Supplementary Material

Manufacture of olefins by the selective hydrodeoxygenation of lignocellulosic ketones over the cobalt molybdate catalyst

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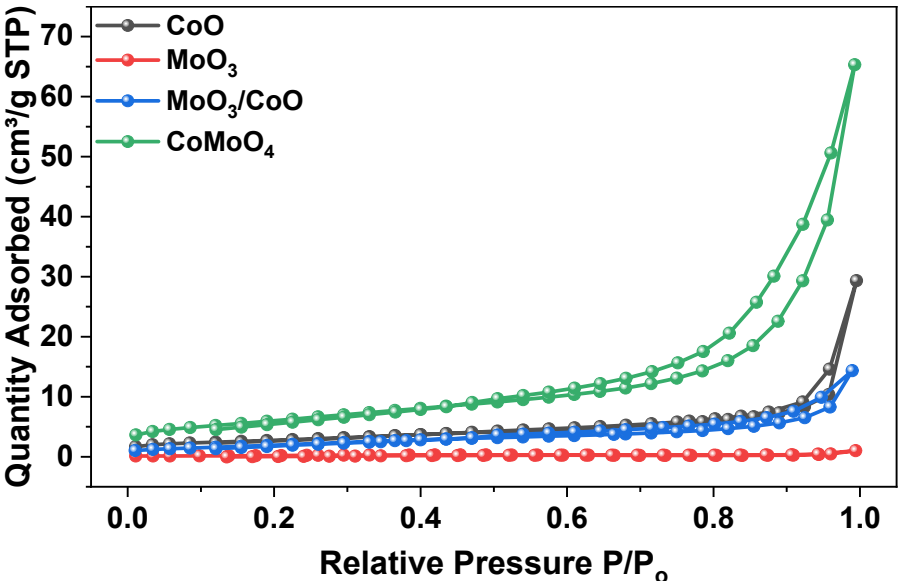

Fig. S1. N_2 adsorption-desorption isotherms of the CoO, MoO_3, MoO_3/CoO and $CoMoO_4$ catalysts.

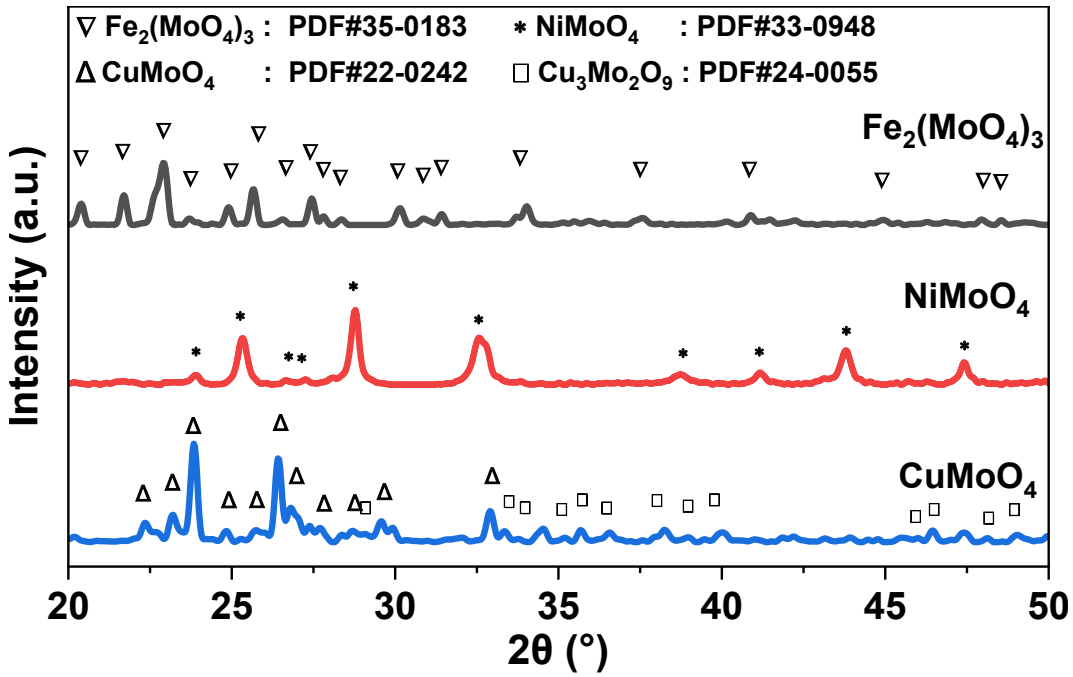

Fig. S2. XRD patterns of the $Fe_2(MoO_4)_3$, $NiMoO_4$ and $CuMoO_4$ catalysts

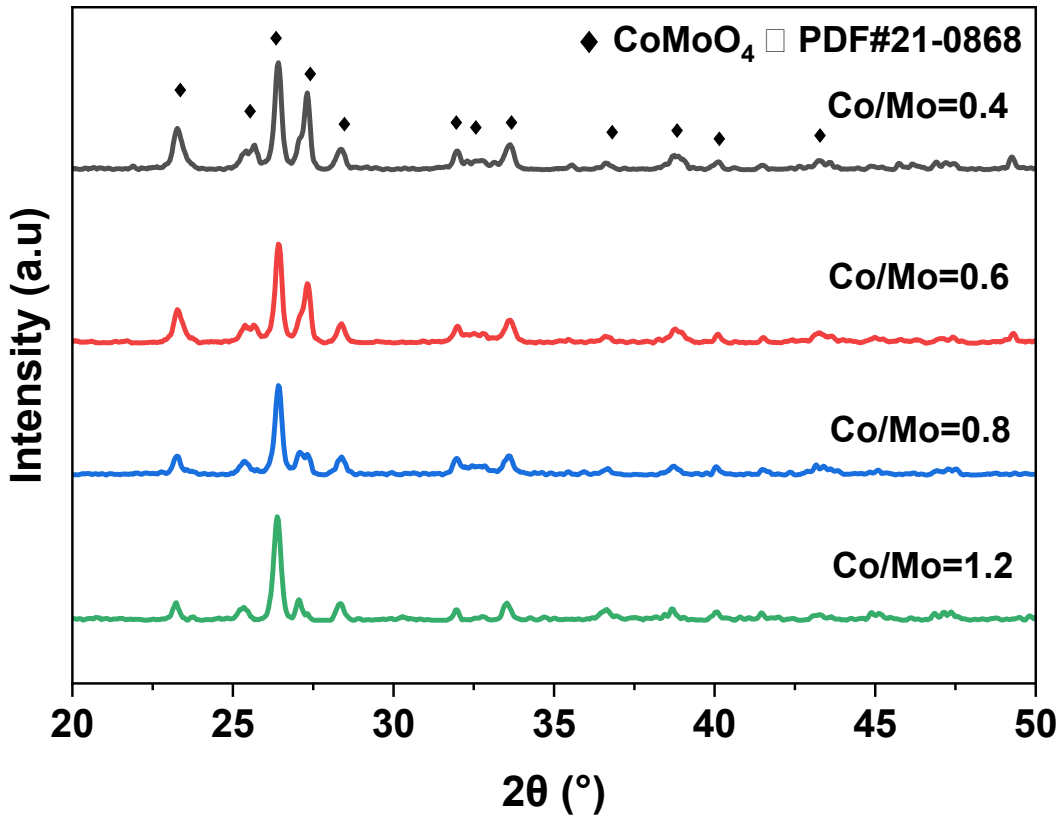

Fig. S3. XRD patterns of the cobalt molybdate catalysts with different Co/Mo atomic ratios.

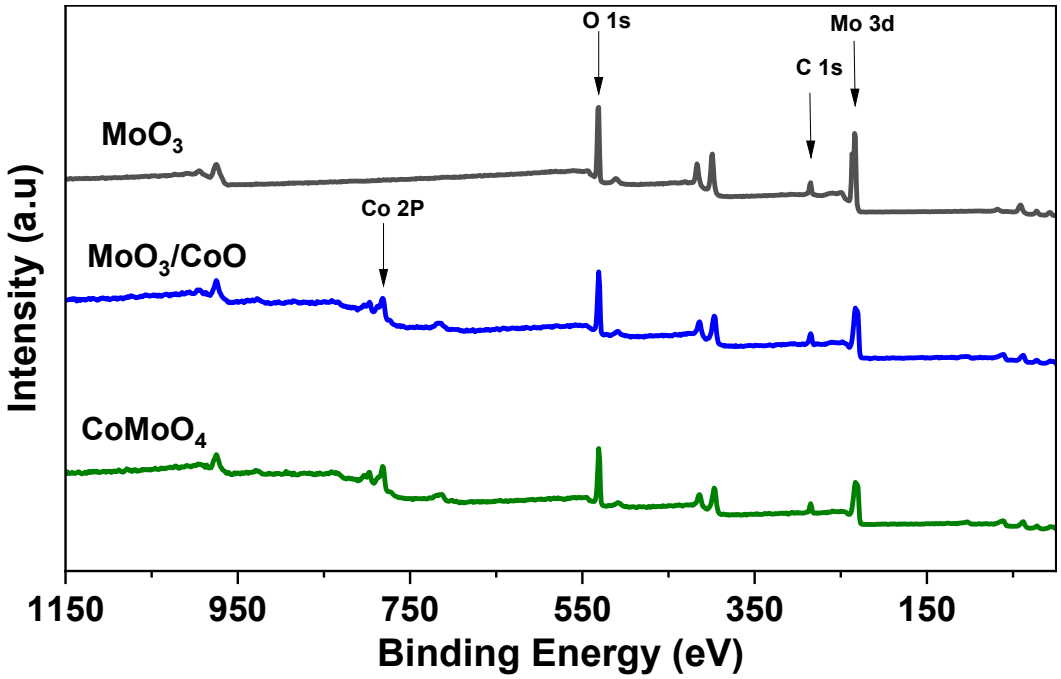

Fig. S4. XPS survey of the reduced MoO_3, MoO_3/CoO and $CoMoO_4$ catalysts.

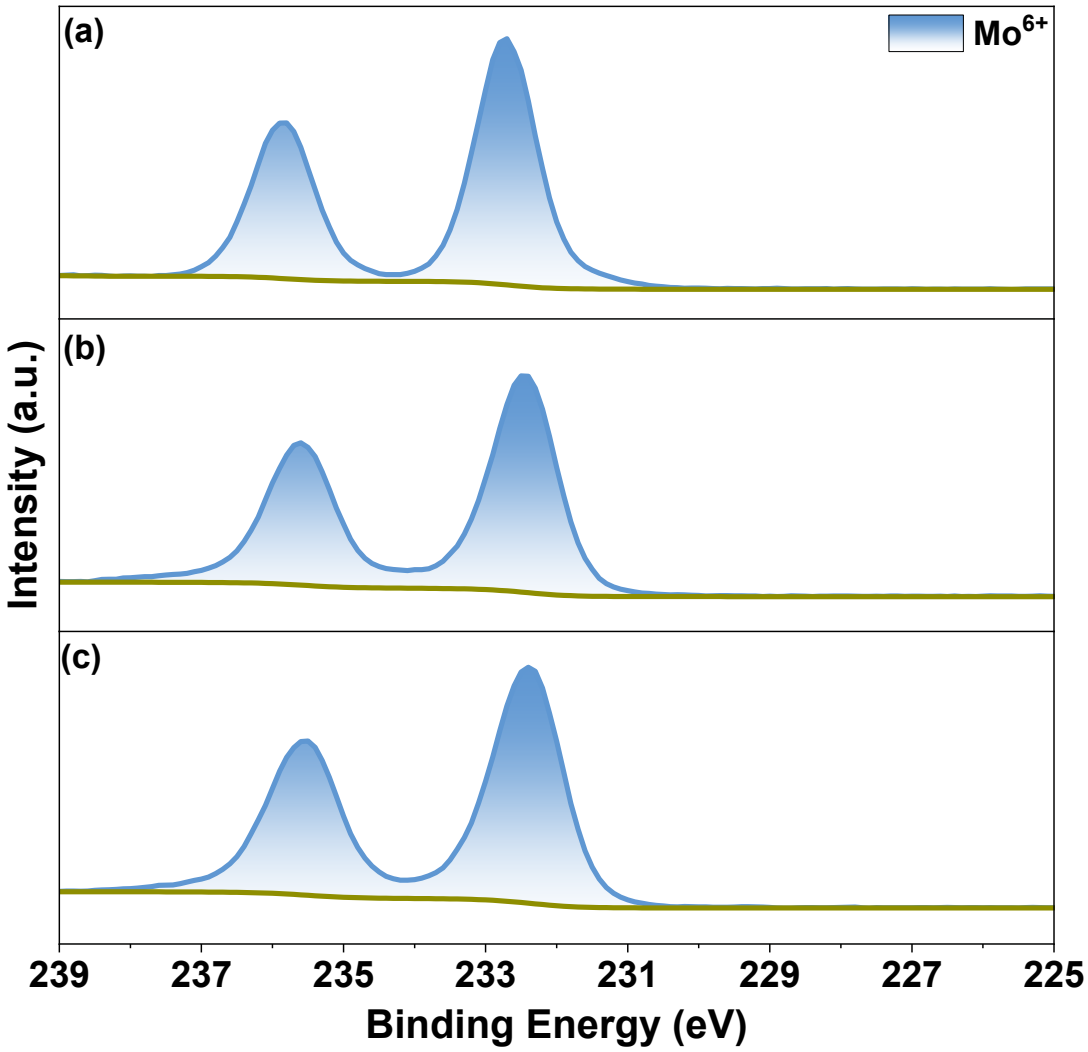

Fig. S5. XPS Mo 3d core level spectra of the unreduced (a) MoO_3, (b) MoO_3/CoO and (c) $CoMoO_4$ catalysts.

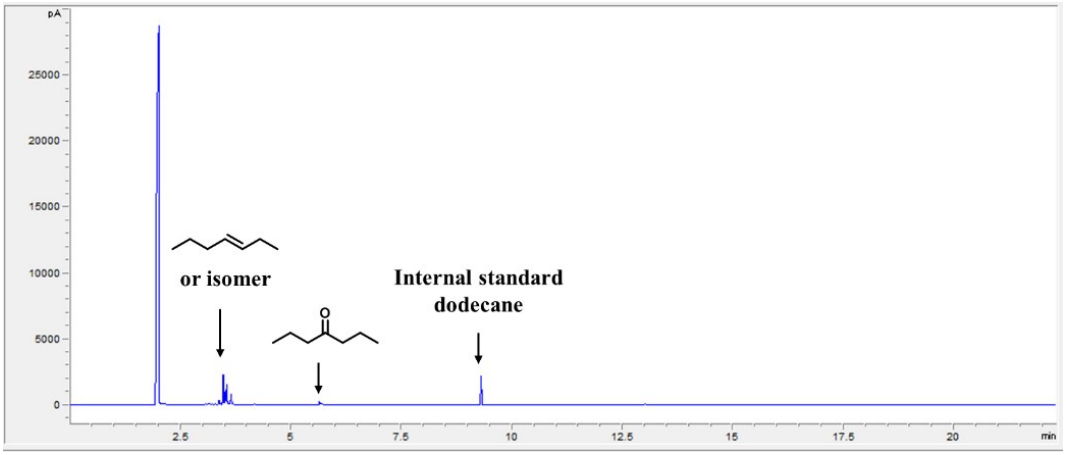

Fig. S6. Gas chromatogram of the products from the selective hydrodeoxygenation (HDO) of 4-heptanone over the $CoMoO_4$ catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 15 h^{-1}, initial H_2/4-heptanone molar ratio = 50:1.

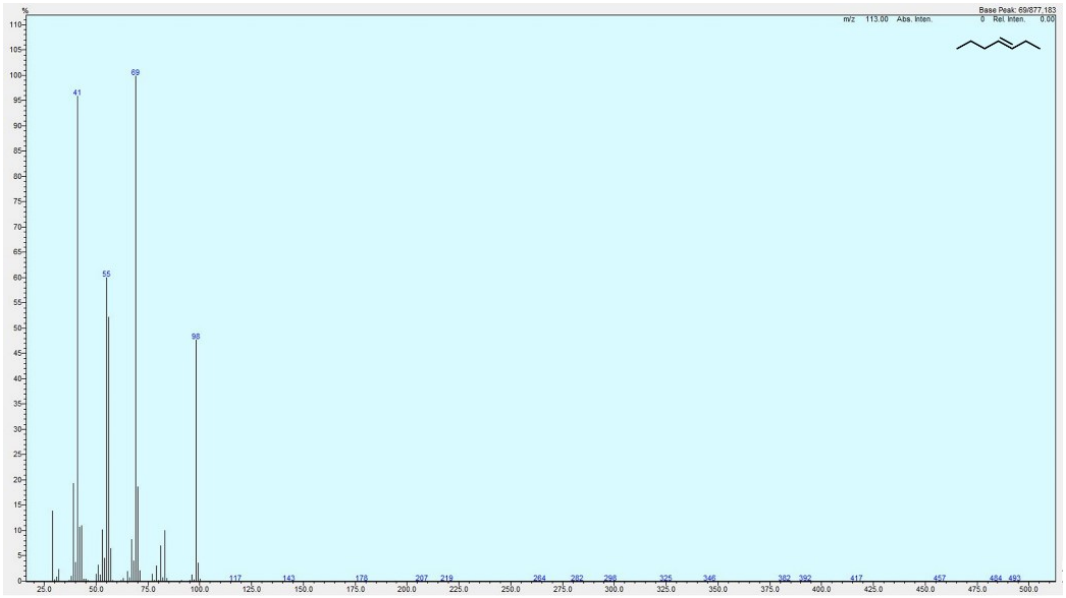

Fig. S7. Mass spectrogram of the heptene from the selective HDO of 4-heptanone over the $CoMoO_4$ catalyst.

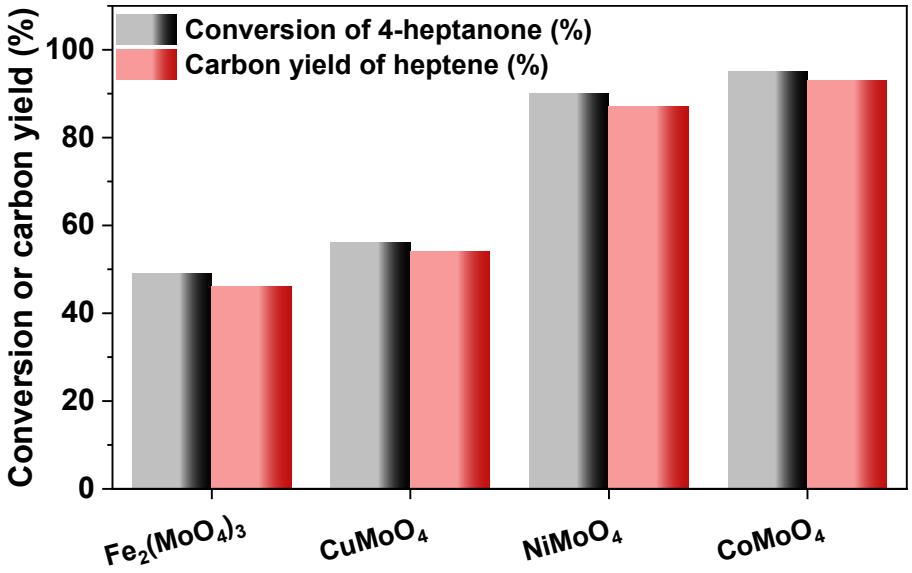

Fig. S8. Conversions of 4-heptanone and the carbon yields of heptene over the $Fe_2(MoO_4)_3$, $CuMoO_4$, $NiMoO_4$ and $CoMoO_4$ catalysts. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 15 h^{-1}, initial H_2/4-heptanone molar ratio = 50:1.

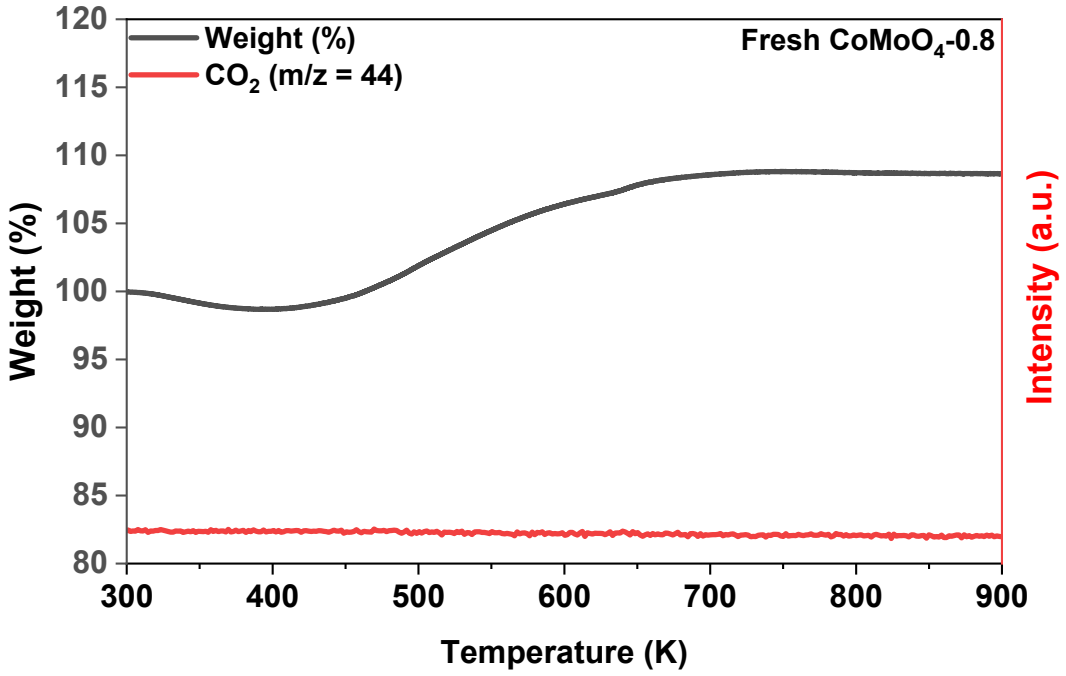

Fig. S9. TG-MS profile of the fresh $CoMoO_4$-0.8 catalyst.

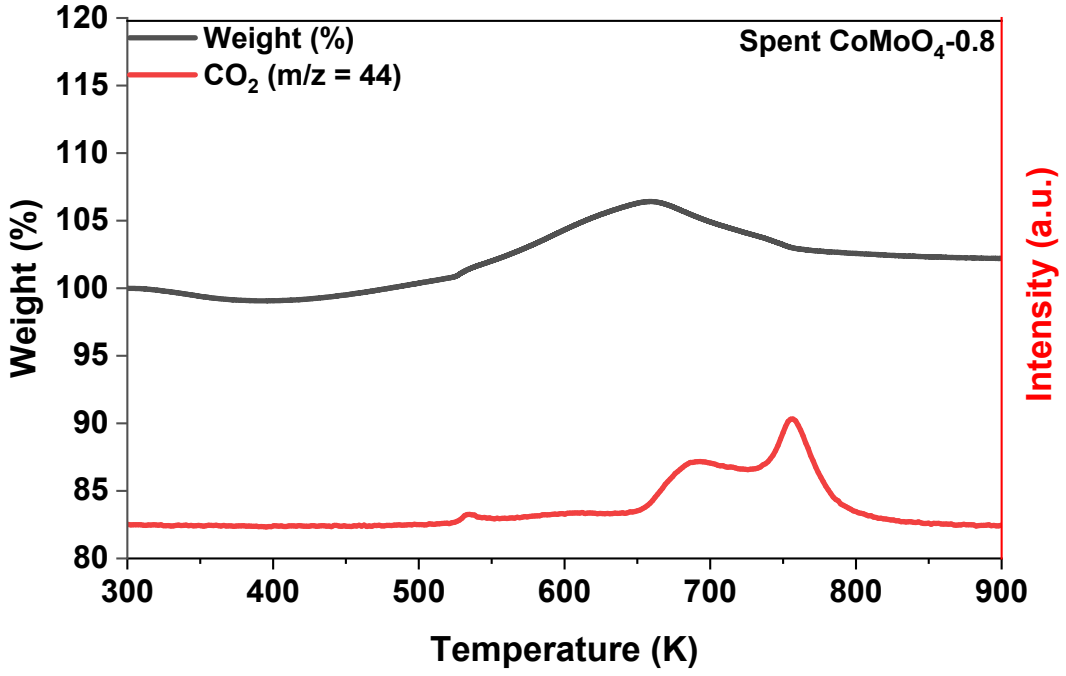

Fig. S10. TG-MS profile of the spent $CoMoO_4$-0.8 catalyst.

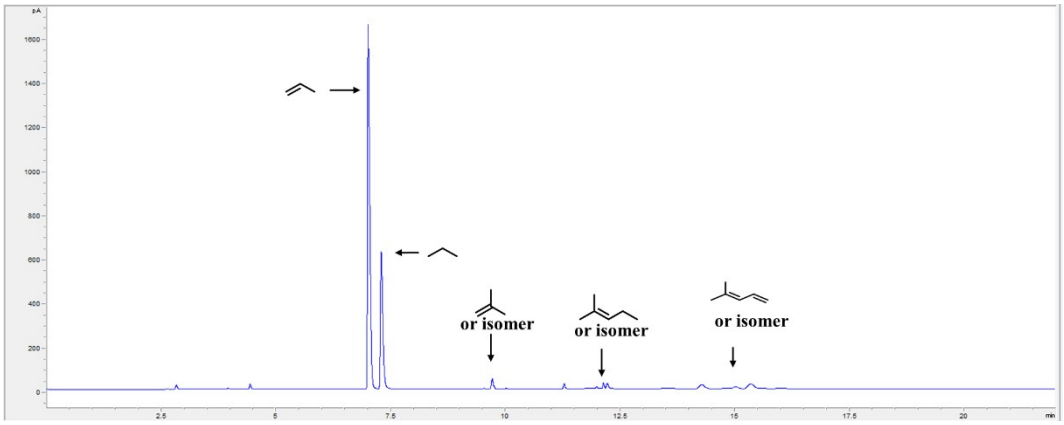

Fig. S11. Gas chromatogram of the products from the reaction of acetone and hydrogen over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 3 h^{-1}, initial H_2/acetone molar ratio = 31:1.

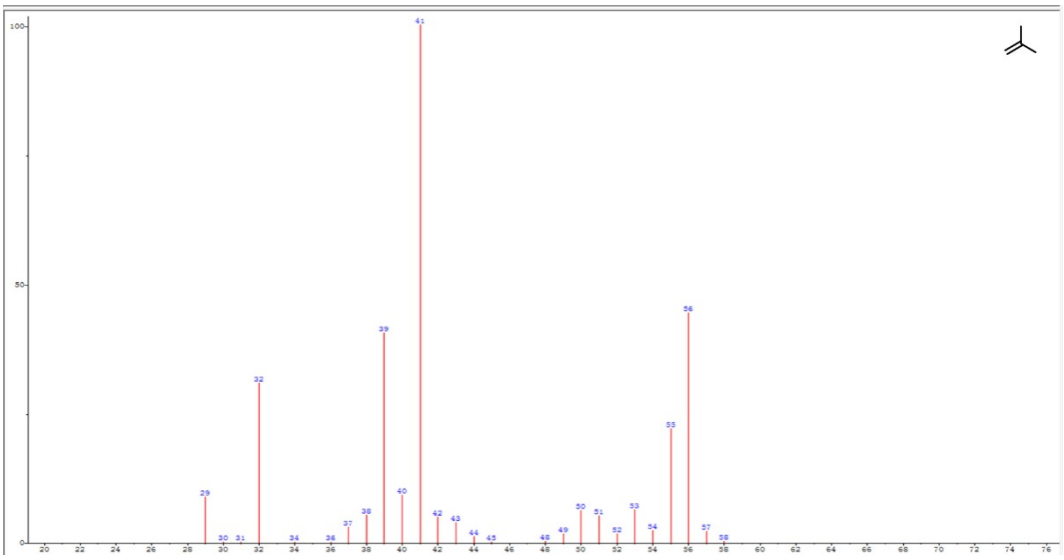

Fig. S12. Mass spectrogram of isobutene from the reaction of acetone and hydrogen over the $CoMoO_4$-0.8 catalyst under H_2 atmosphere.

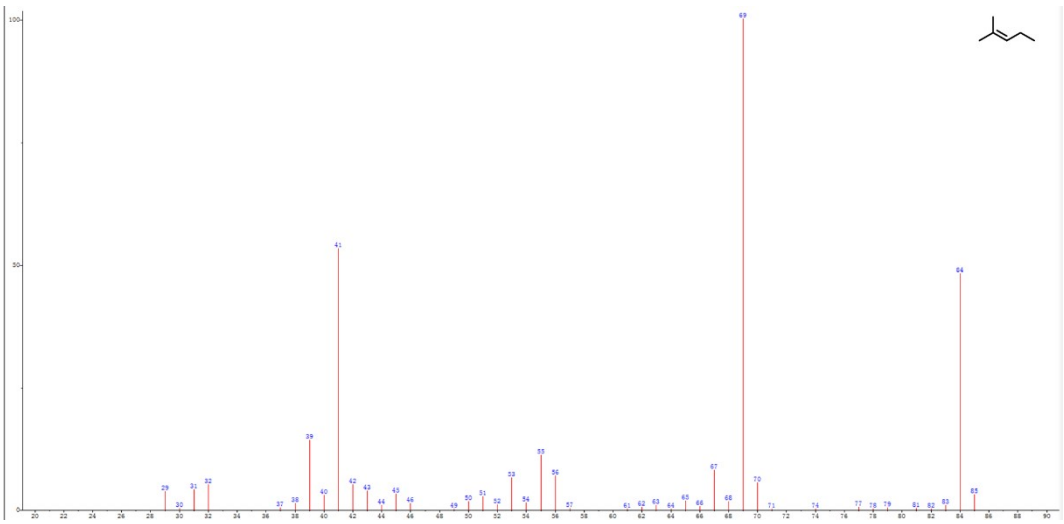

Fig. 13. Mass spectrogram of the methyl pentene from the reaction of acetone and hydrogen over the $CoMoO_4$-0.8 catalyst under H_2 atmosphere.

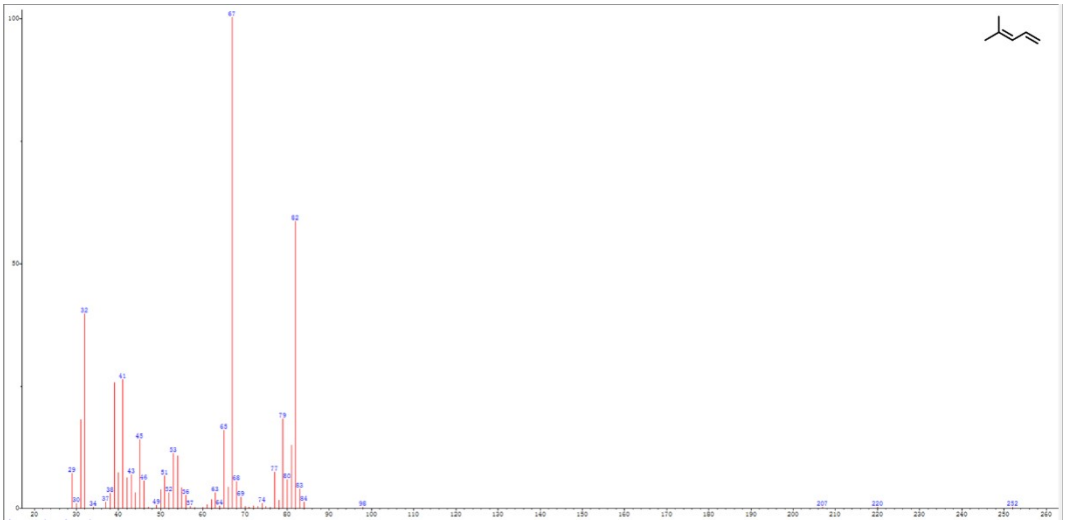

Fig. S14. Mass spectrogram of the methyl pentadiene from the reaction of acetone and hydrogen over the $CoMoO_4$-0.8 catalyst.

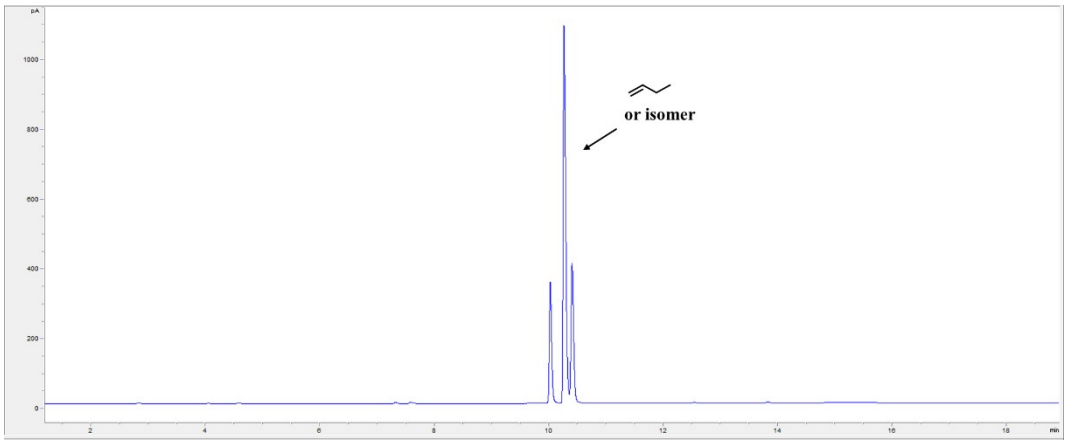

Fig. S15. Gas chromatogram of the products from the selective HDO of butanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 3 h^{-1}, initial H_2/butanone molar ratio = 32:1.

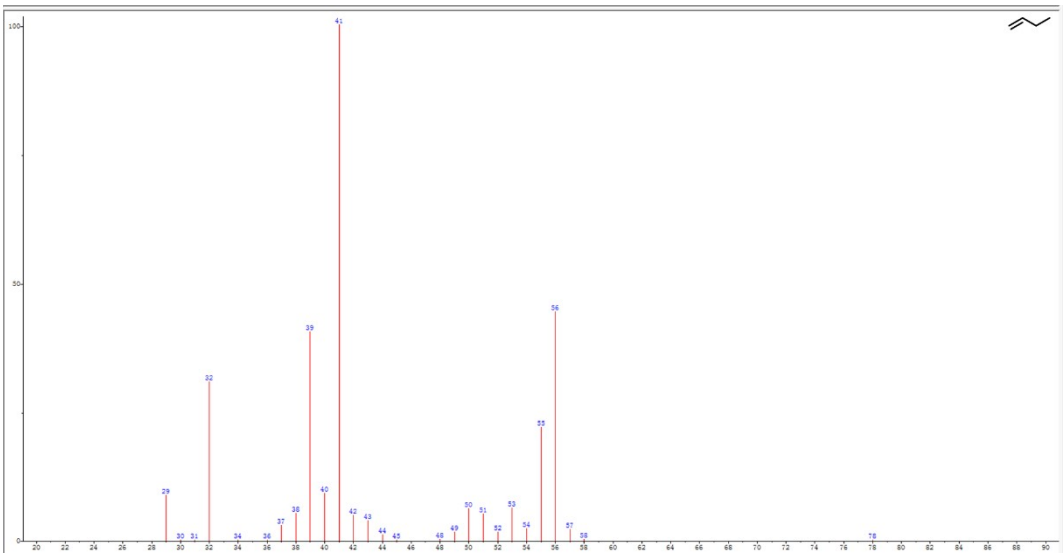

Fig. S16. Mass spectrogram of butene from the selective HDO of butanone over the $CoMoO_4$-0.8 catalyst.

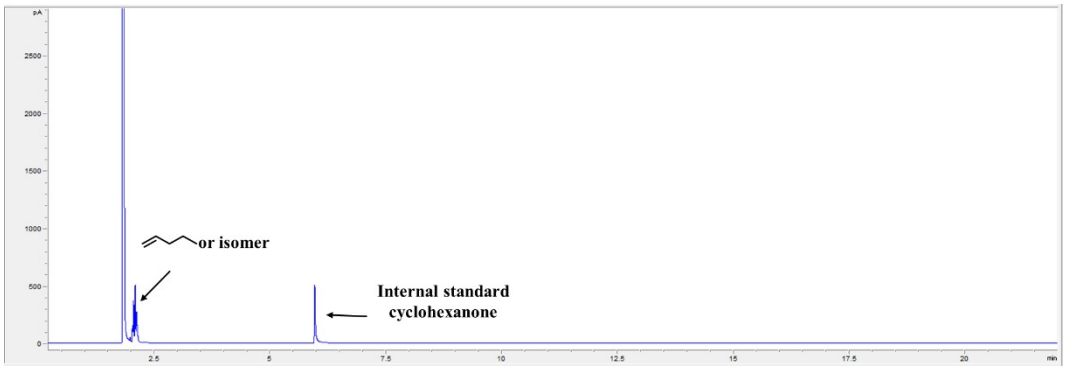

Fig. S17. Gas chromatogram of the products from the selective HDO of 2-pentanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 6 h^{-1}, initial H_2/2-pentanone molar ratio = 79:1.

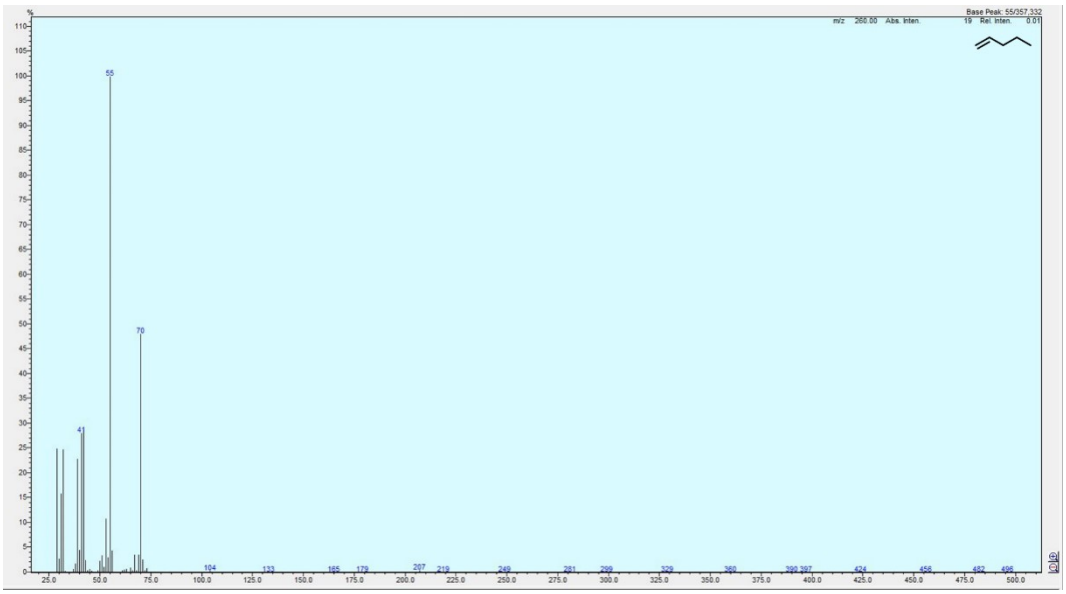

Fig. S18. Mass spectrogram of pentene from the selective HDO of 2-pentanone over the $CoMoO_4$-0.8 catalyst.

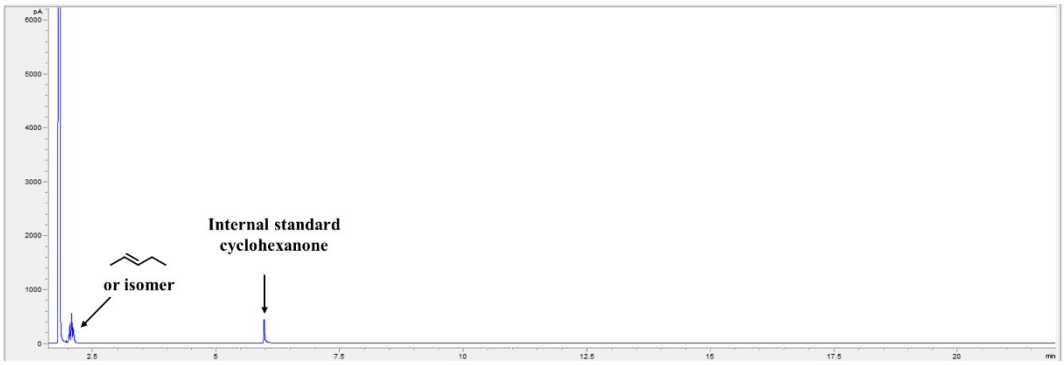

Fig. S19. Gas chromatogram of the products from the selective HDO of 3-pentanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 6 h^{-1}, initial H_2/3-pentanone molar ratio = 77:1.

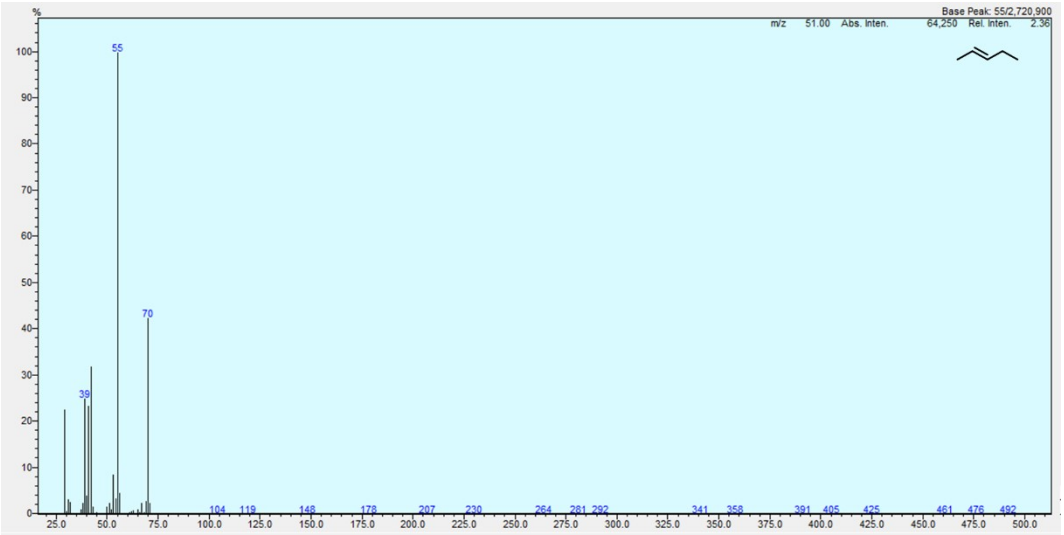

Fig. S20. Mass spectrogram of pentene from the selective HDO of 3-pentanone over the $CoMoO_4$-0.8 catalyst.

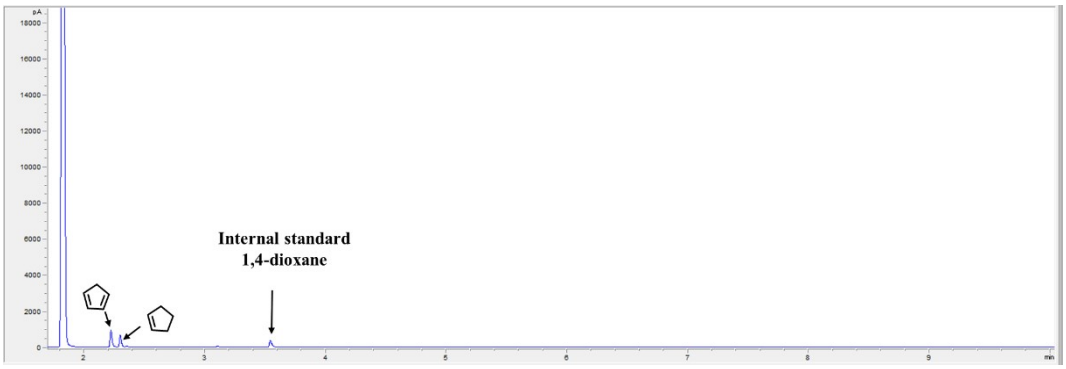

Fig. S21. Gas chromatogram of the products from the selective HDO of cyclopentanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 723 K, P_{H_2} = 0.1 MPa, WHSV = 2 h^{-1}, initial H_2/ cyclohexanone molar ratio = 64:1.

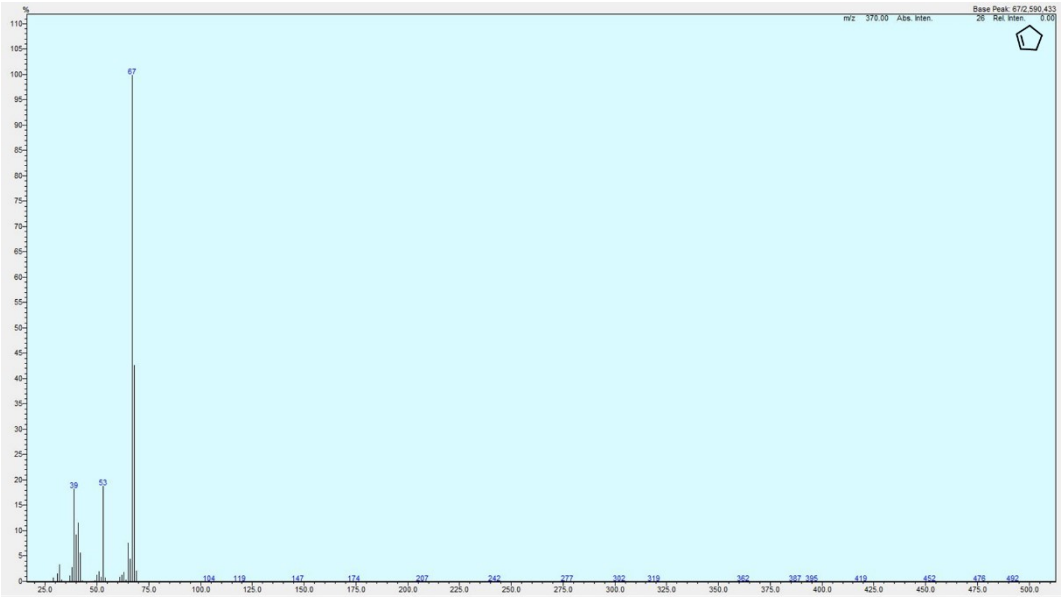

Fig. S22. Mass spectrogram of cyclopentene from the selective HDO of cyclopentanone over the $CoMoO_4$-0.8 catalyst.

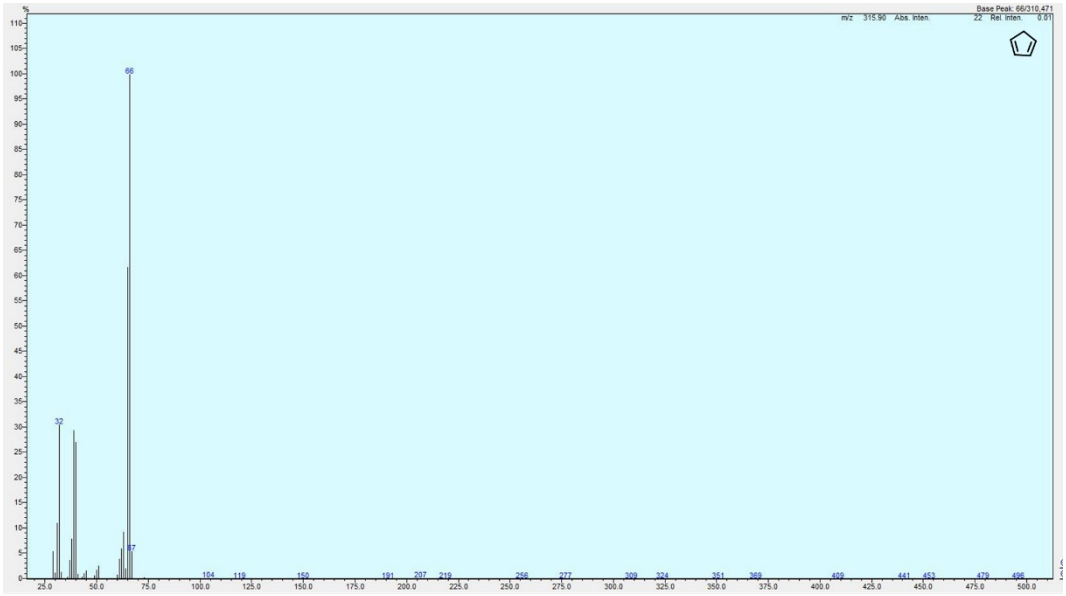

Fig. S23. Mass spectrogram of cyclopentadiene from the selective HDO of cyclopentanone over the $CoMoO_4$-0.8 catalyst.

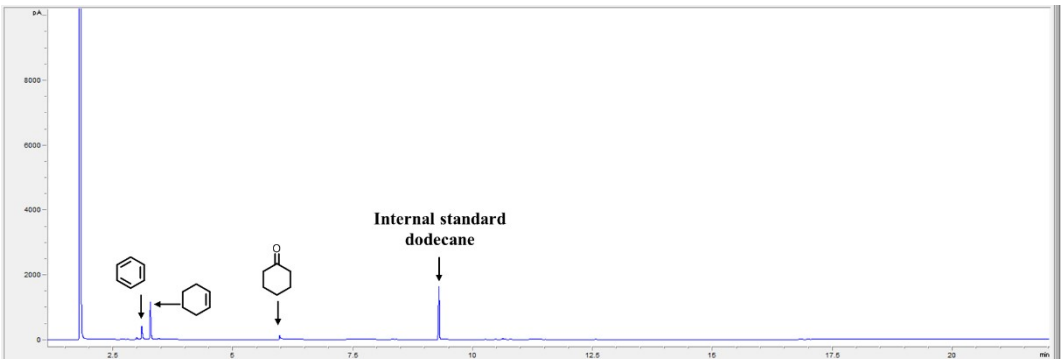

Fig. S24. Gas chromatogram of the products from the selective HDO of cyclohexanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 8 h^{-1}, initial H_2/ cyclohexanone molar ratio = 73:1.

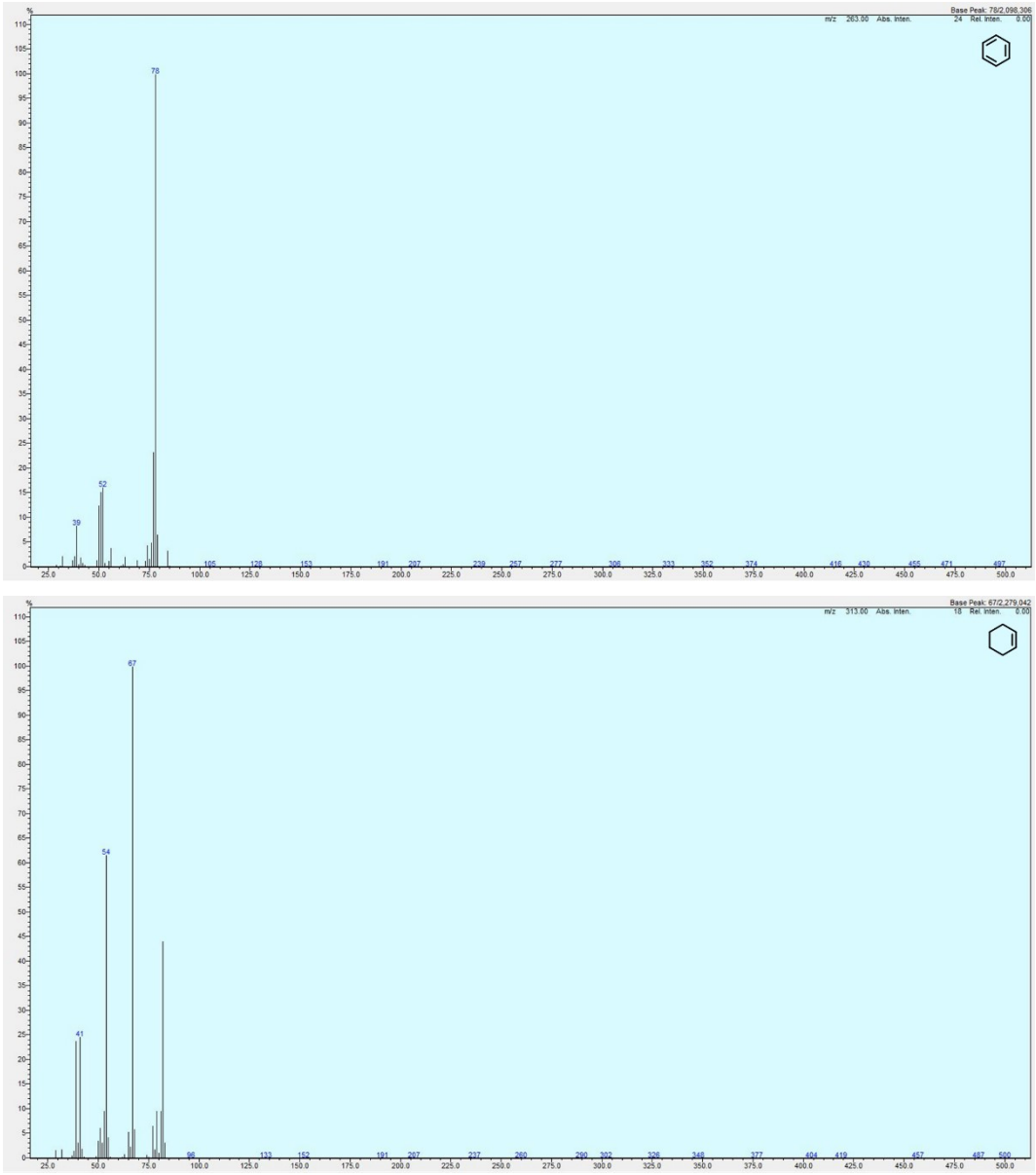

Fig. S25. Mass spectrograms of the benzene and cyclohexene from the selective HDO of cyclohexanone over the $CoMoO_4$-0.8 catalyst.

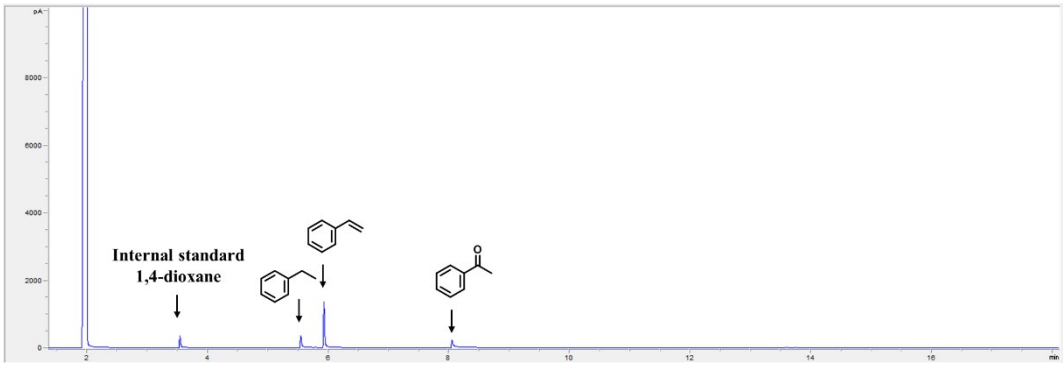

Fig. S26. Gas chromatogram of the products from the selective HDO of acetophenone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 633 K, P_{H_2} = 0.1 MPa, WHSV = 5 h^{-1}, initial H_2/acetophenone molar ratio = 38:1.

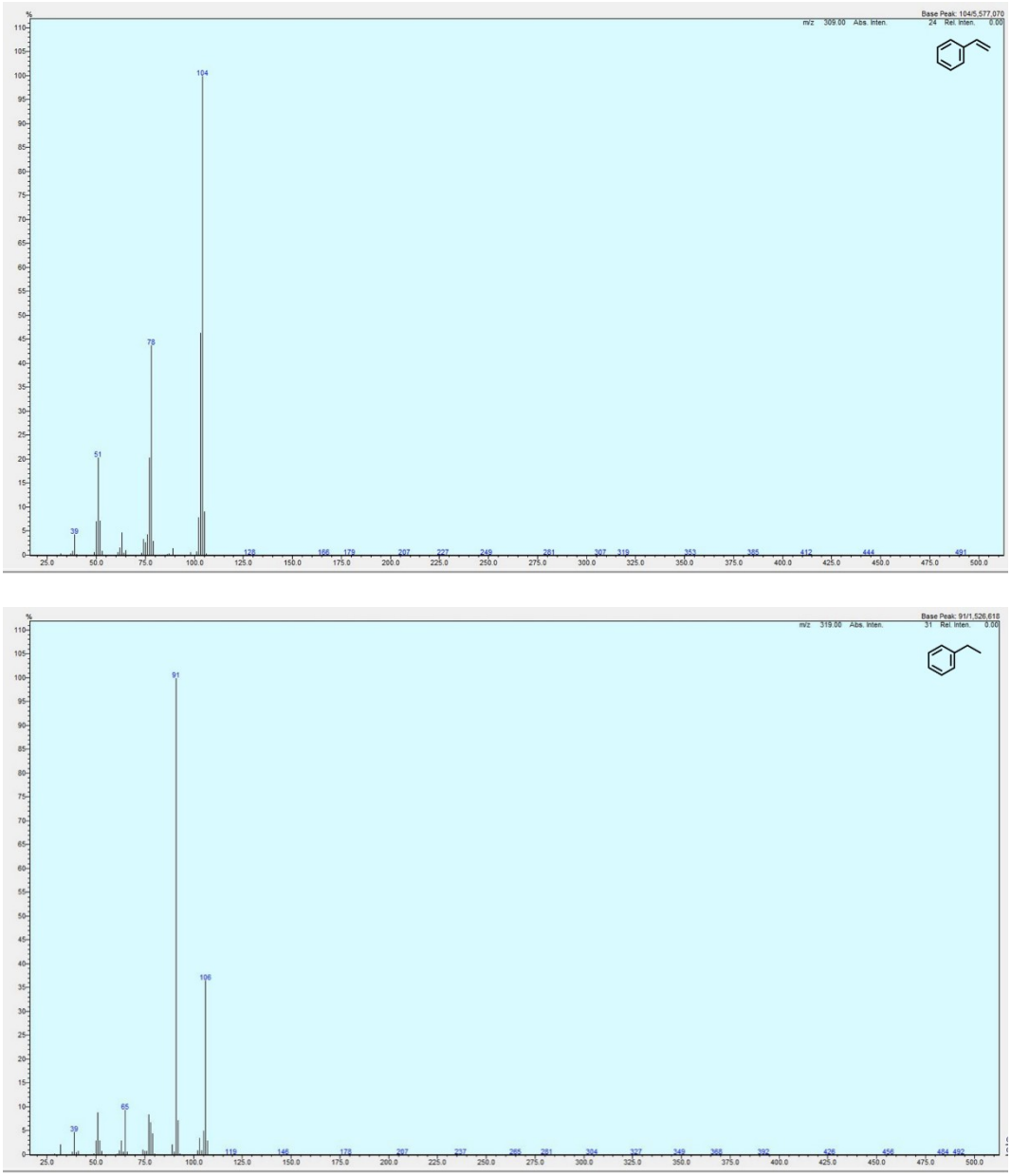

Fig. S27. Mass spectrograms of the styrene and ethylbenzene from the selective HDO of acetophenone over the $CoMoO_4$-0.8 catalyst.

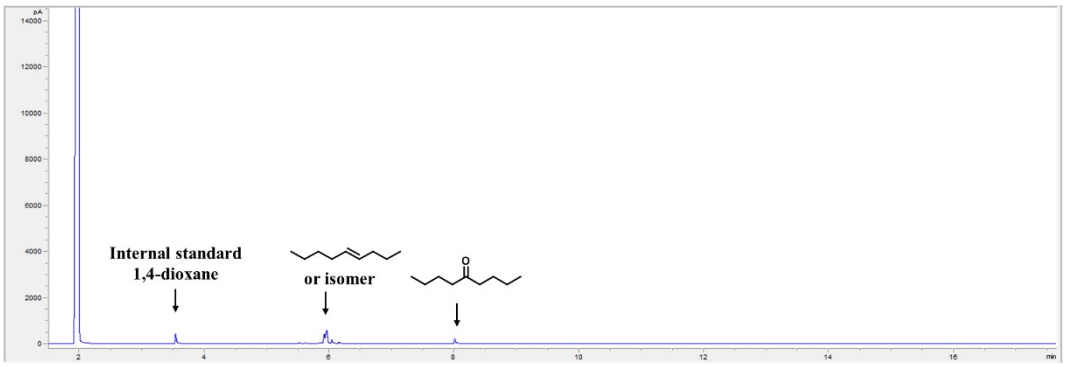

Fig. S28. Gas chromatogram of the products from the selective HDO of 5-nonanone over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 673 K, P_{H_2} = 0.1 MPa, WHSV = 10 h^{-1}, initial H_2/5-nonanone molar ratio = 125:1.

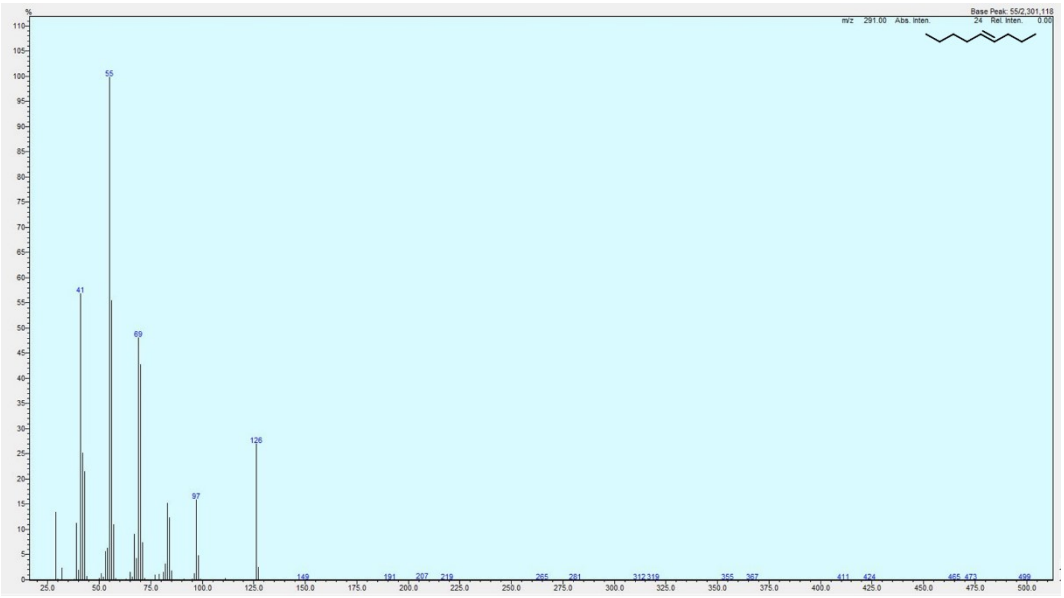

Fig. S29. Mass spectrogram of nonene from the selective HDO of 5-nonanone over the $CoMoO_4$-0.8 catalyst.

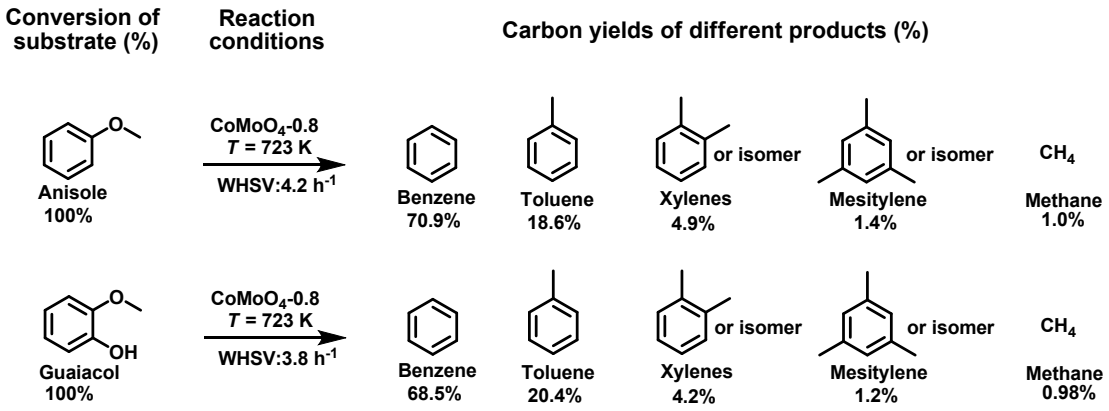

Fig. S30. Conversions of aryl ethers (anisole and guaiacol) and the carbon yields of different products over the $CoMoO_4$-0.8 catalyst.

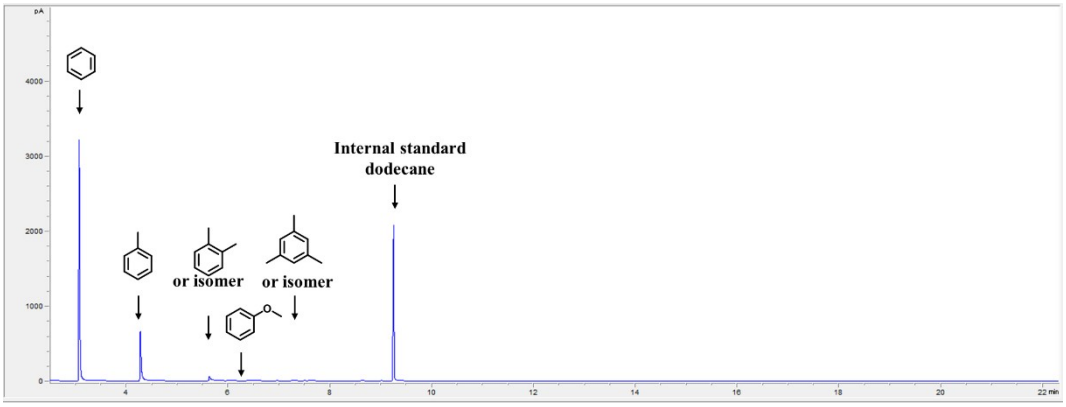

Fig. S31. Gas chromatogram of the products from the selective HDO of anisole over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 723 K, P_{H_2} = 0.1 MPa, WHSV = 4.2 h^{-1}, initial H_2/5-nonanone molar ratio = 78:1.

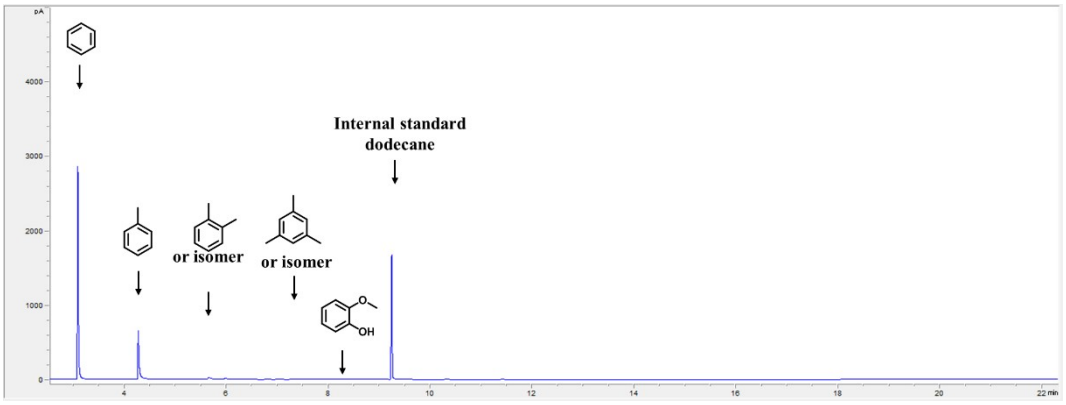

Fig. S32. Gas chromatogram of the products from the selective HDO of guaiacol over the $CoMoO_4$-0.8 catalyst. Reaction conditions: T = 723 K, P_{H_2} = 0.1 MPa, WHSV = 3.8 h^{-1}, initial H_2/5-nonanone molar ratio = 78:1.

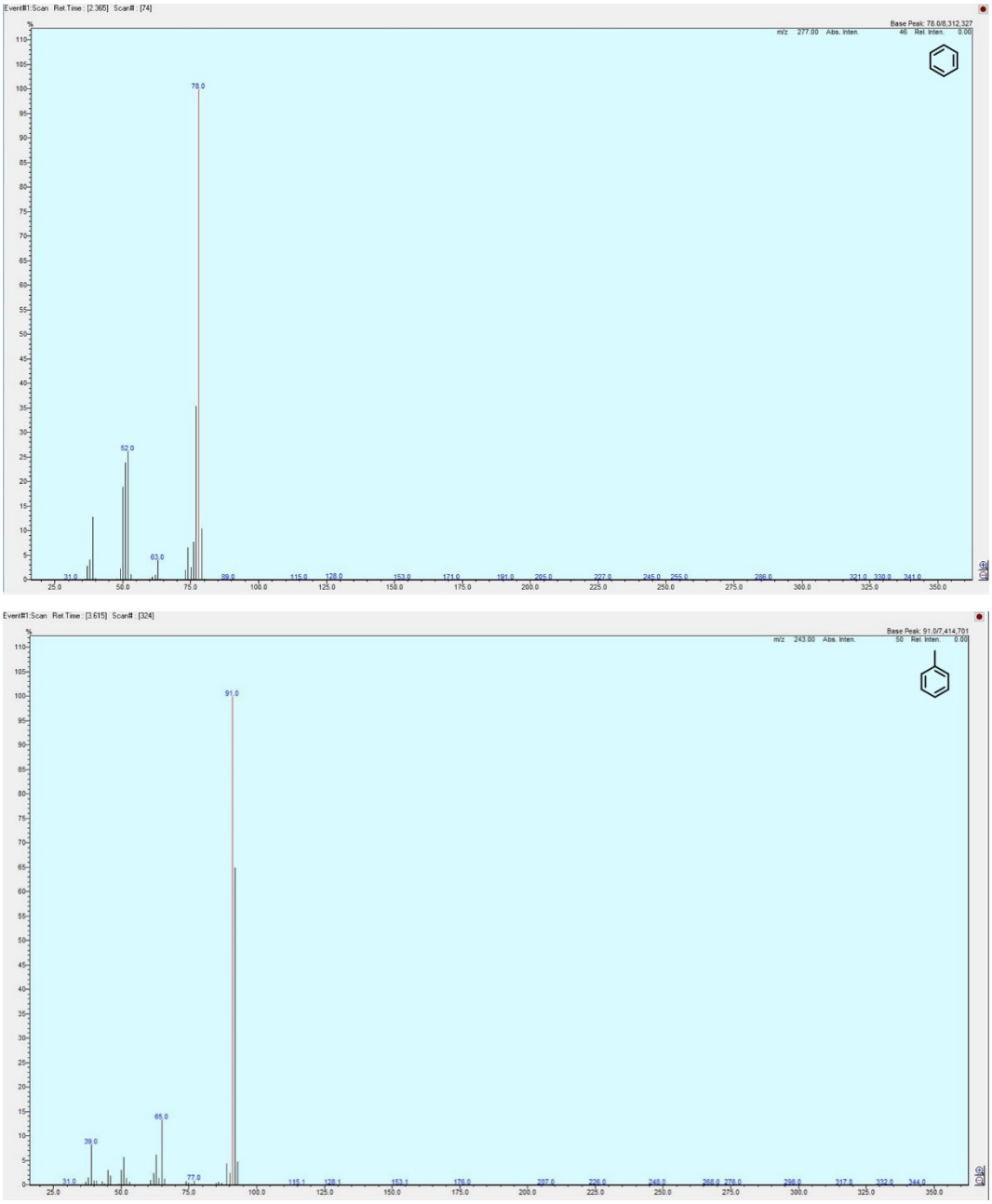

Fig. S33. Mass spectrograms of the benzene and toluene from the selective HDO of anisole or guaiacol over the $CoMoO_4$-0.8 catalyst.

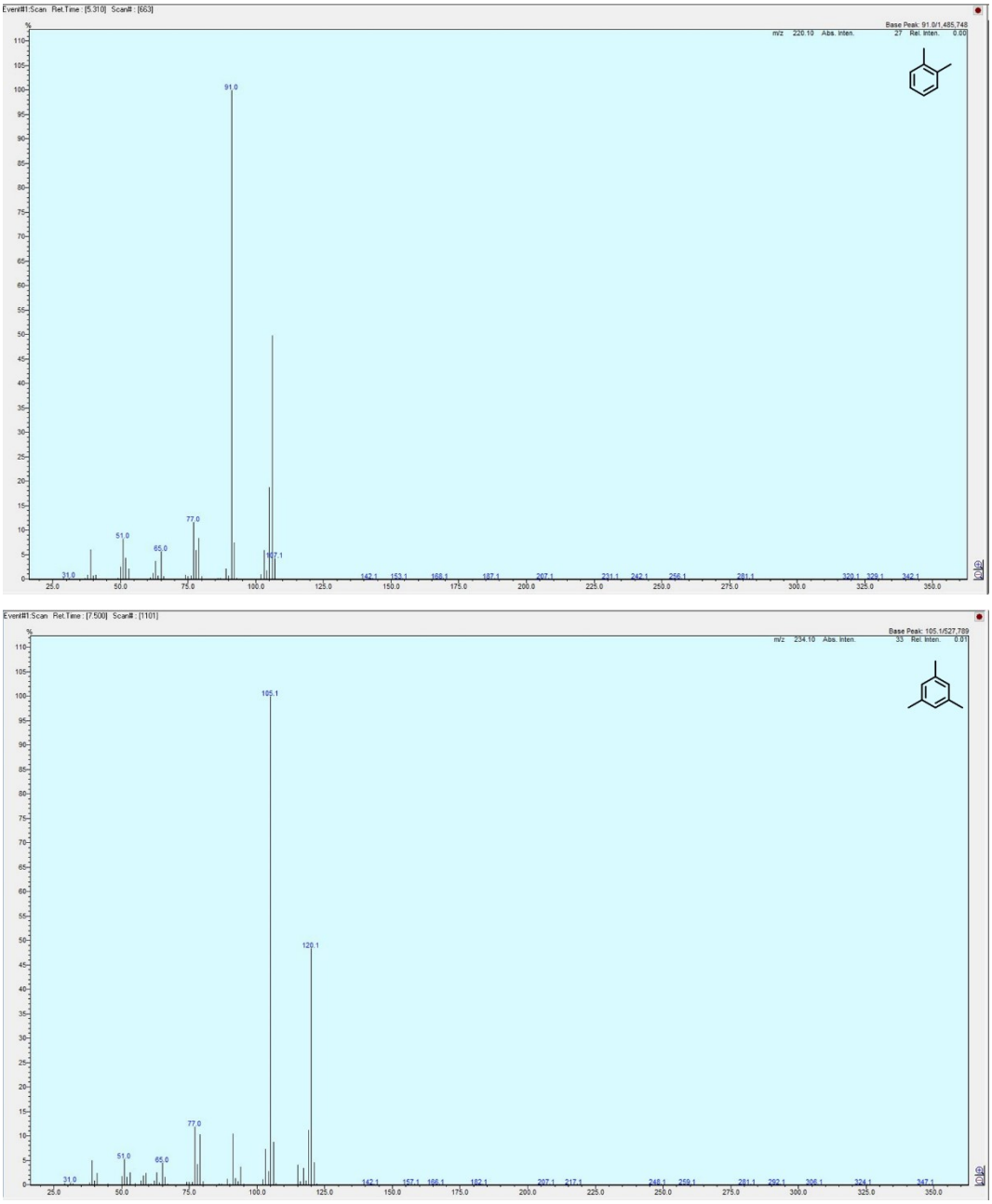

Fig. S34. Mass spectrograms of the xylene and mesitylene from the selective HDO of anisole or guaiacol over the $CoMoO_4$-0.8 catalyst.