

**Fe₃O₄ Supported O-Phenylenediamine Based Tetraaza (N₄ Donor) Schiff Base-Cu (II)
Complex as A Novel Nanomagnetic Catalytic System for synthesis of Pyrano[2,3-
c]pyrazoles**

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Copies of by ¹H and ¹³C NMR spectra:

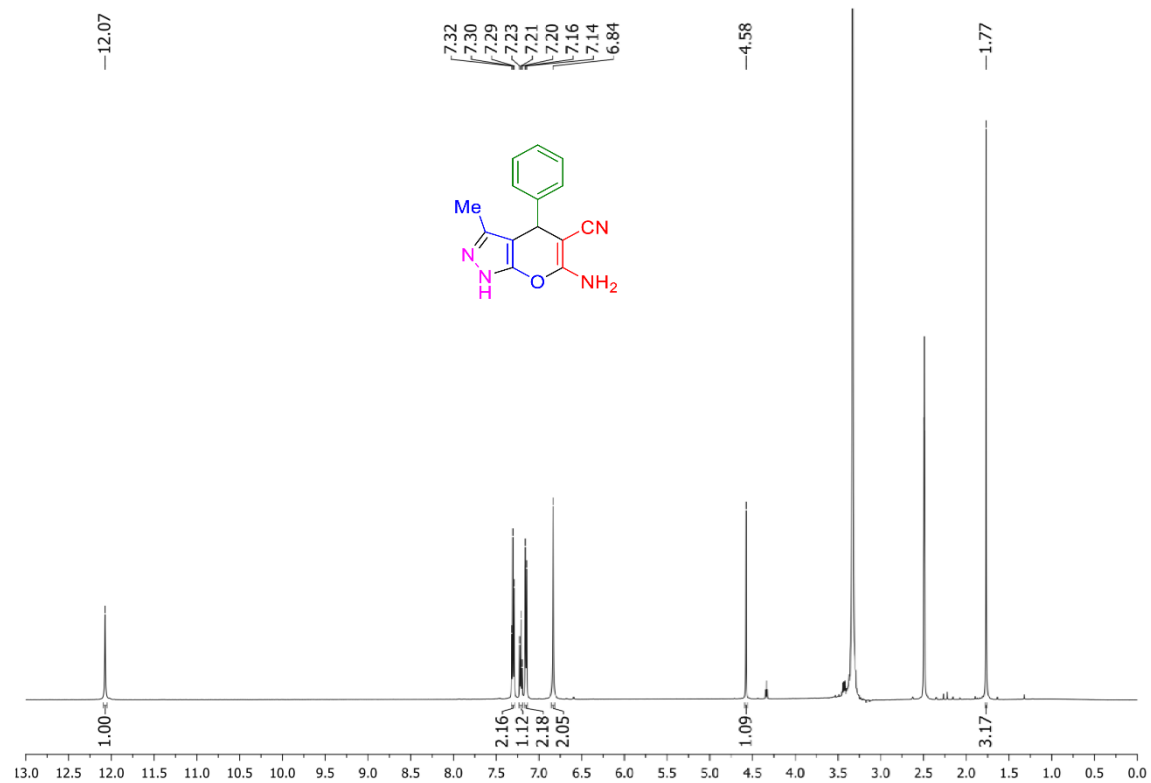


Figure S1. ¹H NMR spectra of 6-Amino-3-methyl-4-phenyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

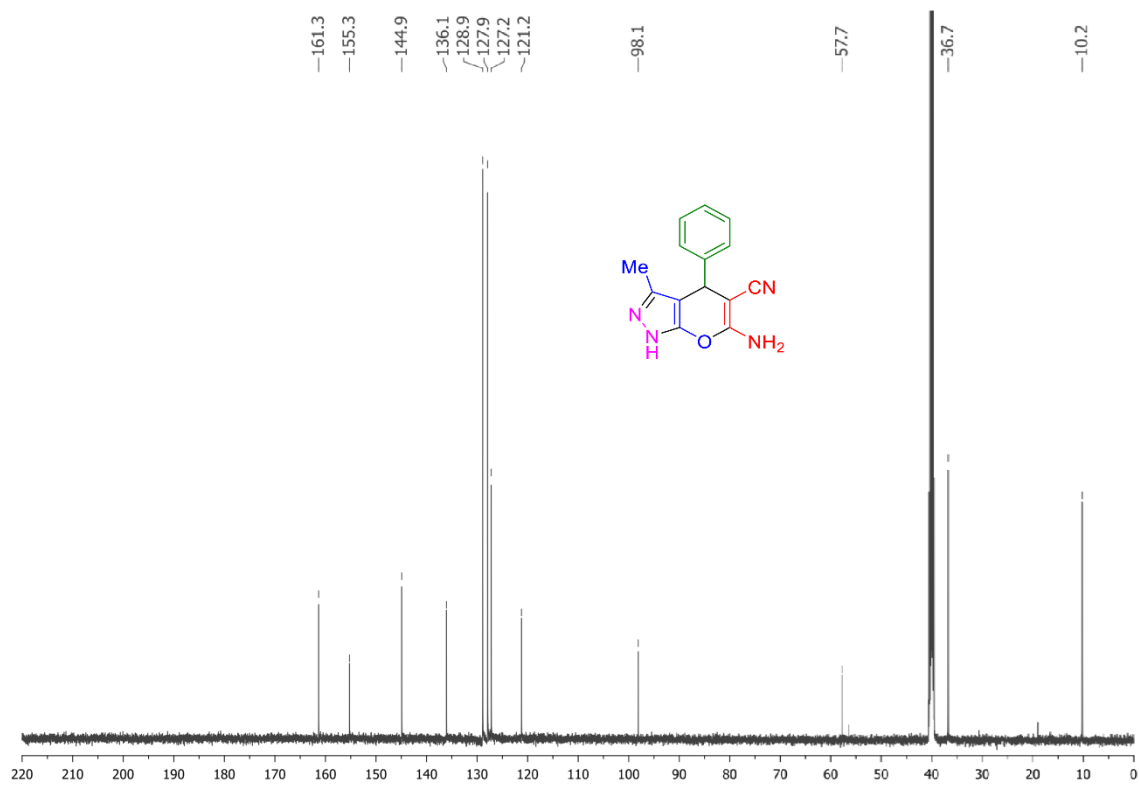


Figure S2. ^{13}C NMR spectra of 6-Amino-3-methyl-4-phenyl-2,4-dihydroprano[2,3-c]pyrazole-5-carbonitrile.

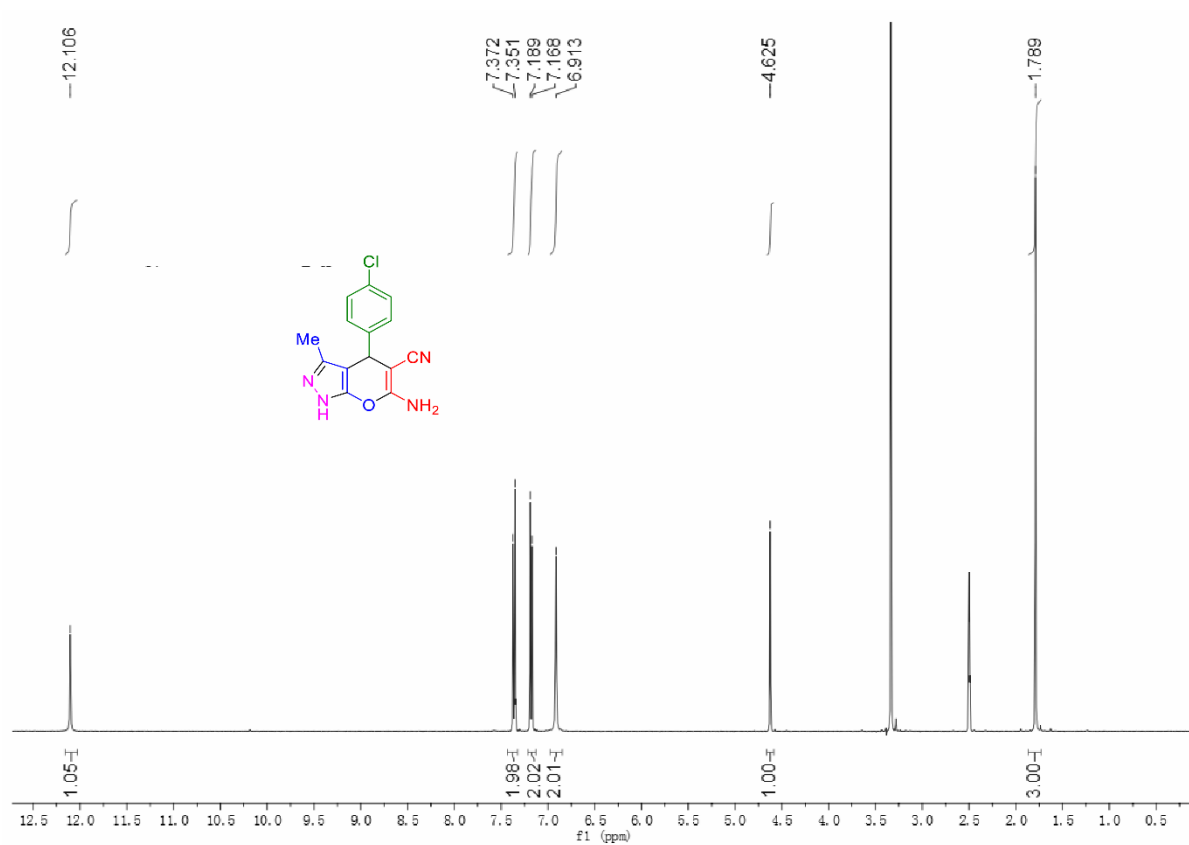


Figure S3. ¹H NMR spectra of 6-Amino-4-(4-chlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

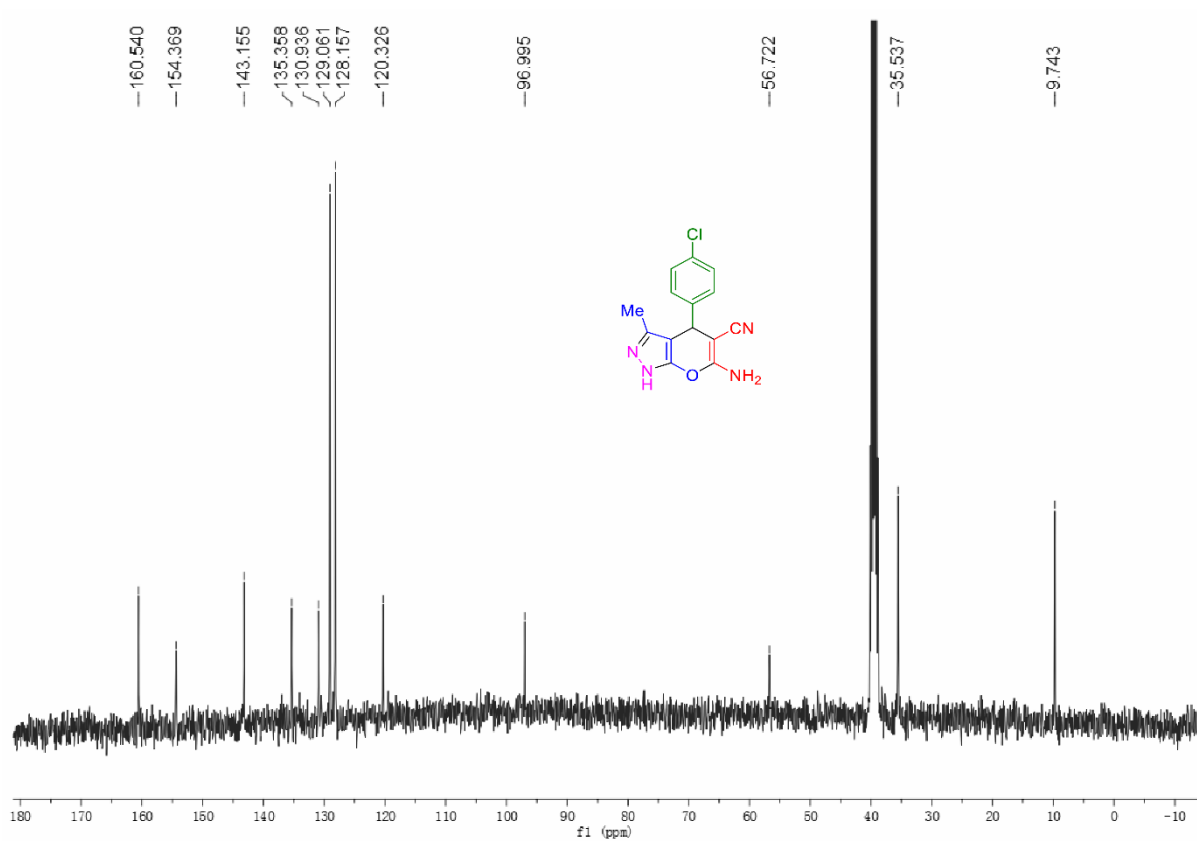


Figure S4. ^{13}C NMR spectra of 6-Amino-4-(4-chlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

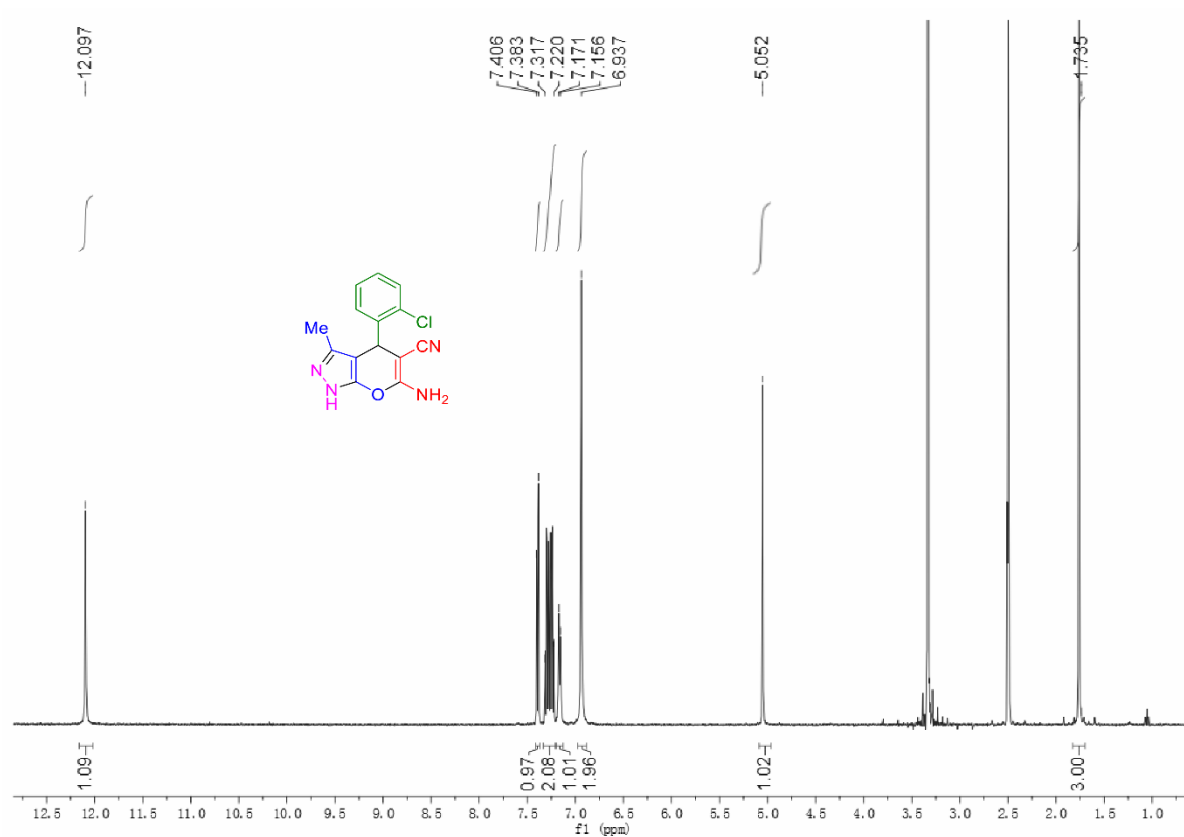


Figure S5. ¹H NMR spectra of 6-Amino-4-(2-chlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

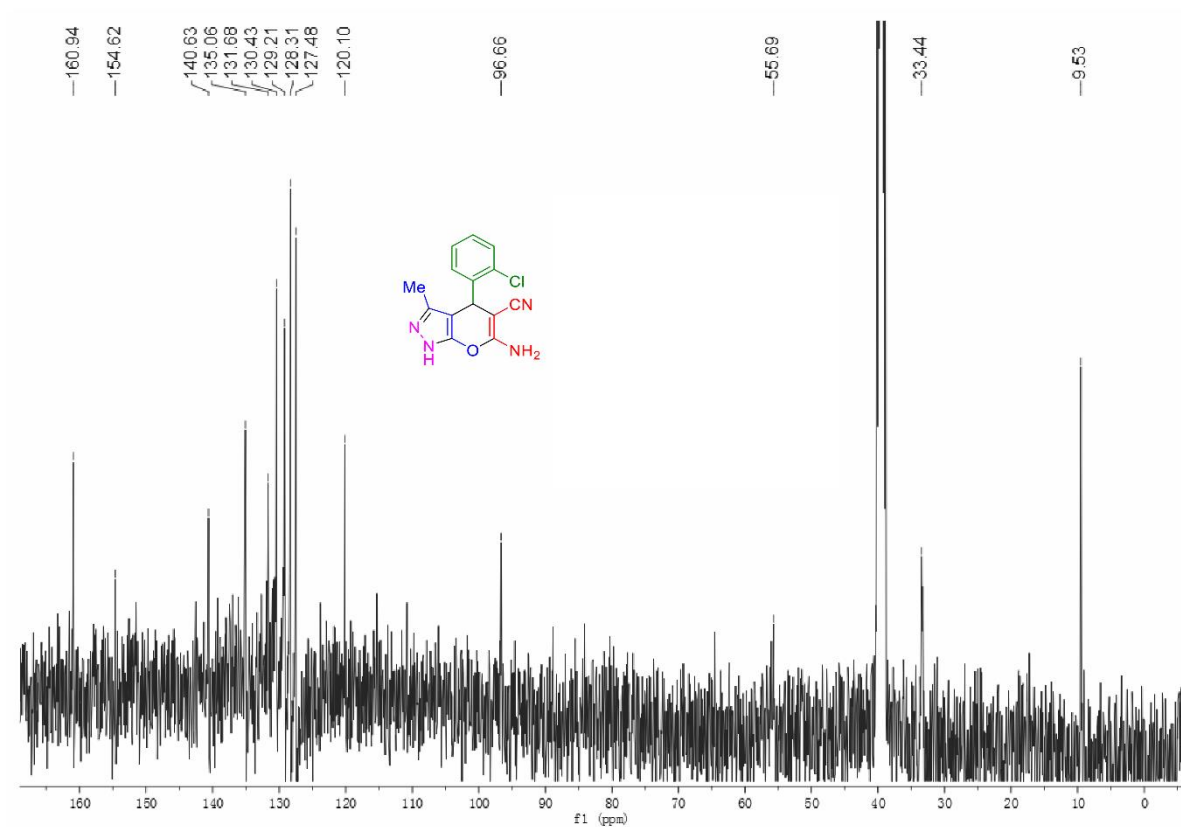


Figure S6. ¹³C NMR spectra of 6-Amino-4-(2-chlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

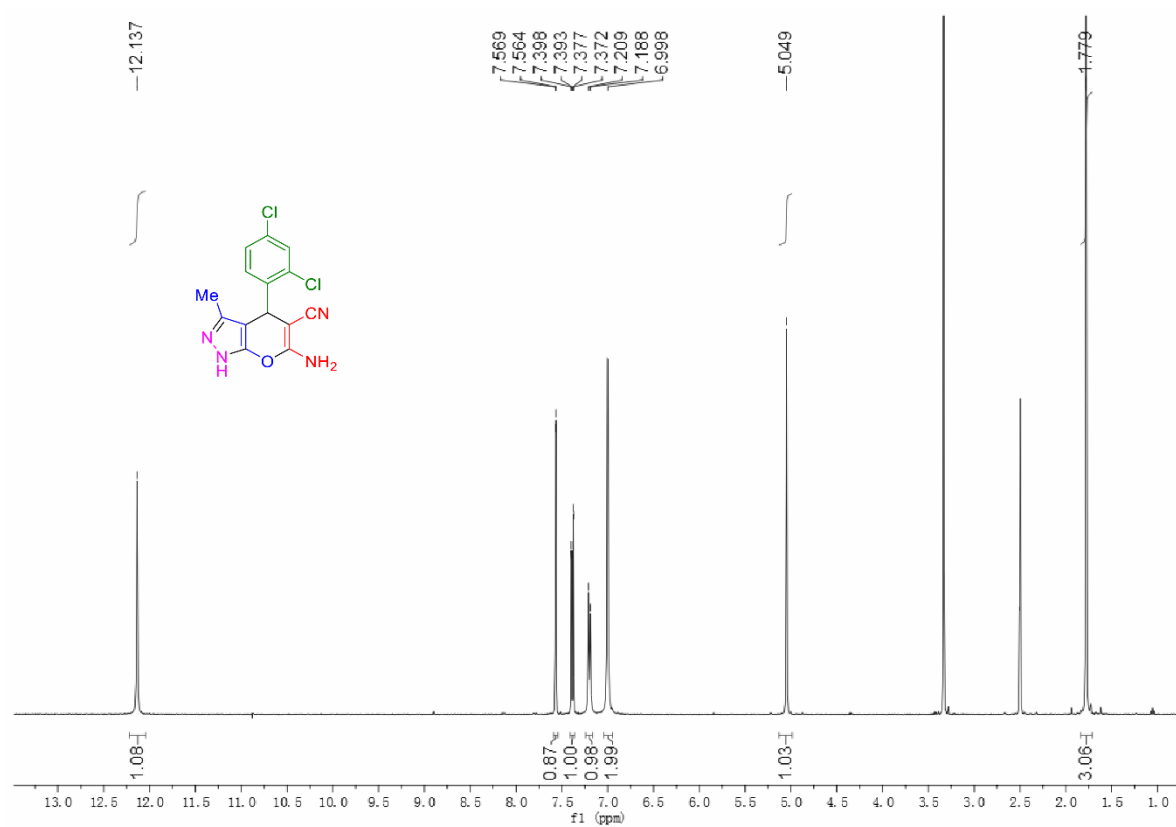


Figure S7. ¹H NMR spectra of 6-Amino-4-(2,4-dichlorophenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

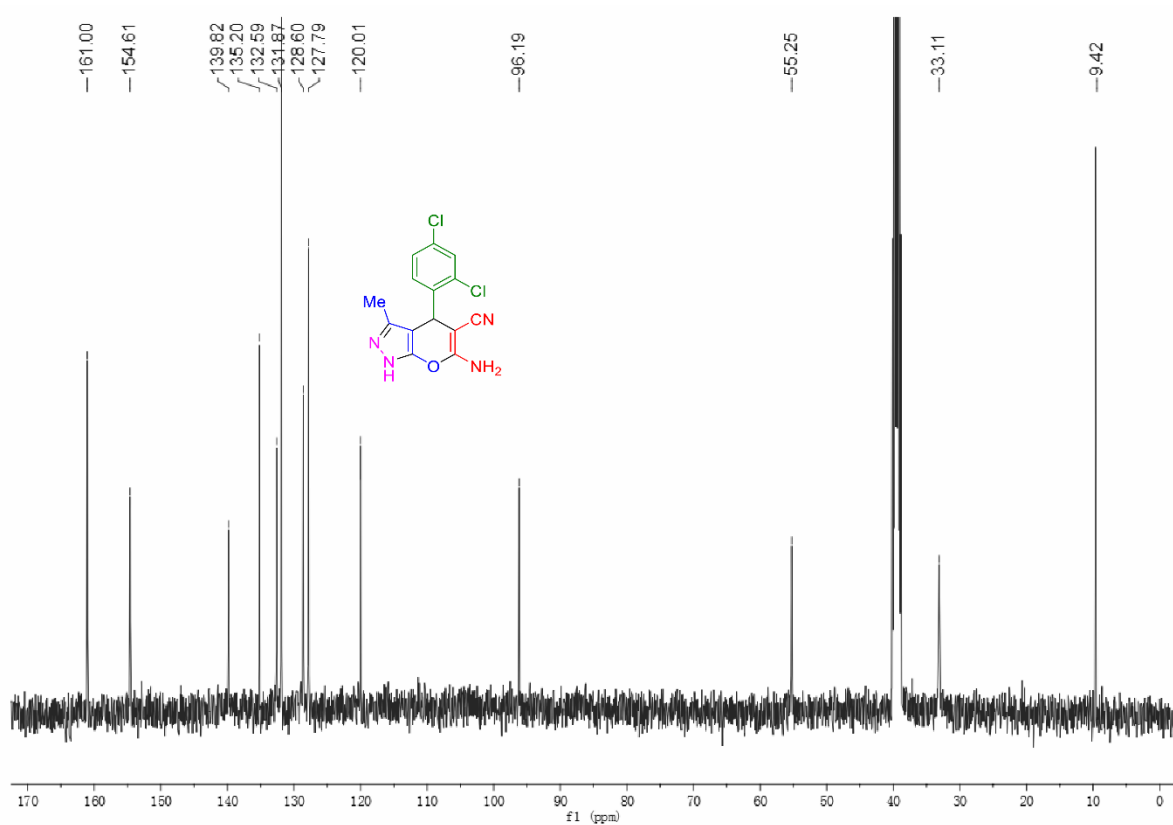


Figure S8. ^{13}C NMR spectra of 6-Amino-4-(2,4-dichlorophenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

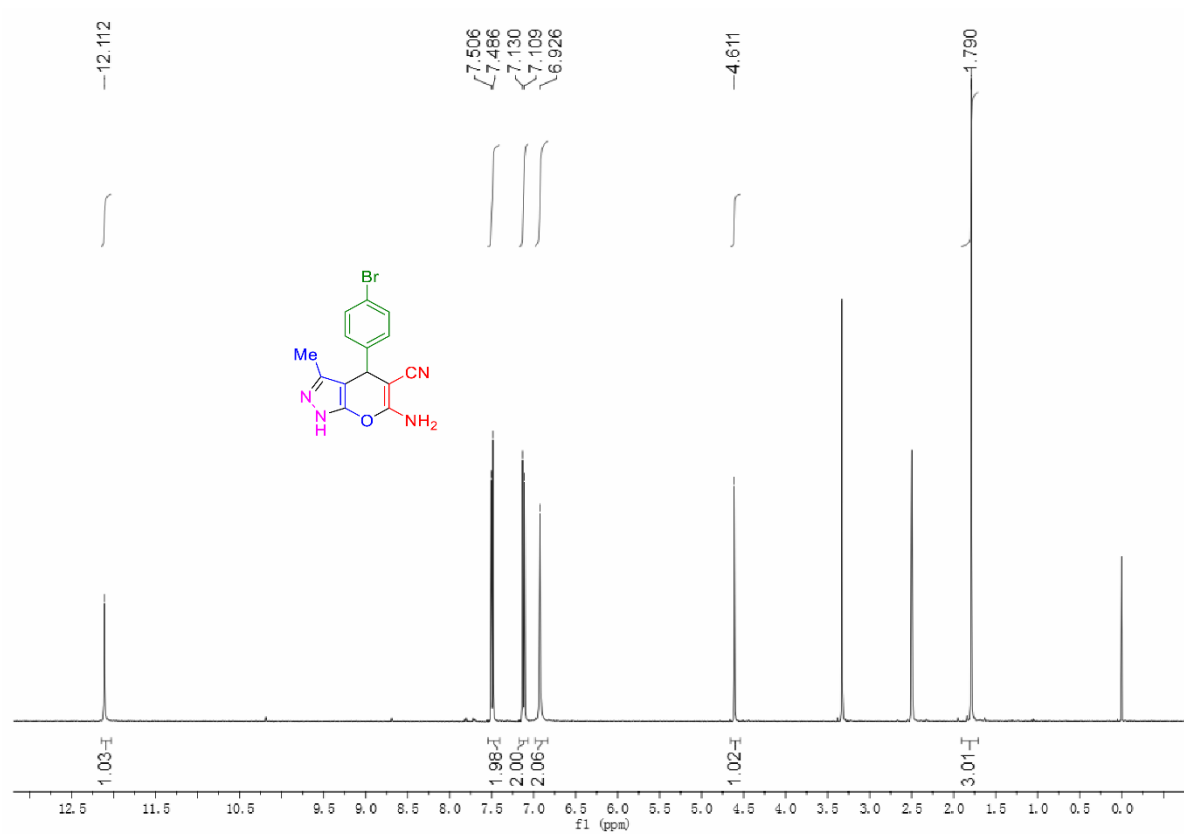


Figure S9. ¹H NMR spectra of 6-Amino-4-(4-bromophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

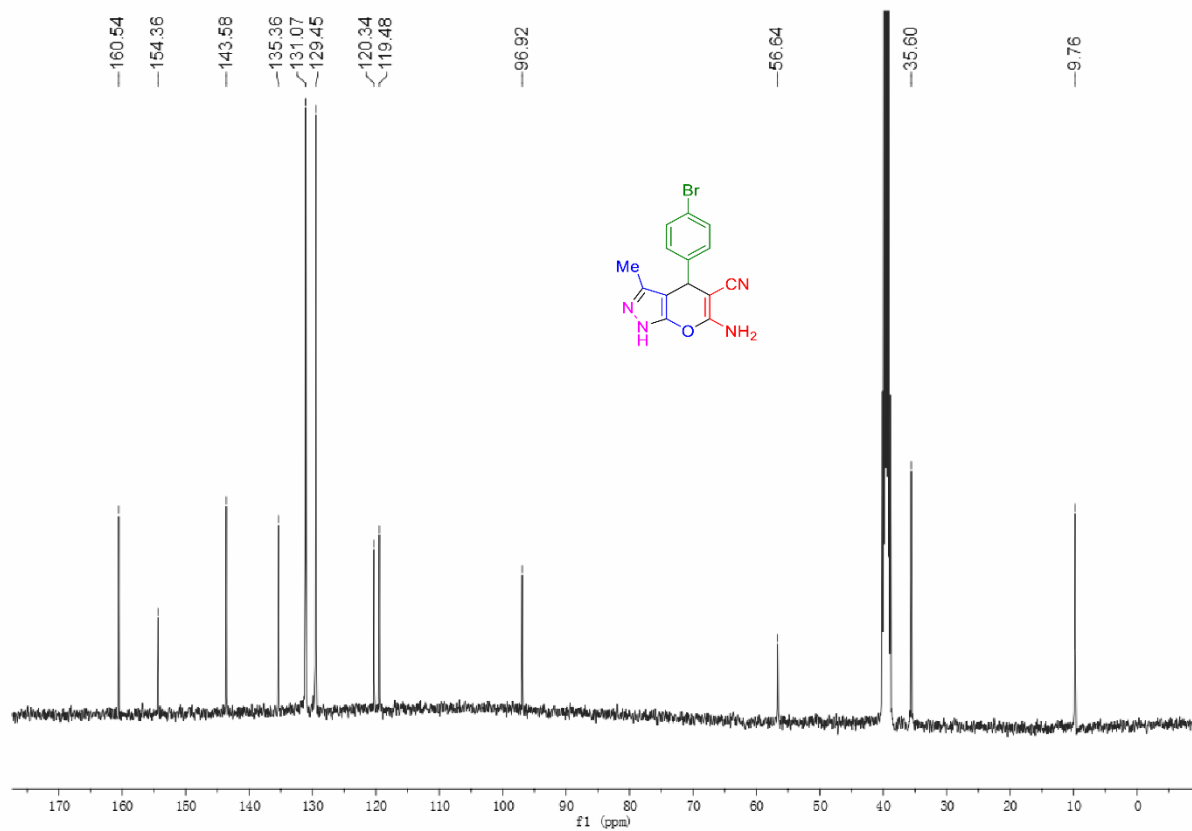


Figure S10. ^{13}C NMR spectra of 6-Amino-4-(4-bromophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

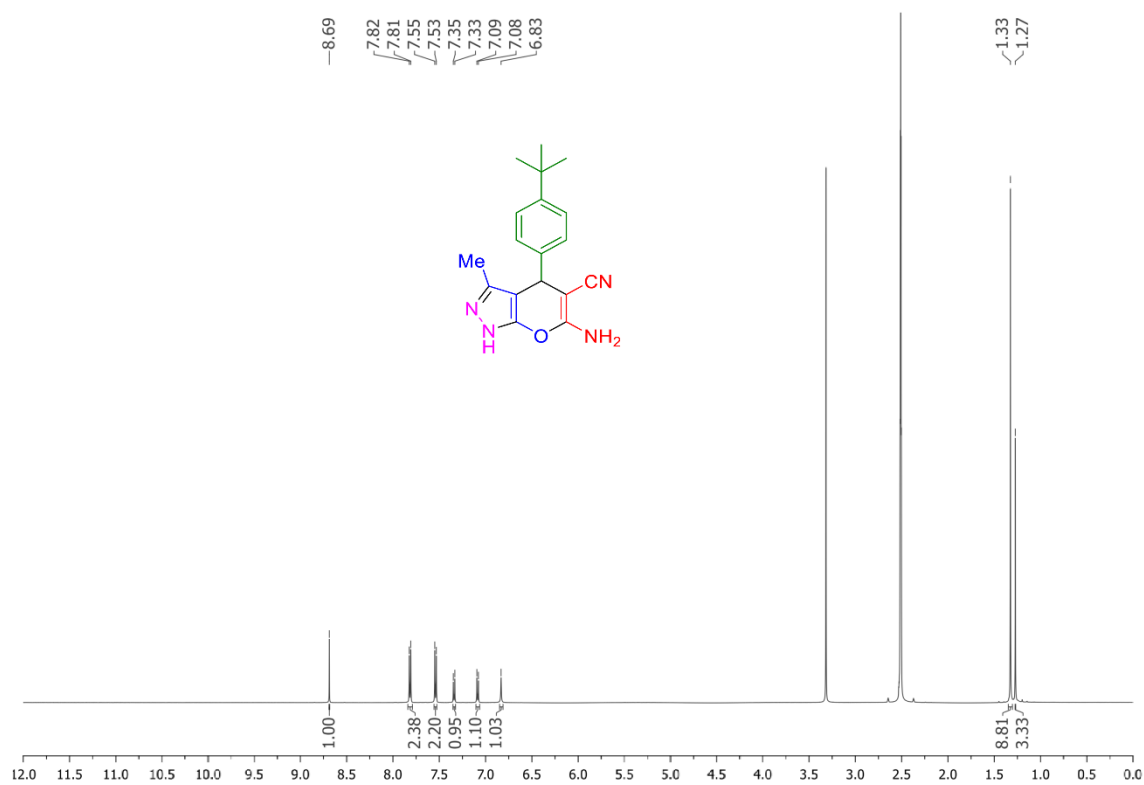


Figure S11. ¹H NMR spectra of 6-Amino-4-(4-(tert-butyl)phenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

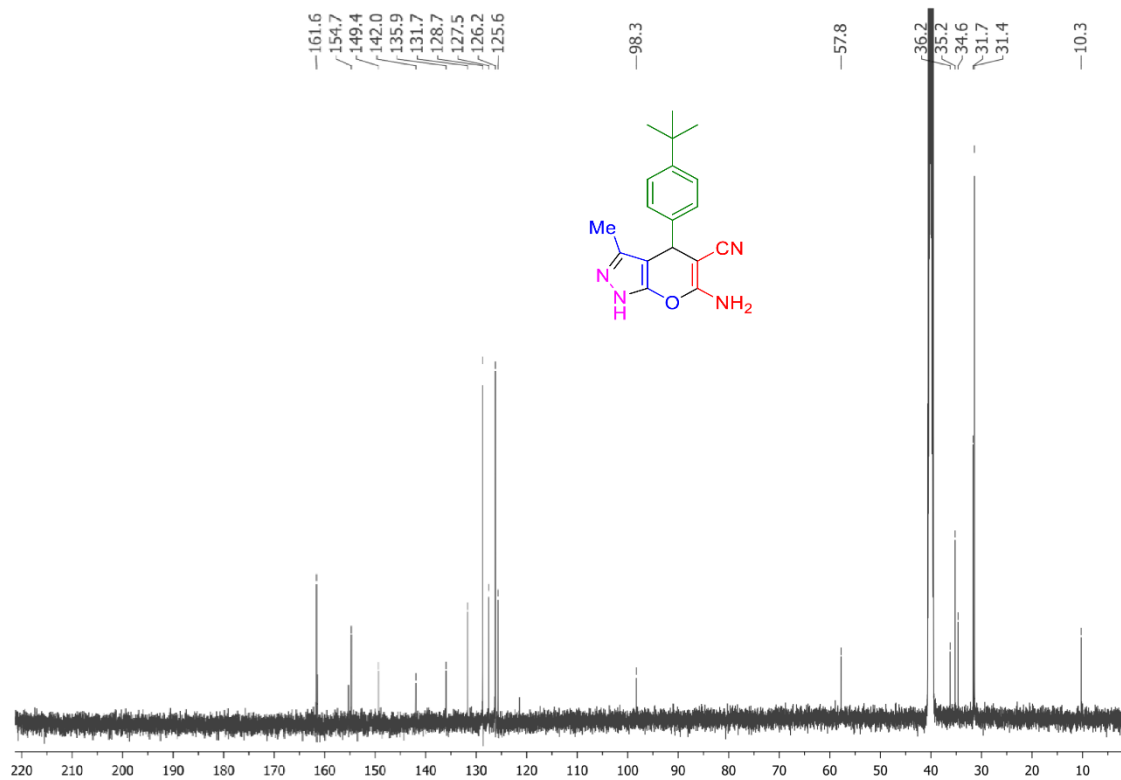


Figure S12. ¹³C NMR spectra of 6-Amino-4-(4-(tert-butyl)phenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

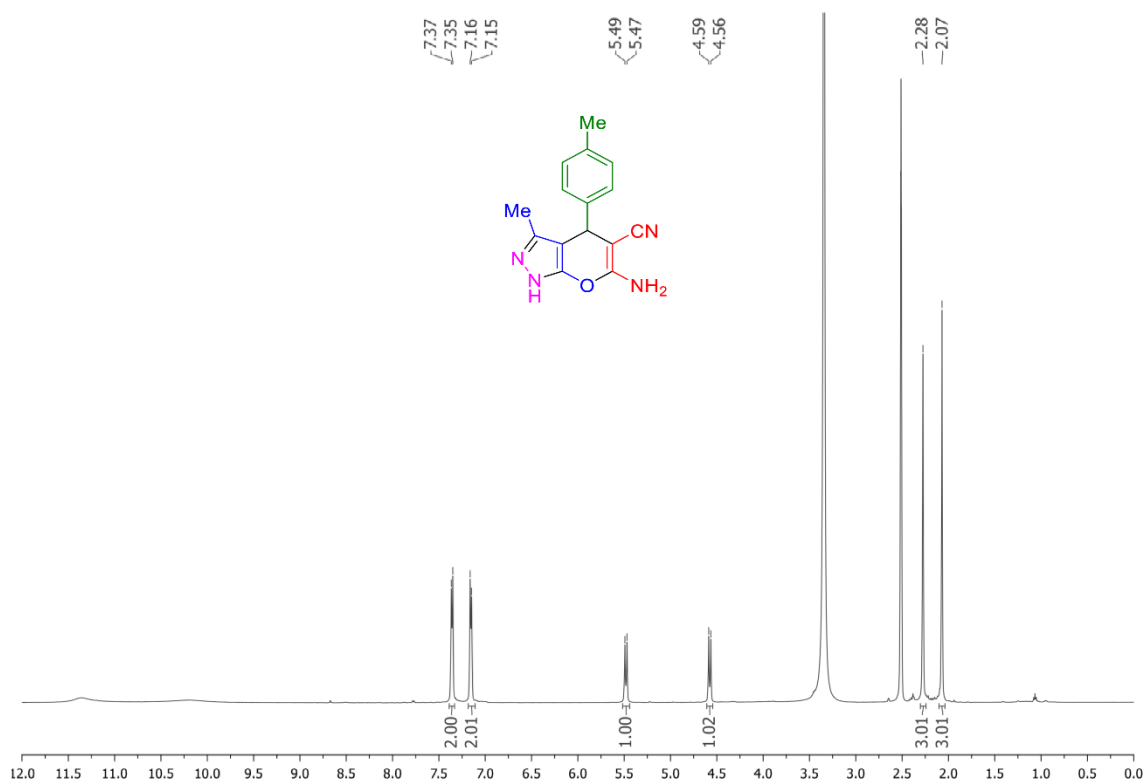


Figure S13. ¹H NMR spectra of 6-Amino-3-methyl-4-(p-tolyl)-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

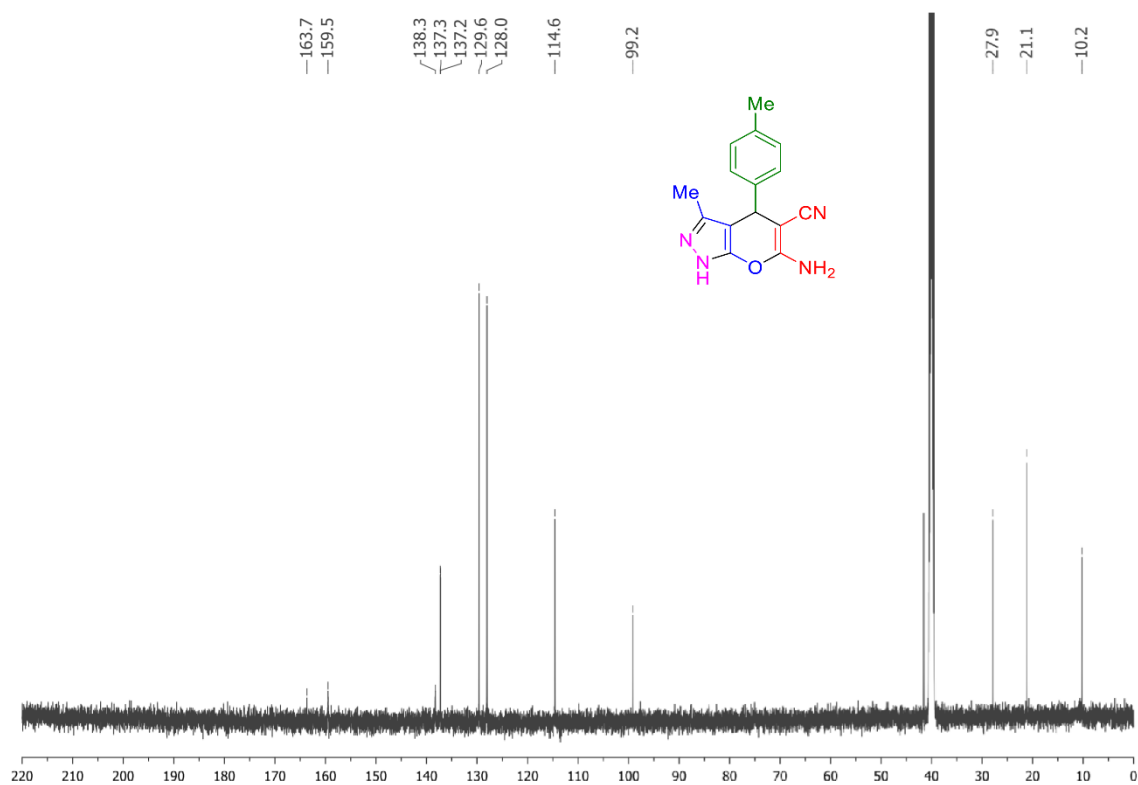


Figure S14. ^{13}C NMR spectra of 6-Amino-3-methyl-4-(p-tolyl)-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

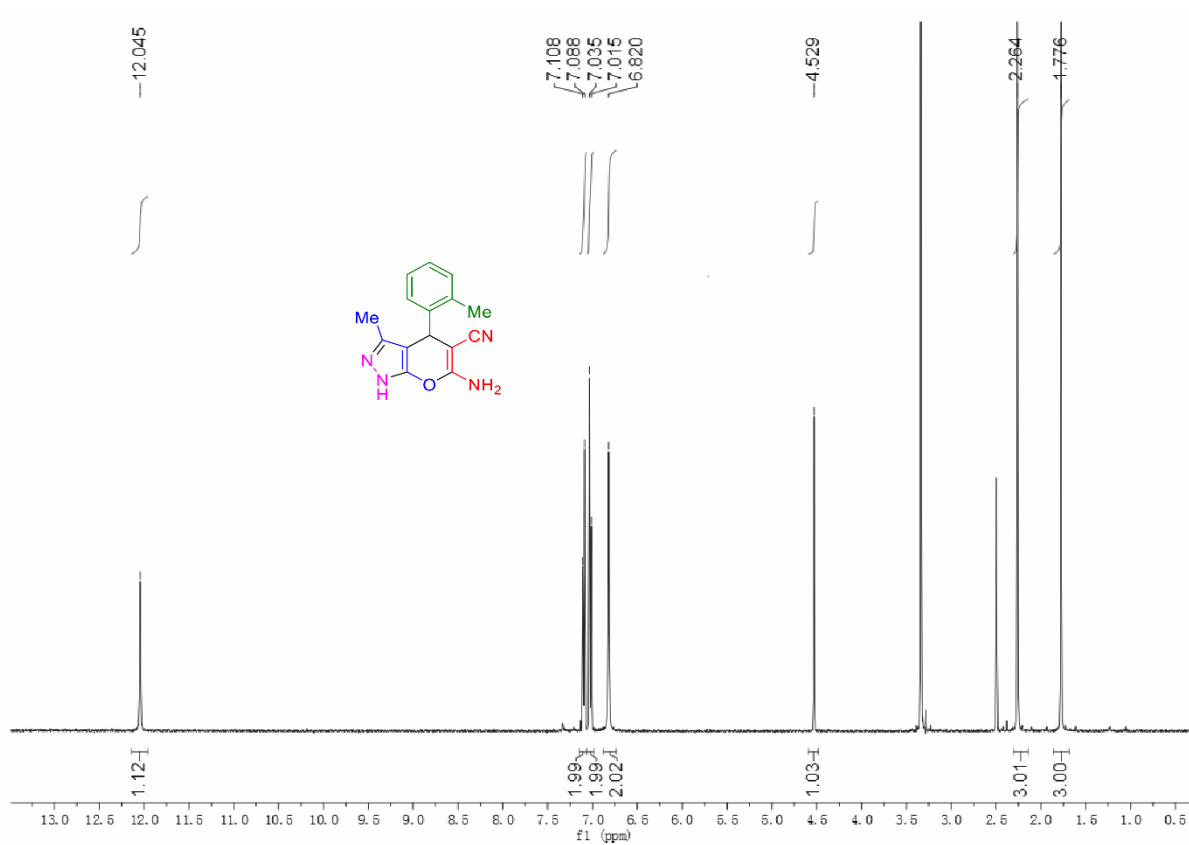


Figure S15. ¹H NMR spectra of 13C NMR spectra of 6-Amino-3-methyl-4-(*o*-tolyl)-

2,4-dihydropyrano[2,3-*c*]pyrazole-5-carbonitrile.

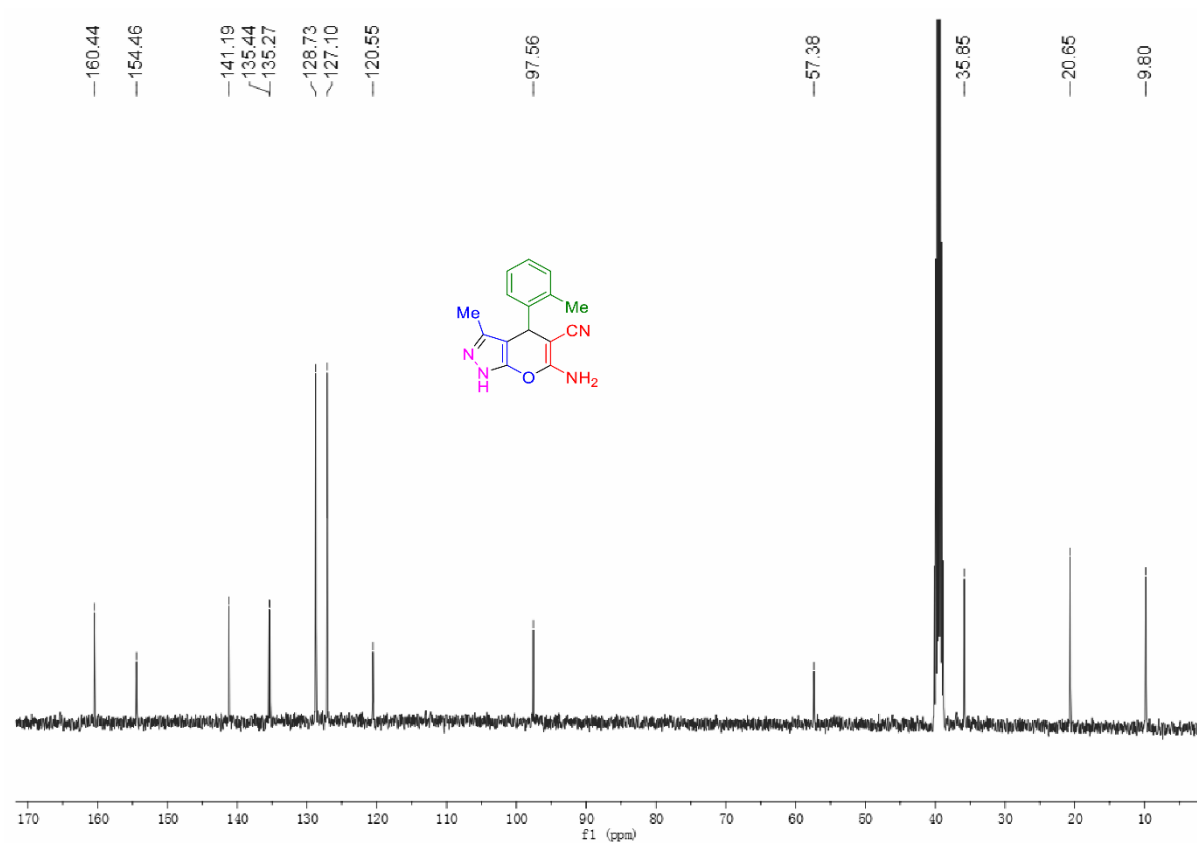


Figure S16. ^{13}C NMR spectra of 6-Amino-3-methyl-4-(o-tolyl)-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

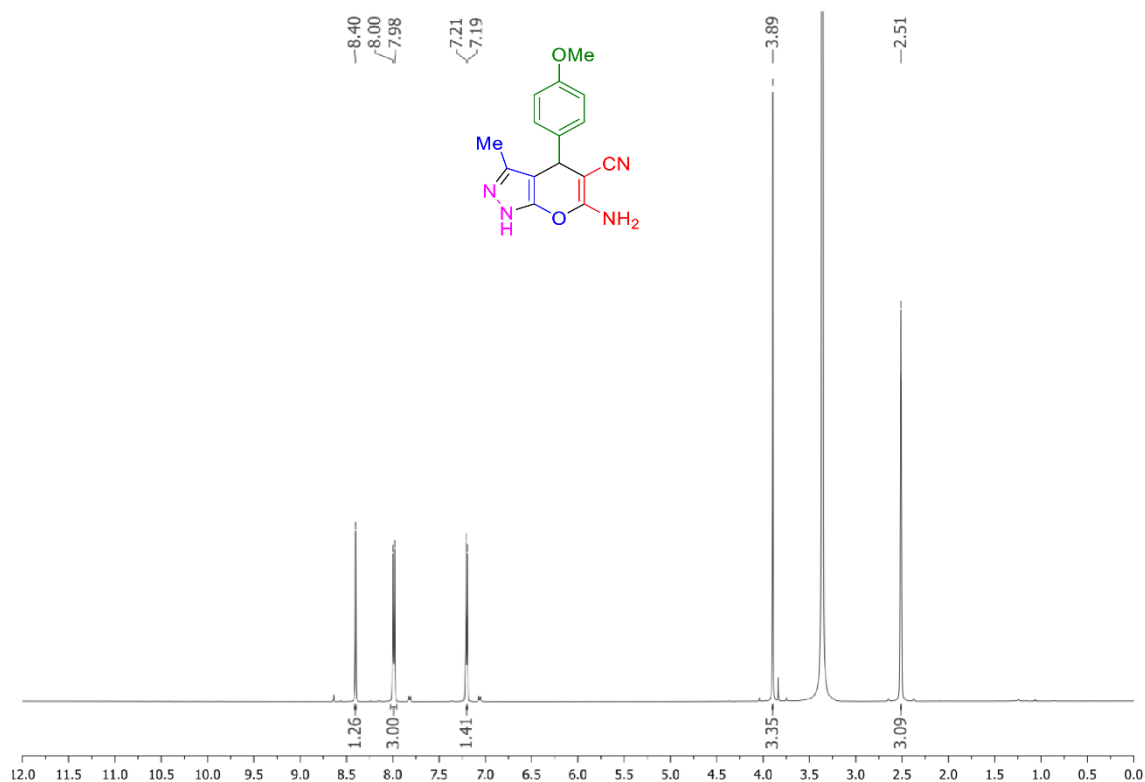


Figure S17. ¹H NMR spectra of 6-Amino-4-(4-methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

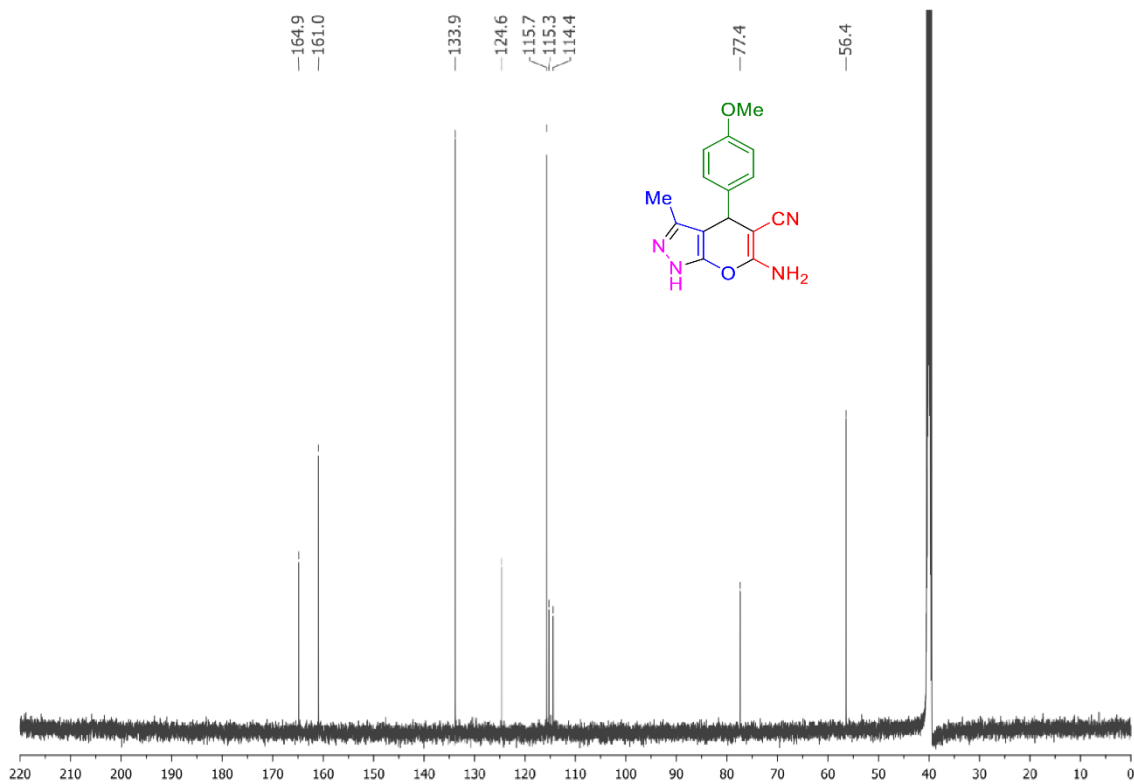


Figure S18. ^{13}C NMR spectra of 6-Amino-4-(4-methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

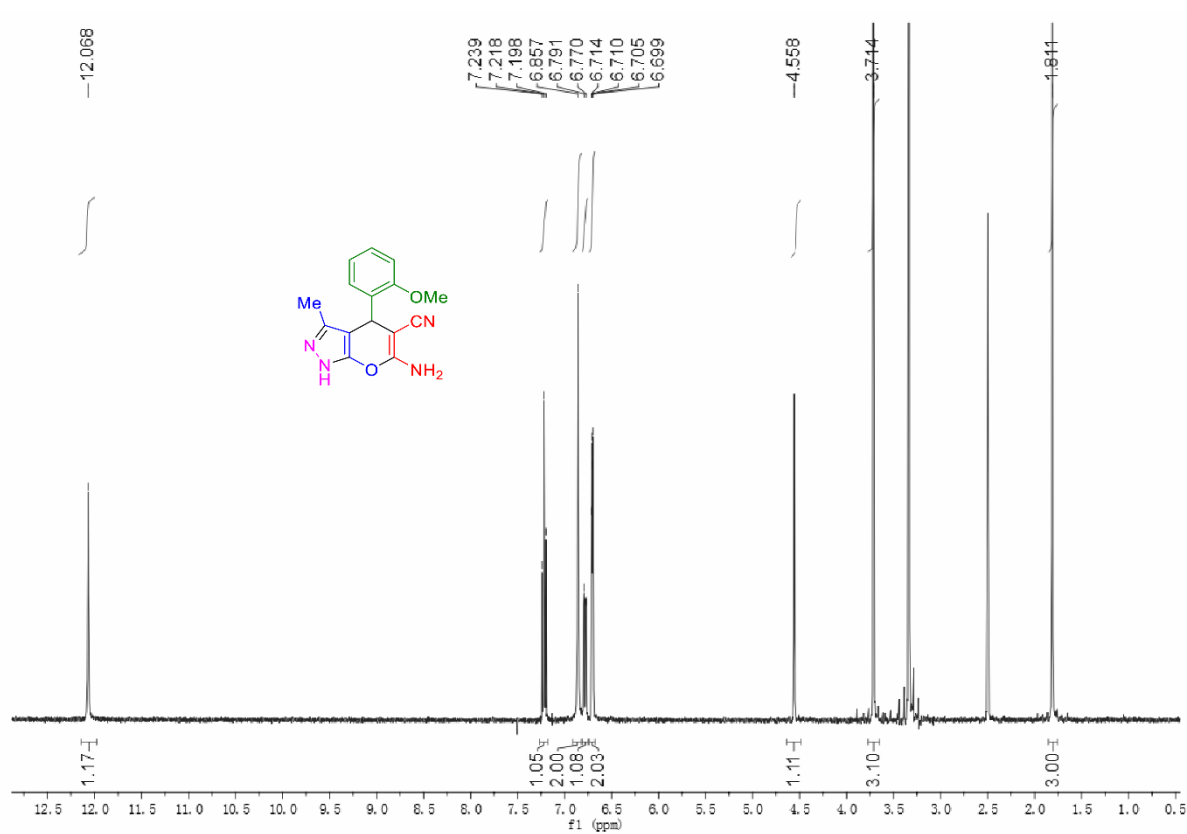


Figure S19. ^1H NMR spectra of 6-Amino-4-(2-Methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

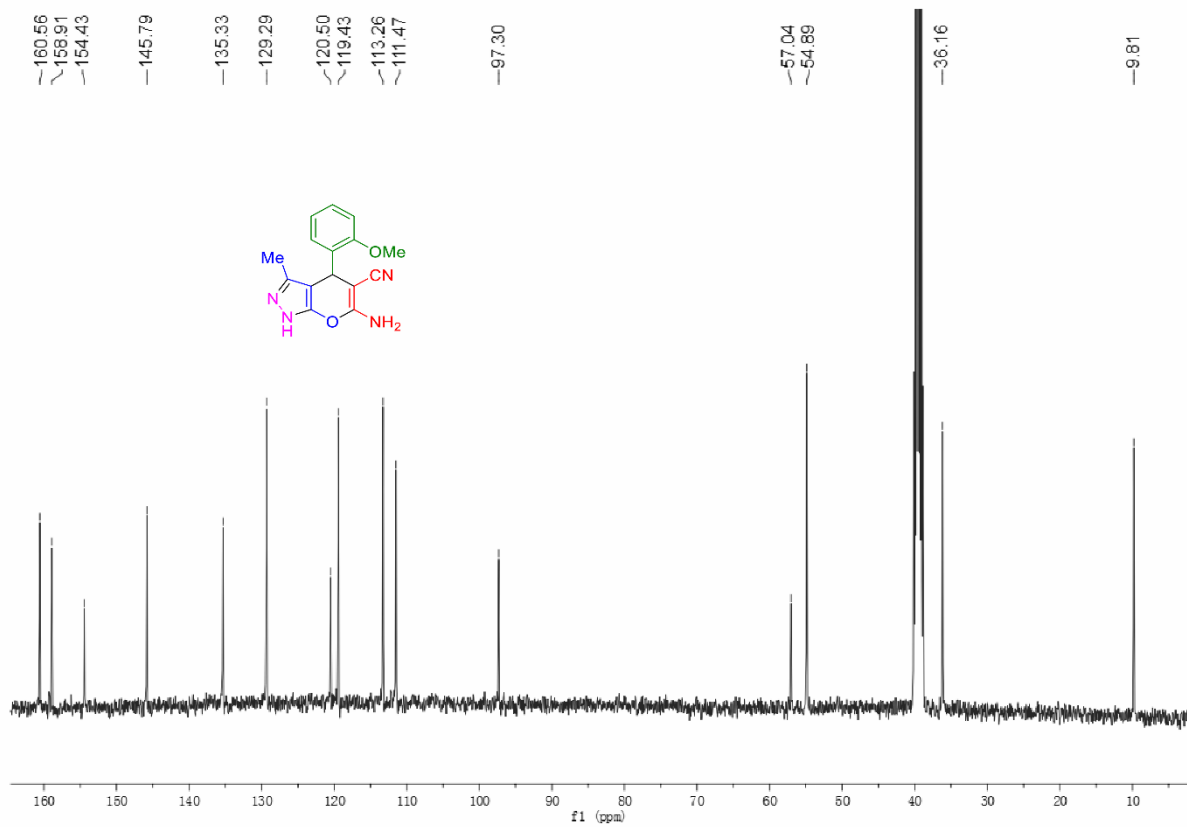


Figure S20. ^{13}C NMR spectra of 6-Amino-4-(2-Methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

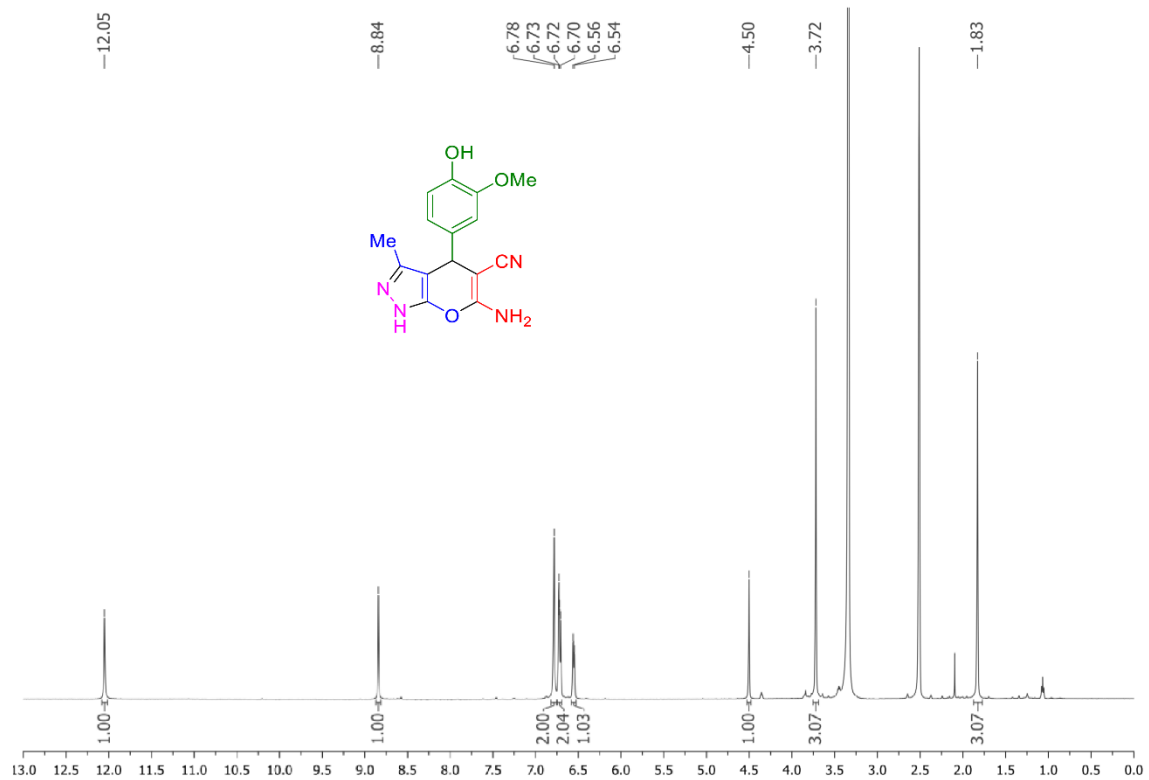


Figure S21. ¹H NMR spectra of 6-Amino-4-(4-hydroxy-3-methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

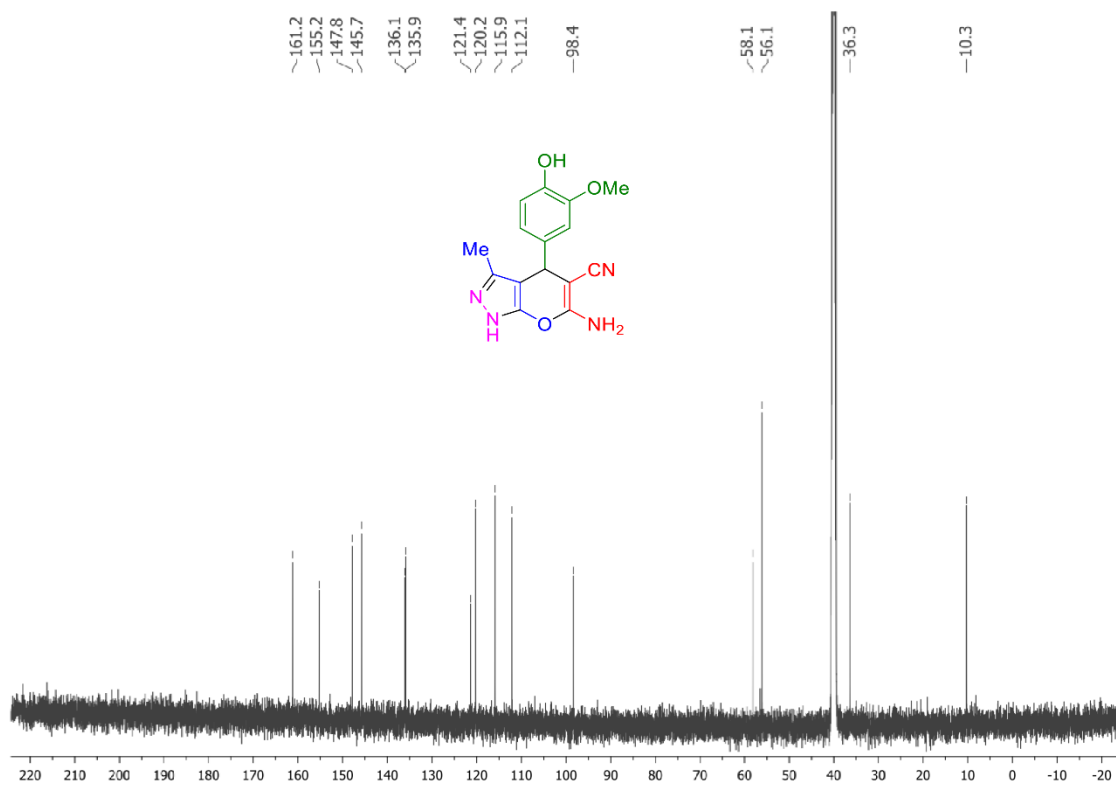


Figure S22. ^{13}C NMR spectra of 6-Amino-4-(4-hydroxy-3-methoxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

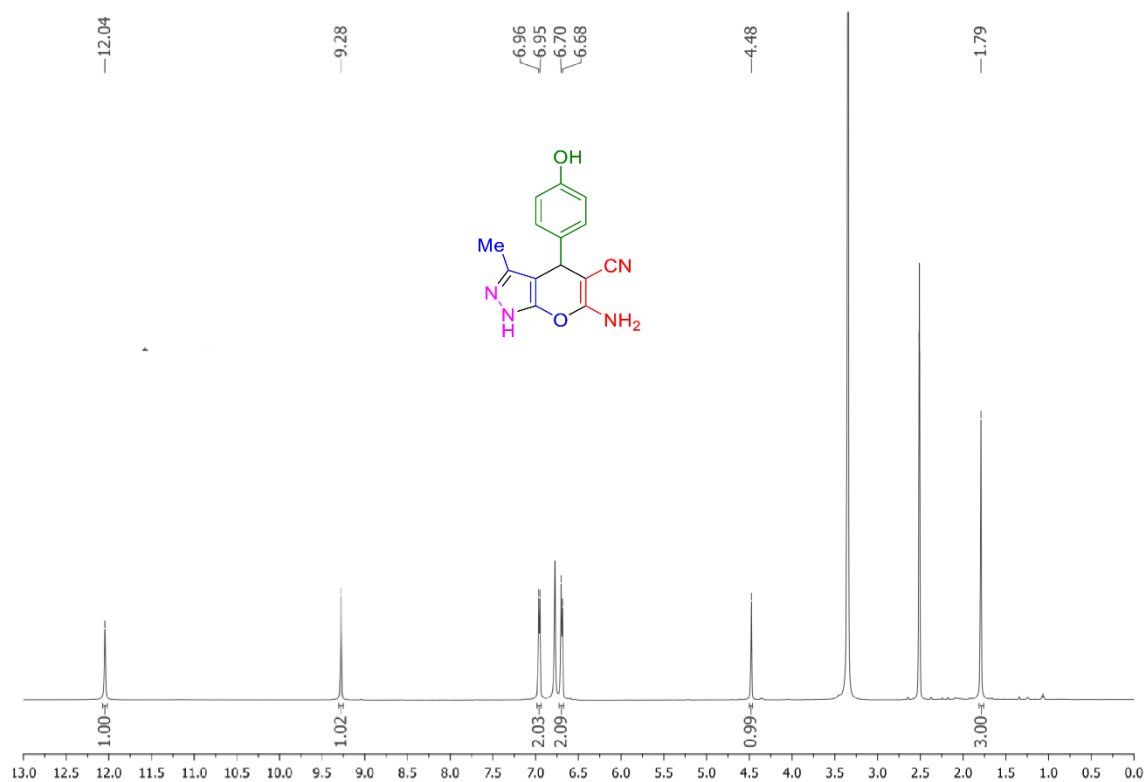


Figure S23. ¹H NMR spectra of 6-Amino-4-(4-hydroxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

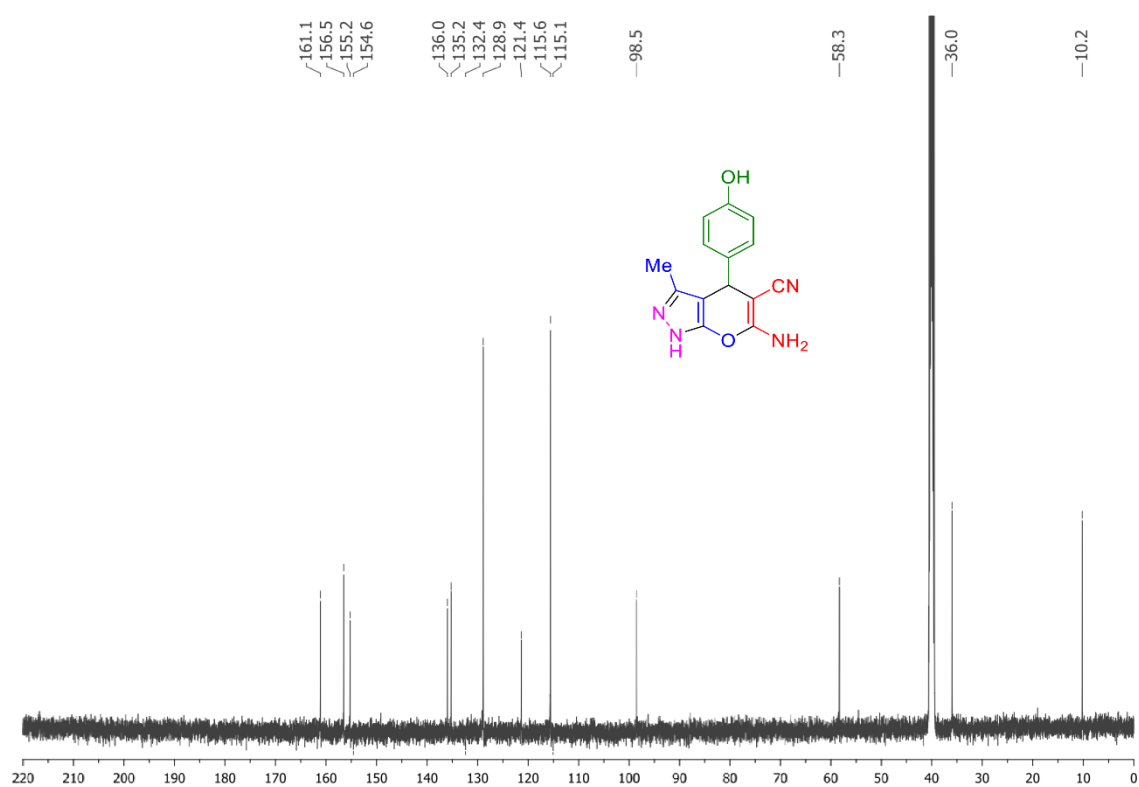


Figure S24. ^{13}C NMR spectra of 6-Amino-4-(4-hydroxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

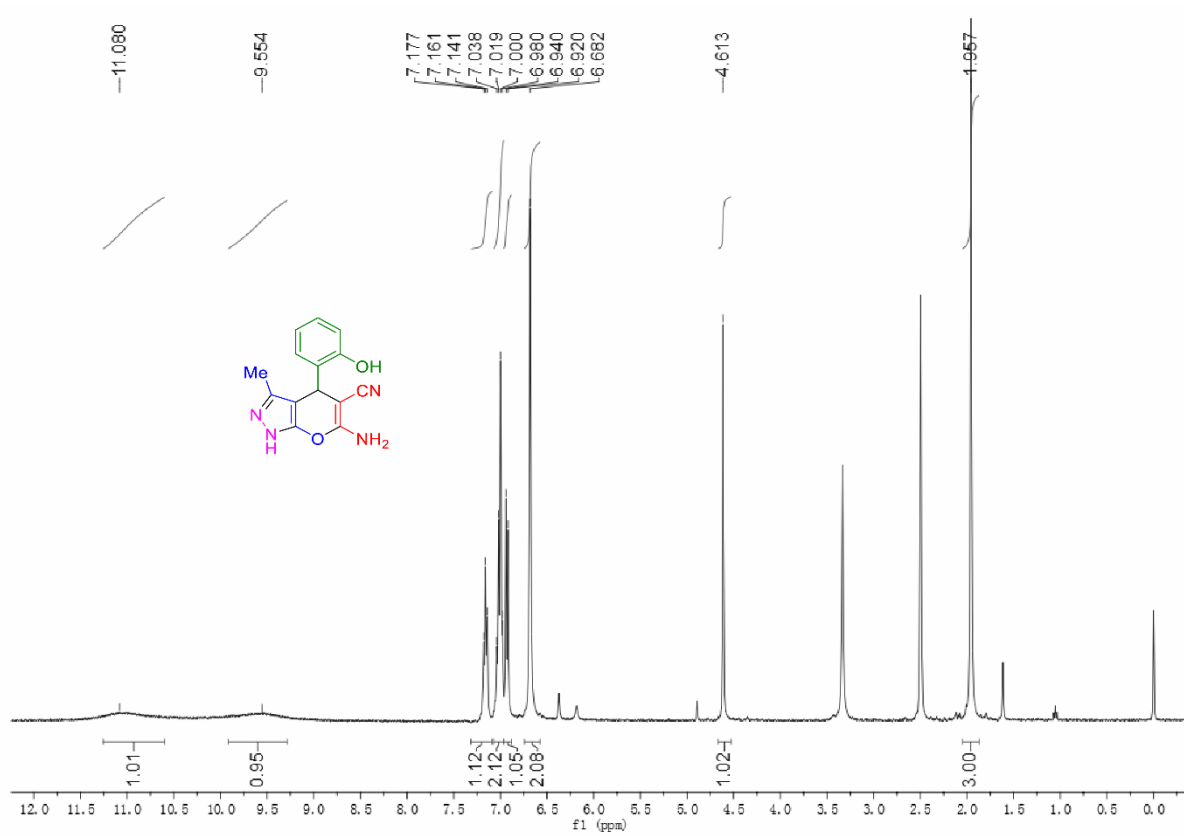


Figure S25. ¹H NMR spectra of 6-Amino-4-(2-hydroxyphenyl)-3-methyl-1,4-dihydroprano[2,3-c]pyrazole-5-carbonitrile.

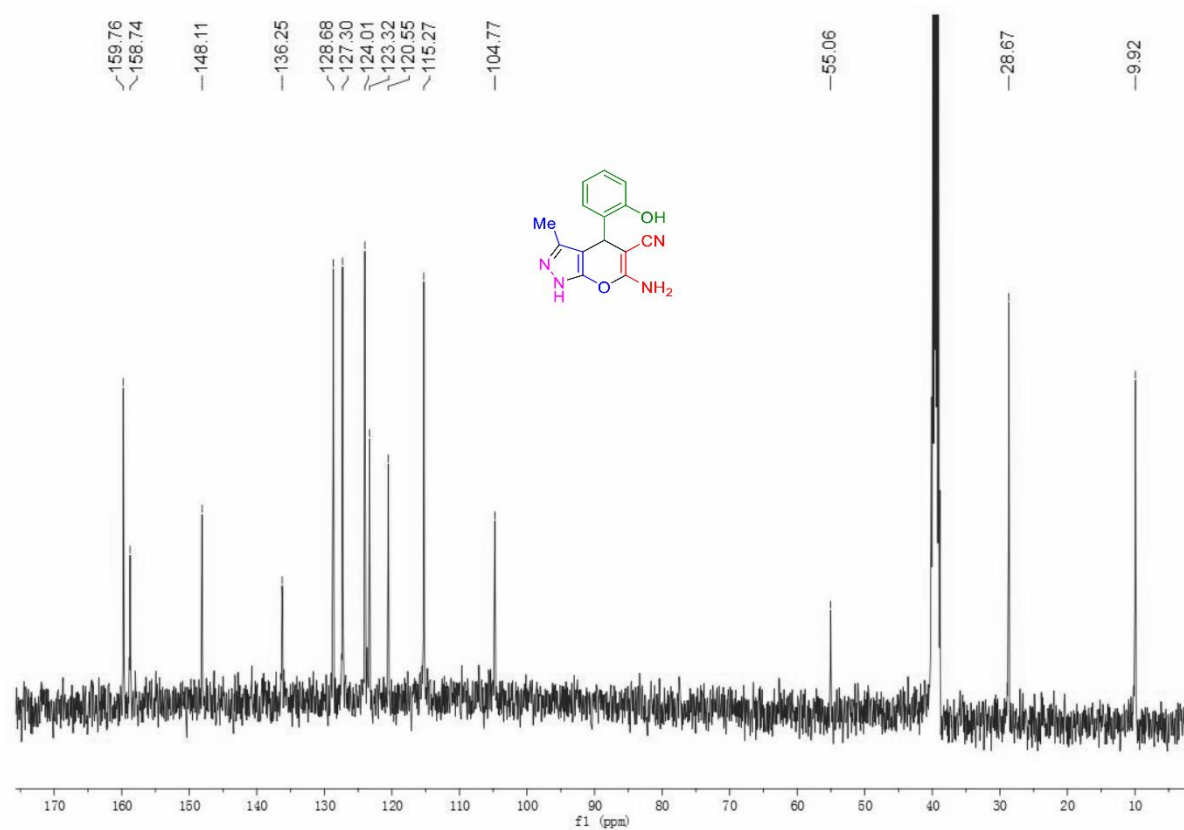


Figure S26. ^{13}C NMR spectra of 6-Amino-4-(2-hydroxyphenyl)-3-methyl-1,4-dihydroprano[2,3-c]pyrazole-5-carbonitrile.

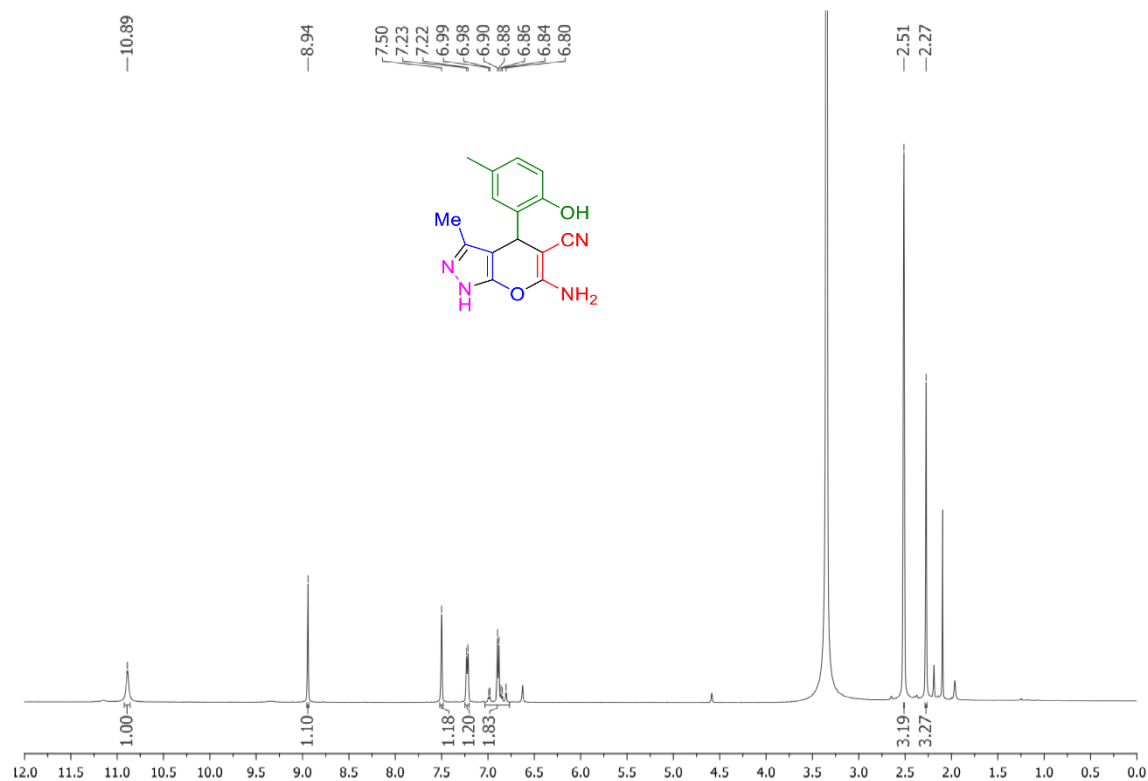


Figure S27. ¹H NMR spectra of 6-Amino-4-(2-hydroxy-5-methylphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

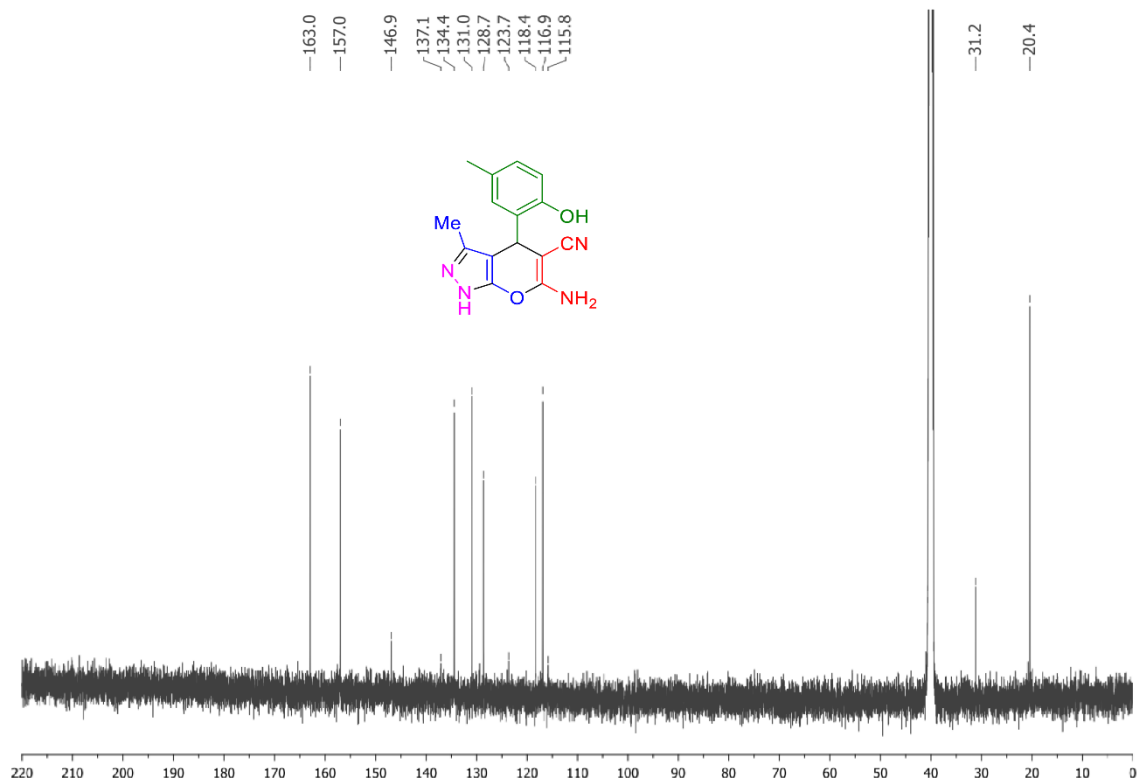


Figure S28. ¹³C NMR spectra of 6-Amino-4-(2-hydroxy-5-methylphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

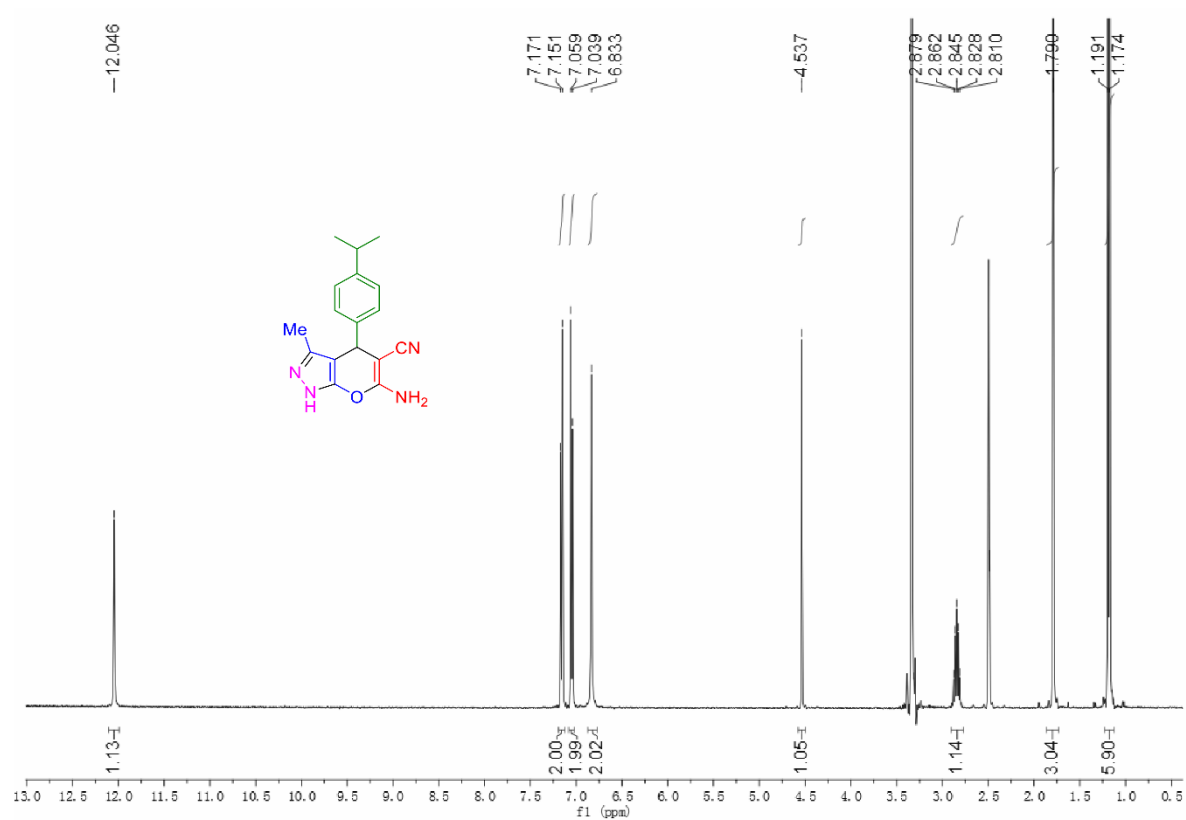


Figure S29. ¹H NMR spectra of 6-Amino-4-(4-isopropylphenyl)-3-methyl-2,4-dihydroprano[2,3-c]pyrazole-5-carbonitrile.

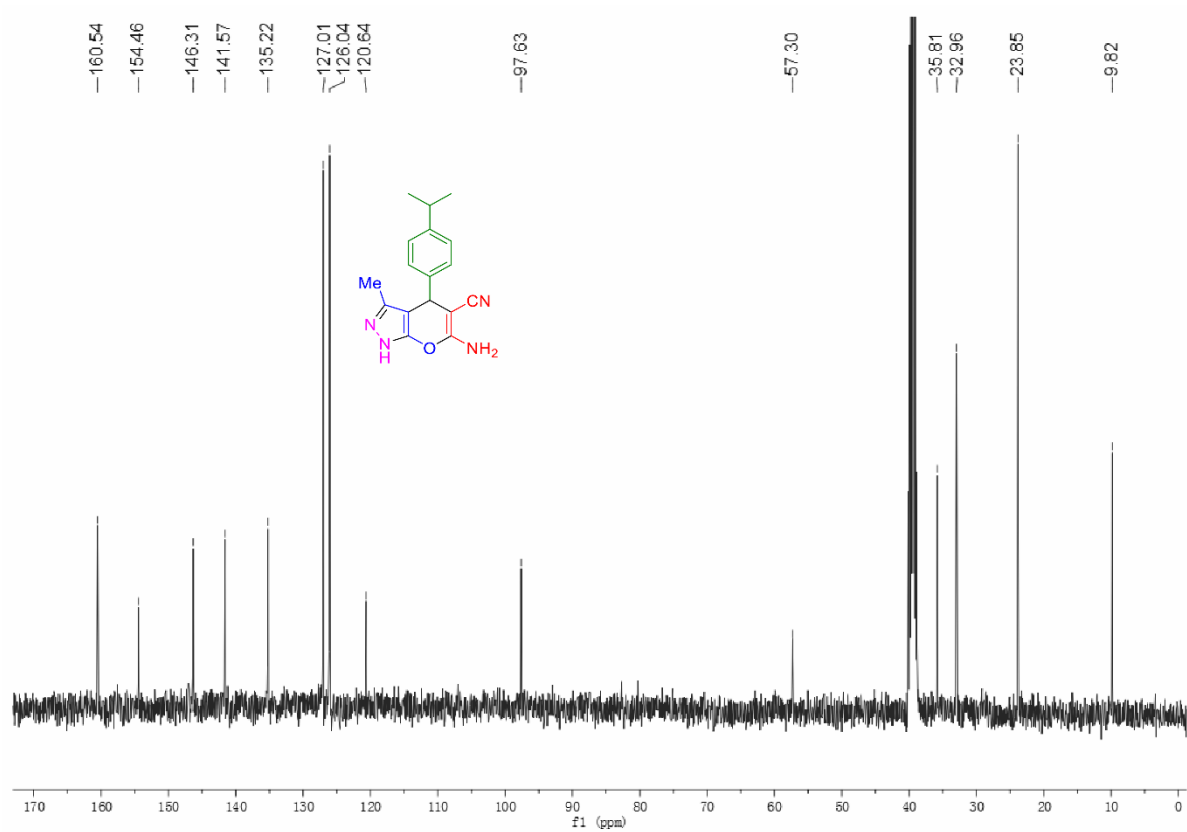


Figure S30. ^{13}C NMR spectra of 6-Amino-4-(4-isopropylphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

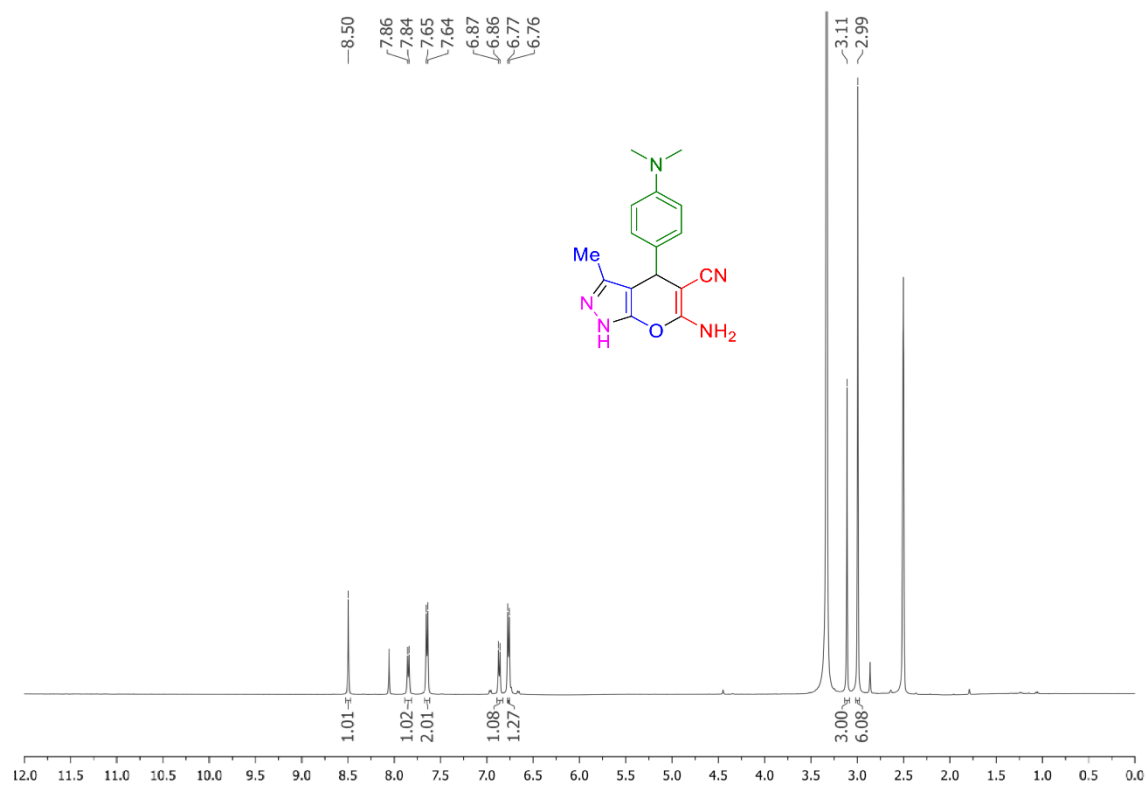


Figure S31. ¹H NMR spectra of 6-Amino-4-(4-(dimethylamino)phenyl)-3-methyl-2,4-dihydroprano[2,3-c]pyrazole-5-carbonitrile.

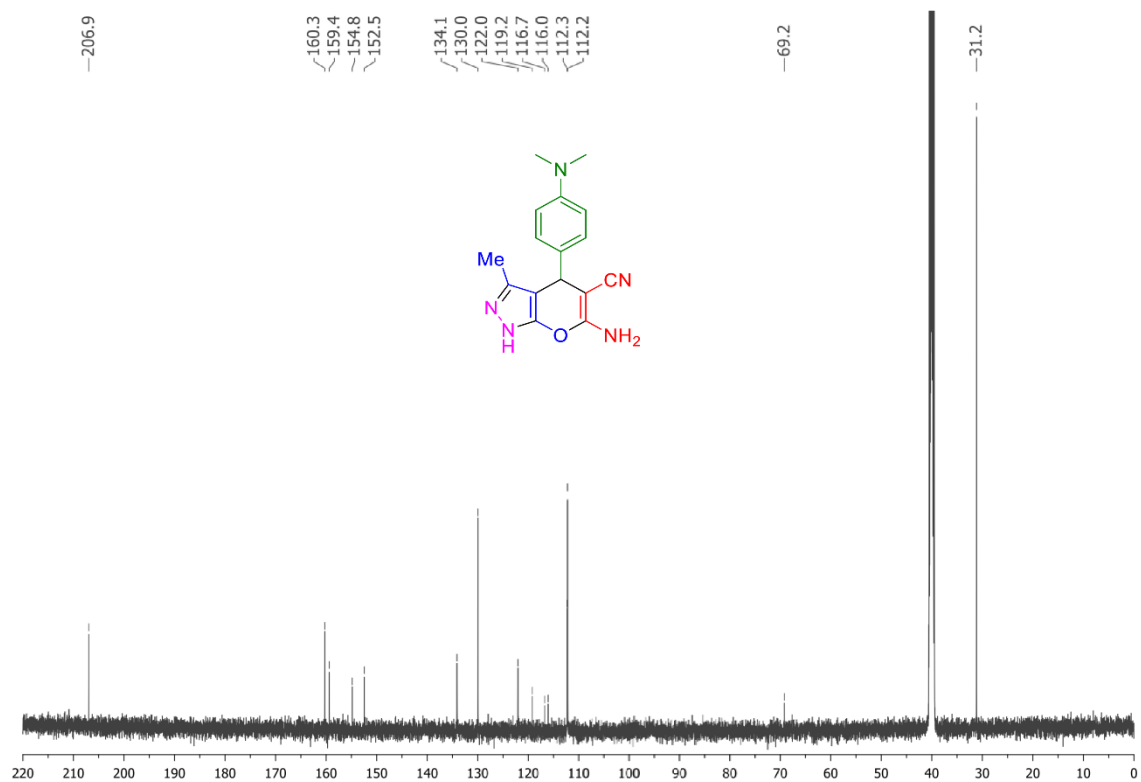


Figure S32. ^{13}C NMR spectra of 6-Amino-4-(4-(dimethylamino)phenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

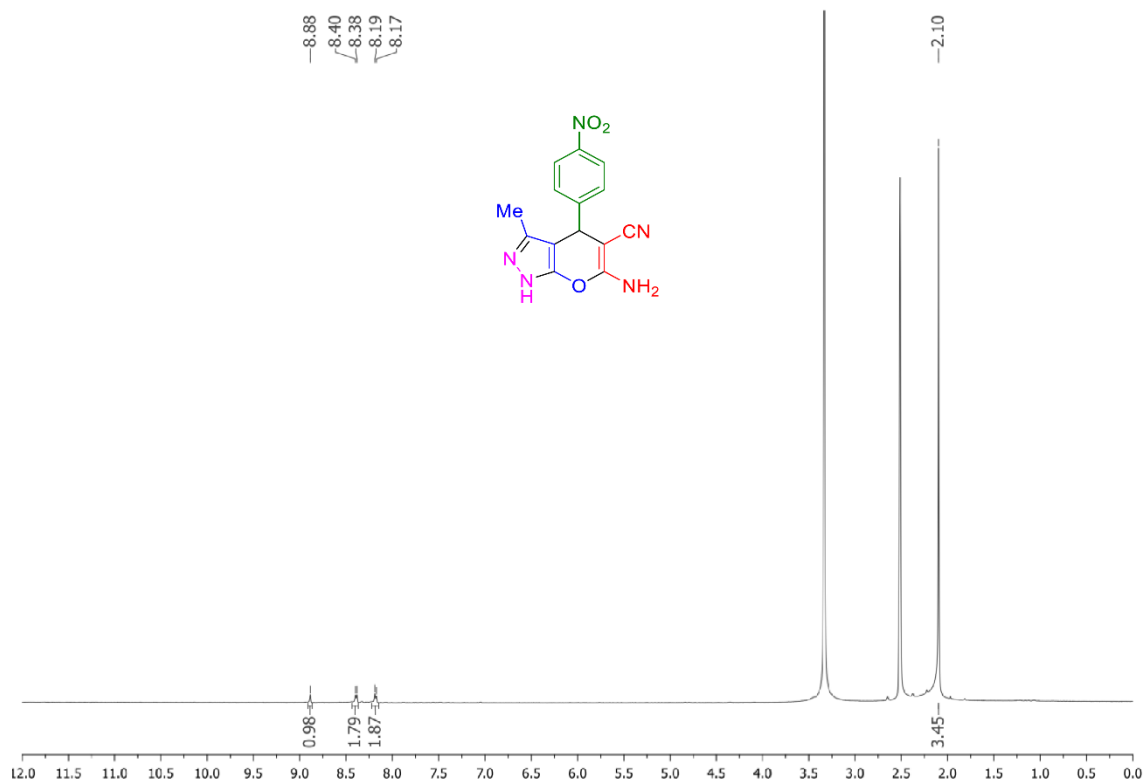


Figure S33. ¹H NMR spectra of 6-Amino-4-(4-hydroxyphenyl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

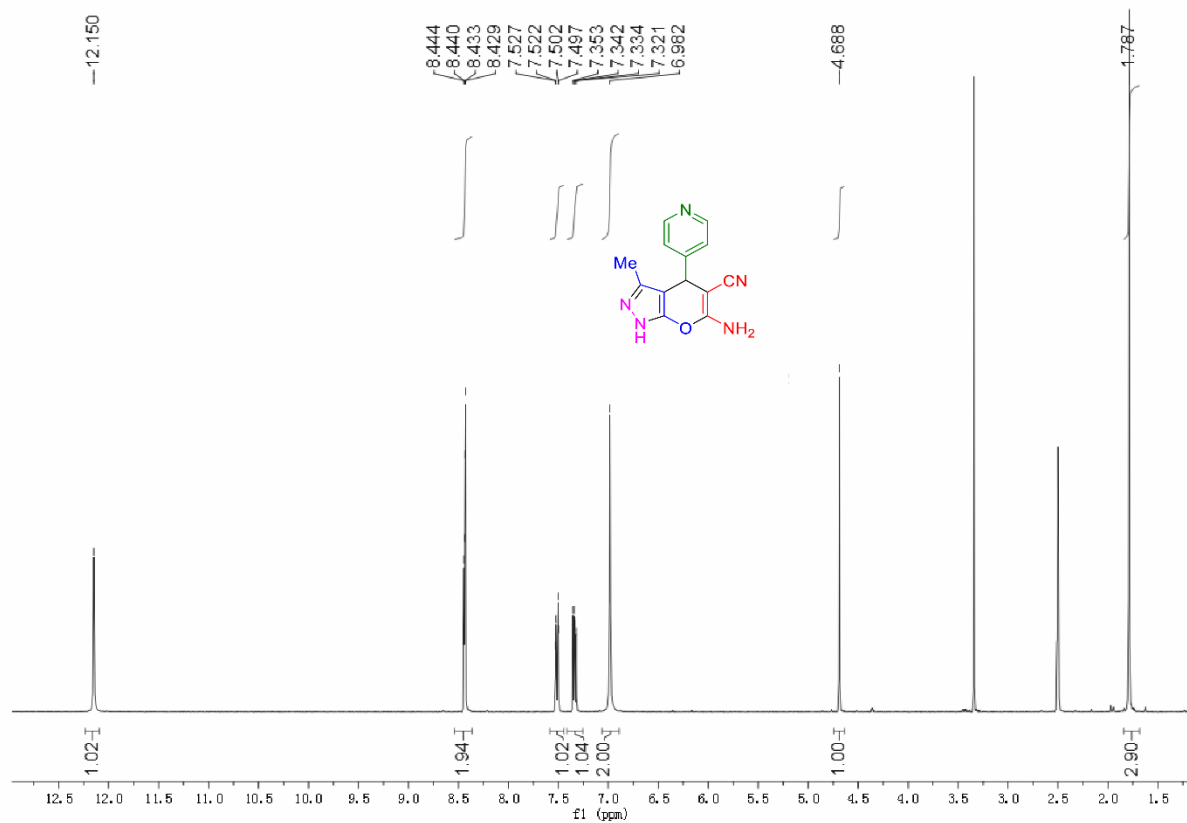


Figure S34. ¹H NMR spectra of 6-Amino-4-(pyridine-4-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

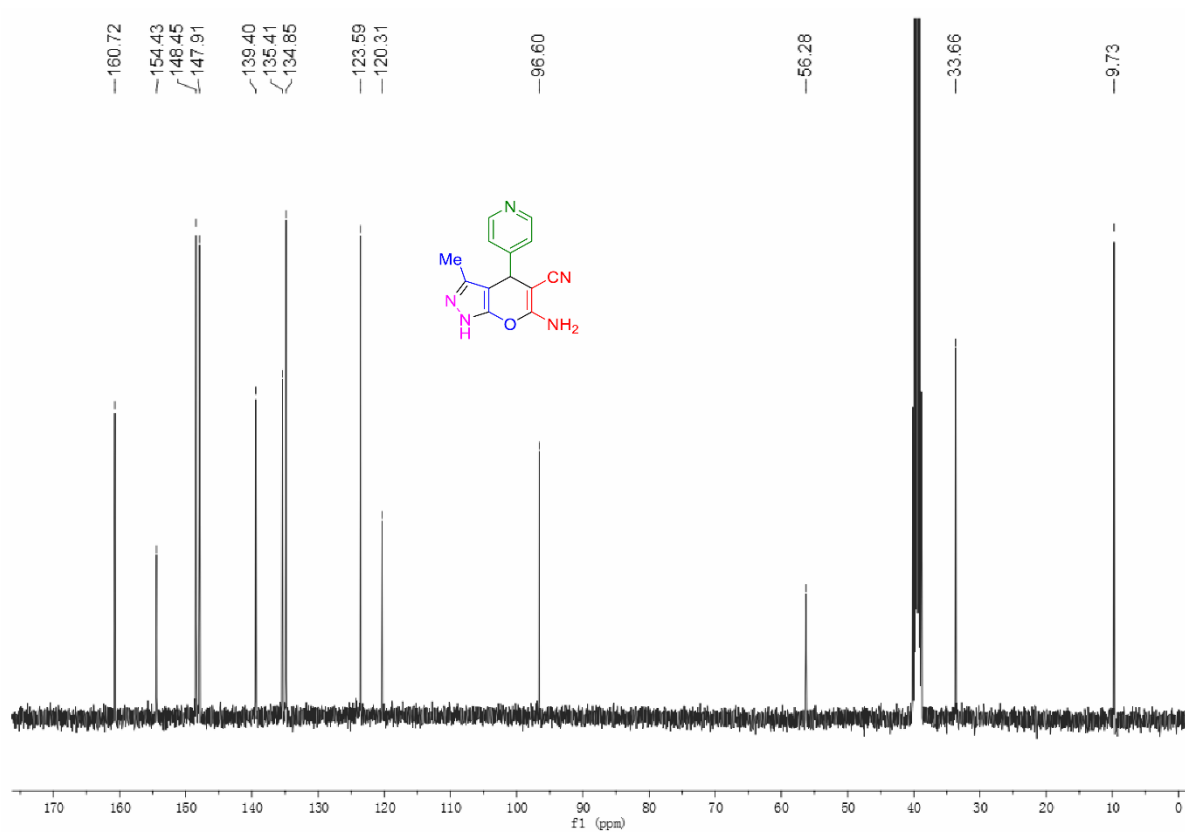


Figure S35. ¹³C NMR spectra of 6-Amino-4-(pyridine-4-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

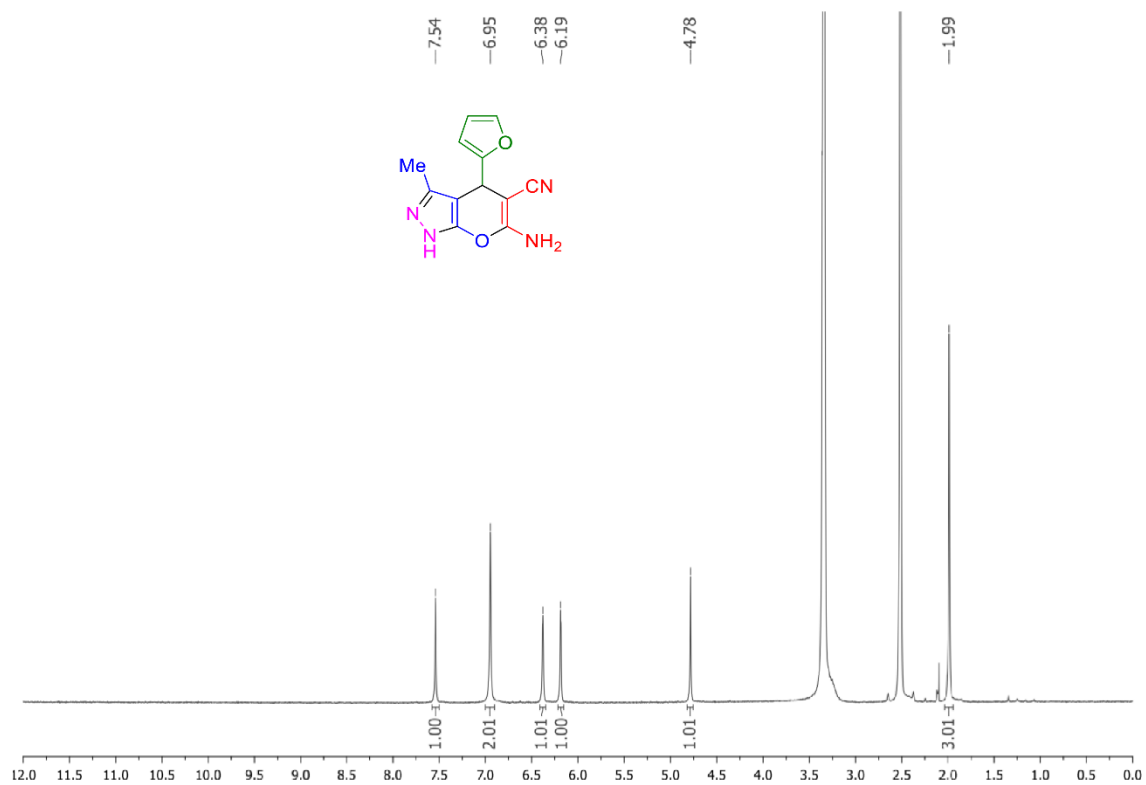


Figure S36. ¹H NMR spectra of 6-Amino-4-(furan-2-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

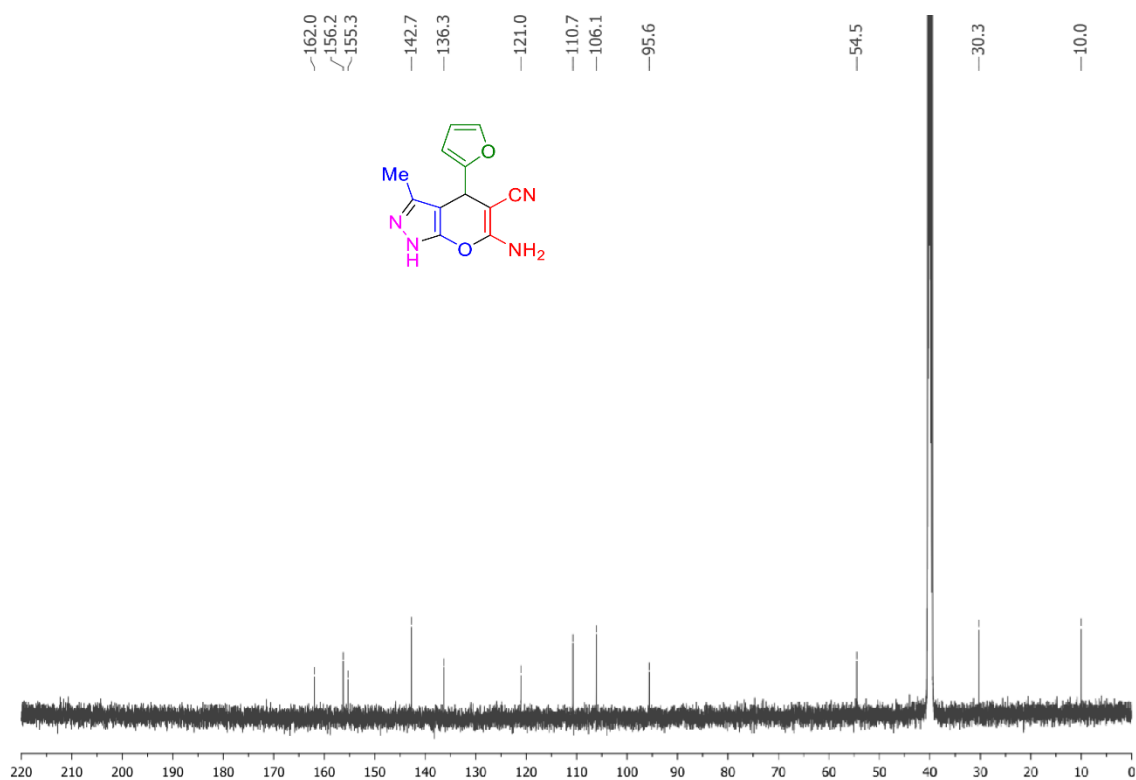


Figure S37. ^{13}C NMR spectra of 6-Amino-4-(furan-2-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

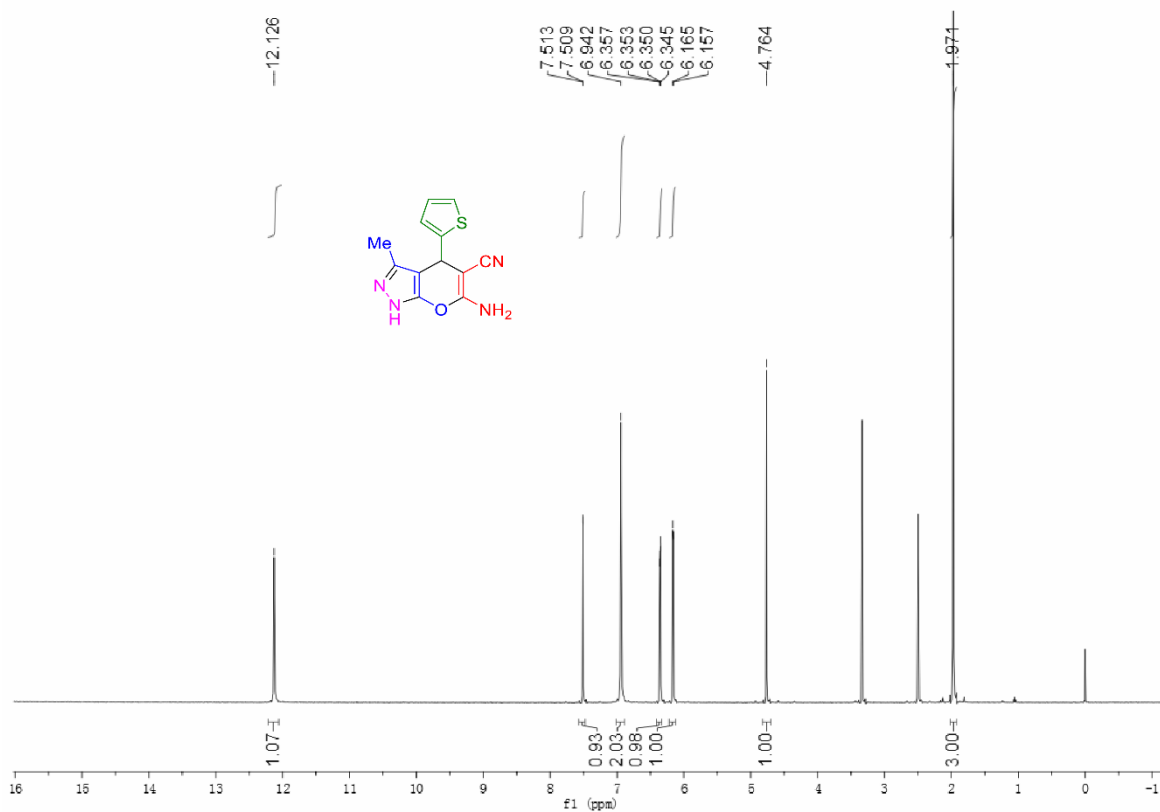


Figure S38. ^1H NMR spectra of 6-Amino-4-(thiophene-2-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.

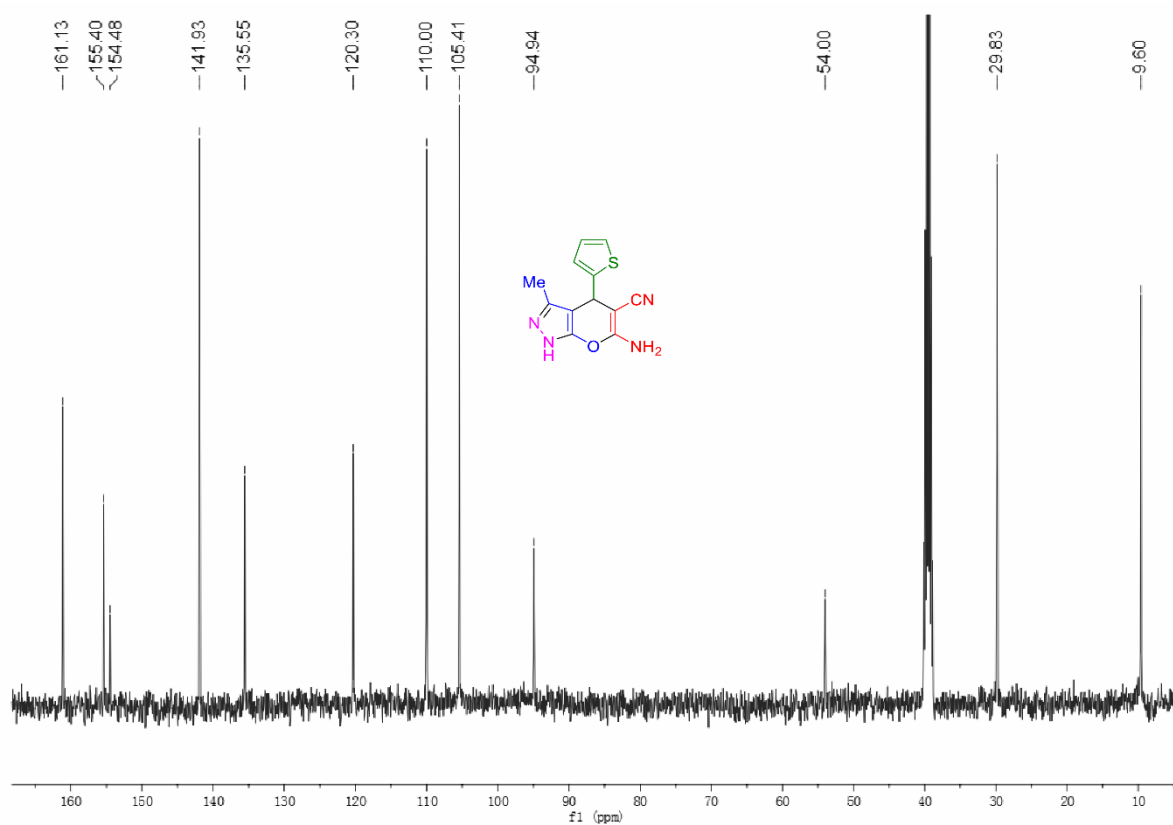


Figure S39. ¹³C NMR spectra of 6-Amino-4-(thiophene-2-yl)-3-methyl-2,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile.