

# Synthesis of a New Series of Nitrogen/Sulfur Heterocycles by Linking Four Rings: Indole; 1,2,4-Triazole; Pyridazine; and Quinoxaline

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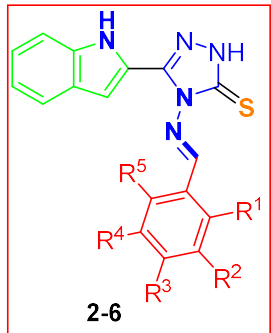
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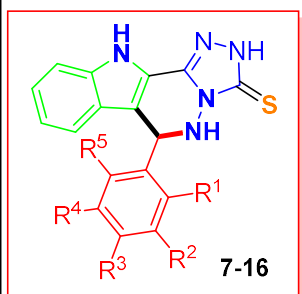
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Tel.: +966-11467-5901 (A.B.); Fax: +966-11467-5992 (A.B.).

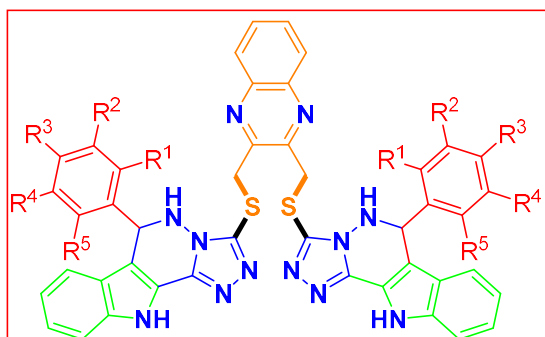
# NMR Spectra



- 2  $R^1 = R^2 = R^3 = R^4 = R^5 = H$
- 3  $R^1 = R^2 = H, R^3 = F, R^4 = R^5 = H$
- 4  $R^1 = R^3 = R^4 = R^5 = H, R^2 = Br$
- 5  $R^1 = R^2 = H, R^3 = CH_3, R^4 = R^5 = H$
- 6  $R^1 = OH, R^2 = OCH_3, R^3 = R^4 = R^5 = H$



- 7  $R^1 = R^2 = R^3 = R^4 = R^5 = H$
- 8  $R^1 = R^2 = H, R^3 = F, R^4 = R^5 = H$
- 9  $R^1 = R^3 = R^4 = R^5 = H, R^2 = Br$
- 10  $R^1 = R^2 = H, R^3 = CH_3, R^4 = R^5 = H$
- 11  $R^1 = R^2 = R^3 = OCH_3, R^4 = R^5 = H$
- 12  $R^1 = R^2 = H, R^3 = Cl, R^4 = R^5 = H$
- 13  $R^1 = R^2 = H, R^3 = Br, R^4 = R^5 = H$
- 14  $R^1 = R^4 = R^5 = H, R^2 = R^3 = OH,$
- 15  $R^1 = R^4 = R^5 = H, R^2 = OCH_3, R^3 = OH$
- 16  $R^1 = OH, R^2 = OCH_3, R^3 = R^4 = R^5 = H$



- 19  $R^1 = R^2 = R^3 = R^4 = R^5 = H$
- 20  $R^1 = R^2 = H, R^3 = F, R^4 = R^5 = H$
- 21  $R^1 = R^3 = R^4 = R^5 = H, R^2 = Br$
- 22  $R^1 = R^2 = R^4 = R^5 = H, R^3 = CH_3,$
- 23  $R^1 = R^2 = R^3 = OCH_3, R^4 = R^5 = H$
- 24  $R^1 = R^2 = H, R^3 = Cl, R^4 = R^5 = H$
- 25  $R^1 = R^2 = R^4 = R^5 = H, R^3 = Br$

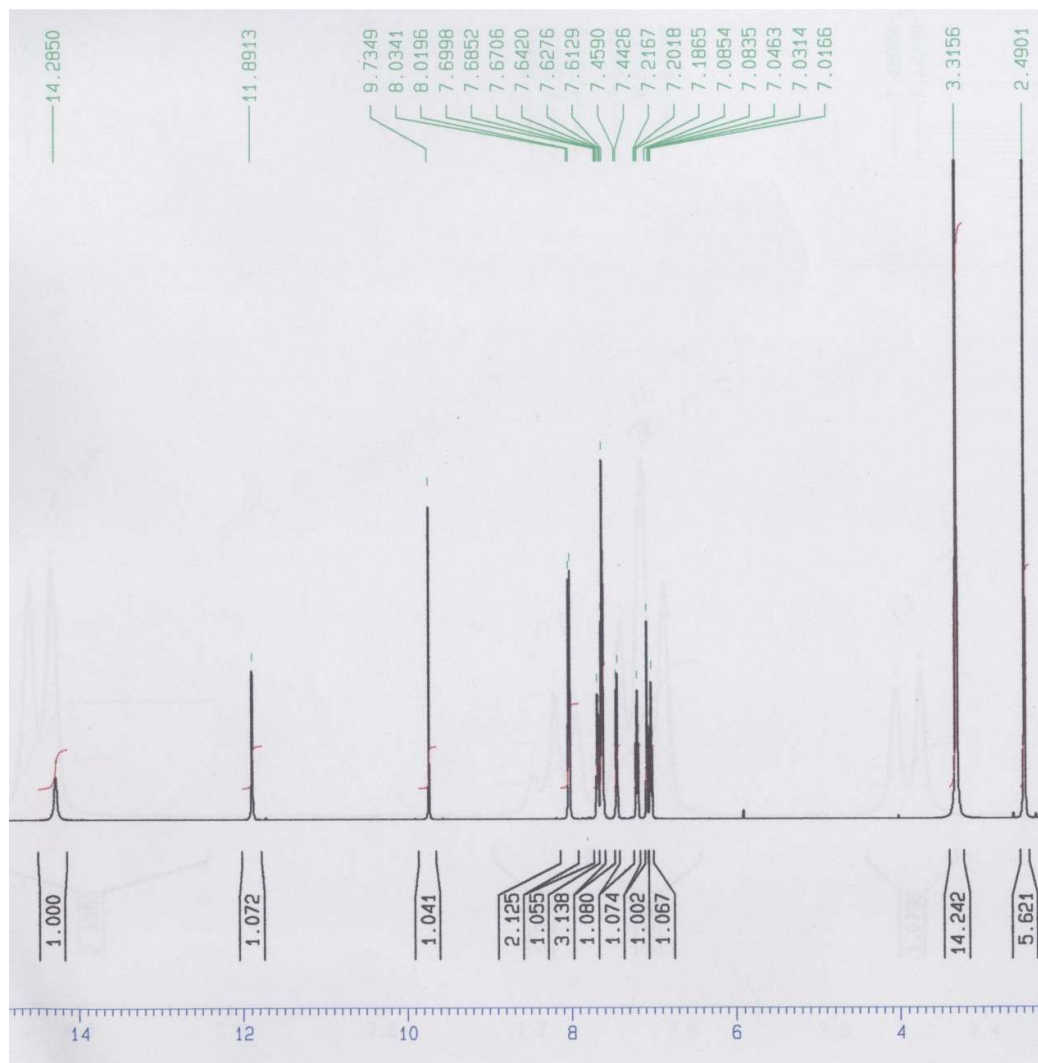
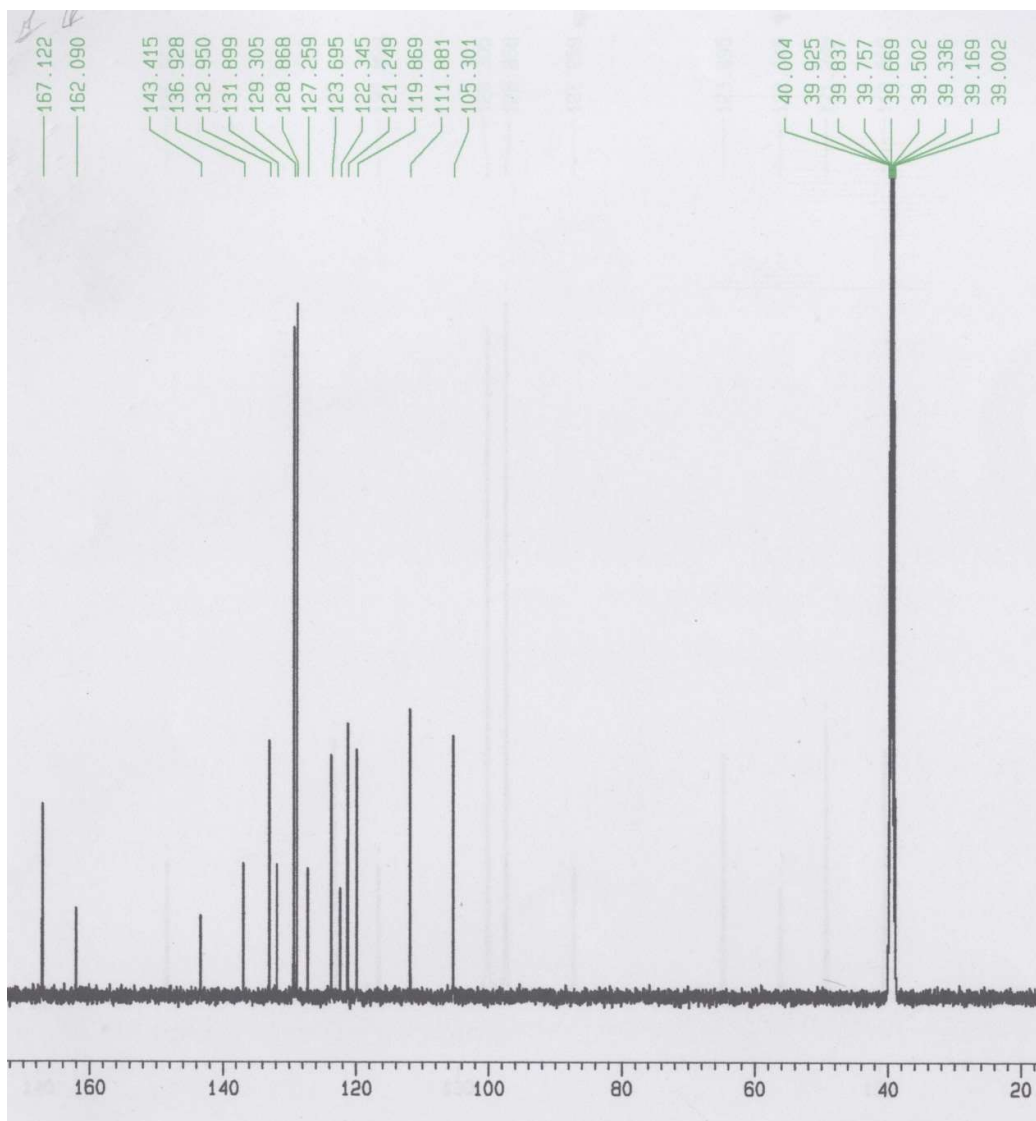


Figure S1. <sup>1</sup>H NMR of 2



**Figure S2.**  $^{13}\text{C}$  NMR of **2**

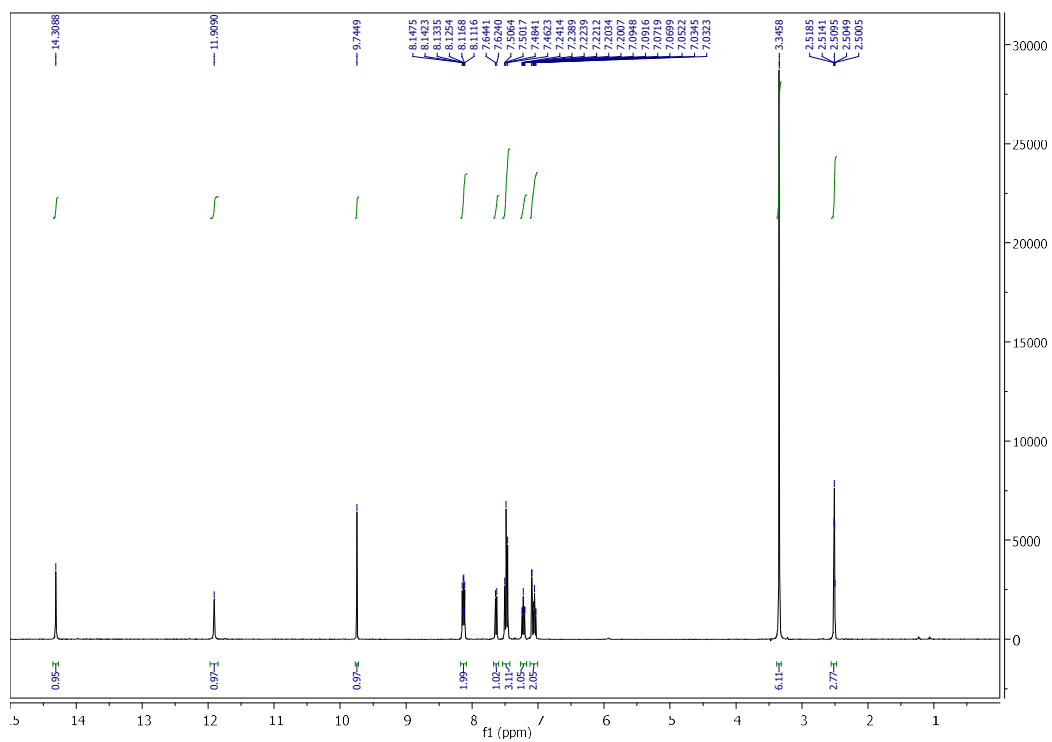


Figure S3.  $^1\text{H}$  NMR of 3

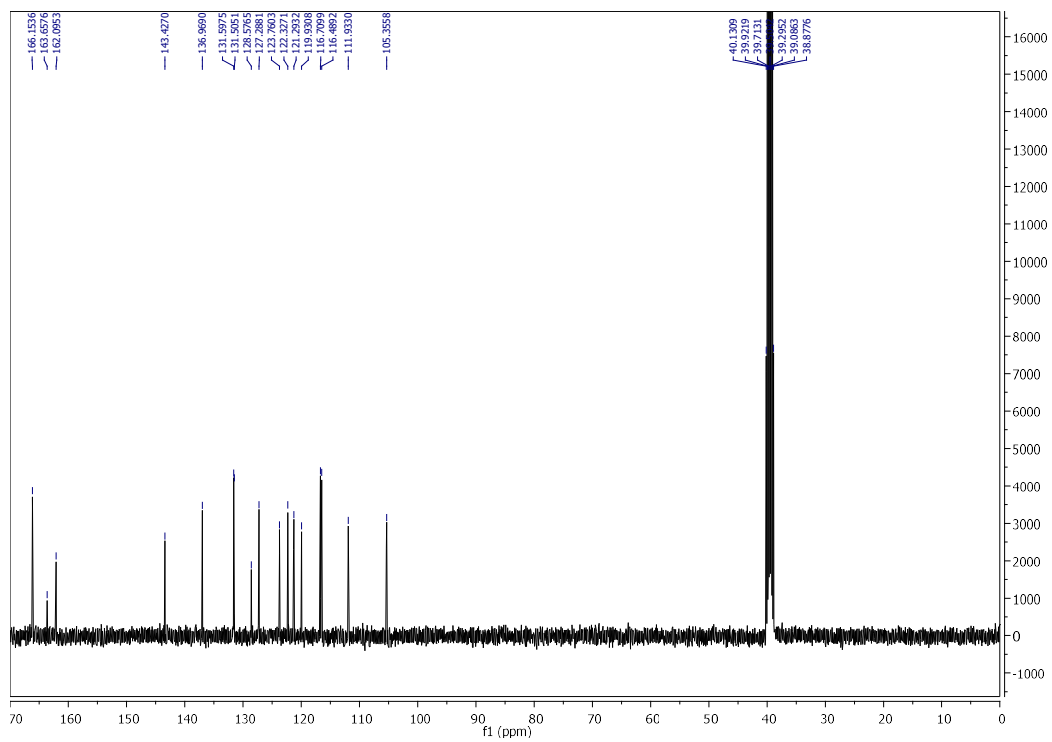


Figure S4.  $^{13}\text{C}$  NMR of 3

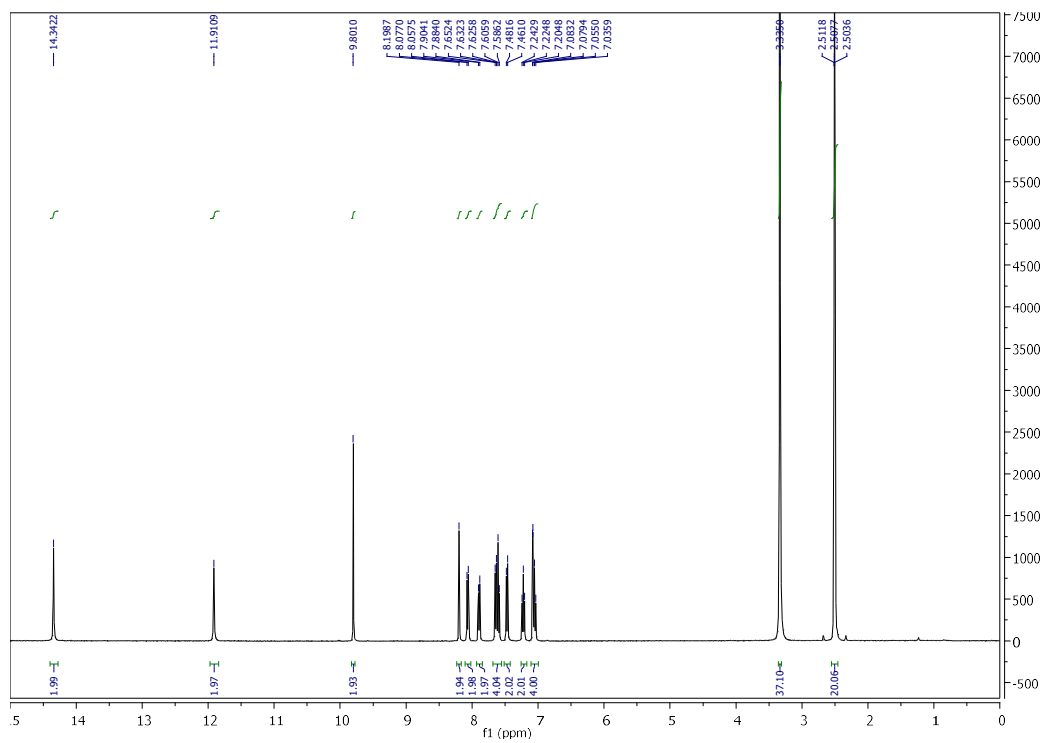


Figure S5.  $^1\text{H}$  NMR of 4

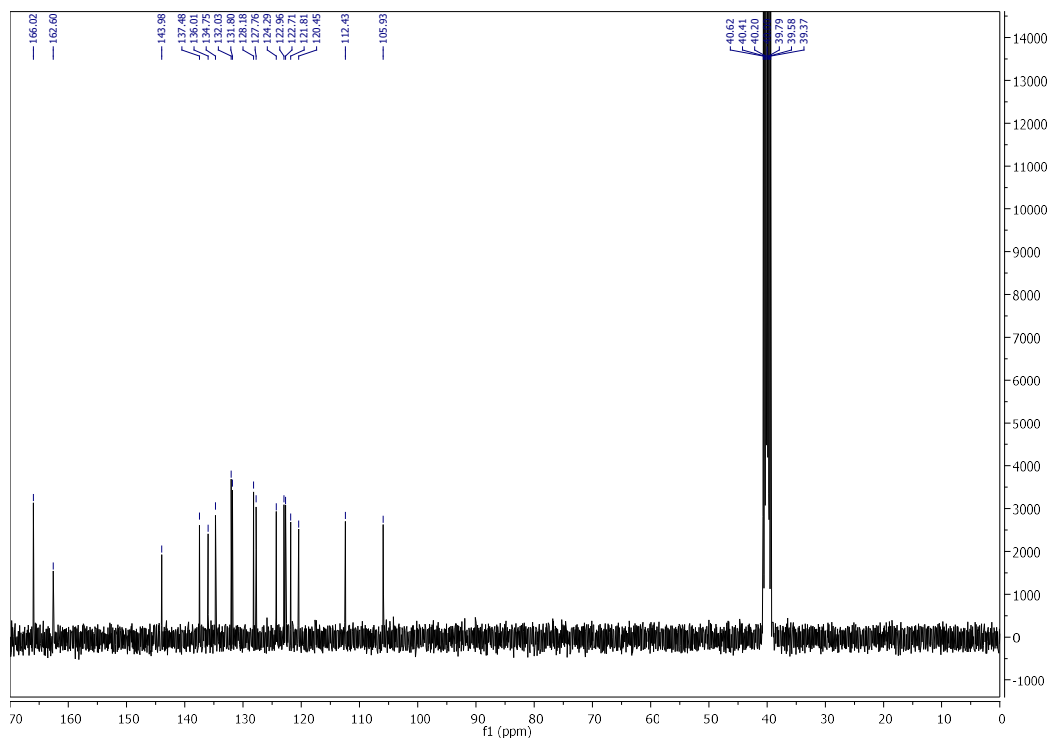


Figure S6.  $^{13}\text{C}$  NMR of 4

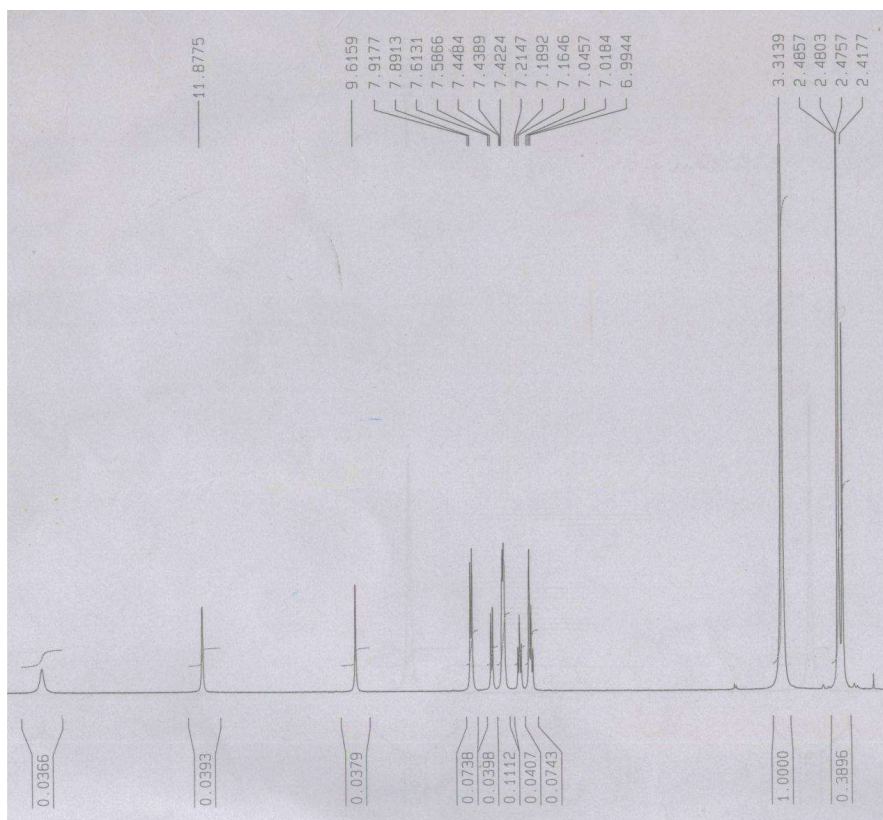


Figure S7.  $^1\text{H}$  NMR of 5

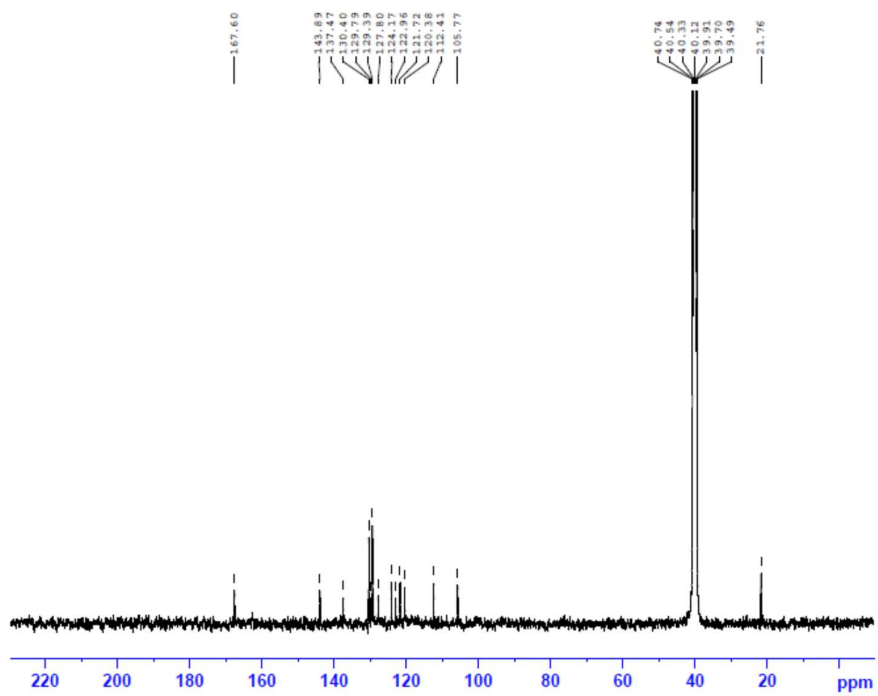


Figure S8.  $^{13}\text{C}$  NMR of 5



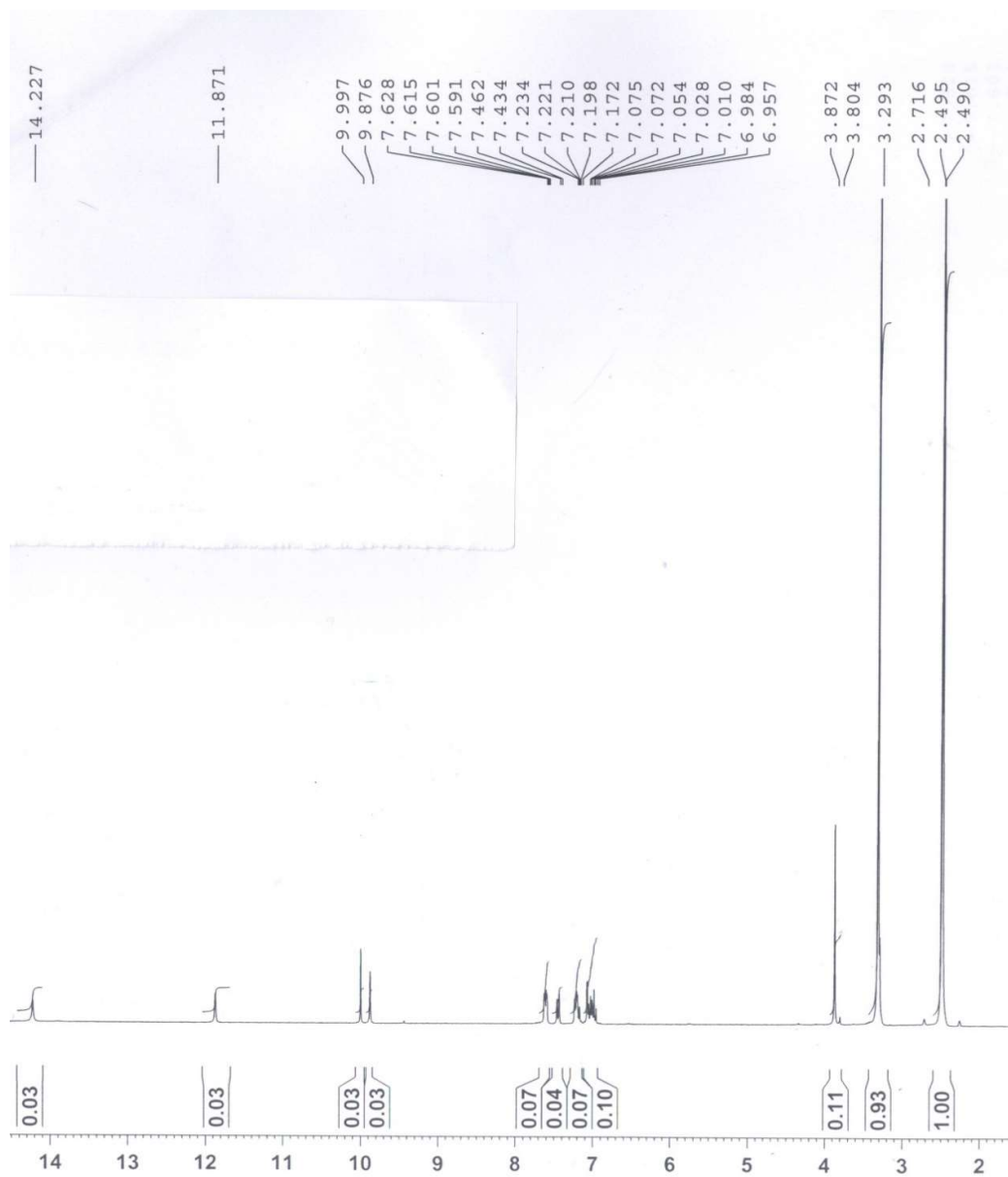


Figure S9.  $^1\text{H}$  NMR of **6**

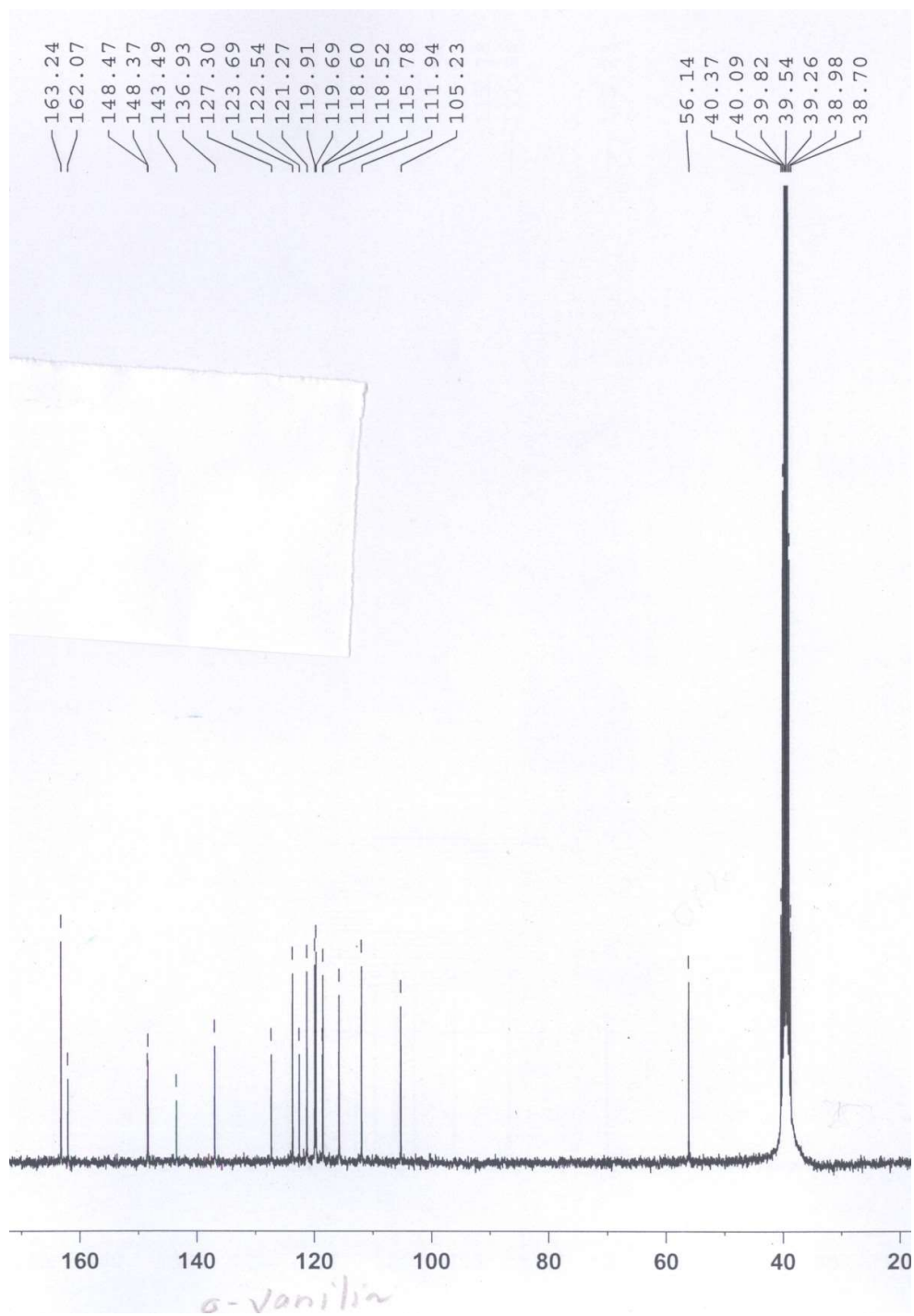


Figure S10.  $^{13}\text{C}$  NMR of 6

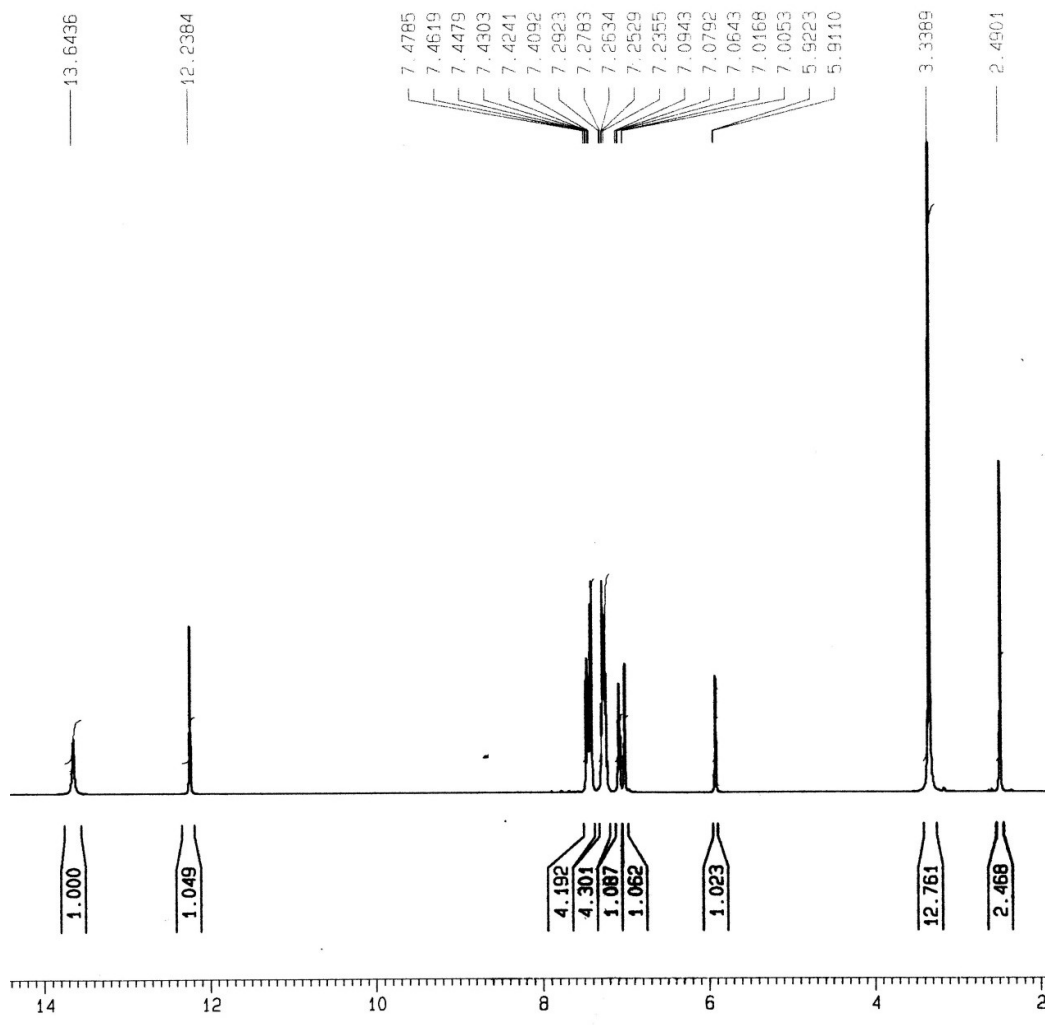


Figure S11. <sup>1</sup>H NMR of 7

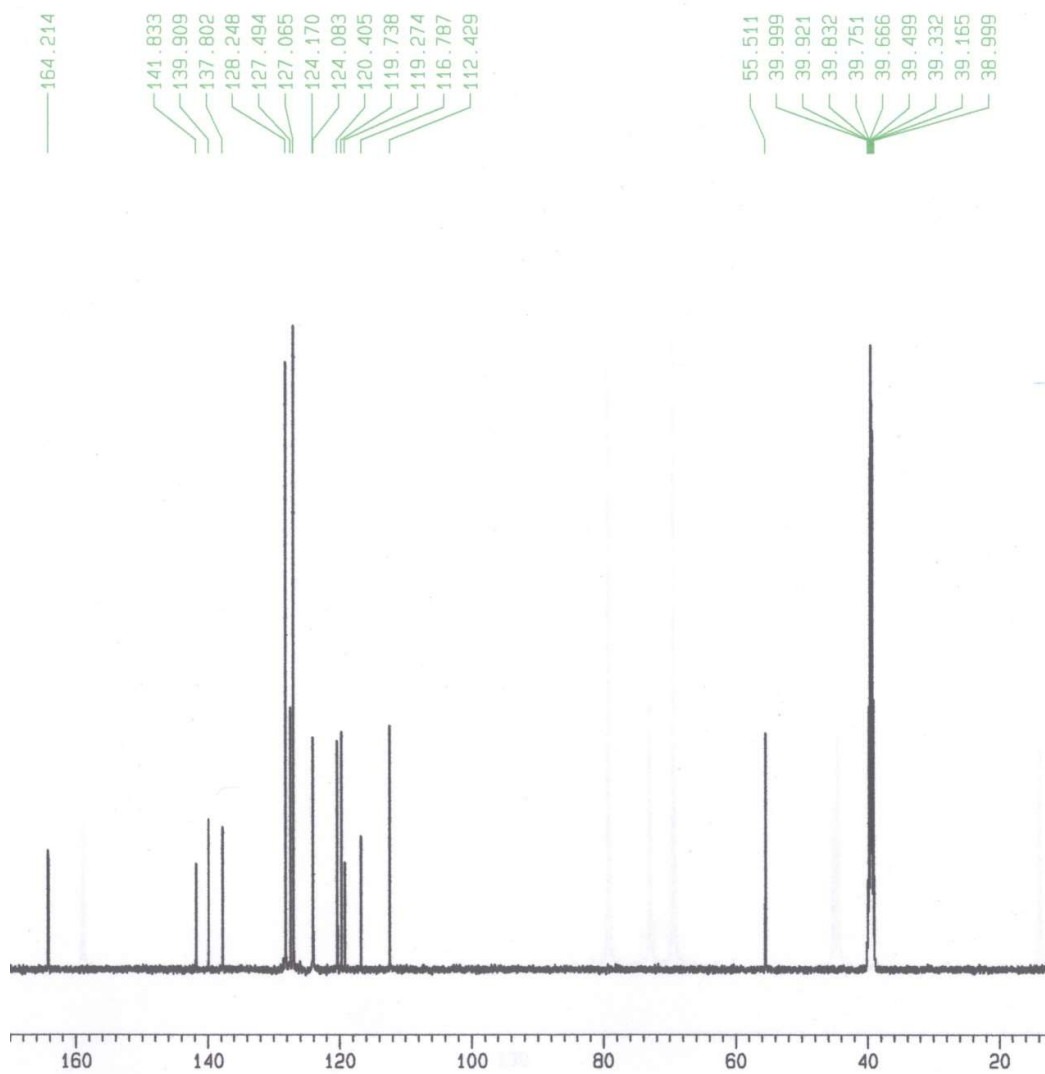


Figure S12.  $^{13}\text{C}$  NMR of 7

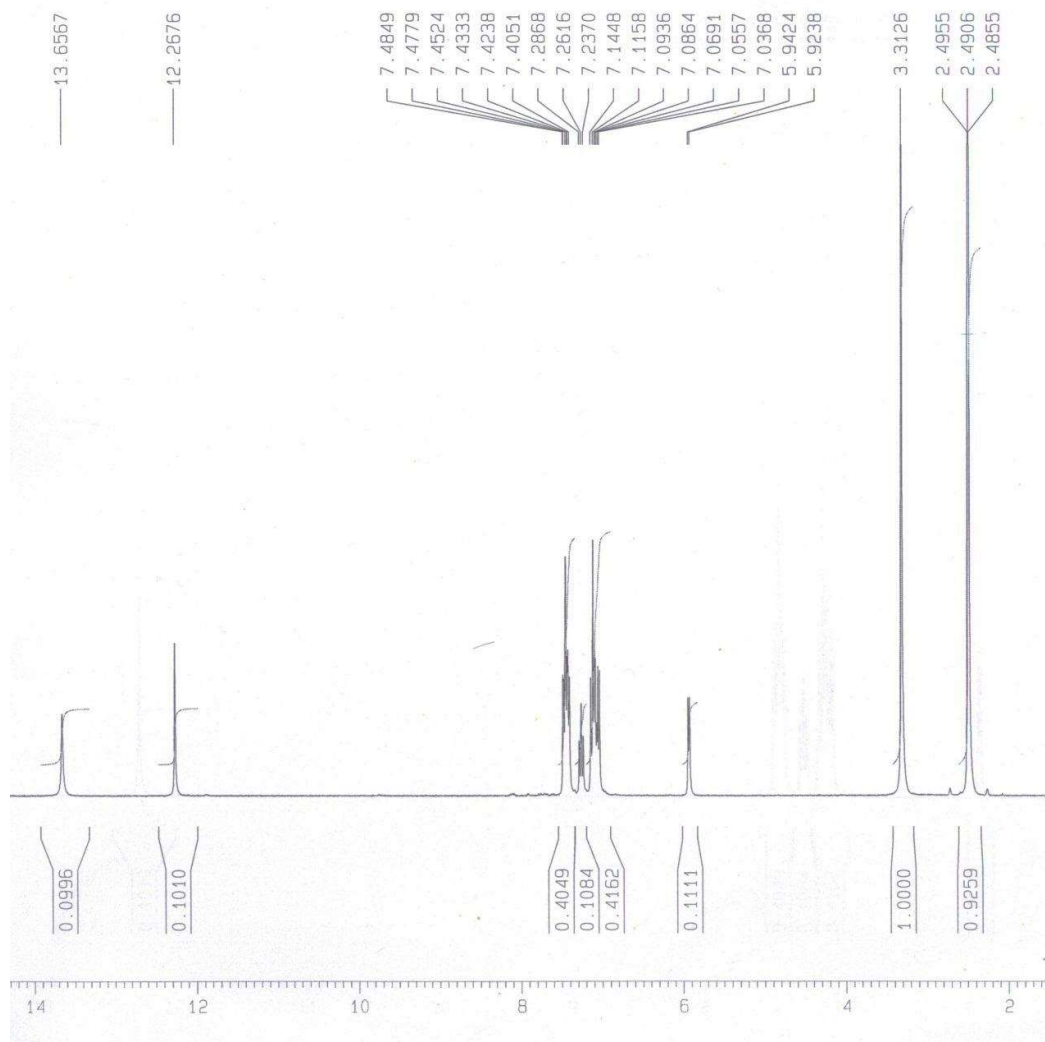


Figure S13.  $^1\text{H}$  NMR of **8**

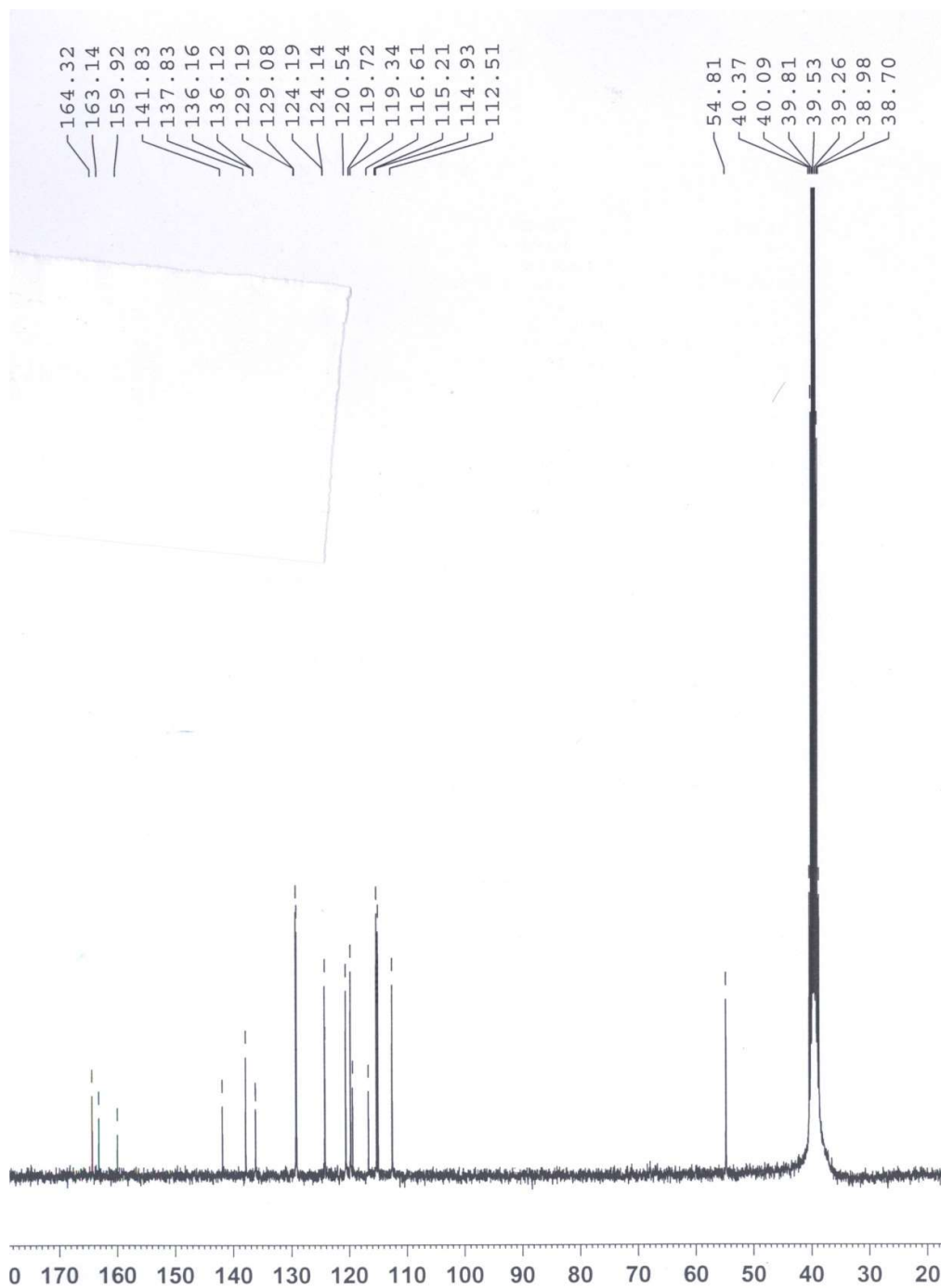


Figure S14.  $^{13}\text{C}$  NMR of **8**

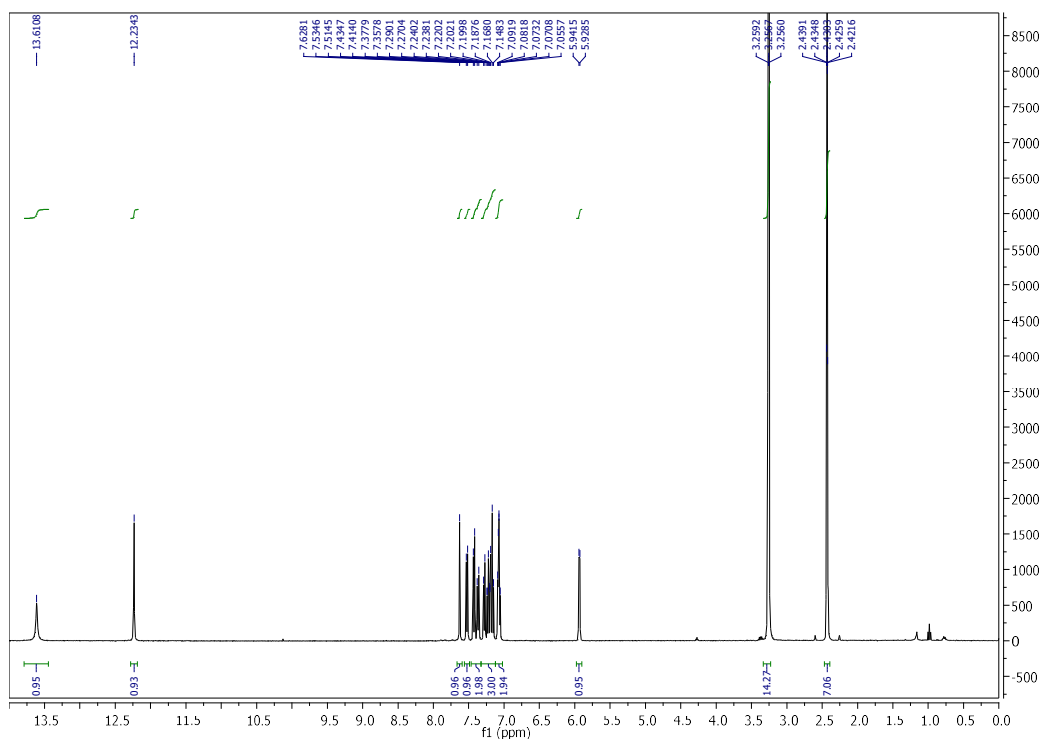


Figure S15.  $^1\text{H}$  NMR of 9

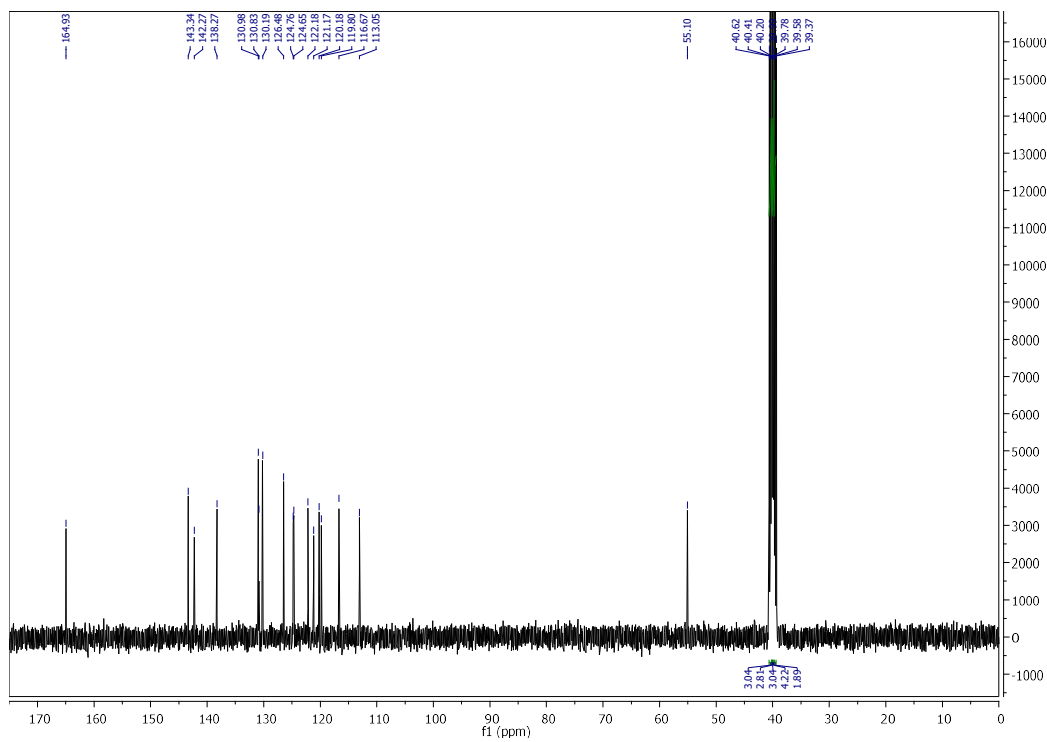


Figure S16.  $^{13}\text{C}$  NMR of 9

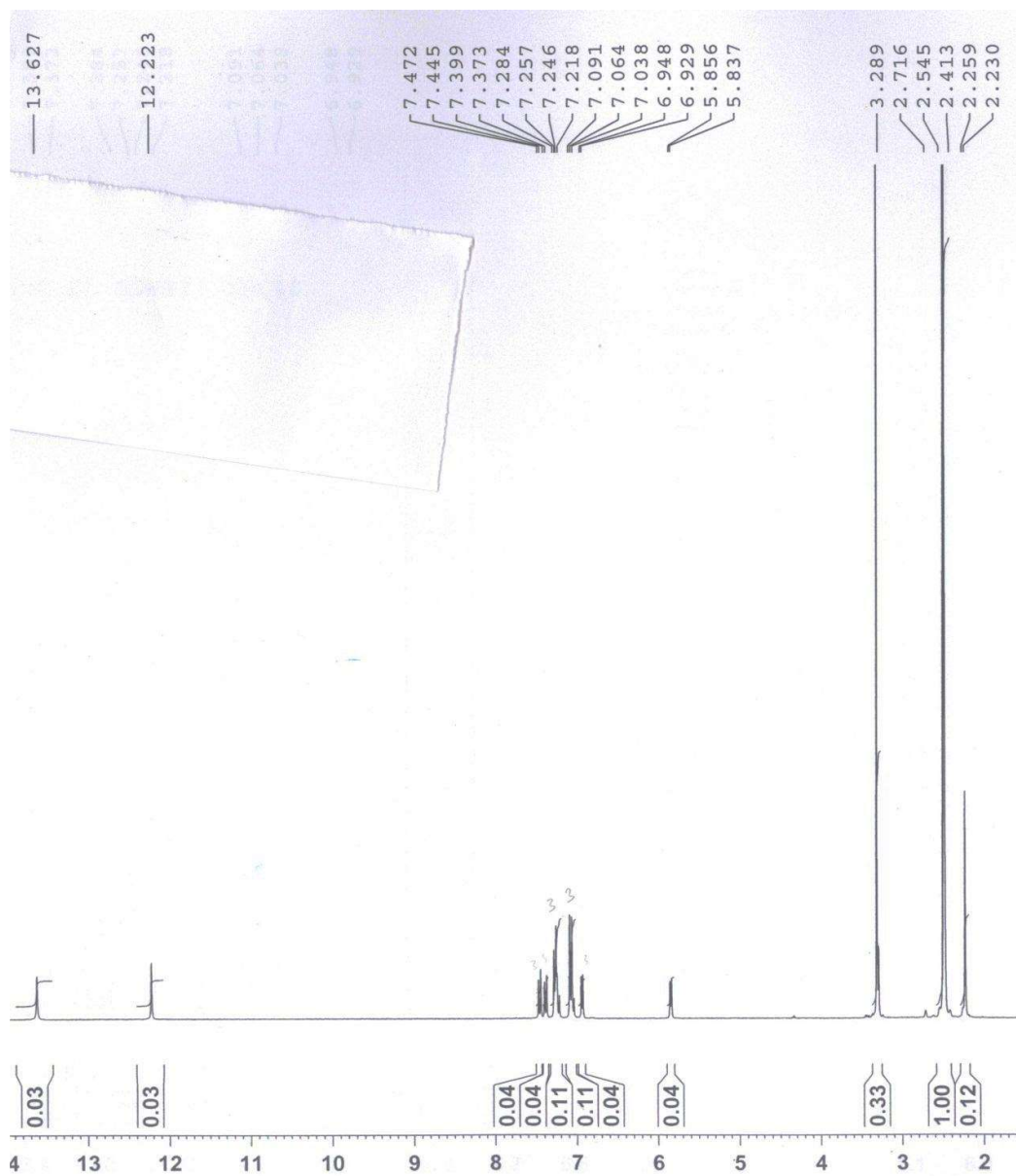


Figure S17.  $^1\text{H}$  NMR of 10





Figure S18.  $^{13}\text{C}$  NMR of 10

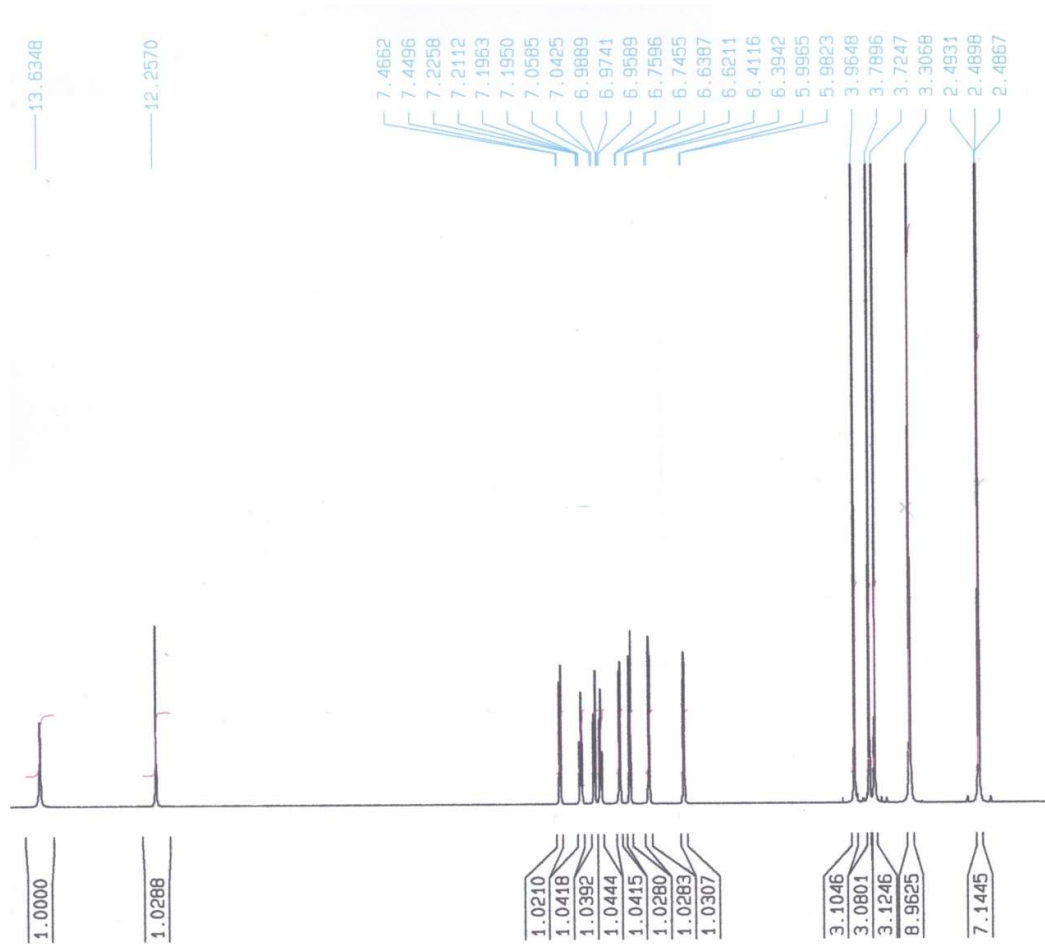


Figure S19. <sup>1</sup>H NMR of 11

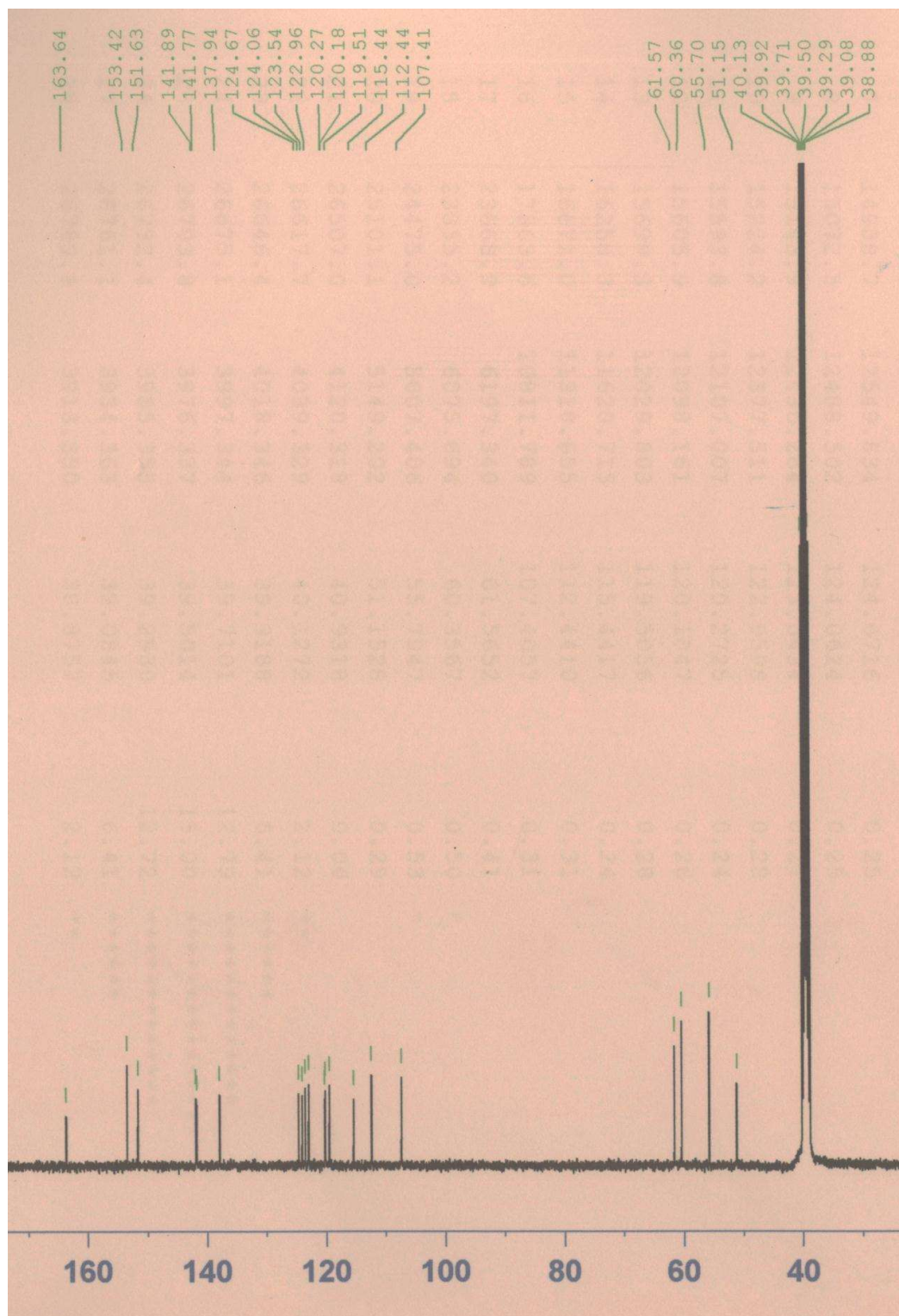


Figure S20.  $^{13}\text{C}$  NMR of 11

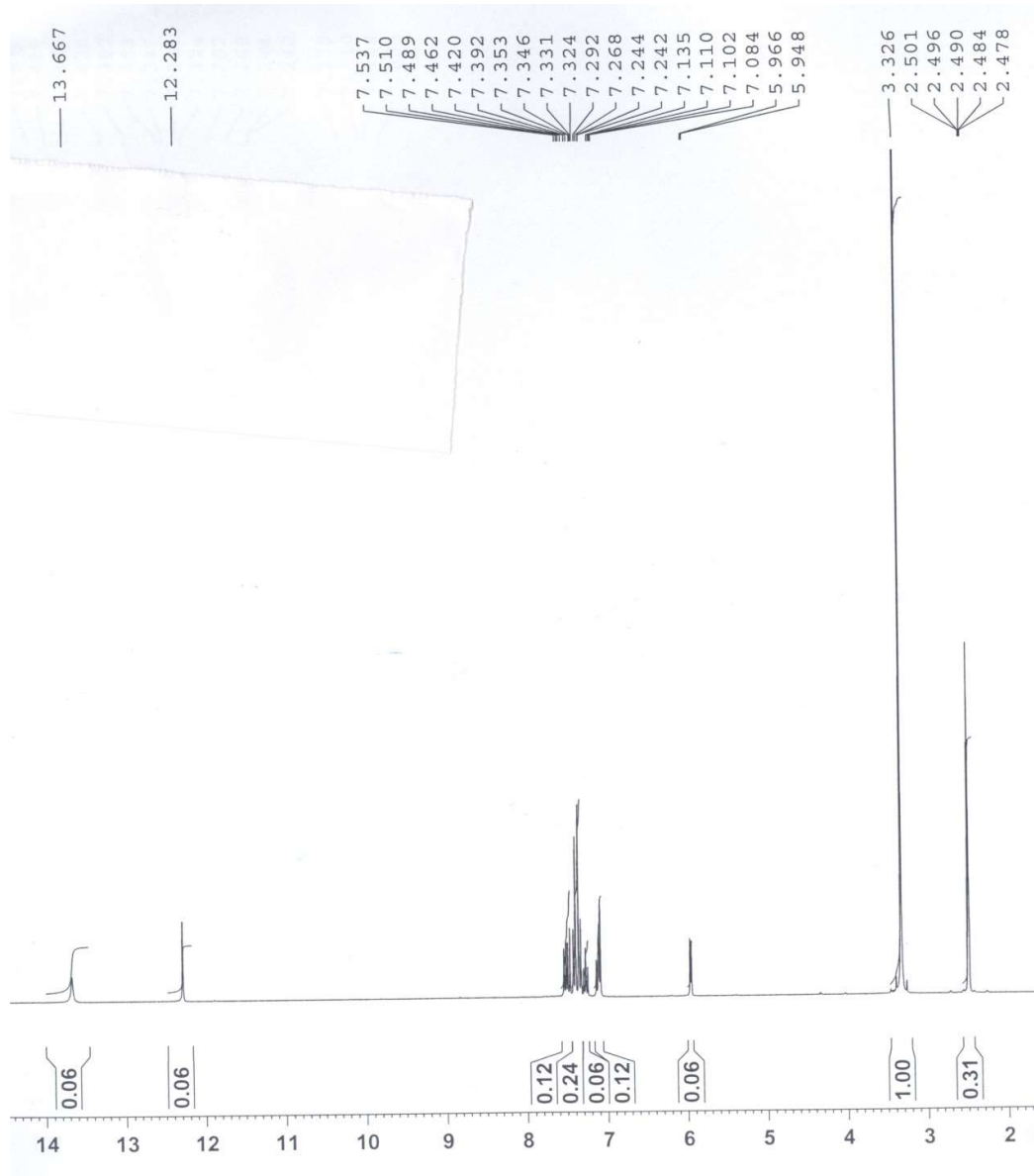


Figure S21.  $^1\text{H}$  NMR of 12

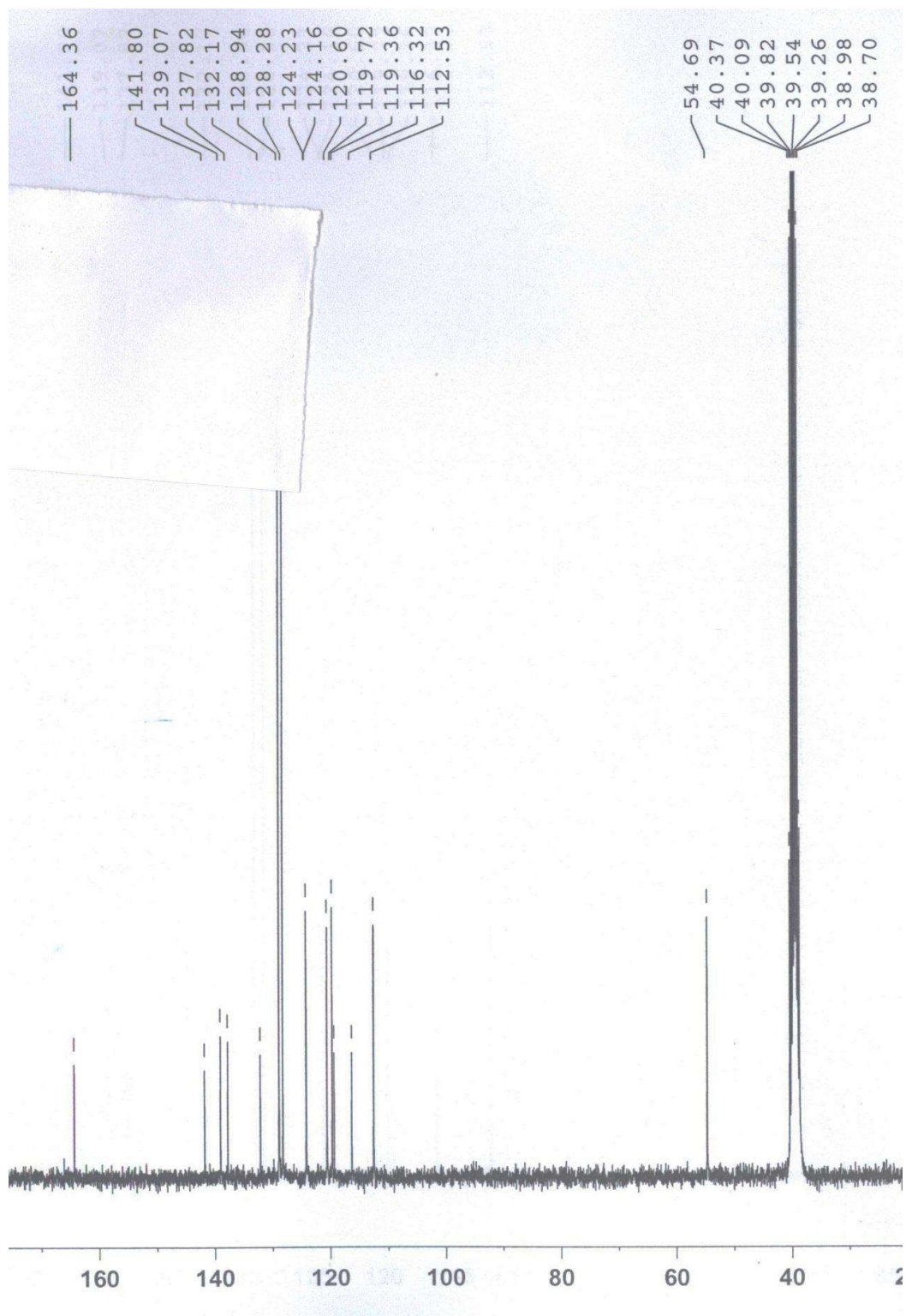


Figure S22.  $^{13}\text{C}$  NMR of 12

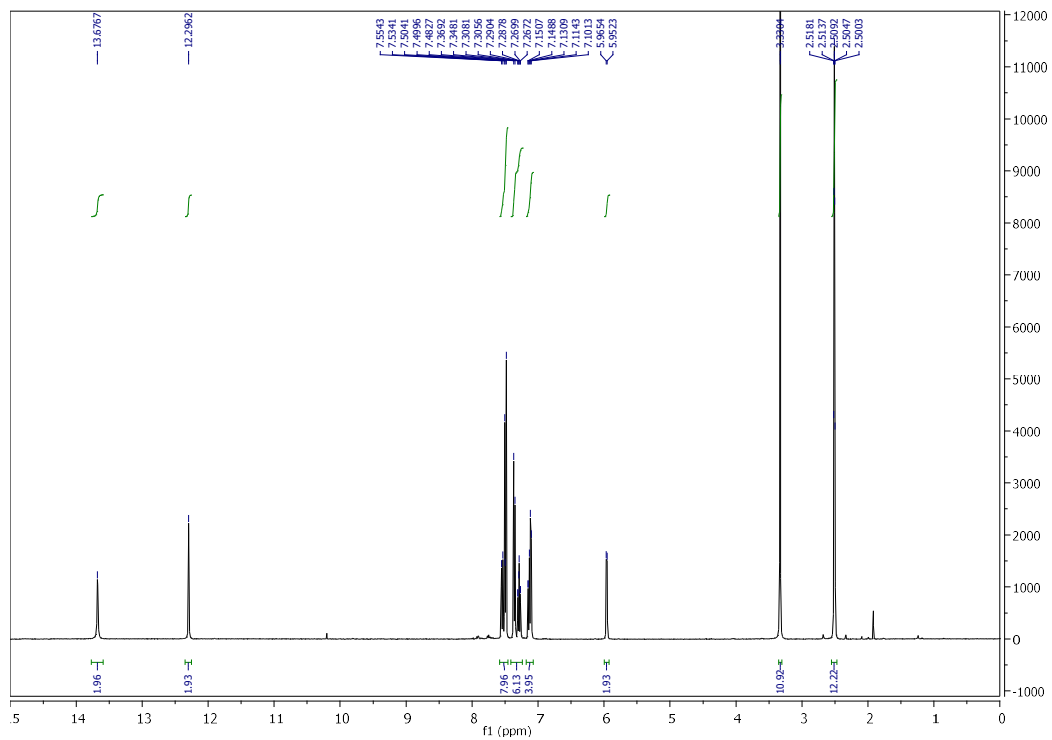


Figure S23.  $^1\text{H}$  NMR of 13

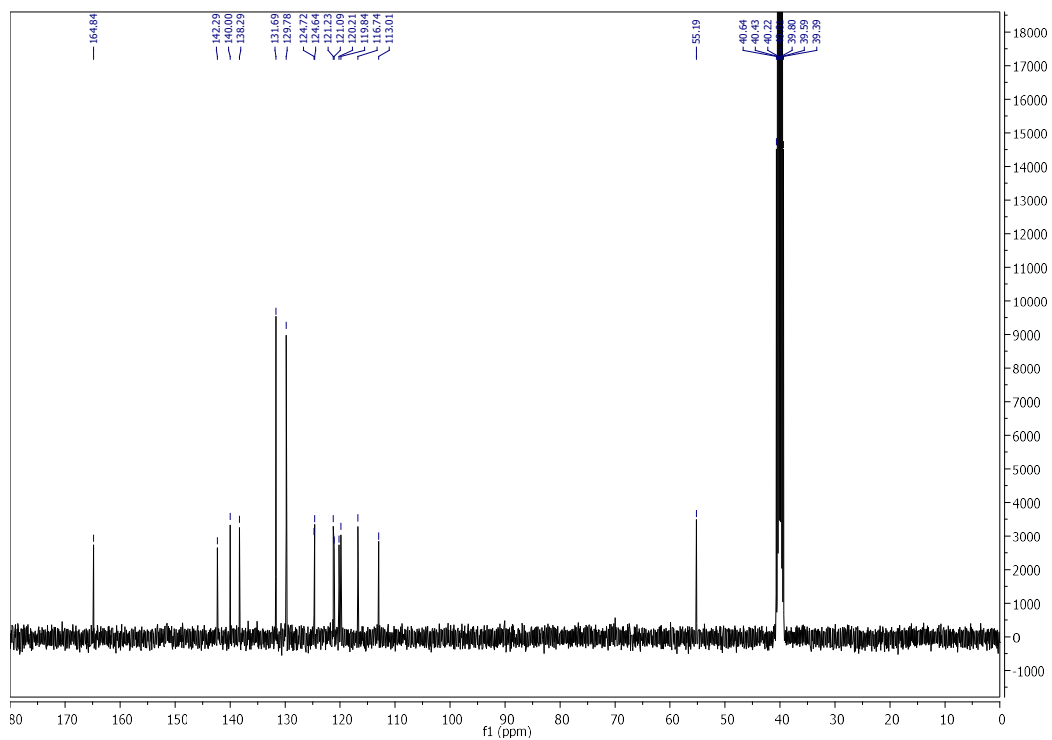


Figure S24.  $^{13}\text{C}$  NMR of 13

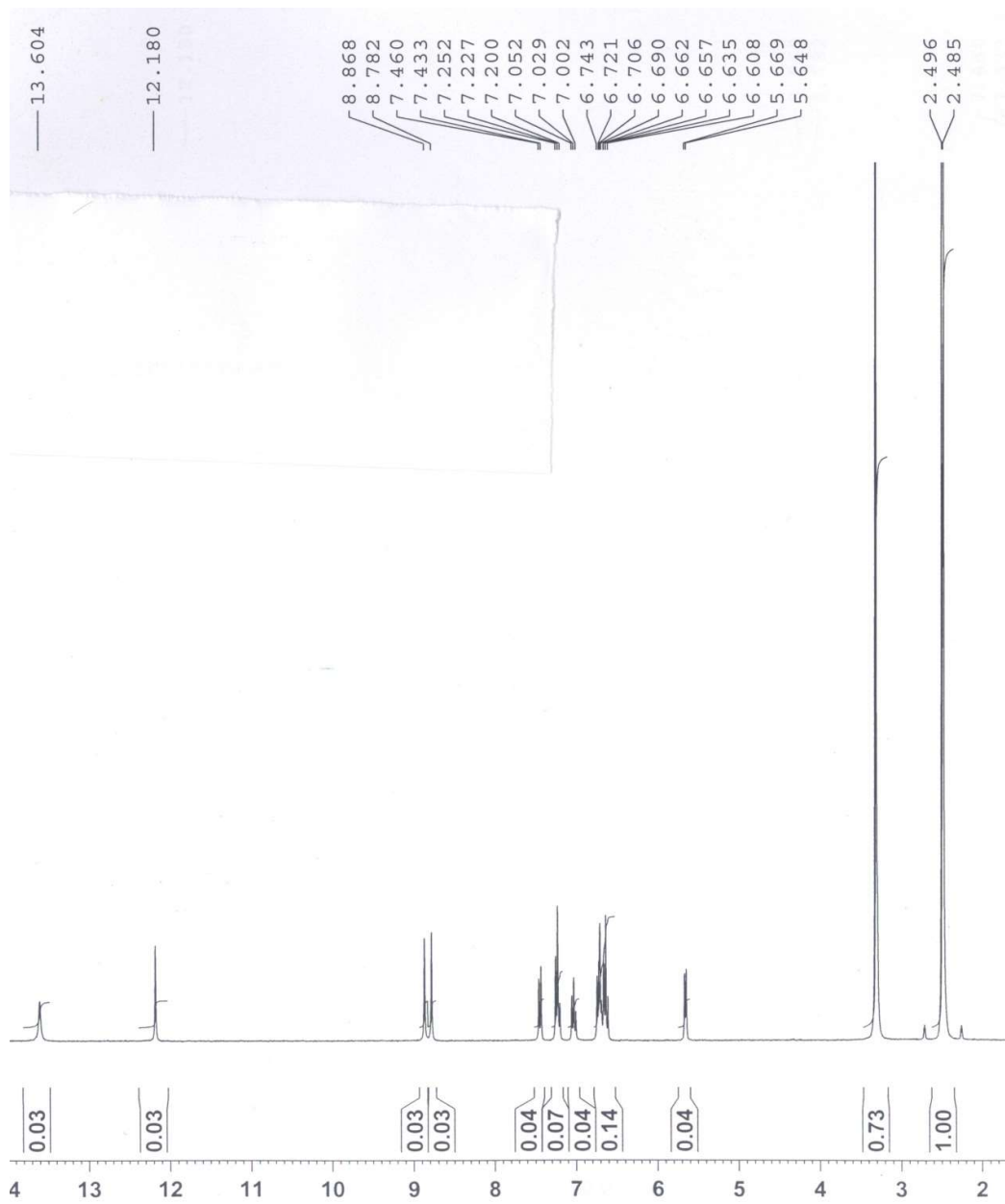


Figure S25.  $^1\text{H}$  NMR of 14



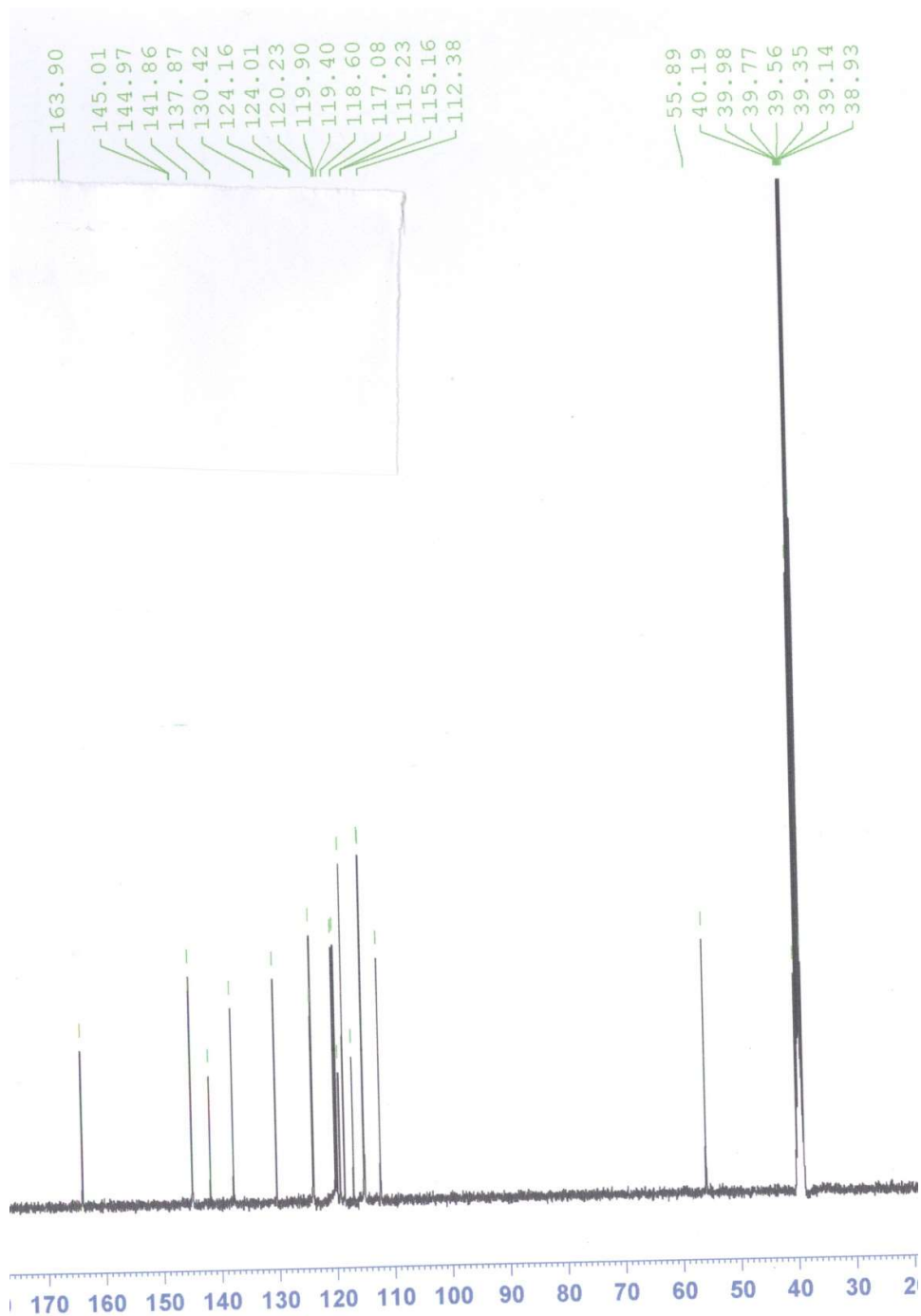


Figure S26.  $^{13}\text{C}$  NMR of 14



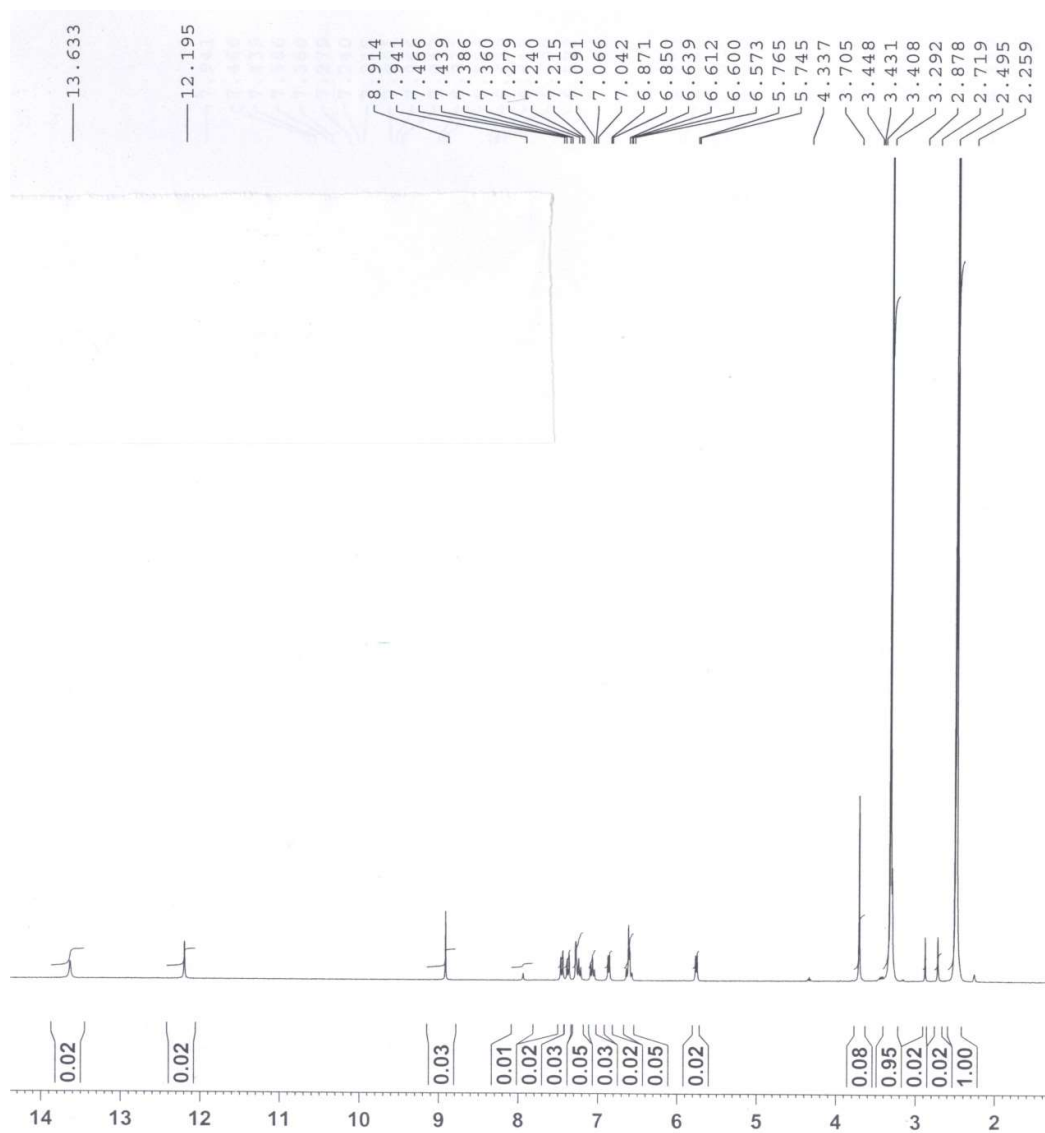


Figure S27.  $^1\text{H}$  NMR of 15



Figure S28.  $^{13}\text{C}$  NMR of 15

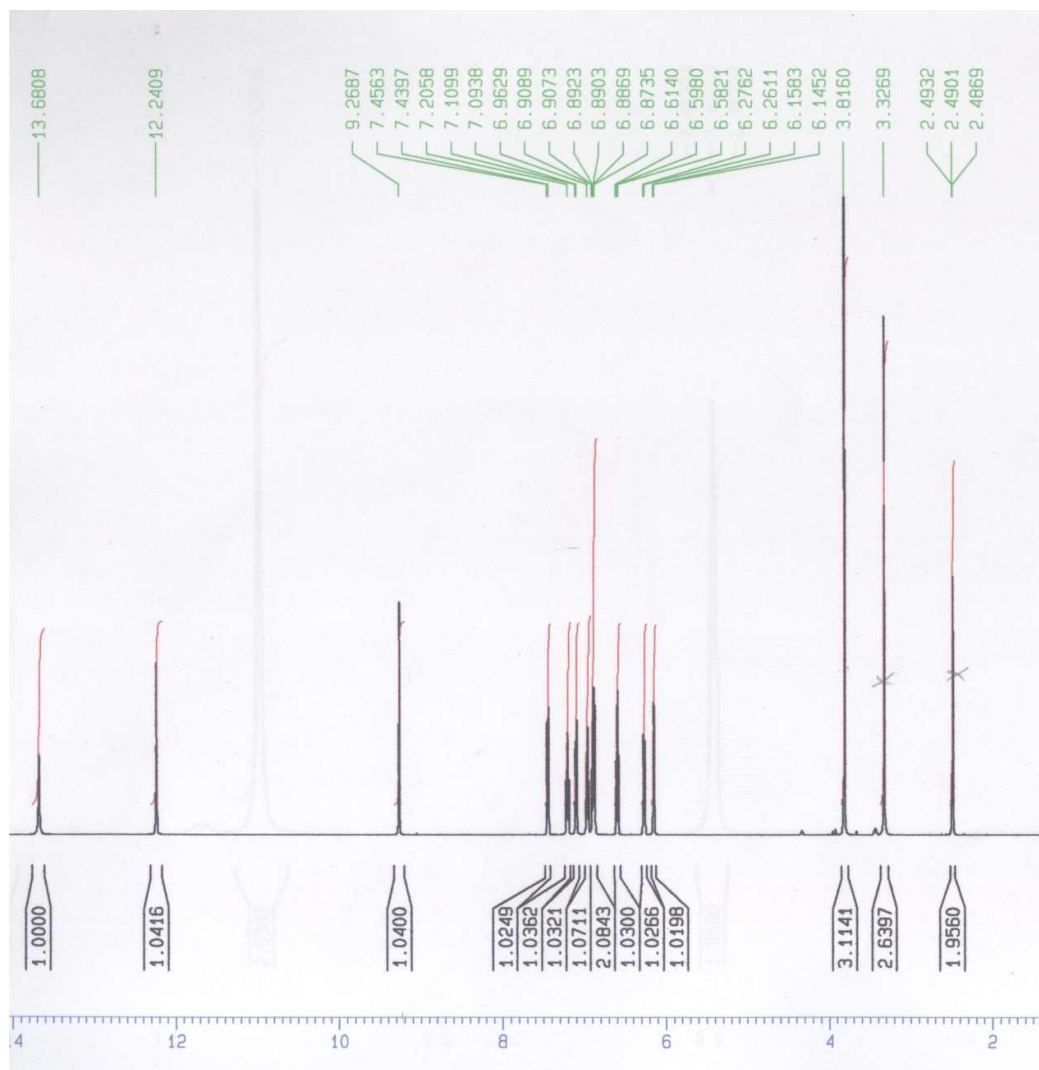


Figure S29.  $^1\text{H}$  NMR of 16

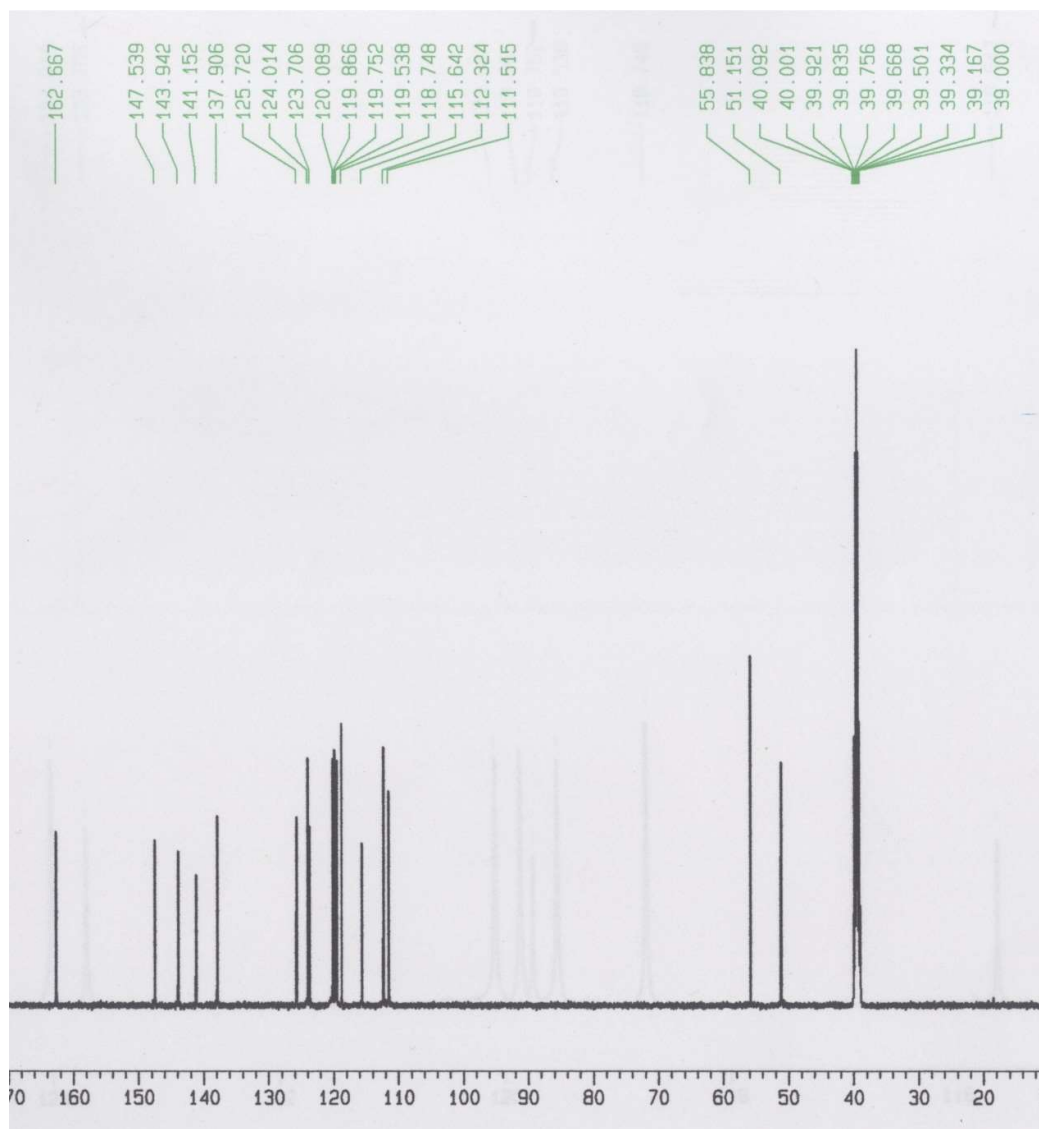


Figure S30.  $^{13}\text{C}$  NMR of 16

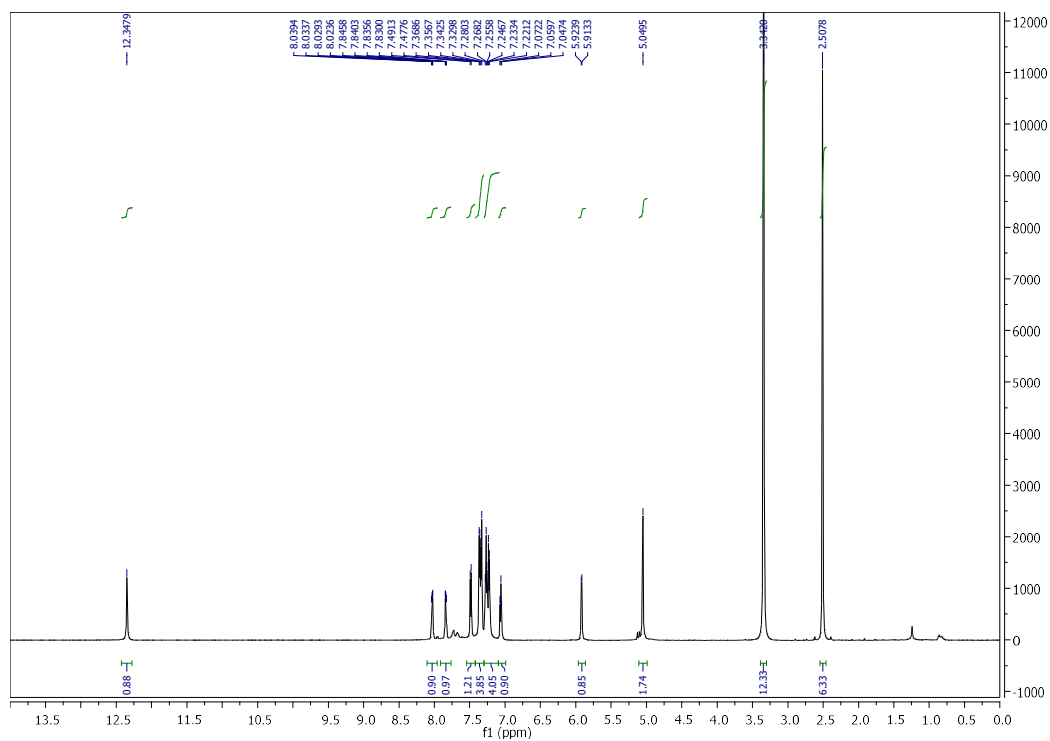


Figure S31.  $^1\text{H}$  NMR of 19

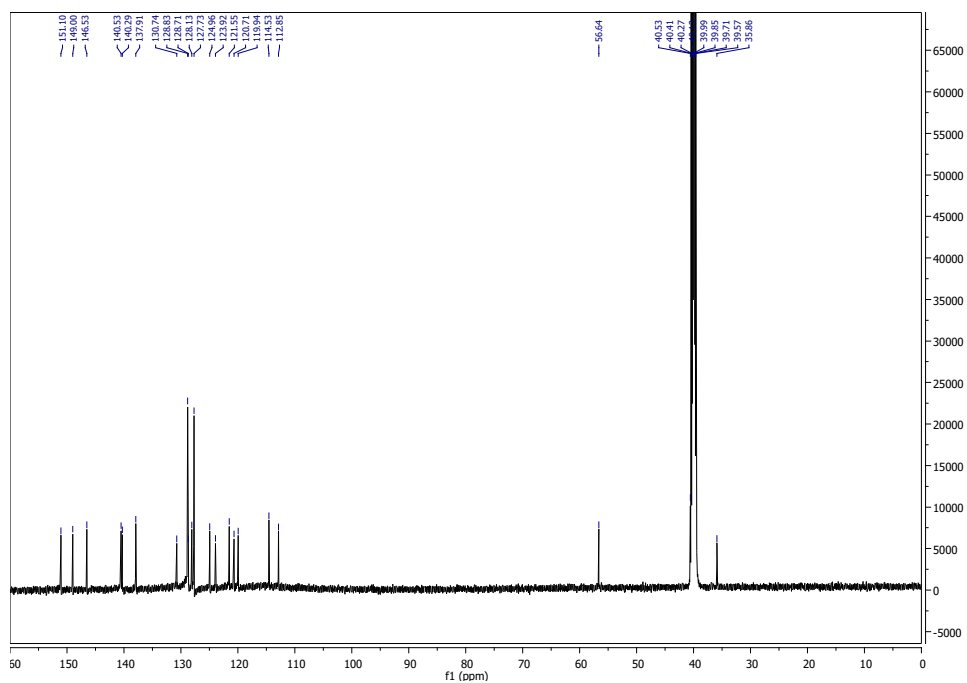


Figure S32.  $^{13}\text{C}$  NMR of 19

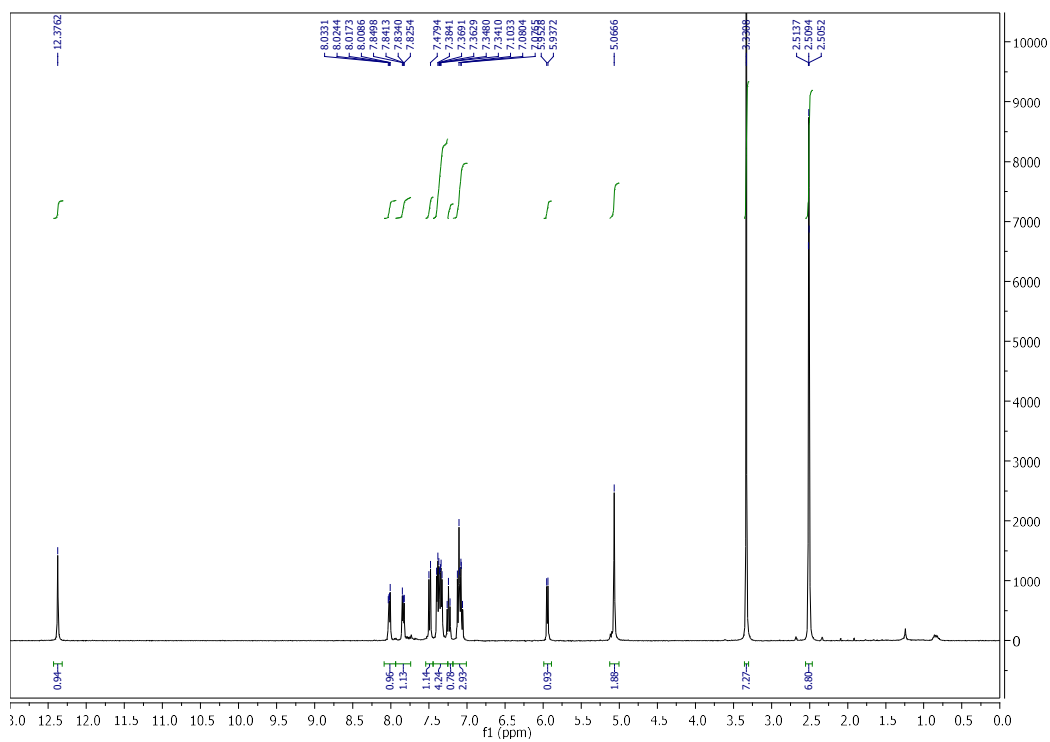


Figure S33. <sup>1</sup>H NMR of 20

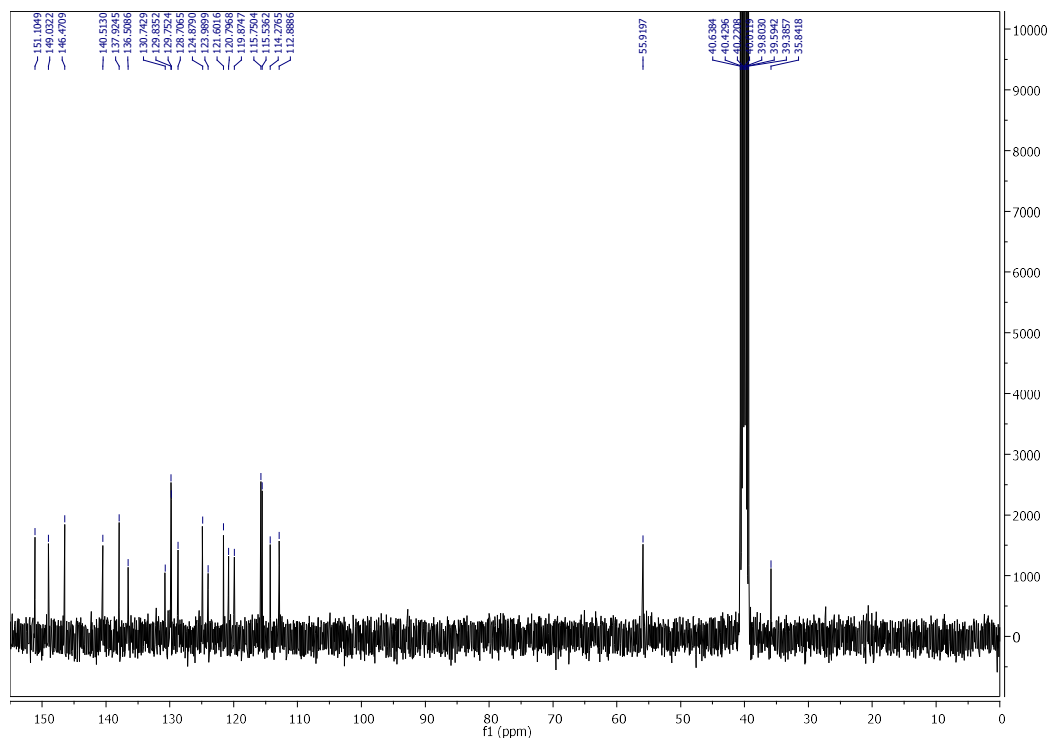


Figure S34. <sup>13</sup>C NMR of 20

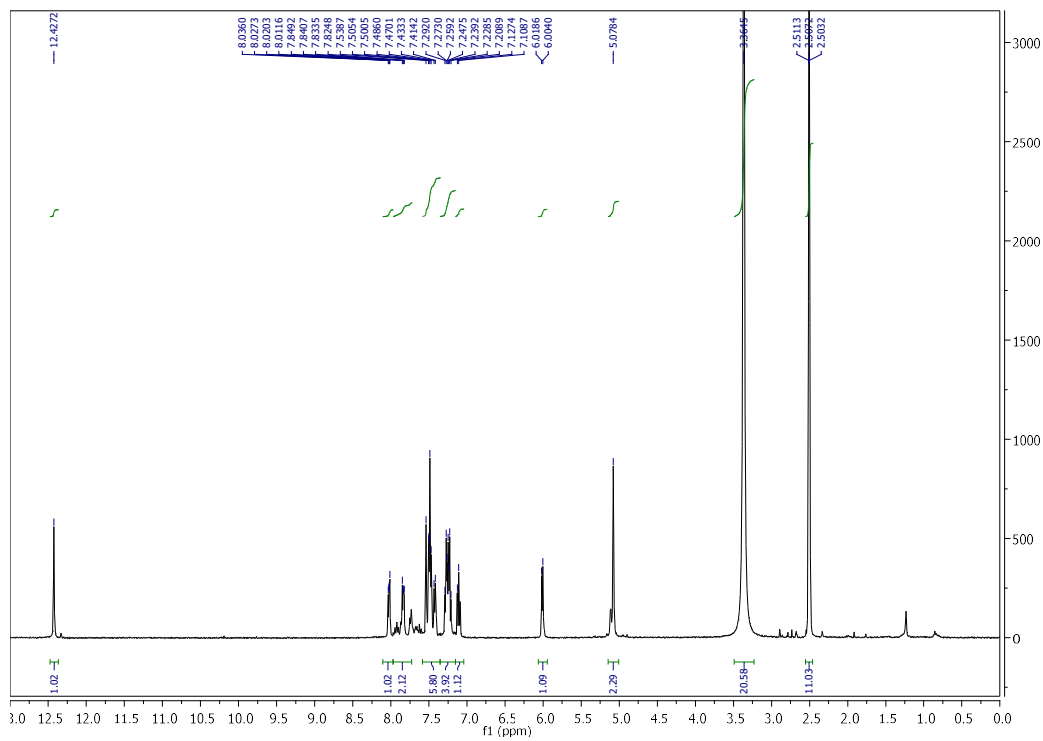


Figure S35.  $^1\text{H}$  NMR of 21

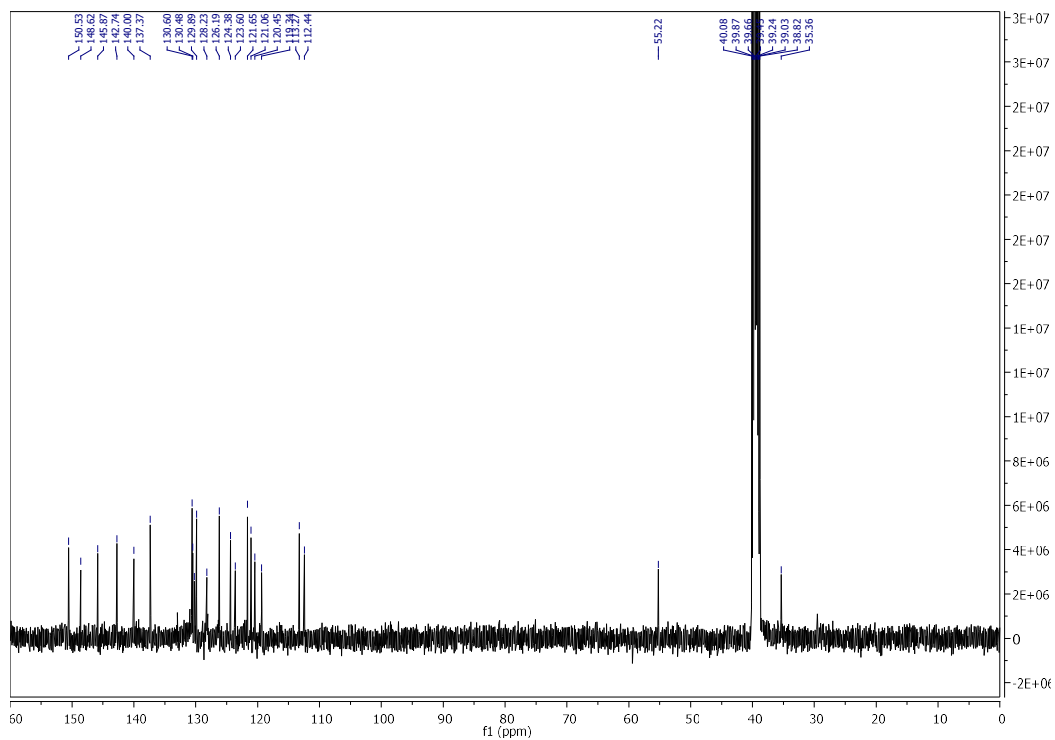


Figure S36.  $^{13}\text{C}$  NMR of 21

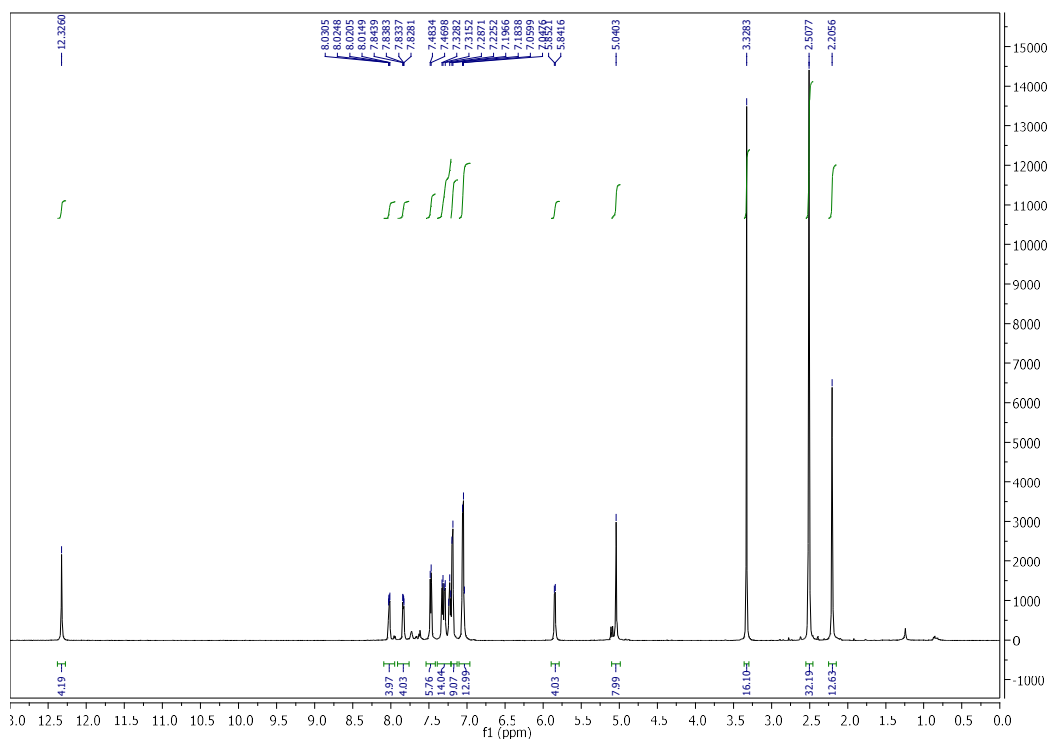


Figure S37.  $^1\text{H}$  NMR of 22

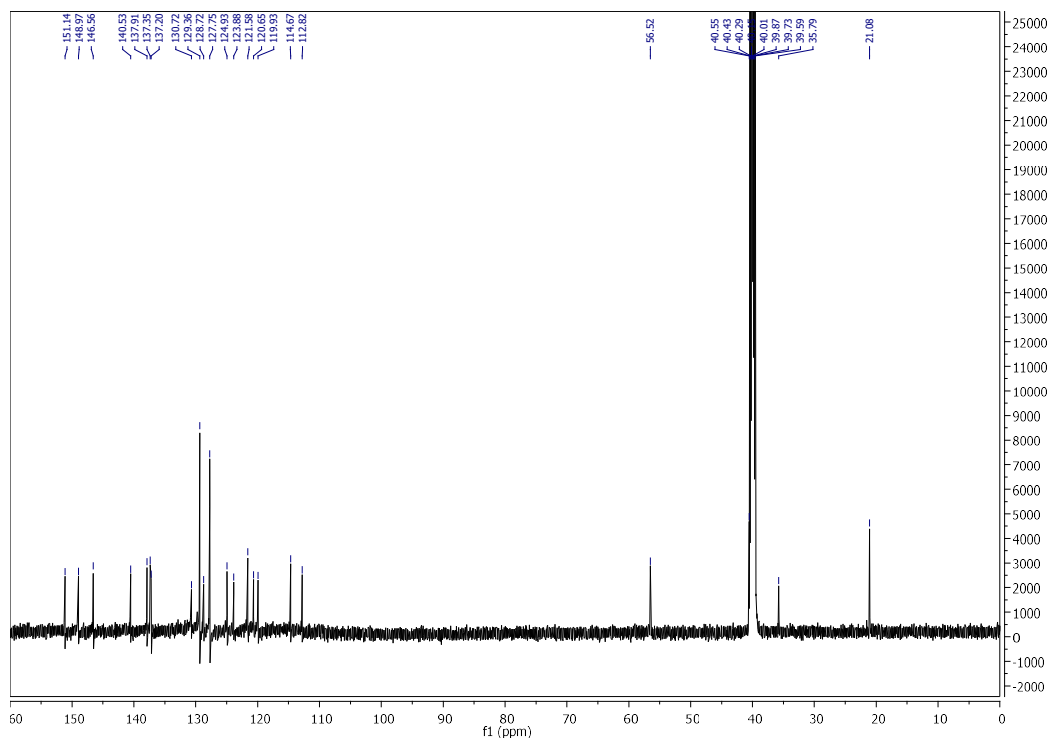


Figure S38.  $^{13}\text{C}$  NMR of 22



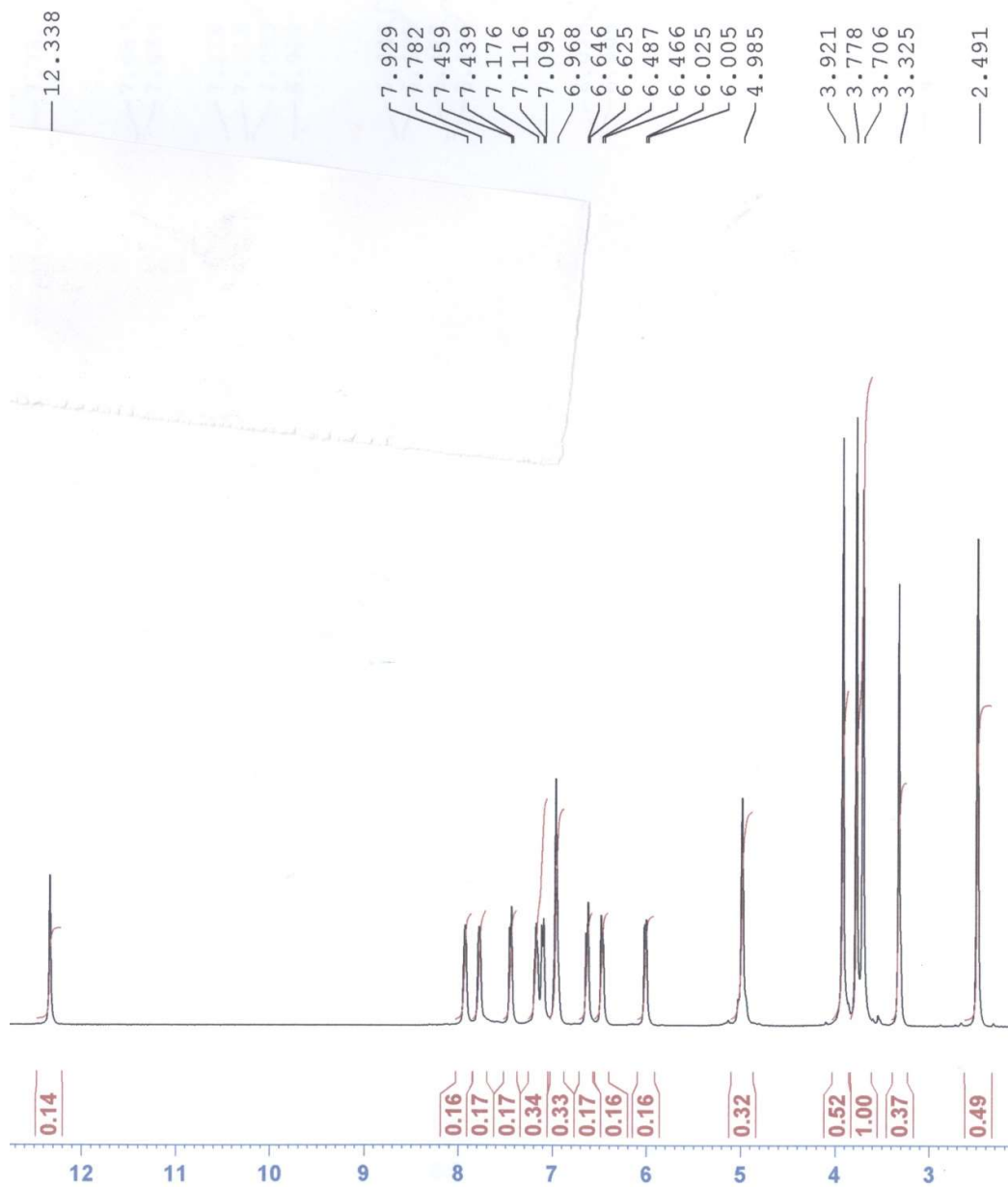


Figure S39.  $^1\text{H}$  NMR of 23

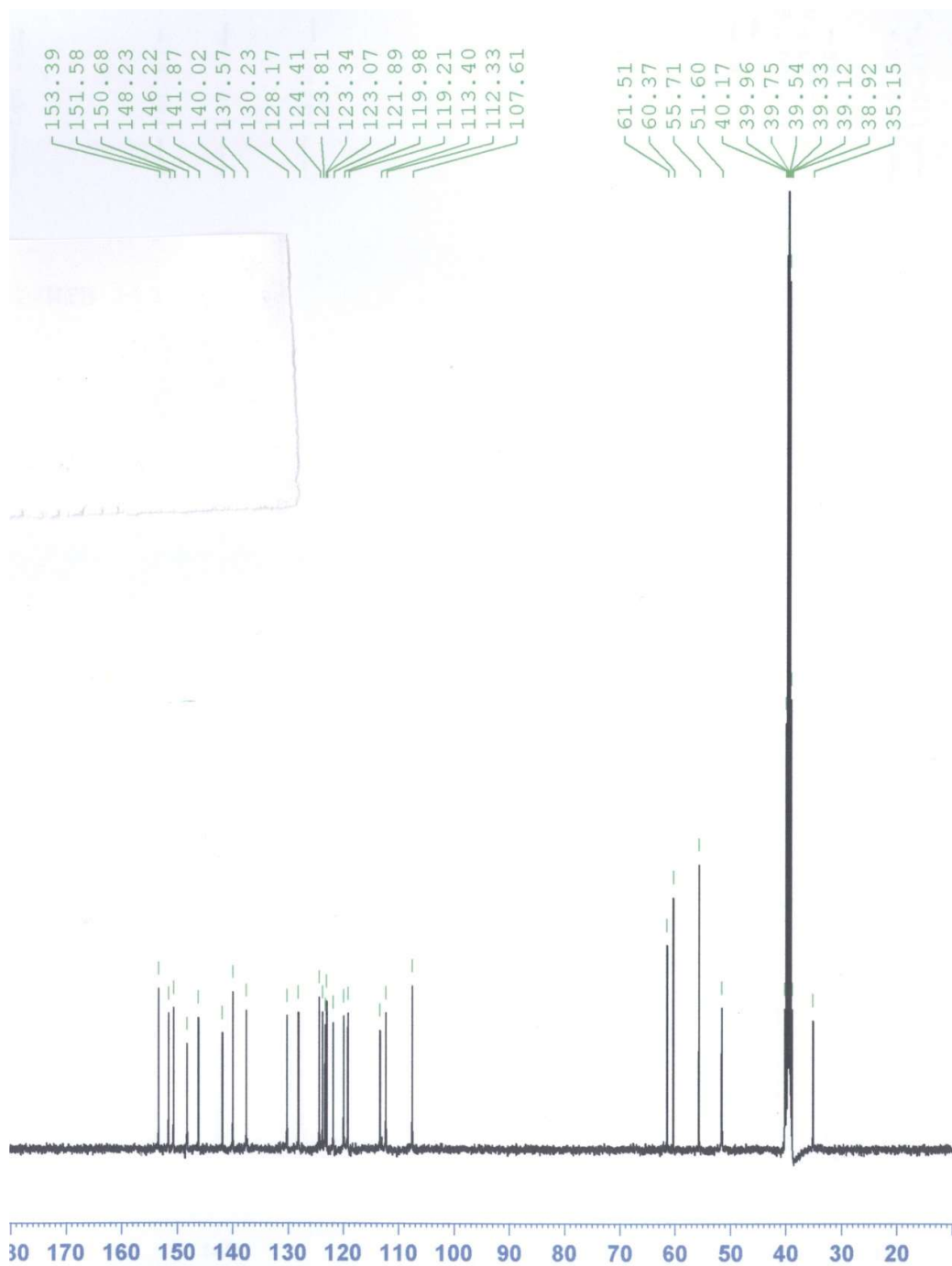


Figure S40.  $^{13}\text{C}$  NMR of 23

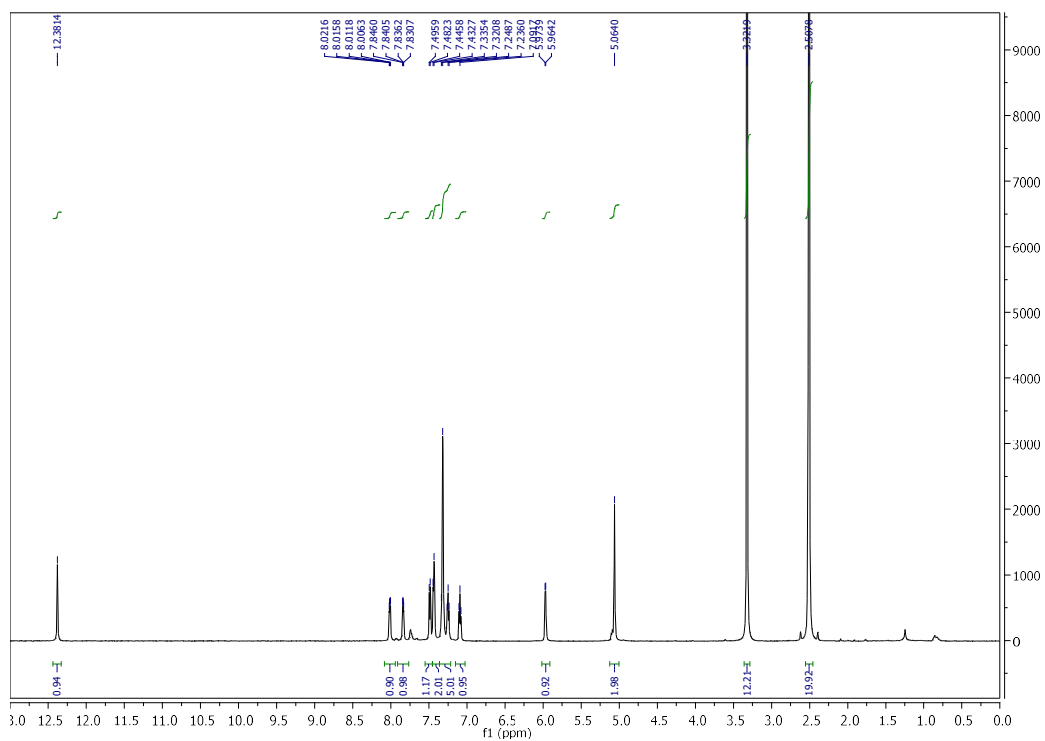


Figure S41. <sup>1</sup>H NMR of 24

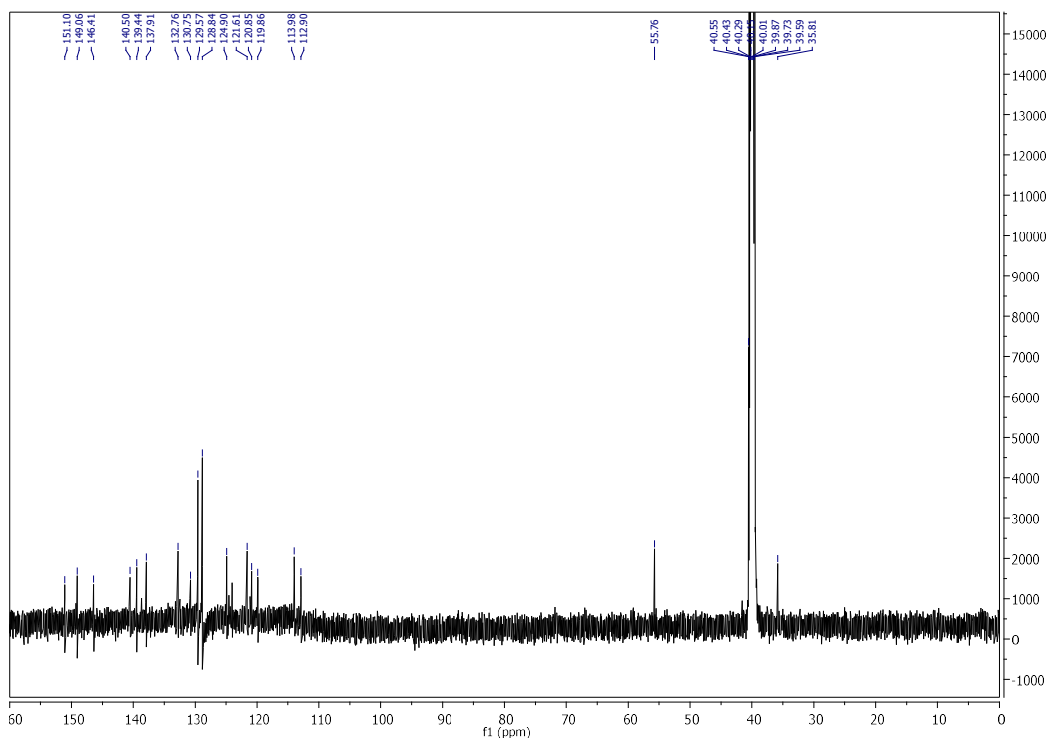


Figure S42. <sup>13</sup>C NMR of 24

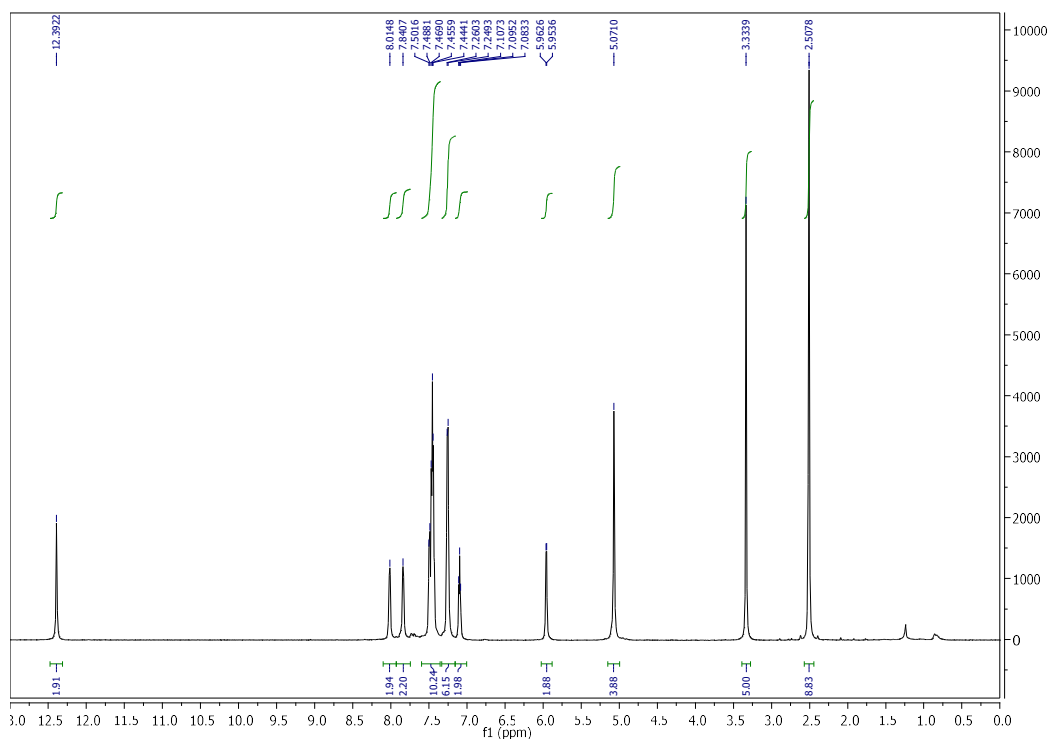


Figure S43. <sup>1</sup>H NMR of 25

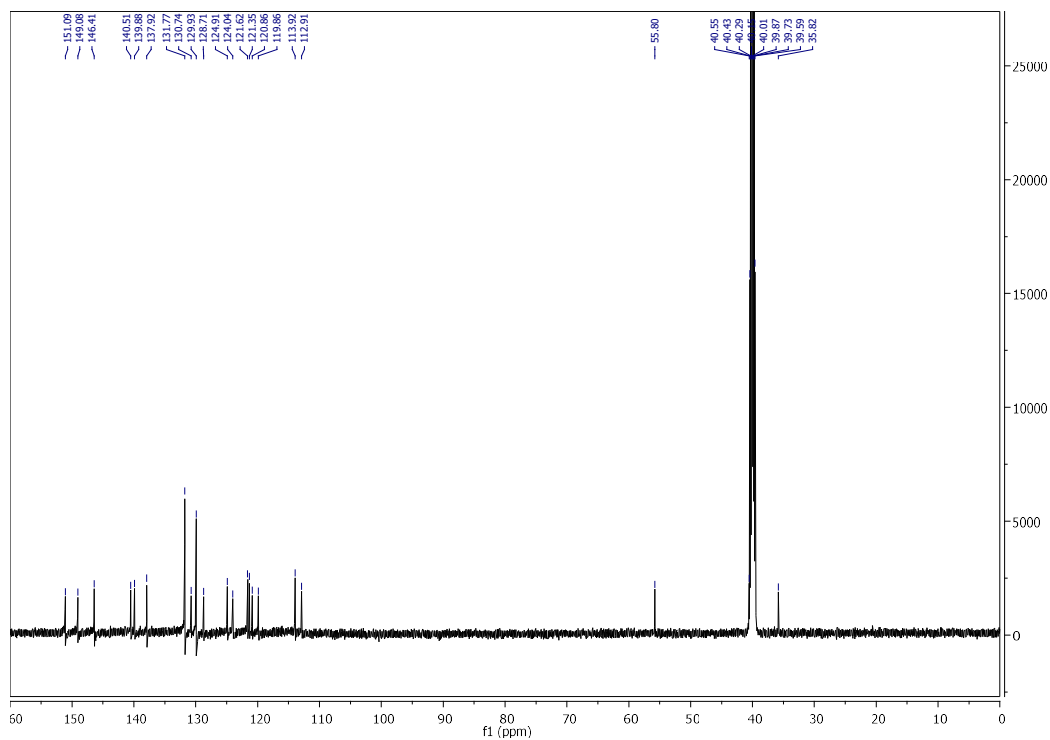
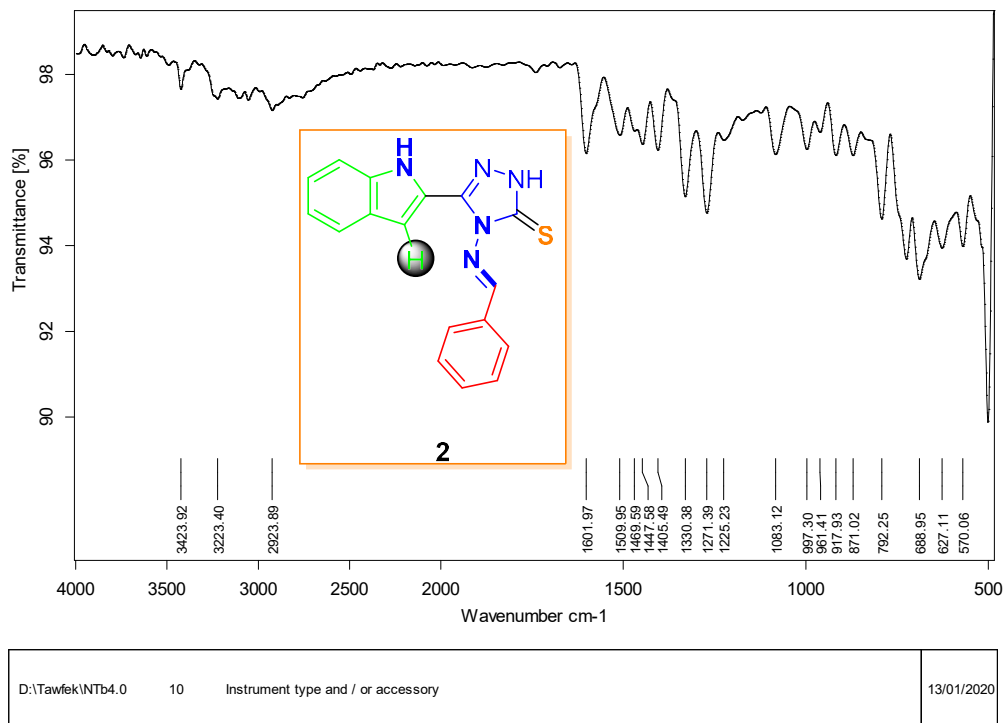


Figure S44. <sup>13</sup>C NMR of 25

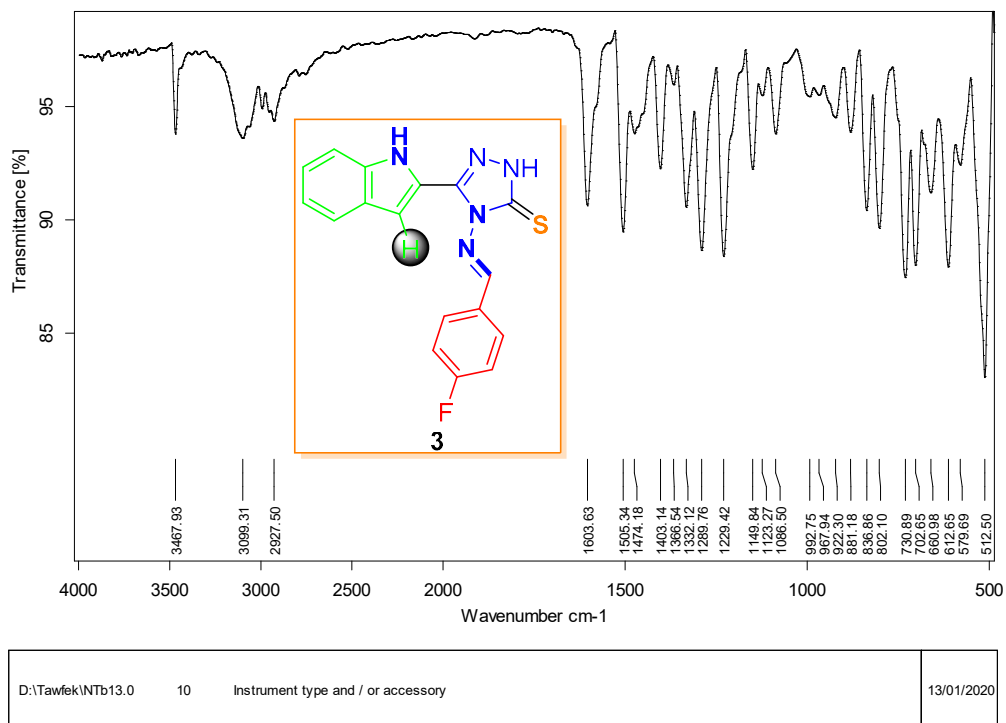
# IR Spectra

**IR spectra were detected  
using Bruker Alpha ATR-  
FTIR.**



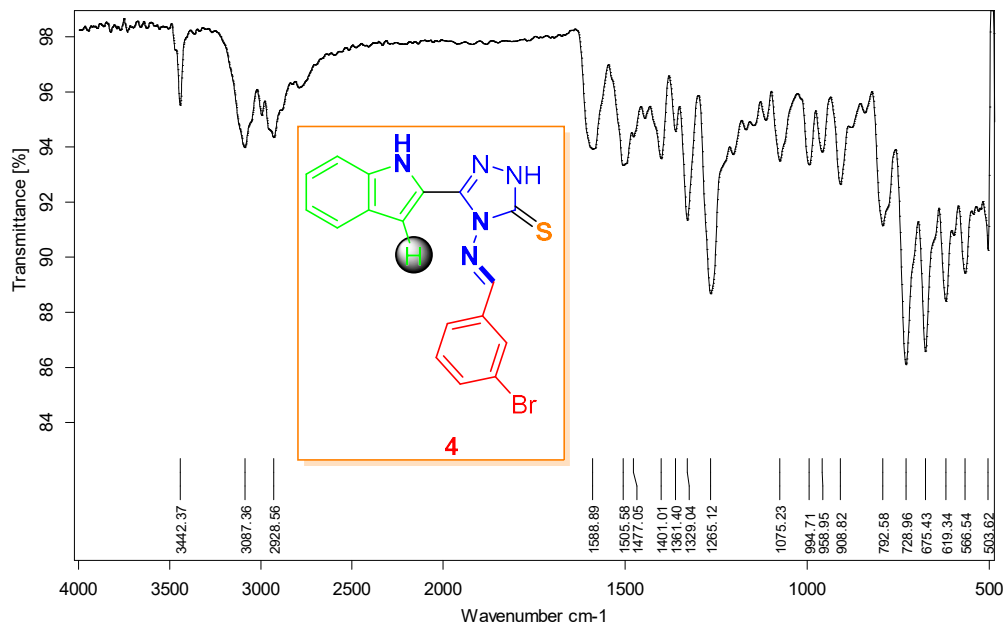
Page 1/1

Figure S45. IR of 2



Page 1/1

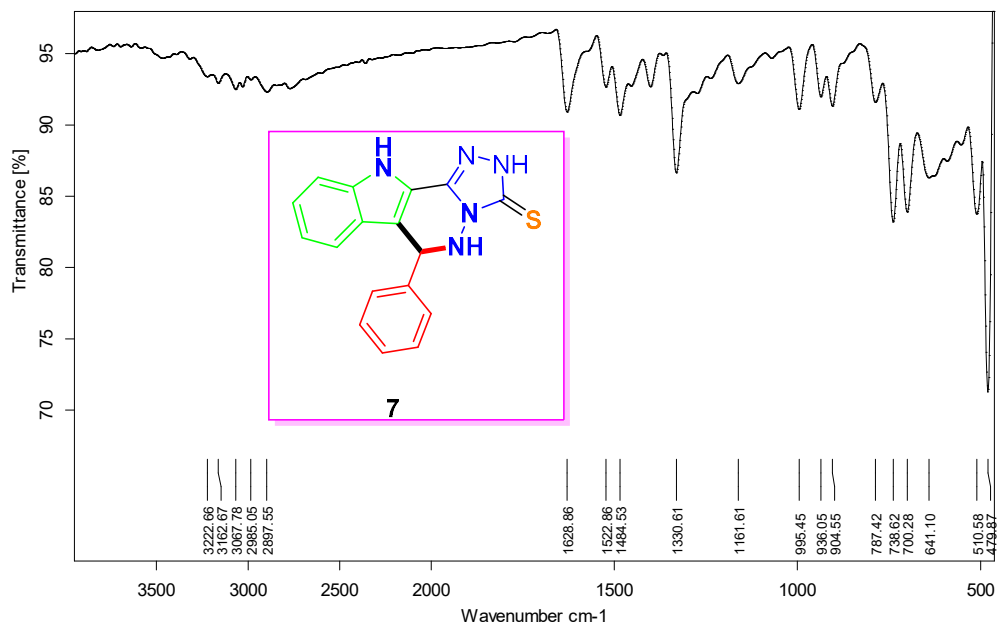
Figure S46. IR of 3



D:\Tawfek\INTb21.0	10	Instrument type and / or accessory	13/01/2020
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Page 1/1

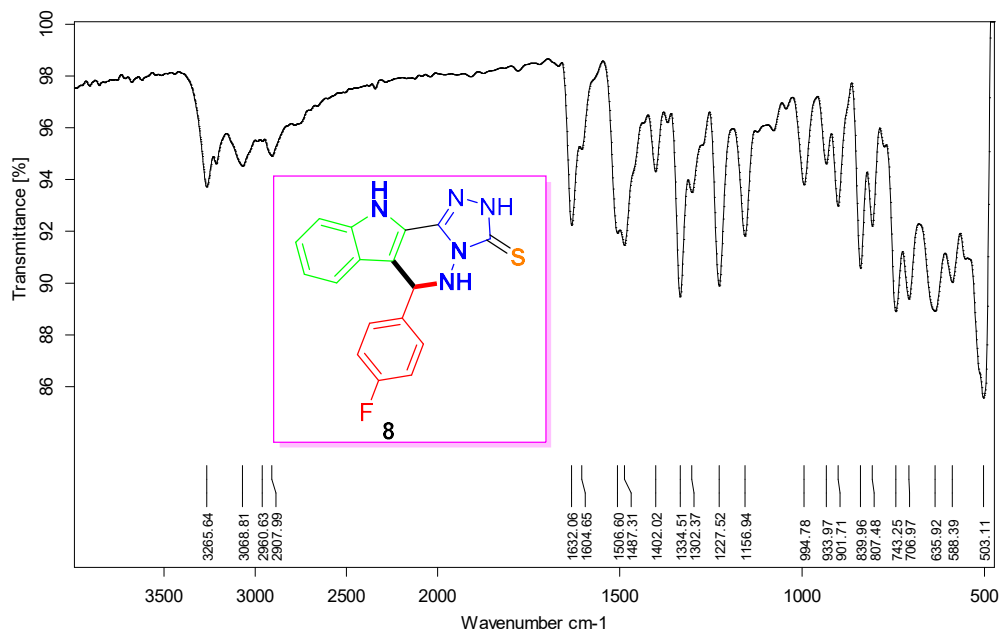
Figure S47. IR of 4



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Page 1/1

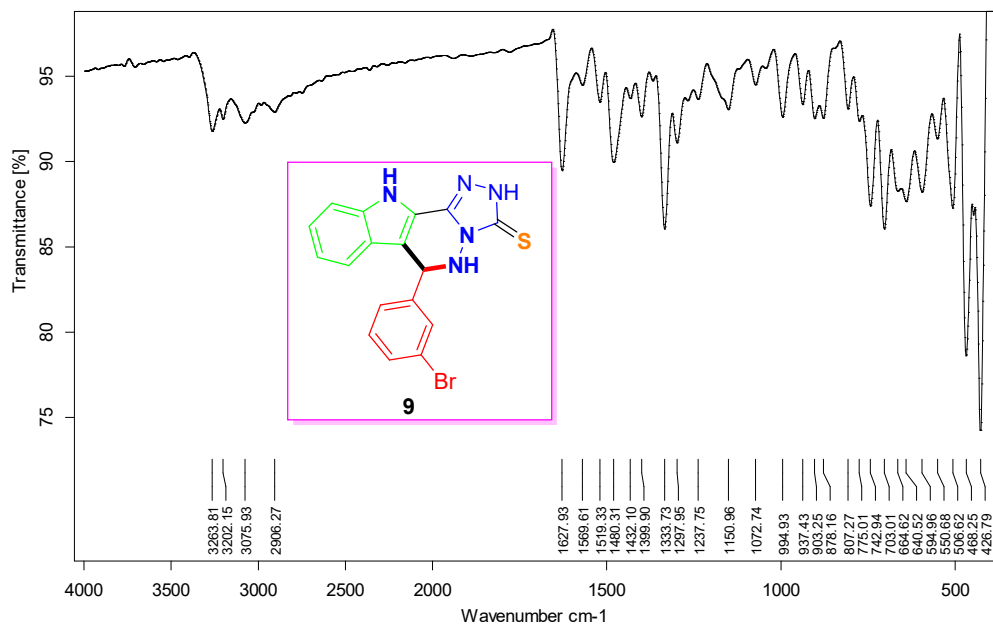
Figure S48. IR of 7



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Page 1/1

Figure S49. IR of 8

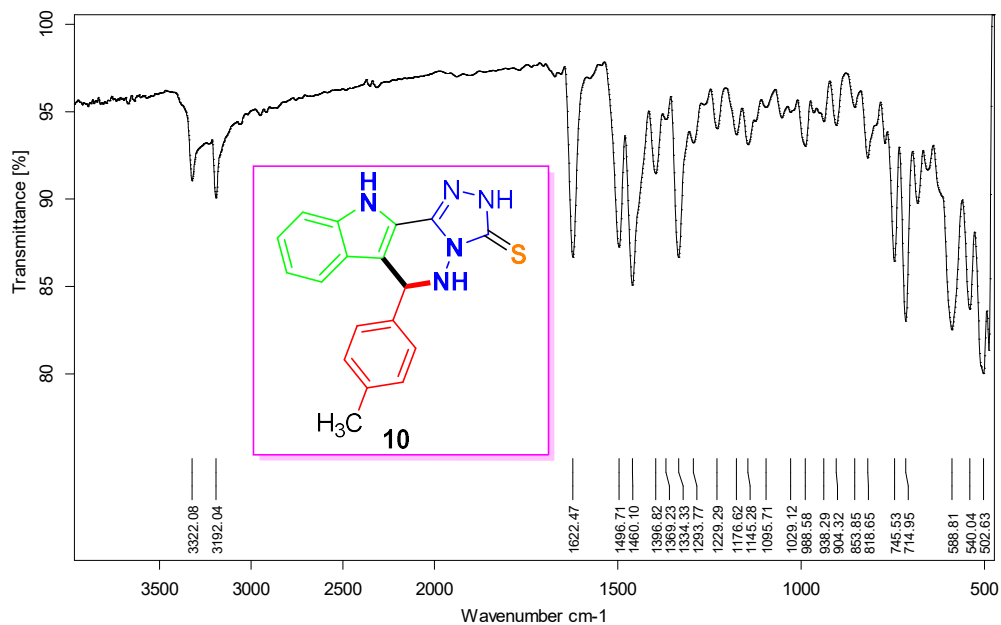


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Page 1/1

Figure S50. IR of 9

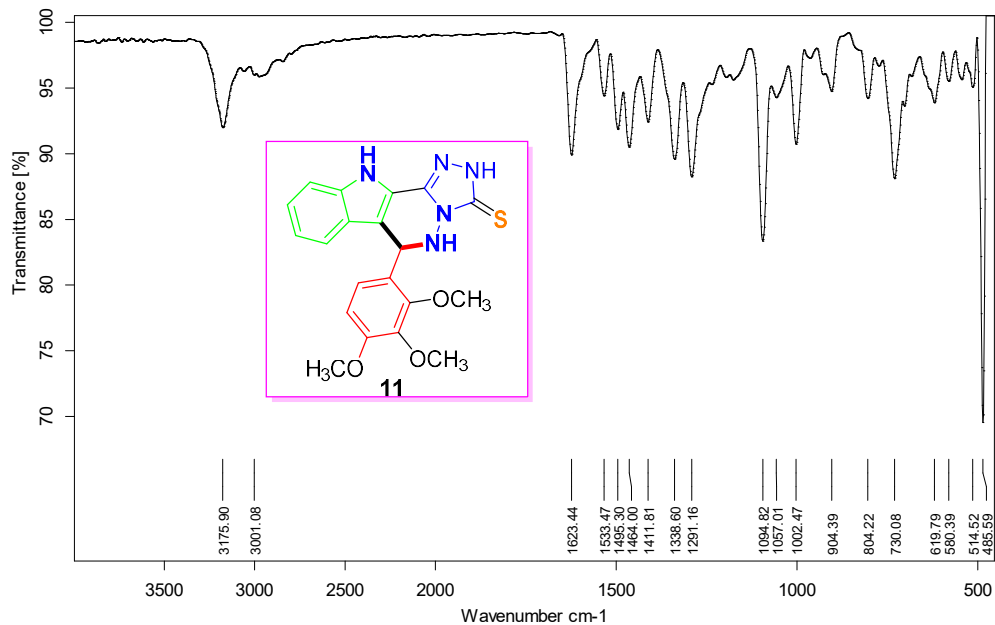




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Page 1/1

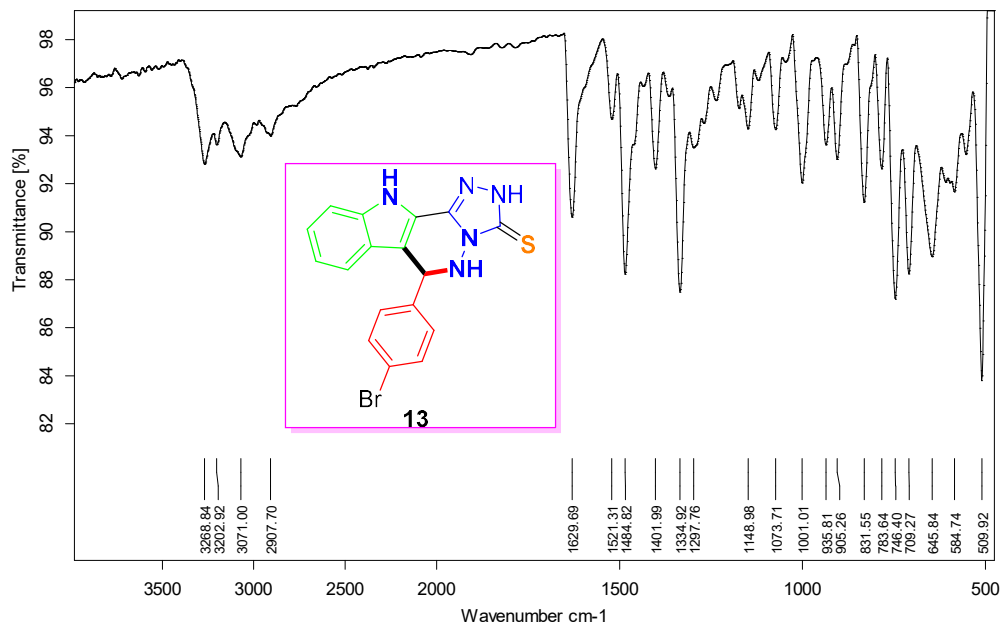
Figure S51. IR of 10



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Page 1/1

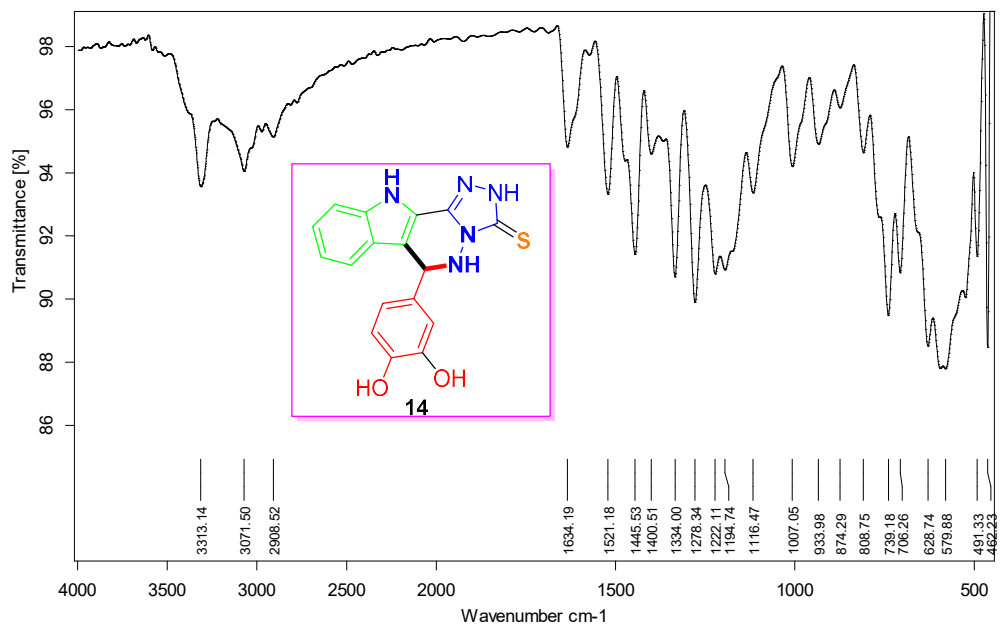
Figure S52. IR of 11



D:\Tawfek\INTb11.0	10	Instrument type and / or accessory	13/01/2020
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Page 1/1

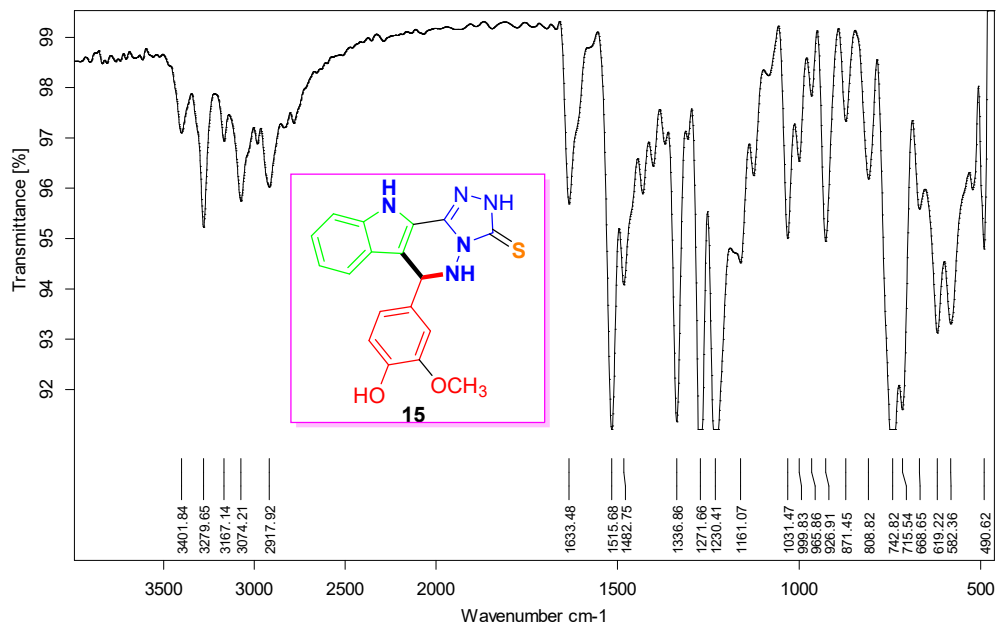
Figure S53. IR of 13



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Page 1/1

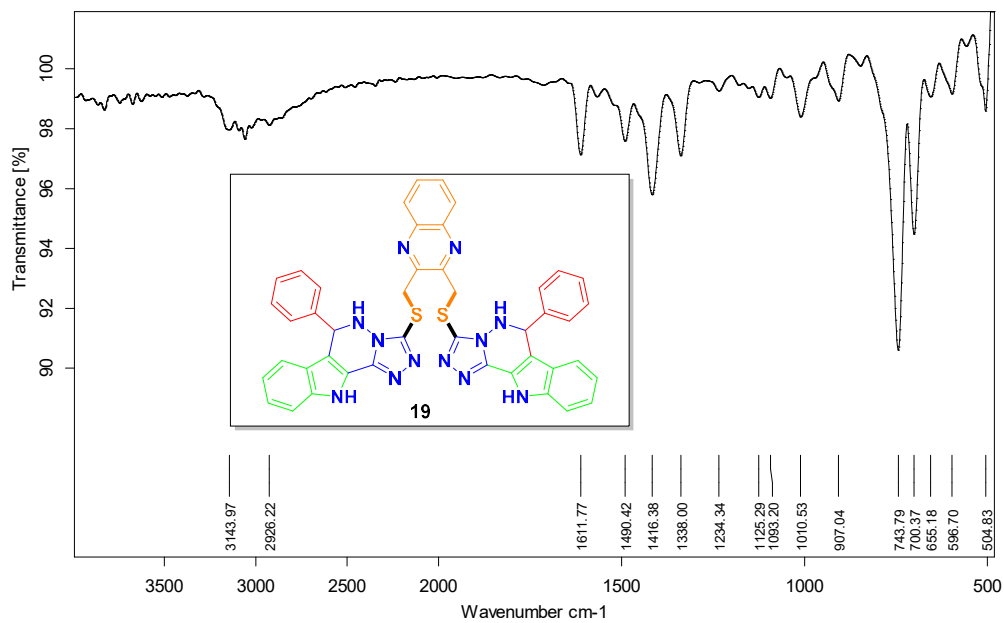
Figure S54. IR of 14



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Page 1/1

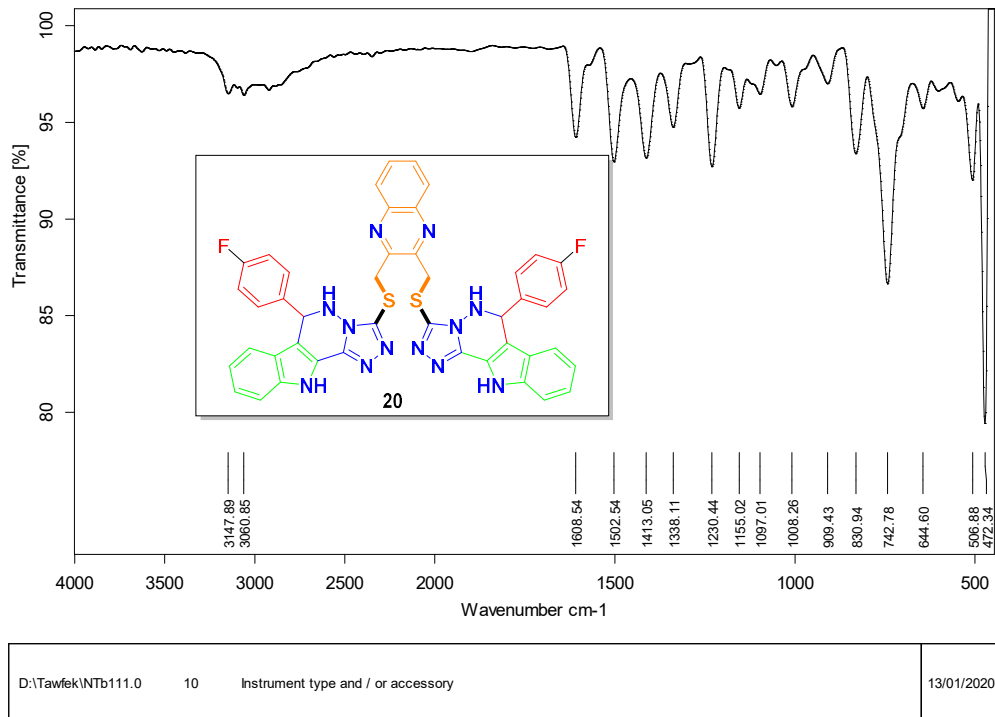
Figure S55. IR of 15



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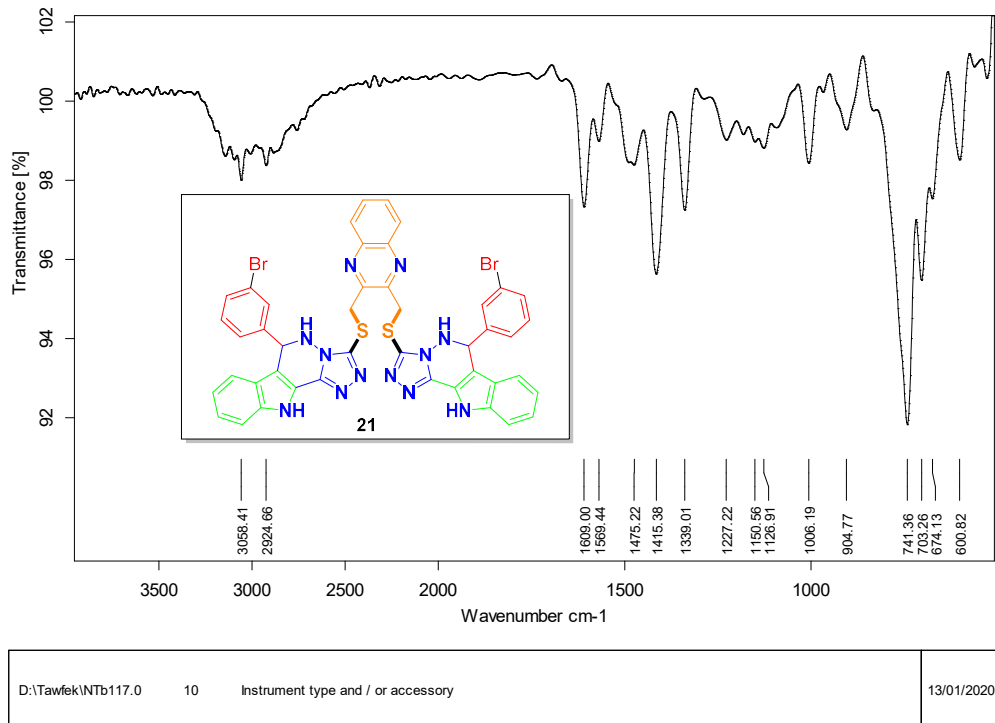
Page 1/1

Figure S56. IR of 19



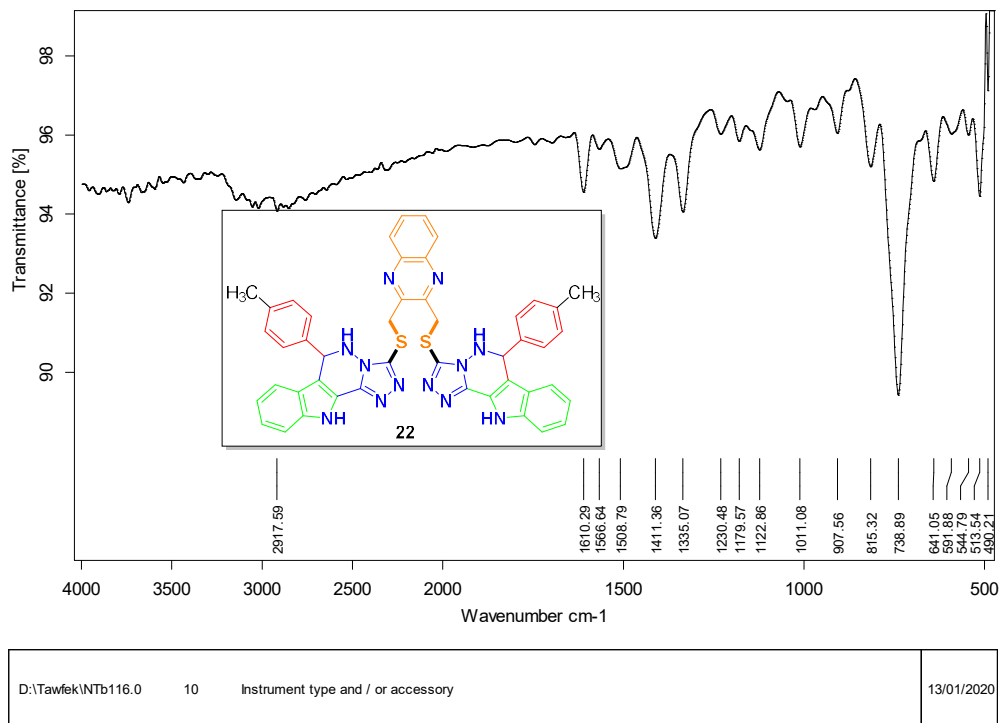
Page 1/1

Figure S57. IR of 20



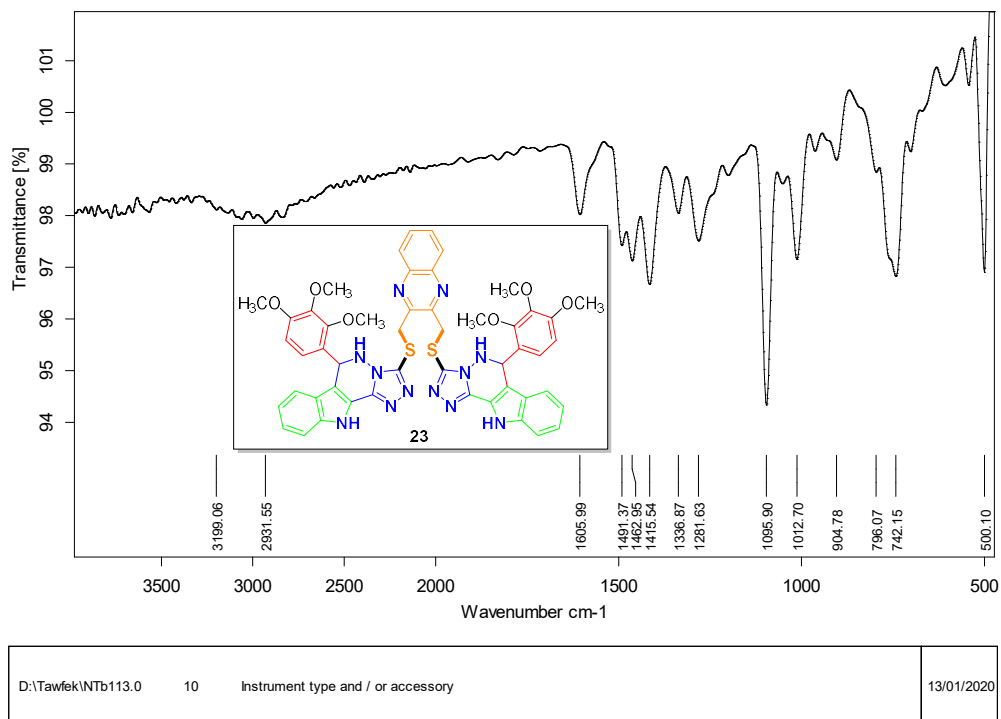
Page 1/1

Figure S58. IR of 21



Page 1/1

Figure S59. IR of 22



Page 1/1

Figure S60. IR of 23