

## Supplementary Information

### **Catalytic aerobic oxidation of 5-hydroxymethylfurfural to 2,5-furandicarboxylic acid using Co-Mn/N-C catalysts in aqueous media**

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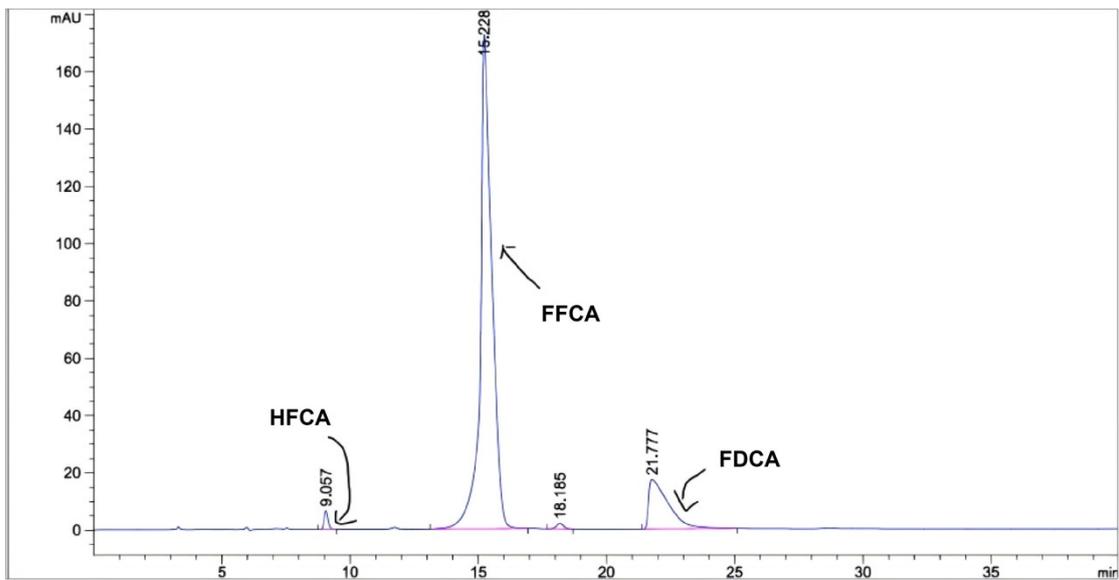
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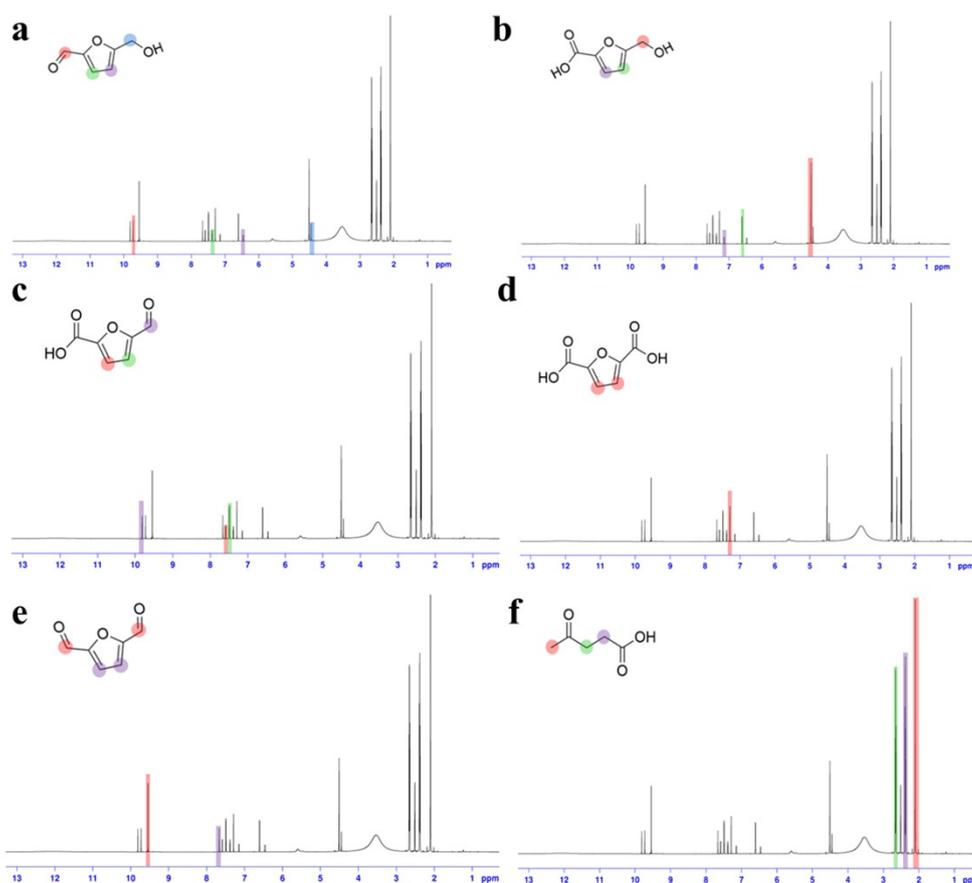
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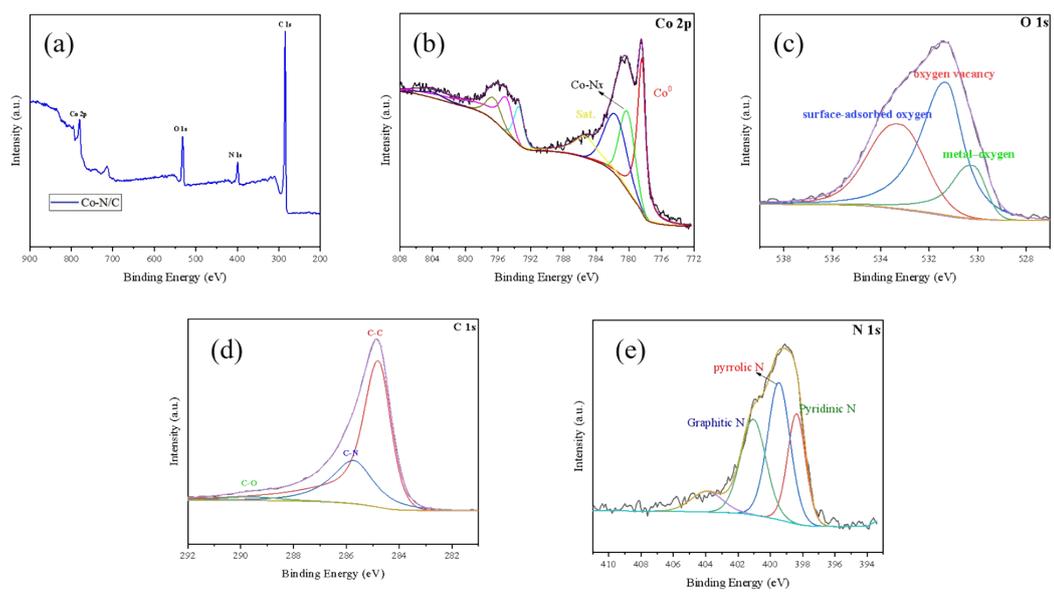
E-mail addresses: lxx@hunnu.edu.cn (X.X. Liu).



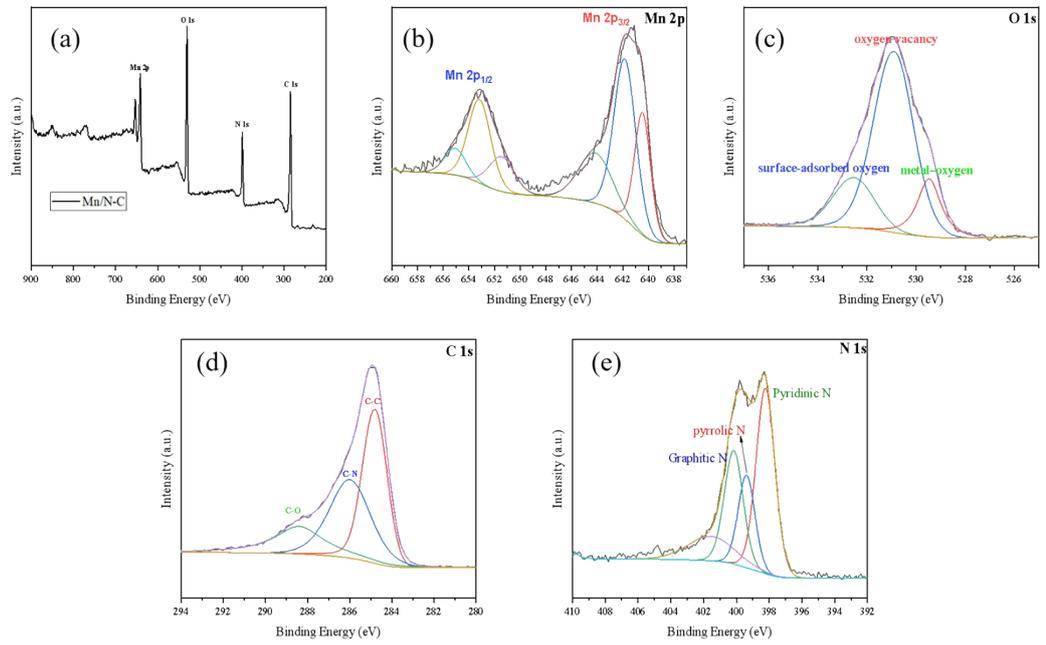
**Fig S1.** HPLC chromatogram for the main product from HMF oxidation



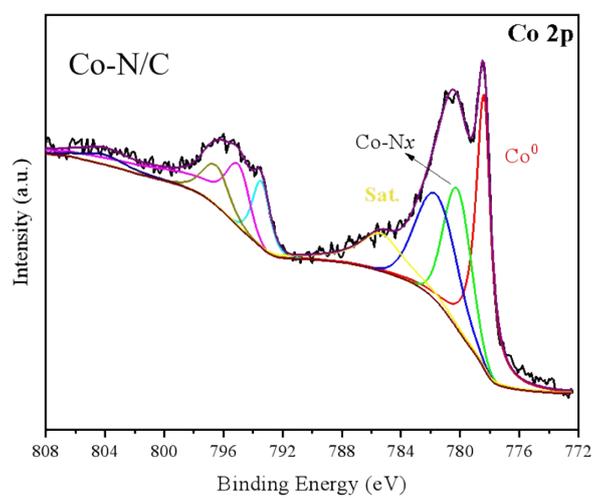
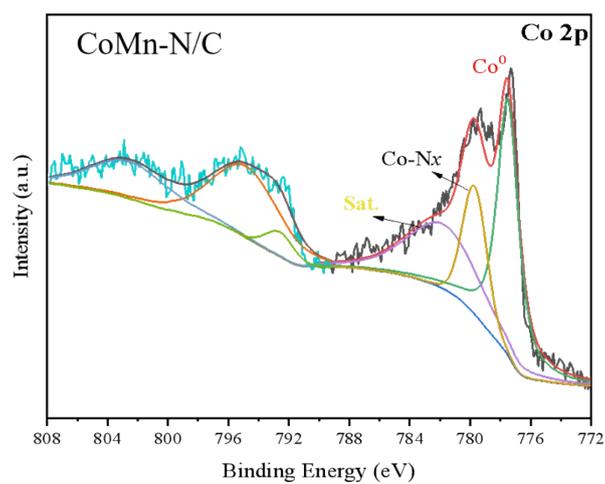
**Fig S2.**  $^1\text{H}$  NMR analysis of crude reaction mixture: HMF (a), HFCA (b), FFCA (c), FDCA (d), DFF (e), levulinic acid (LA) (f). After a simple concentration step, the reaction mixture was dissolved in  $\text{DMSO-d}_6$  for analysis. HMF shows four signals: aldehyde group (red, 9.7 ppm), furan ring (green and purple, 7.3 ppm and 6.4 ppm), and hydroxymethyl group (blue, 4.4 ppm) (a). HFCA shows three signals: furan ring (green and purple, 6.6 ppm and 7.1 ppm) and hydroxymethyl group (red, 4.5 ppm) (b). FFCA shows three signals: furan ring (red and green, 7.5 ppm and 7.4 ppm) and aldehyde group (purple, 9.8 ppm) (c). FDCA only shows one signal: furan ring (red, 7.2 ppm) for protons (d). DFF shows two signals for the furan ring (purple, 7.6 ppm) and the aldehyde group (red, 9.5 ppm) (e). LA shows three signals for the methylene group adjacent to the carbonyl group (red, 2.0 ppm), and the methyl and methylene groups on the alkyl chain (green and purple, 2.6 ppm and 2.3 ppm) (f).



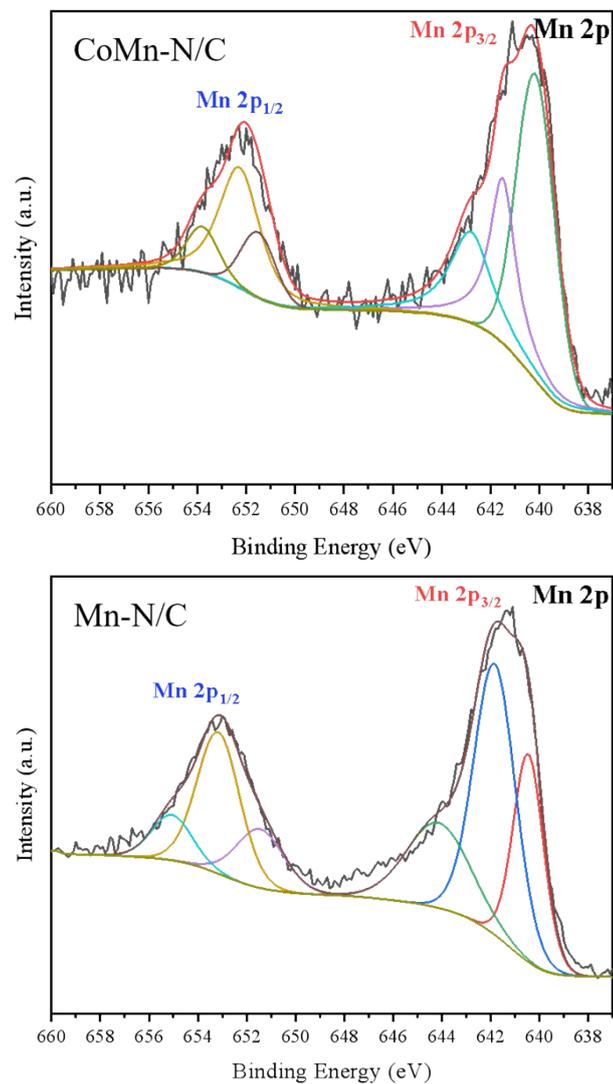
**Fig. S3.** XPS spectra for Co/N-C: (a) The survey; (b) Co 2p<sub>3/2</sub>; (c) O 1s; (d) C 1s; (e) N 1s



**Fig. S4.** XPS spectra for Mn/N-C: (a) The survey; (b) Mn 2p; (c) O 1s; (d) C 1s; (e) N 1s



**Fig. S5** Co 2p XPS spectra of Co-Mn/N-C and Co/N-C



**Fig. S6** Mn 2p XPS spectra of Co-Mn/N-C and Mn/N-C

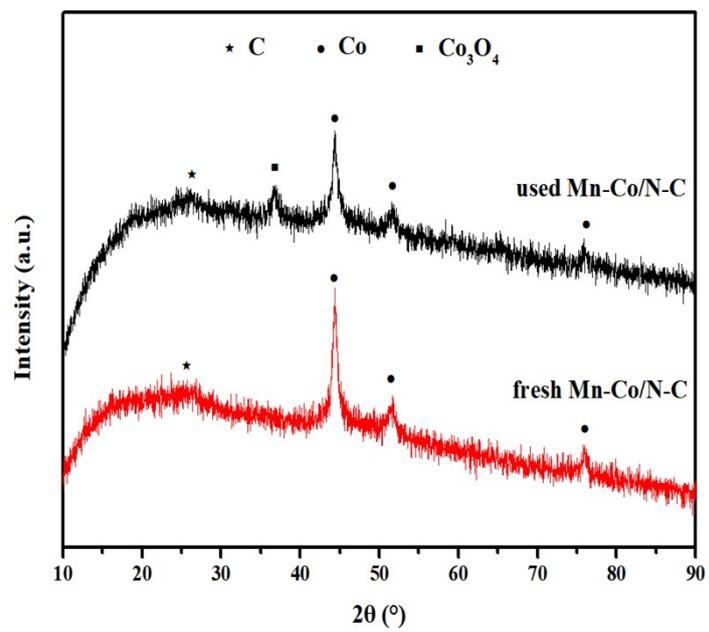


Fig. S7. XRD spectra of used Co-Mn/N-C and fresh Co-Mn/N-C