Electronic Supplementary Material (ESI) for RSC Advances.

Experimental and theoretical studies of the nanostructured {Fe3O4@SiO2@(CH2)3Im}C(CN)3 catalyst for 2-amino-3-cyanopyridines preparation via an anomeric based oxidation

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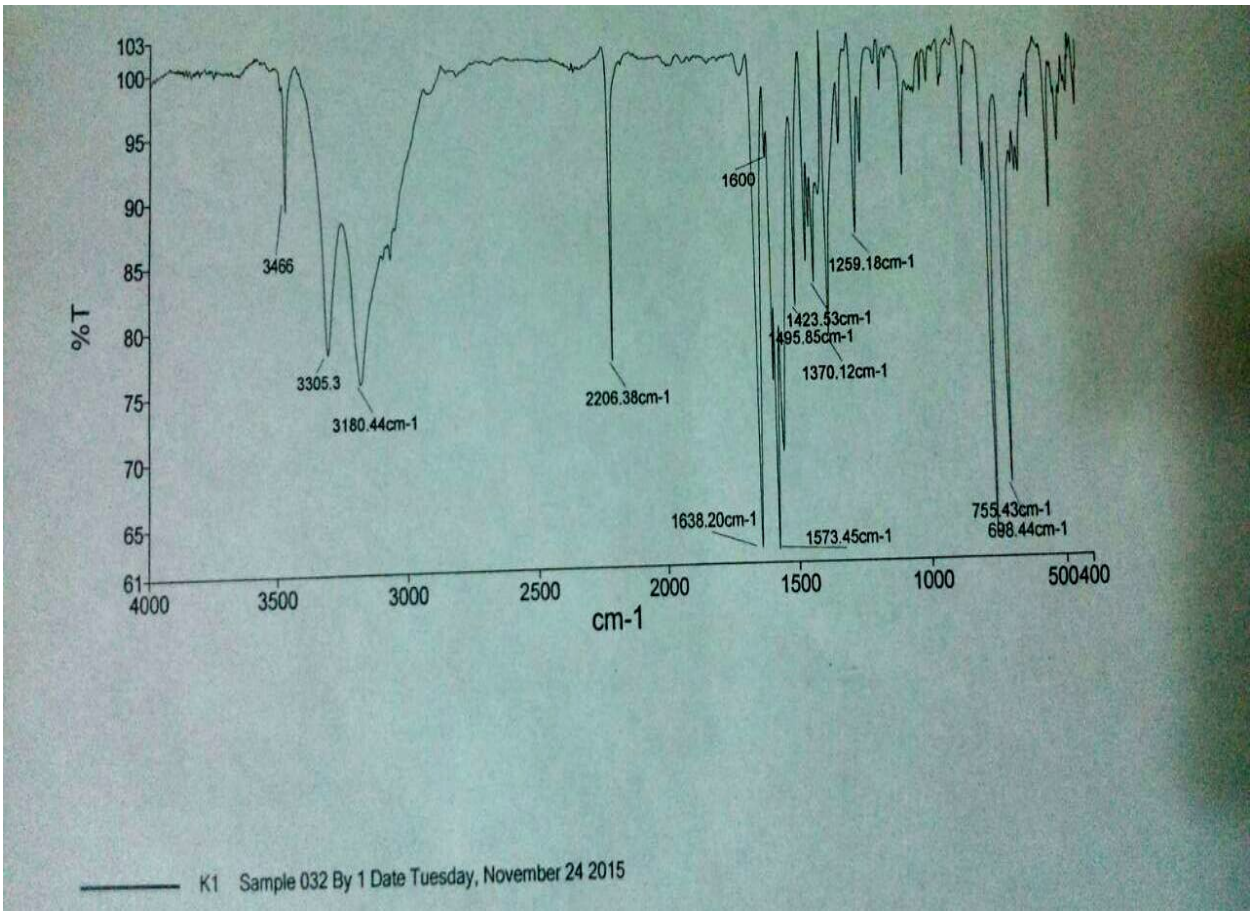
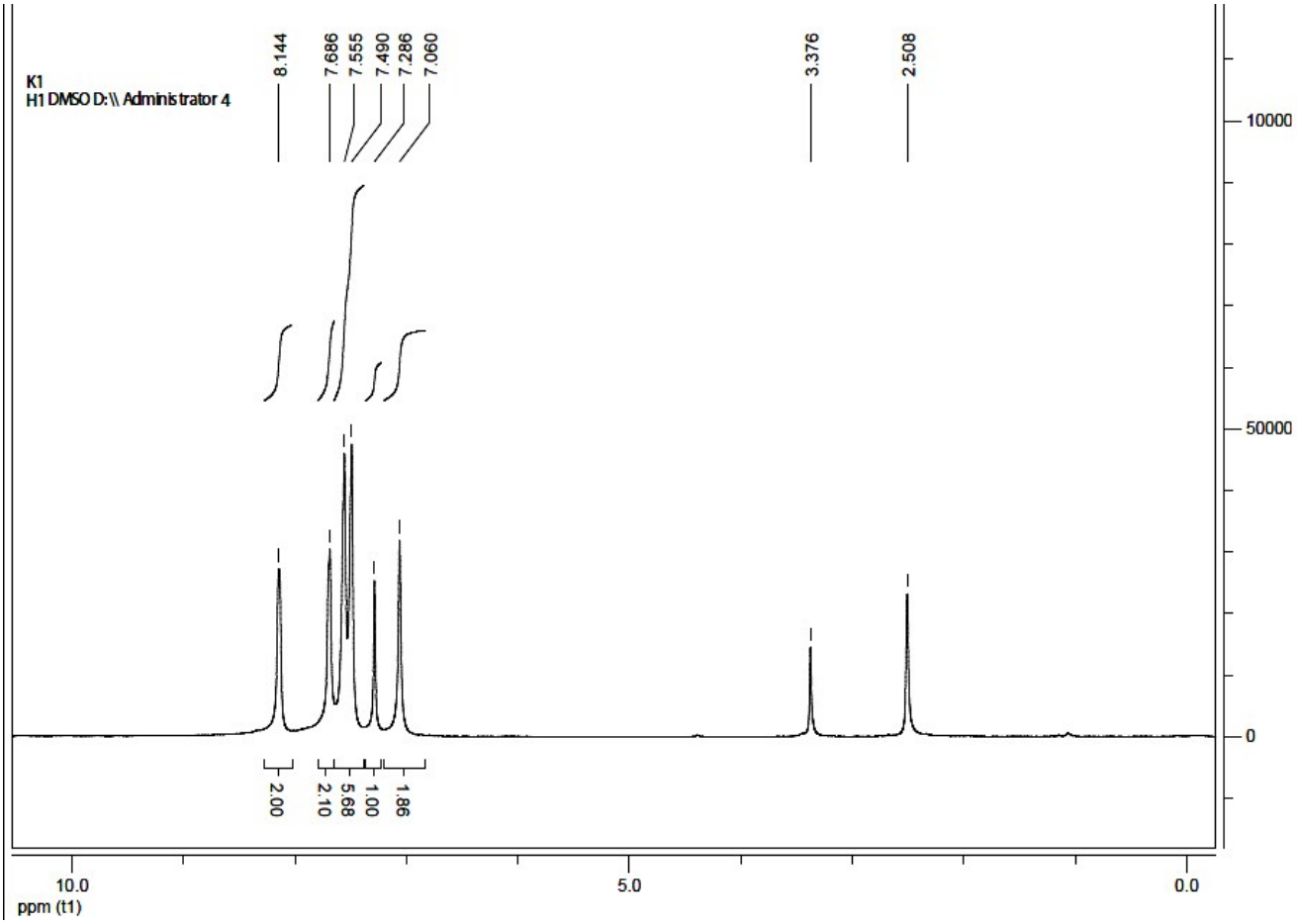
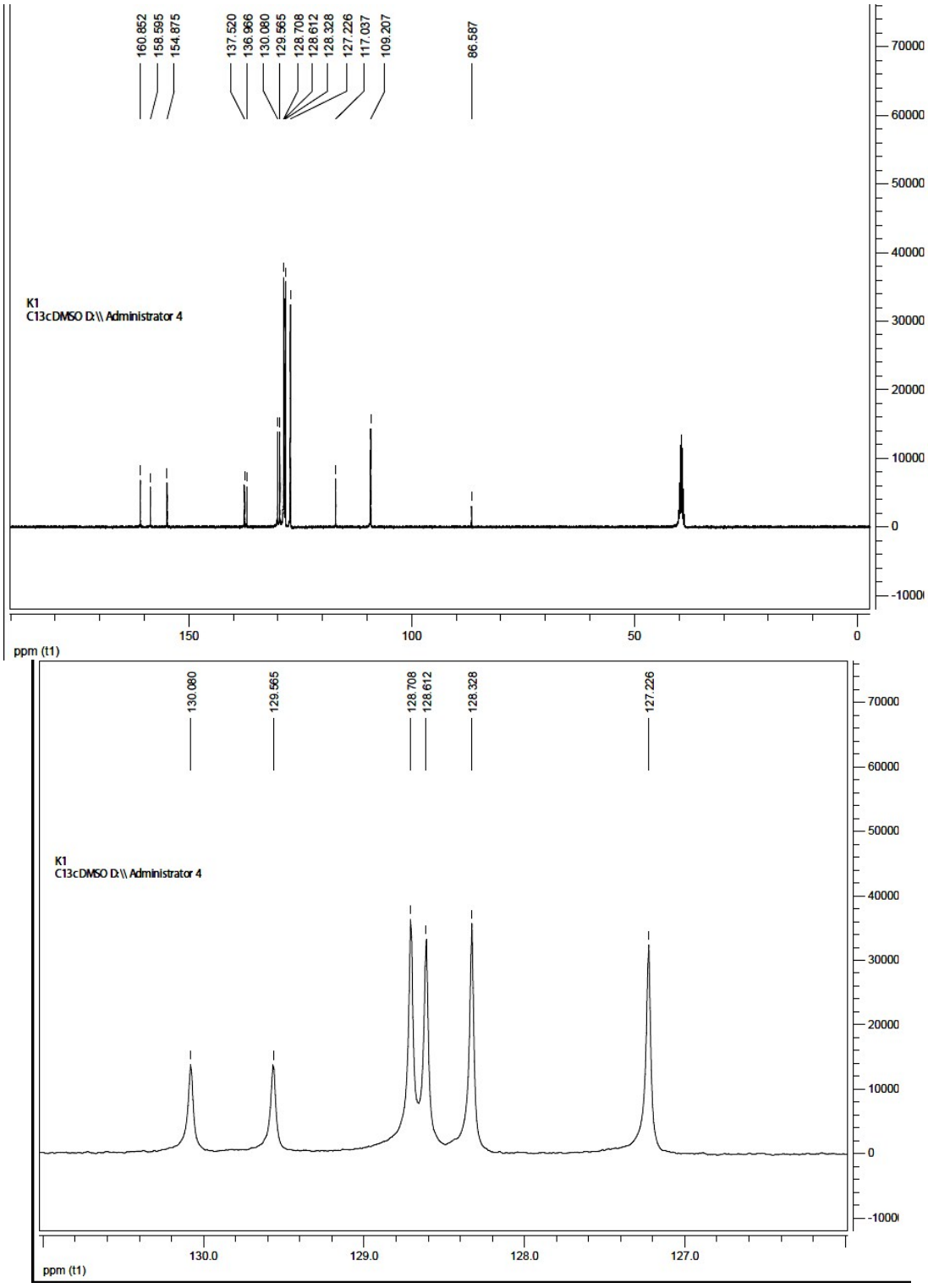


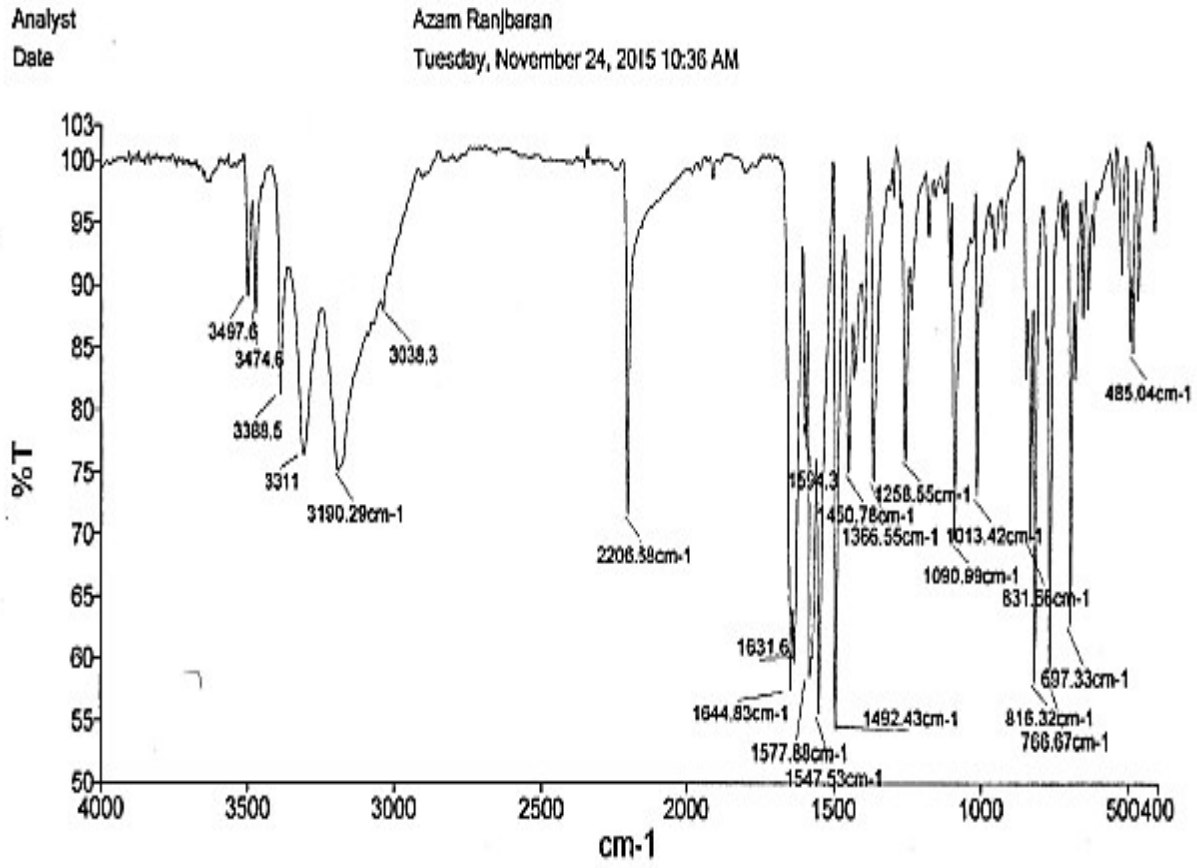
2. ^{1}H NMR spectra of 2-amino-4,6-diphenylnicotinonitrile (1a)



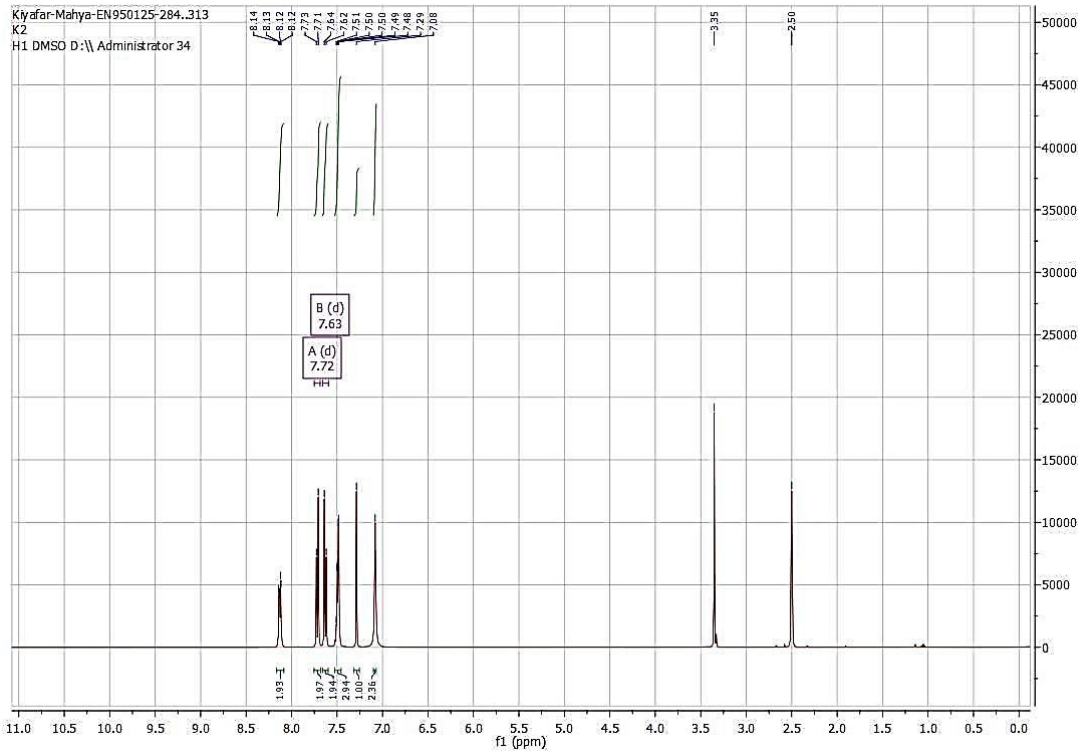
3. ^{13}C NMR spectra of 2-amino-4,6-diphenylnicotinonitrile (1a)

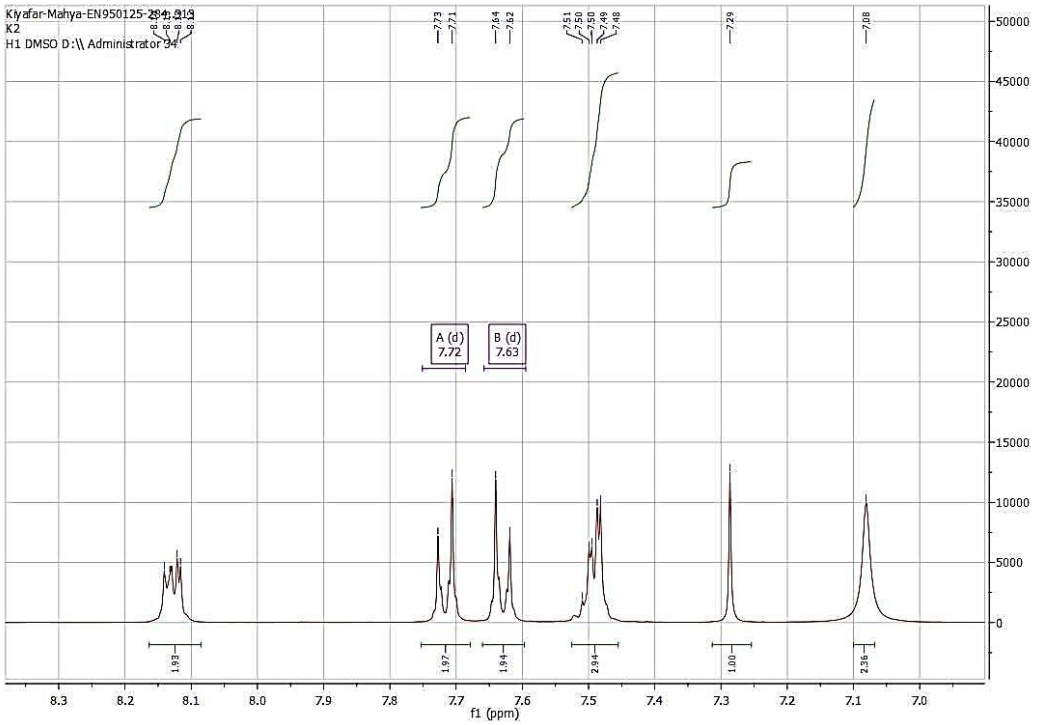


4. FT-IR spectra of 2-amino-4-(4-chlorophenyl)-6-phenylnicotinonitrile (1b)

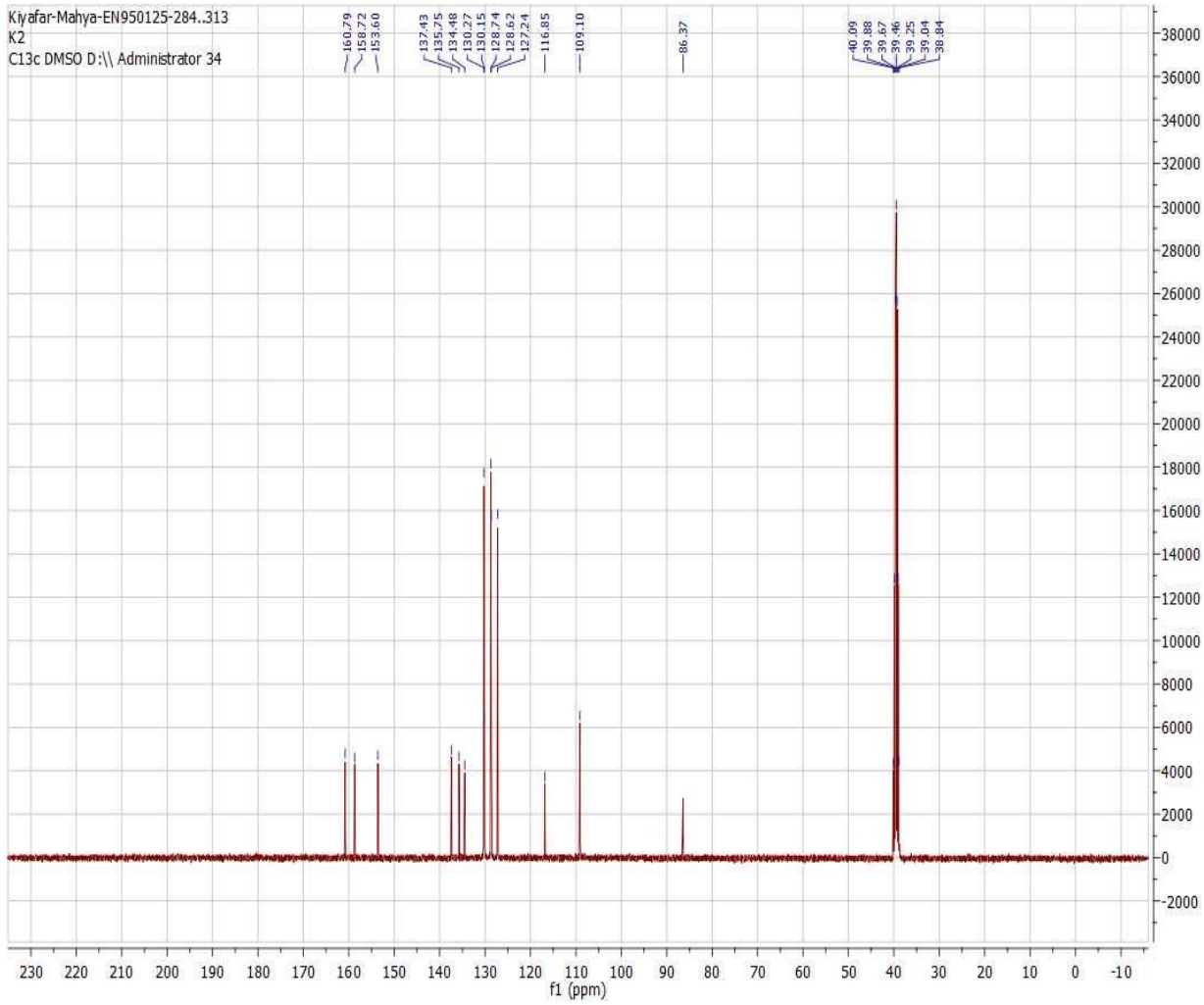


5. ^{1}H NMR spectra of 2-amino-4-(4-chlorophenyl)-6-phenylnicotinonitrile (1b)

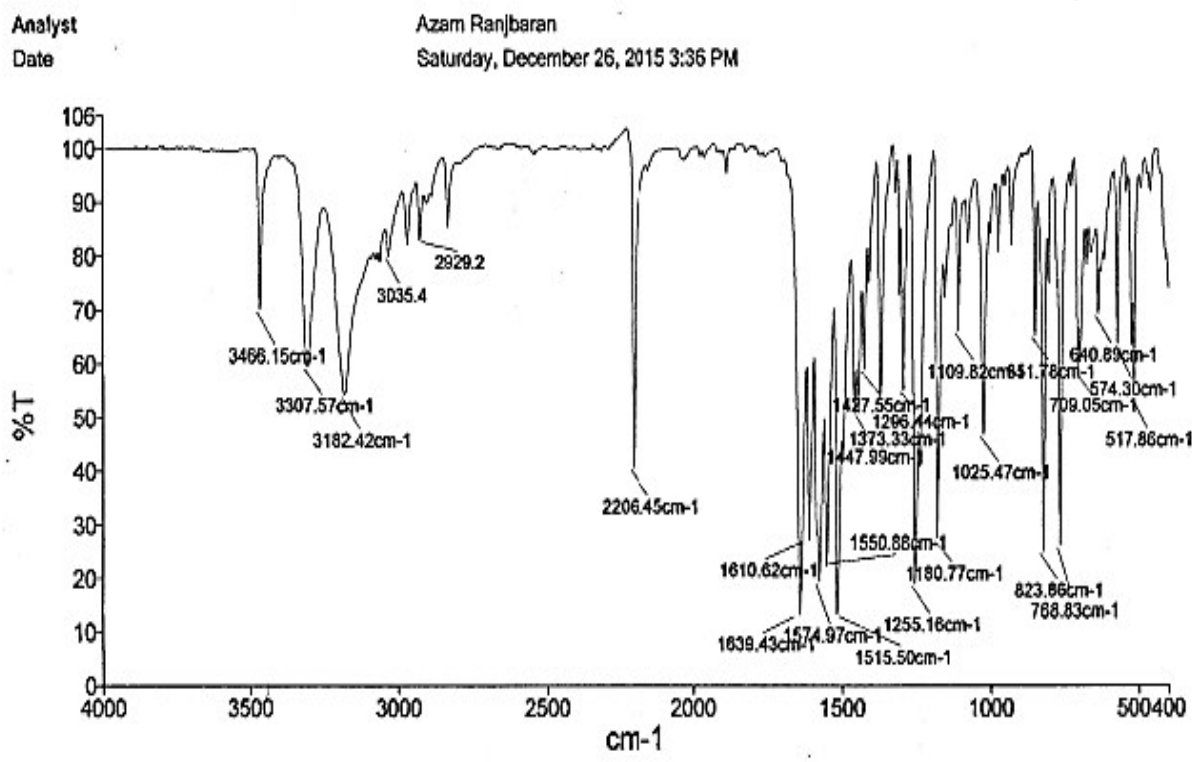




6. ^{13}C NMR spectra of 2-amino-4-(4-chlorophenyl)-6-phenylnicotinonitrile (1b)



7. FT-IR spectra of 2-amino-4-(4-methoxyphenyl)-6-phenylnicotinonitrile (1c)



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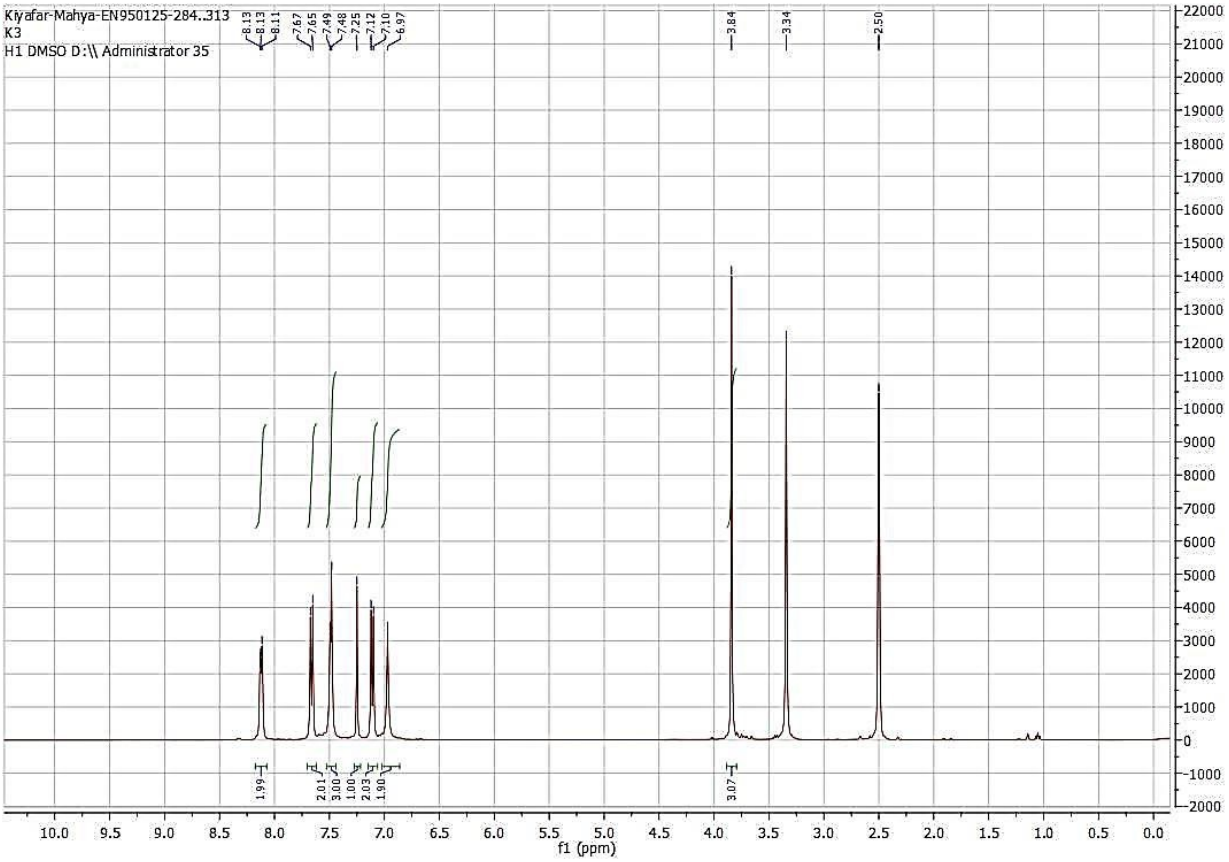

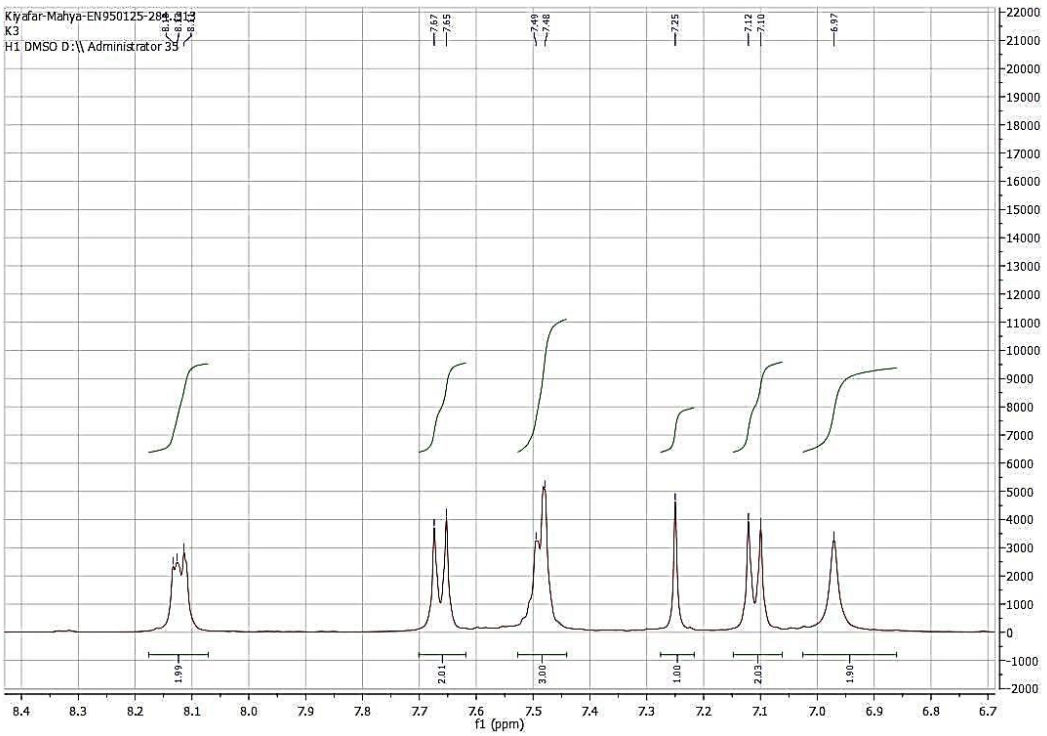

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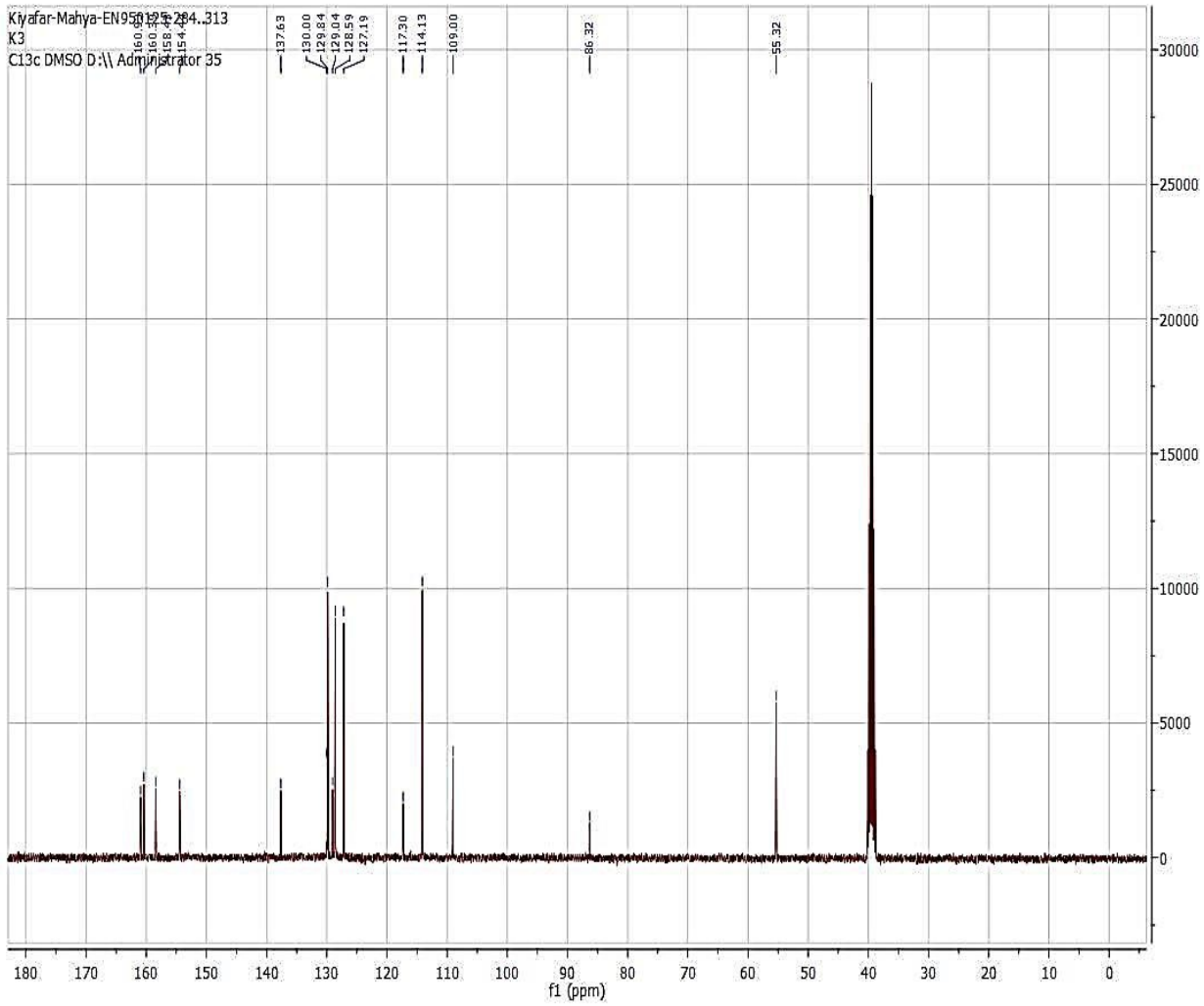
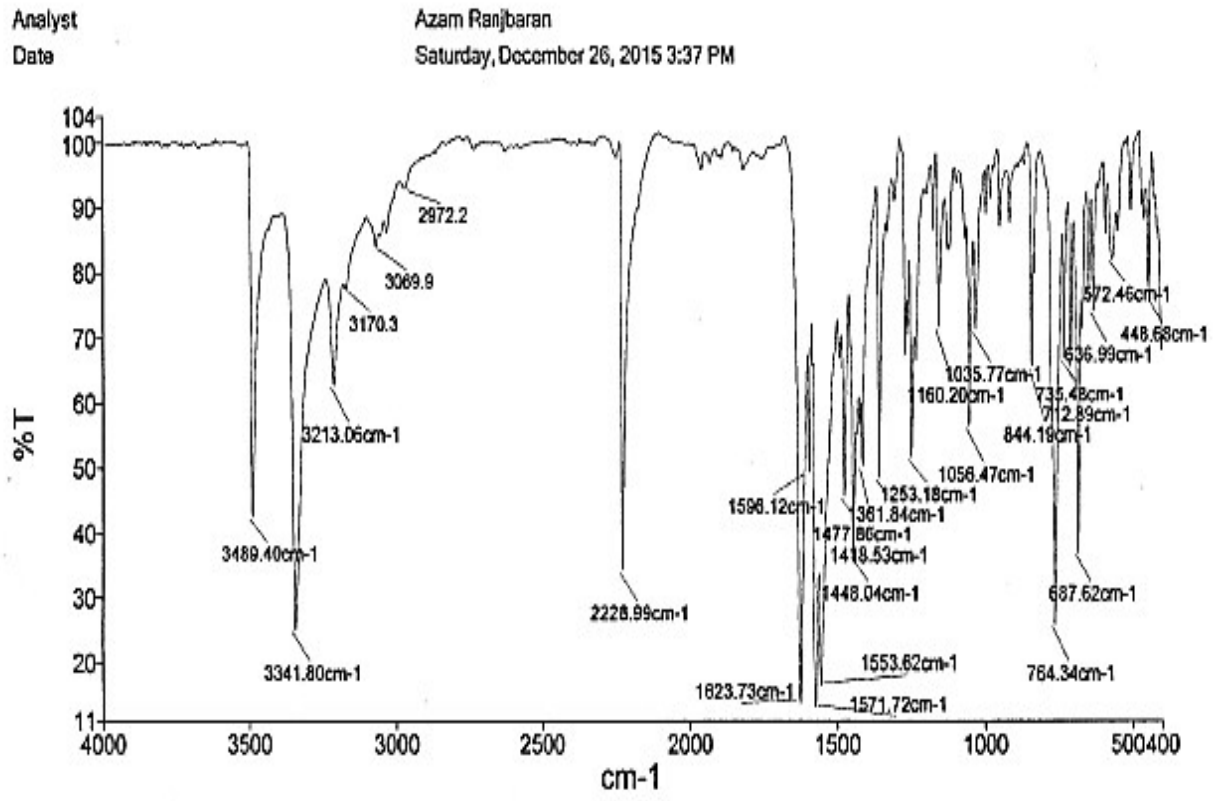


10. FT-IR spectra of 2-amino-4-(2-chlorophenyl)-6-phenylnicotinonitrile (1d)



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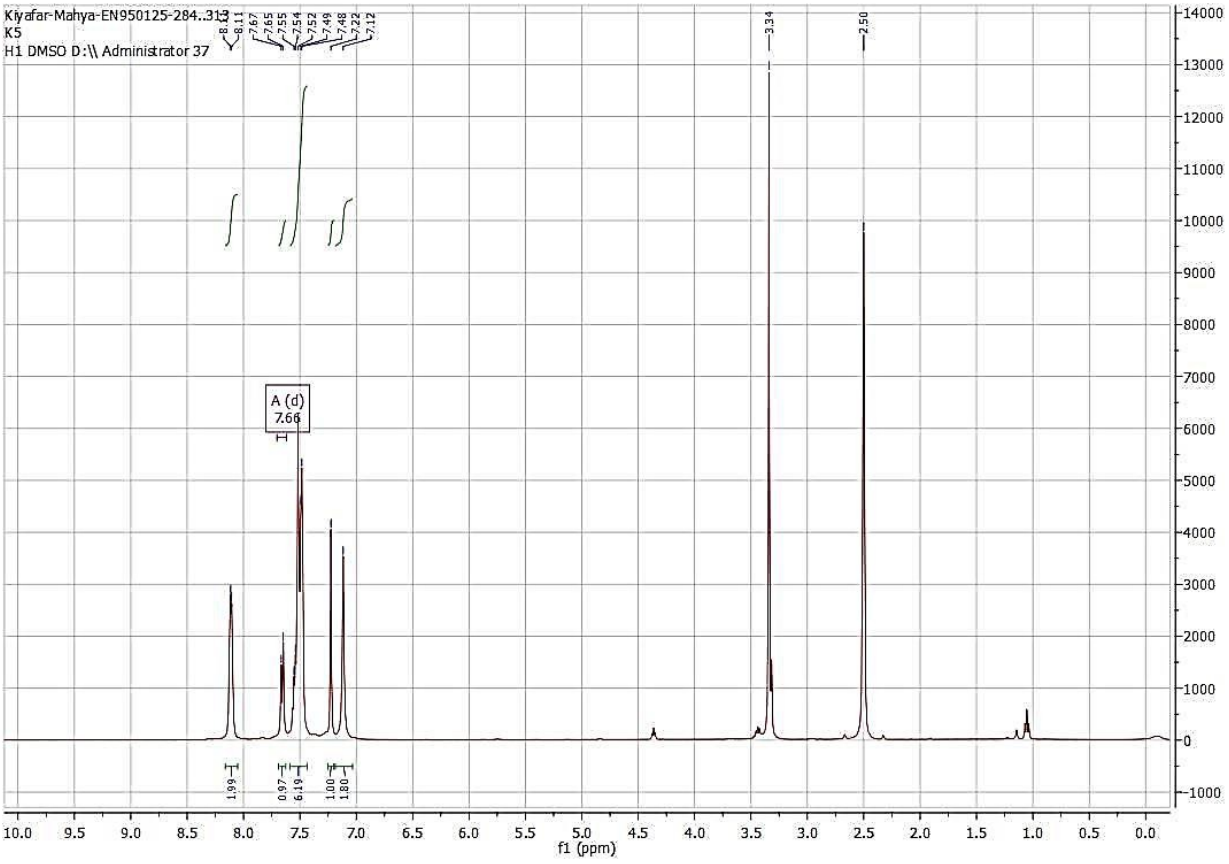

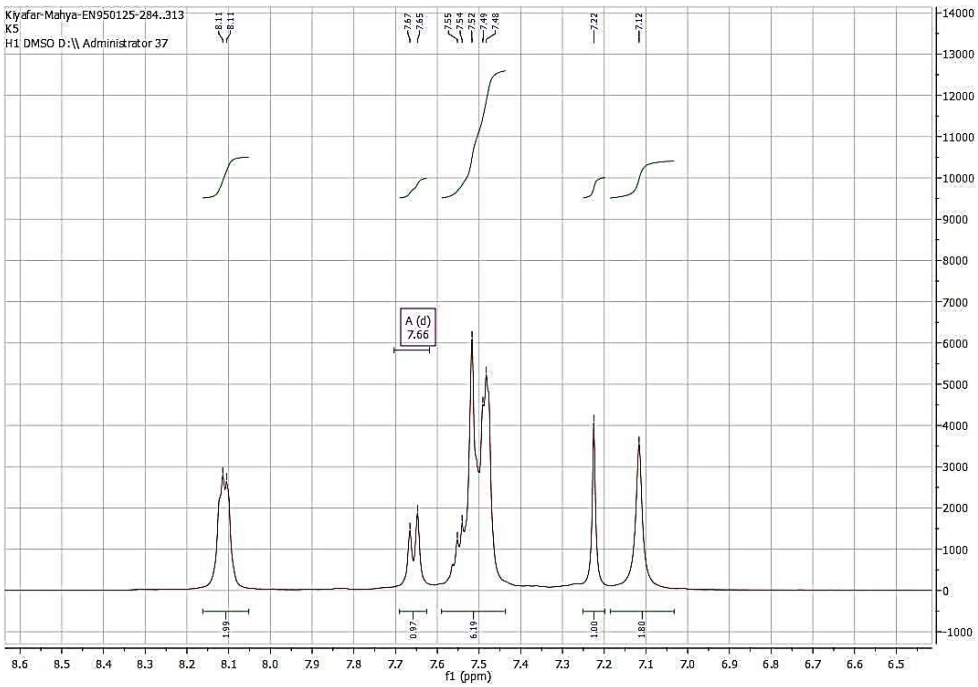

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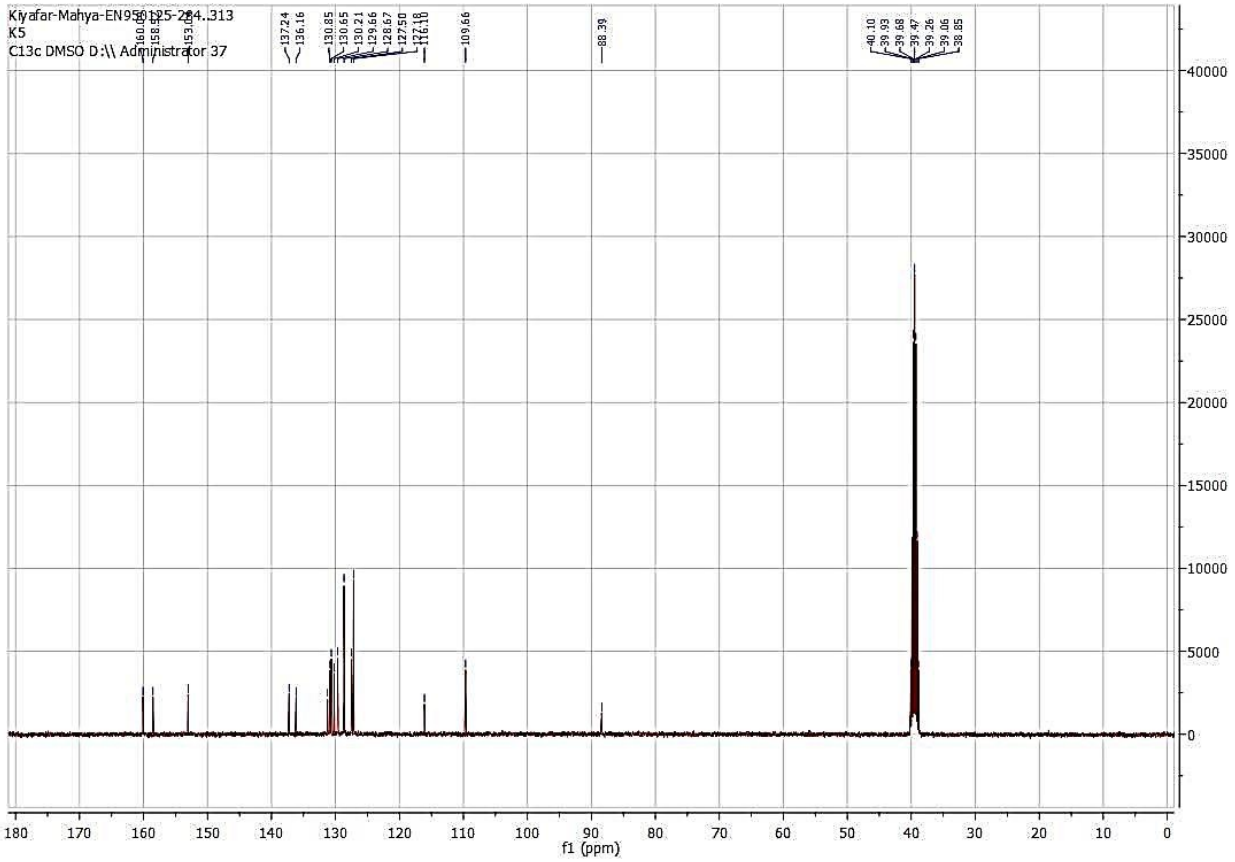
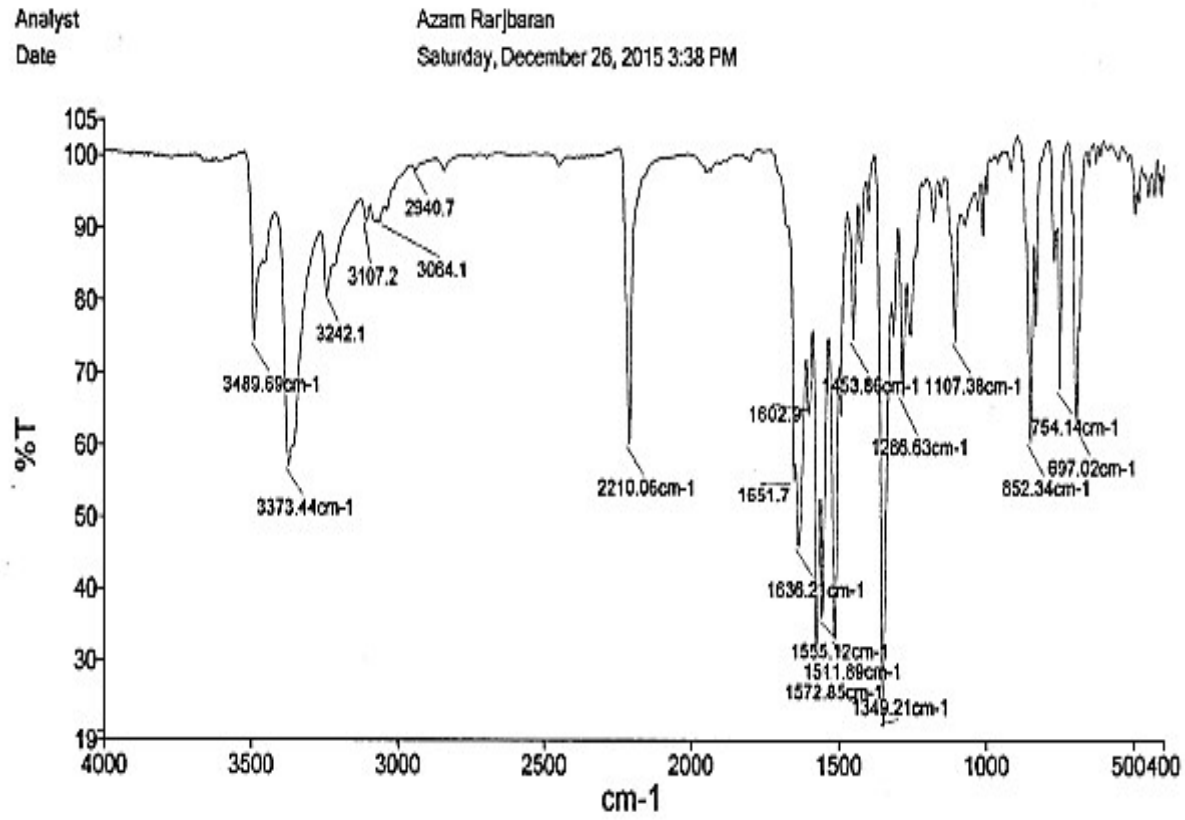


13. FT-IR spectra of 2-amino-4-(4-nitrophenyl)-6-phenylnicotinonitrile (1e)



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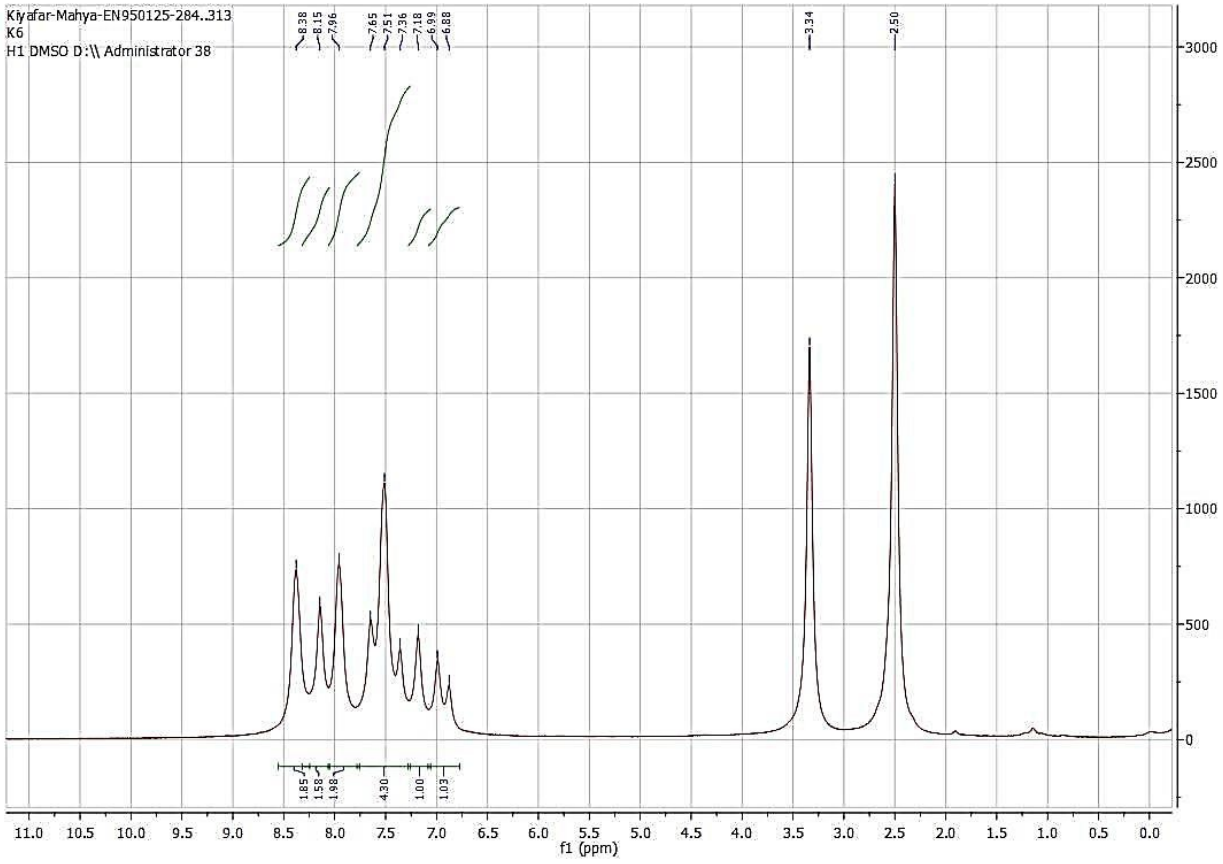
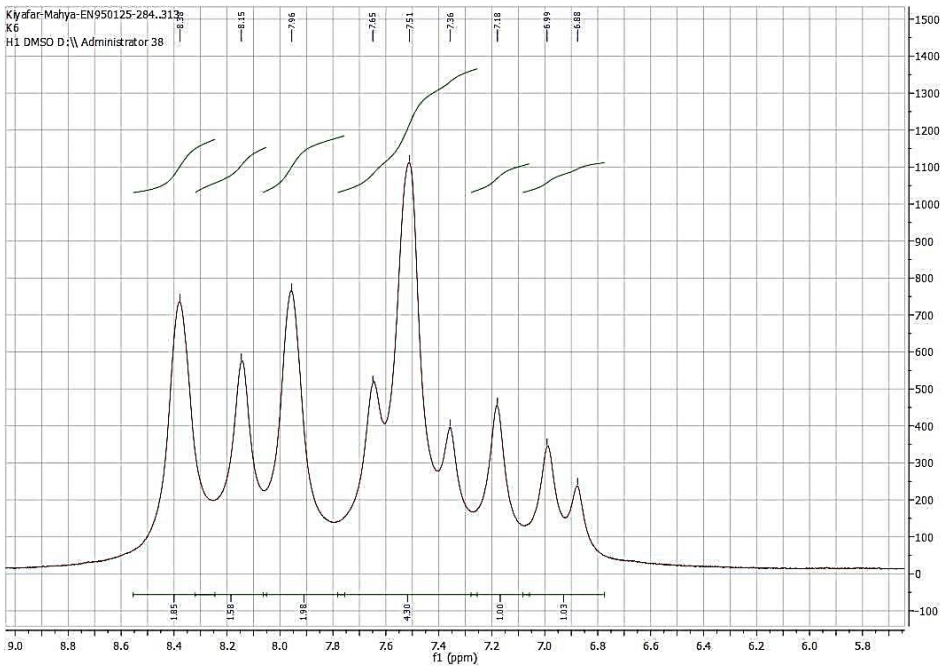
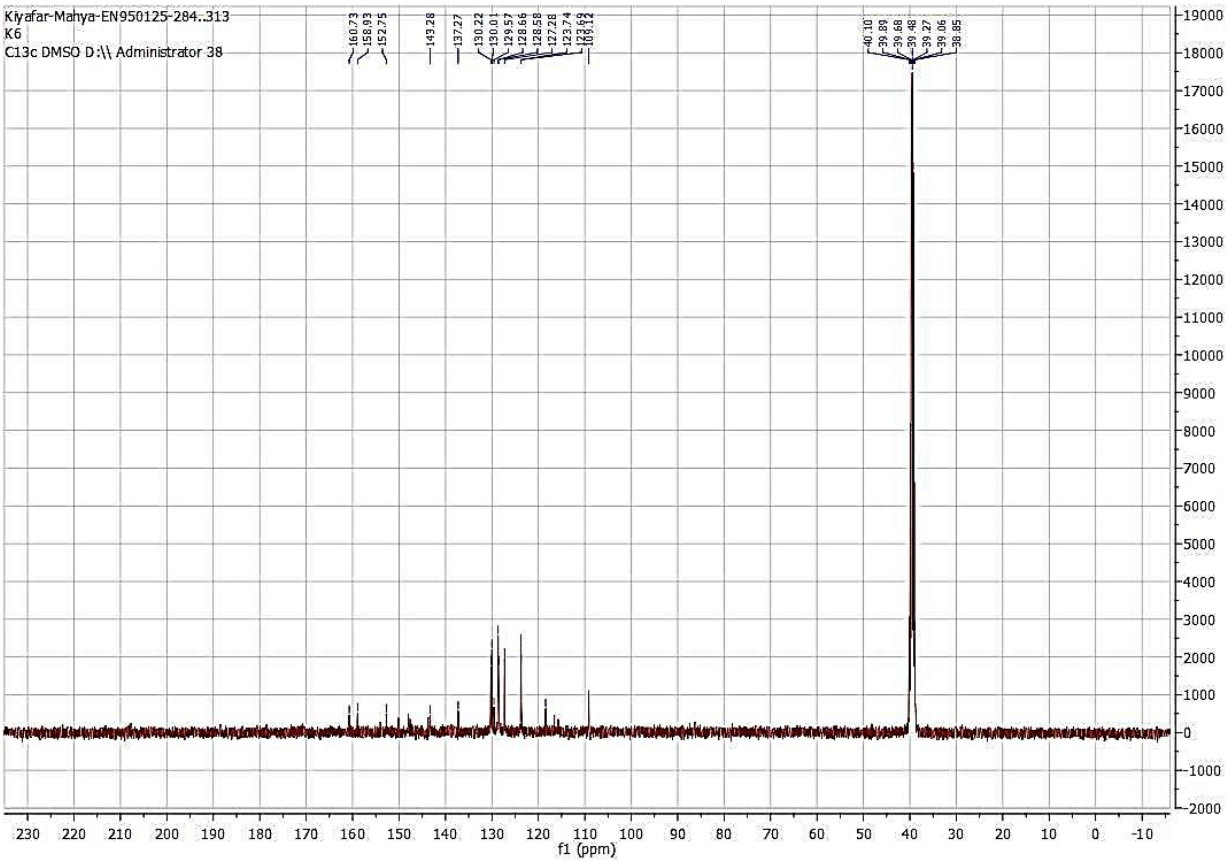
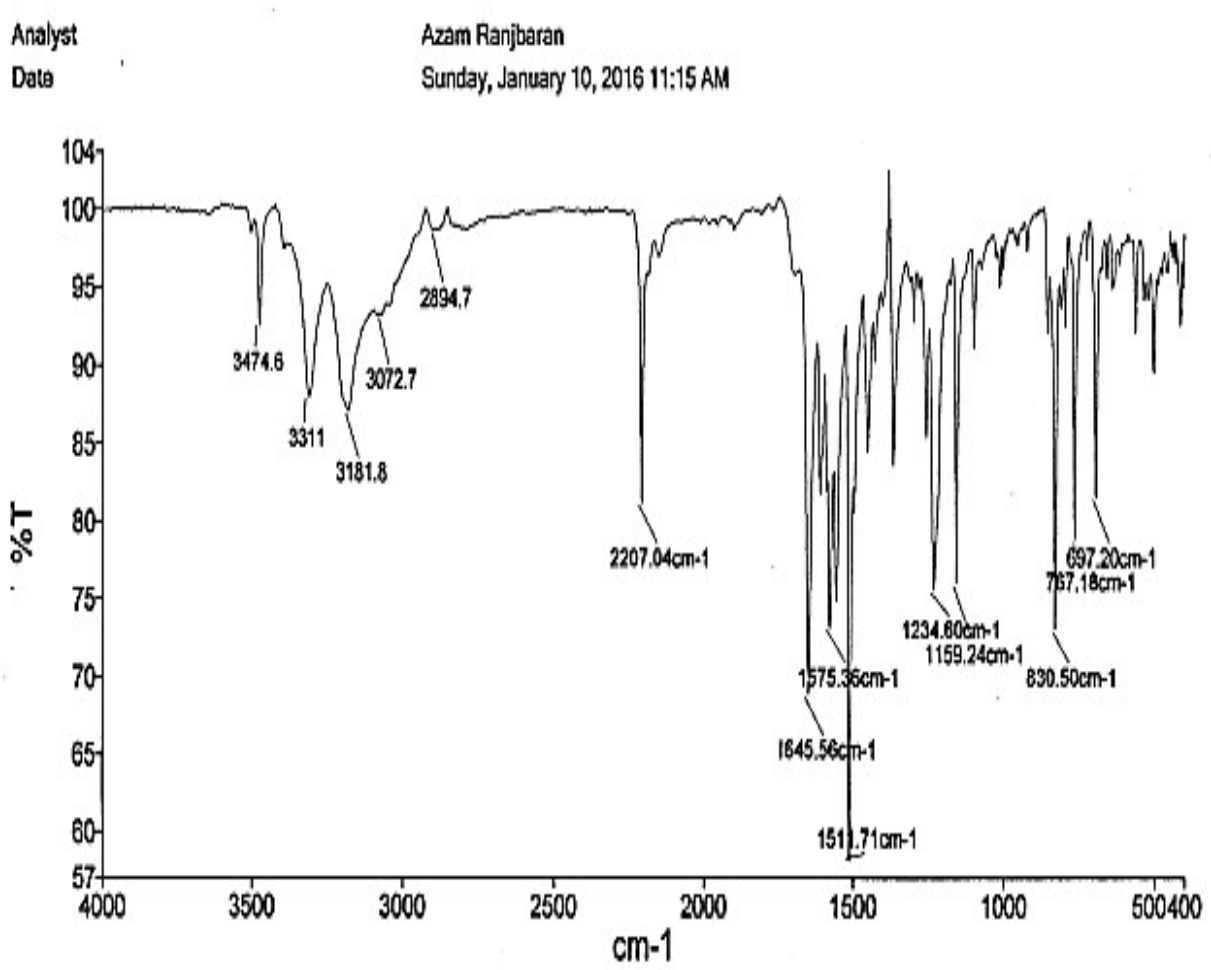




15. ^{13}C NMR spectra of 2-amino-4-(4-nitrophenyl)-6-phenylnicotinonitrile (1e)



16. FT-IR spectra of 2-amino-4-(4-fluorophenyl)-6-phenylnicotinonitrile (1f)



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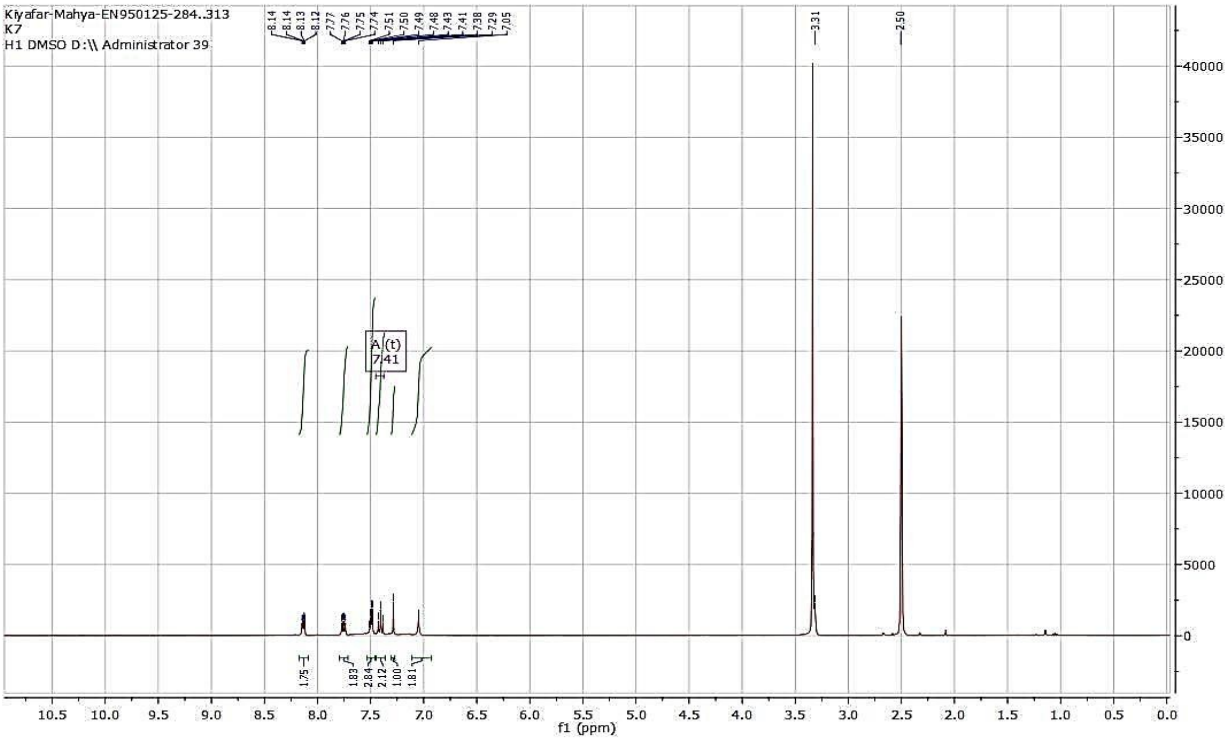
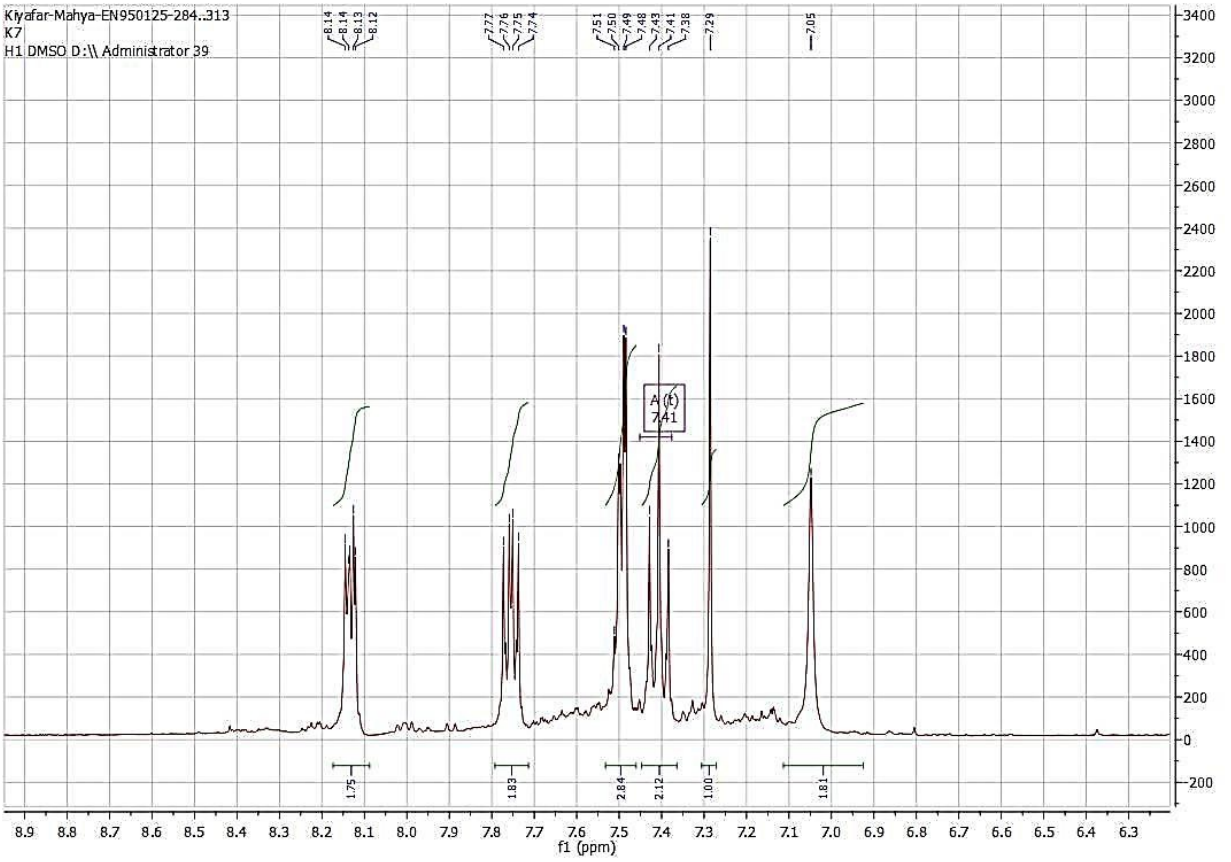
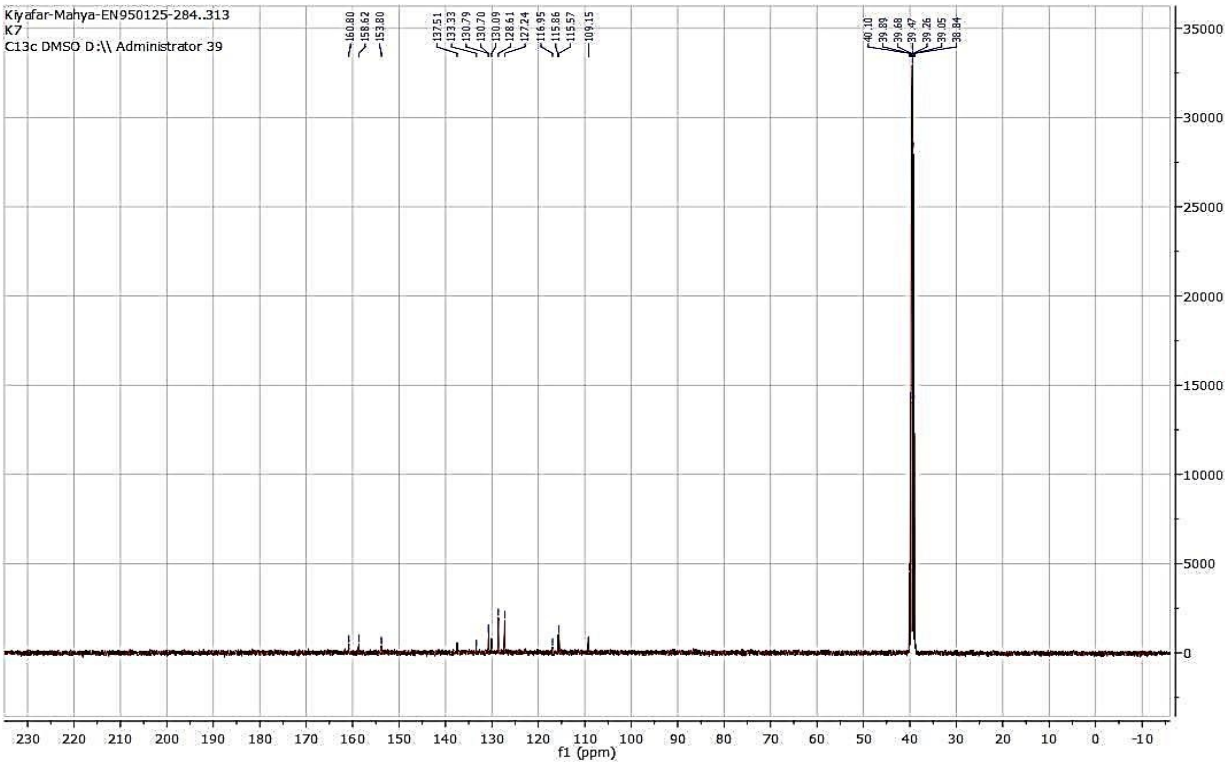
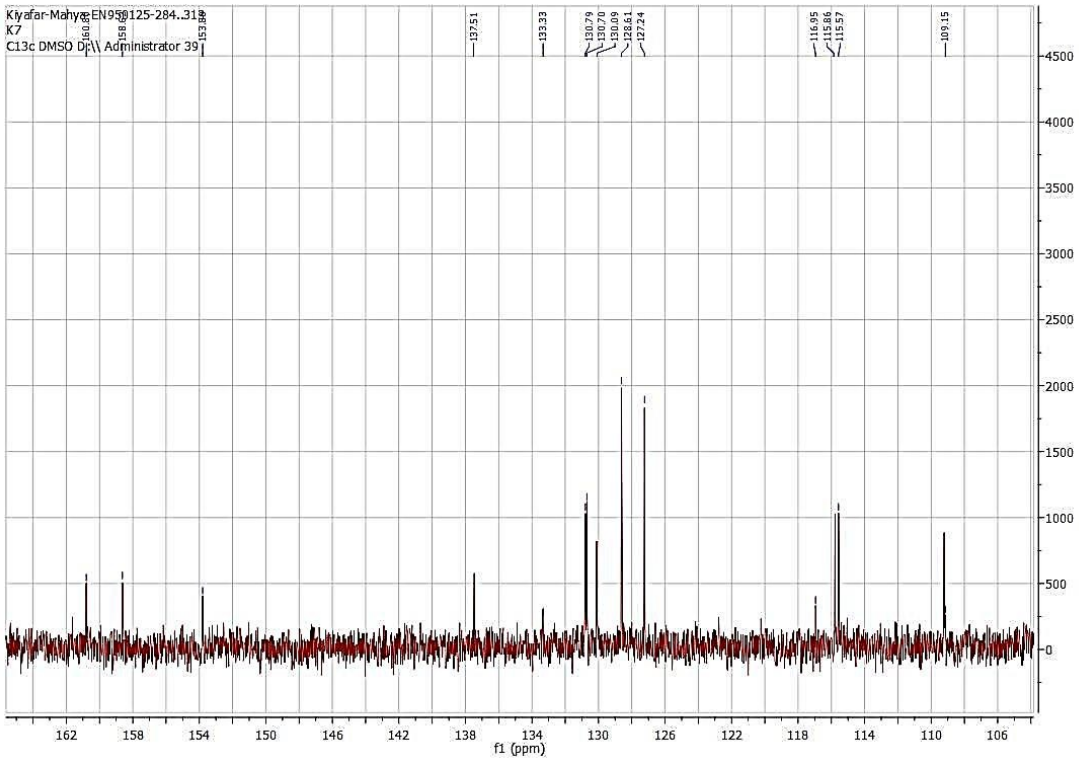


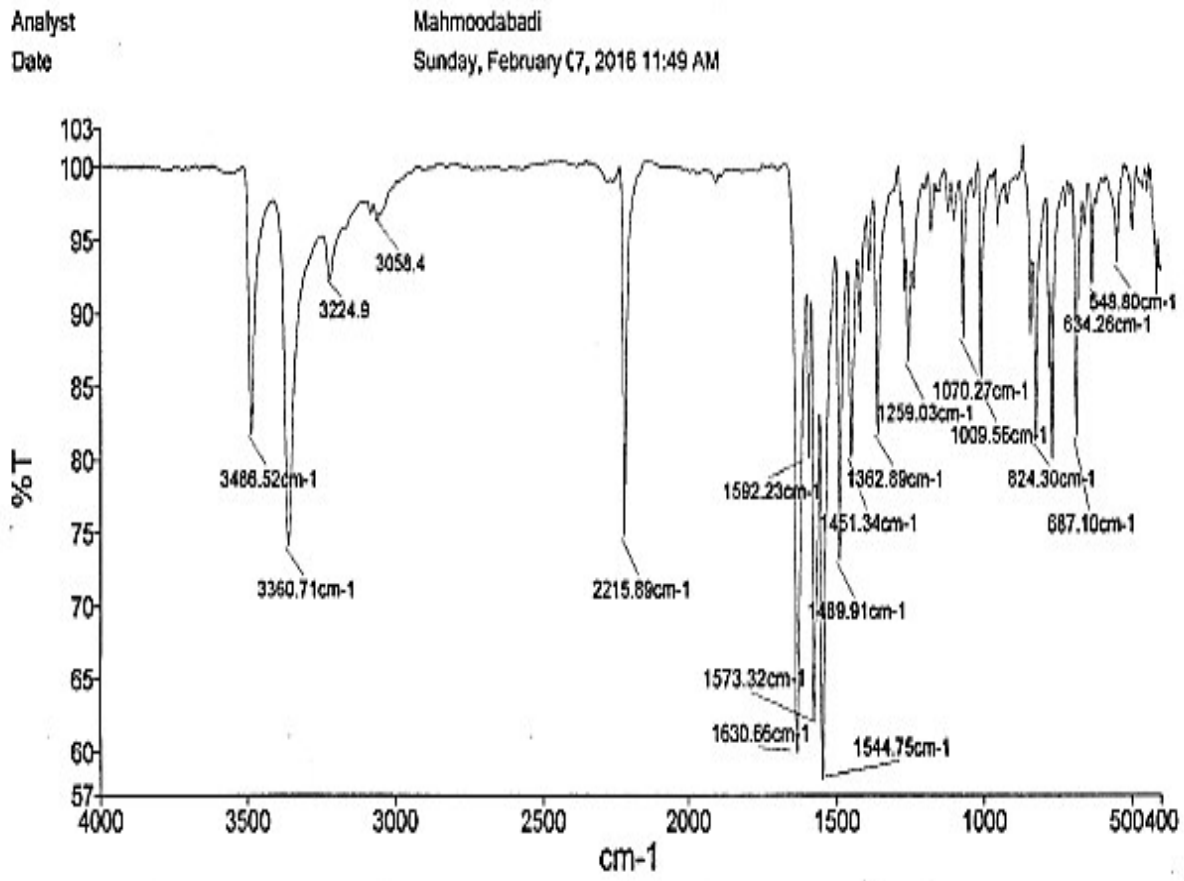


18. ^{13}C NMR spectra of 2-amino-4-(4-fluorophenyl)-6-phenylnicotinonitrile (1f)





19. FT-IR spectra of 2-amino-4-(4-bromophenyl)-6-phenylnicotinonitrile (1g)



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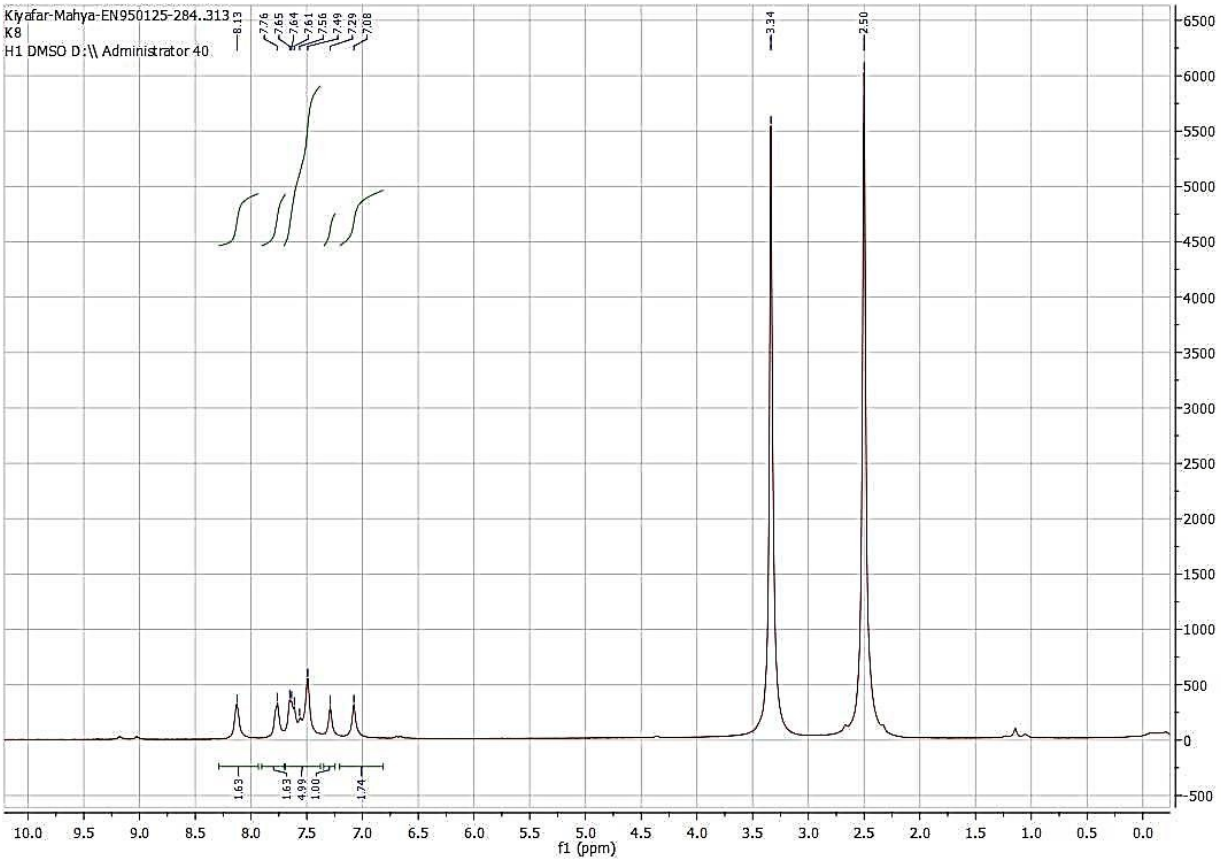
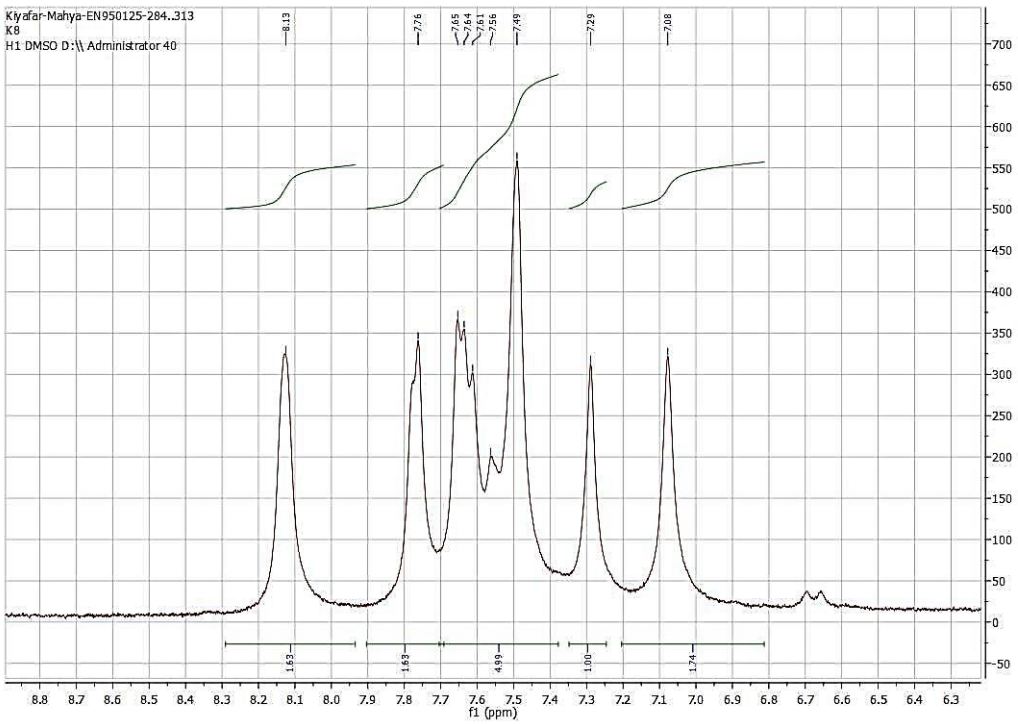
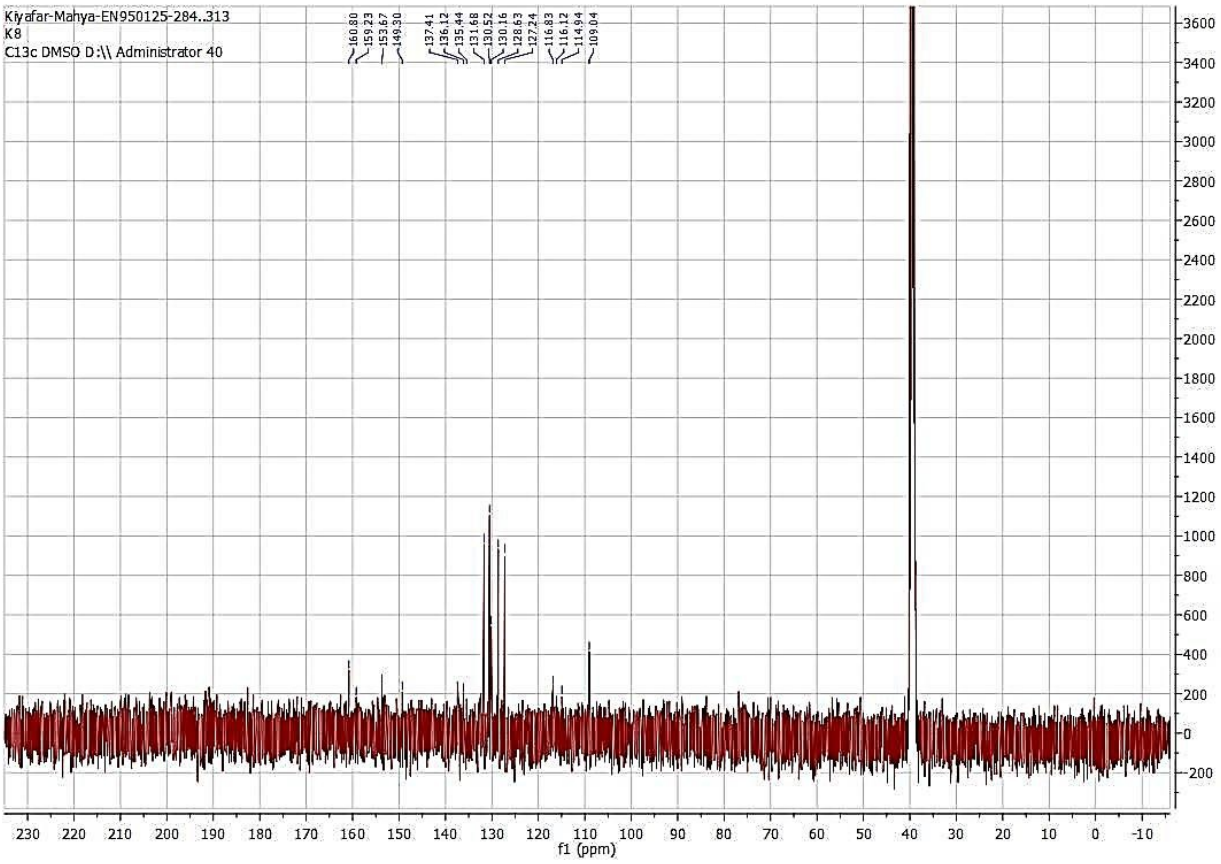
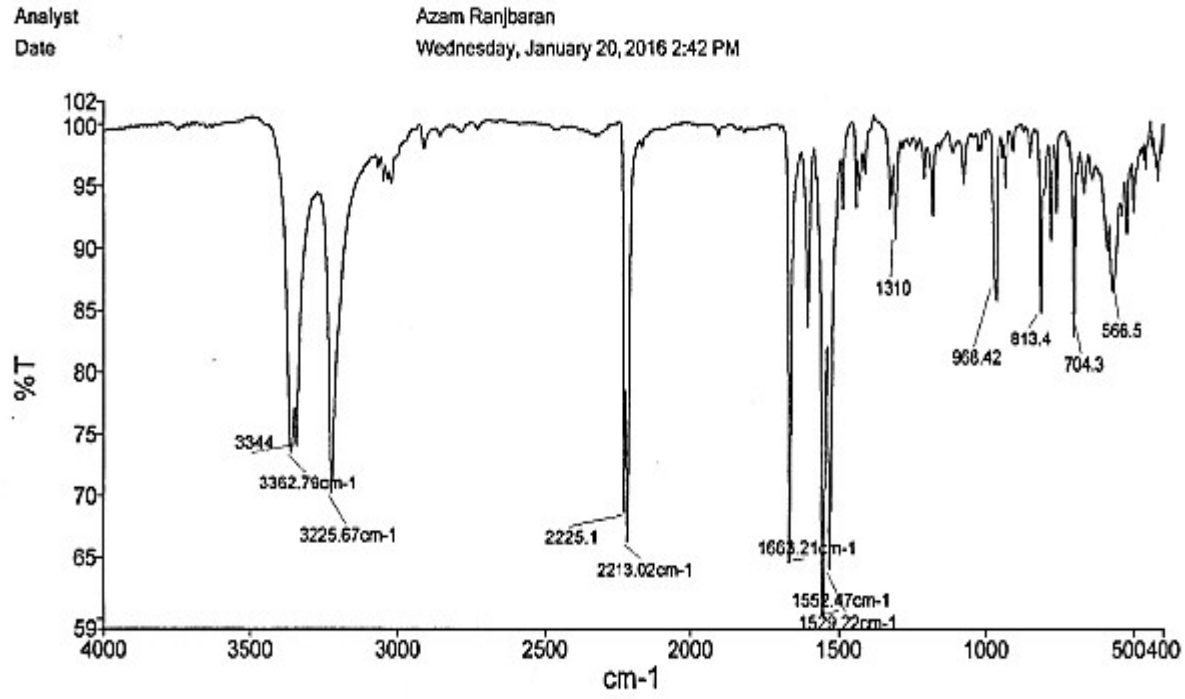




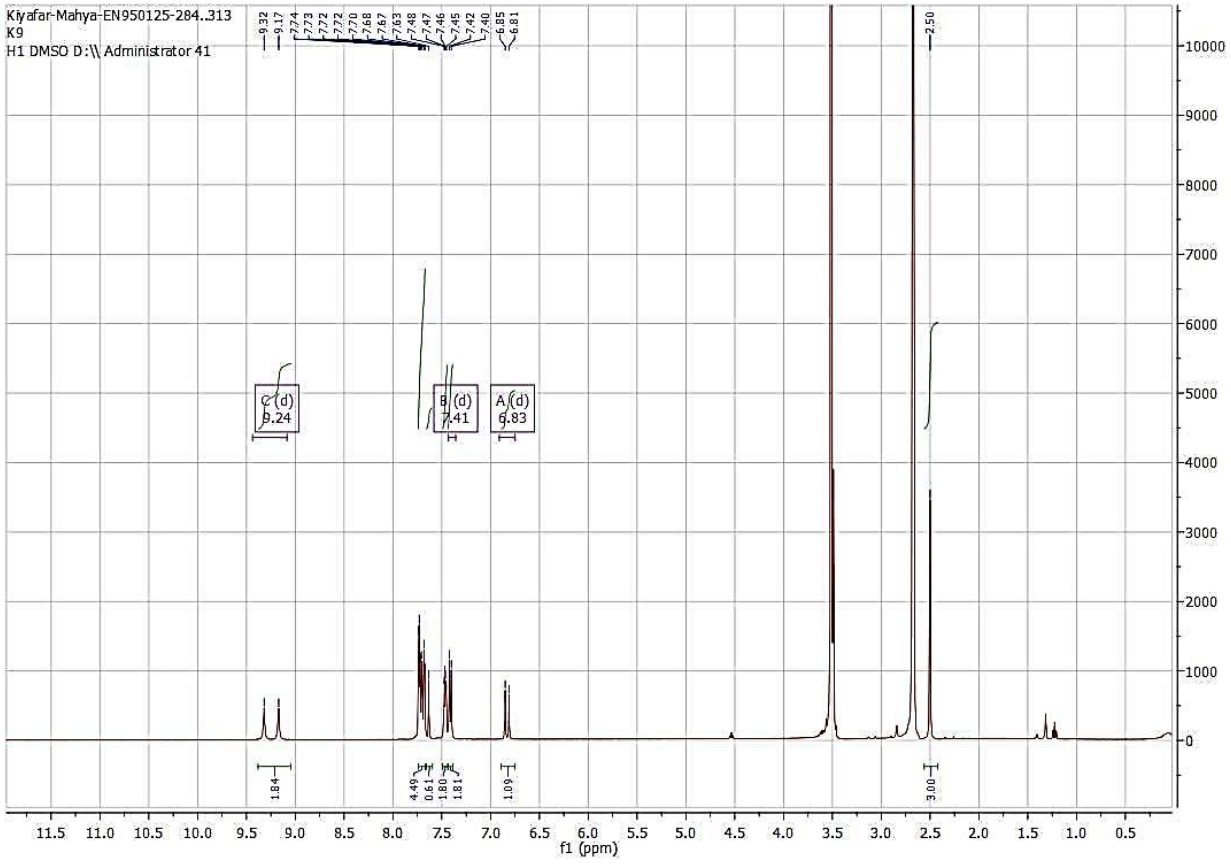
21. ^{13}C NMR spectra of 2-amino-4-(4- bromophenyl)-6-phenylnicotinonitrile (1g)

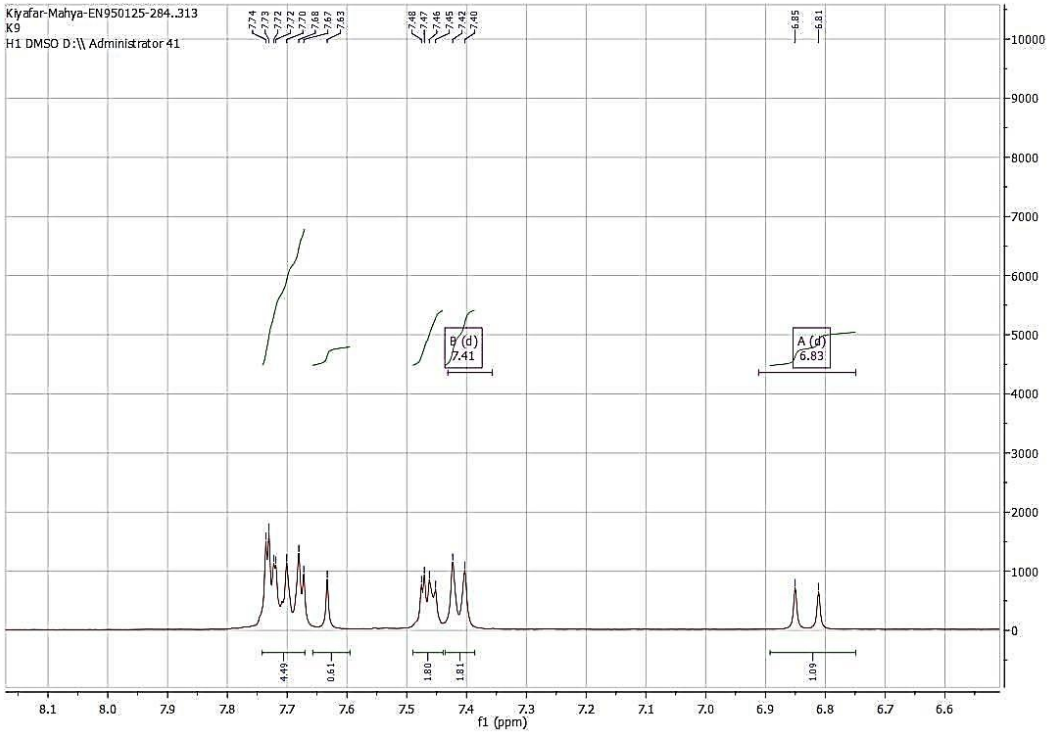


22. FT-IR spectra of 2-amino-6-phenyl-4-(p-tolyl)nicotinonitrile (1h)

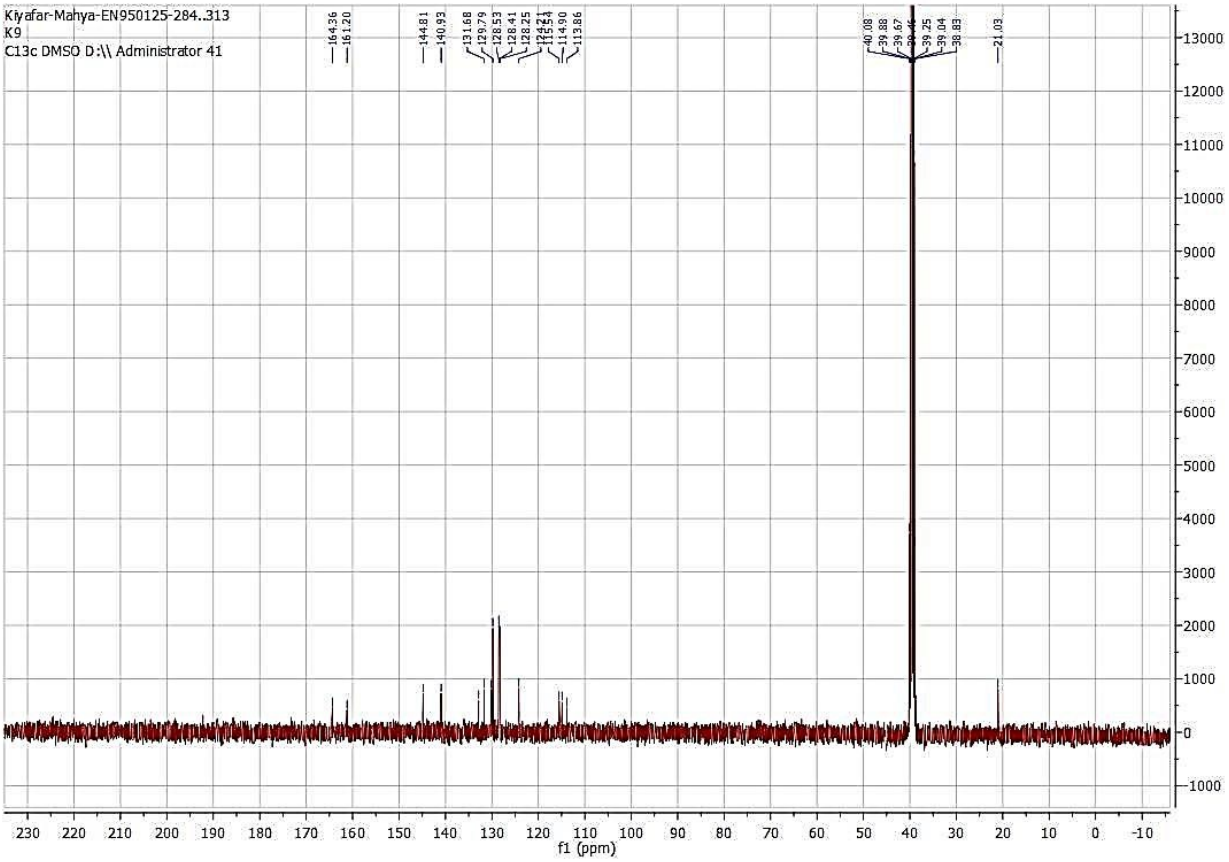


23. ^{1}H NMR spectra of 2-amino-6-phenyl-4-(p-tolyl)nicotinonitrile (1h)

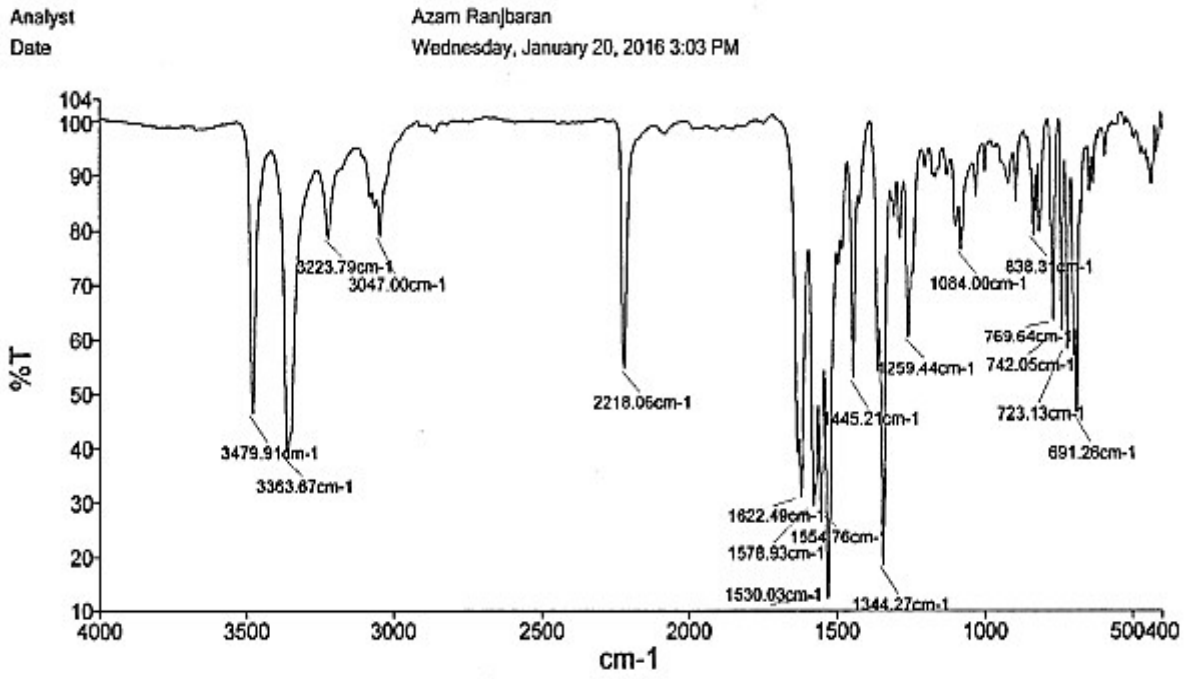




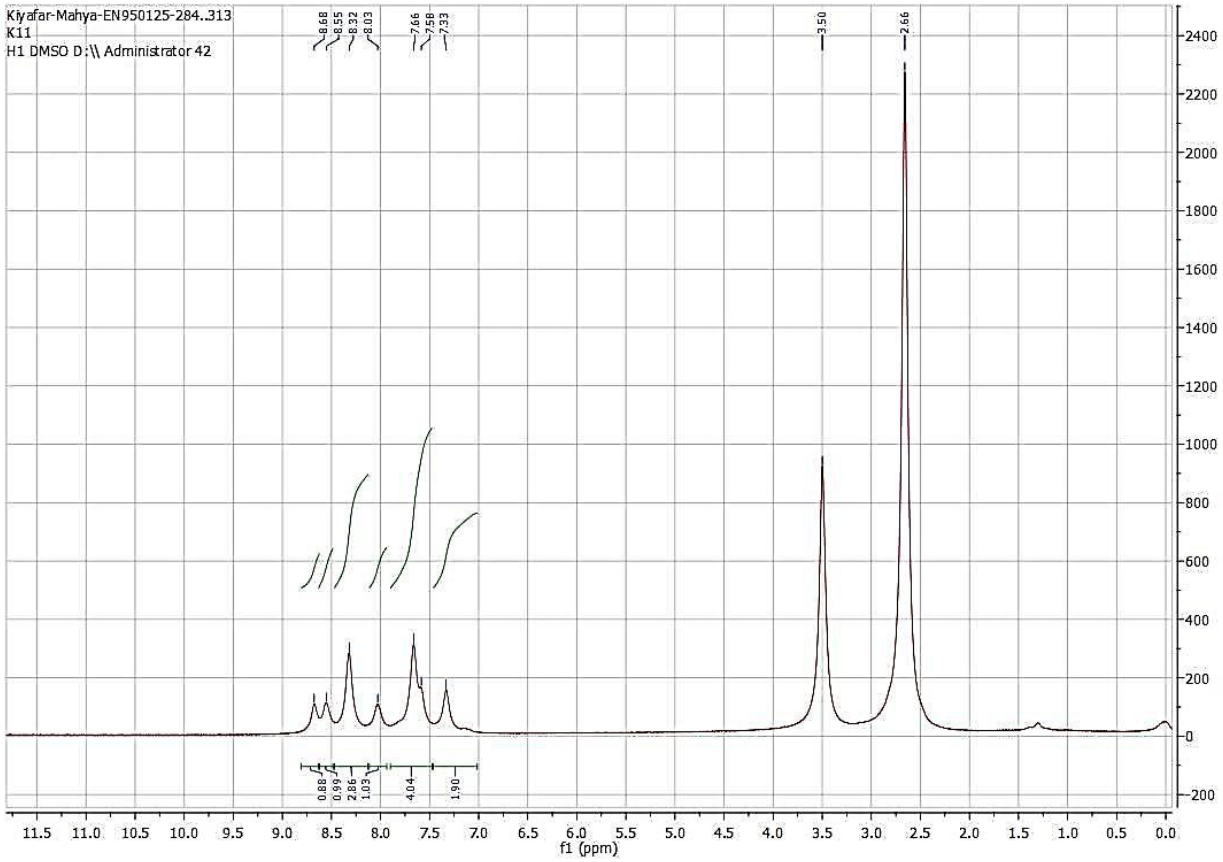
24. ^{13}C NMR spectra of 2-amino-6-phenyl-4-(p-tolyl)nicotinonitrile (1h)

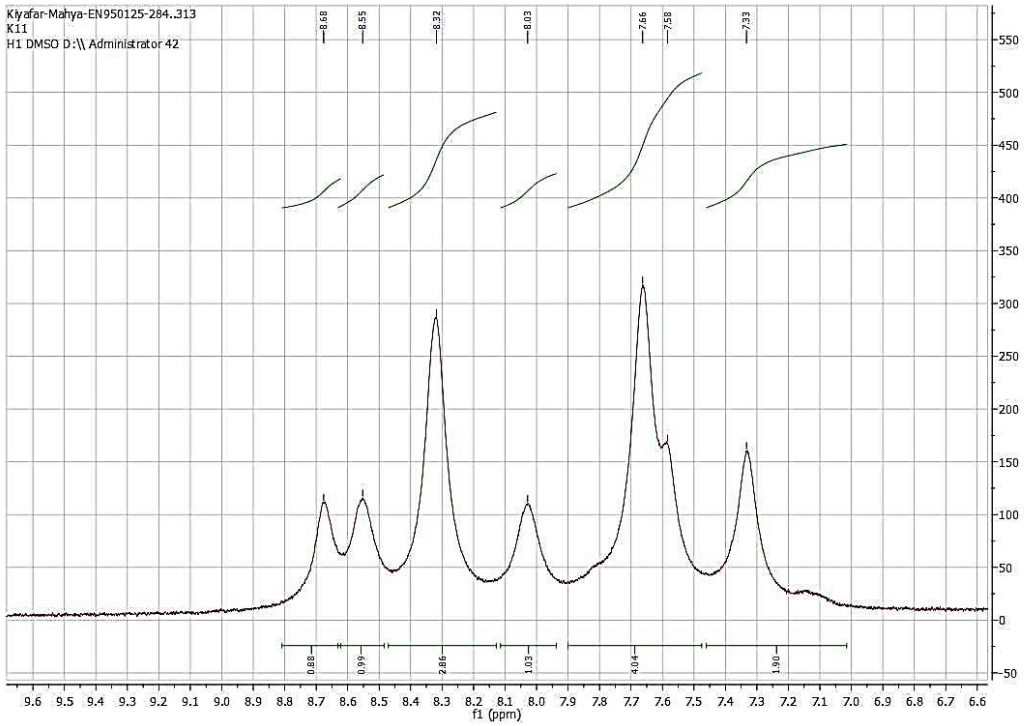


25. FT-IR spectra of 2-amino-4-(3-nitrophenyl)-6-phenylnicotinonitrile (1i)

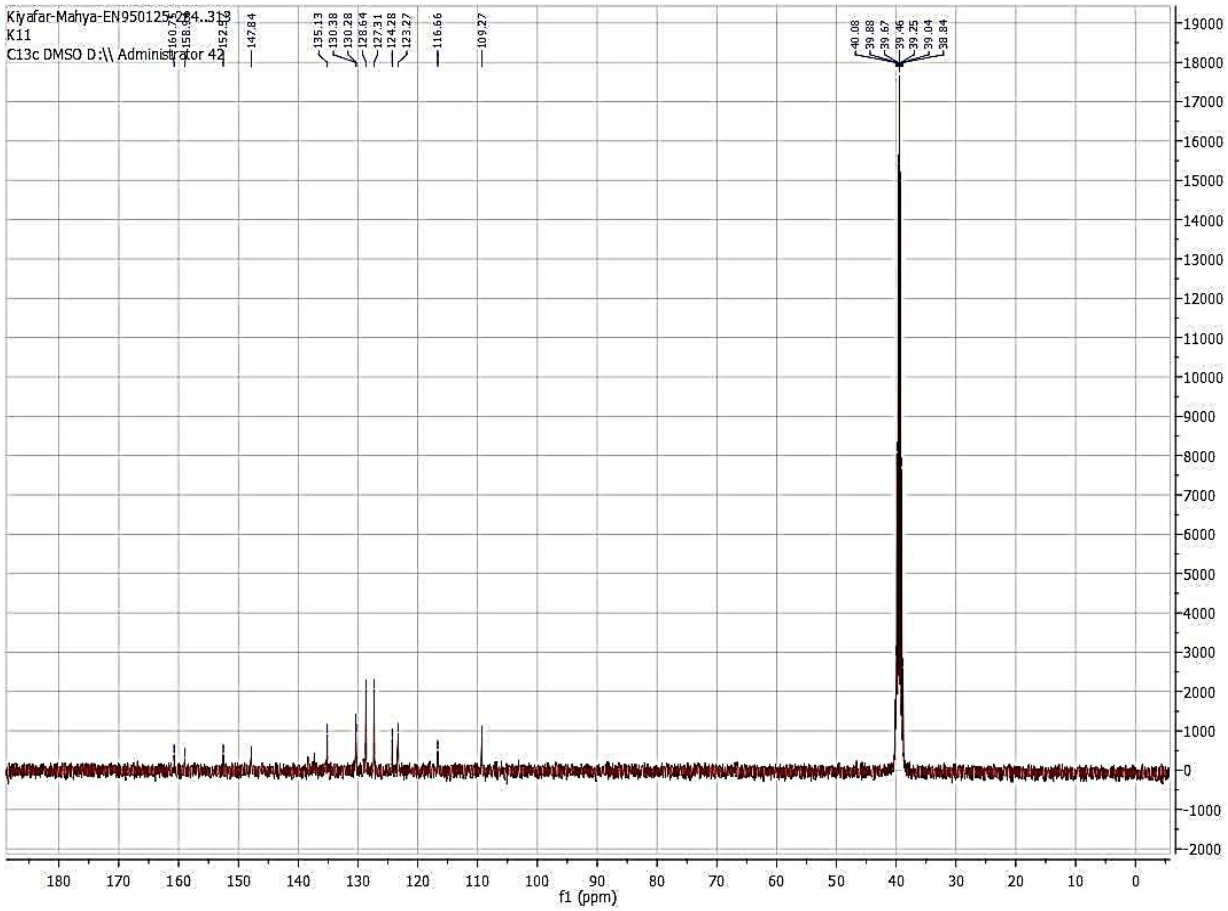


26. ^{1}H NMR spectra of 2-amino-4-(3-nitrophenyl)-6-phenylnicotinonitrile (1i)

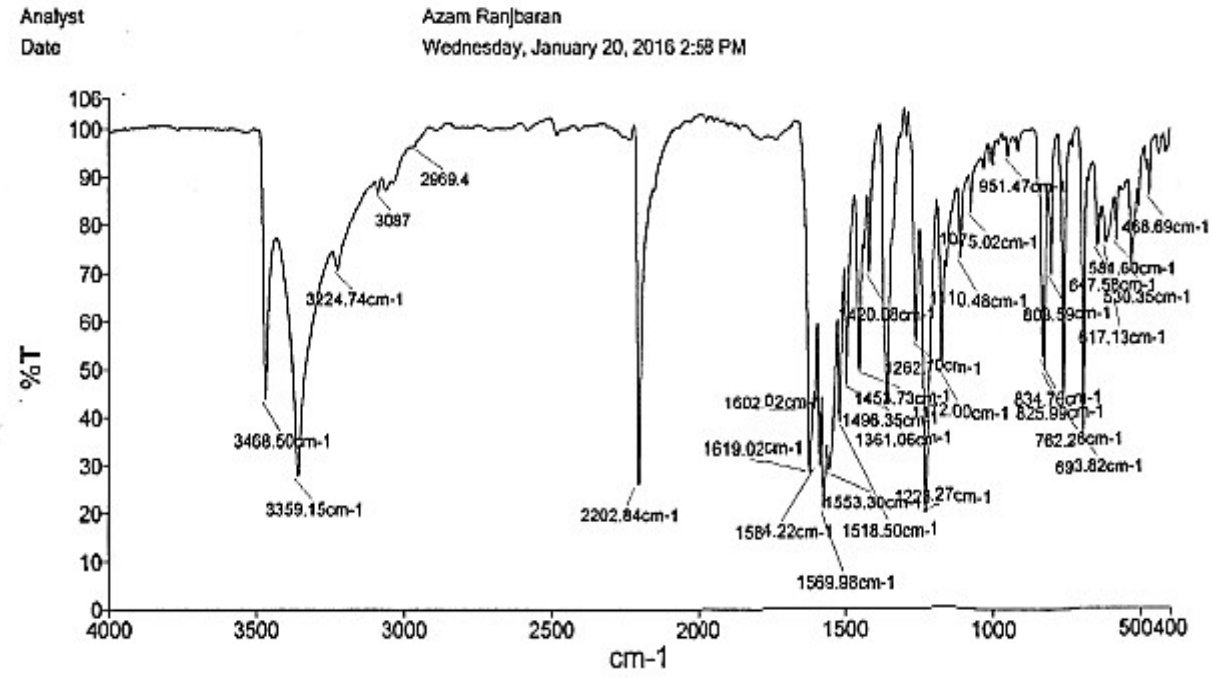




27. ^{13}C NMR spectra of 2-amino-4-(3-nitrophenyl)-6-phenylnicotinonitrile (1i)



28. FT-IR spectra of 2-amino-6-(4-hydroxyphenyl)-4-phenylnicotinonitrile (1j)



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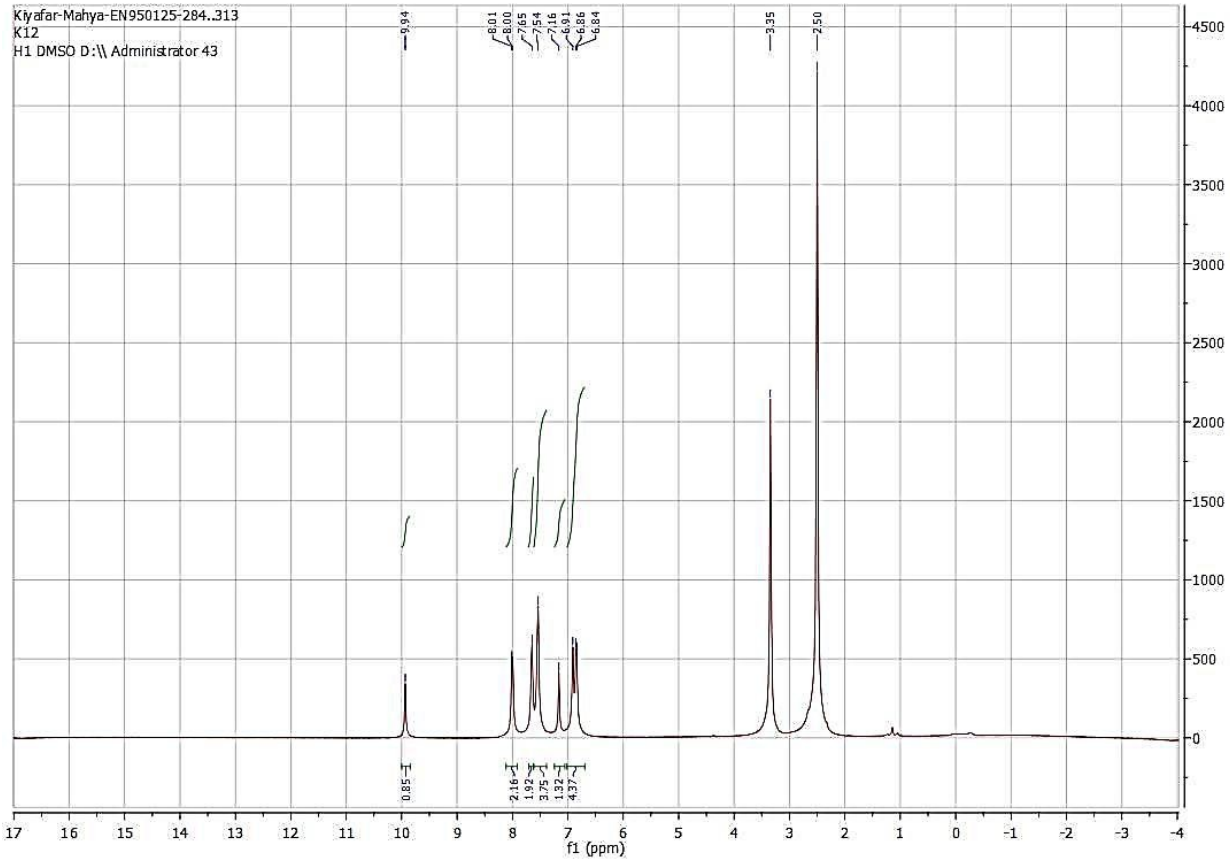

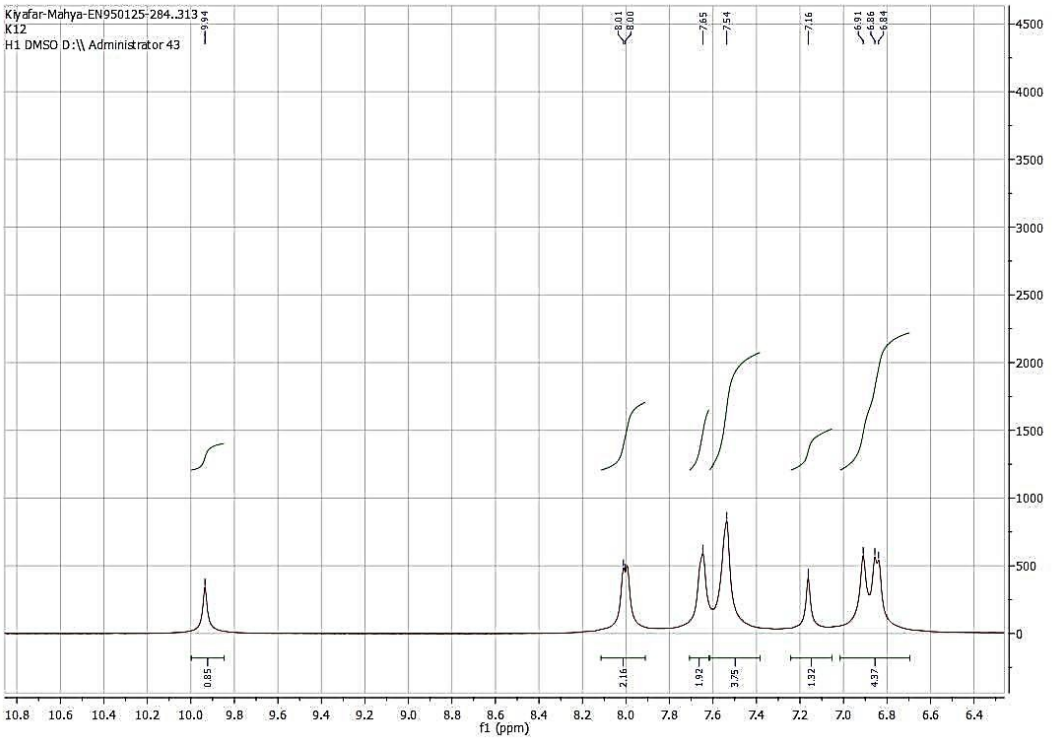

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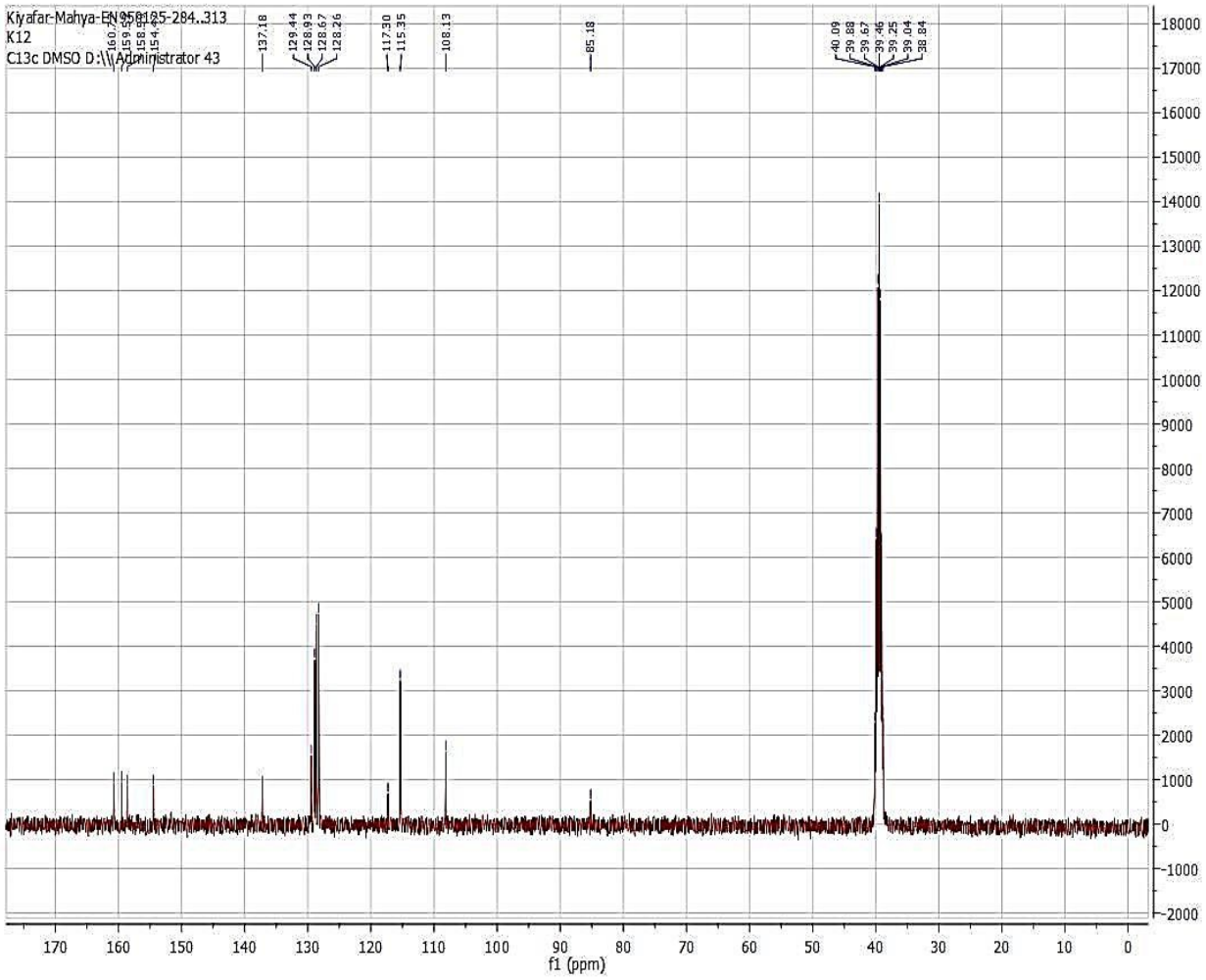
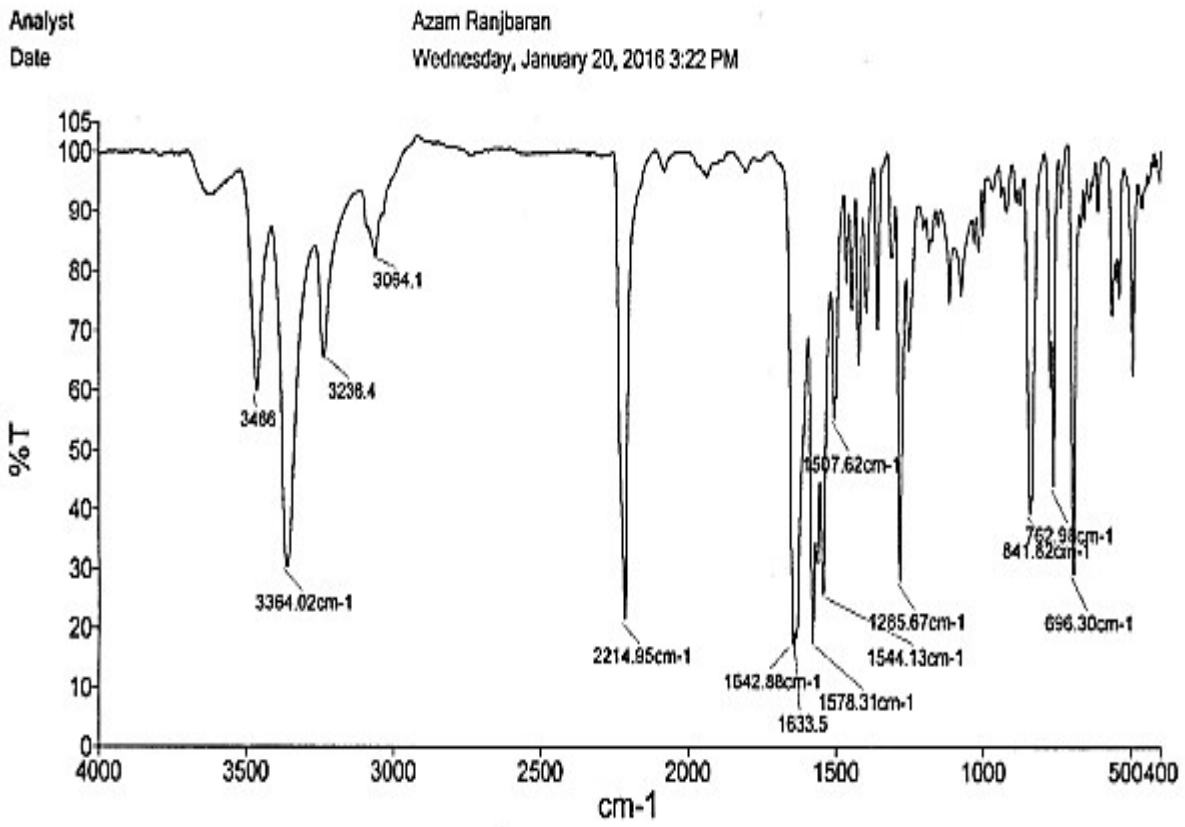


31. FT-IR spectra of 2-amino-4-(4-cyanophenyl)-6-phenylnicotinonitrile (1k)



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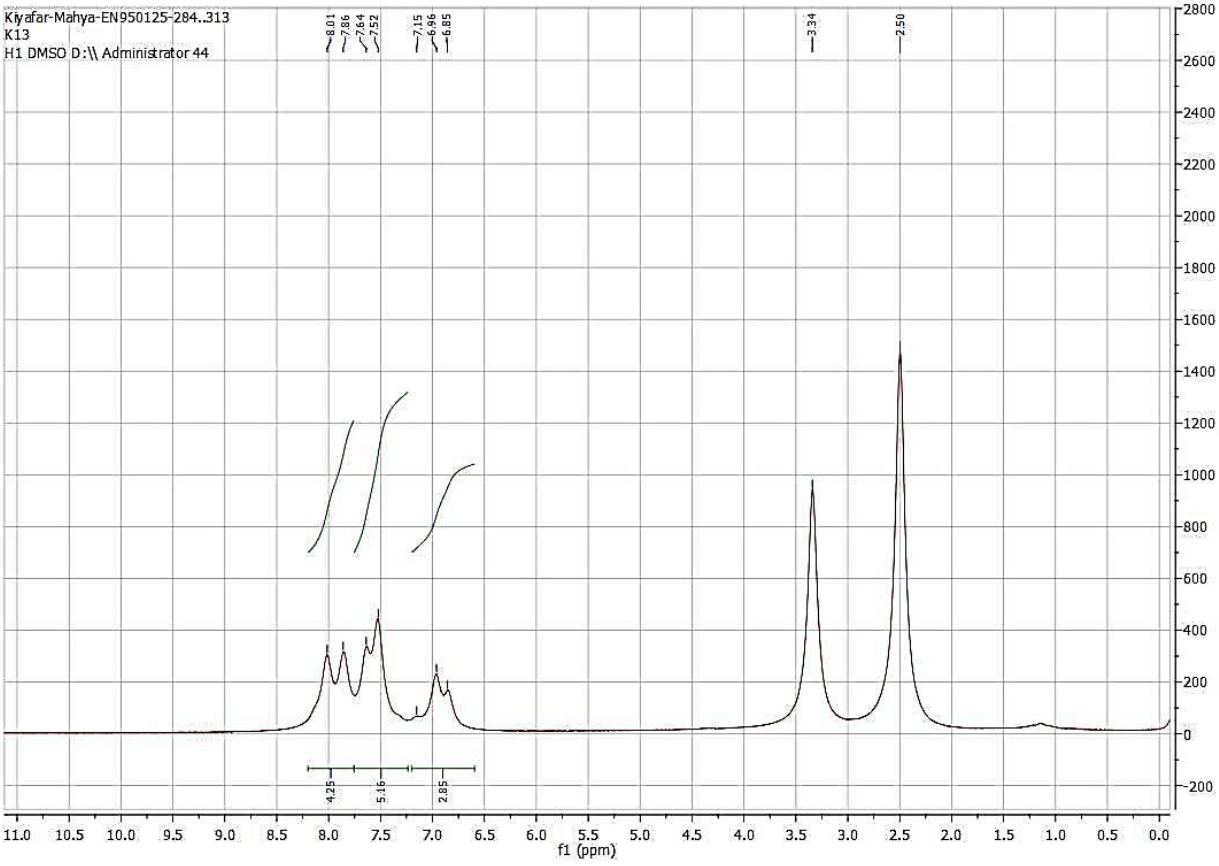

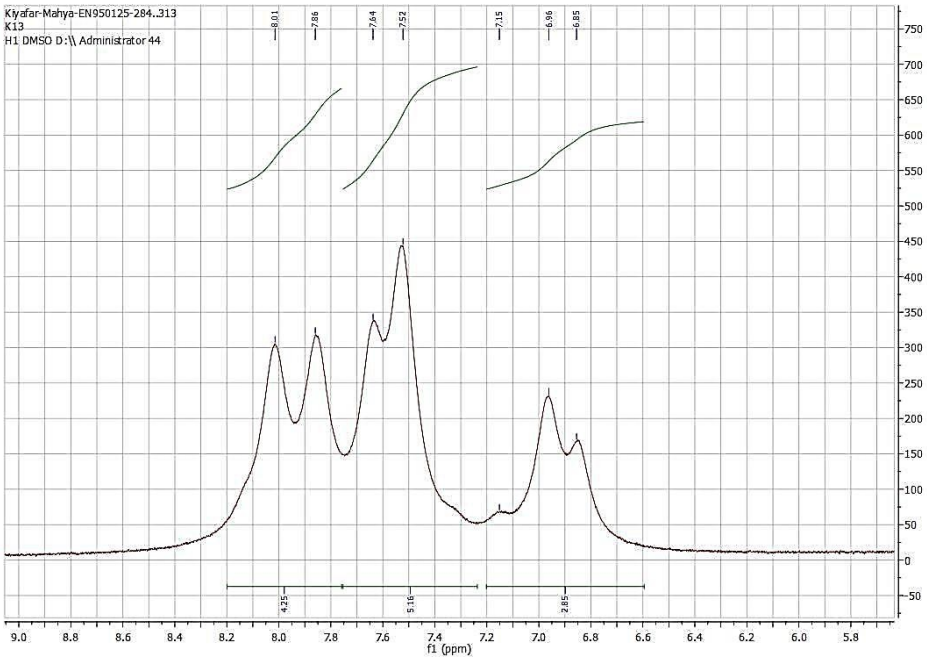

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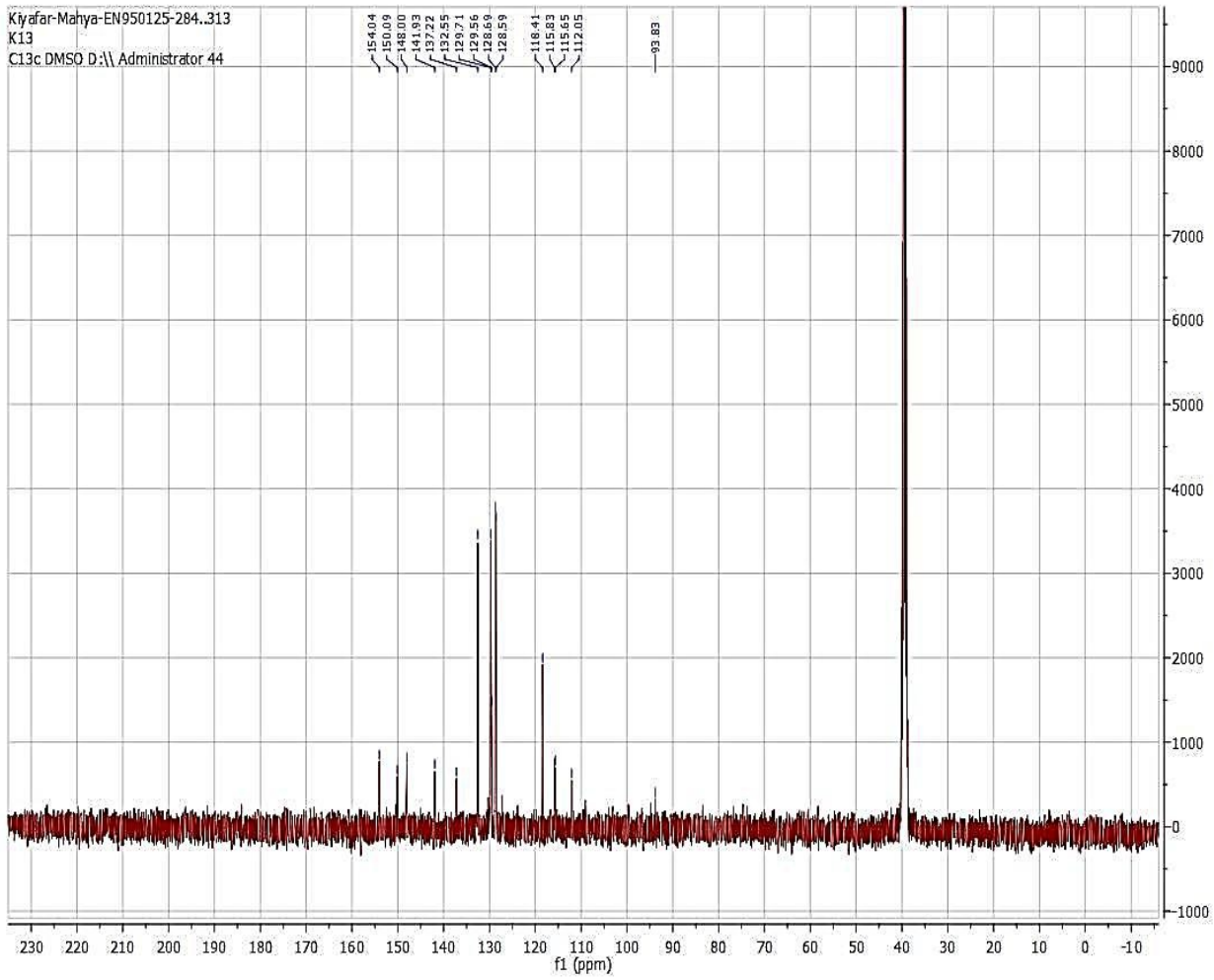

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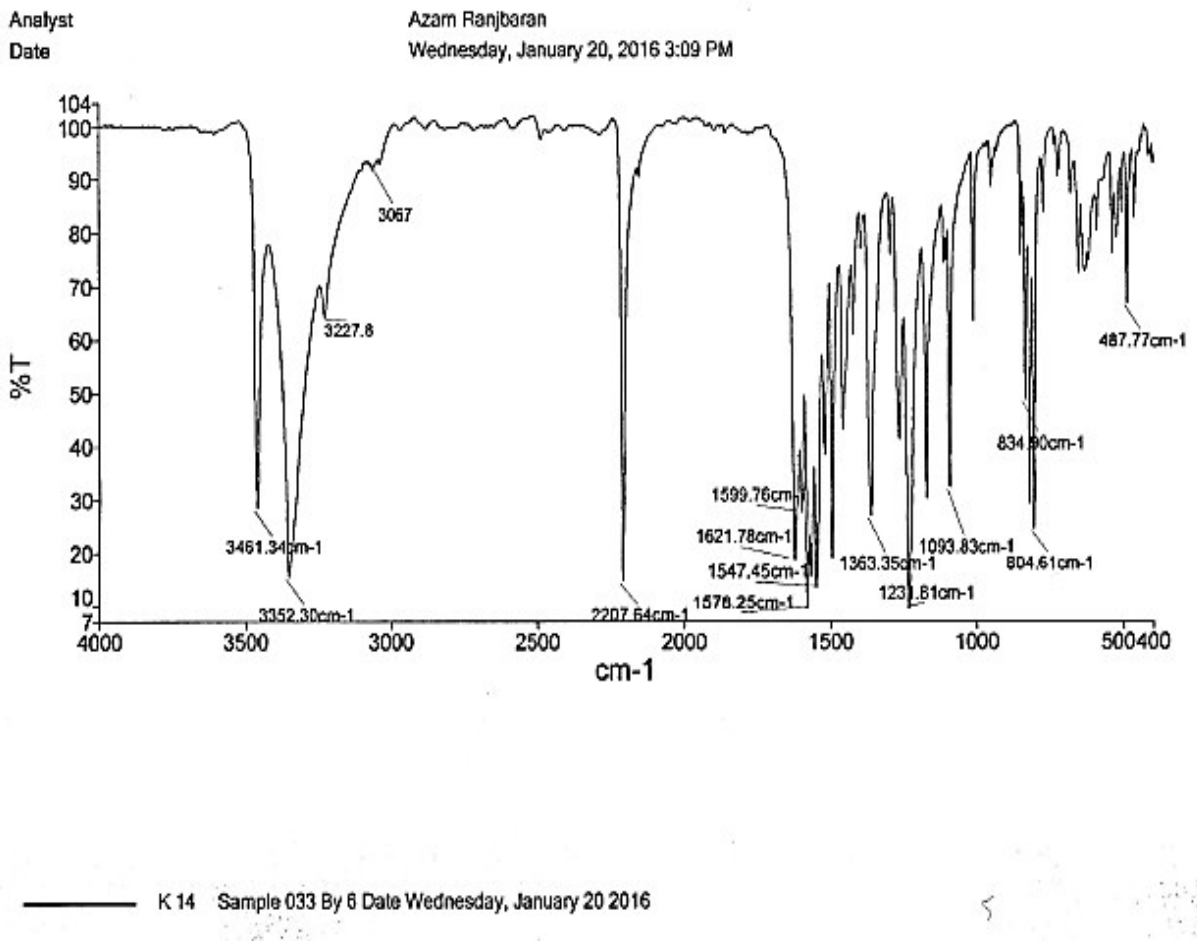

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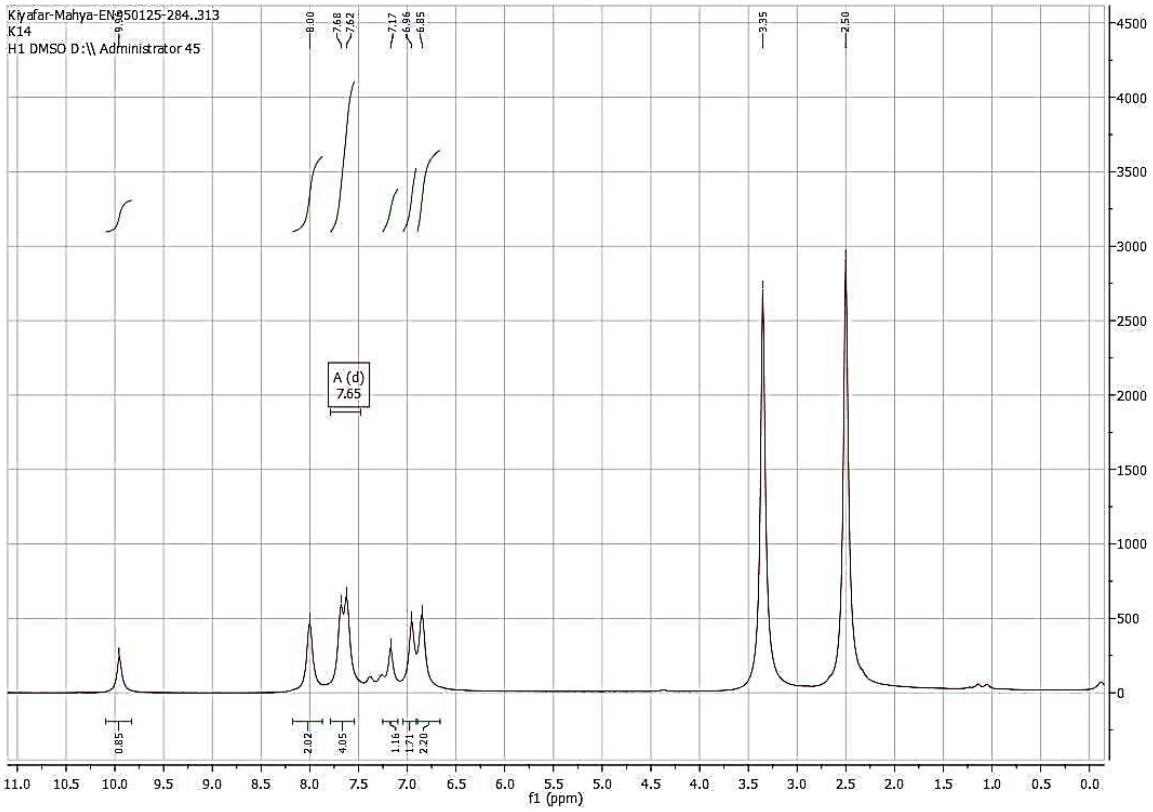

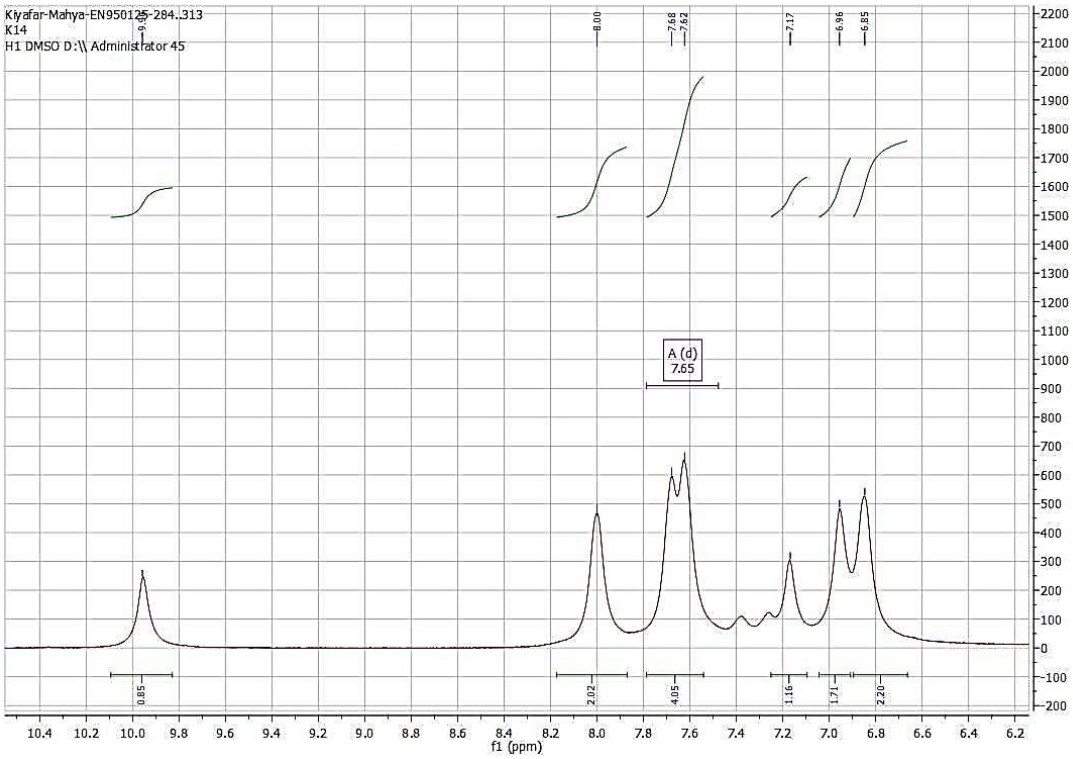

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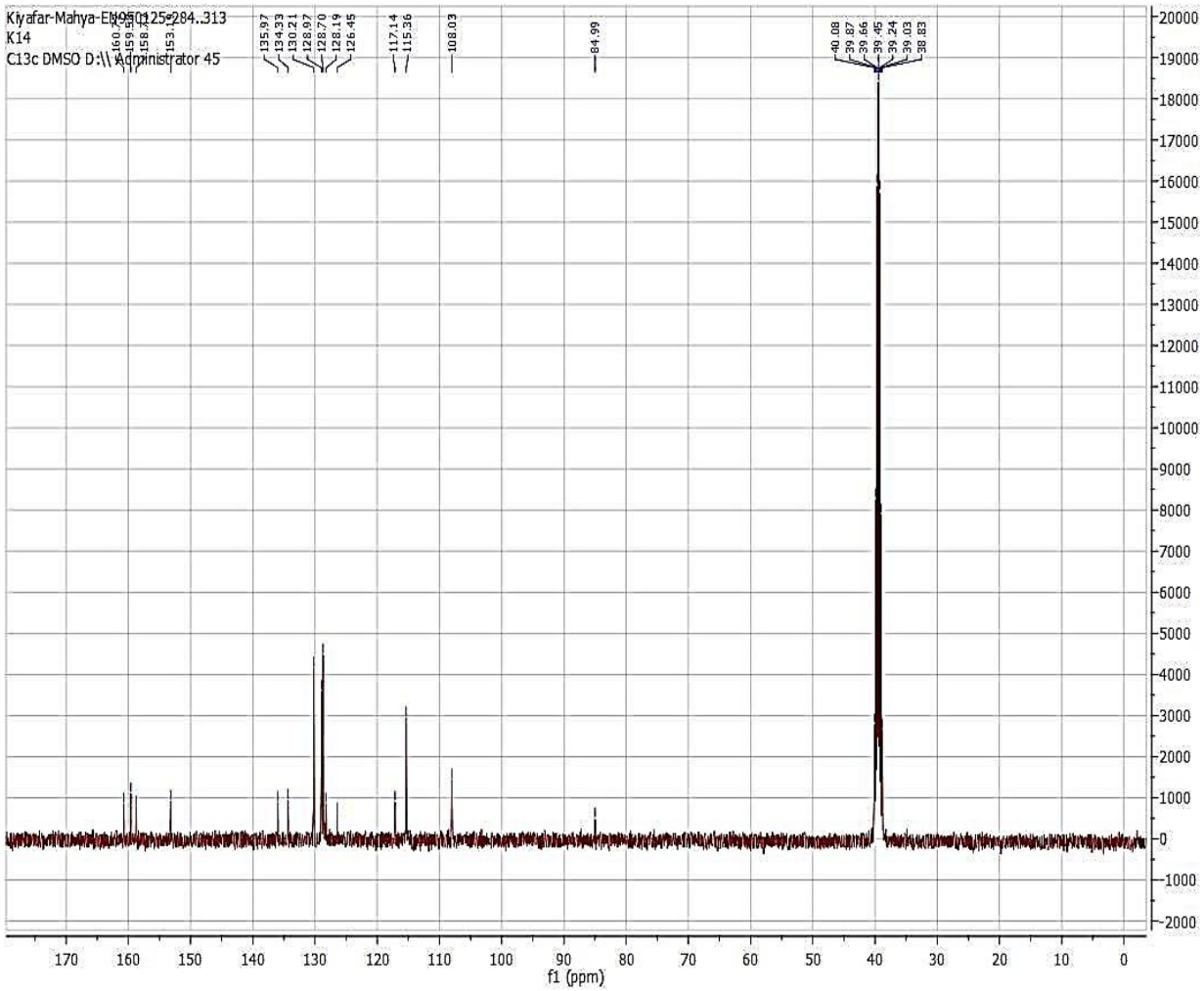

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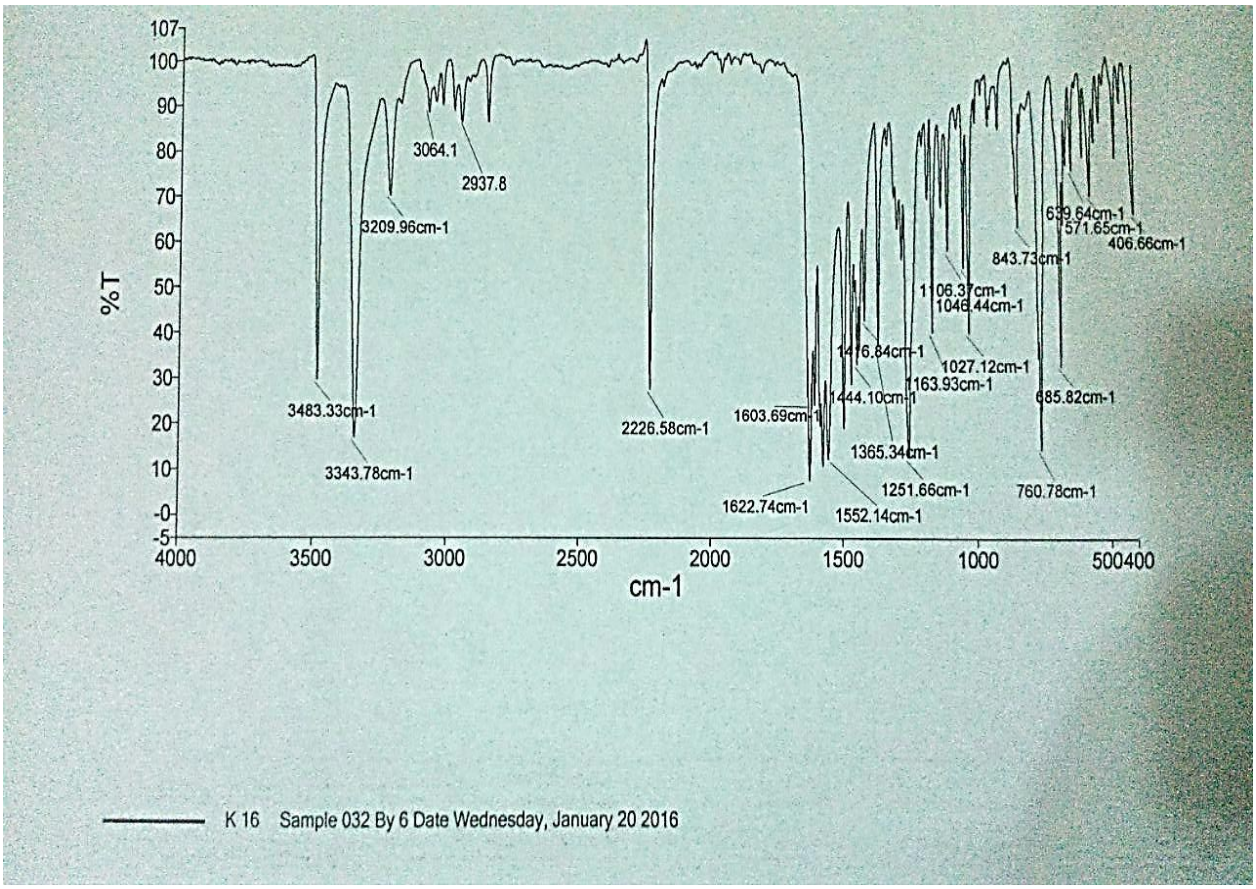

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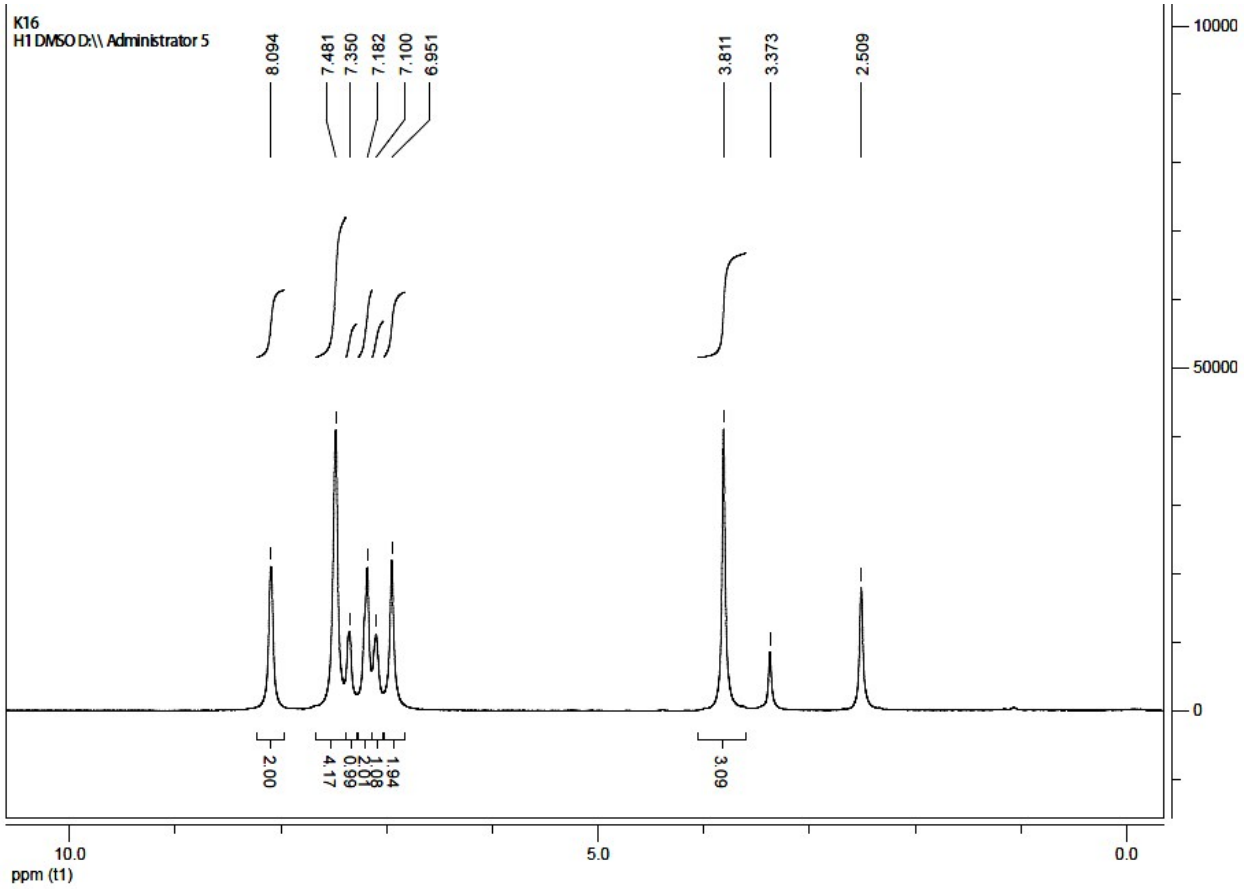
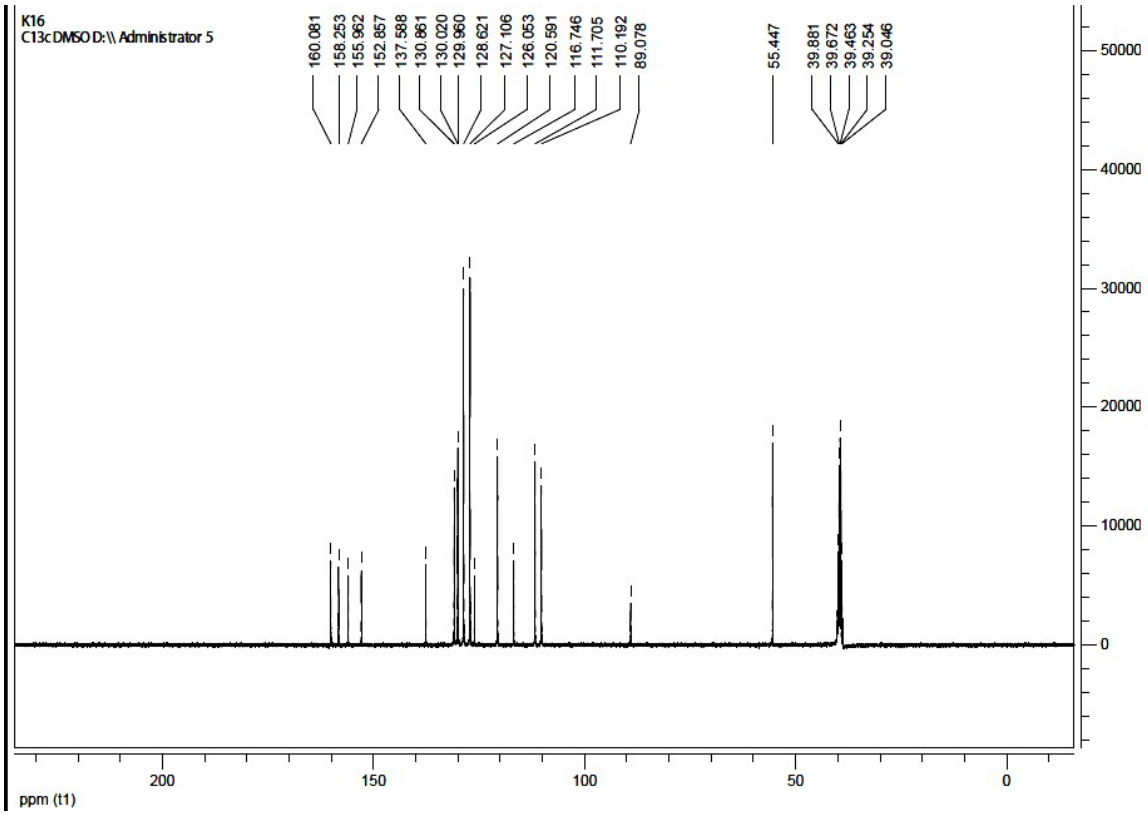
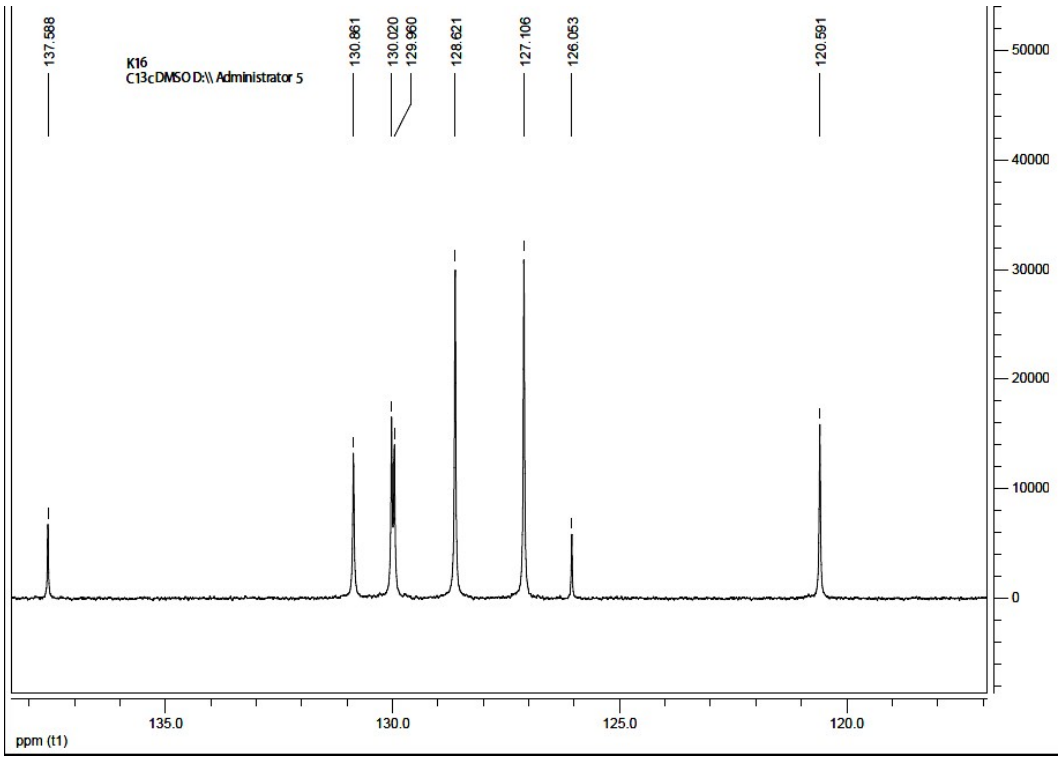
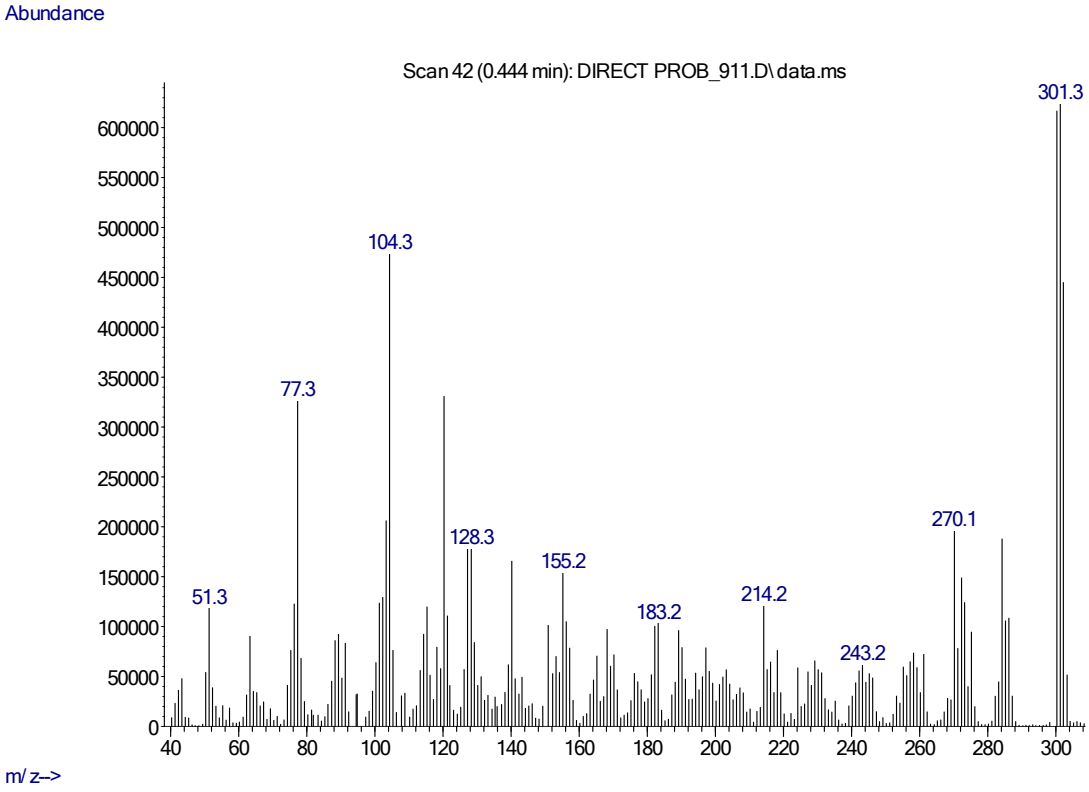


39. ^{13}C NMR spectra of 2-amino-4-(2-methoxyphenyl)-6-phenylnicotinonitrile (1m)

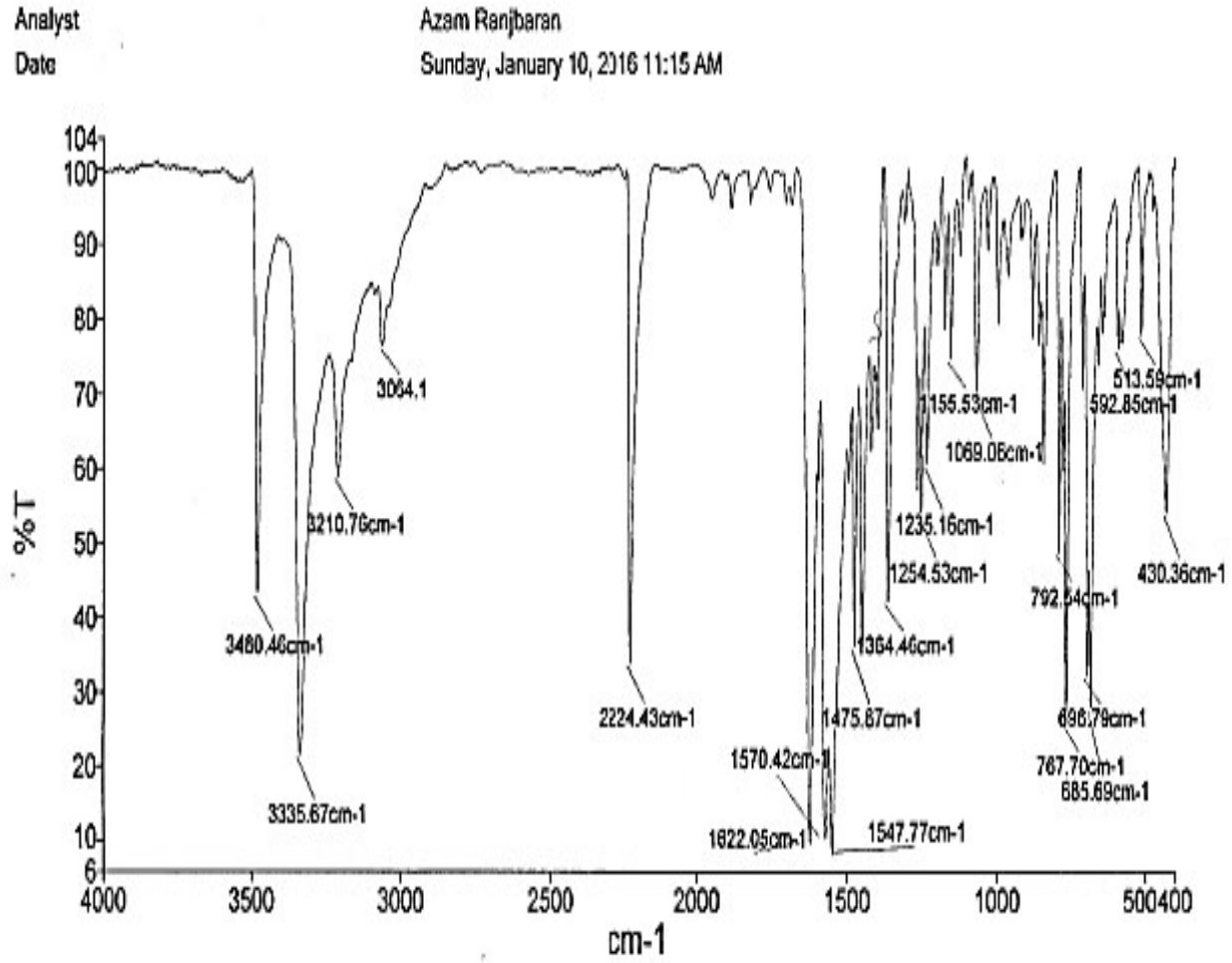




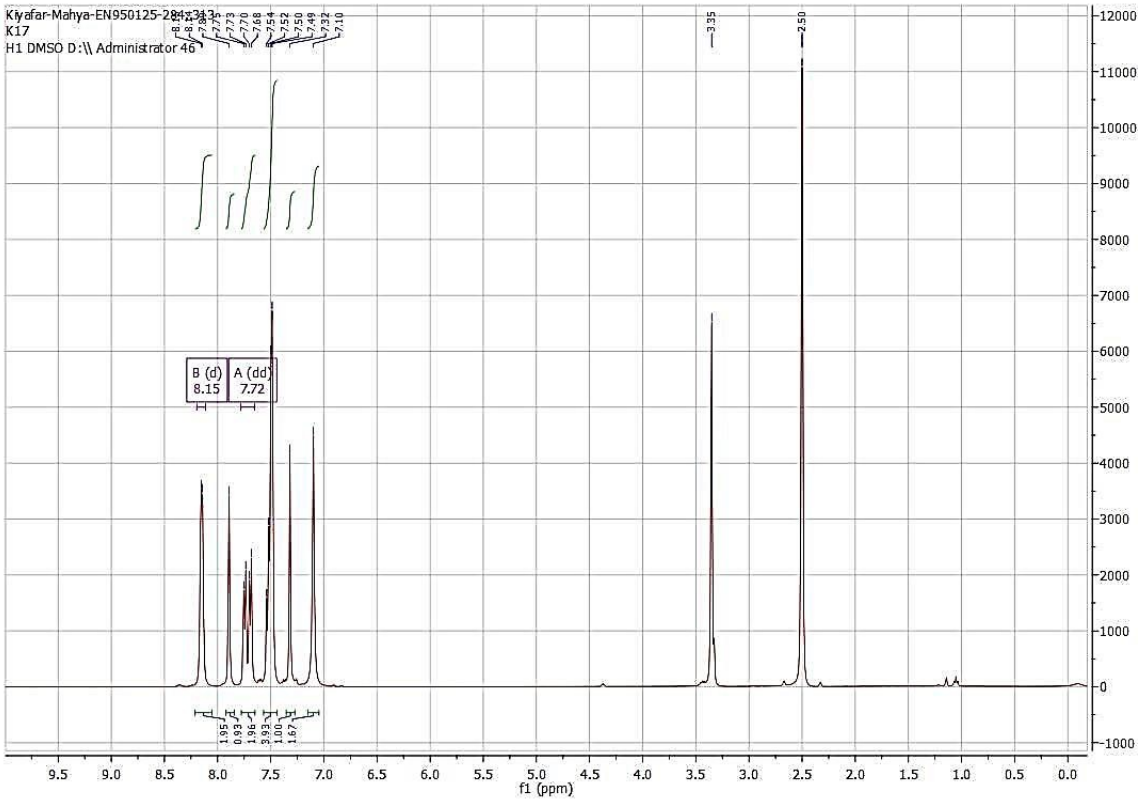
40. Mass analysis of 2-amino-4-(2-methoxyphenyl)-6-phenylnicotinonitrile (1m)

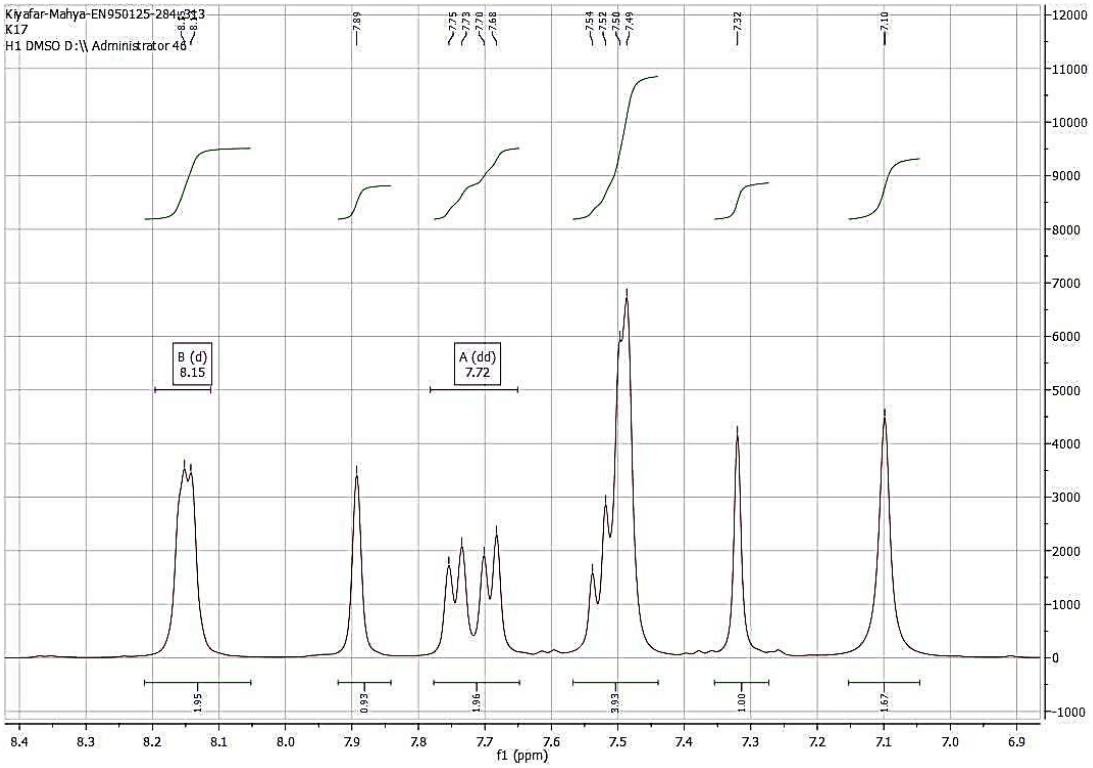


41. FT-IR spectra of 2-amino-4-(3- bromophenyl)-6-phenylnicotinonitrile (1n)

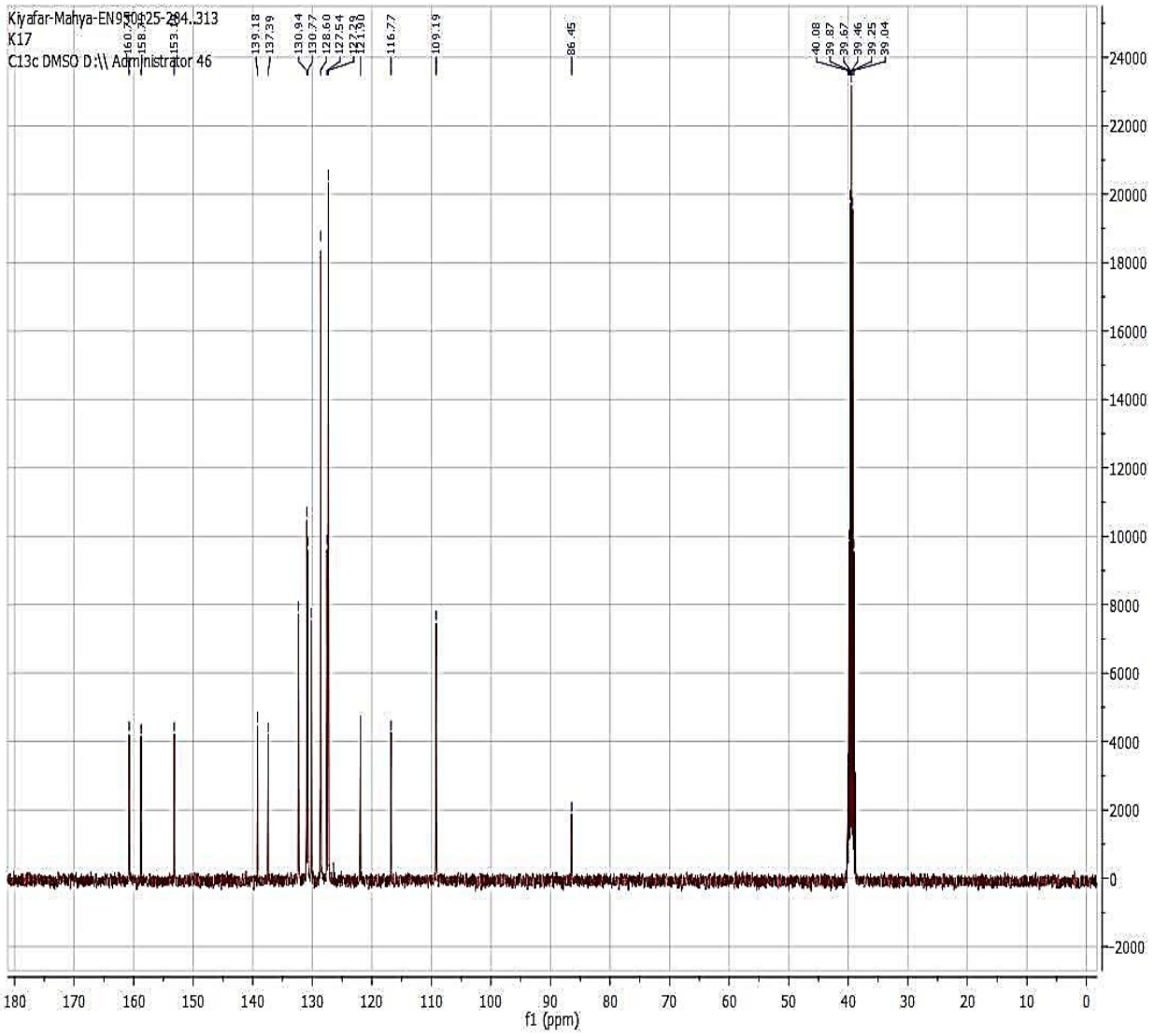


42. ^{1}H NMR spectra of 2-amino-4-(3- bromophenyl)-6-phenylnicotinonitrile (1n)

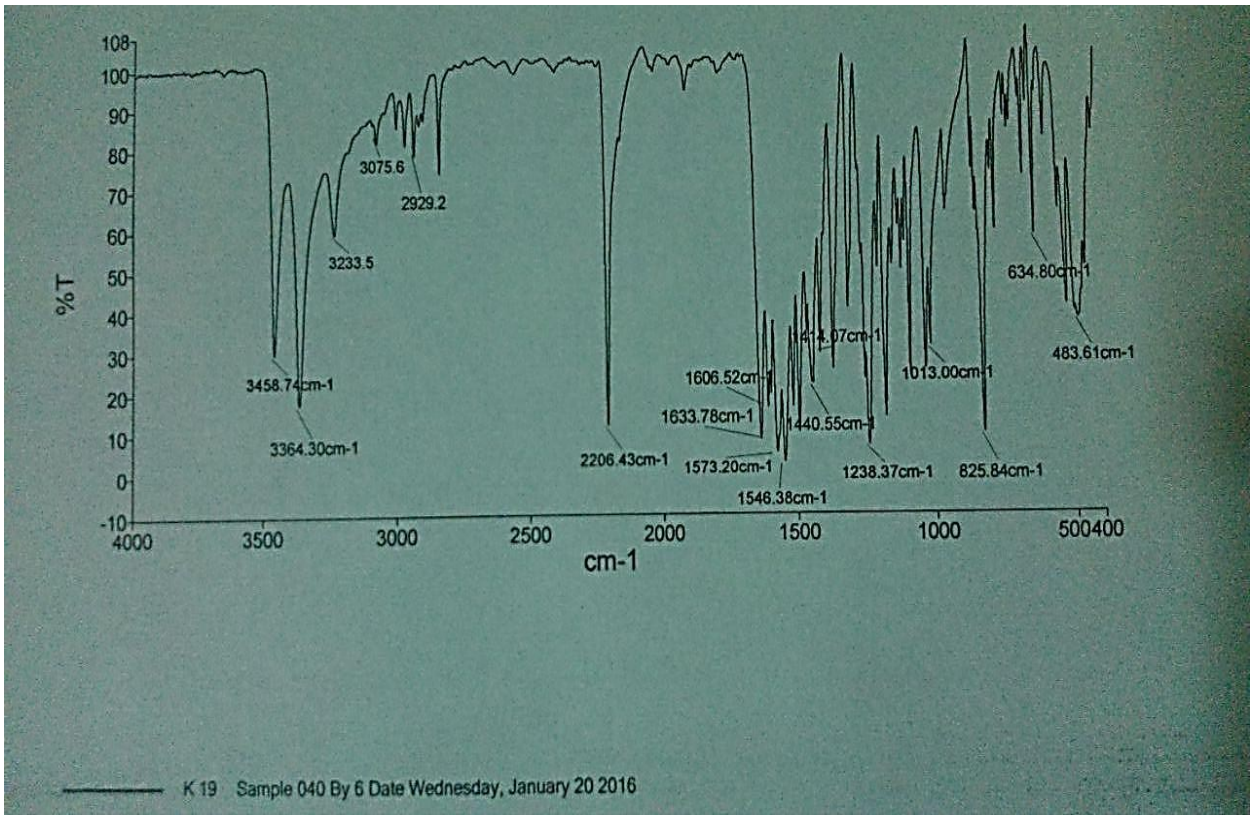




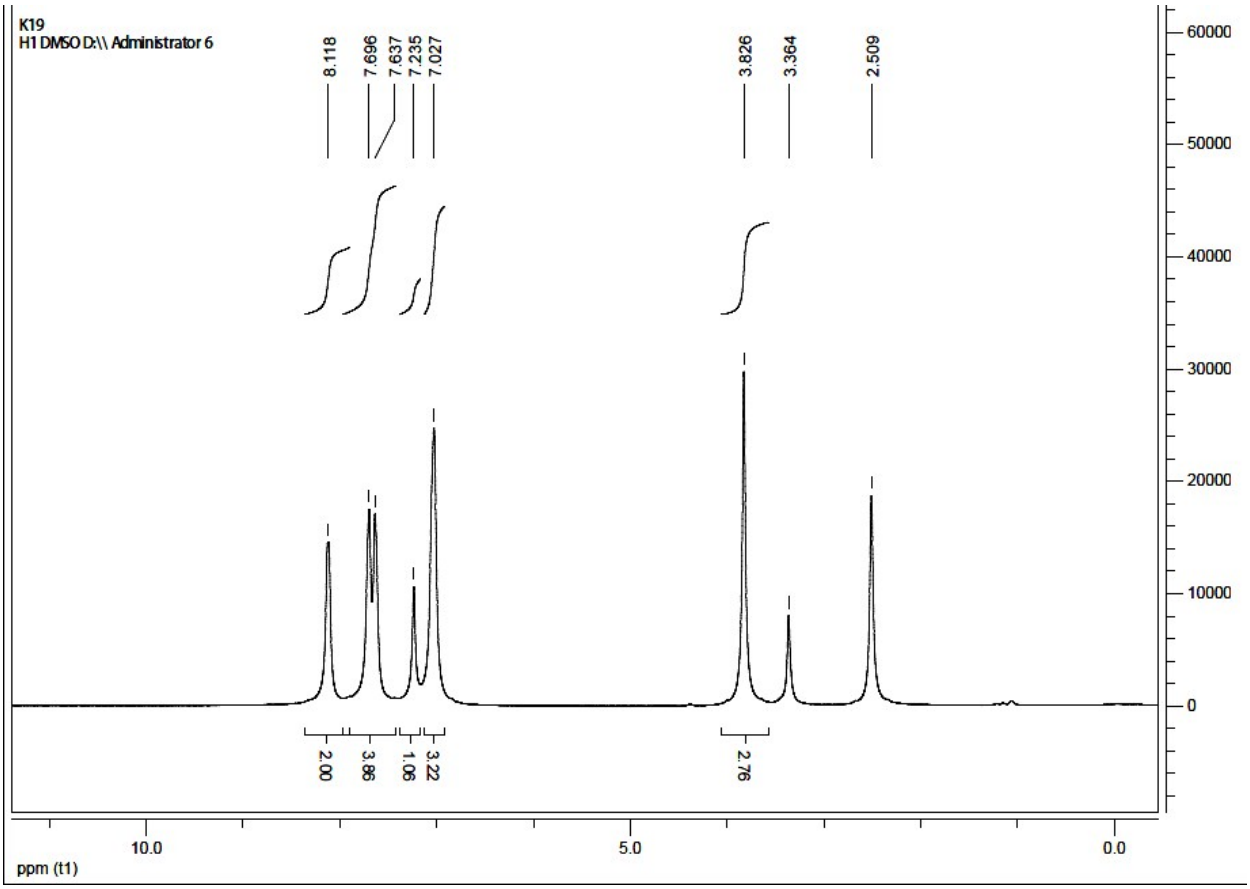
43. ^{13}C NMR spectra of 2-amino-4-(3- bromophenyl)-6-phenylnicotinonitrile (1n)



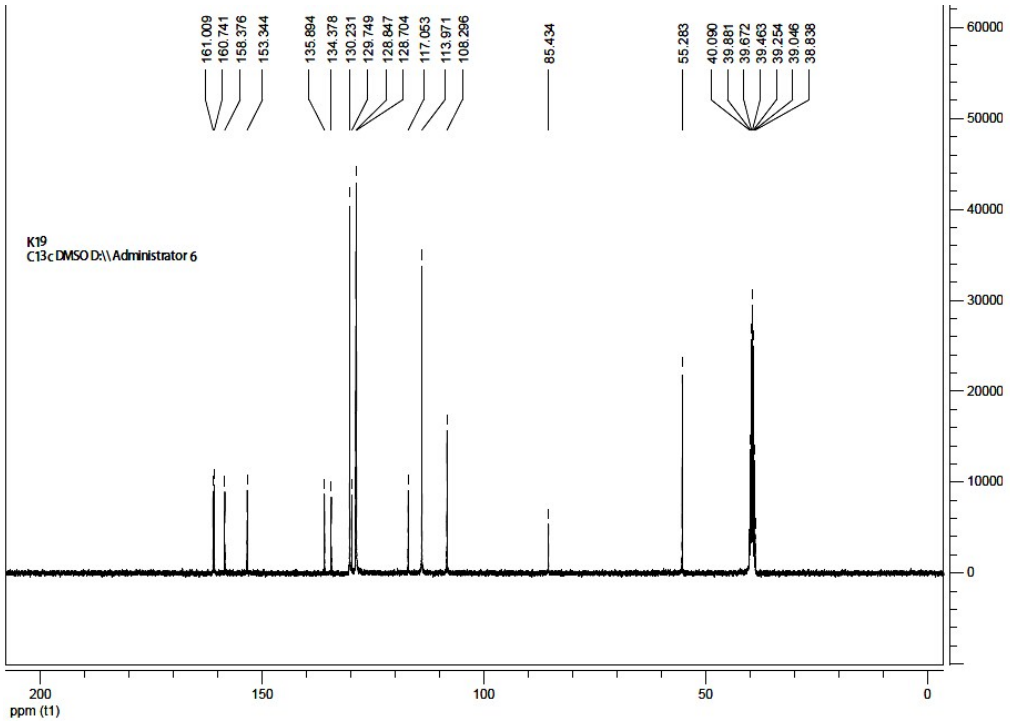
44. FT-IR spectra of 2-amino-4-(4-chlorophenyl)-6-(4-methoxyphenyl)nicotinonitrile (1o)

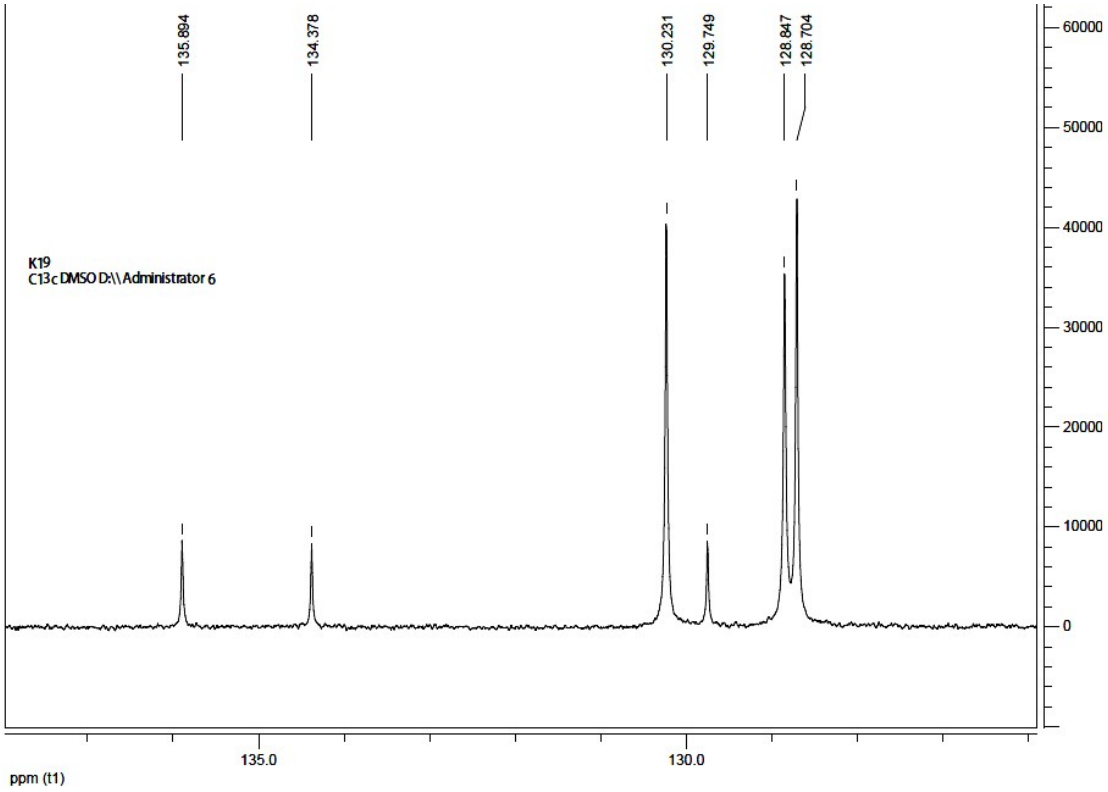


45. ^{1}H NMR spectra of 2-amino-4-(4-chlorophenyl)-6-(4-methoxyphenyl)nicotinonitrile (1o)

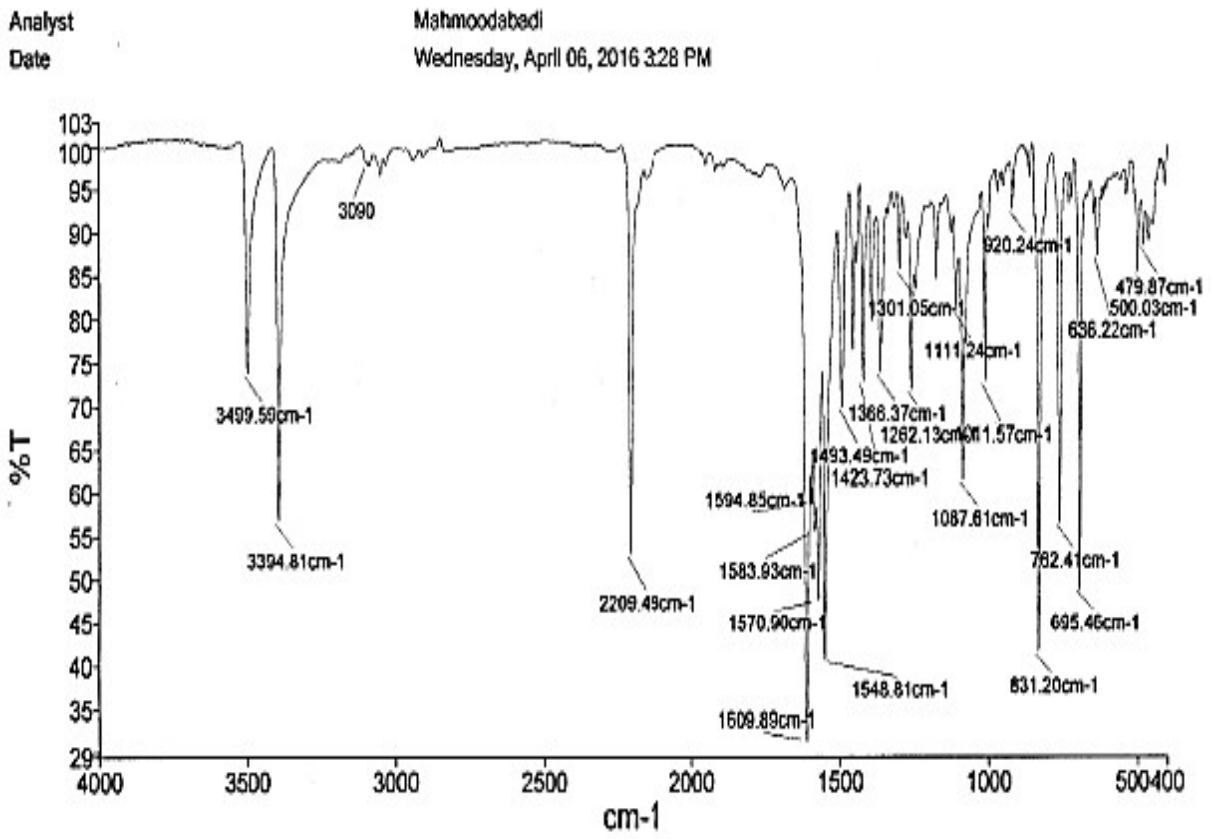


46. ^{13}C NMR spectra of 2-amino-4-(4-chlorophenyl)-6-(4-methoxyphenyl)nicotinonitrile (1o)

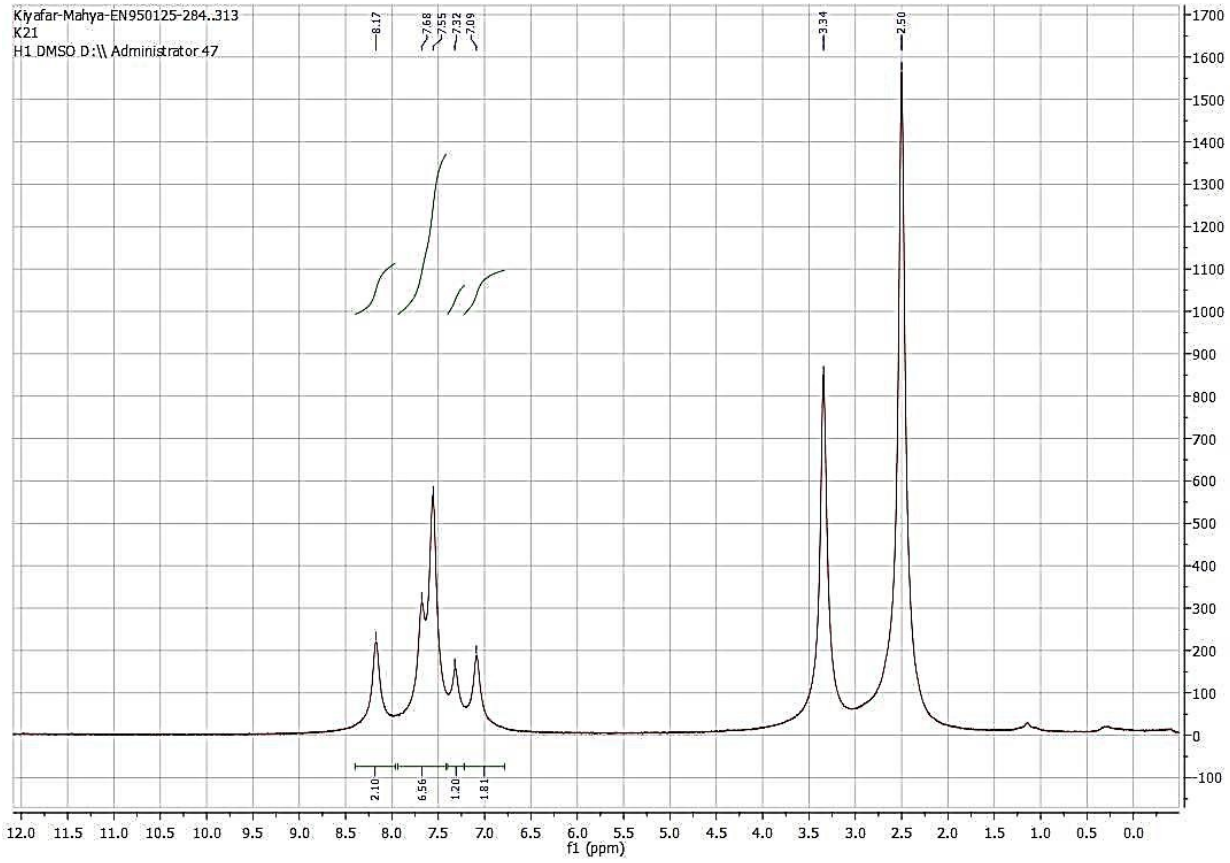




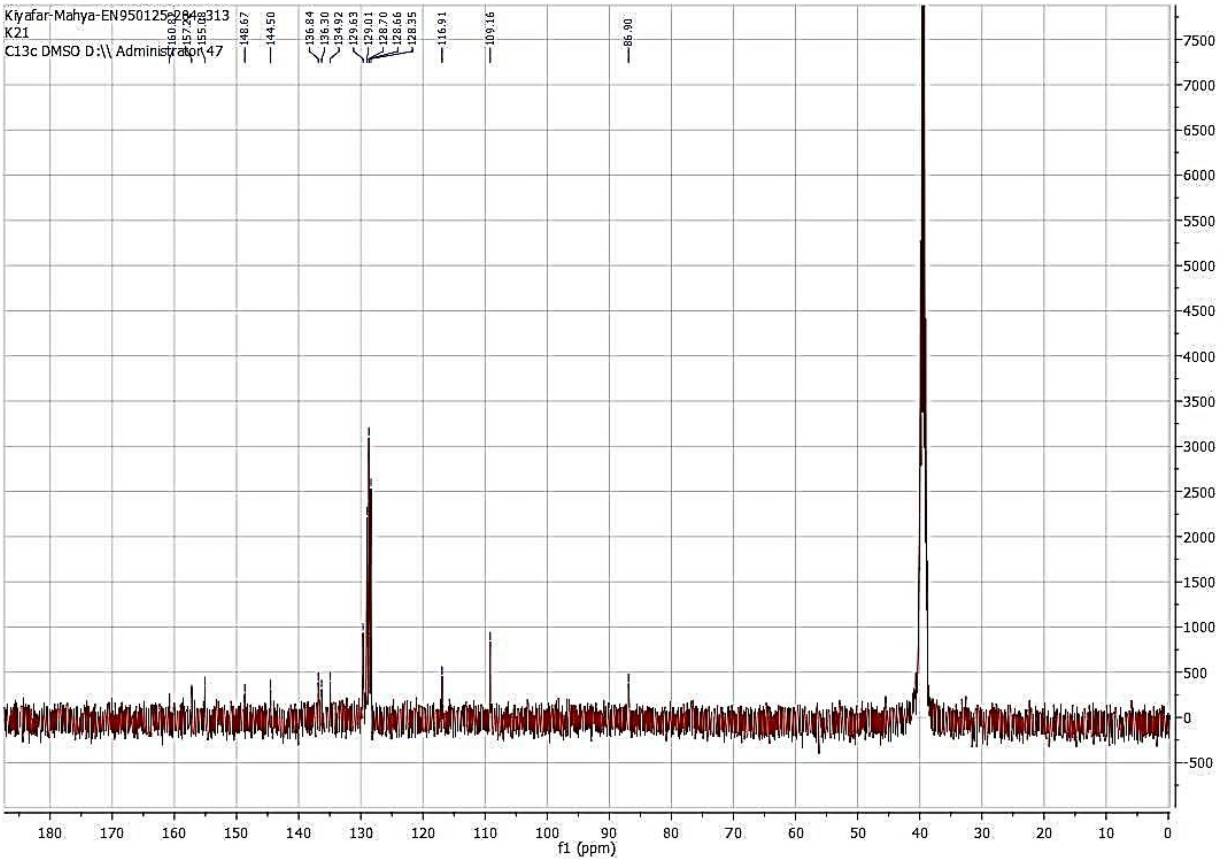
47. FT-IR spectra of 2-amino-6-(4-chlorophenyl)-4-phenylnicotinonitrile (1p)



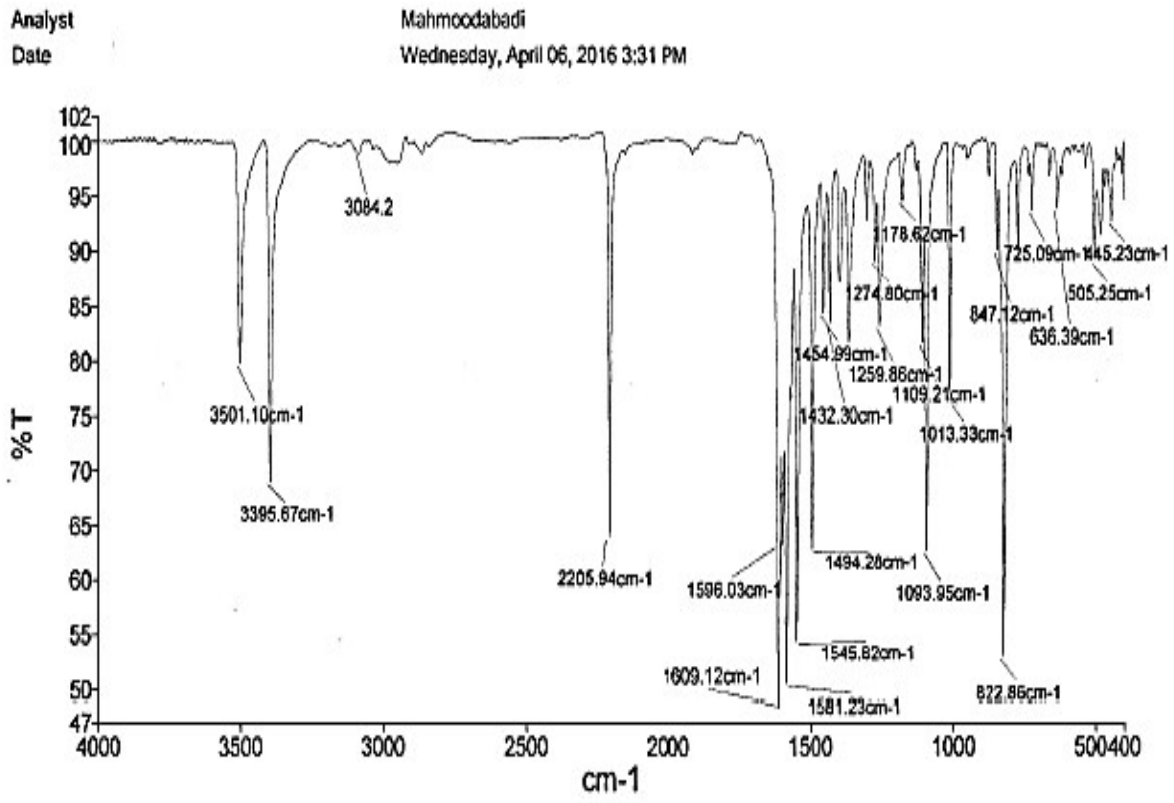
48. ^{1}H NMR spectra of 2-amino-6-(4-chlorophenyl)-4-phenylnicotinonitrile (1p)



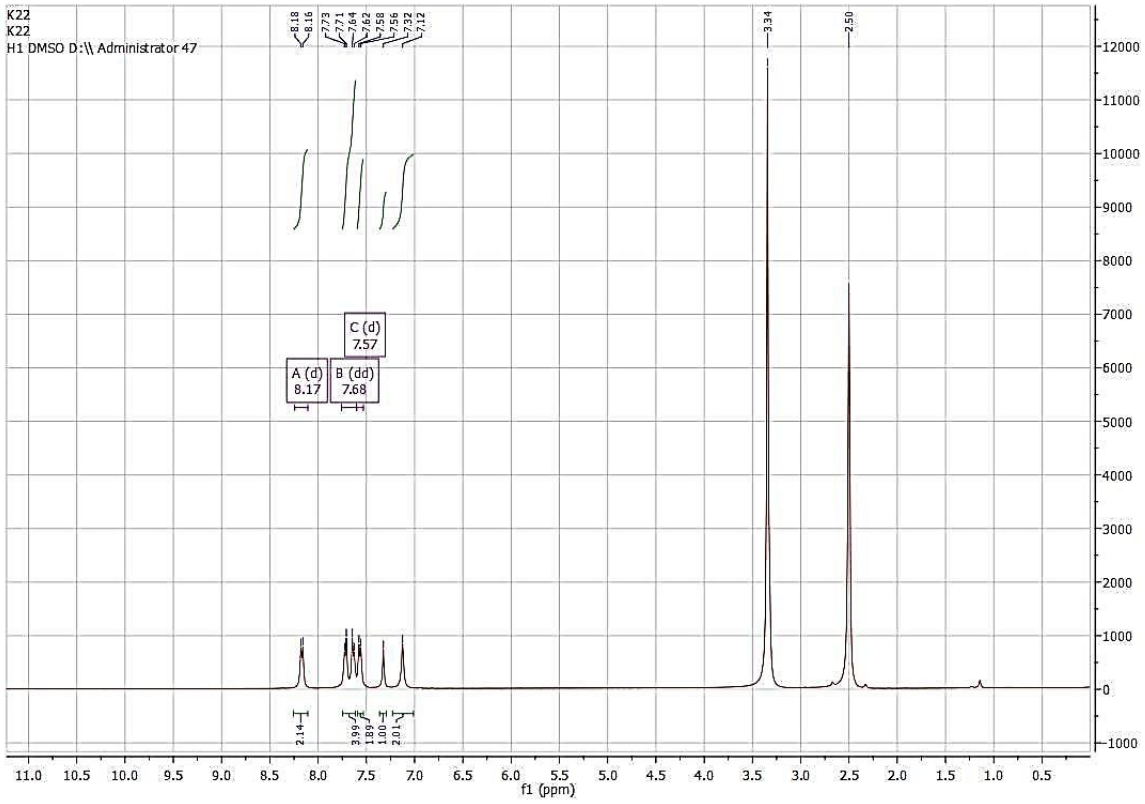
49. ^{13}C NMR spectra of 2-amino-6-(4-chlorophenyl)-4-phenylnicotinonitrile (1p)

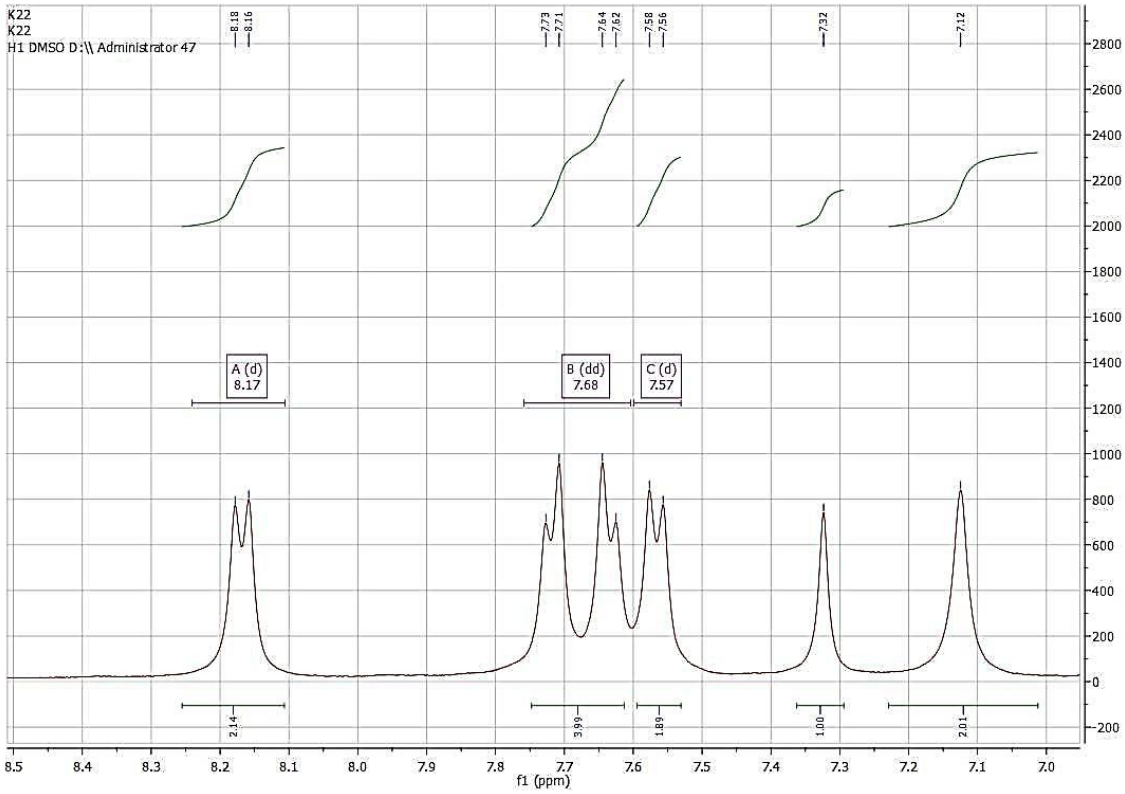


50. FT-IR spectra of 2-amino-4,6-bis(4-chlorophenyl)nicotinonitrile (1q)

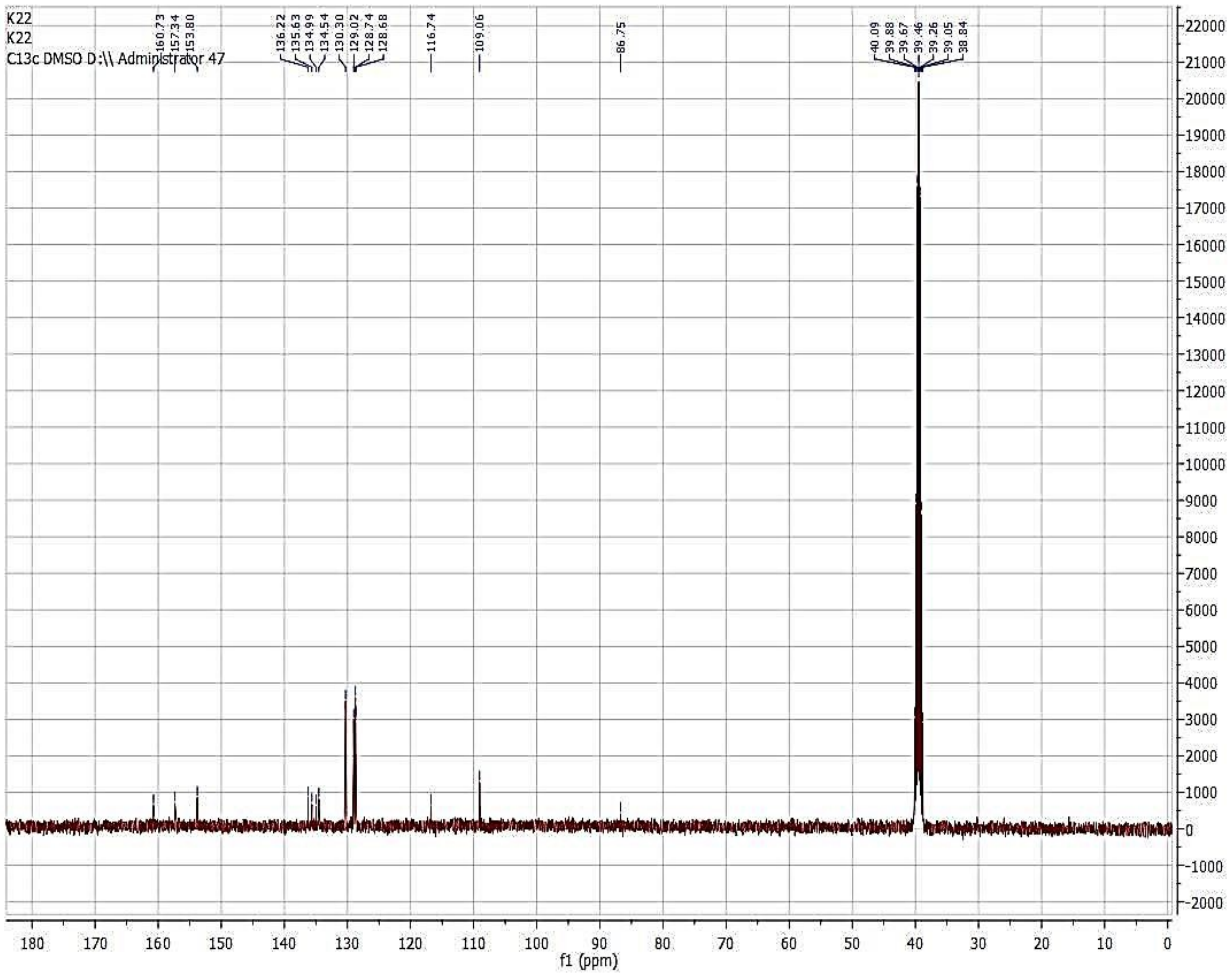


51. ^{1}H NMR spectra of 2-amino-4,6-bis(4-chlorophenyl)nicotinonitrile (1q)

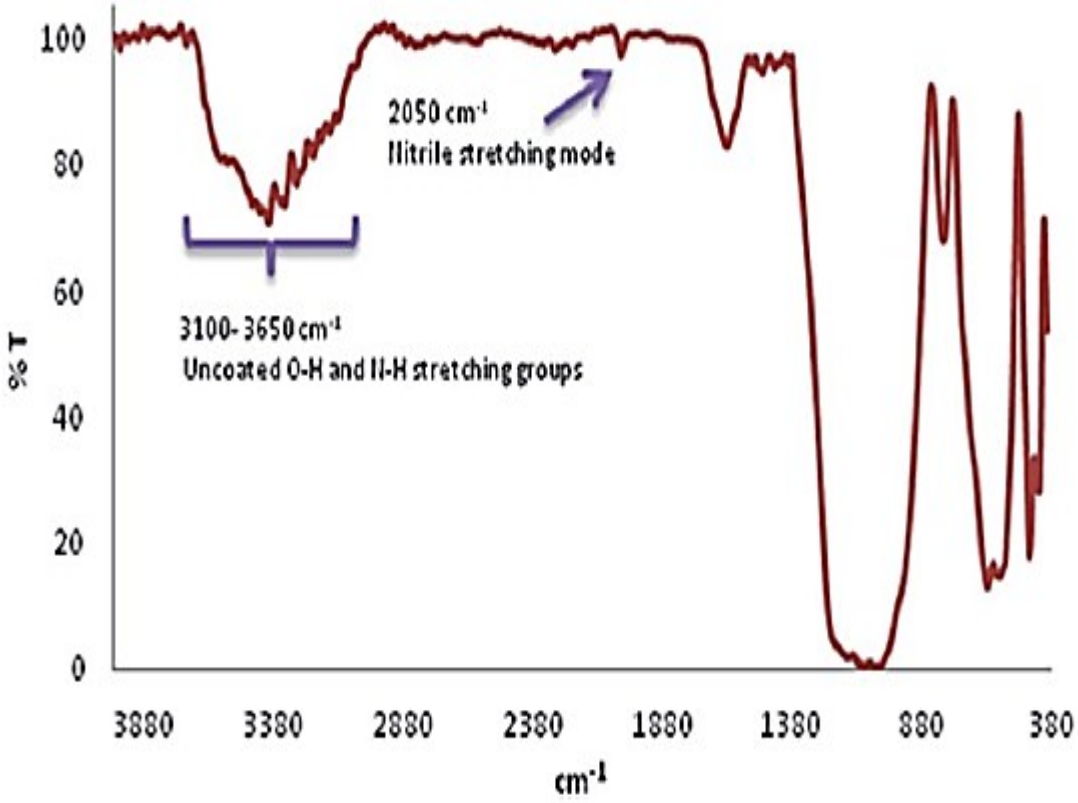




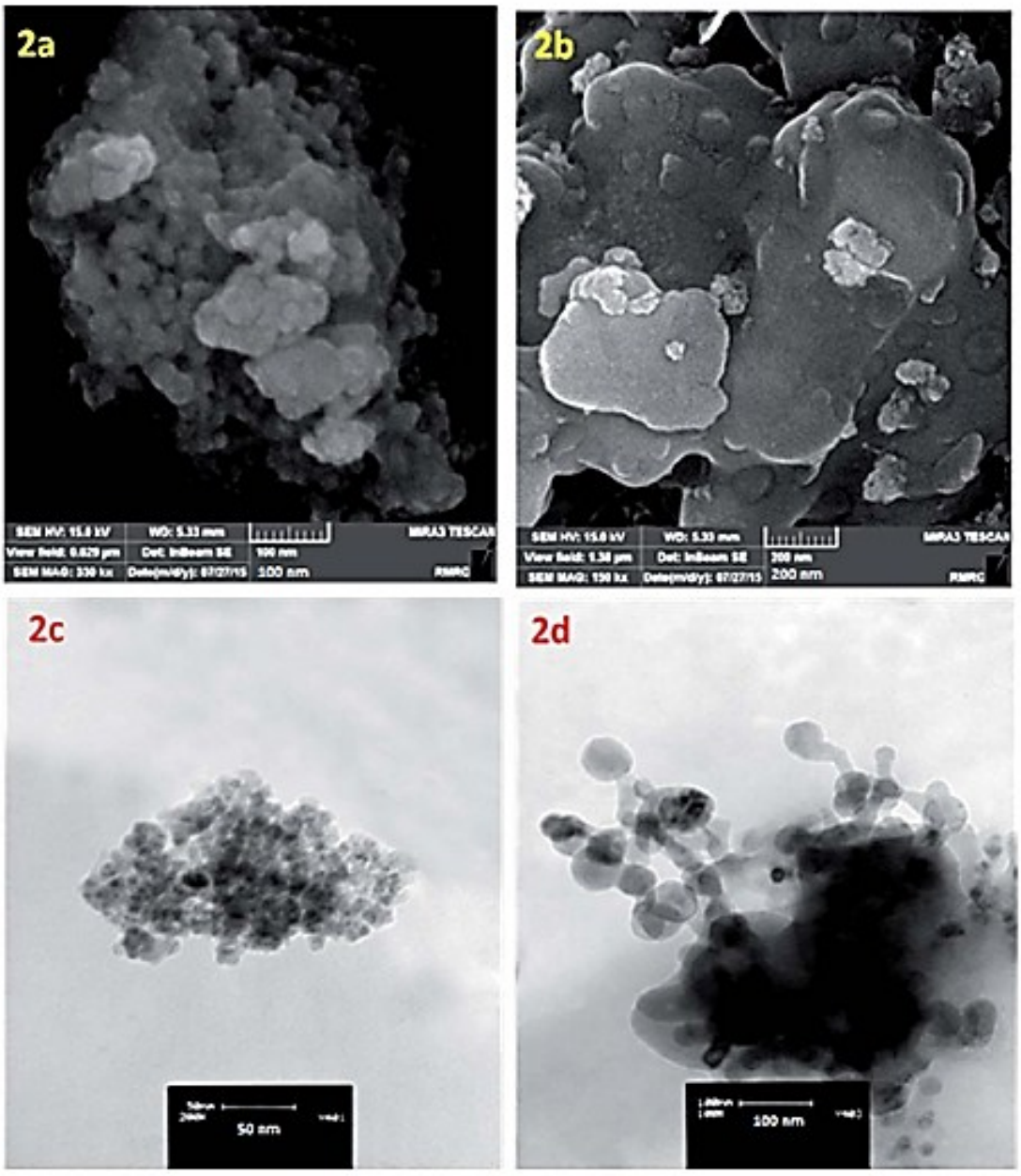
52. ^{13}C NMR spectra of 2-amino-4,6-bis(4-chlorophenyl)nicotinonitrile (1q)



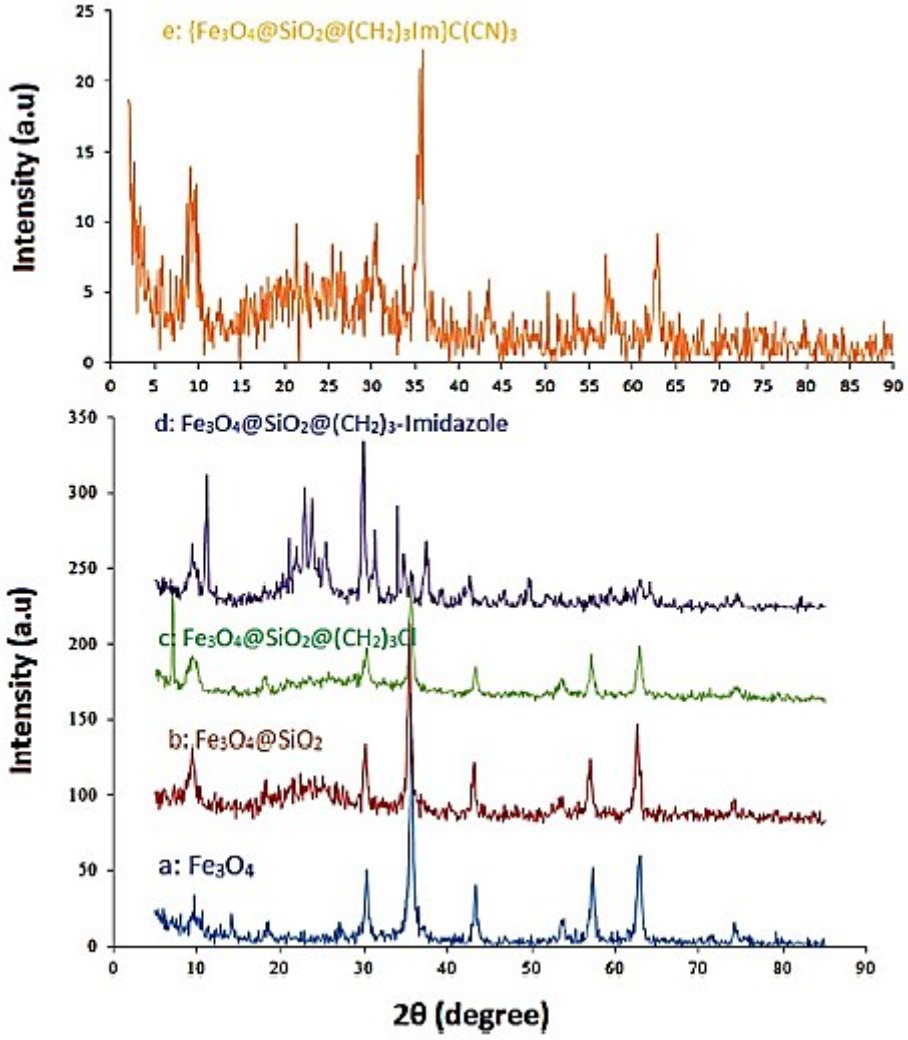
53. The IR spectrum of the $\{Fe_3O_4@SiO_2@(CH_2)_3Im\}C(CN)_3$



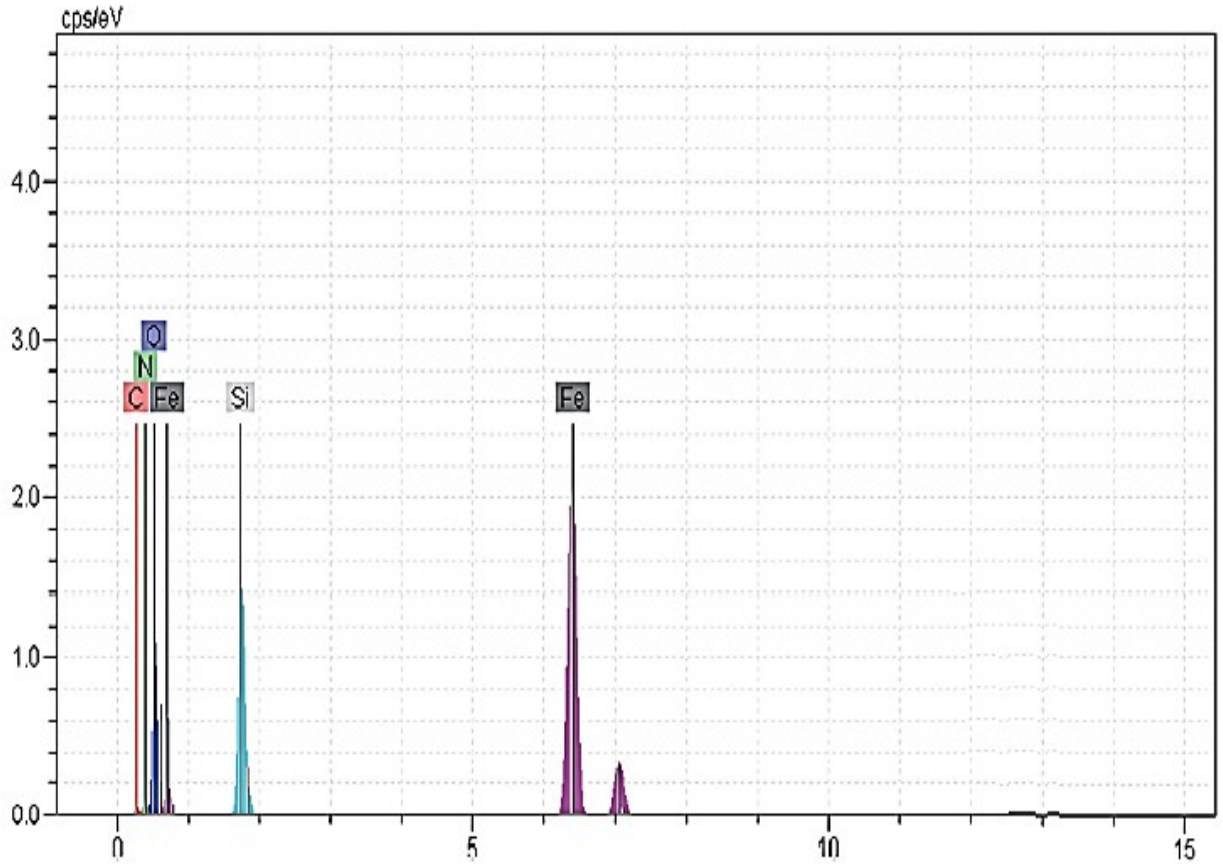
54. The scanning electron microscopy (2a and 2b) and the transmission electron microscopy (2c and 2d) images of the catalyst



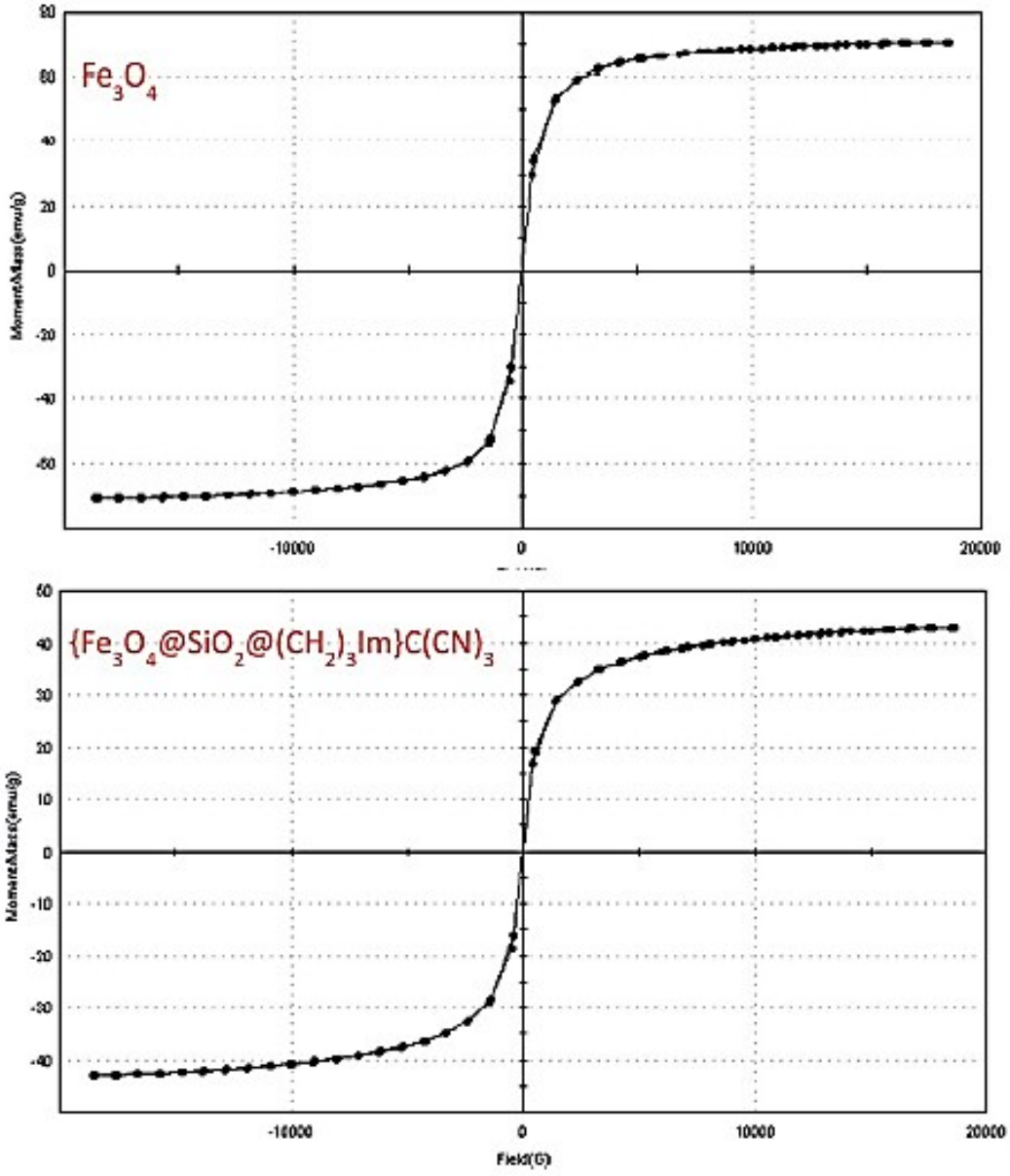
55. XRD patterns of the catalyst (a–e) XRD pattern of the catalyst in comparison with the different stepwise synthesized materials.



56. Energy-dispersive X-ray spectroscopy (EDX) of the catalyst



57. The vibrating sample magnetometer (VSM) analysis of the novel catalyst in comparison with Fe_3O_4 nano particles



58. Thermal gravimetry (TG) curve of the prepared catalyst