Versatile catalysis of Iron: tunable and selective transformation of renewable furfural in aliphatic alcohol

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Supporting Information

Catalyst characterizations

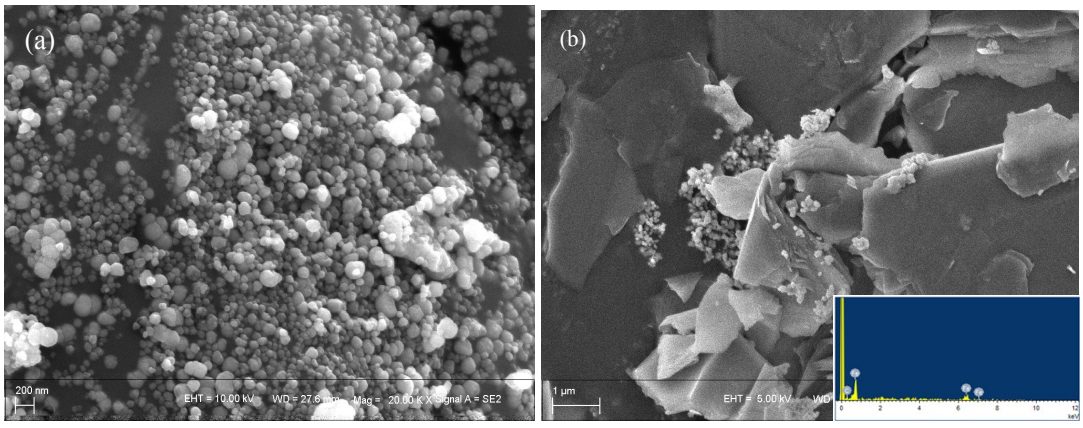


Figure S1. scanning electron microscopy (SEM) images of (a)Fe-EDTA complex and (b) Fe@C catalyst (the corresponding EDXS spectrum attached)

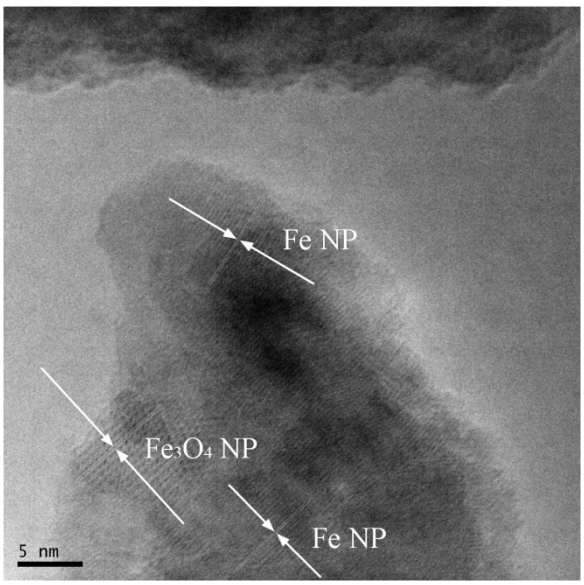


Figure S2. HRTEM image of surface structures of Fe nanoparticle covered by thin carbon layers

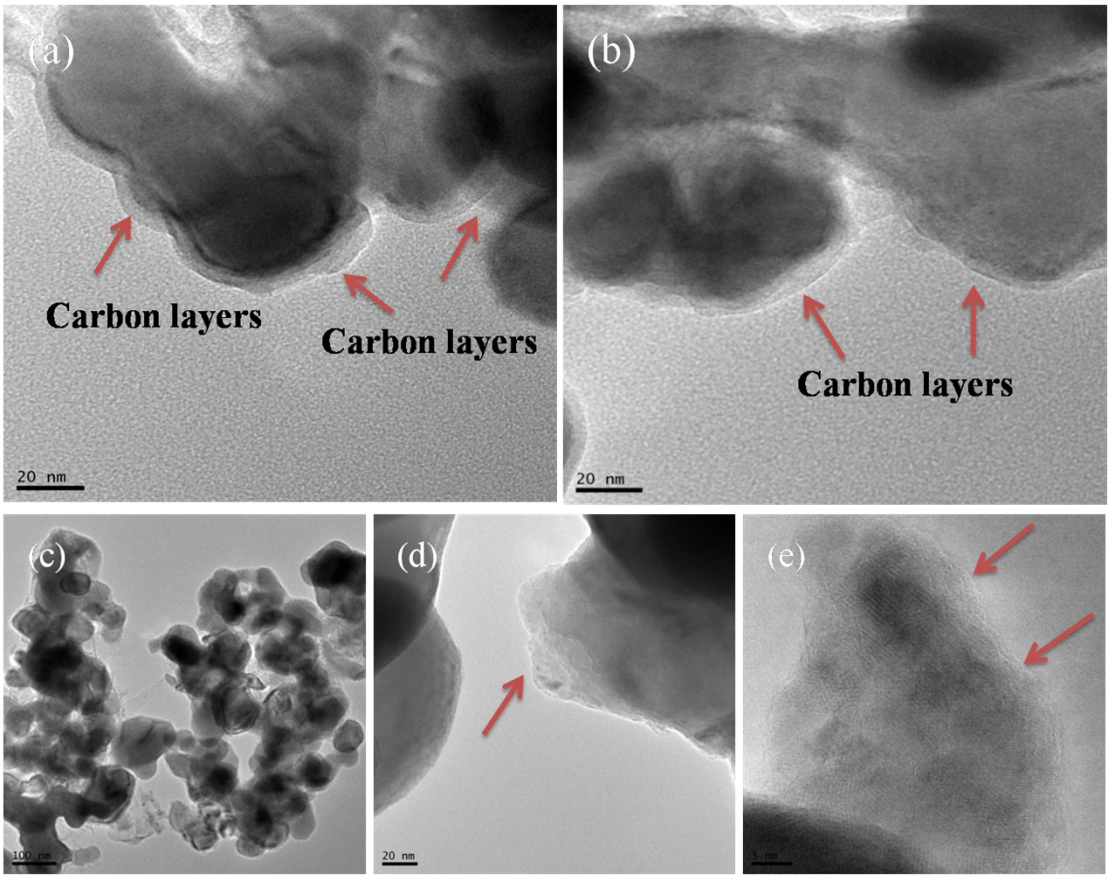


Figure S3. TEM image of surface structures of Fe particles covered by thin carbon layers with cracks indicated by red arrow

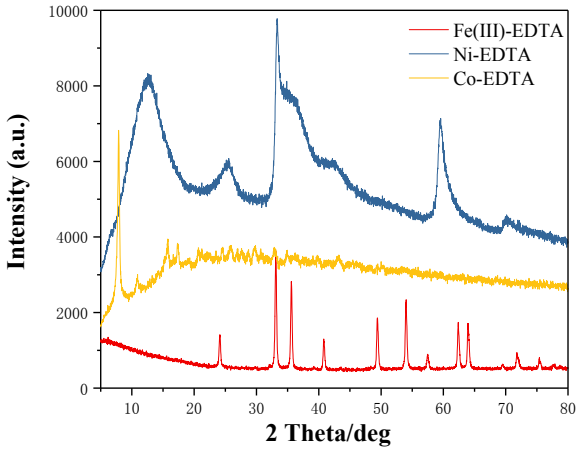


Figure S4. The XRD patterns of the Fe-EDTA, Co-EDTA and Ni-EDTA samples

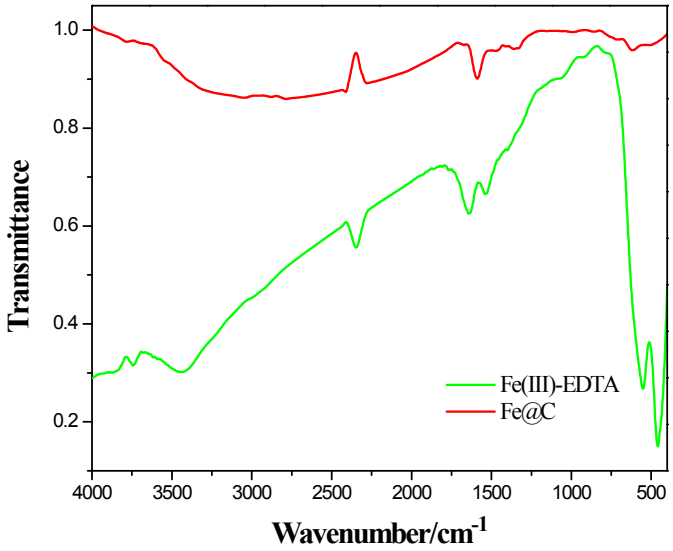


Figure S5. FT-IR spectrum of pre-catalyst Fe-EDTA and Fe@C

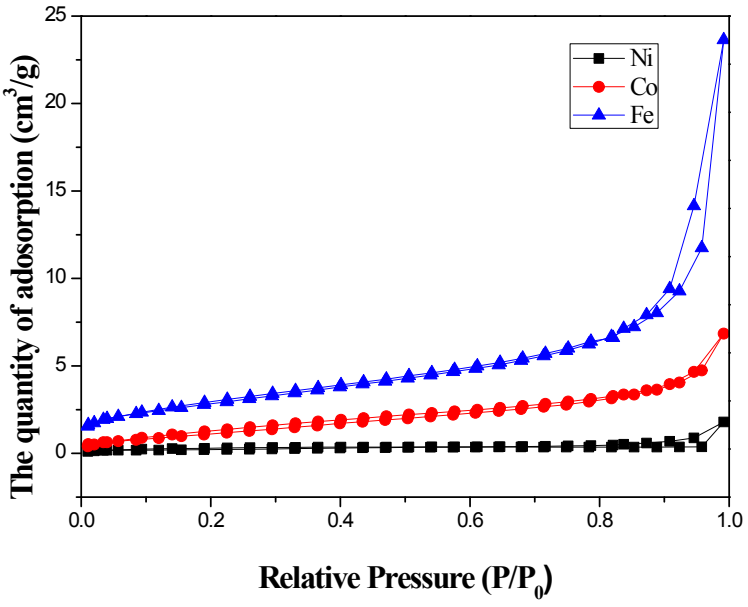


Figure S6. BET results of Fe@C, Ni@C and Co @C catalysts

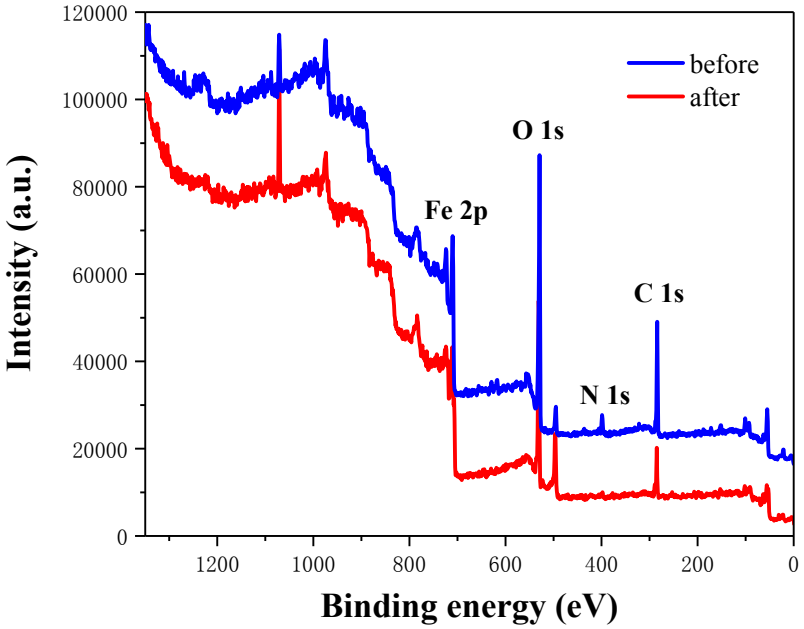


Figure S7. XPS results of Fe@C catalyst before and after reduced by H_2

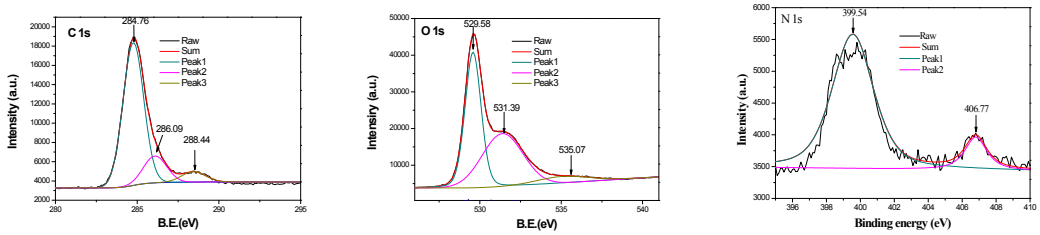


Figure S8. C1s, O1s and N1s high-resolution XPS spectrum of Fe(III)-EDTA

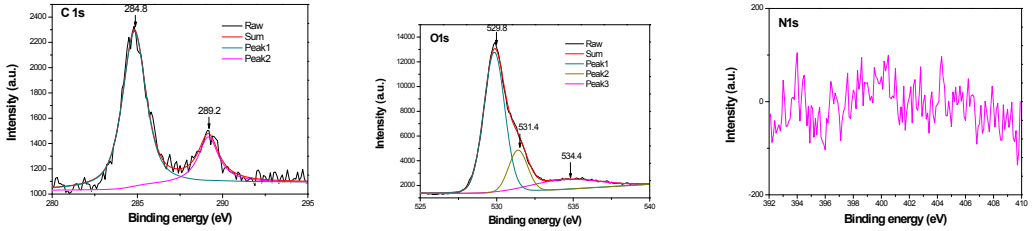


Figure S9. C1s, O1s and N1s high-resolution XPS spectrum of Fe@C

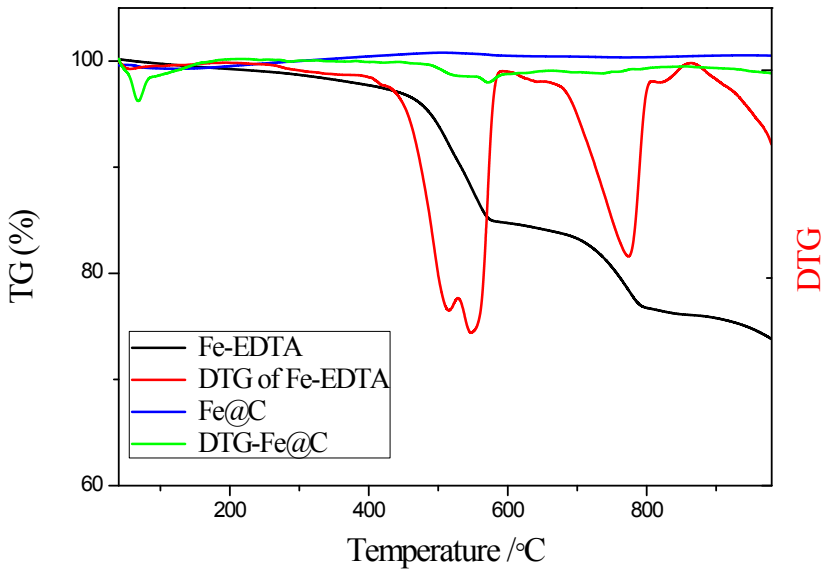


Figure S10. TGA ann DTG results of Fe@C catalyst and as-prepared Fe-EDTA complex

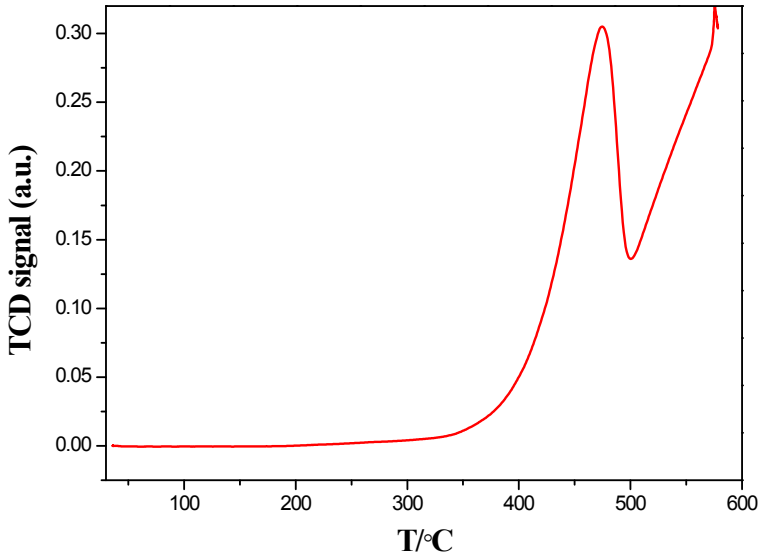


Figure S11. H_2-TPR profiles for pre-catalyst Fe(Ⅲ)-EDTA

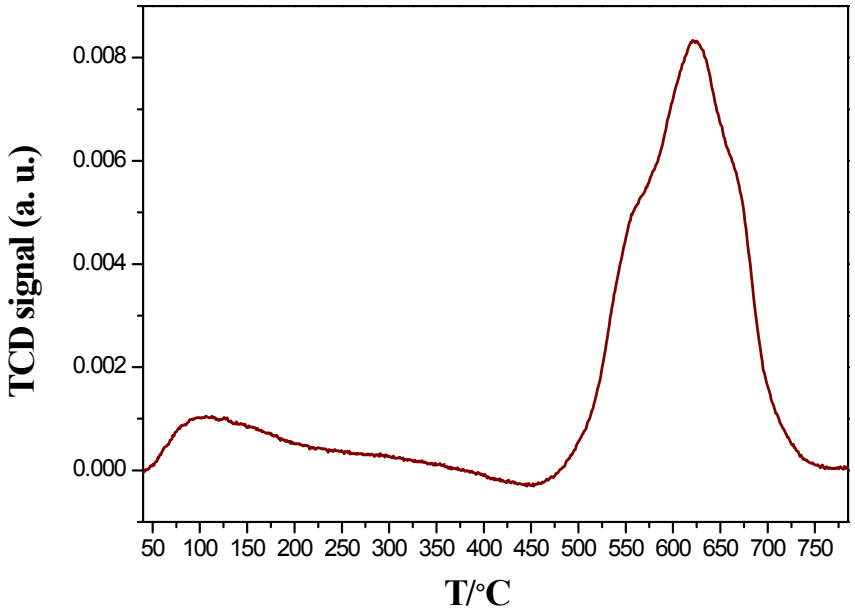


Figure S12. NH_3-TPD profiles for Fe@C solid catalyst

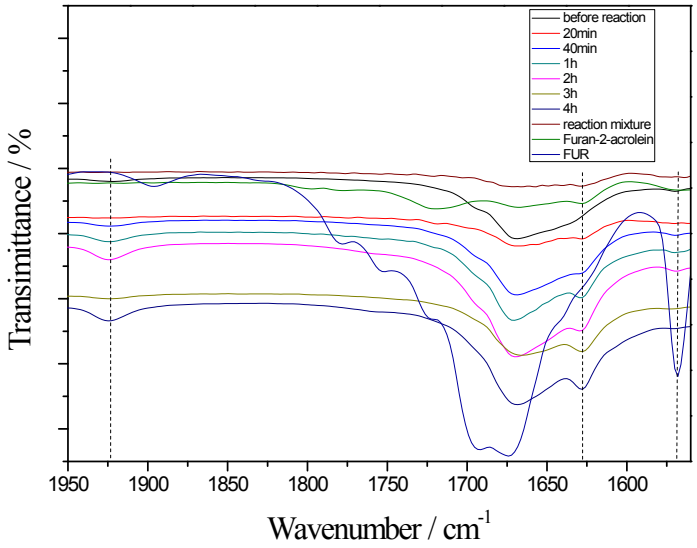


Figure S13. The FT-IR spectra for the detection of oxidation condensation of furfural

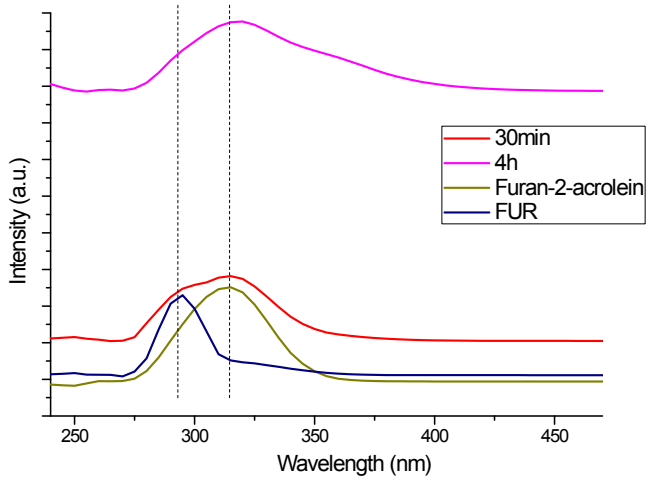
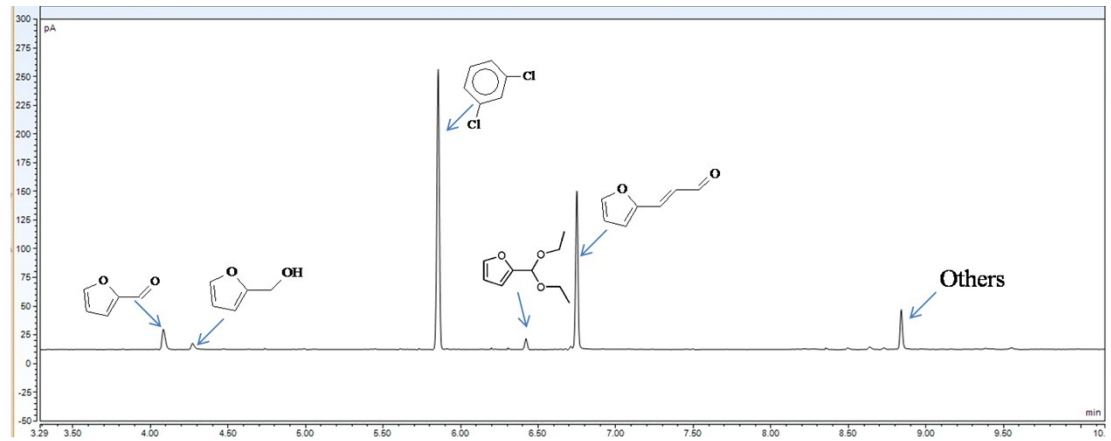


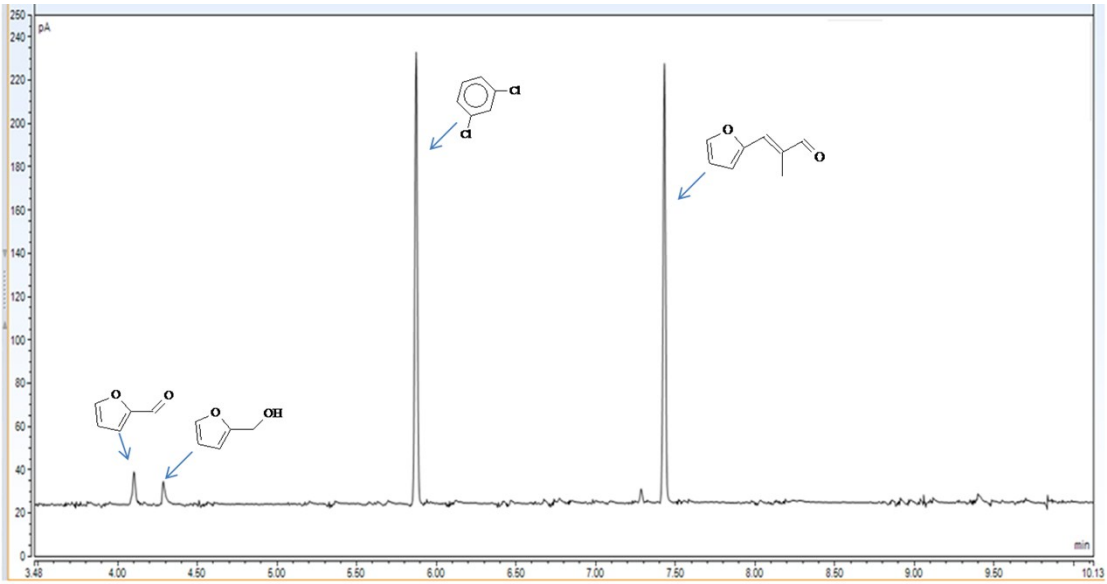
Figure S14. The UV-vis spectra for detection of oxidative condensation of furfural with ethanol

Figure S15. The magnetic properties Fe-EDTA (left) and Fe@C catalyst (right)

The detection of products



(a)



(b)

Figure S16. GC spectra for oxidative condensation of FUR with ethanol (a) and n-propanol (b)

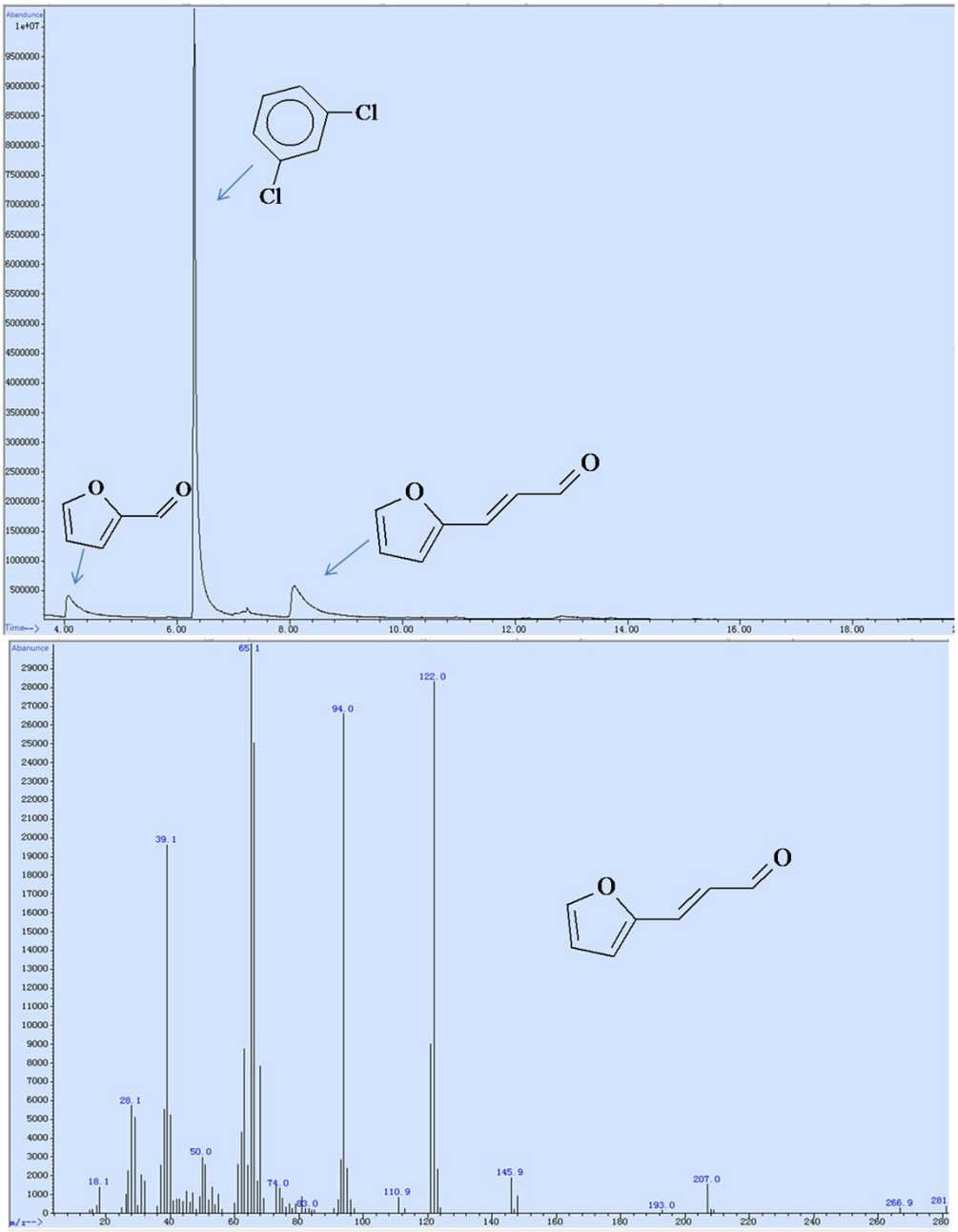


Figure S17. GC-MS analysis for the oxidative condensation of FUR with ethanol

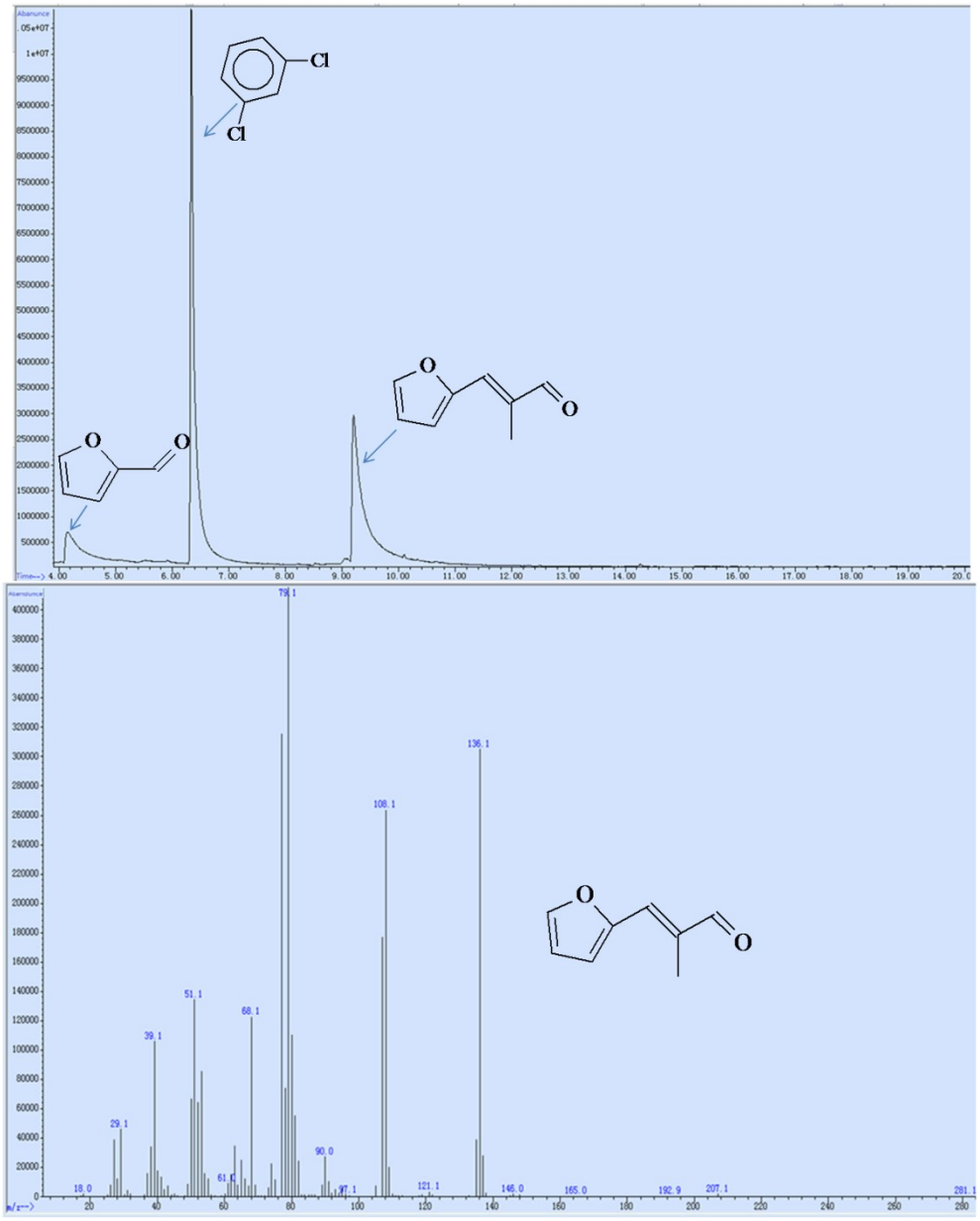


Figure S18. GC-MS analysis for the oxidative condensation of FUR with n-propanol

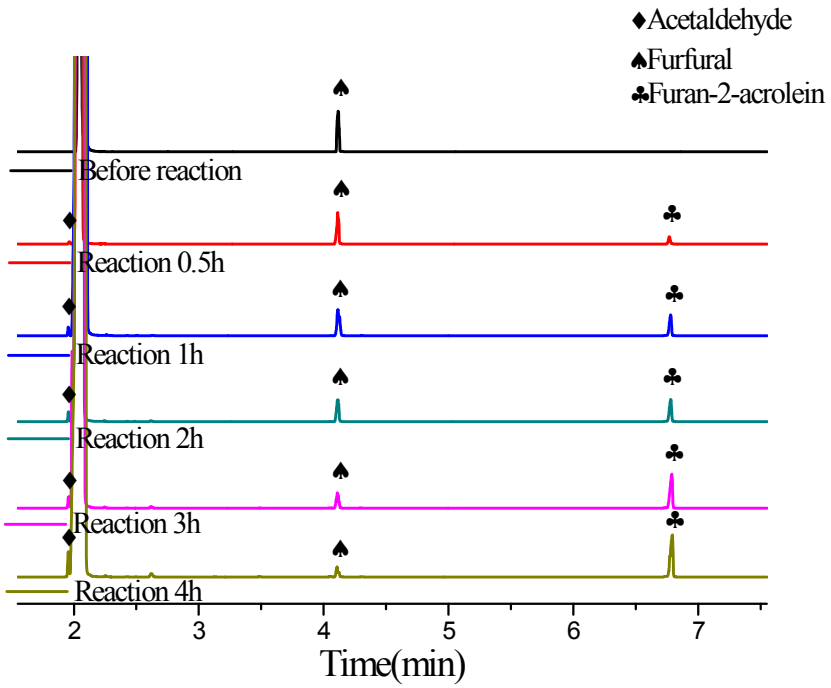
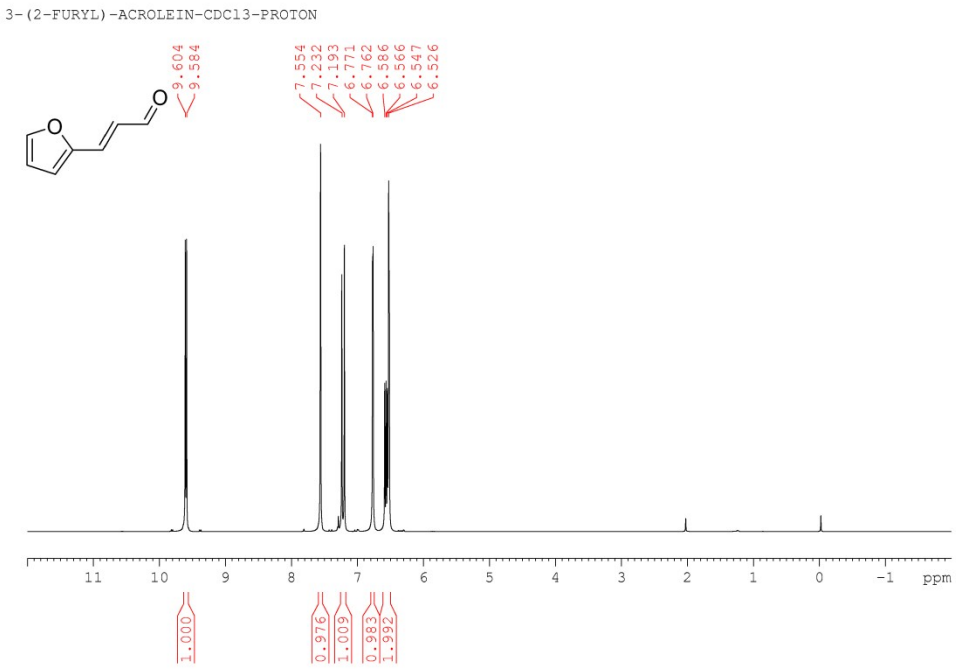


Figure S19 The detection of acetaldehyde (t=1.955) and reaction product by GC



(c)

Figure S20. The ^{1}H NMR spectrum for furan-2acrolein obtained in the “FUR-ethanol-O2” system