

Electronic Supplementary Information for

Direct Degradation of Cellulose to 5-Hydroxymethylfurfural in Hot Compressed Steam with Inorganic Acidic Salts

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Contents

Fig S1-S4 showed the impact of reaction time, reaction temperature, carrier gas flow rate and the catalyst dosage on the products yields. All these reaction was conducted with NaHSO₄ as catalyst.

Fig S5-S7 showed the GC chromatogram, ¹H NMR and ¹³C NMR spectrum of products isolated from the aqueous solvent by evaporation process. The evaporation process is conducted at 80 °C in the air.

Fig S8 showed the photograph of the apparatus used

Supplementary Figures

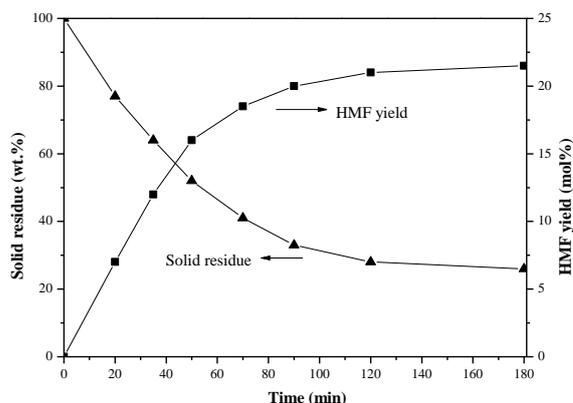


Fig. S1 Solid residue weight and HMF yield as function of reaction time under following reaction condition: temperature, 210°C; reaction pressure, 1.3MPa; water feed, 1.0ml/min; carrier gas flow rate, 500ml/min; NaHSO₄ as catalyst with loading of 10wt.%

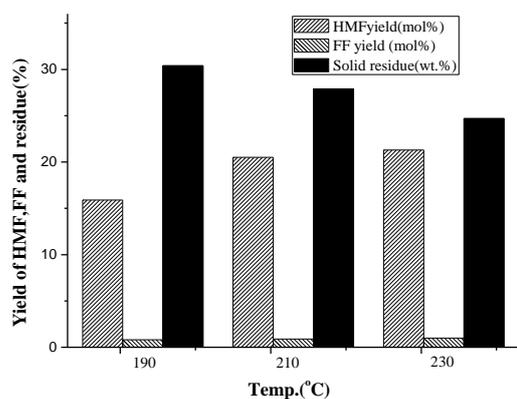


Fig. S2 Influence of temperature on the degradation of cellulose in the steam. Reaction condition: carrier gas flow rate 500ml/min; pressure, 1.3MPa; water feed, 1.0ml/min; reaction time, 180min; NaHSO₄ as catalyst with loading of 10wt.%

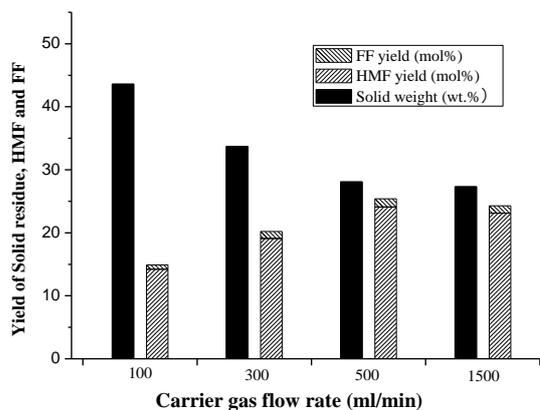


Fig. S3 Influence of the carrier gas flow rate on the HMF yield
Reaction condition: temperature, 210 °C; pressure, 1.3MPa; water feed, 1.0ml/min; reaction time, 180min; NaHSO₄ as catalyst with loading of 10wt.%

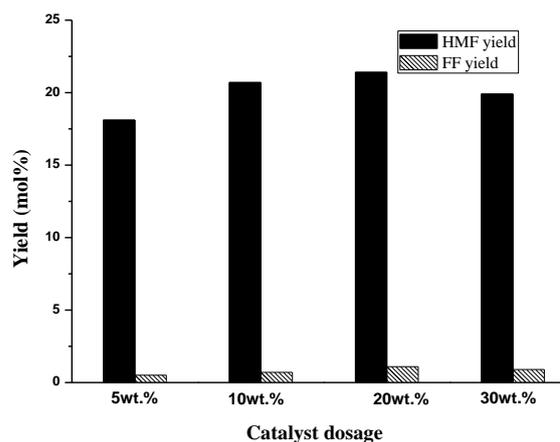


Fig. S4 Influence of the catalyst dosage on the HMF yield
Reaction condition: temperature, 210 °C; pressure, 1.3MPa; water feed, 1.0ml/min; reaction time, 180min; NaHSO₄ as catalyst; carrier gas flow rate 500ml/min

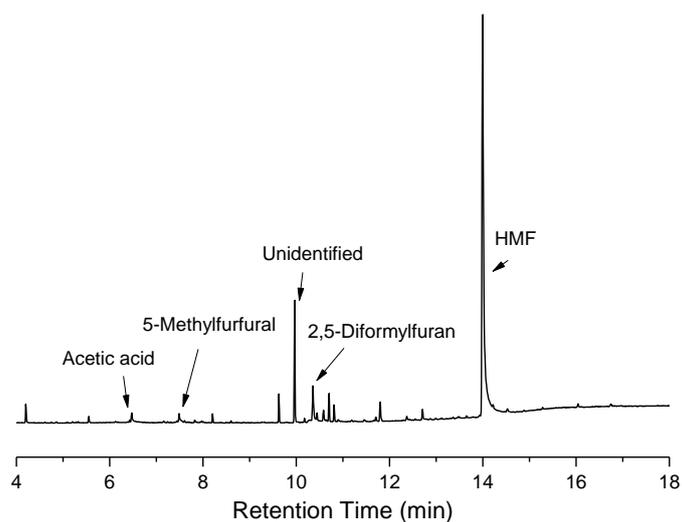


Fig. S5 GC chromatogram of the products isolated from aqueous solution by evaporating out the water.

Due to that the FF and 5-methylfurfural could be evaporated with the water, so neglectable FF and 5-methylfurfural peaks were detected in GC chromatogram. But other reaction such as condensation and oxidation could take place during the evaporation process. A certain amount of HMF was oxidized to 2,5-Diformylfuran during the evaporation process, other condensation reaction also took place during the evaporation process.

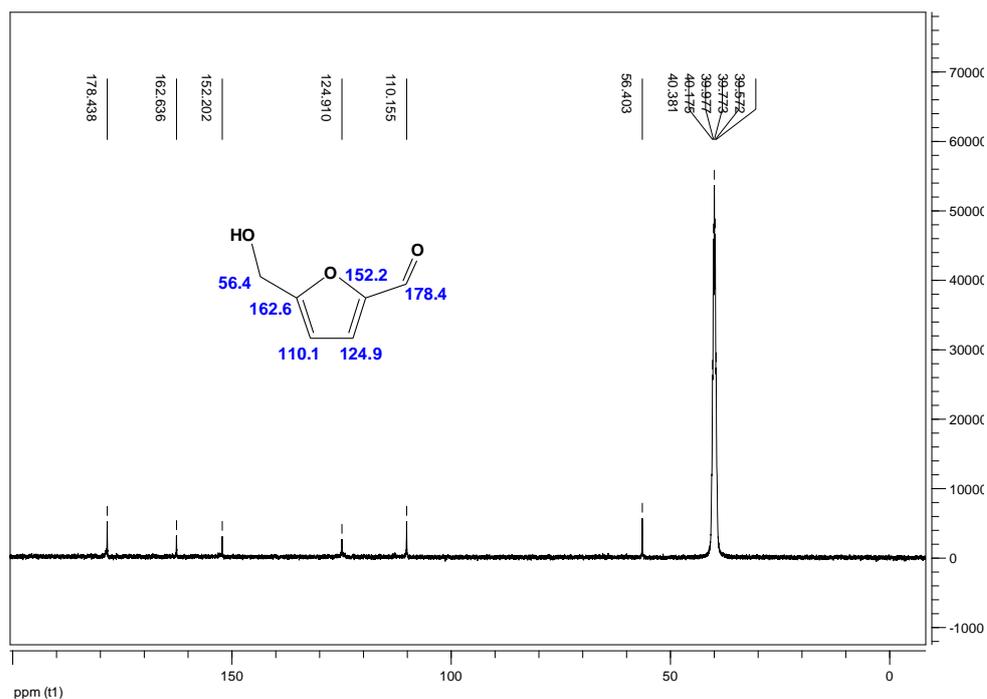


Fig. S6. ^{13}C NMR spectrum of the separated HMF in the Dimethyl sulfoxide- d_6 . The highest peaks around 40 ppm were ascribed to the chemical shift of solvent. The chemical shifts labeled on the HMF molecule structure were corresponding to the spectrum.

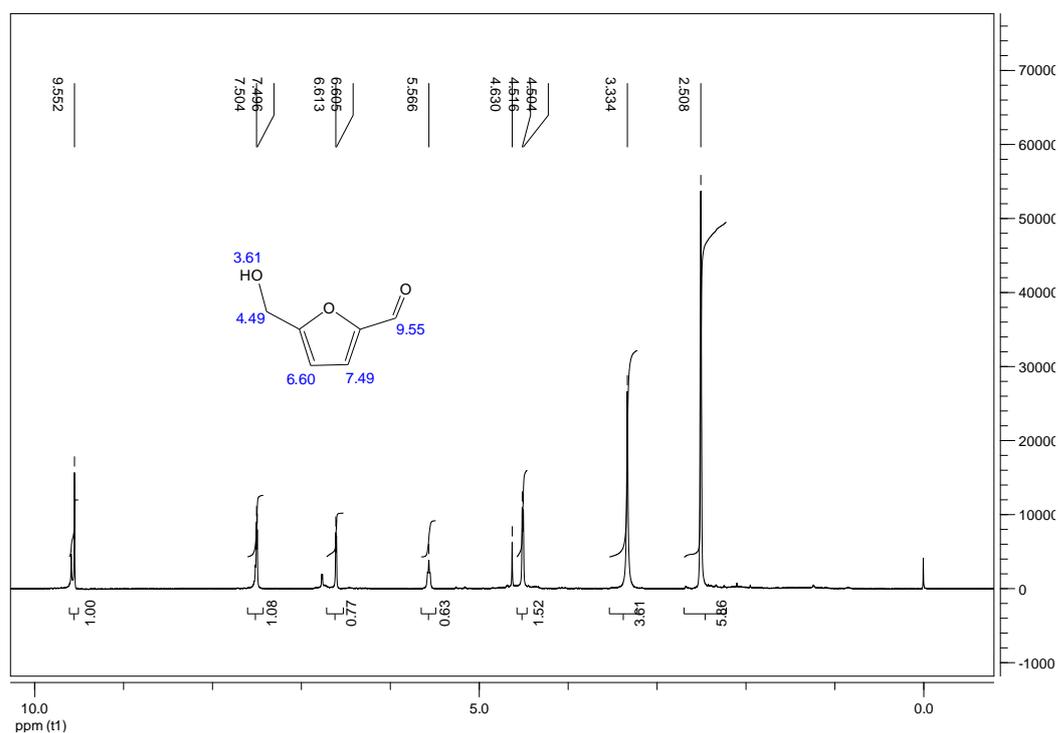


Fig. S7. ^1H NMR spectrum of the isolated products in the Dimethyl sulfoxide- d_6 . Other peaks were ascribed to byproducts such as furfural and 5-methyl-2-furaldehyde.



Fig S8 Photograph of the apparatus used