

Green and efficient synthesis of pyranopyrazoles using [bmim][OH⁻] as an ionic liquid catalyst in water under microwave irradiation and investigation of their antioxidant activity

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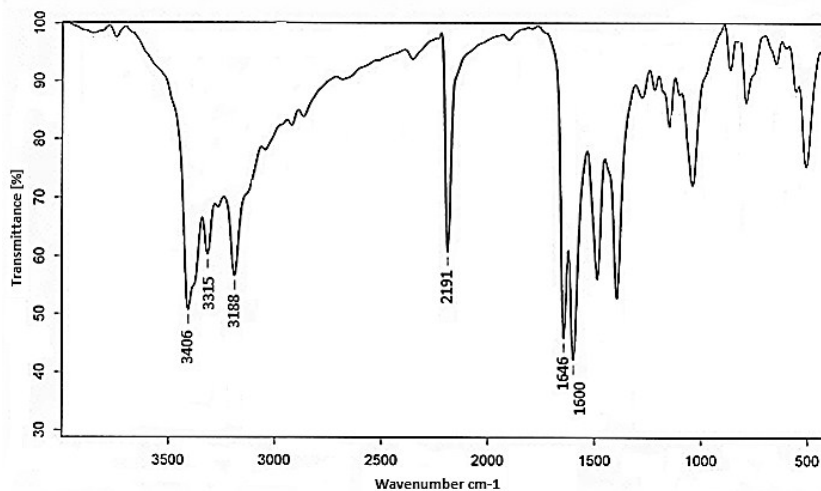


Figure 1. Ft.IR spectrum of 6-amino-3-methyl-4-(p-tolyl)-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4a)

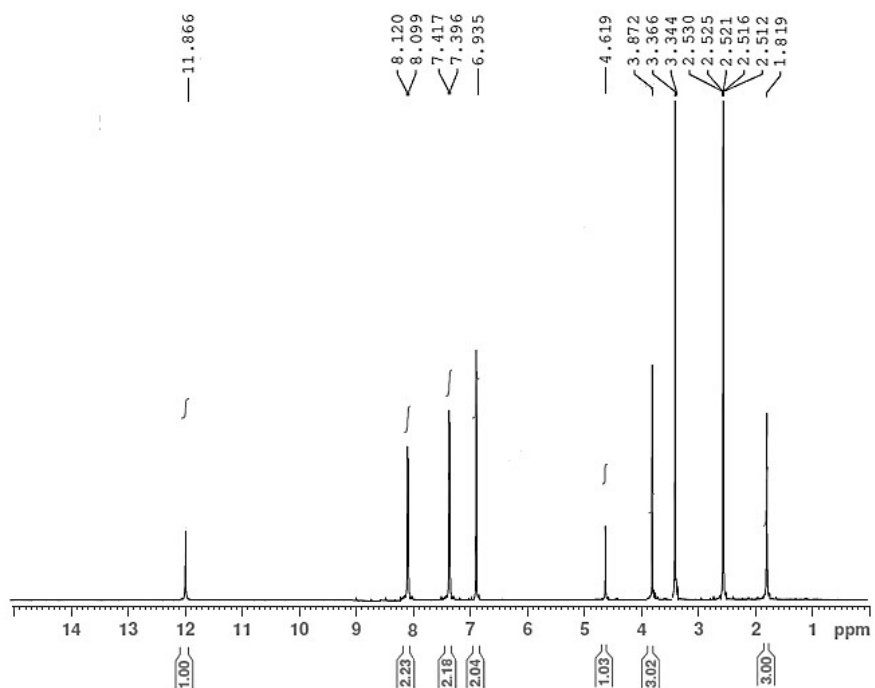


Figure 2. ¹H-NMR spectrum of 6-amino-3-methyl-4-(p-tolyl)-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4a)

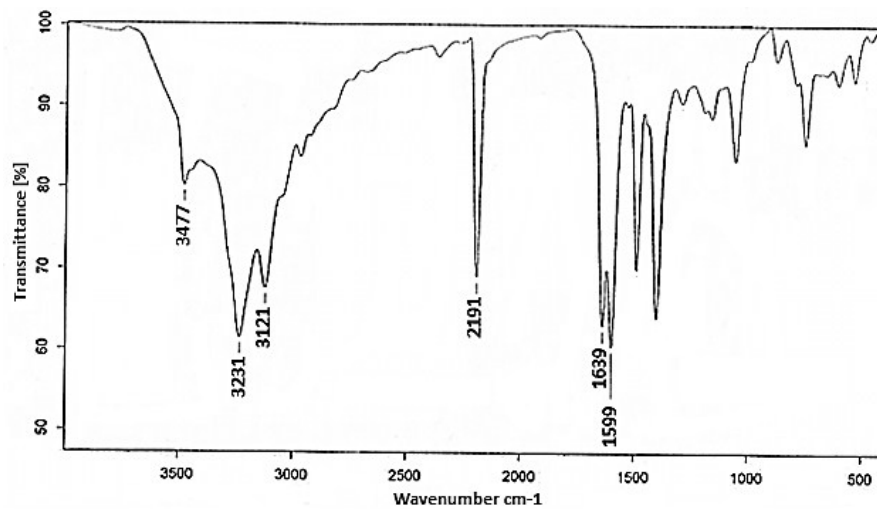


Figure 3. Ft.IR spectrum of 6-amino-1,4-dihydro-3-methyl-4-phenylpyrano[2,3-c]pyrazole-5-carbonitrile (4b)

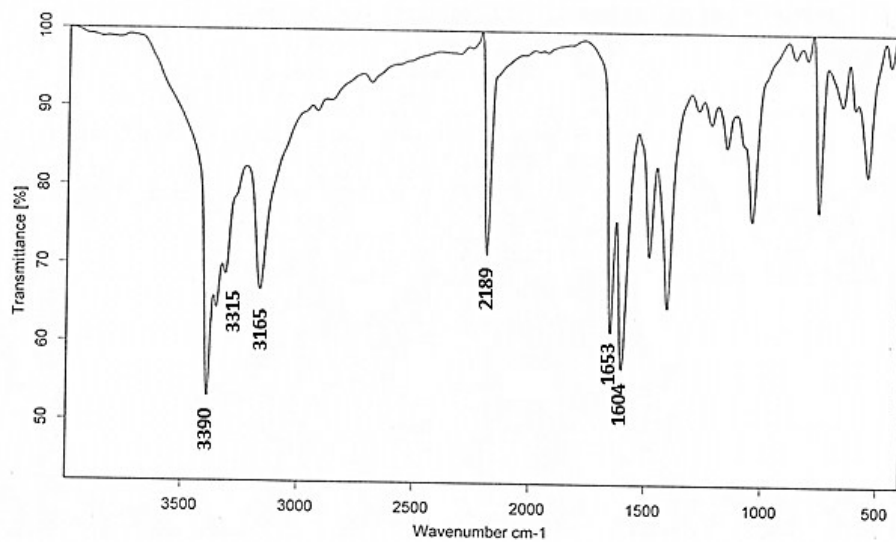


Figure 4. Ft.IR spectrum of 6-amino-4-(2-chlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4c)

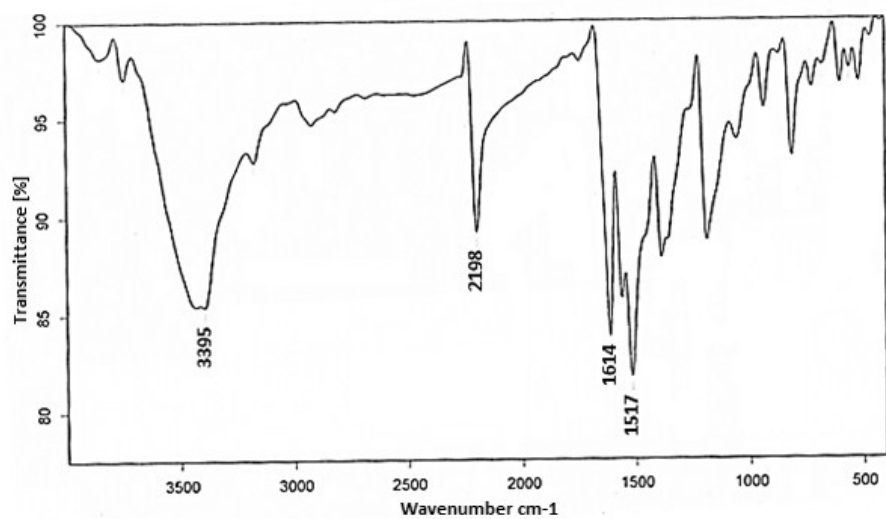


Figure 5. Ft.IR spectrum of 6-amino-4-(4-(dimethylamino)phenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4d)

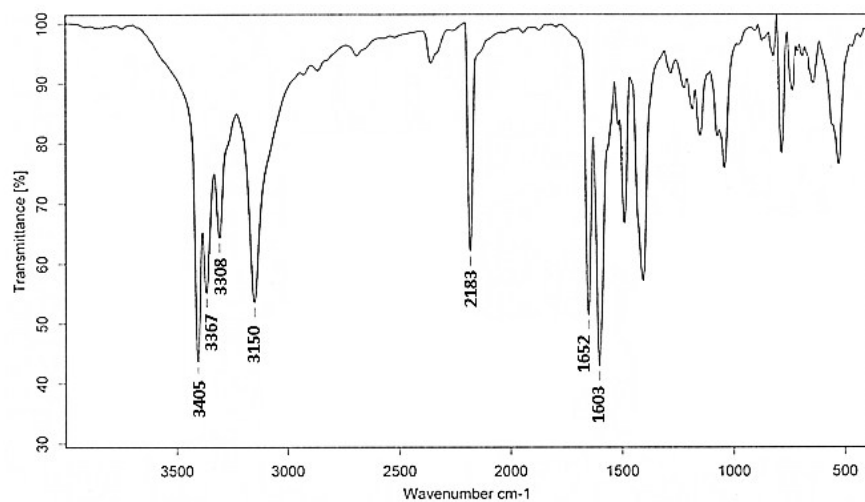


Figure 6. Ft.IR spectrum of 6-amino-4-(4-hydroxyphenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4e)

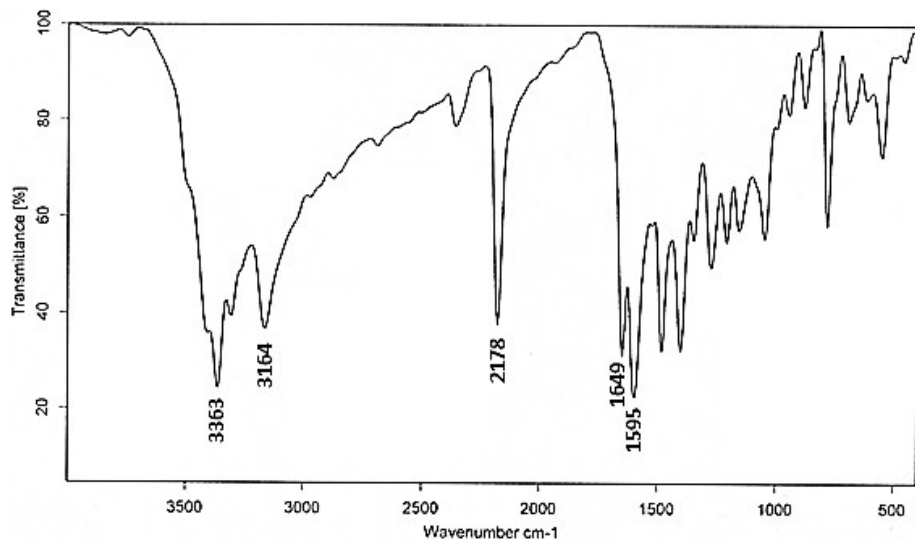


Figure 7. Ft.IR spectrum of 6-amino-4-(3-hydroxyphenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4f)

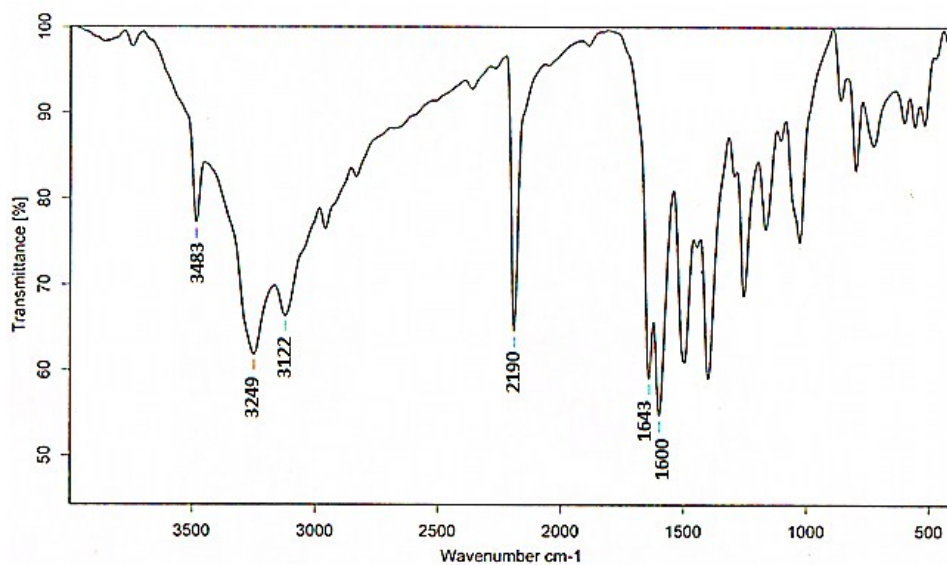


Figure 8. Ft.IR spectrum of 6-amino-4-(4-methoxyphenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4g)

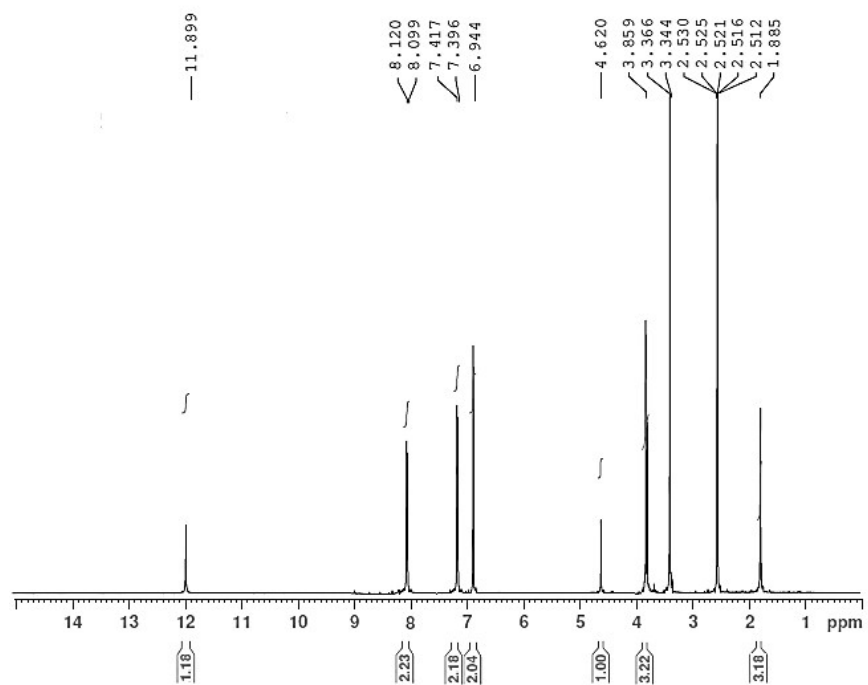


Figure 9. ¹H NMR spectrum of 6-amino-4-(4-methoxyphenyl)-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile (4g)

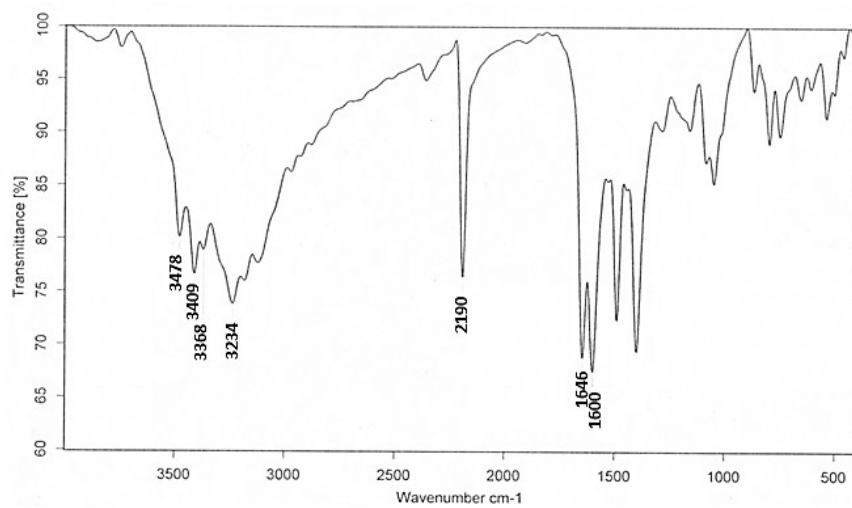


Figure 10. FT-IR spectrum of 6-amino-4-(4-chlorophenyl)-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile (4h)

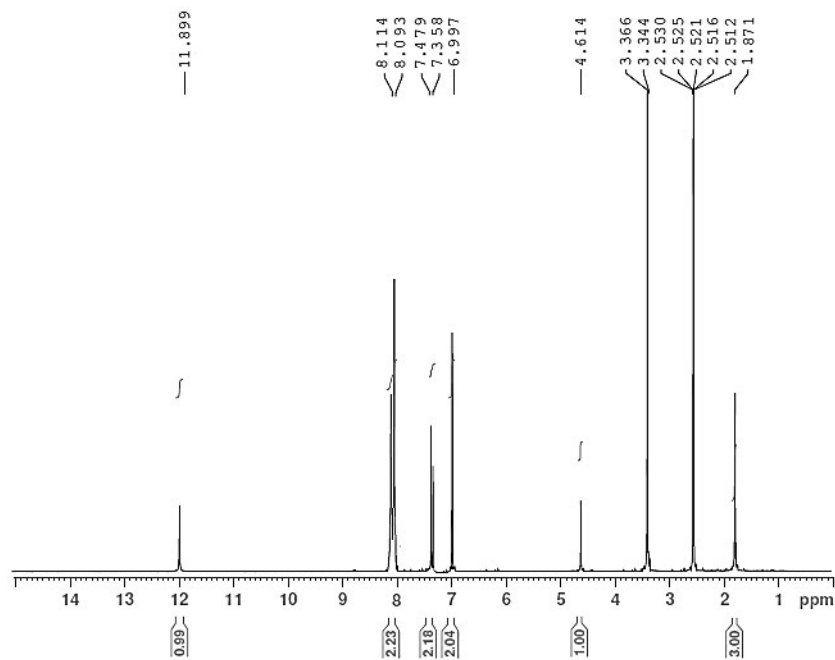


Figure 11. ¹H NMR spectrum of 6-amino-4-(4-chlorophenyl)-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile (4h)

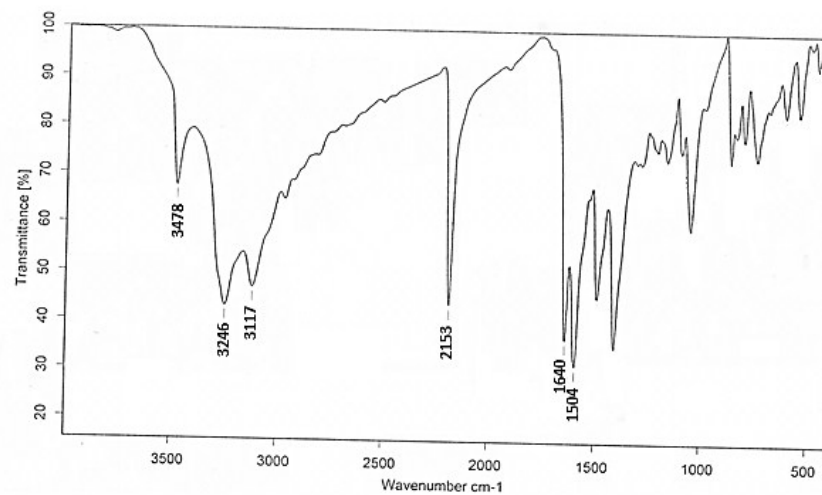


Figure 12. Ft. IR spectrum of 6-amino-4-(2,4-dichlorophenyl)-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile (4i)

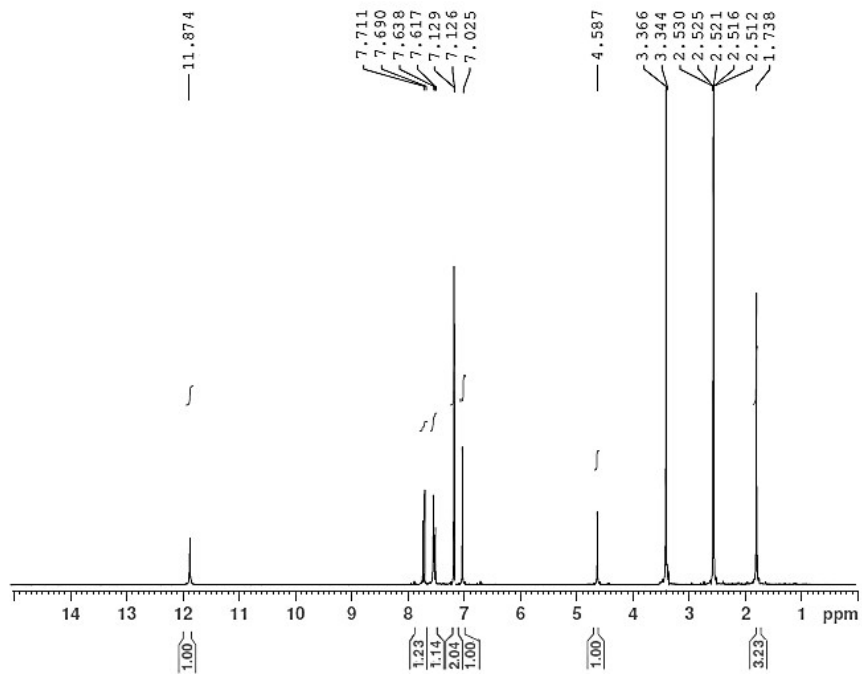


Figure 13. ¹H NMR spectrum of 6-amino-4-(2,4-dichlorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4i)

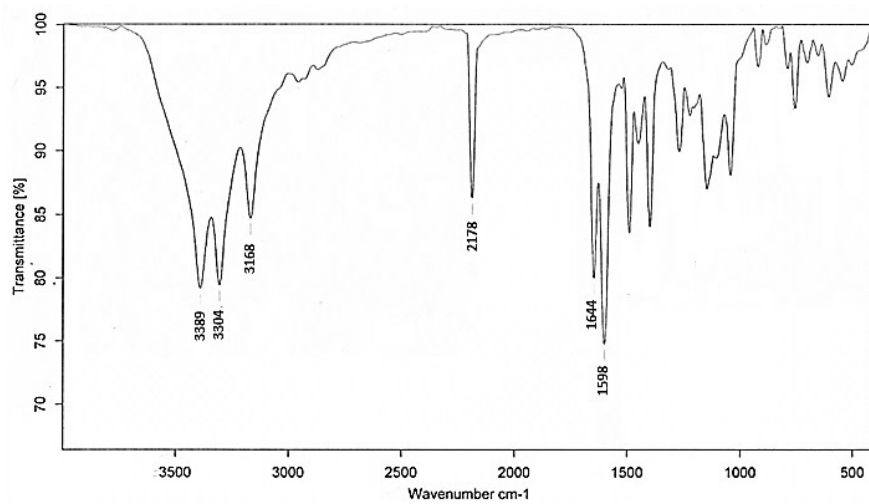


Figure 14. Ft. IR spectrum of 6-amino-4-(4-fluorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4j)

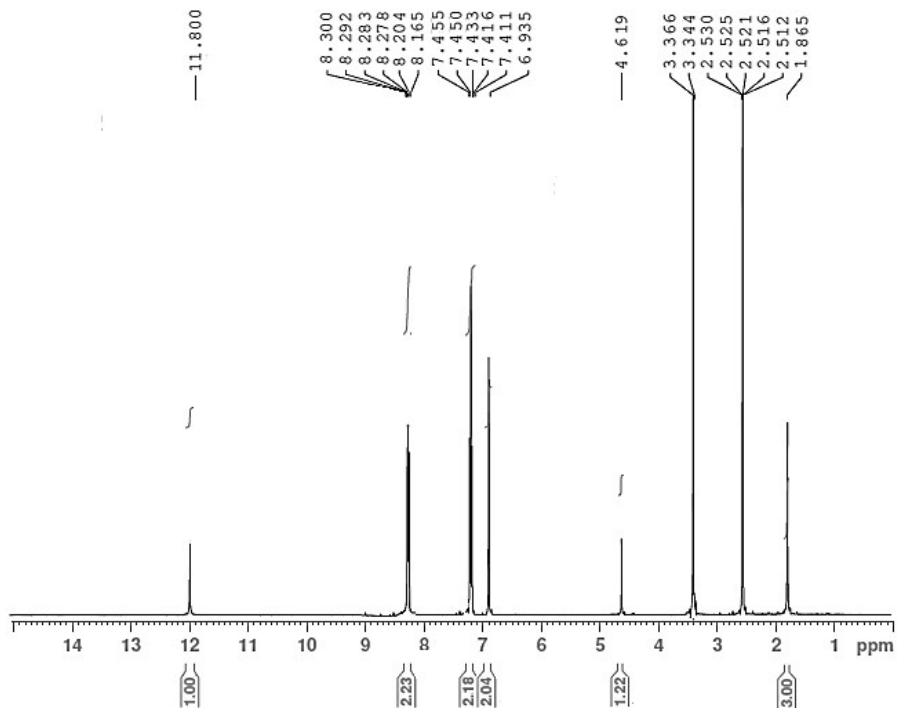


Figure 15. ¹H NMR spectrum of 6-amino-4-(4-fluorophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4j)

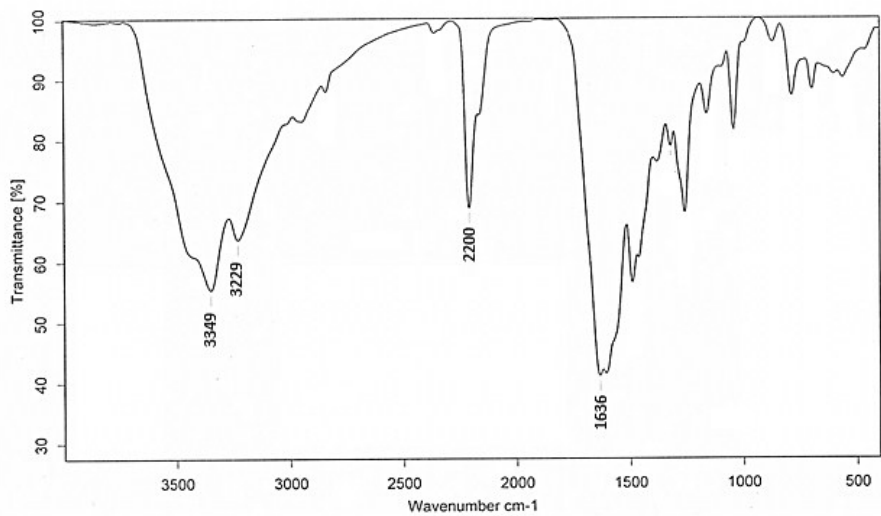


Figure 16. Ft. IR spectrum of 6-amino-4-(3-methoxyphenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4k)

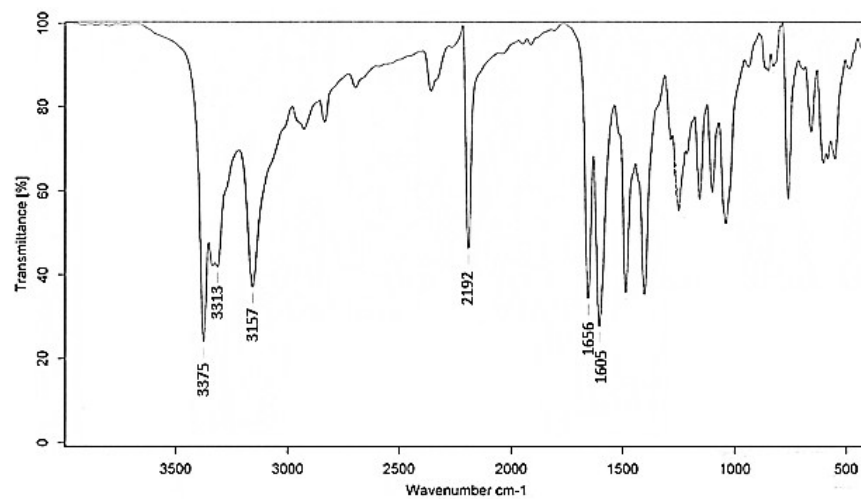


Figure 17. Ft.IR spectrum of 6-amino-4-(2-methoxyphenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4l)

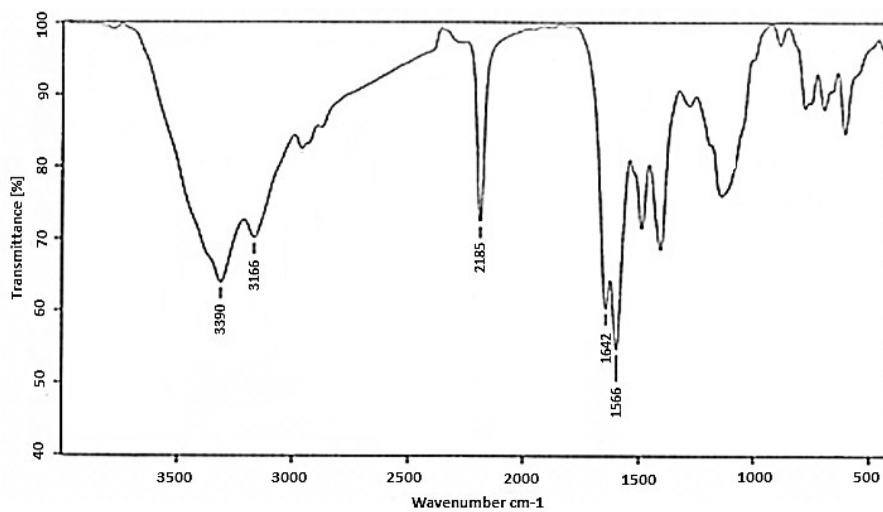


Figure 18. Ft.IR spectrum of 6-amino-3-methyl-4-(4-nitrophenyl)-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4m)

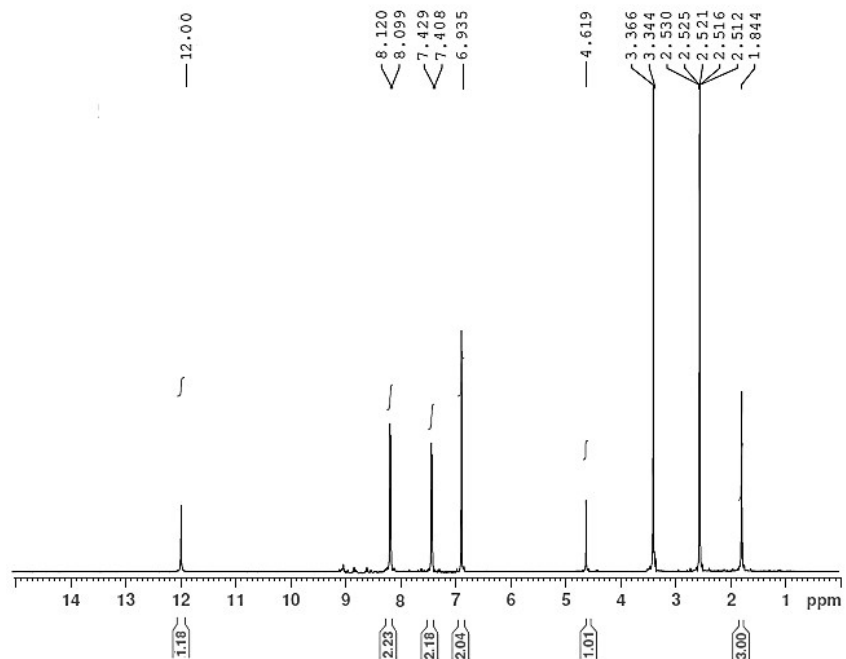


Figure 19. ¹H NMR spectrum of 6-amino-3-methyl-4-(4-nitrophenyl)-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4m)

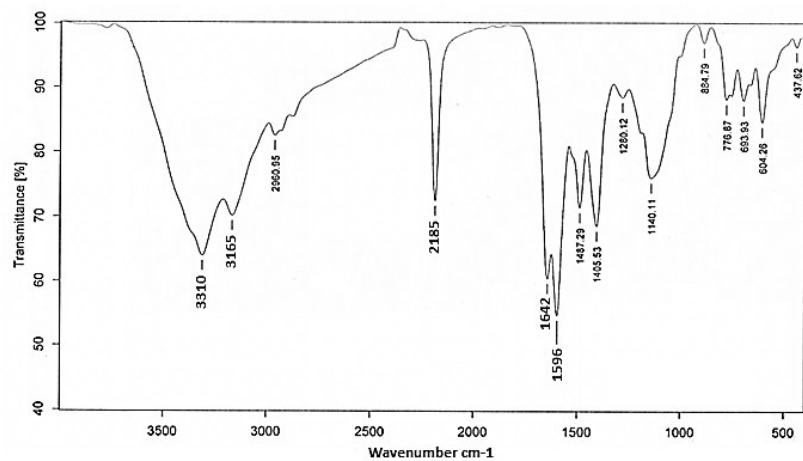


Figure 20. Ft. IR spectrum of 6-amino-4-(3-bromophenyl)-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (4n)

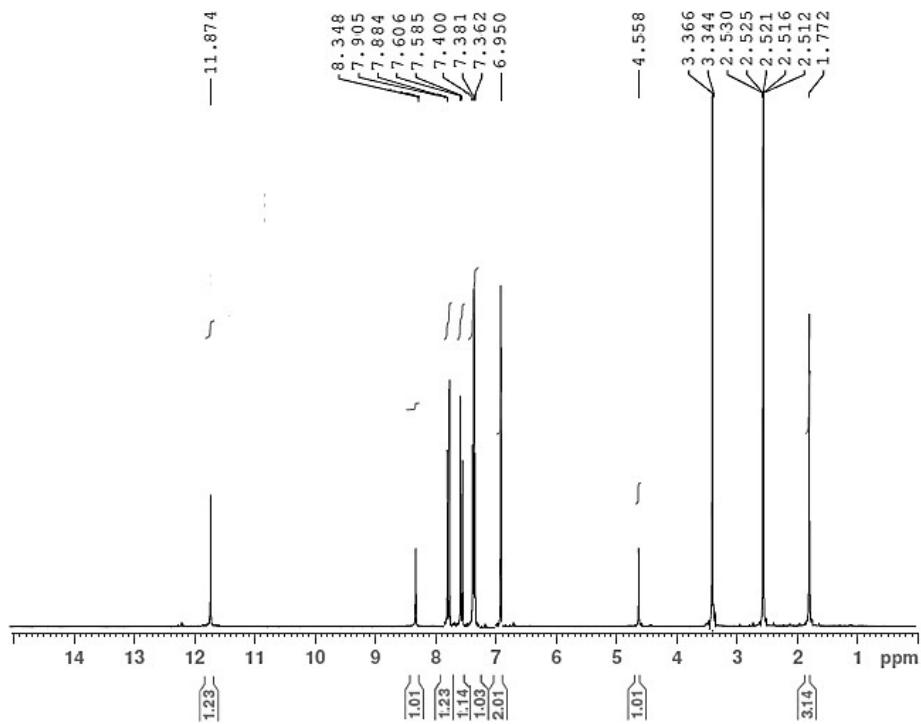


Figure 21. ¹H NMR spectrum of 6-amino-4-(3-bromophenyl)-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile (4n)

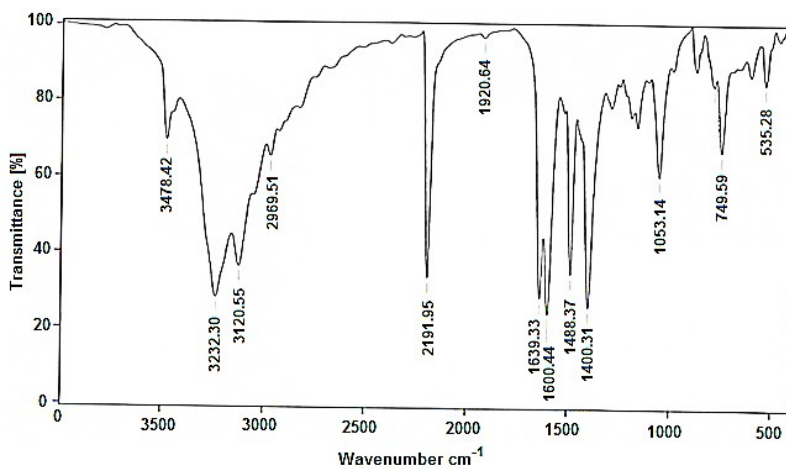


Figure 22. Ft. IR spectrum of 4,4'-(1,4-phenylene)bis(6-amino-3-methyl-1,4-dihydropyranopyrazole-5-carbonitrile) (4o)

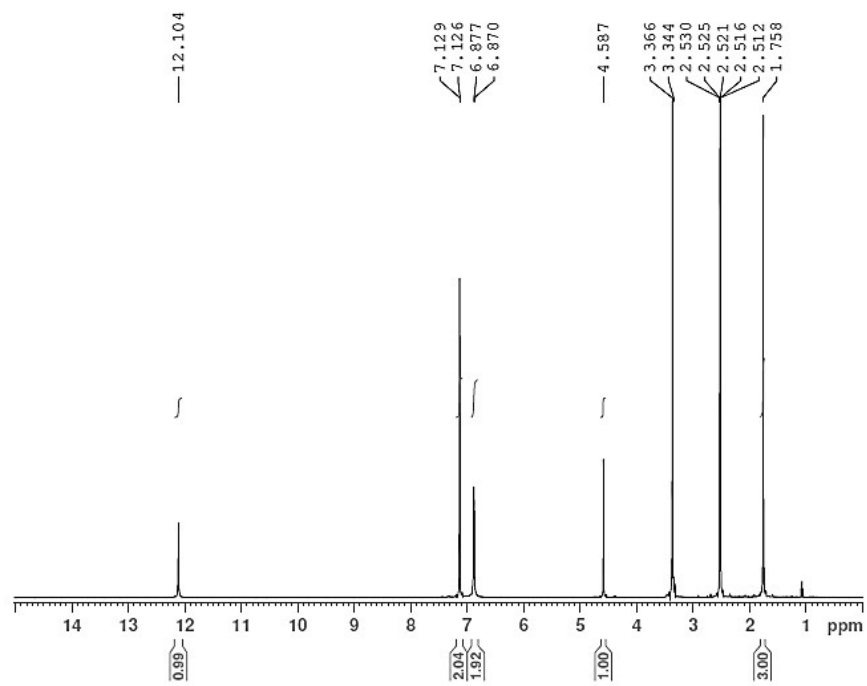


Figure 23. ^1H NMR spectrum of 4,4'-(1,4-phenylene)bis(6-amino-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile) (4o)

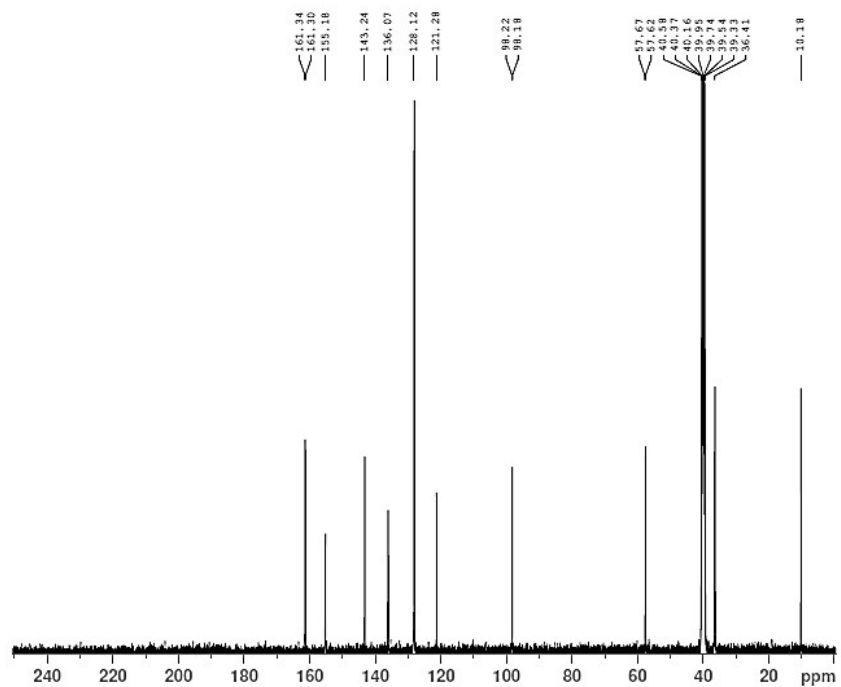


Figure 24. ^{13}C NMR spectrum of 4,4'-(1,4-phenylene)bis(6-amino-3-methyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile) (4o)

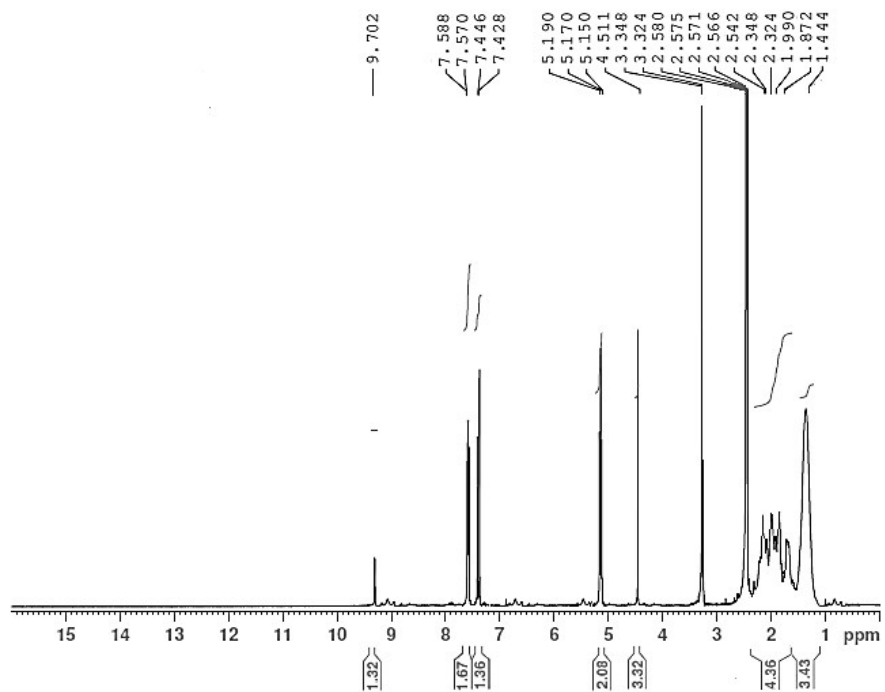


Figure 25. ^1H NMR spectrum of [bmim][OH⁻].