

Supplementary Information

Preparation and characterization of NiCoFe₂O₄ nanoparticles and using as an effective catalyst for synthesis of tri-substituted imidazole derivatives under solvent-free conditions

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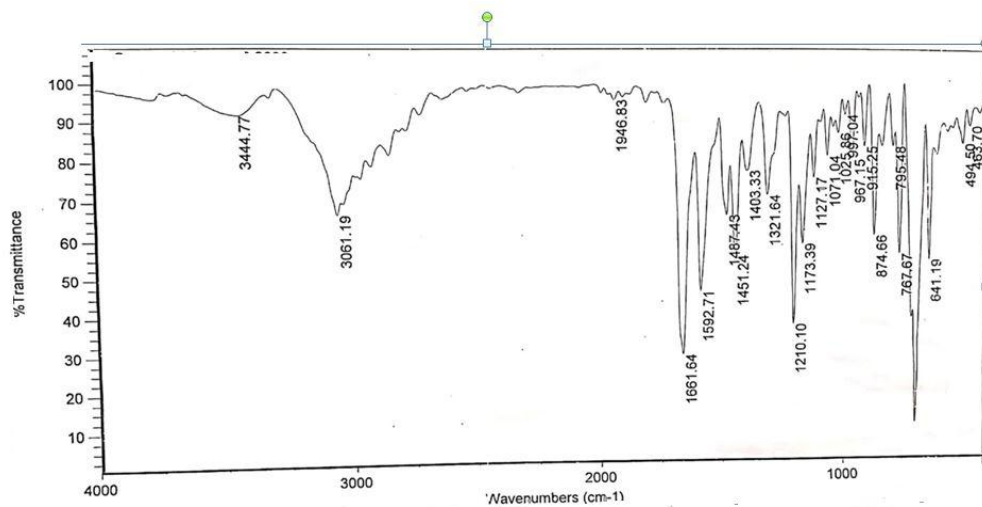
¹H NMR & FT-IR spectra of the products

Table of contents:

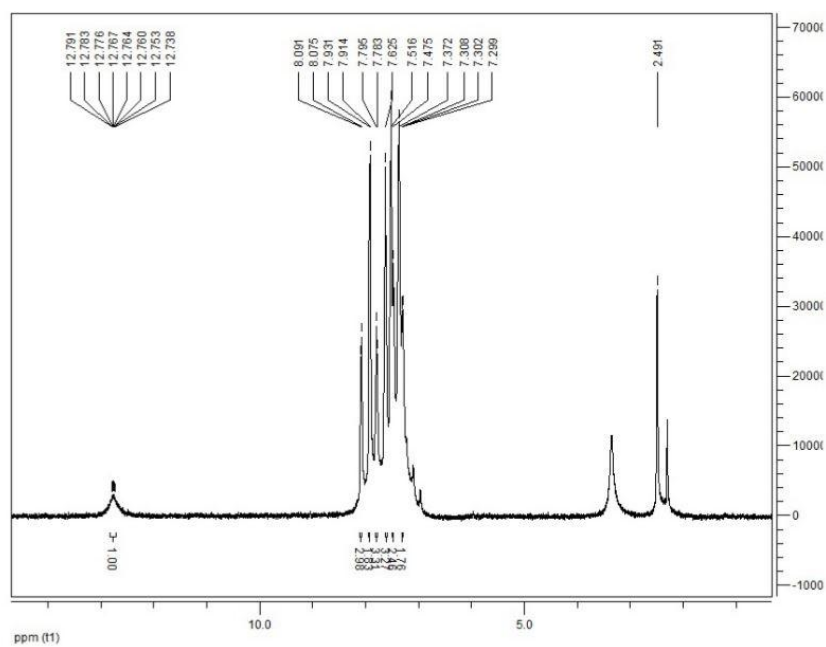
2,4,5-triphenyl-1H-imidazol (4a).....	3
2-(4-Bromo)-4,5-diphenyl-1H-imidazole (4b).....	4
2-(4-Fluoro)-4,5-diphenyl-1H-imidazole (4c).....	5
2-(2,4-Di-Chlorophenyl)-4,5-diphenyl-1H-imidazole (4d).....	6
2-(2-hydroxy phenyl)-4,5-diphenyl- 1H-imidazole (4e).....	7
2-(3-Methoxy phenyl)-4,5-diphenyl-1H-imidazole (4f).....	7
2-(4- Methoxy phenyl)-4,5-diphenyl-1H-imidazol (4g).....	8

2-(4-Chlorophenyl)-4,5-diphenyl- 1H-imidazole (4h).....	9
2-(3-Chlorophenyl)-4,5-diphenyl- 1H-imidazole (4i).....	10
2-(4-Nitro)-4,5-diphenyl-1H-imidazole (4j).....	11
2-(4-hydroxy phenyl)-4,5-diphenyl-1H-imidazole (4k).....	12
2-(2,3 Di-methoxy phenyl)-4,5-diphenyl-1H-imidazole (4l).....	13
4,5-diphenyl-2-p-tolyl-1H-imidazole (4m).....	14
2-(2,3-Di-Chlorophenyl)-4,5-diphenyl-1H-imidazole (4l).....	15

2,4,5-triphenyl-1H-imidazole (4a)

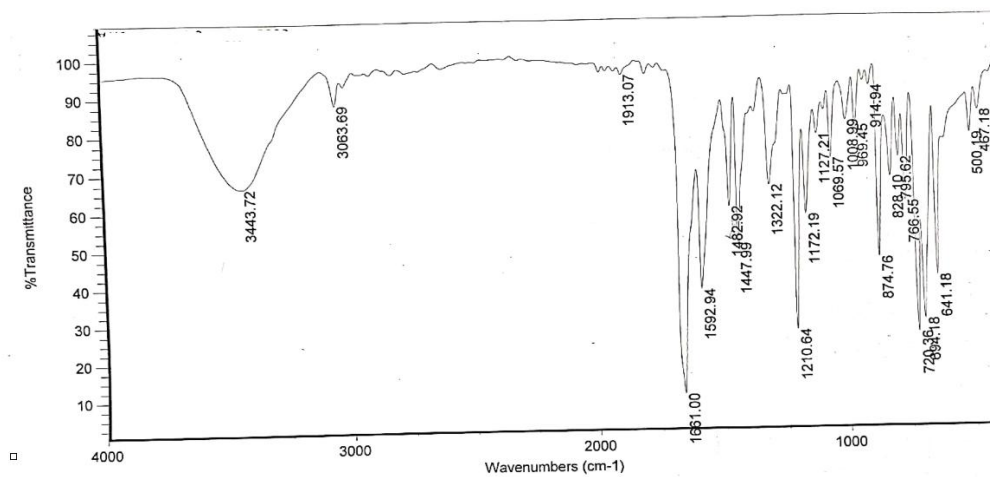


SFigure 1. FT-IR spectrum of 4a

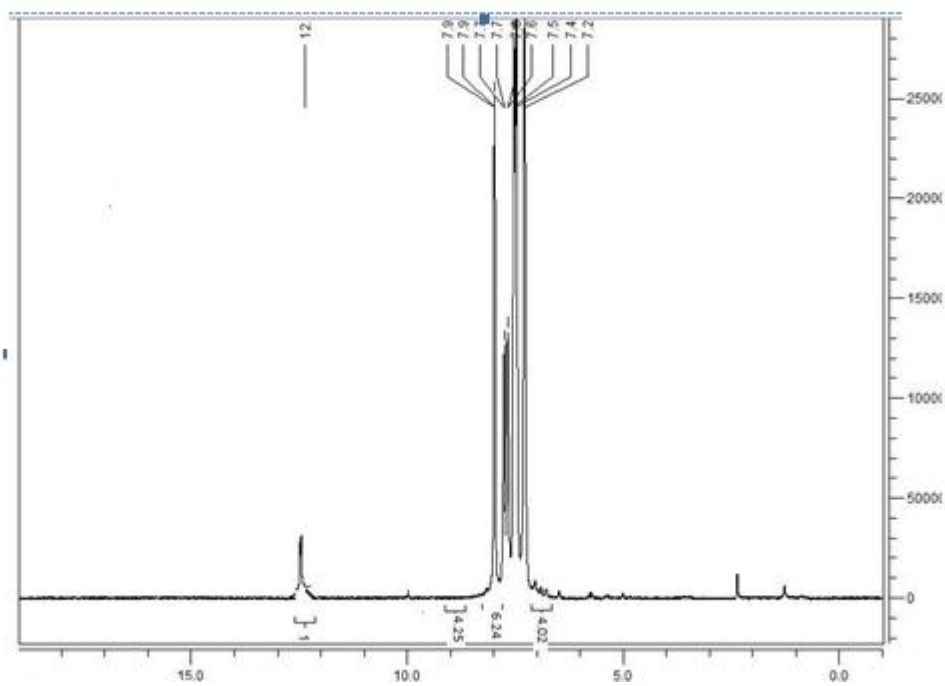


SFigure 2. ¹H NMR spectrum of 4a

2-(4-Bromo)-4,5-diphenyl-1H-imidazole (4b)



SFigure 3. FT-IR spectrum of 4b



SFigure 4. ¹H NMR spectrum of 4b

2-(4-Fluoro)-4,5-diphenyl-1H-imidazole (4c)

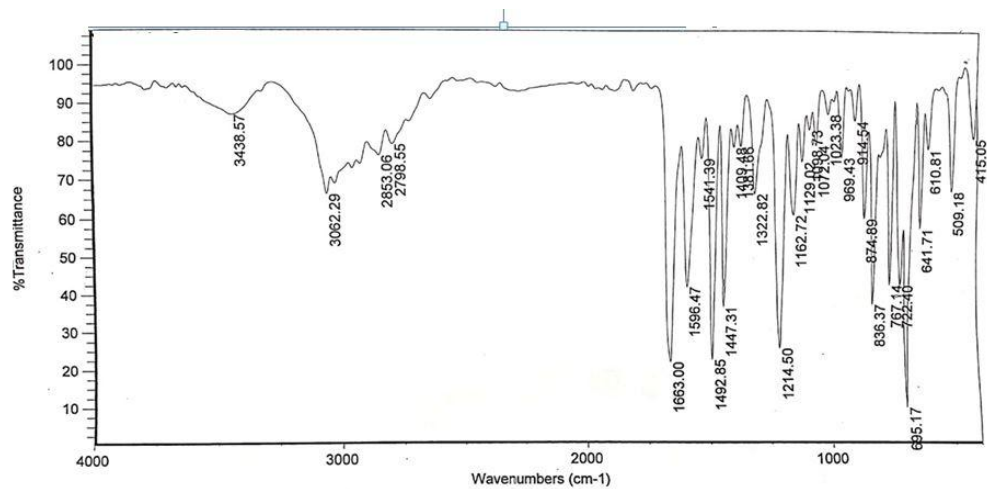


Figure 5. FT-IR spectrum of 4c

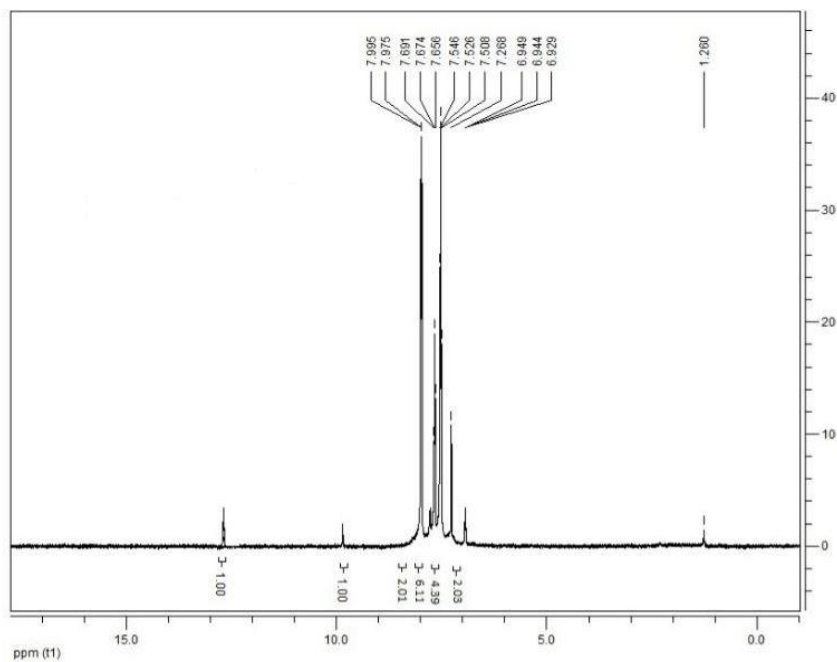


Figure 6. ¹H NMR spectrum of 4c

2-(2,4-Di-Chlorophenyl)-4,5-diphenyl-1H-imidazole (4d)

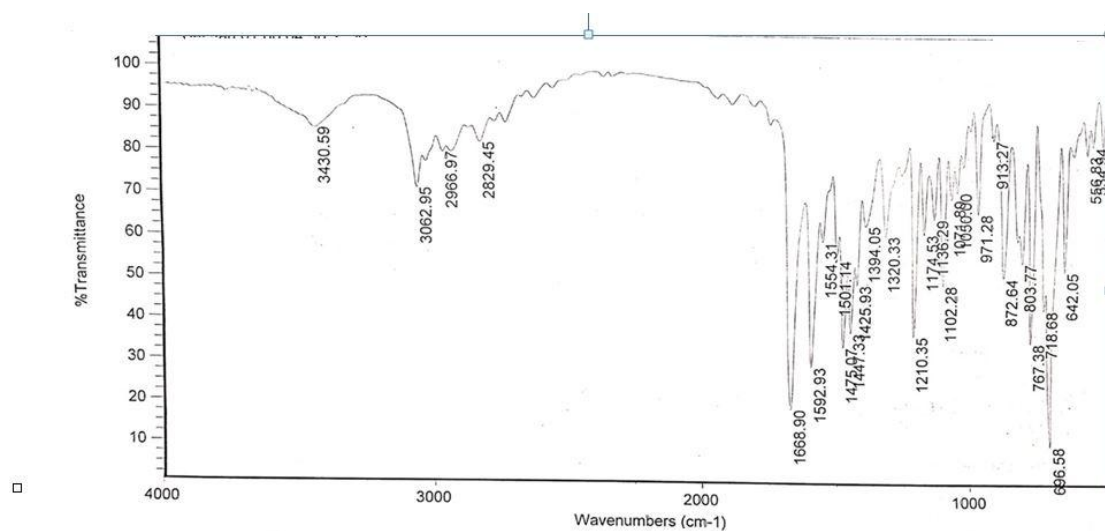


Figure 7. FT-IR spectrum of 4d

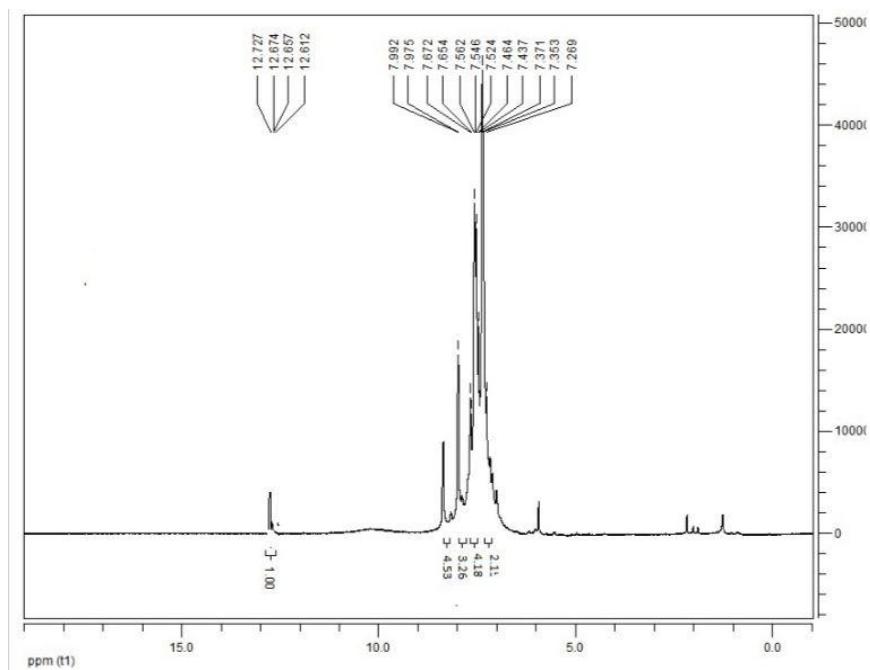
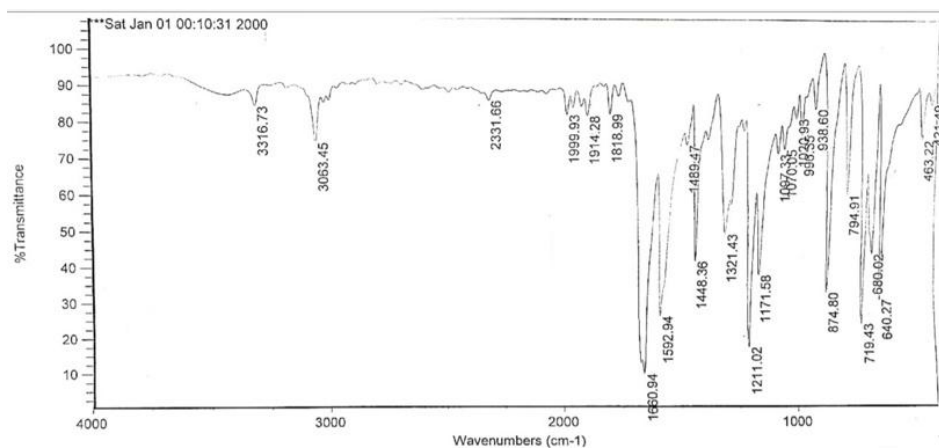
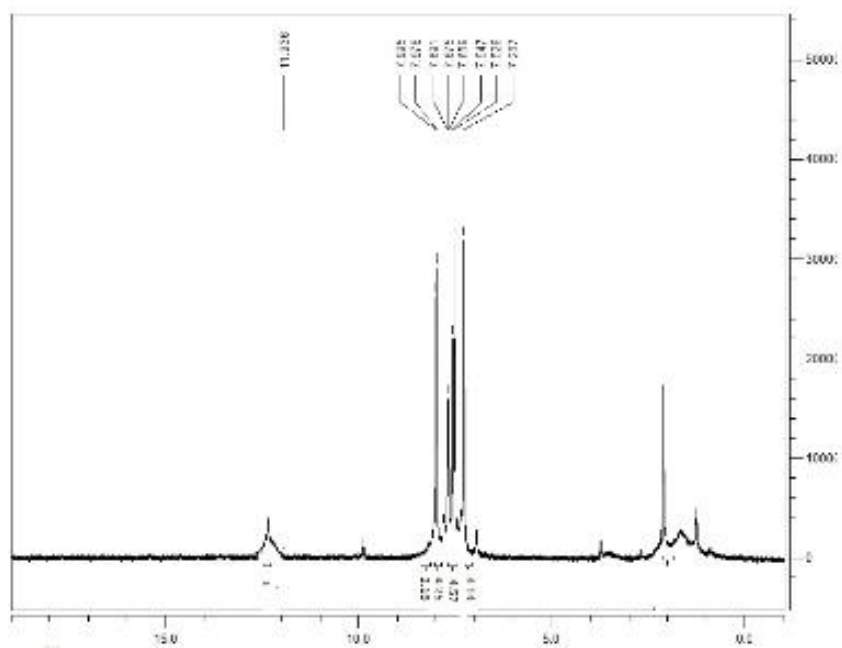


Figure 8. ¹H NMR spectrum of 4d

2-(2-hydroxy phenyl)-4,5-diphenyl- 1H-imidazole (4e)



SFigure 9. FT-IR spectrum of 4e



SFigure 10. ¹H NMR spectrum of 4e

2-(3-Methoxy phenyl)-4,5-diphenyl-1H-imidazole (4f)

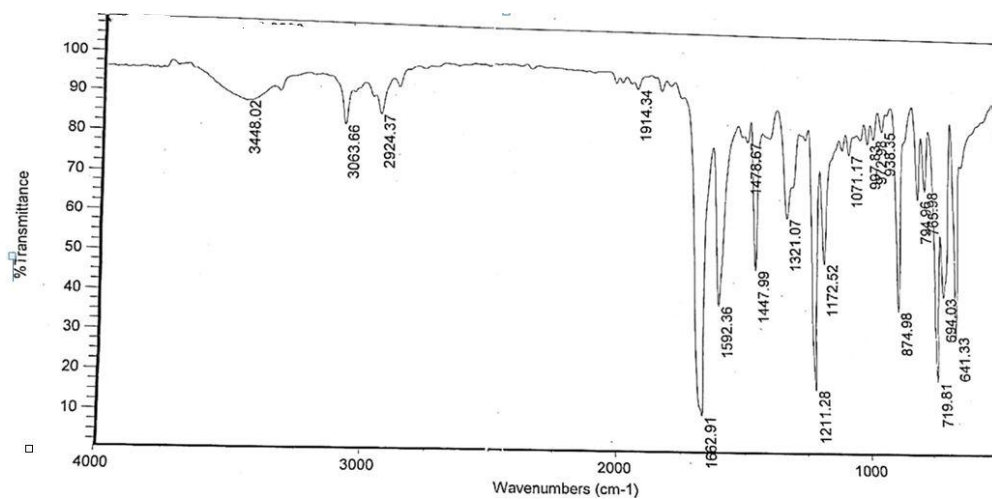


Figure 10. FT-IR spectrum of 4f

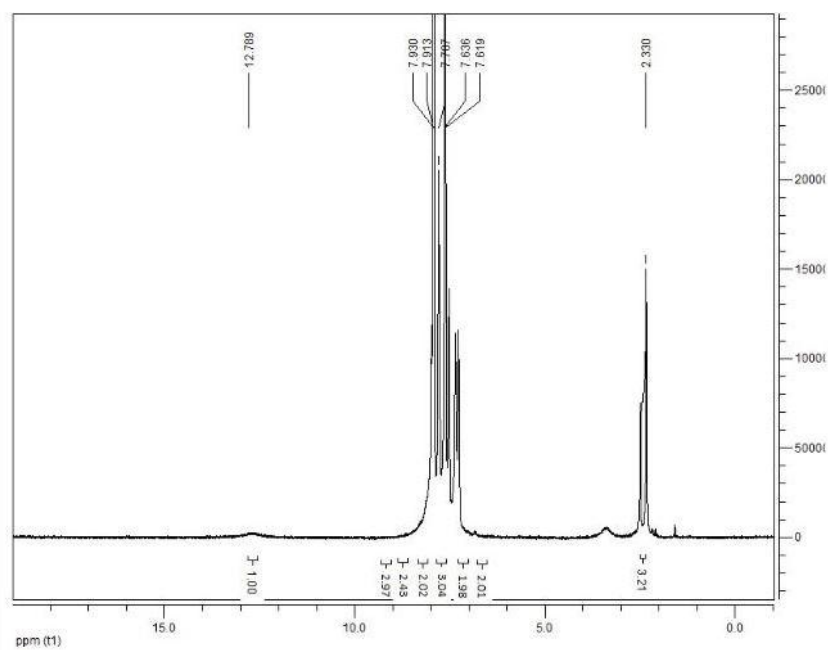
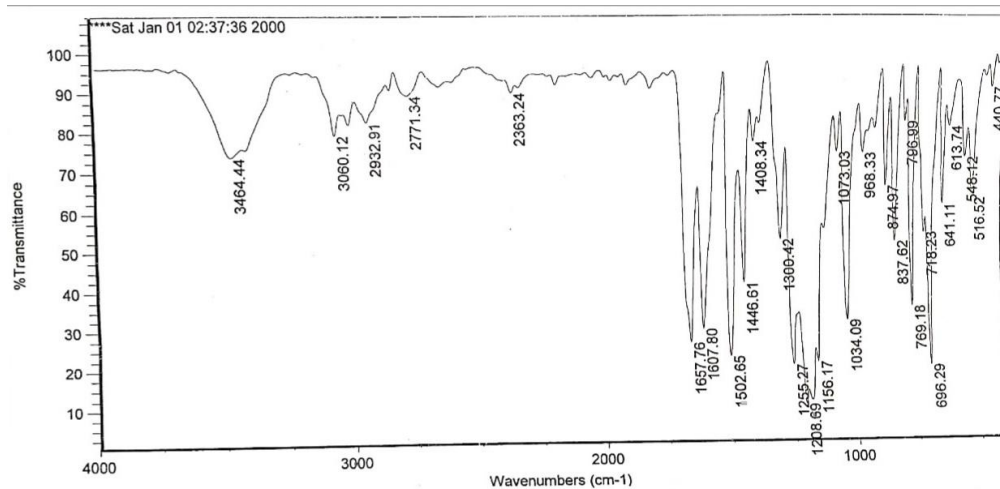
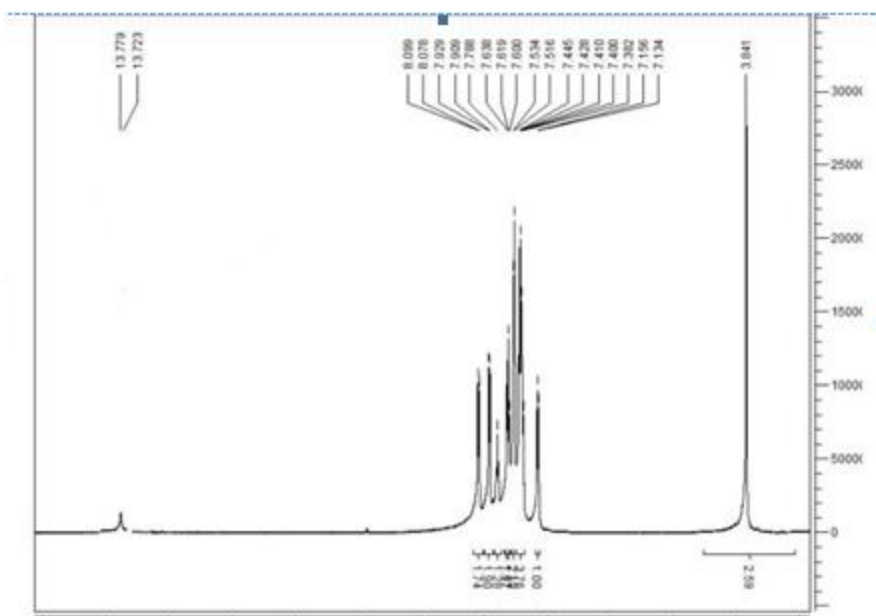


Figure 11. ¹H NMR spectrum of 4f

2-(4-Methoxy phenyl)-4,5-diphenyl-1H-imidazole (4g)



SFigure 11. FT-IR spectrum of 4g



SFigure 12. ¹H NMR spectrum of 4g

2-(4-Chlorophenyl)-4,5-diphenyl-1H-imidazole (4h)

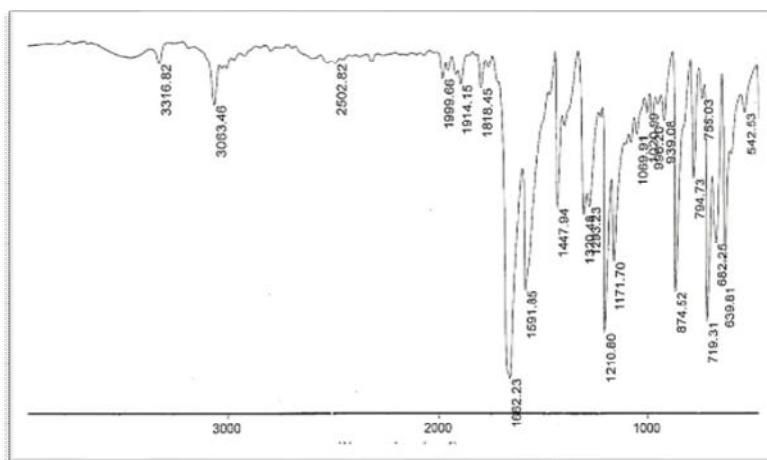


Figure 13. FT-IR spectrum of 4h

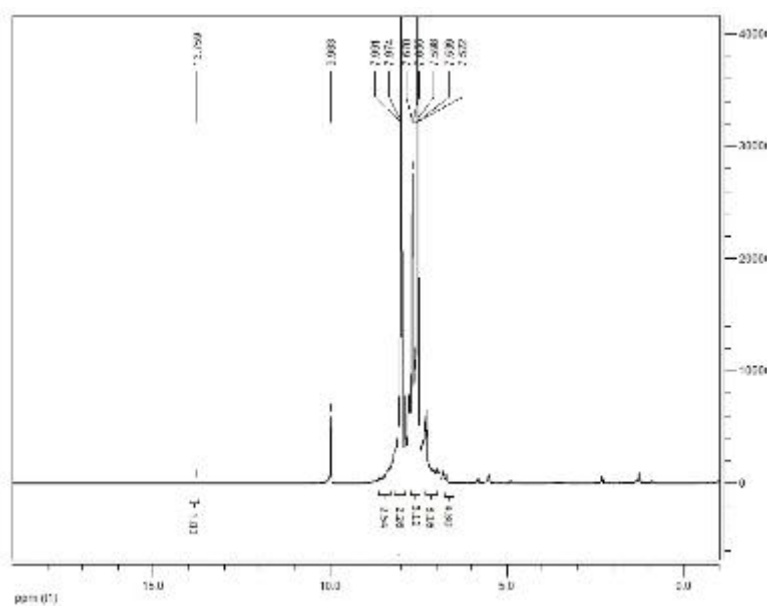


Figure 14. ¹H NMR spectrum of 4h

(3-Chlorophenyl)-4,5-diphenyl- 1H-imidazole (4i)

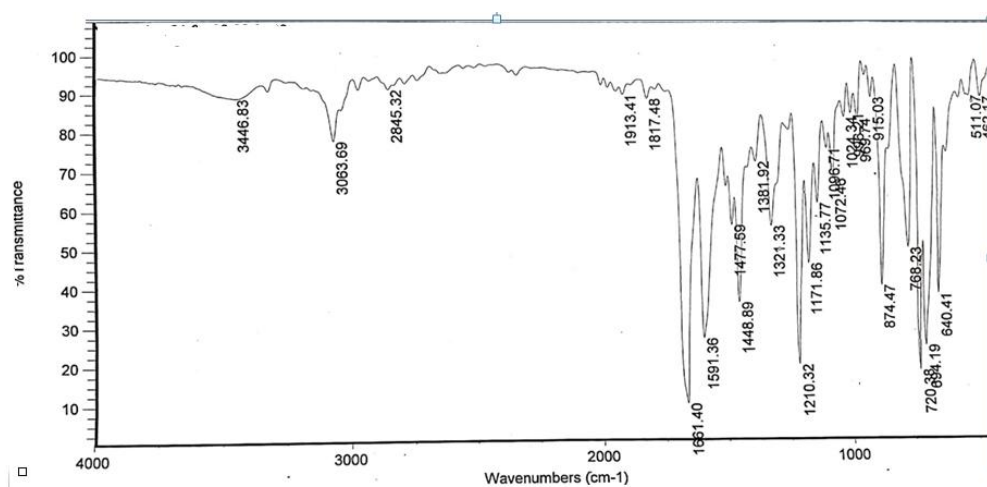


Figure 15. FT-IR spectrum of 4i

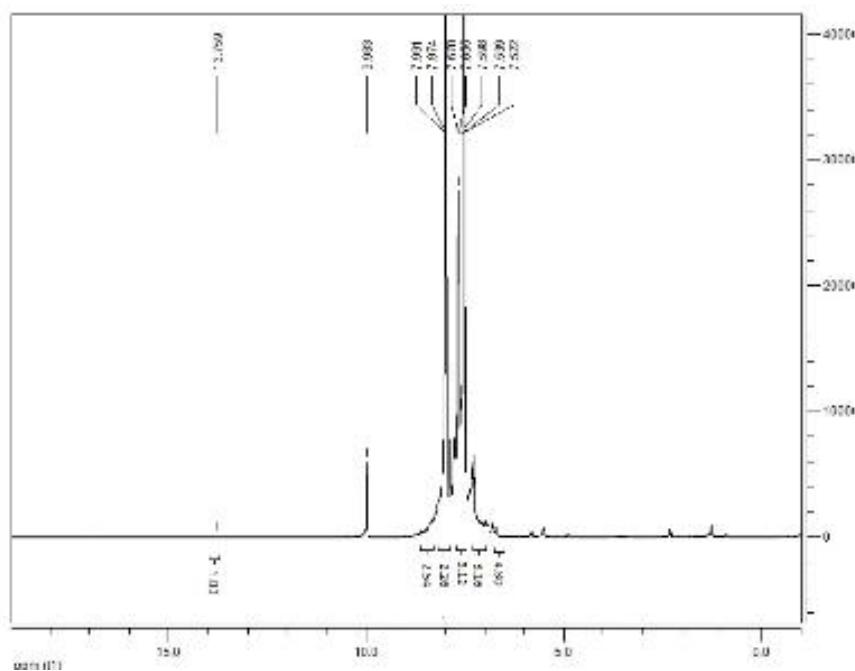


Figure 16. ¹H NMR spectrum of 4i

2-(4-Nitro)-4,5-diphenyl-1H-imidazole (4j)

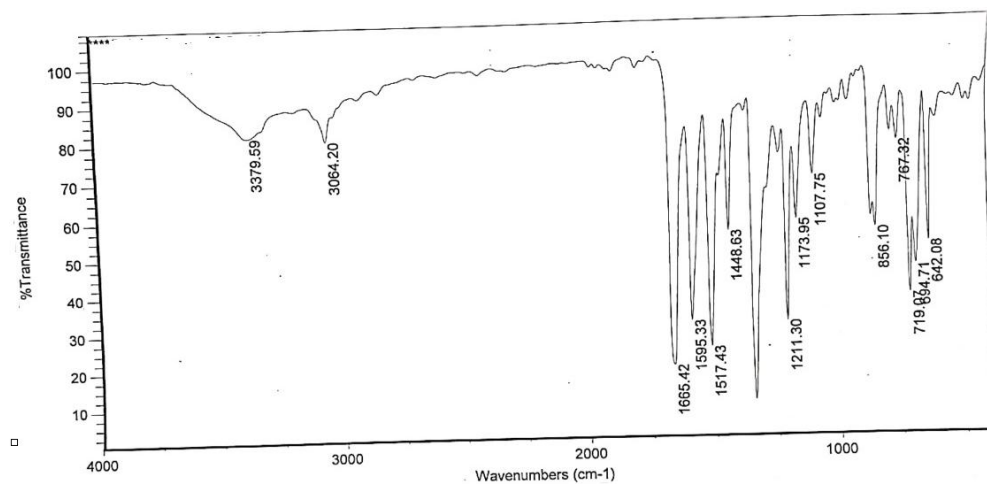
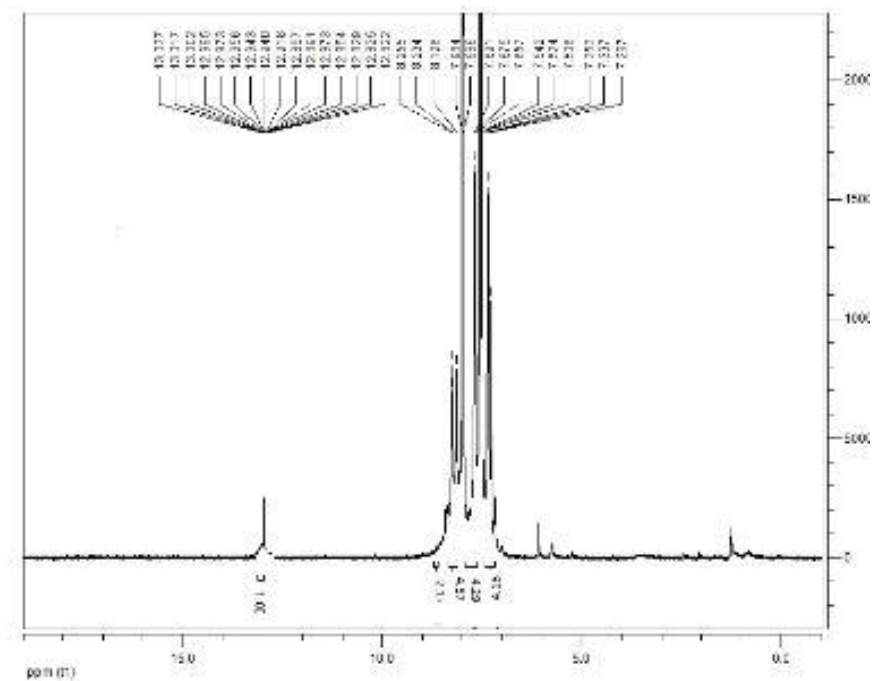
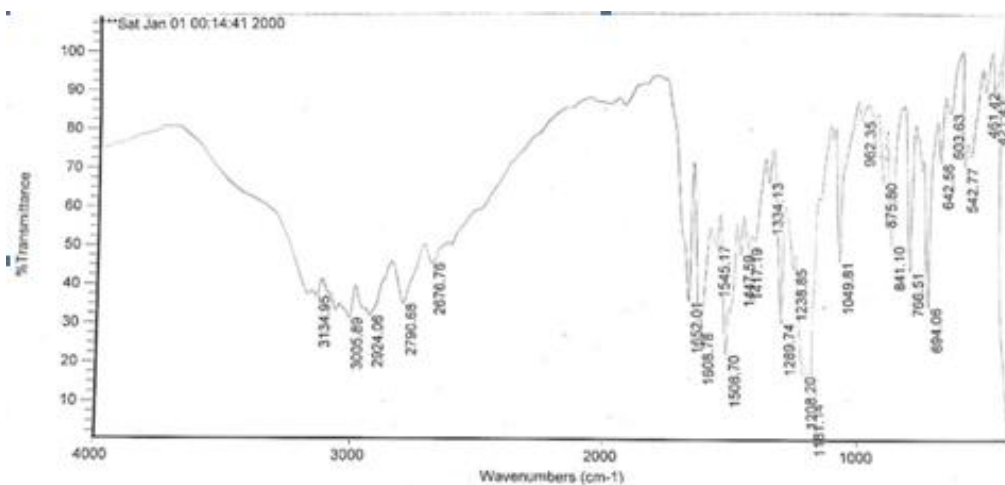


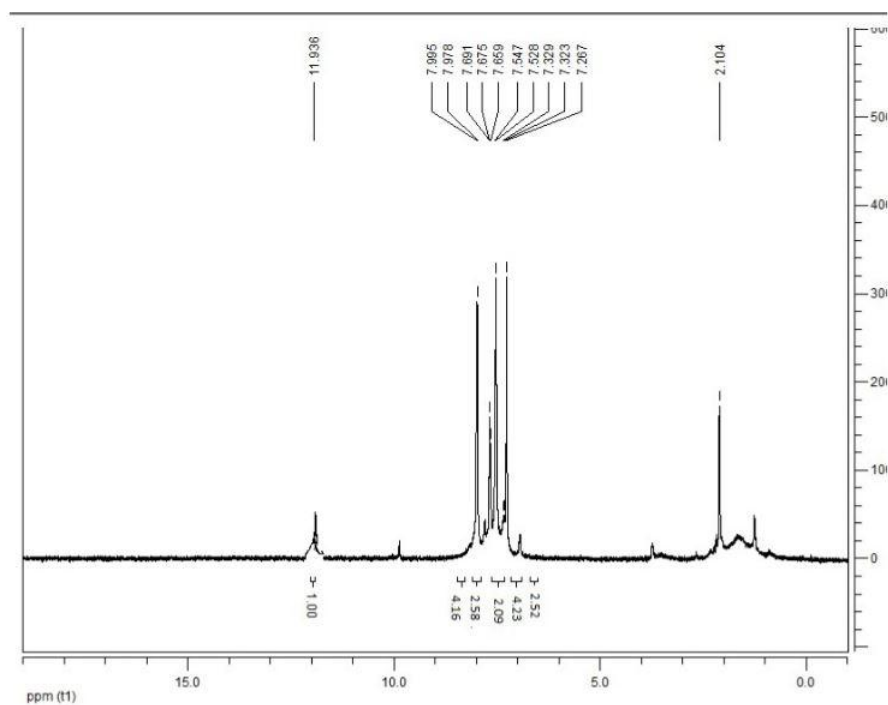
Figure 17. FT-IR spectrum of 4j



2-(4-hydroxy phenyl)-4,5-diphenyl-1H-imidazole (4k)



SFigure 19. FT-IR spectrum of 4k



SFigure 20. ¹H NMR spectrum of 4k

2-(2,3 Di-methoxy phenyl)-4,5-diphenyl-1H-imidazole (4l)

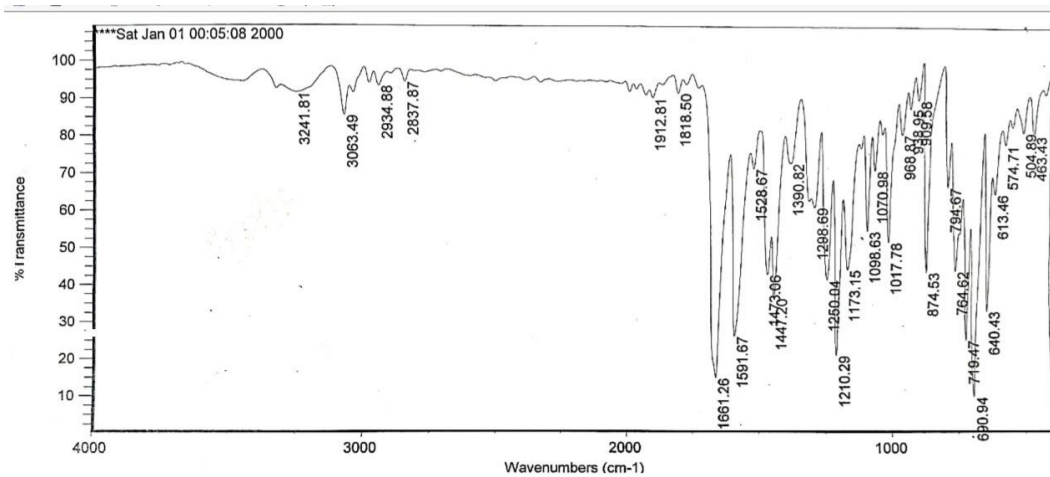


Figure 21. FT-IR spectrum of 4l

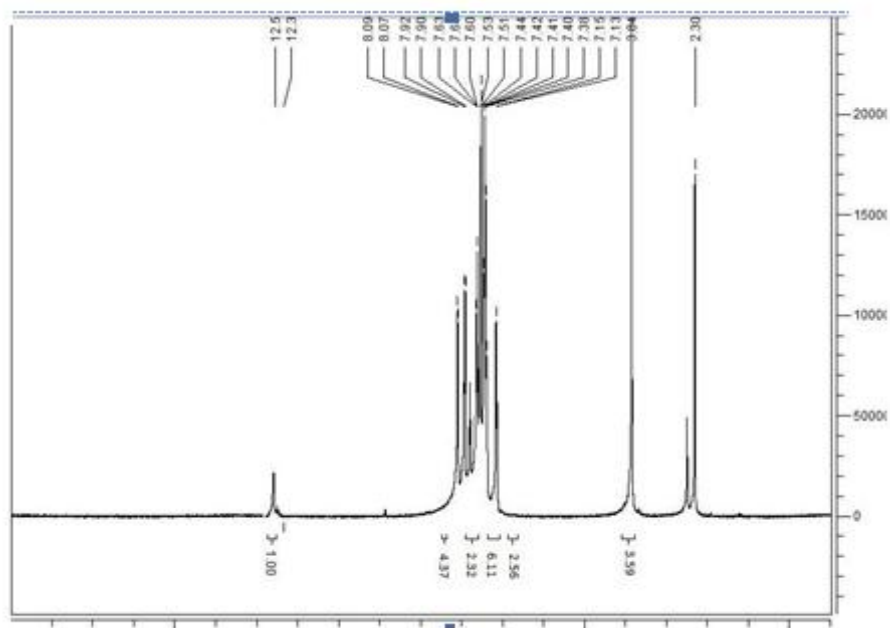
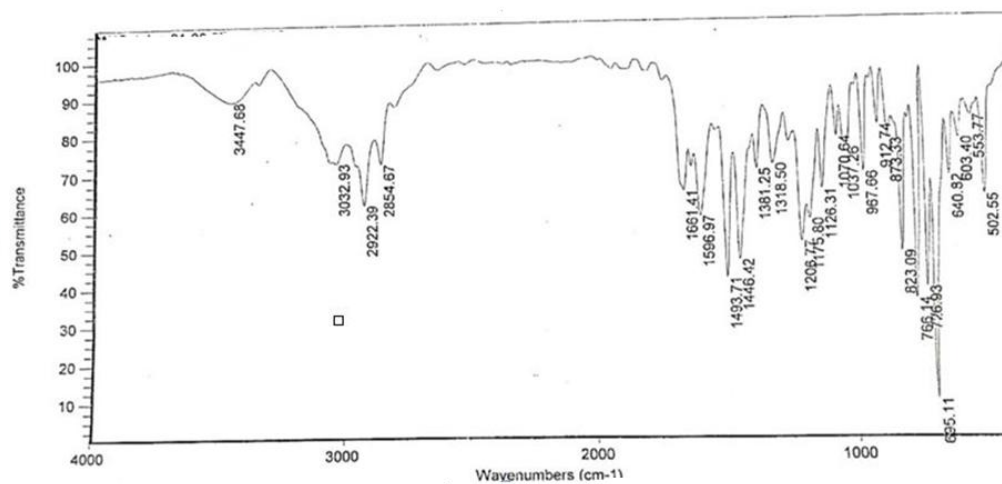
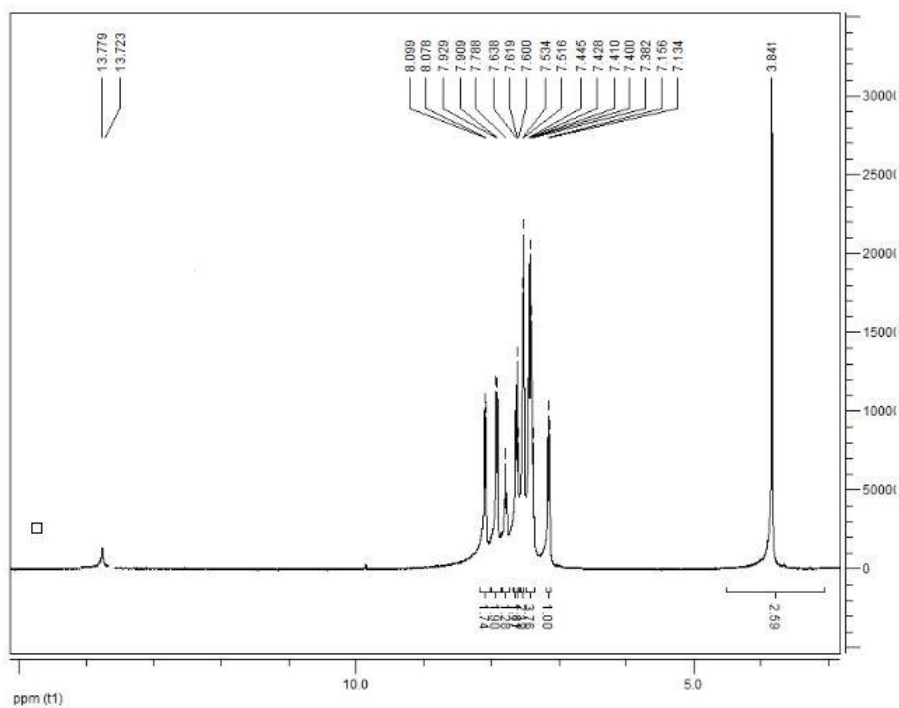


Figure 22. ¹H NMR spectrum of 4l

4,5-diphenyl-2-p-tolyl-1H-imidazole (4m)



SFigure 23. FT-IR spectrum of 2m



SFigure 24. ¹H NMR spectrum of 4m

2-(2,3-Di-Chlorophenyl)-4,5-diphenyl-1H-imidazole (4n)

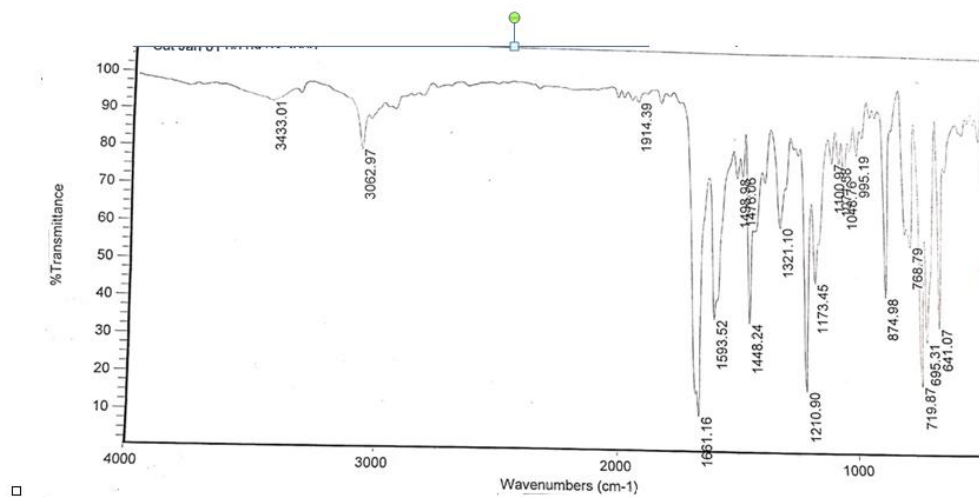


Figure 25. FT-IR spectrum of 4n