

Supplementary Material for

**A Selective and Economic Carbon Catalyst from Waste for Aqueous Conversion
of Fructose into 5-Hydroxymethylfurfural**

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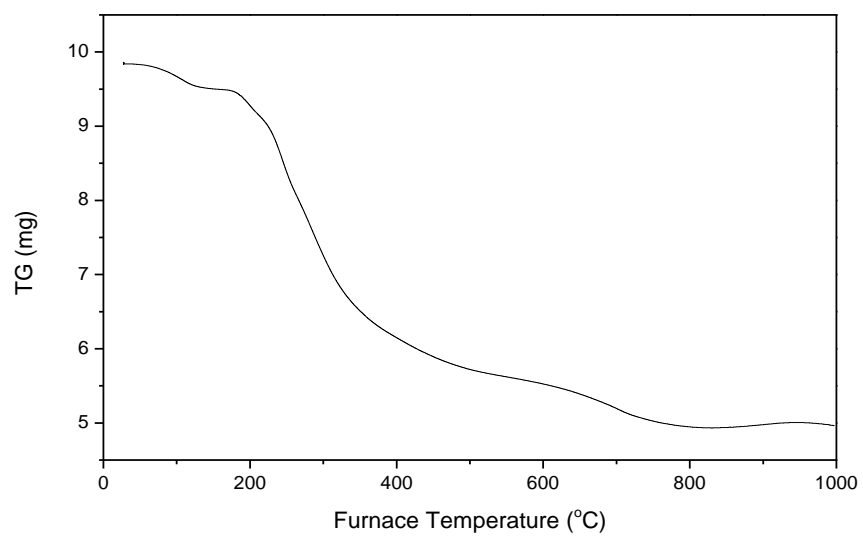


Fig.1S. TG-MS spectrum of Sodium Ligninsulfonate (SLS).

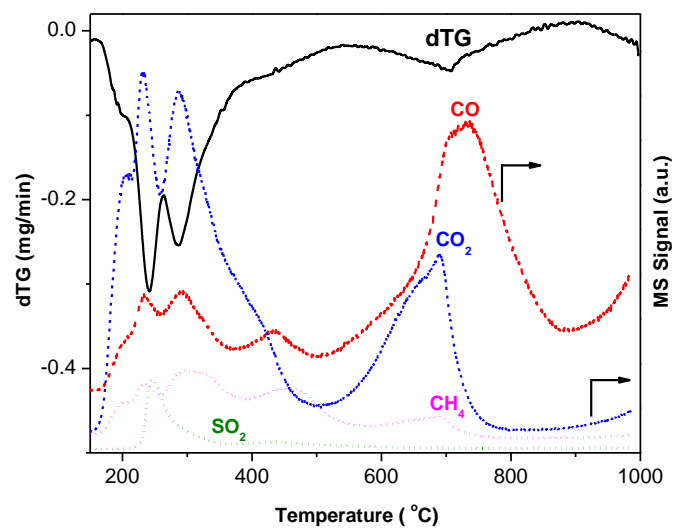


Fig. 2S. dTG-MS spectra of Sodium Ligninsulfonate (SLS).

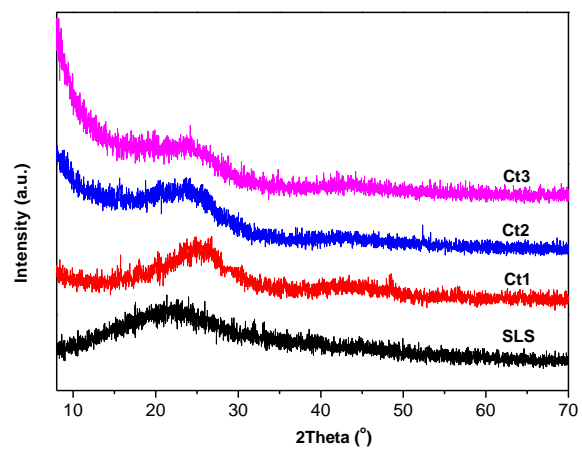


Fig. 3S. XRD patterns of SLS and the carbonized catalysts.

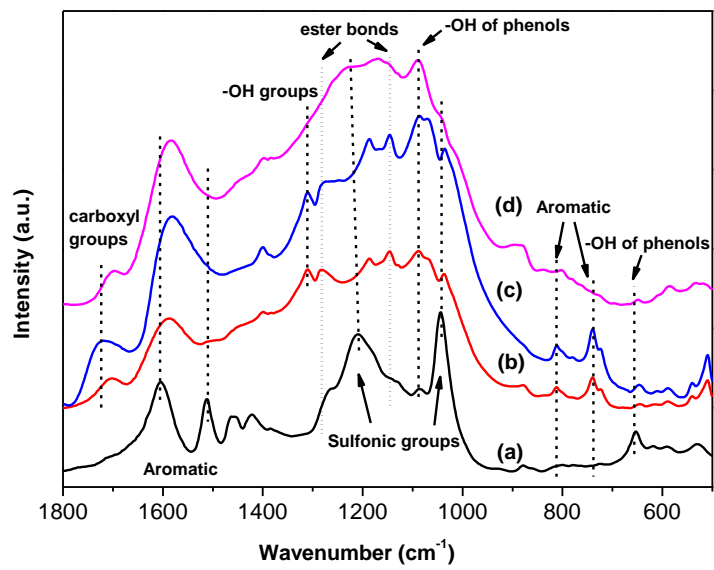


Fig. 4S. FT-IR spectra of (a) SLS, (b) Ct1, (c) Ct2, (d) Ct3.

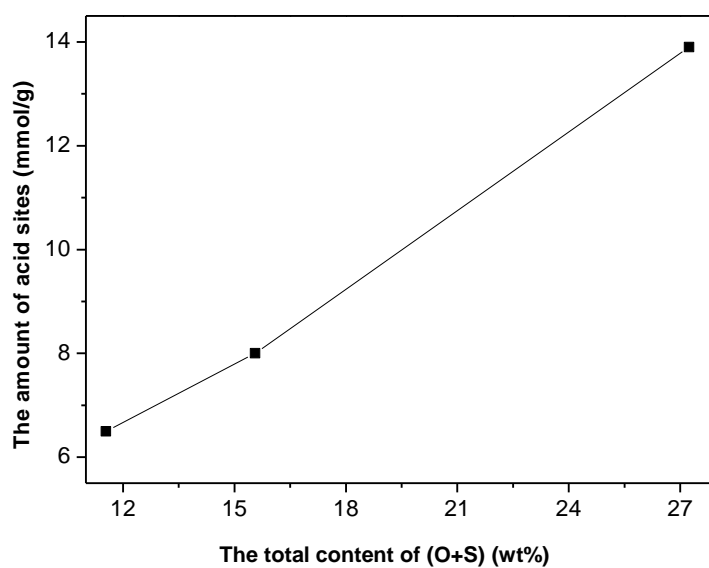


Fig. 5S. Correlation of the amount of total acid sites with the total content of (O+S) in the samples.

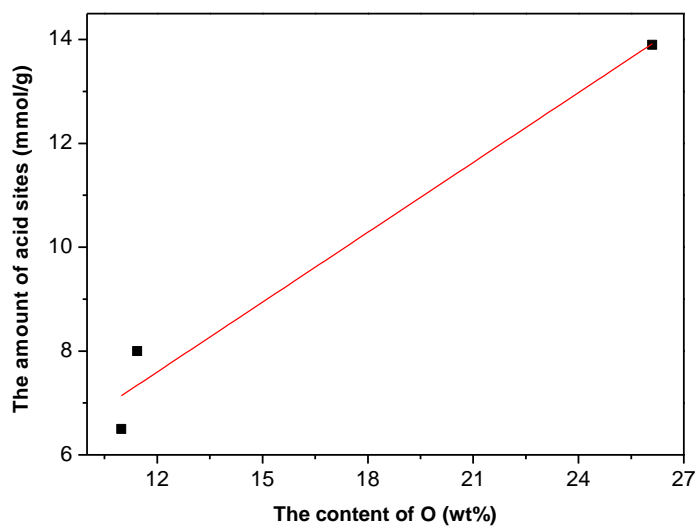


Fig.6S. The relationship between the content of oxygen and the amount of total acid sites in the three catalysts.

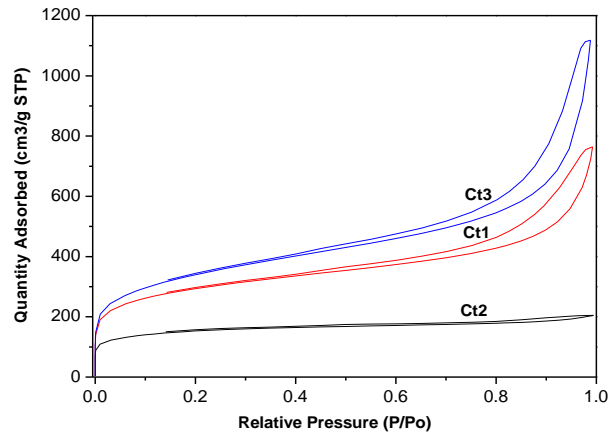
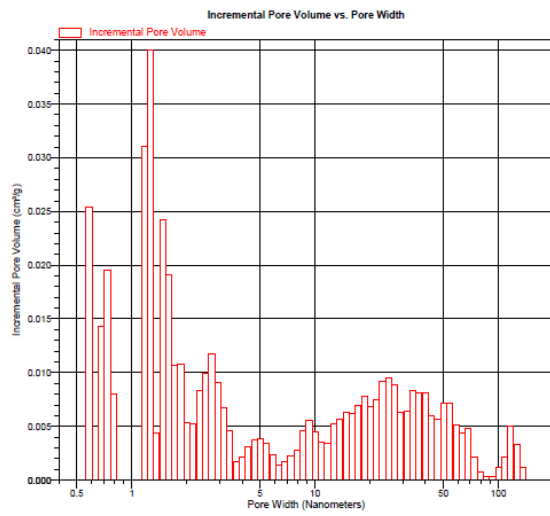
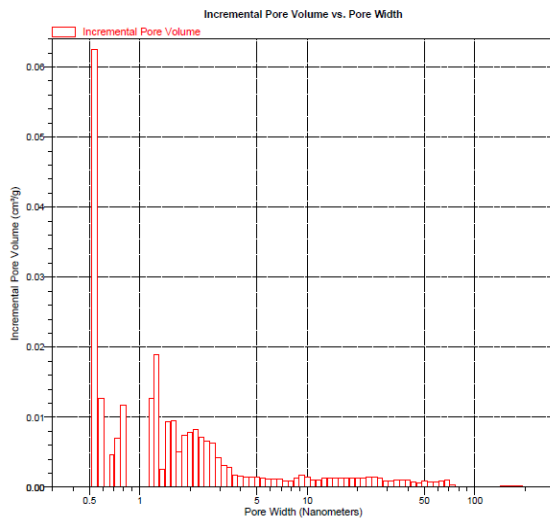


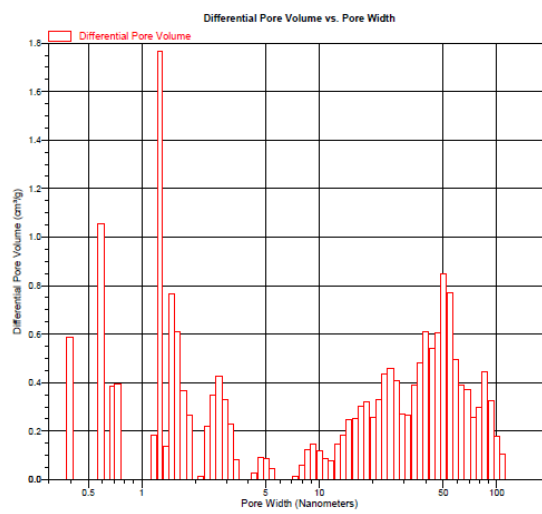
Fig. 7S. Nitrogen adsorption-desorption isotherms of the carbonized catalysts.



Ct1



Ct2



Ct3

Fig.8S. Horvath-Kawazoe analysis of pore size distributions of carbonized catalysts.

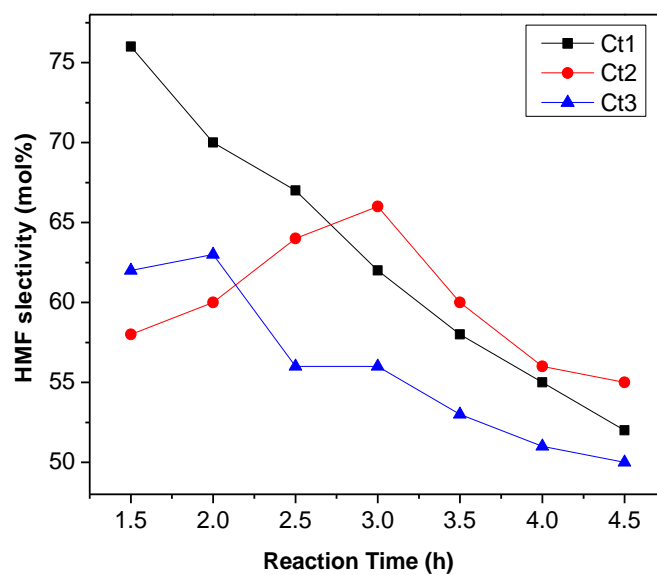
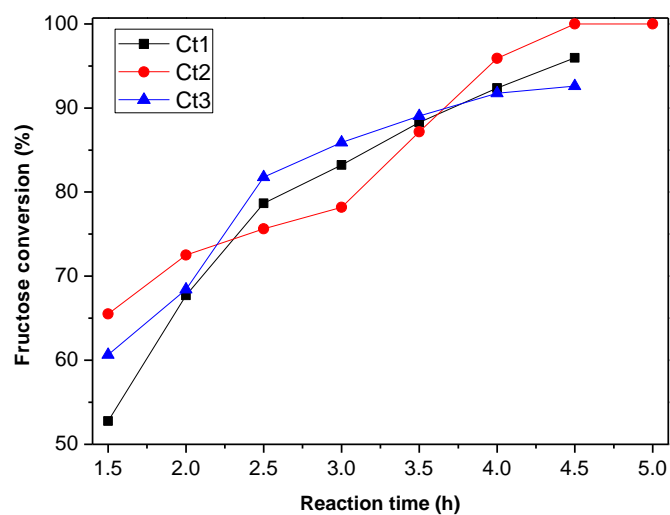


Fig. 9S. The fructose conversions and HMF selectivity on the three catalysts.

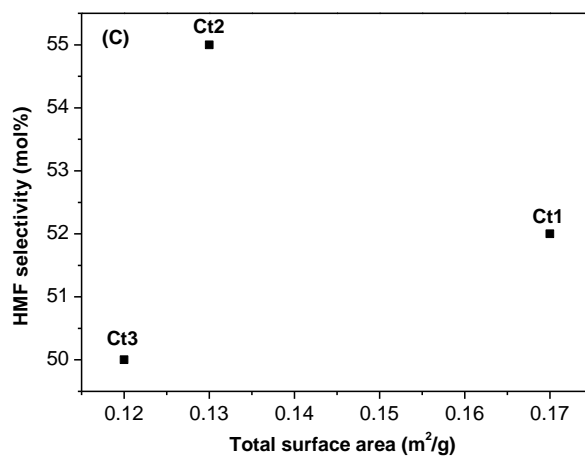
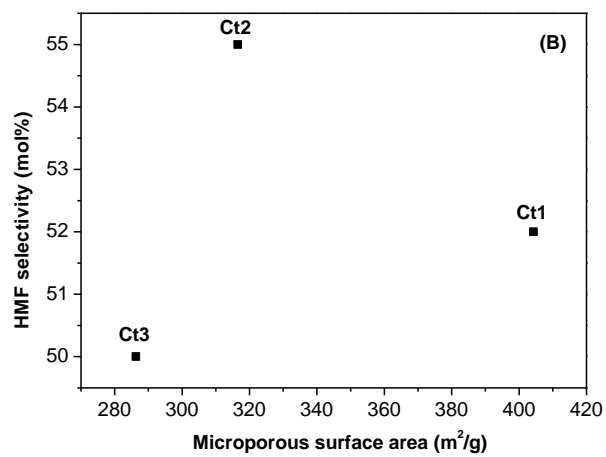
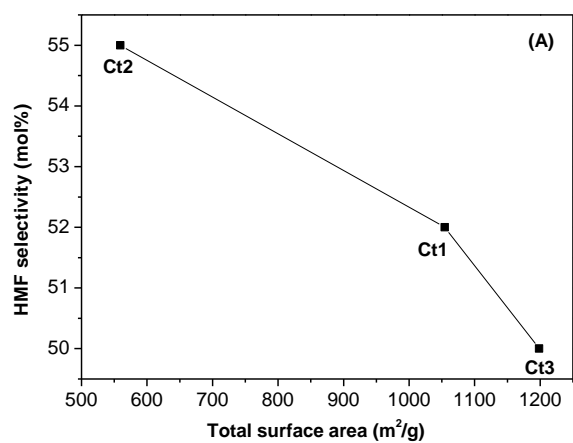


Fig. 10S. Correlation between HMF selectivity and (A) the total surface area of the catalysts, (B) the microporous surface area of the catalysts, and (C) the microporous volume of the catalysts.

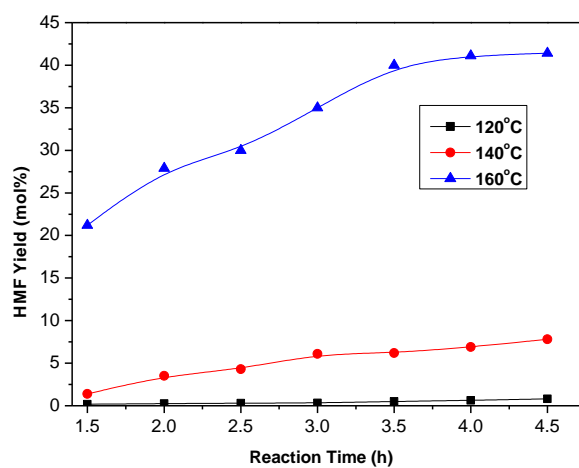


Fig. 11S. Effect of temperature of Ct1 on the conversion of fructose into HMF.

Reaction condition: 5 mg Ct1, 5 ml water, 1.0 mmol fructose.

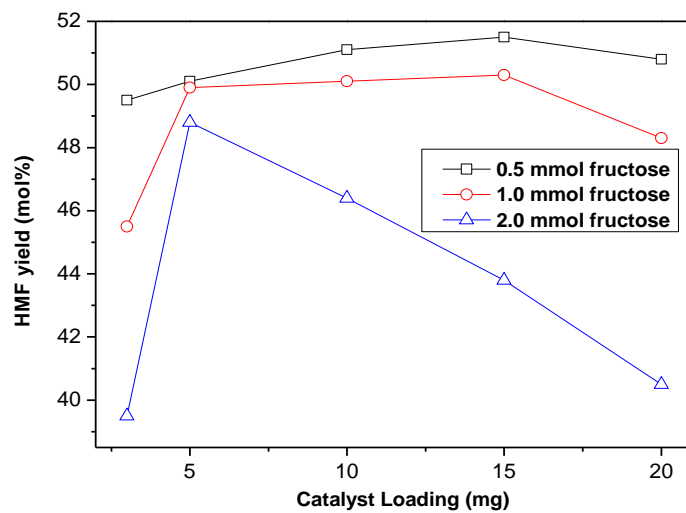


Fig. 12S. Effects of catalyst loading on HMF yield under various fructose concentrations. Reaction condition: Ct1, 170 °C, 5ml water, 4.5 h.

Table 1S The effect of atmosphere on the weight of SLS after carbonization

| Catalyst | Atmosphere | Overall Yield (wt%) |
|----------|---------------------------|---------------------|
| Ct1 | Static air | 25% |
| Ct2 | 80 ml/min, air | 8% |
| Ct3 | 80 ml/min, N ₂ | 35% |

Table 2S Elemental results of SLS and carbon catalysts

| Catalyst | C | O | S | P |
|----------|-------|-------|------|--------|
| Ct1 | 81.49 | 11.43 | 4.13 | 0.19 |
| Ct2 | 55.57 | 26.10 | 1.14 | 0.38 |
| Ct3 | 77.45 | 10.98 | 0.56 | 0.36 |
| SLS | 42.94 | 38.59 | 6.58 | 0.0044 |