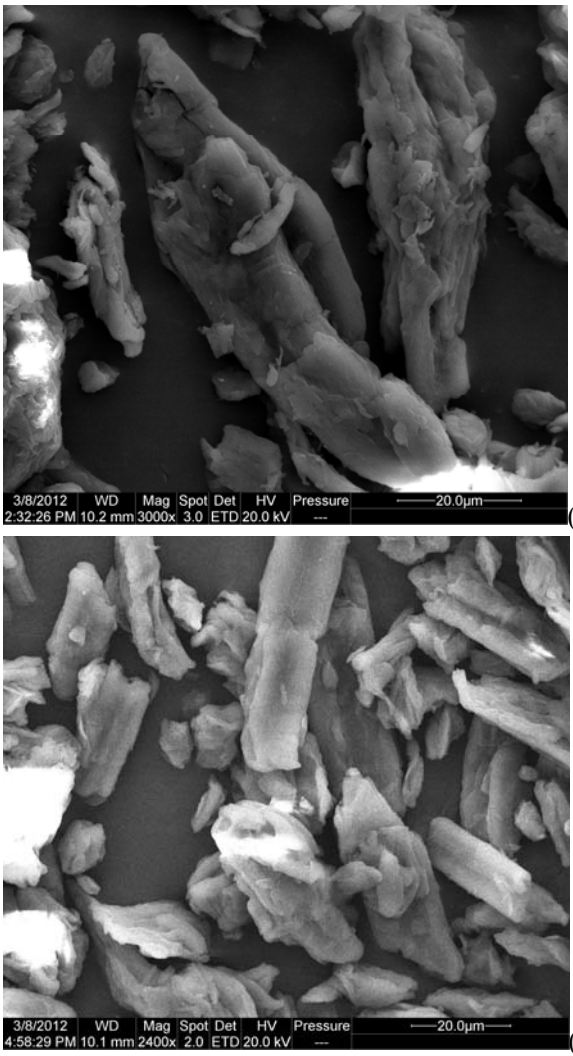


Fig. S9 SEM images of MCC before (a) and after oxidation by air (b).

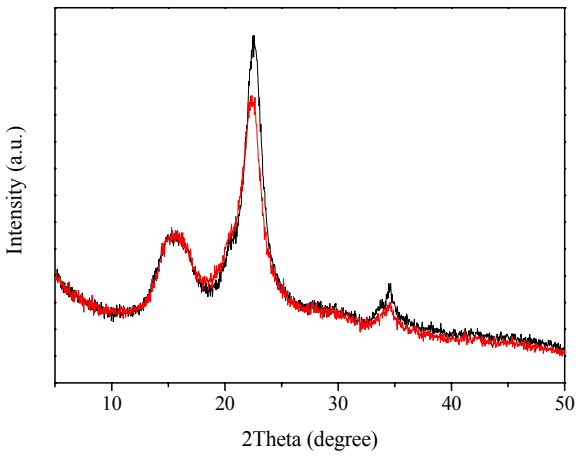


Fig. S10 XRD patterns of MCC parent (black) and after oxidation by air (red).

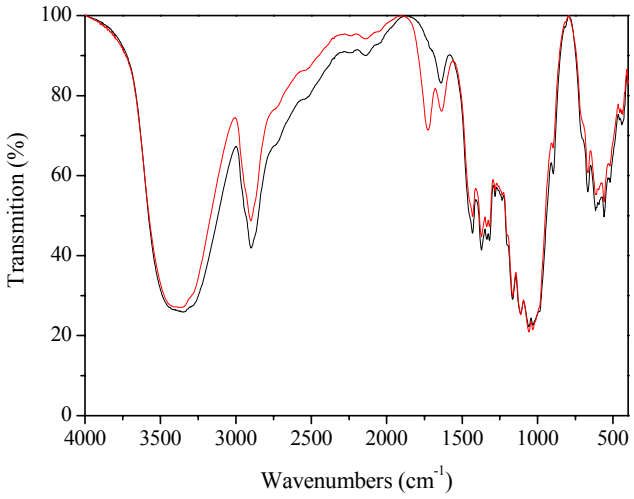


Fig. S11 FTIR spectra of parent MCC (black) and MCC after oxidation by air (red).

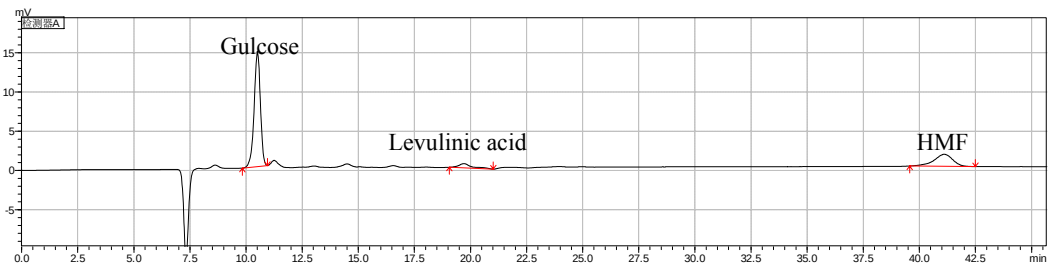


Fig. S12 HPLC results of MCC hydrolysis.

Fig. S13 The picture of the aqueous phase recovered after hydrolysis of oxidized MCC.