Rational design, synthesis, and 2D-QSAR study of anti-oncological alkaloids against hepatoma and cervical carcinoma

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Supplementary material

Figure captions

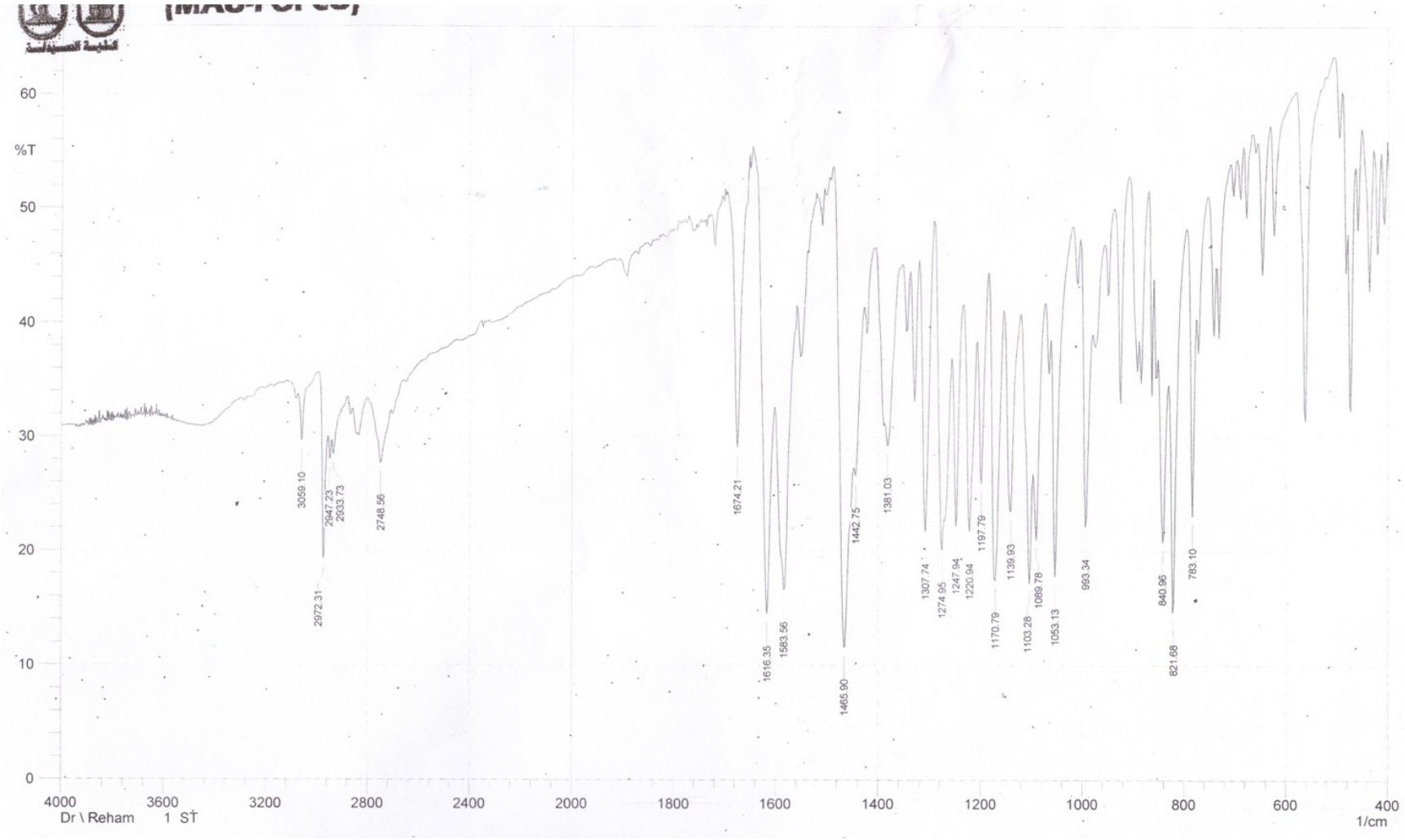


Figure S1. IR spectrum of compound **3**.

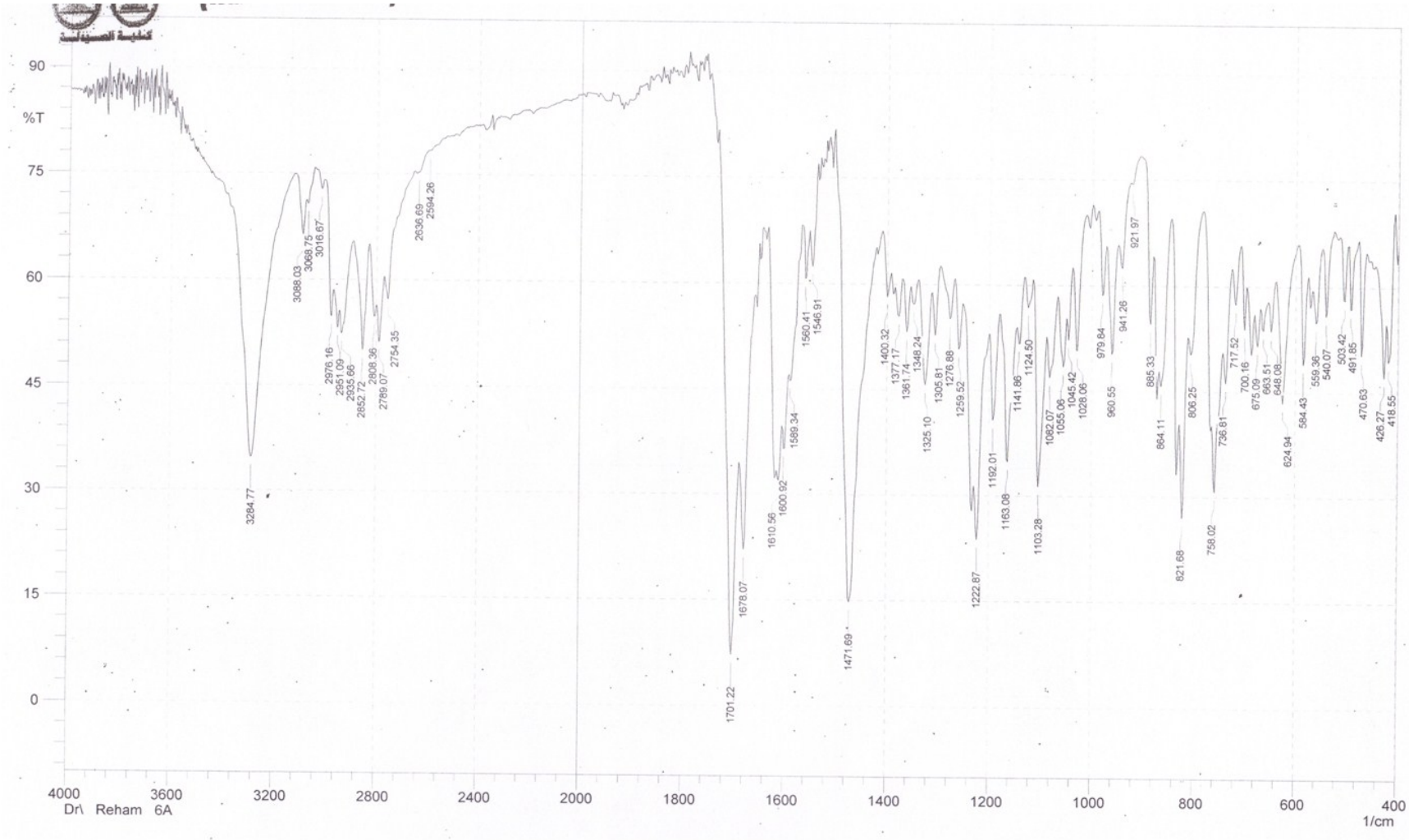


Figure S2. IR spectrum of compound **11**.

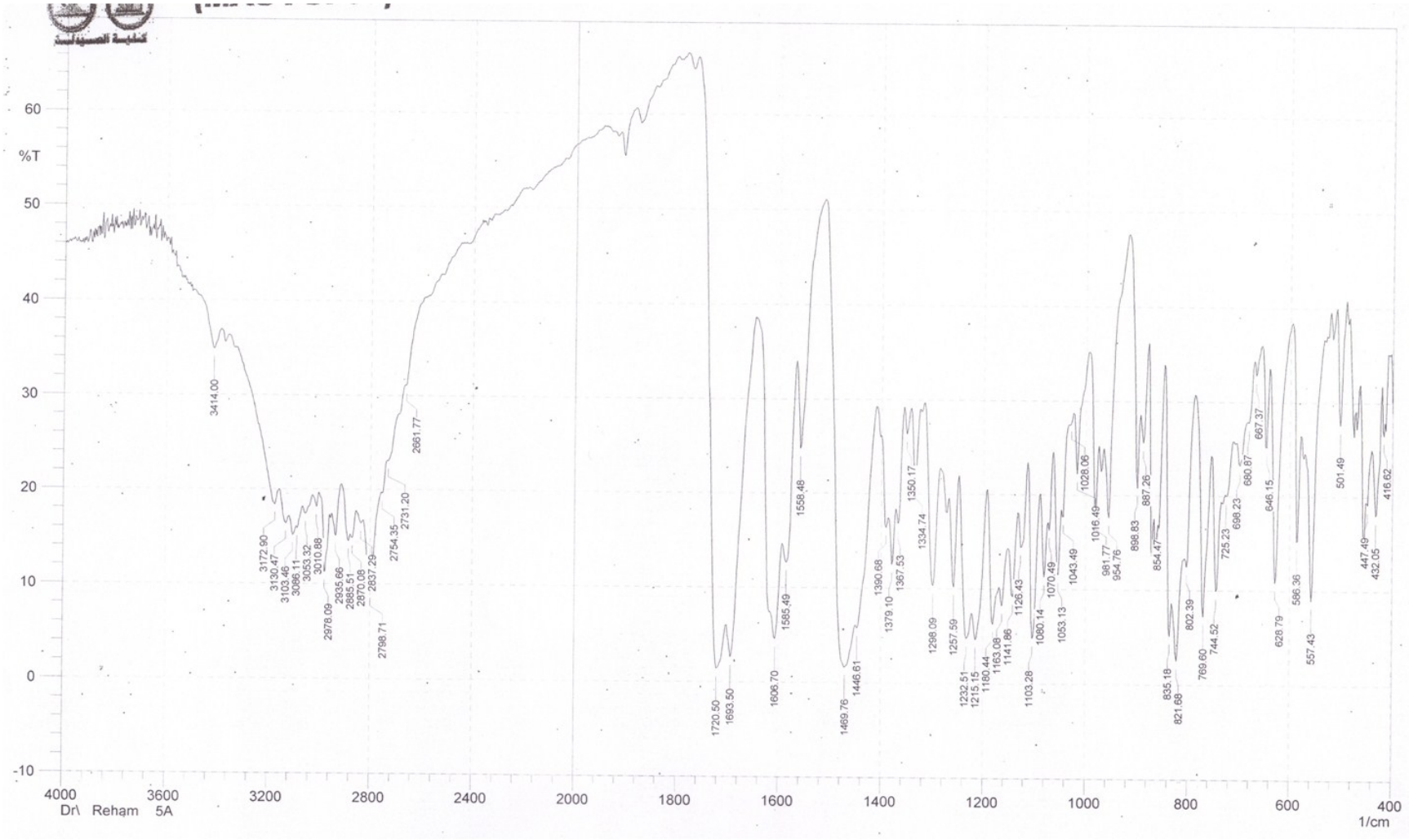


Figure S3. IR spectrum of compound **12**.

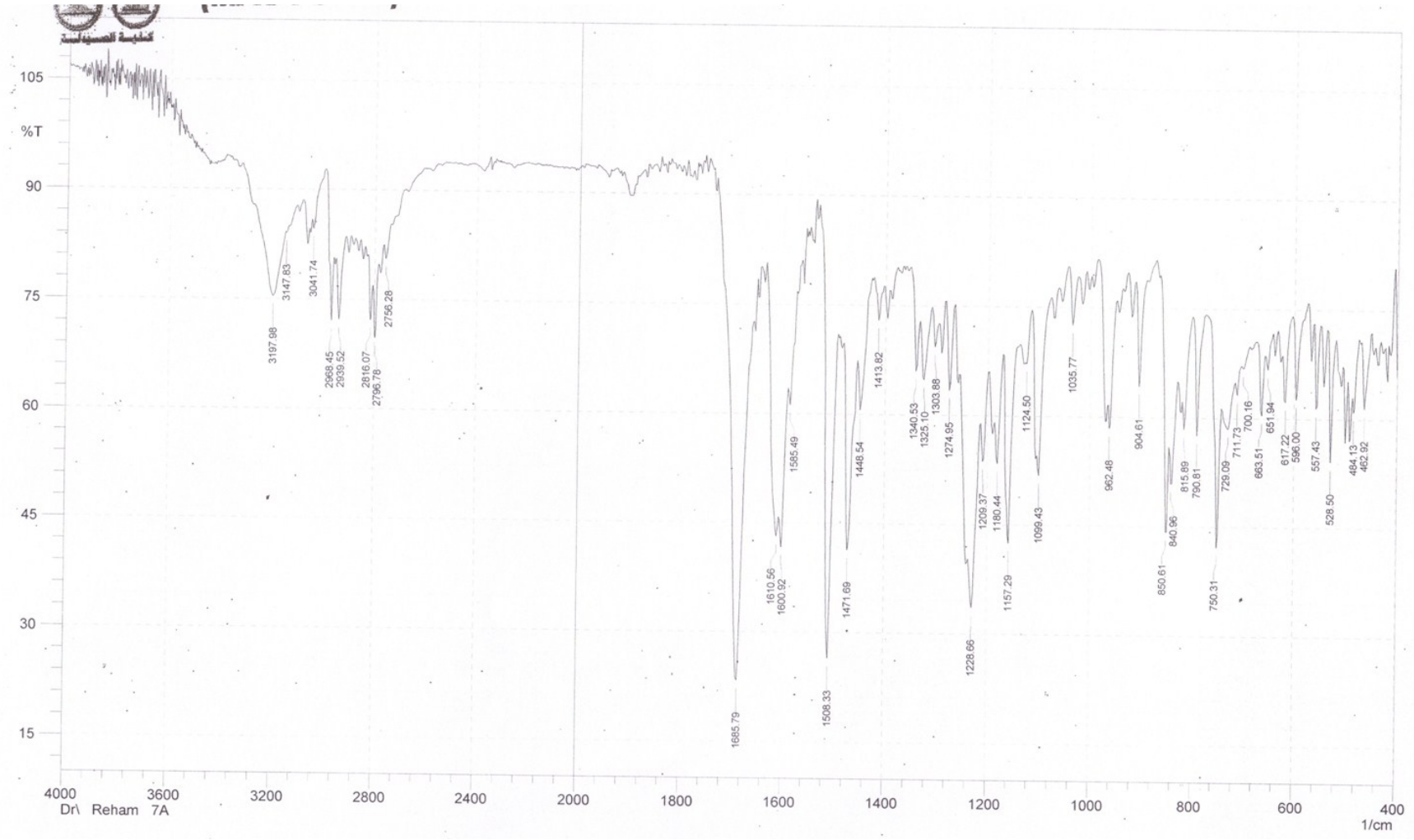


Figure S4. IR spectrum of compound **13**.

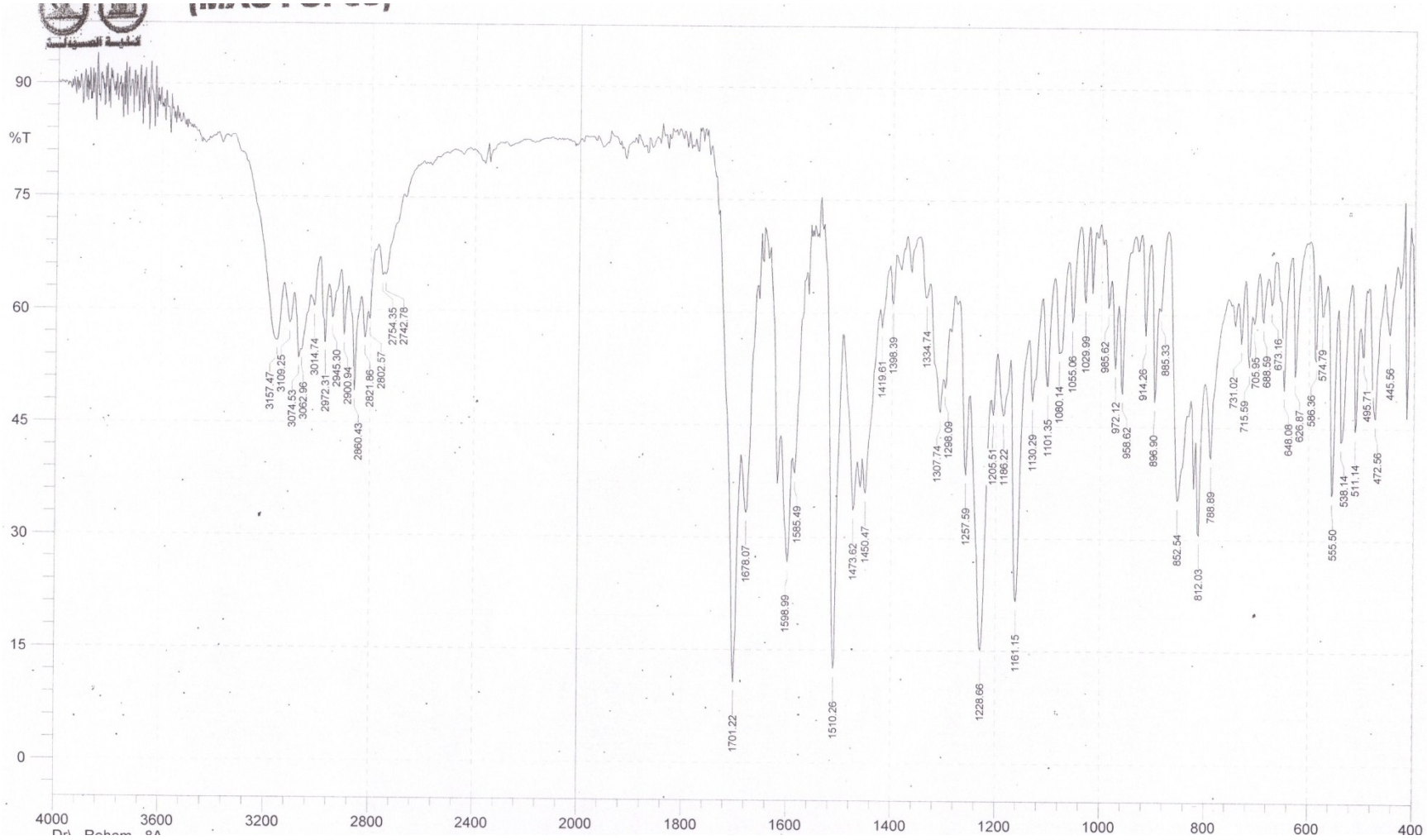


Figure S5. IR spectrum of compound **14**.

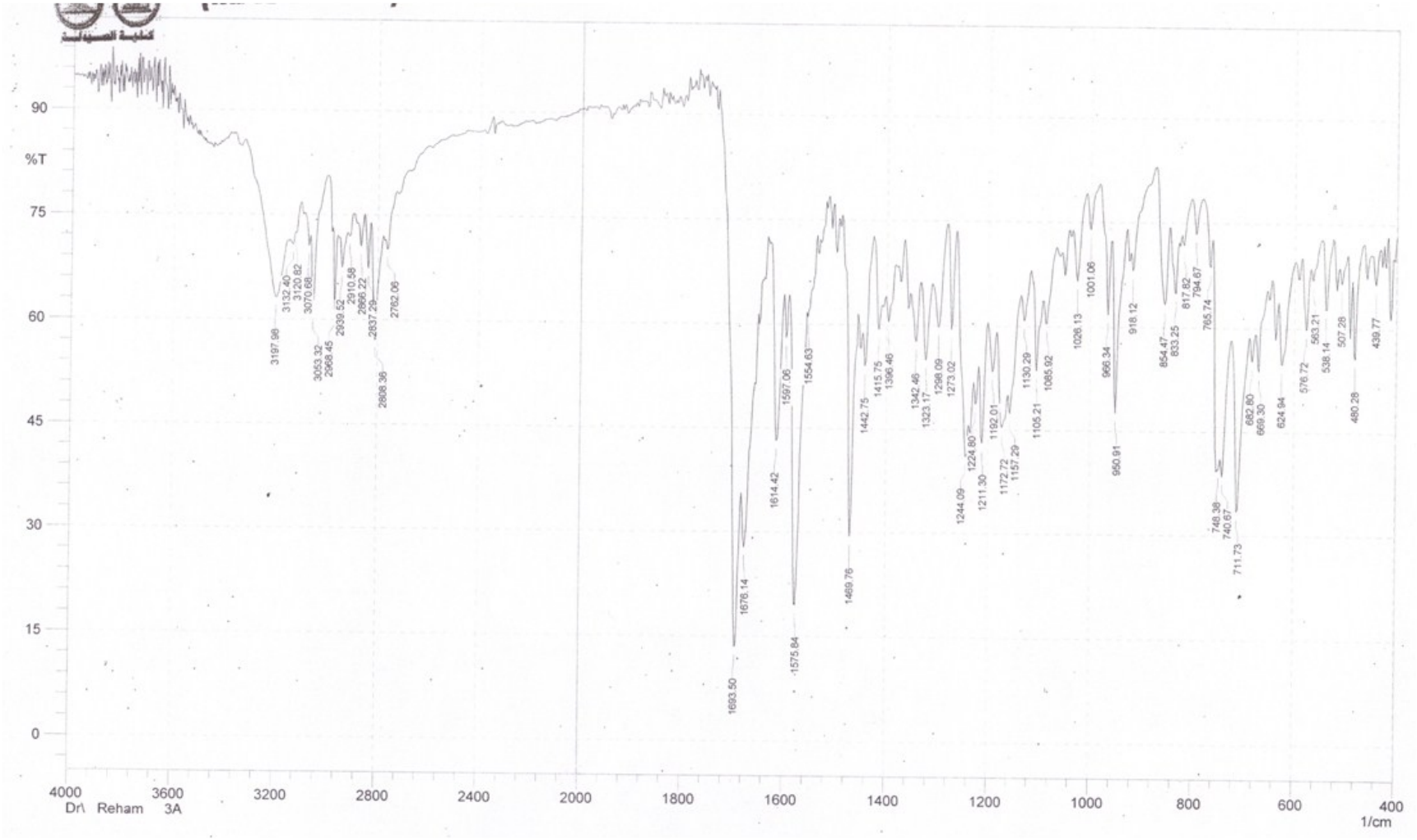


Figure S6. IR spectrum of compound **15**.

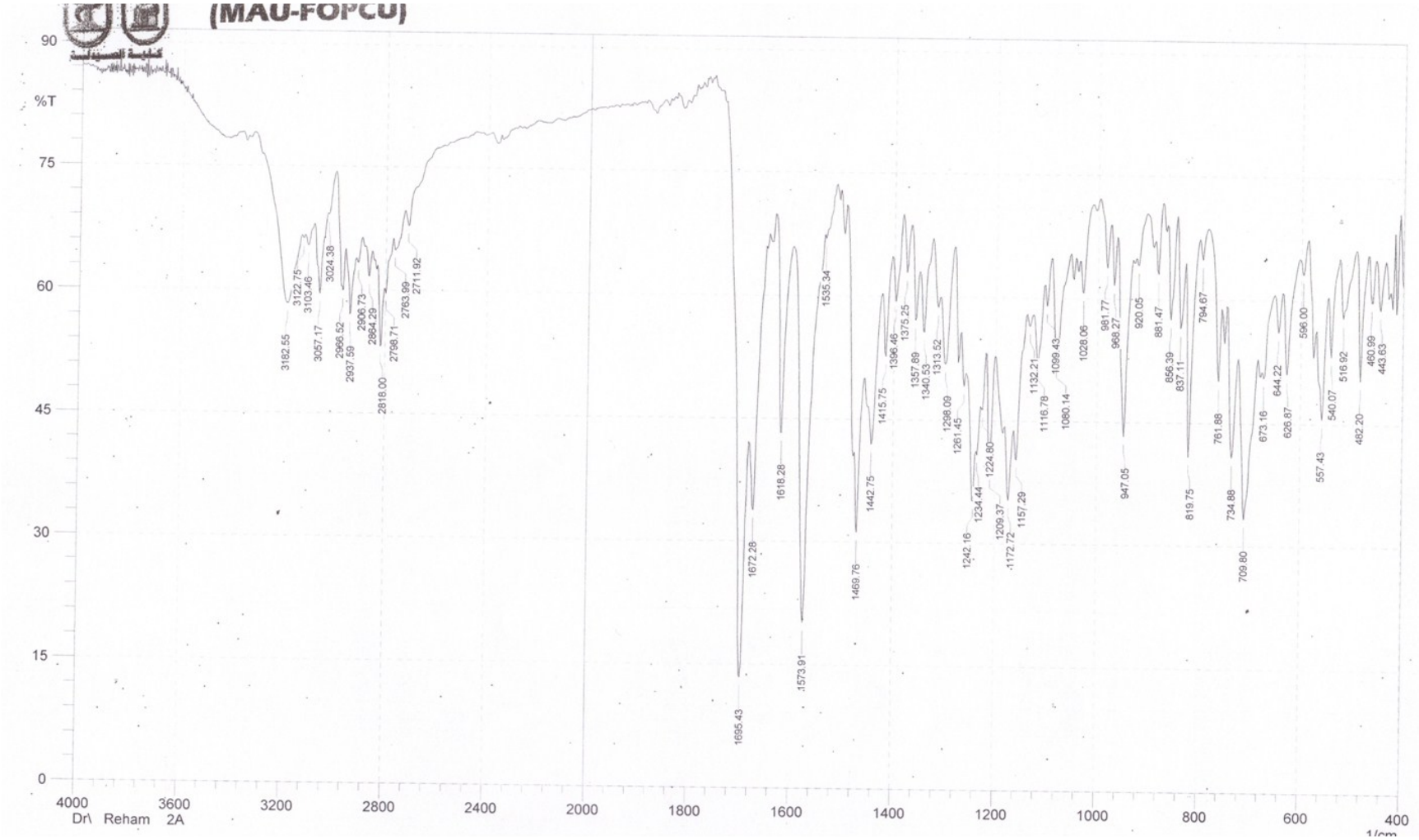


Figure S7. IR spectrum of compound **16**.

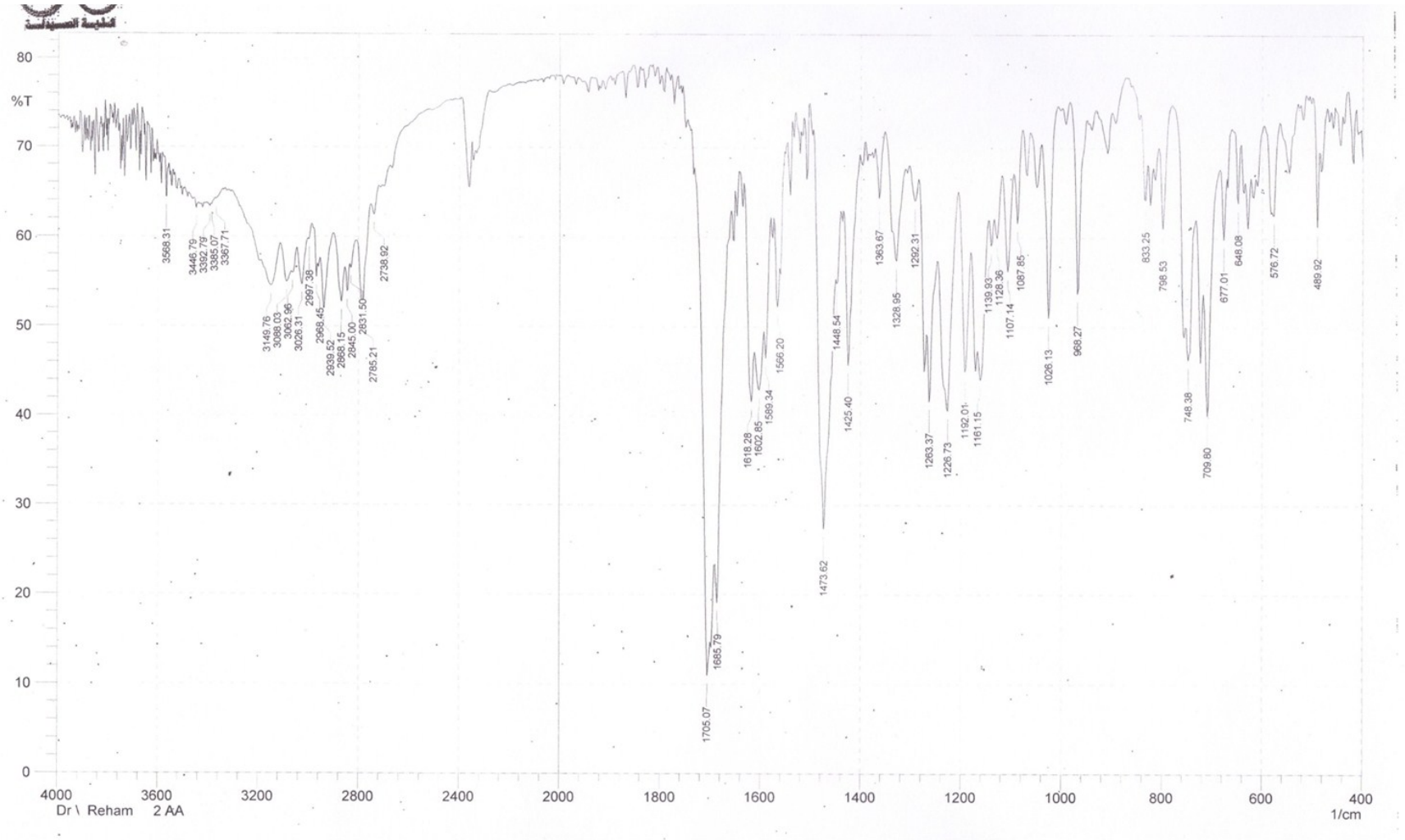


Figure S8. IR spectrum of compound **17**.

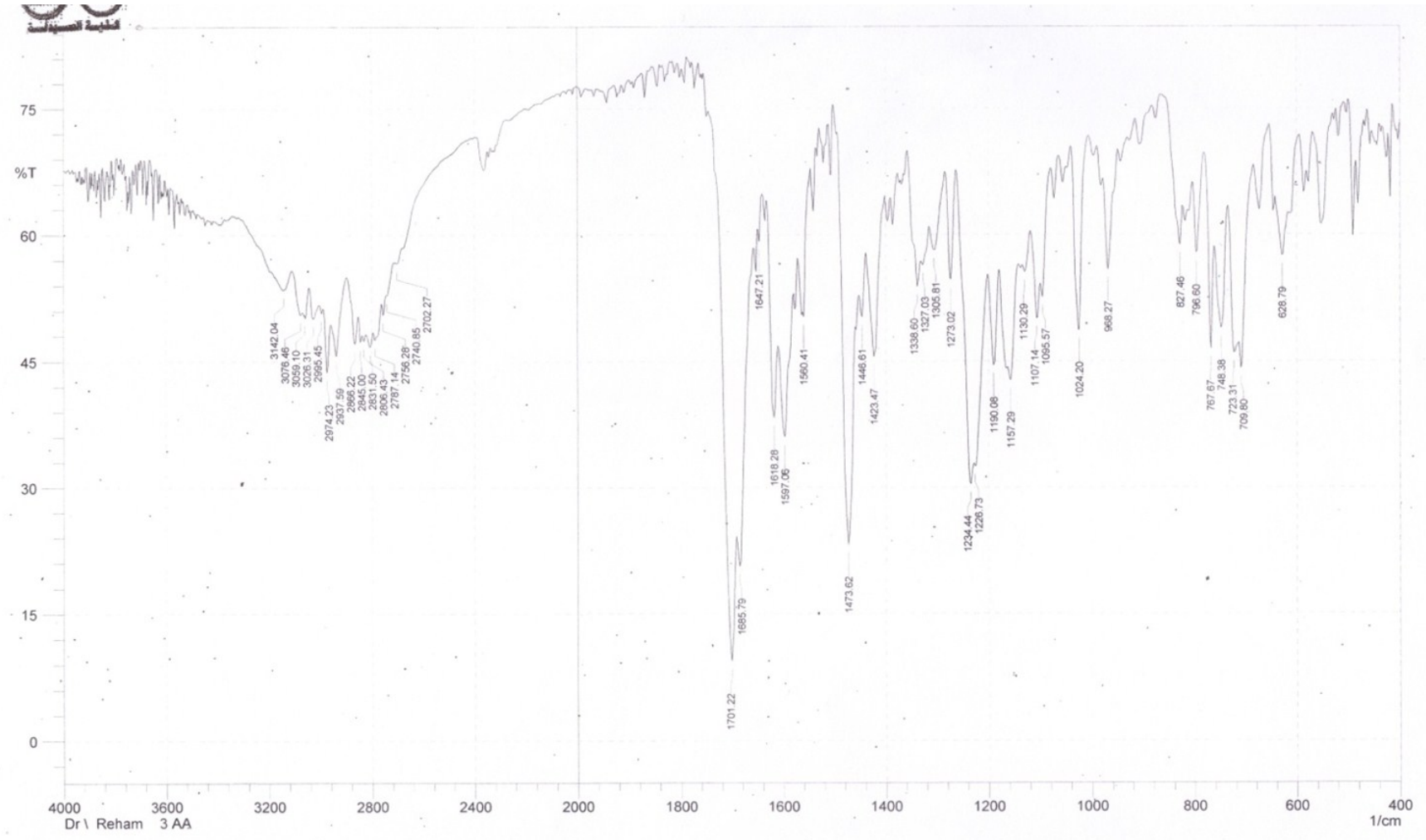


Figure S9. IR spectrum of compound **18**.

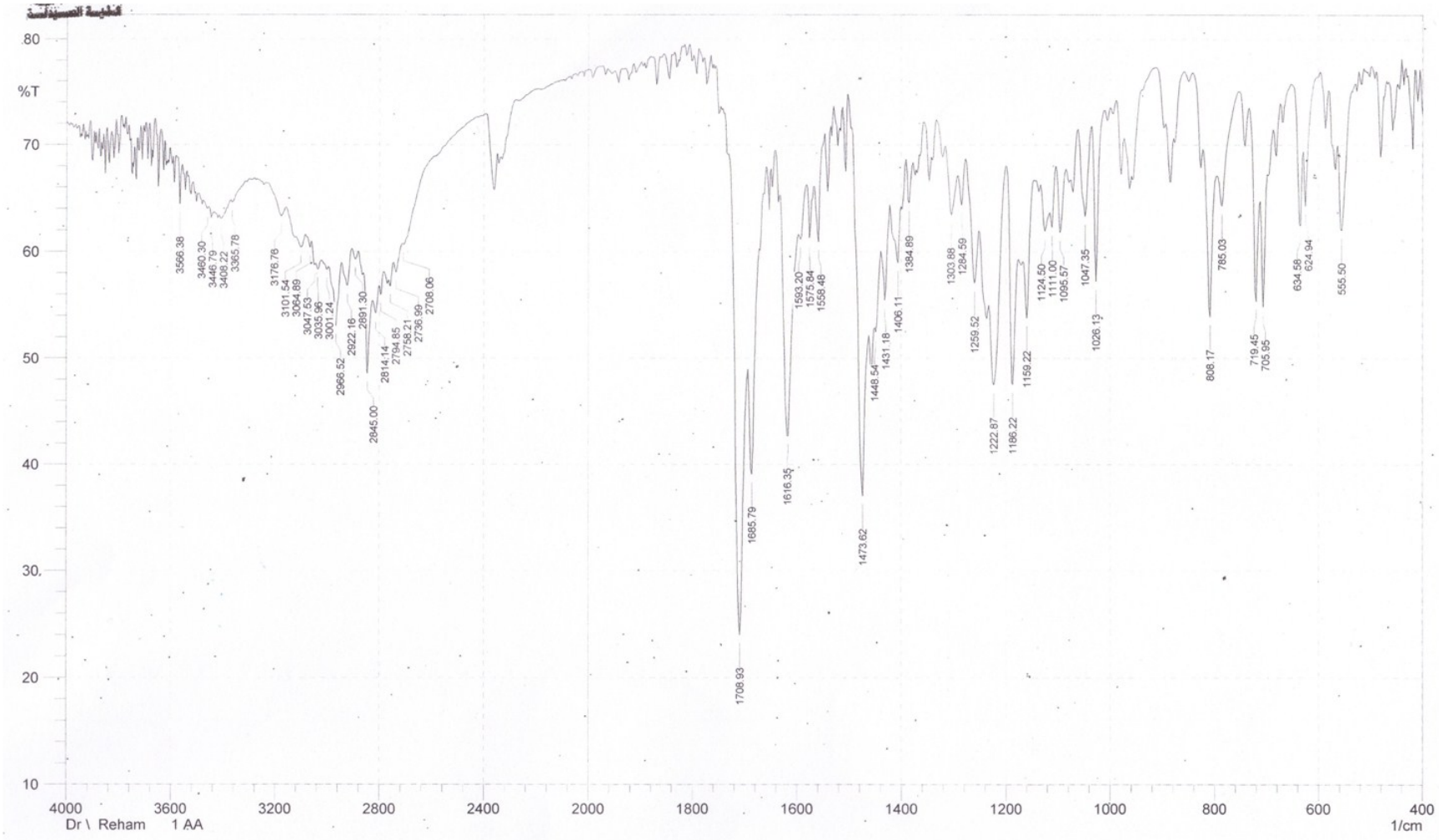


Figure S10. IR spectrum of compound **19**.

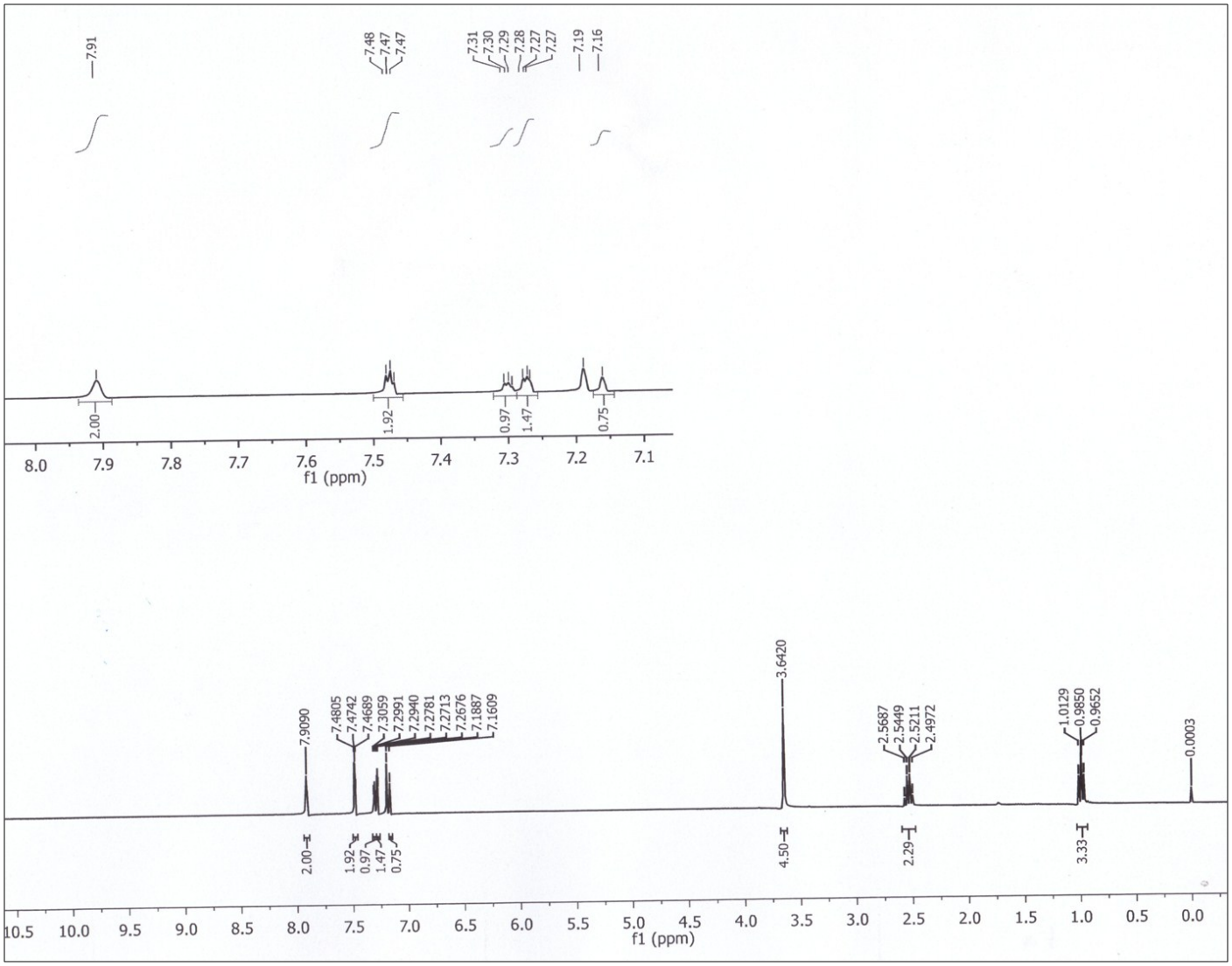


Figure S11. ^{1}H-NMR spectrum of compound **3**.

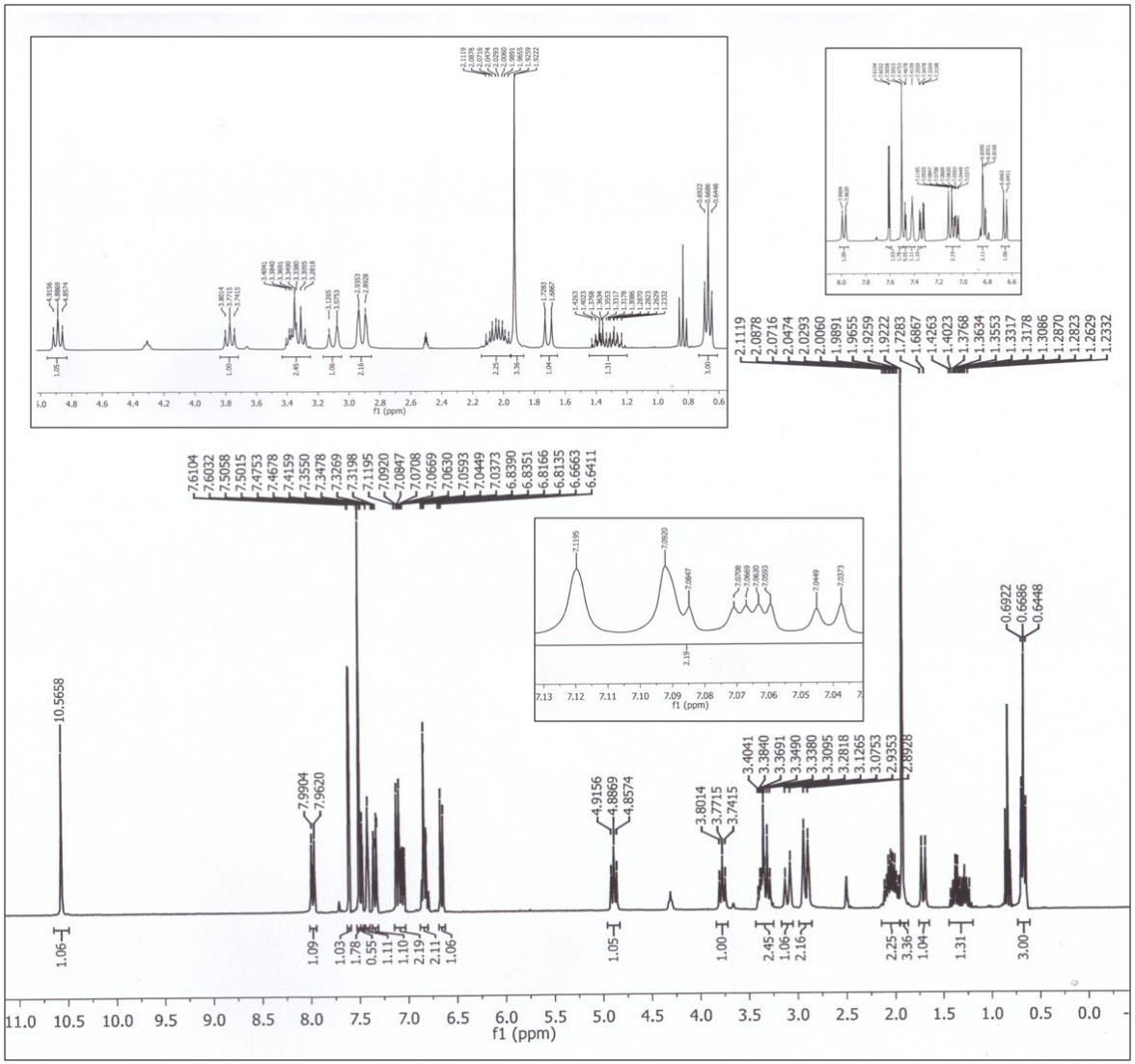


Figure S12. [1]H-NMR spectrum of compound **11**.

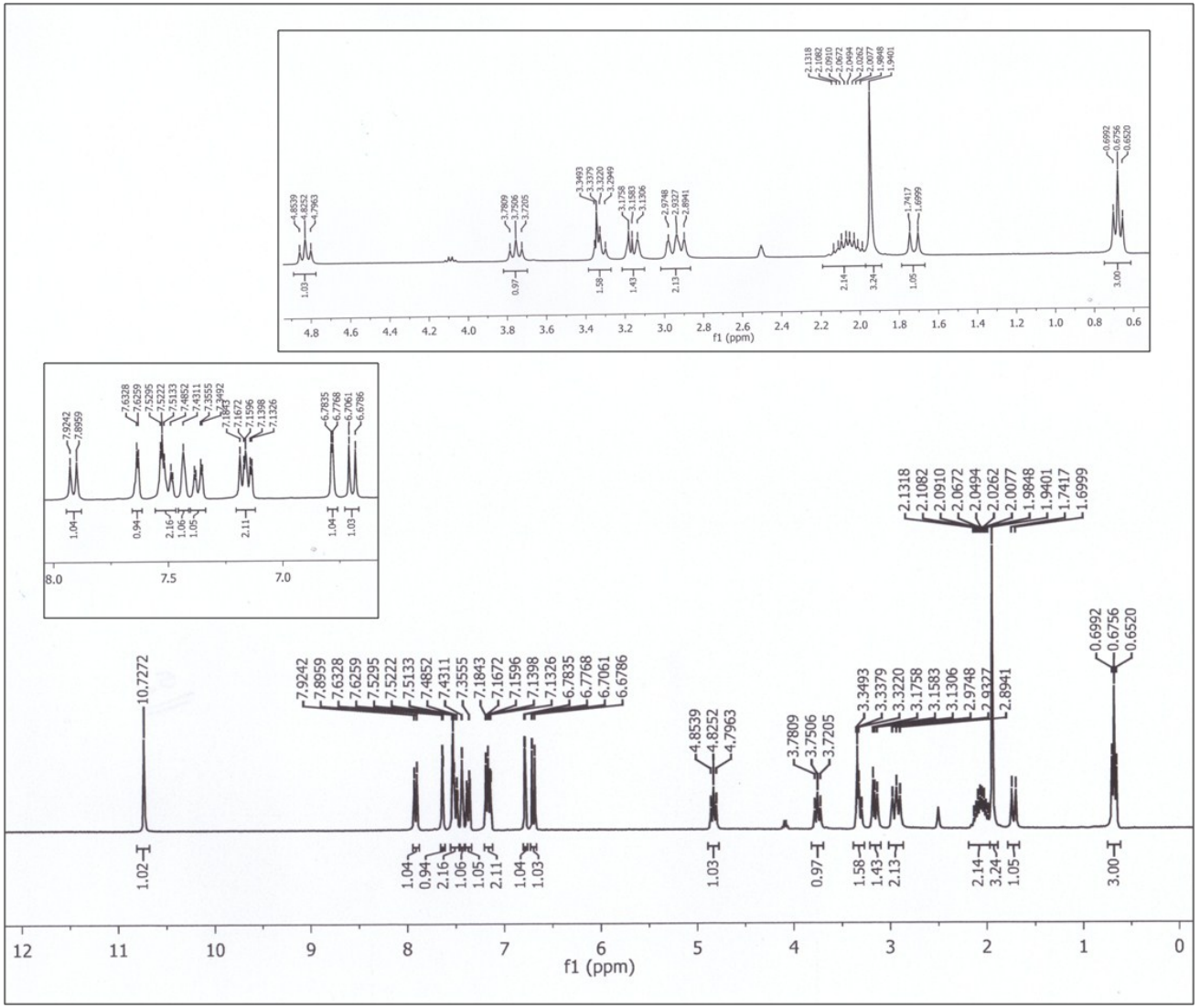


Figure S13. [1]H-NMR spectrum of compound **12**.

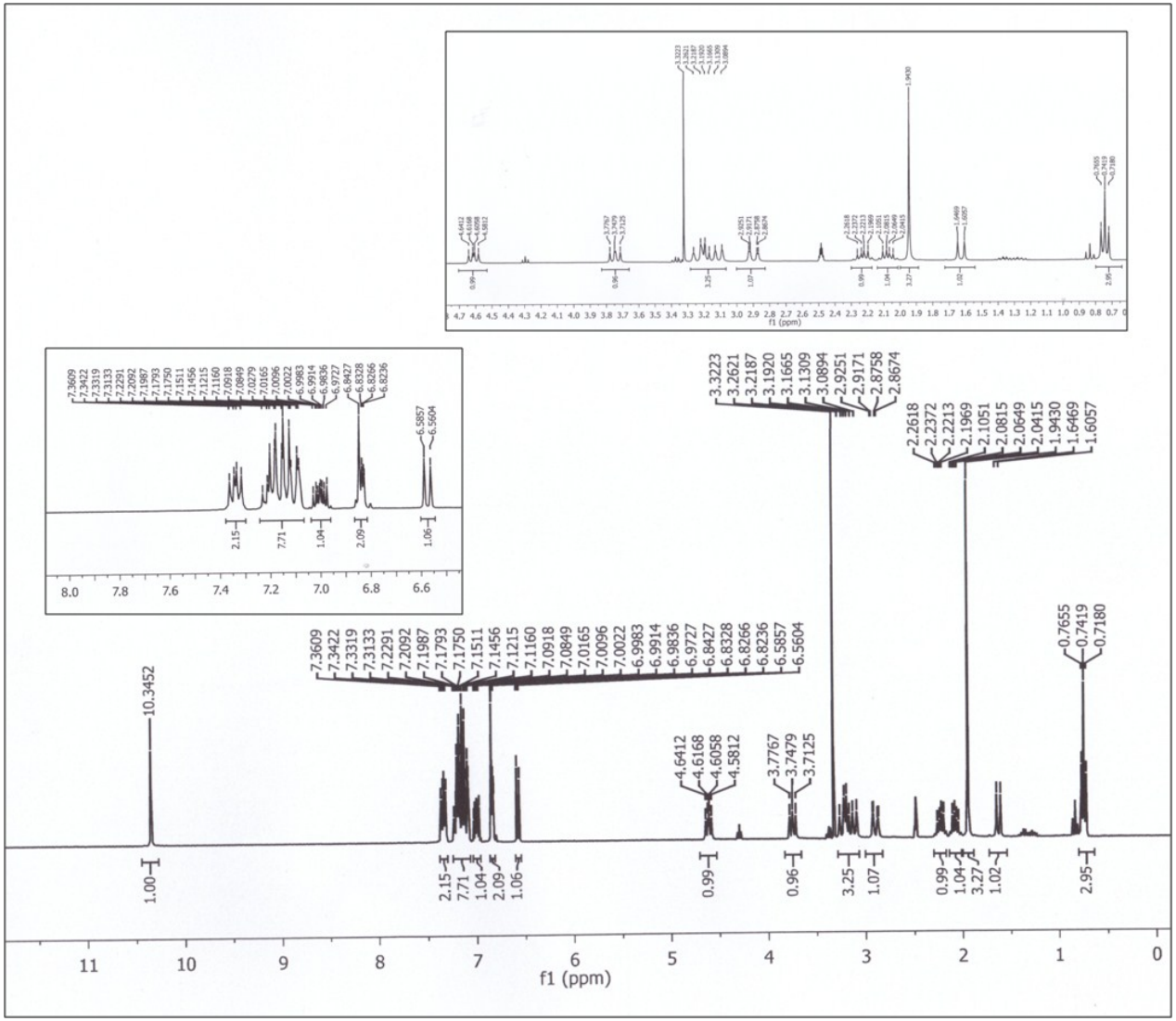


Figure S14. [1]H-NMR spectrum of compound **13**.

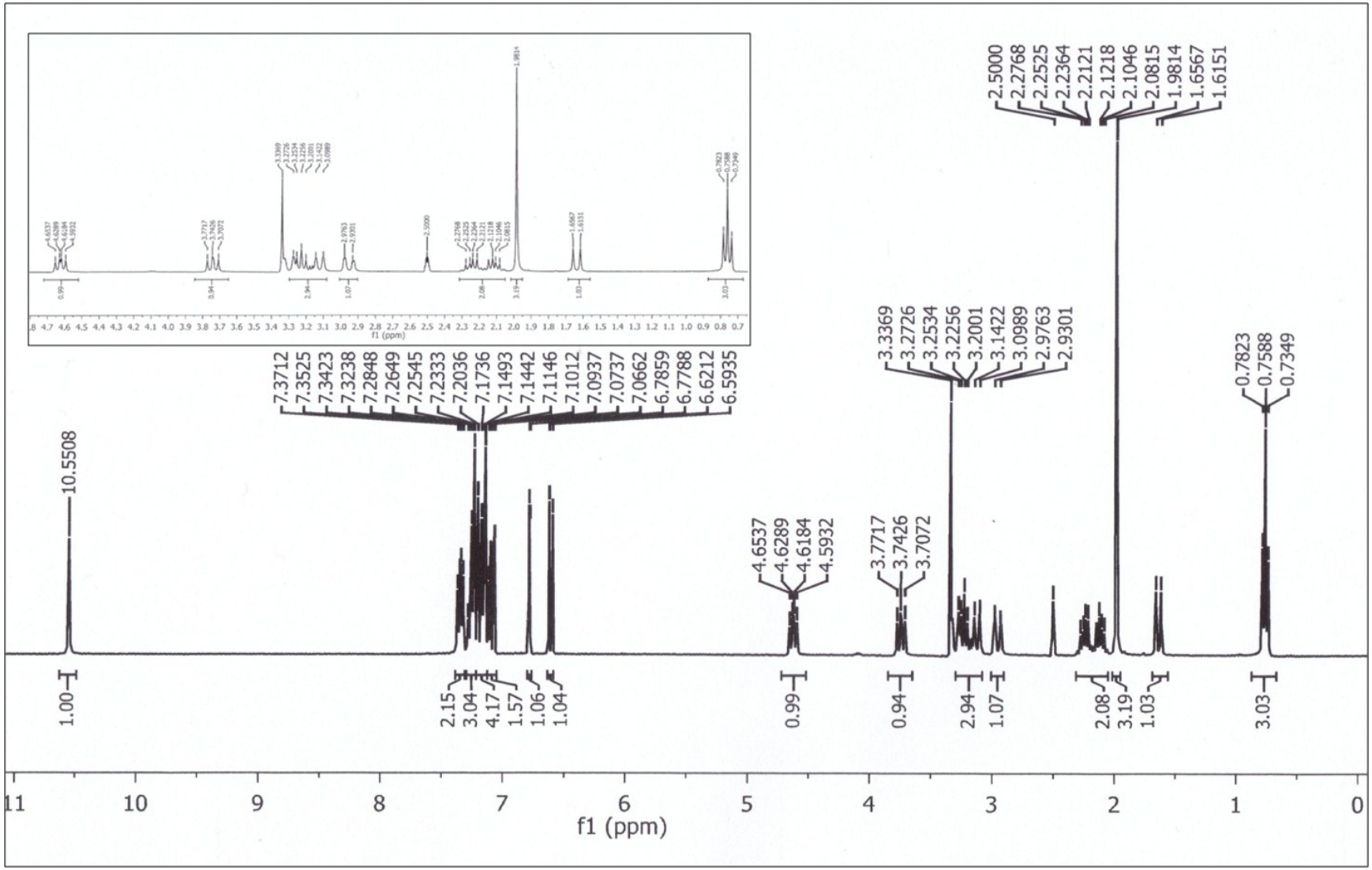


Figure S15. ^{1}H-NMR spectrum of compound **14**.

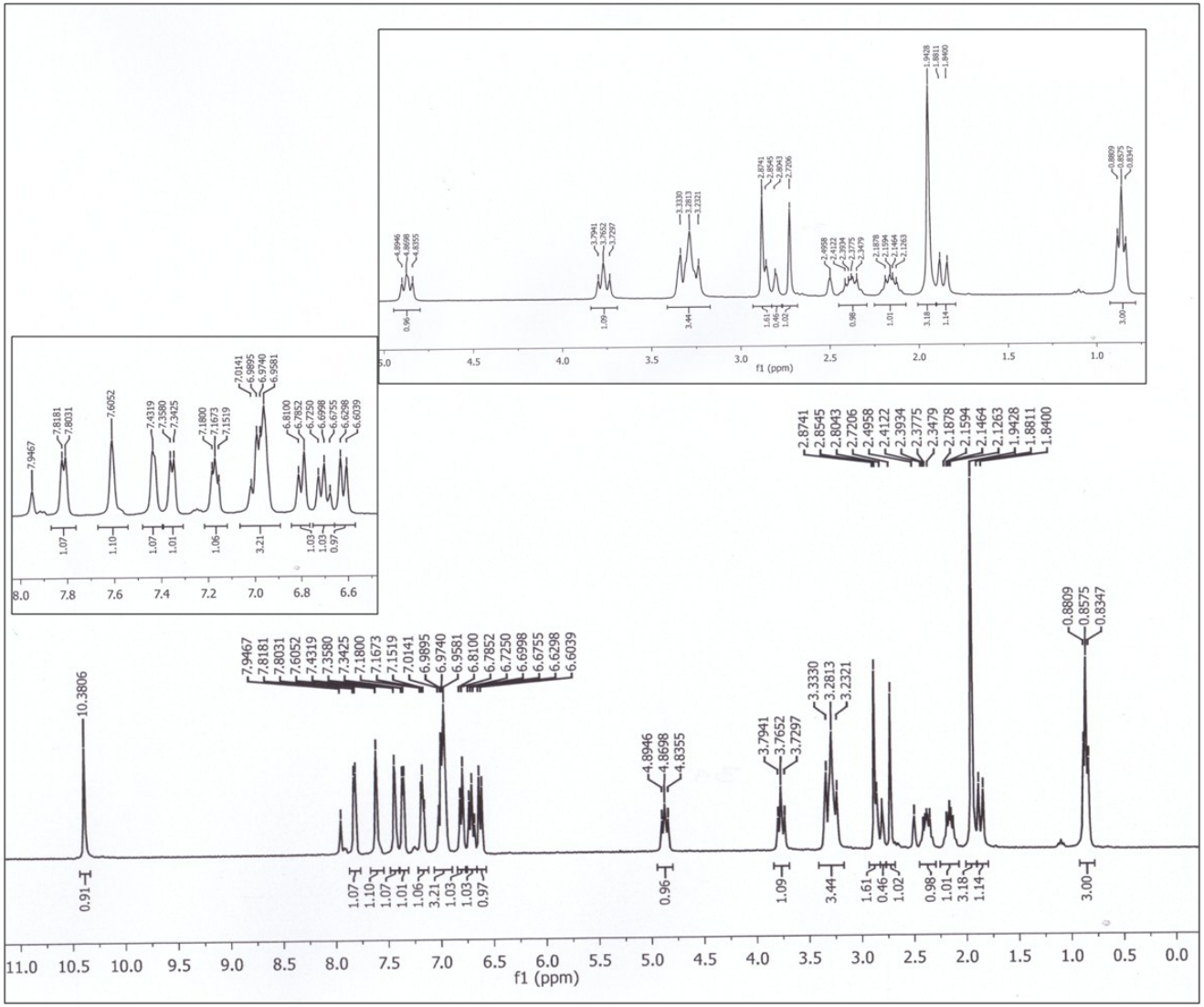


Figure S16. [1]H-NMR spectrum of compound **15**.

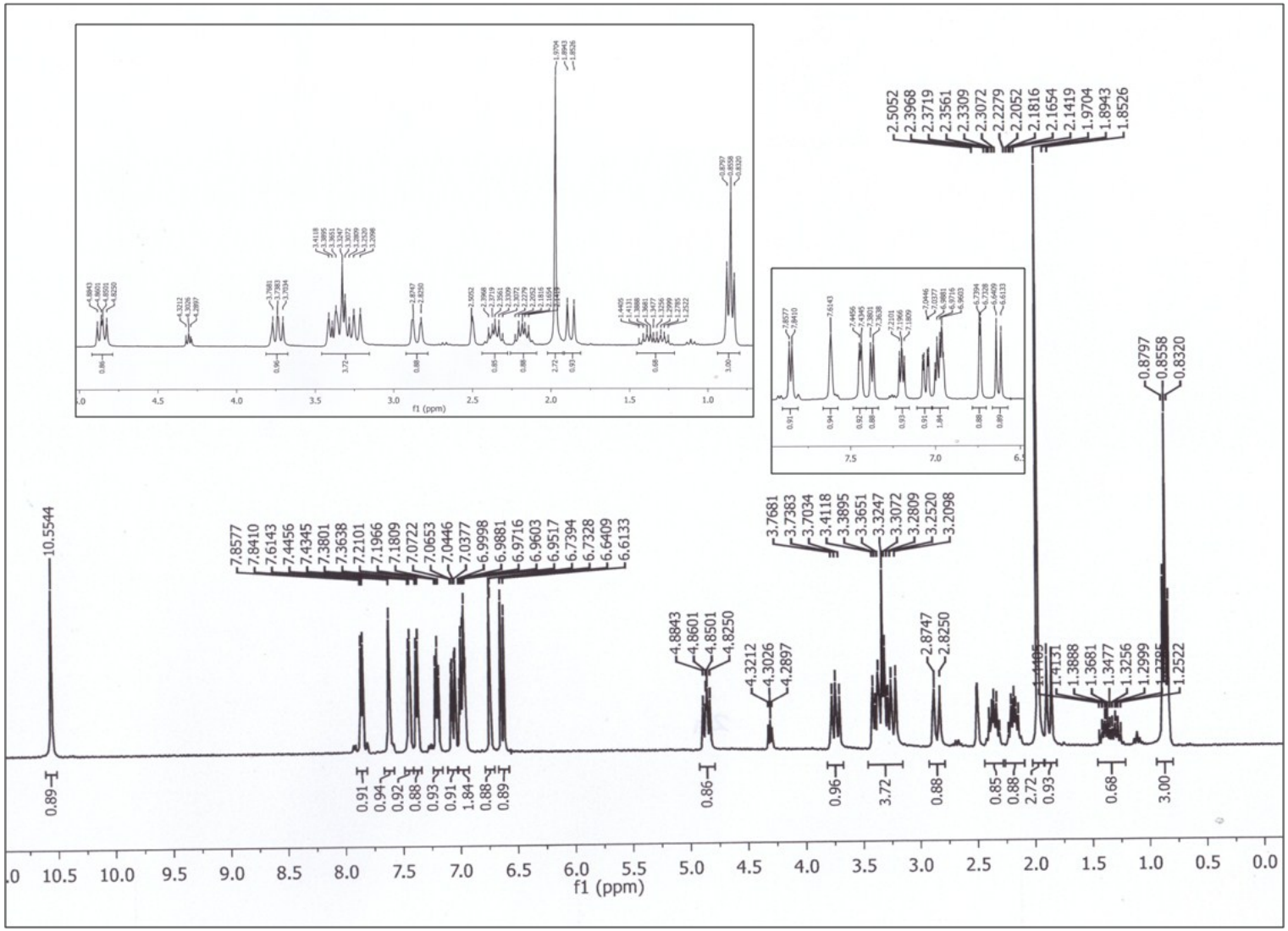


Figure S17. ^{1}H-NMR spectrum of compound **16**.

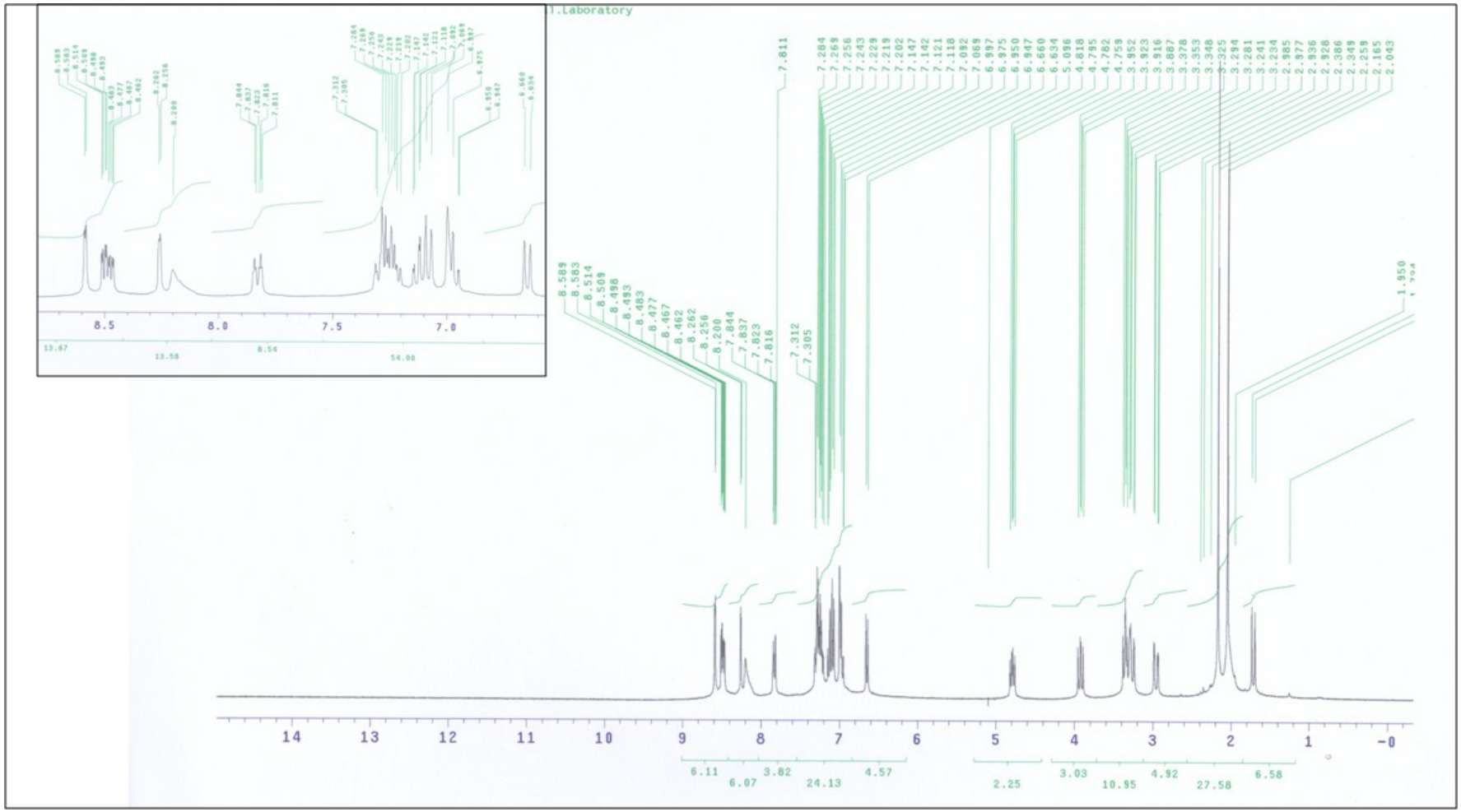


Figure S18. [1]H-NMR spectrum of compound **17**.

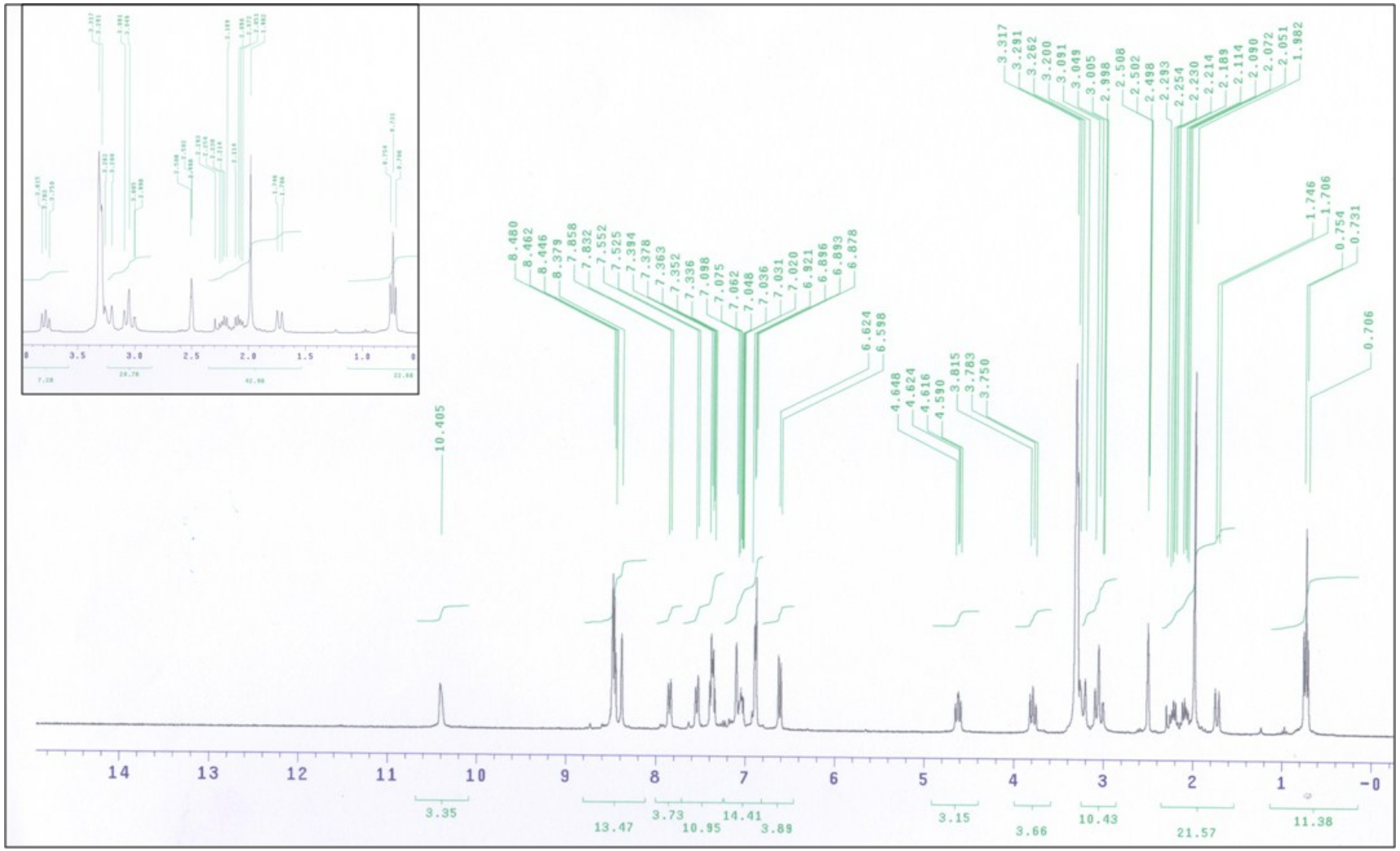


Figure S19. ^{1}H-NMR spectrum of compound **18**.

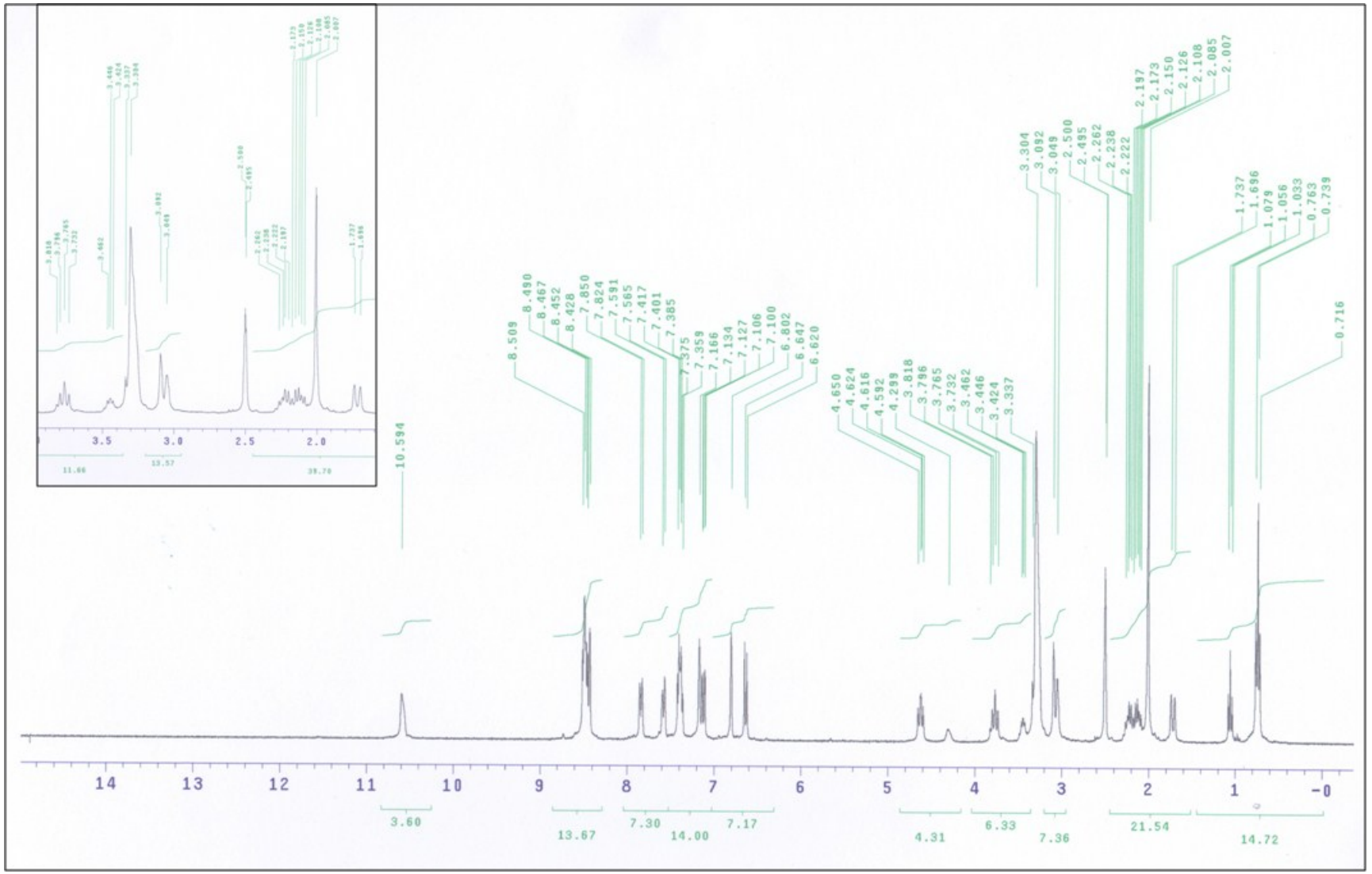


Figure S20. ^{1}H-NMR spectrum of compound **19**.

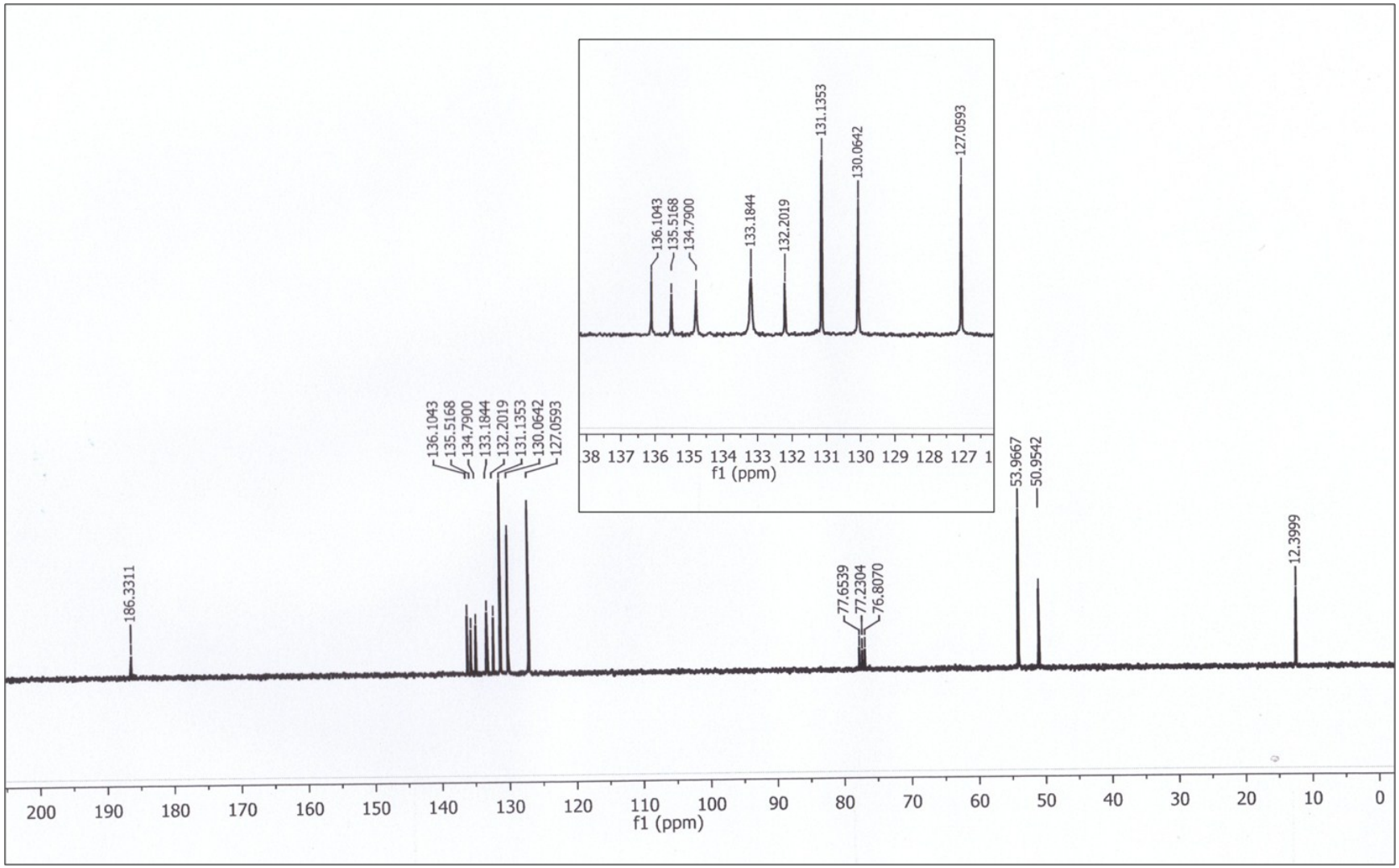


Figure S21. ^{13}C-NMR spectrum of compound **3**.

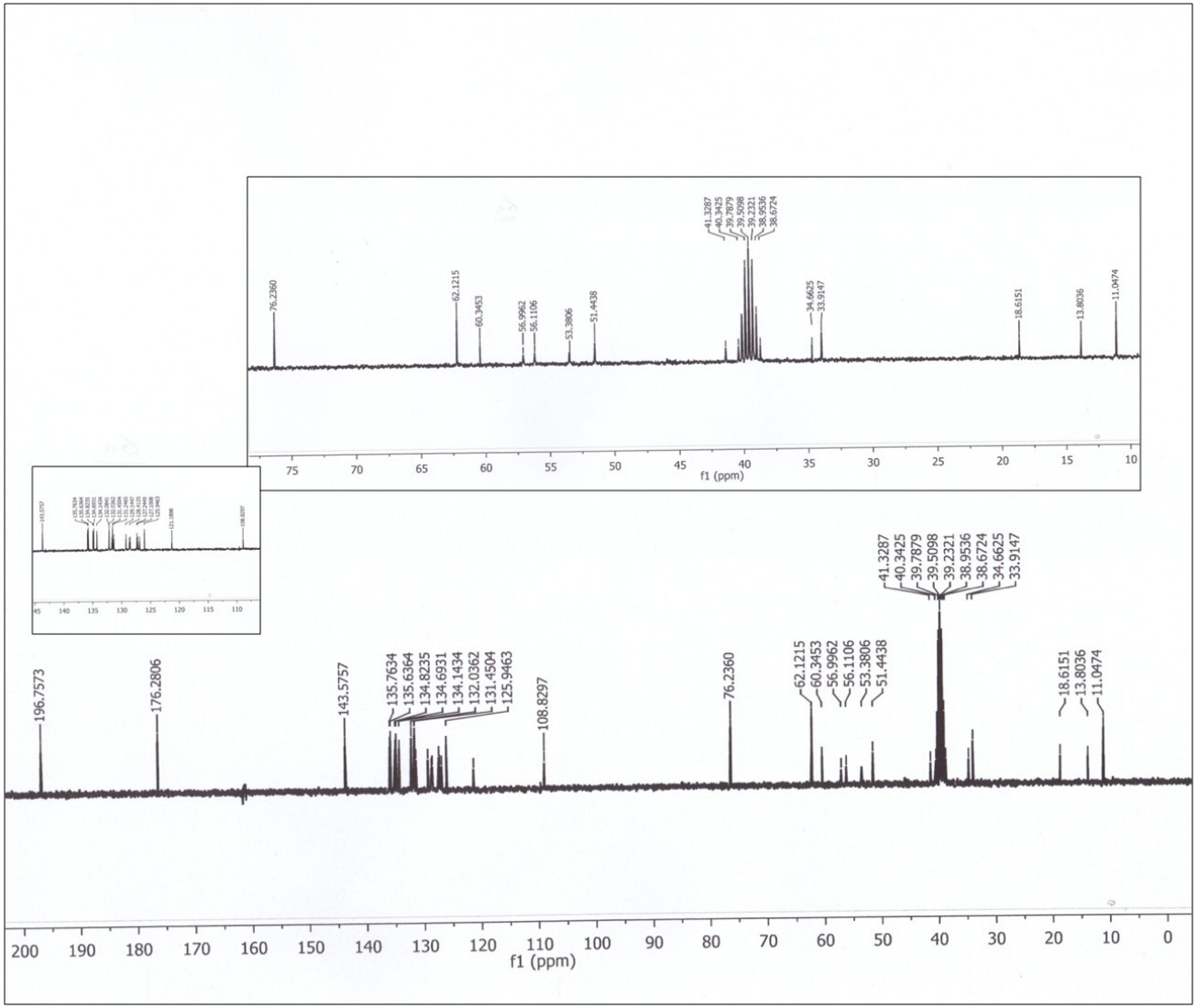


Figure S22. ^{13}C-NMR spectrum of compound **11**.

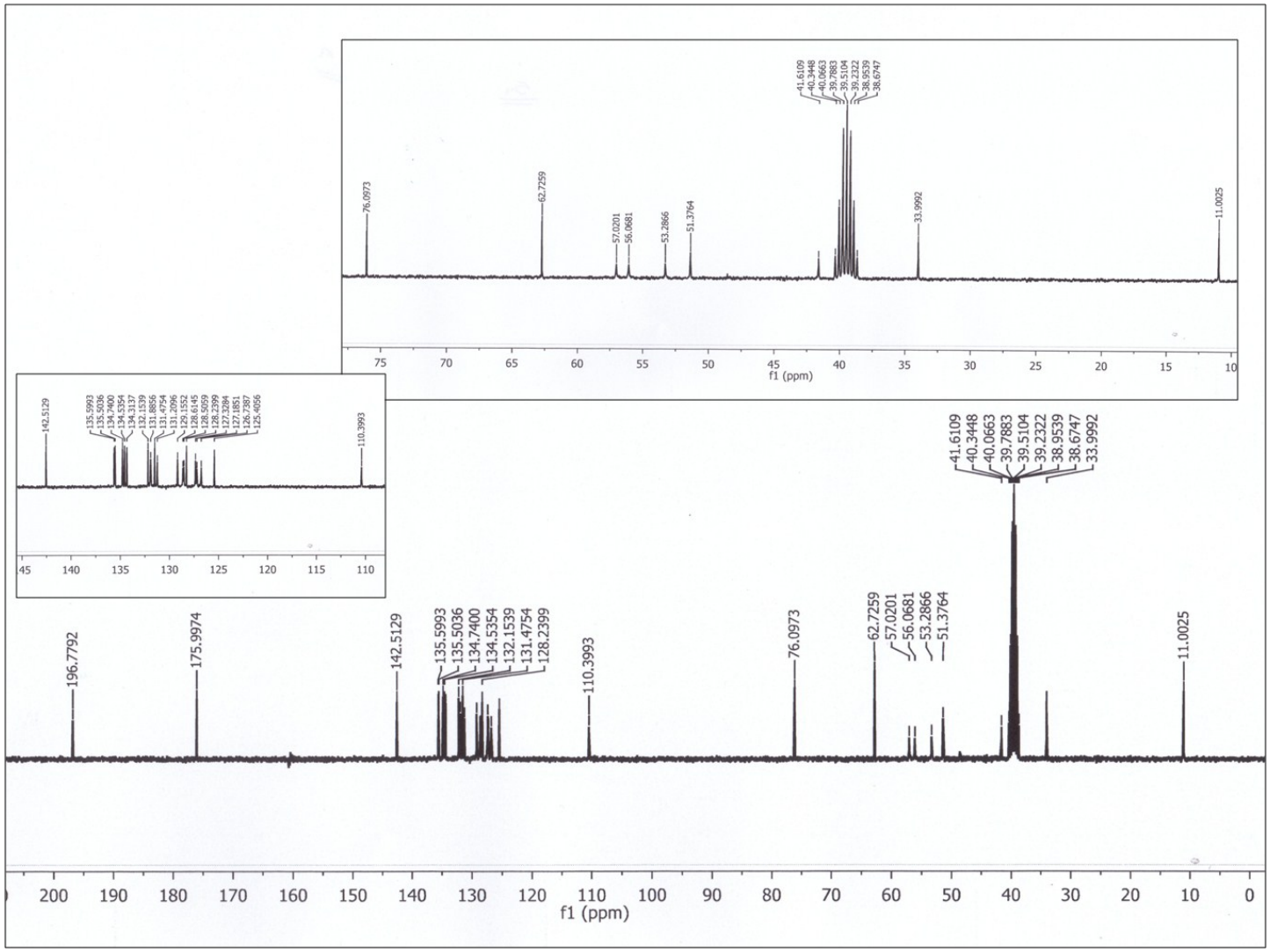


Figure S23. ^{13}C-NMR spectrum of compound **12**.

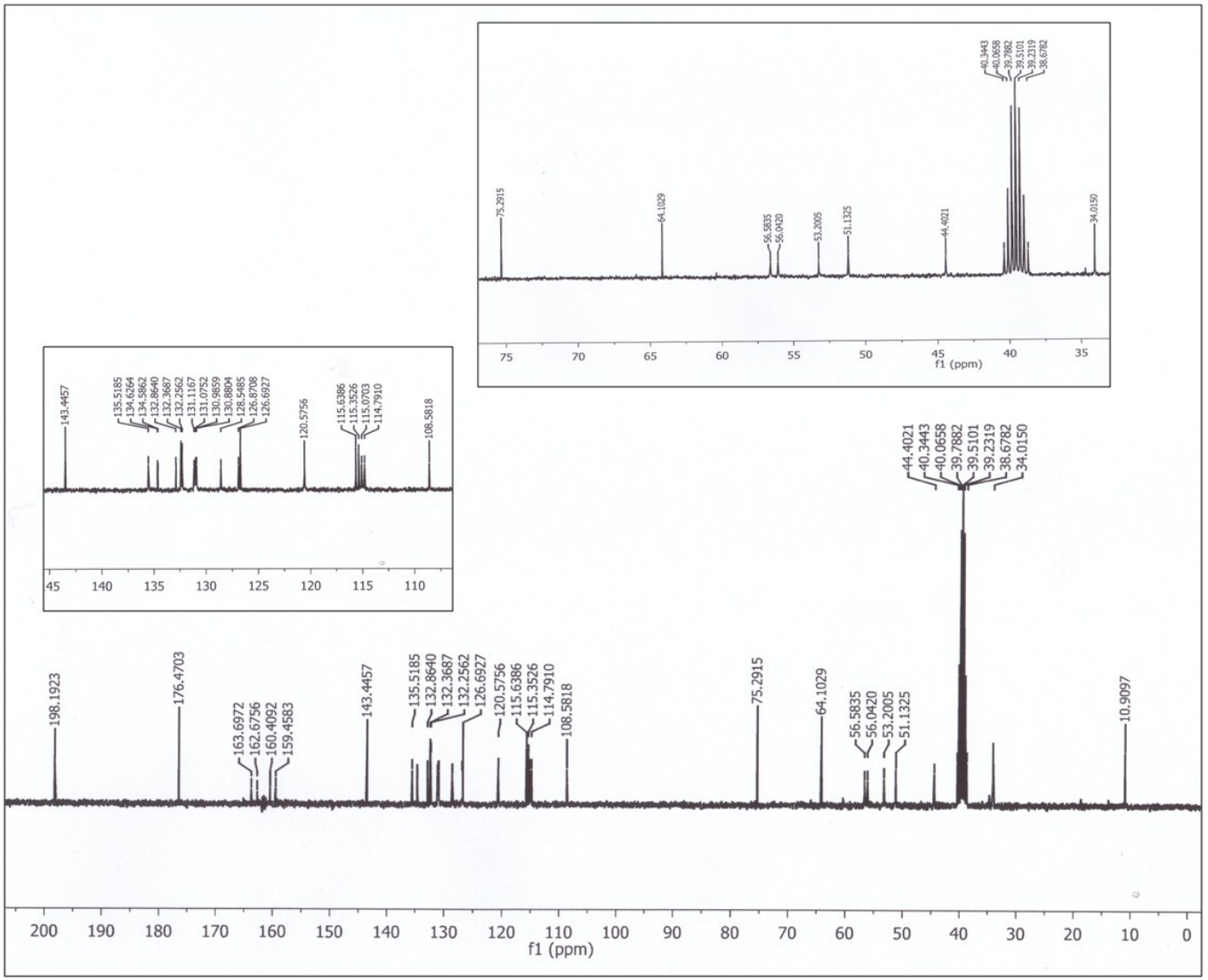


Figure S24. ^{13}C-NMR spectrum of compound **13**.

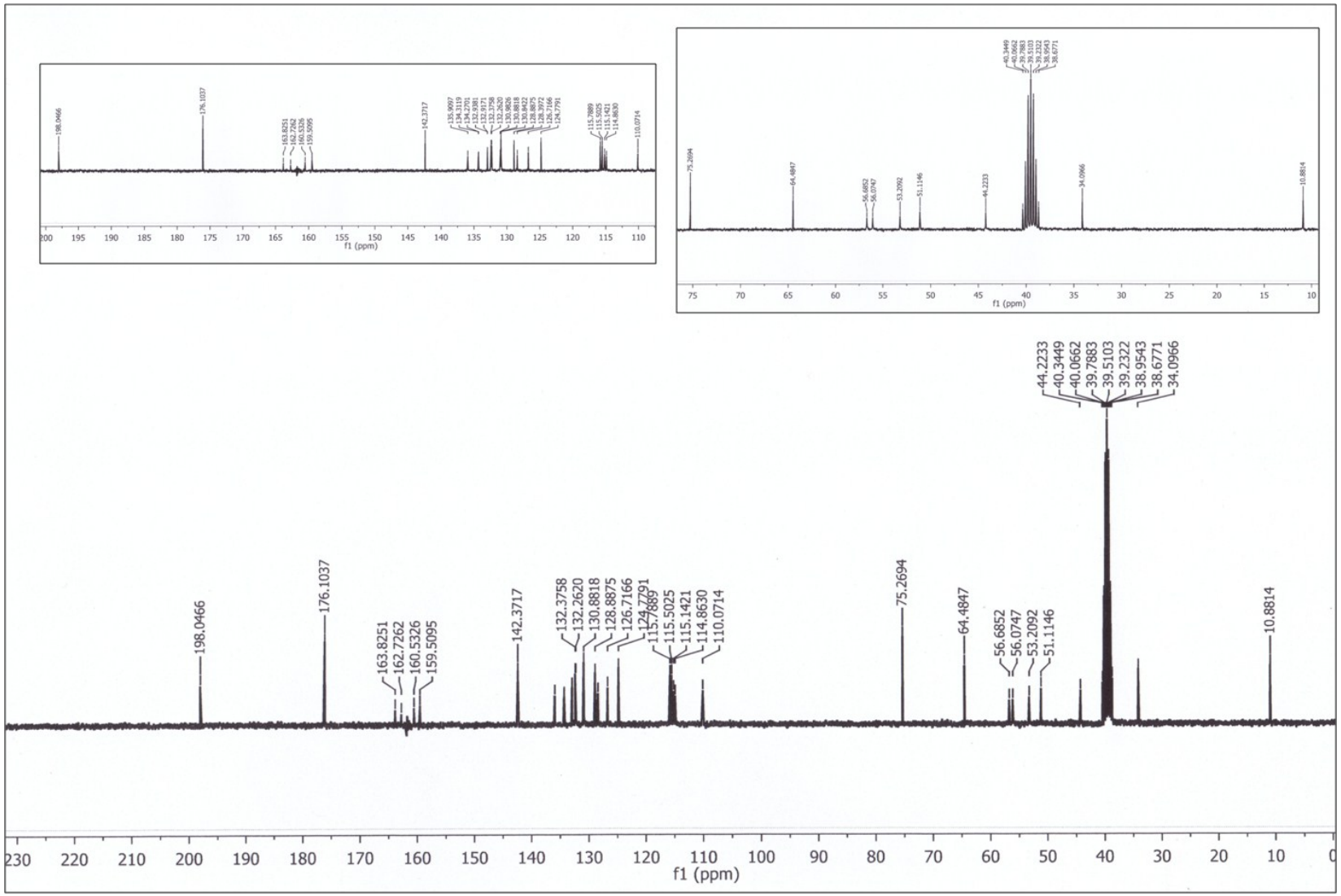


Figure S25. ^{13}C-NMR spectrum of compound **14**.

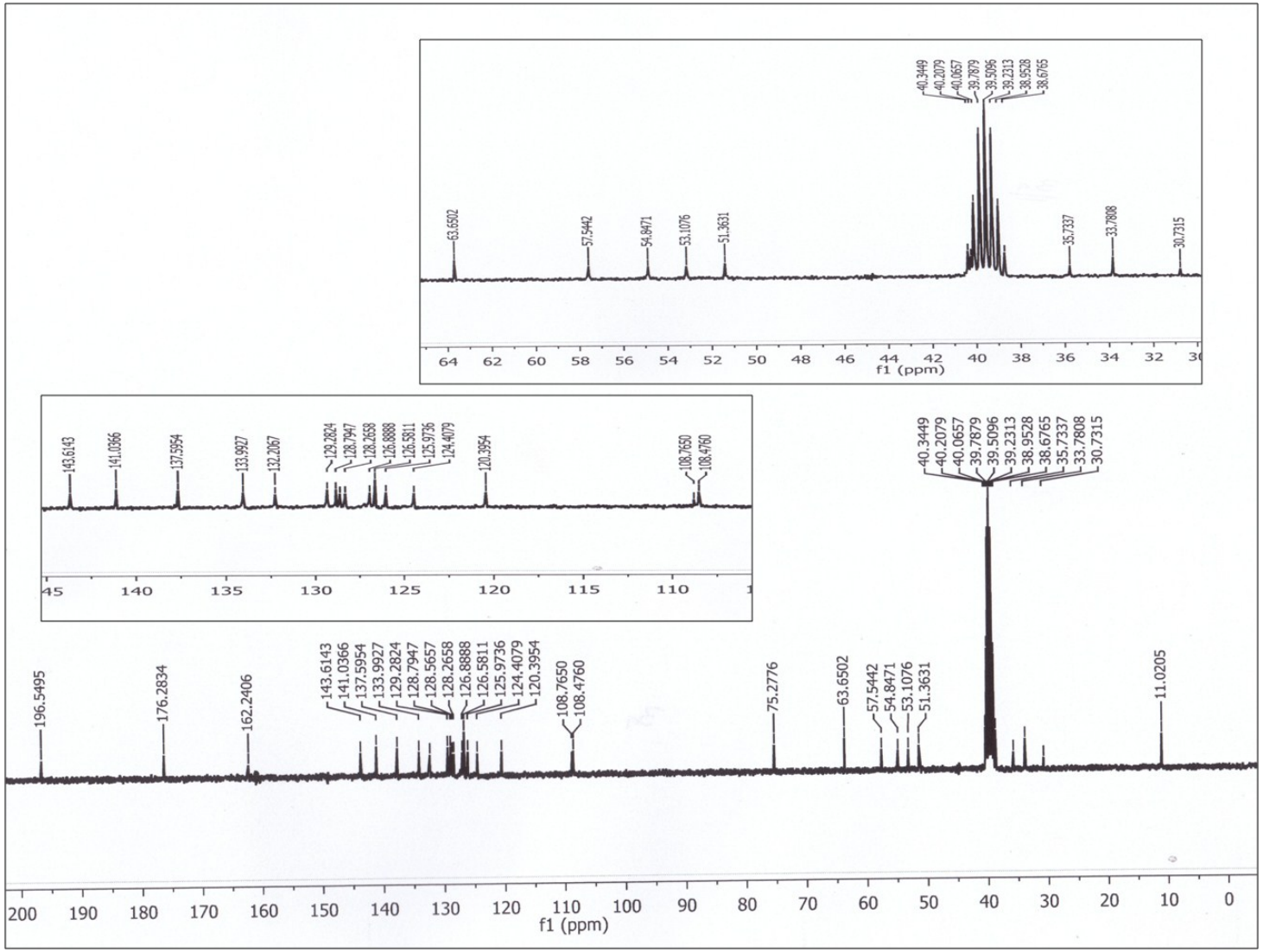


Figure S26. ^{13}C-NMR spectrum of compound **15**.

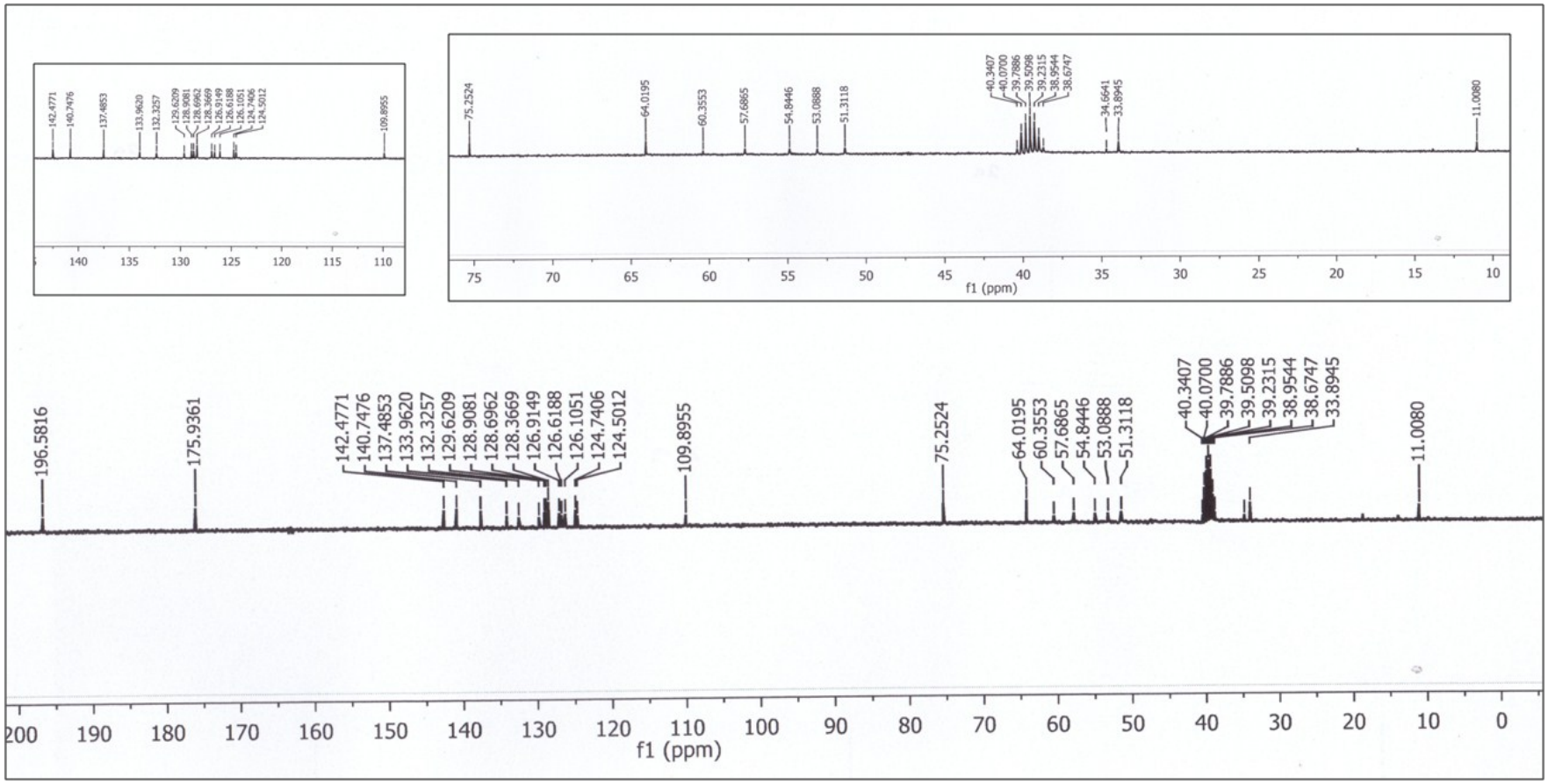


Figure S27. ^{13}C-NMR spectrum of compound **16**.

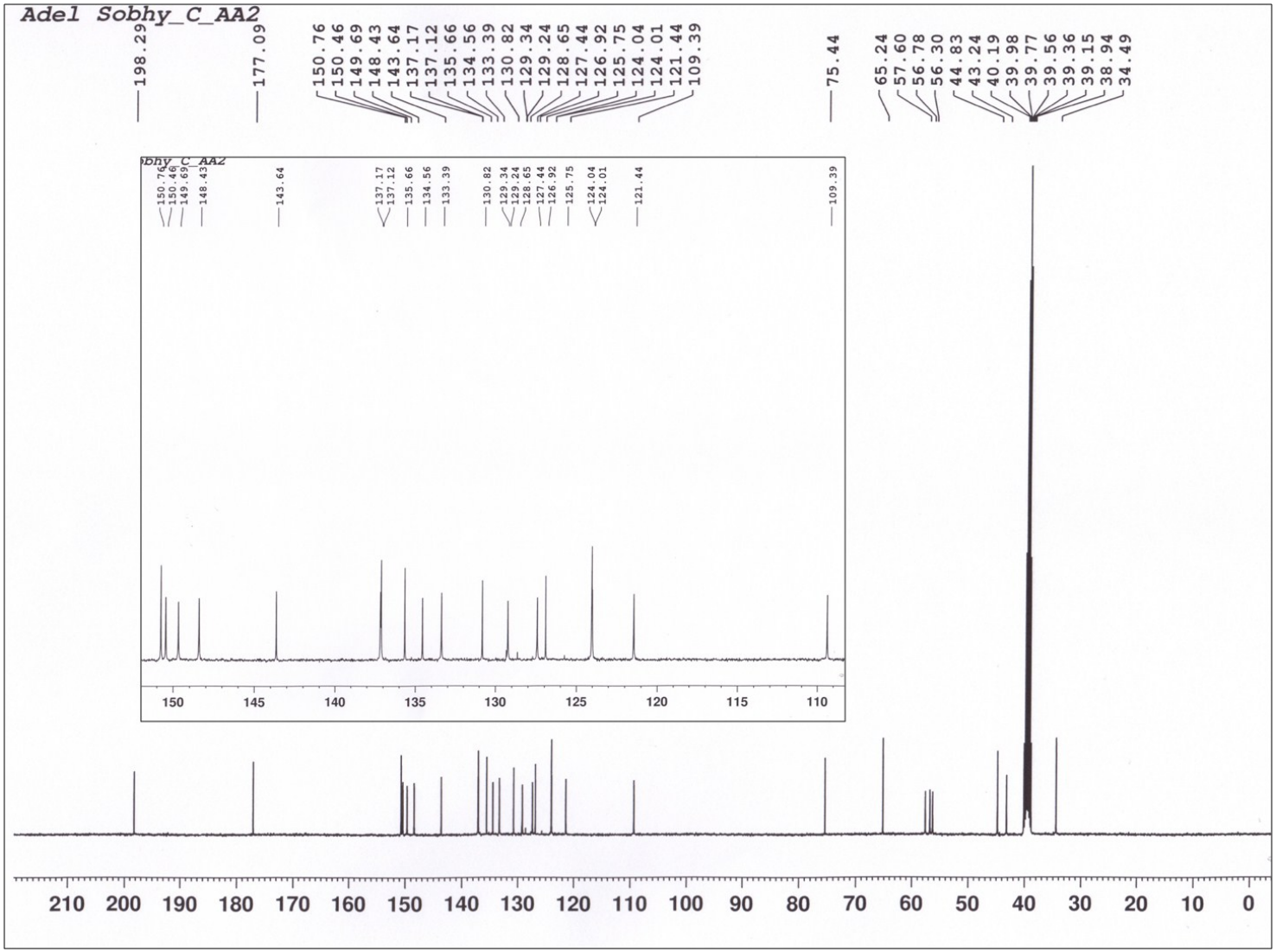


Figure S28. ^{13}C-NMR spectrum of compound **17**.

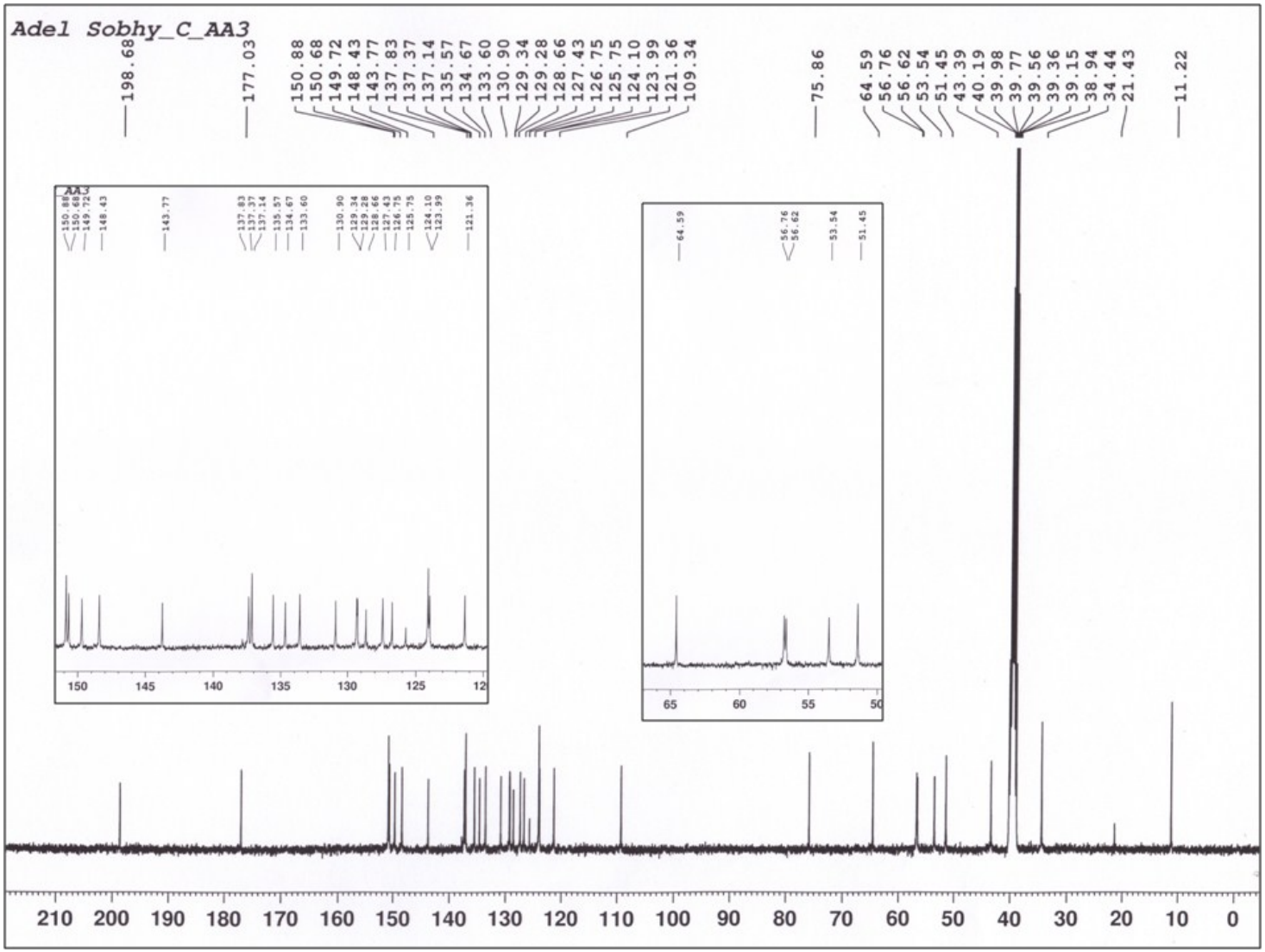


Figure S29. ^{13}C-NMR spectrum of compound **18**.

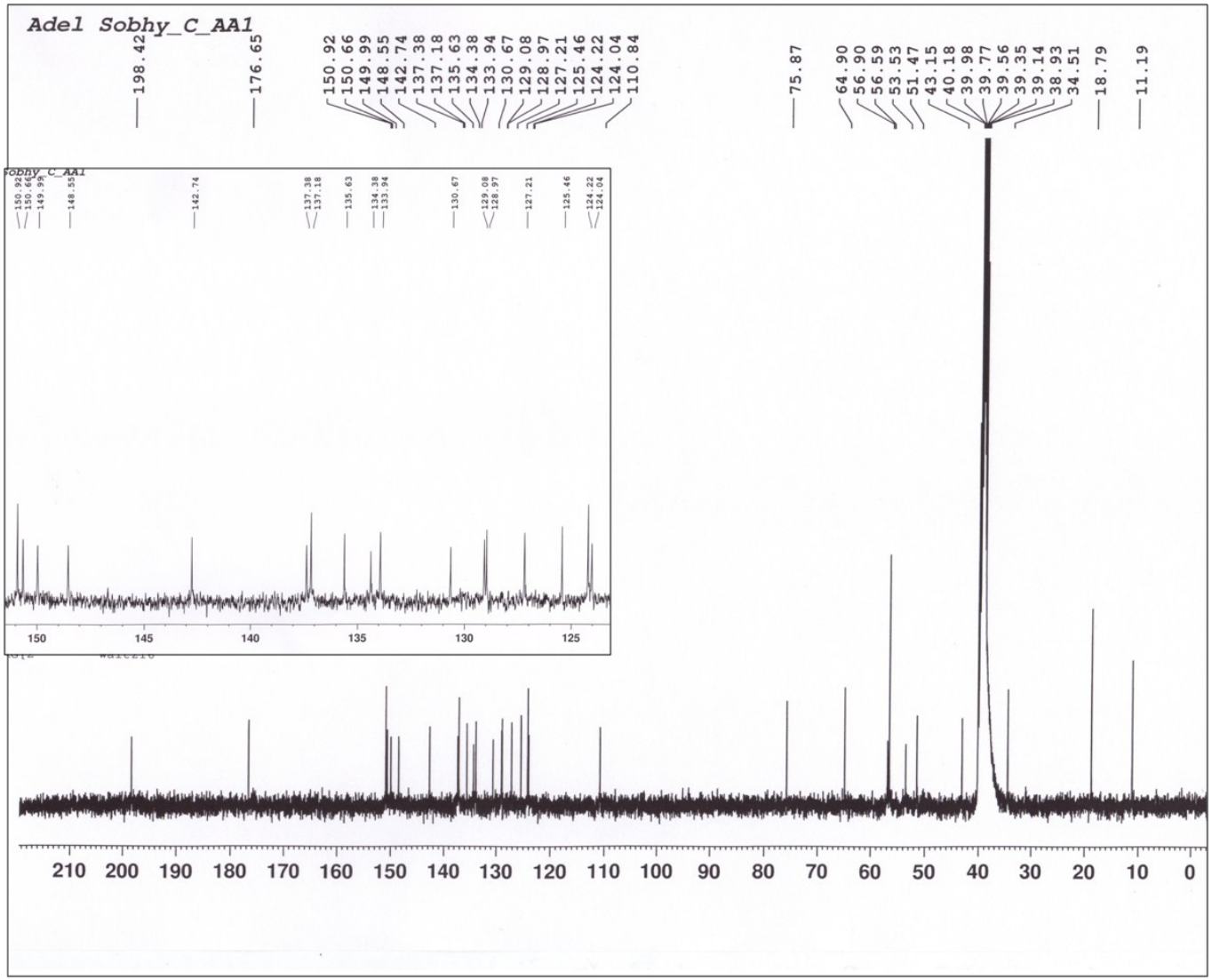


Figure S30. ^{13}C-NMR spectrum of compound **19**.

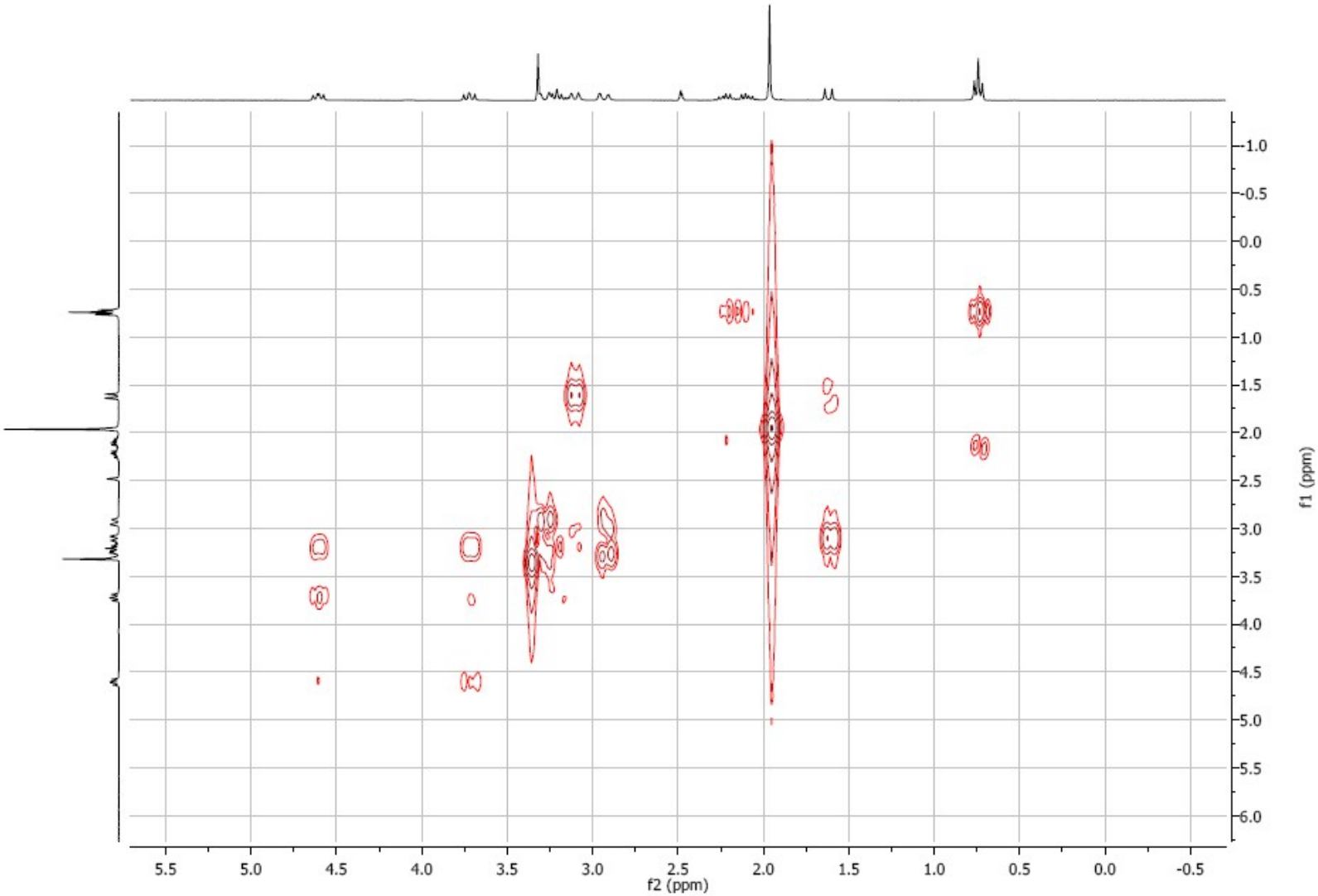


Figure S31. ^{1}H, ^{1}H-COSY spectrum of compound **14**.

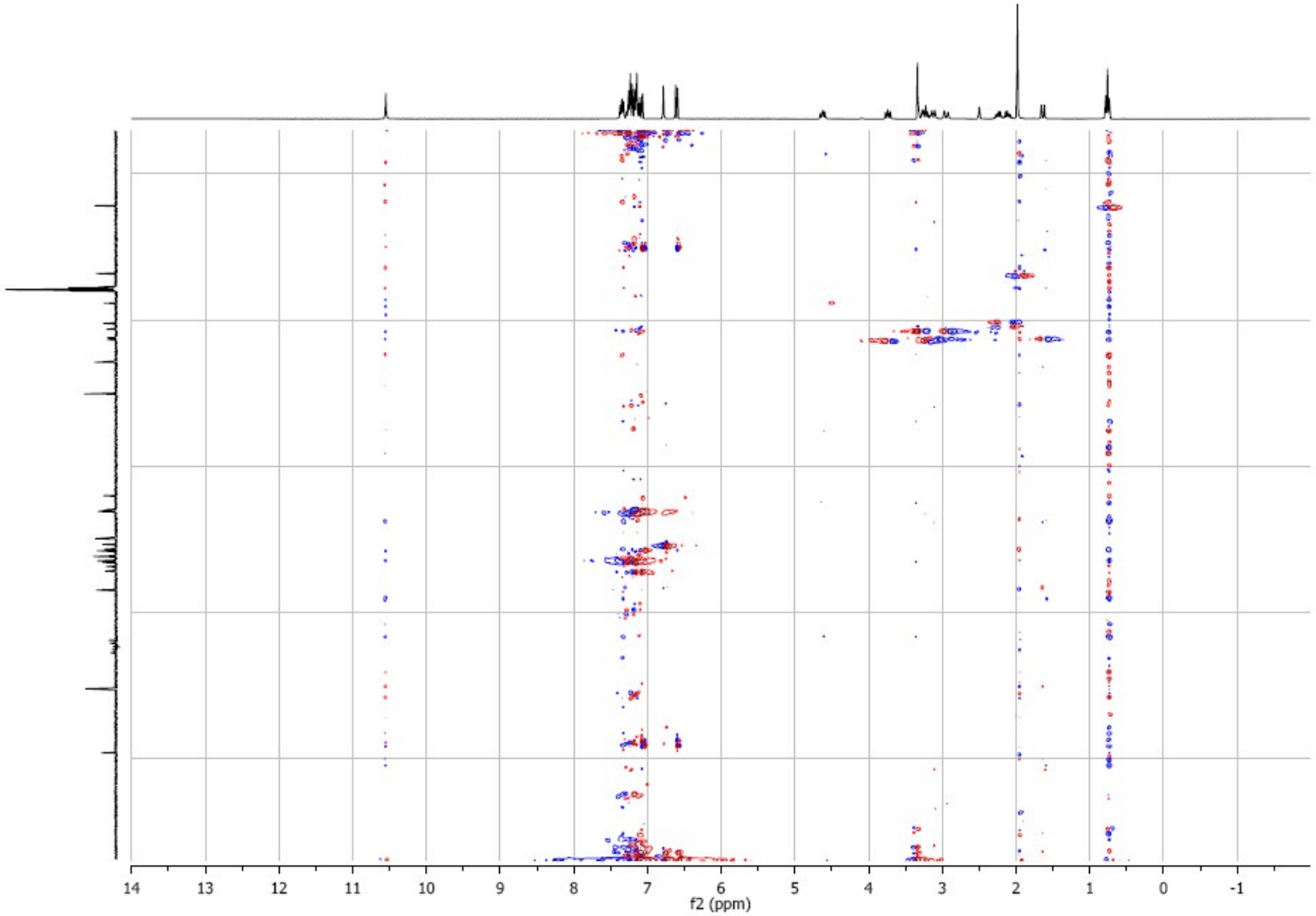


Figure S32A. $^{1}H,^{13}C$-Heteronuclear Single Quantum Coherence (HSQC) spectrum of compound **14** (full spectrum).

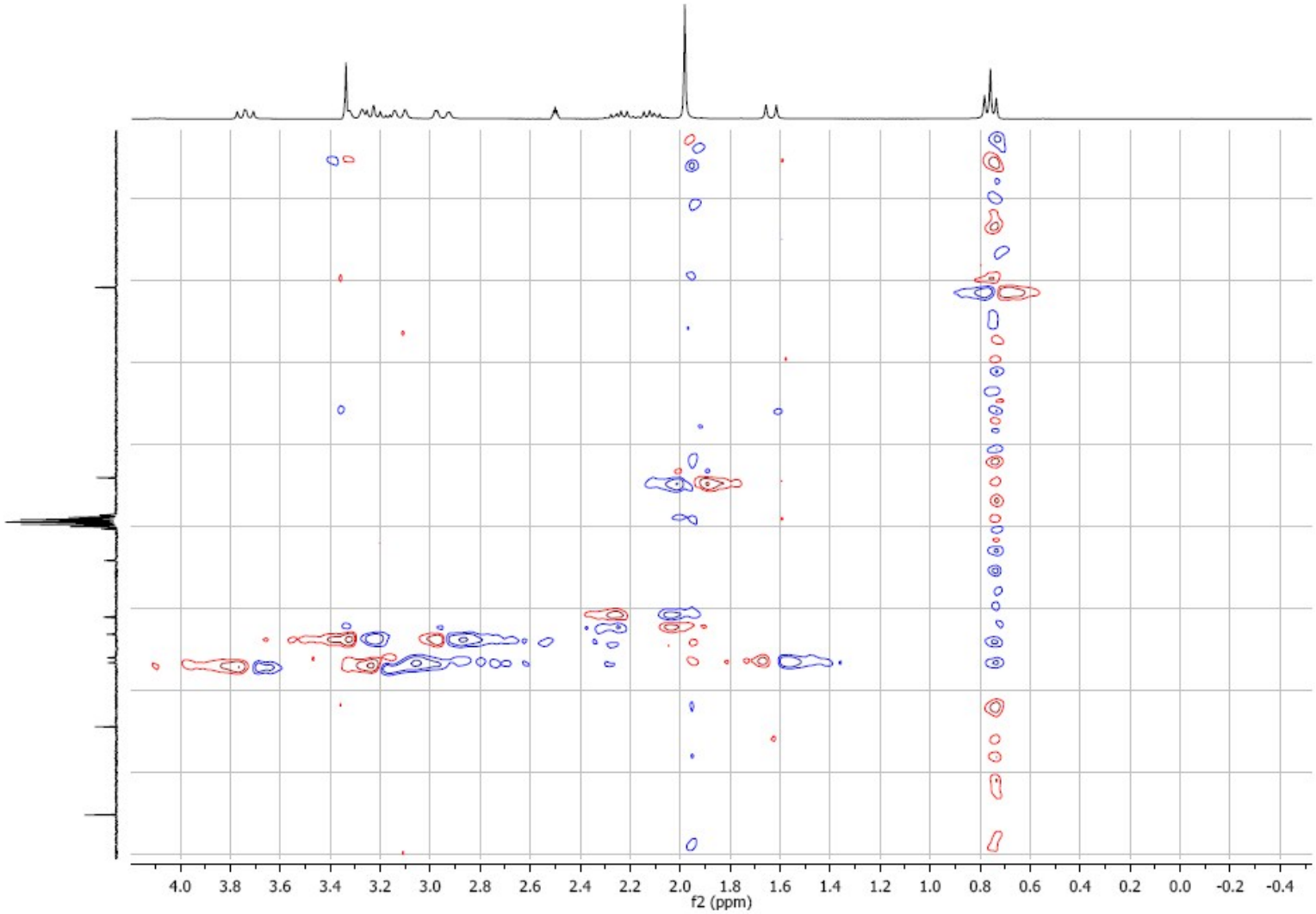
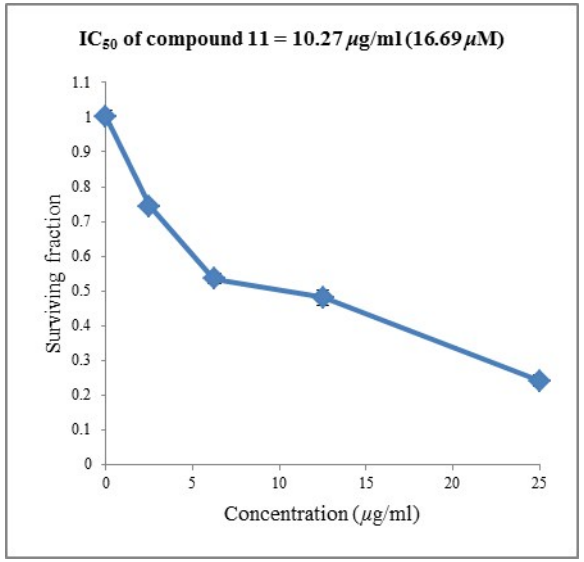
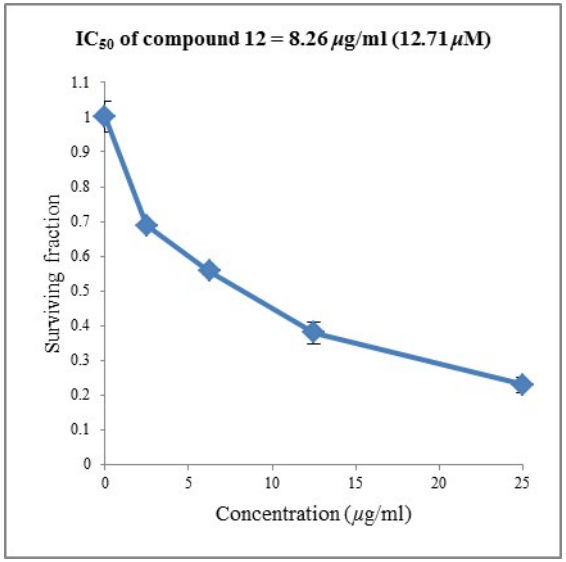
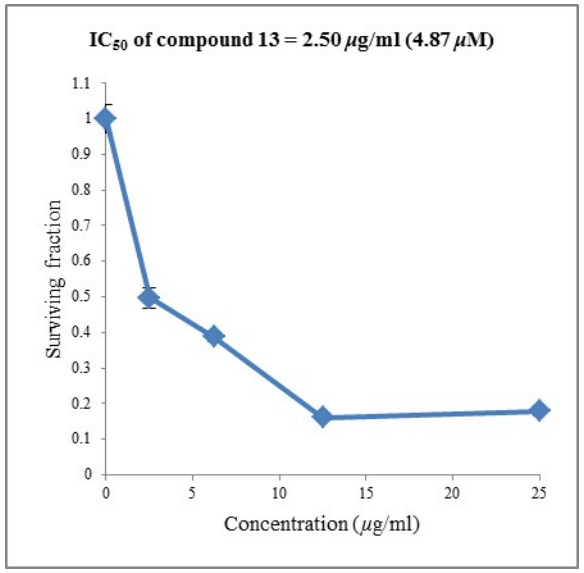
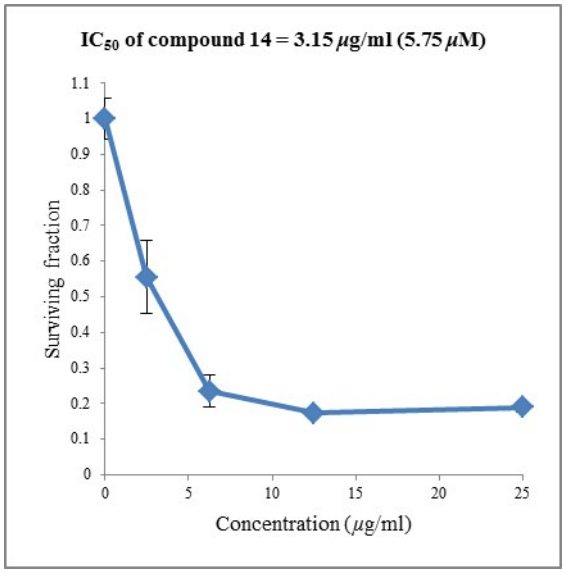


Figure S32B. $^{1}H,^{13}C$-Heteronuclear Single Quantum Coherence (HSQC) spectrum of compound **14** (δ_H = -0.4–4.1, δ_C = 0–80).


IC50 of compound 11 = 10.27 μg/ml (16.69 μM)
Surviving fraction
Concentration (μg/ml)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25


IC50 of compound 12 = 8.26 μg/ml (12.71 μM)
Surviving fraction
Concentration (μg/ml)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25


IC50 of compound 13 = 2.50 μg/ml (4.87 μM)
Surviving fraction
Concentration (μg/ml)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25


IC50 of compound 14 = 3.15 μg/ml (5.75 μM)
Surviving fraction
Concentration (μg/ml)
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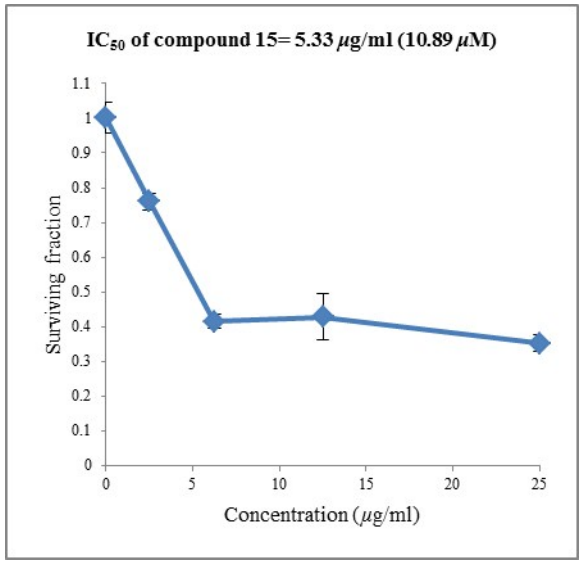
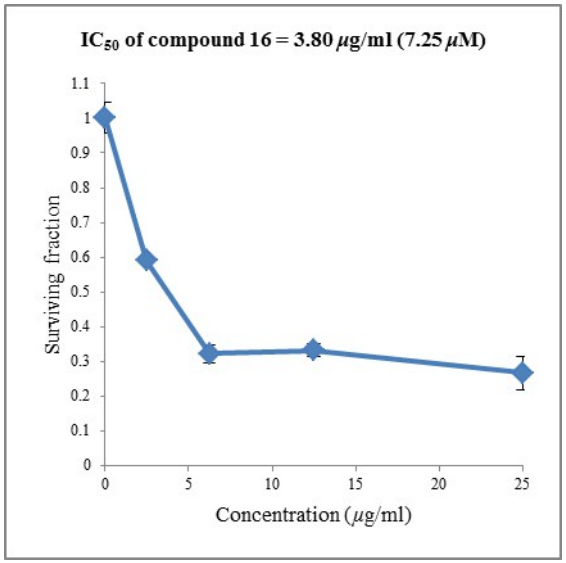
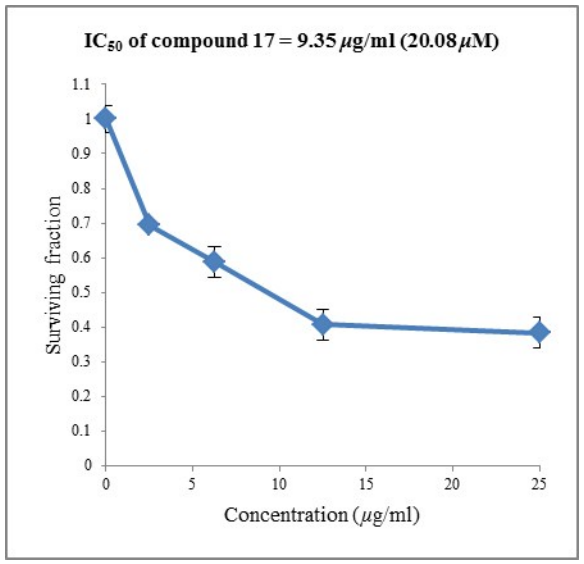
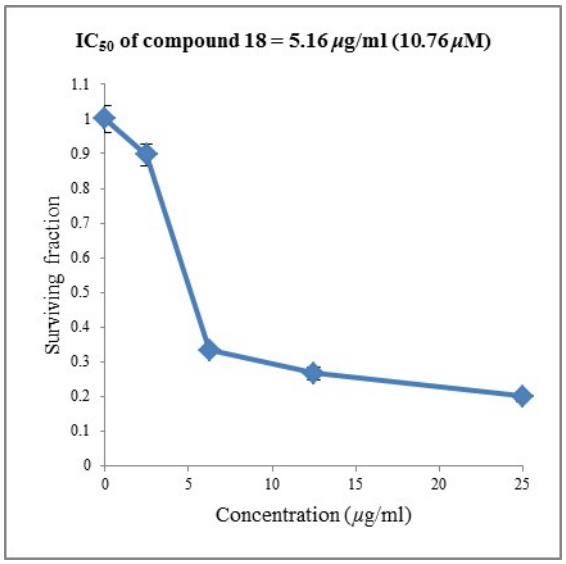
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25


IC50 of compound 15= 5.33 μg/ml (10.89 μM)
Surviving fraction
Concentration (μg/ml)


IC50 of compound 16 = 3.80 μg/ml (7.25 μM)
Surviving fraction
Concentration (μg/ml)


IC50 of compound 17 = 9.35 μg/ml (20.08 μM)
Surviving fraction
Concentration (μg/ml)


IC50 of compound 18 = 5.16 μg/ml (10.76 μM)
Surviving fraction
Concentration (μg/ml)

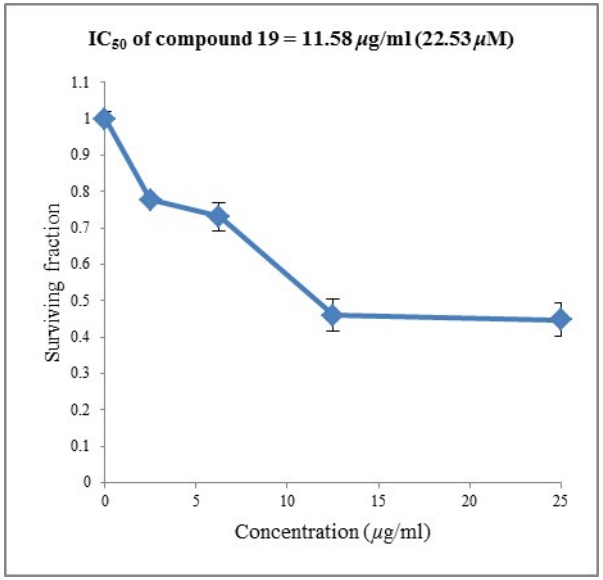
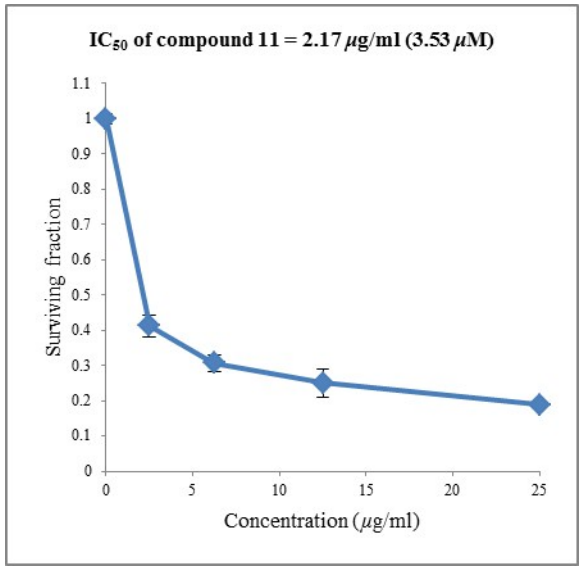
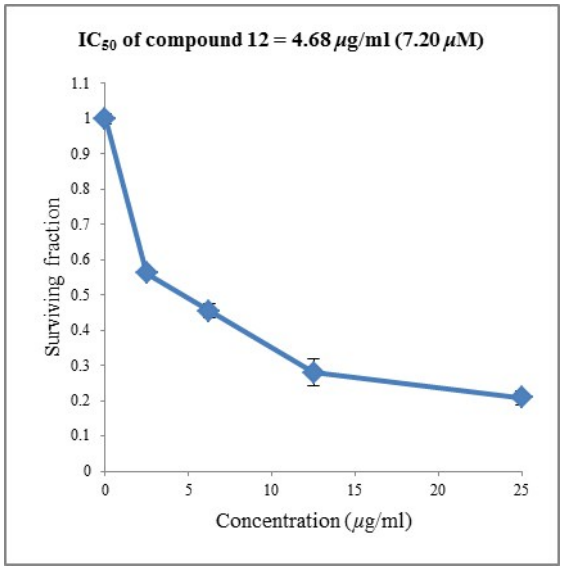
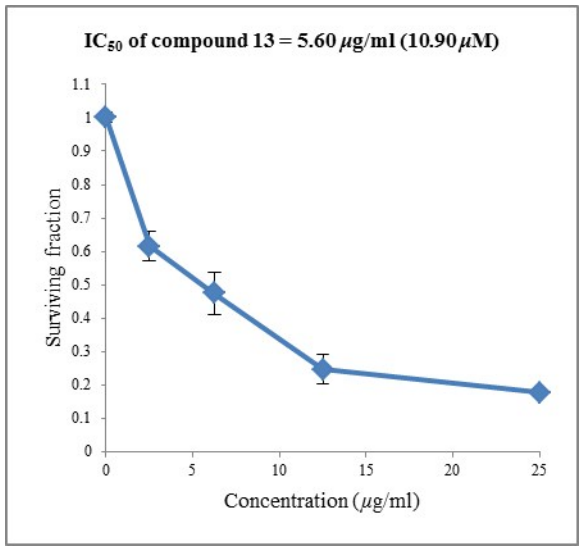
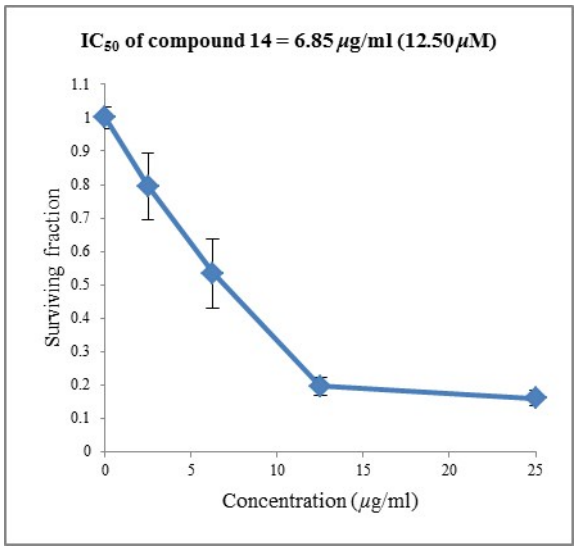


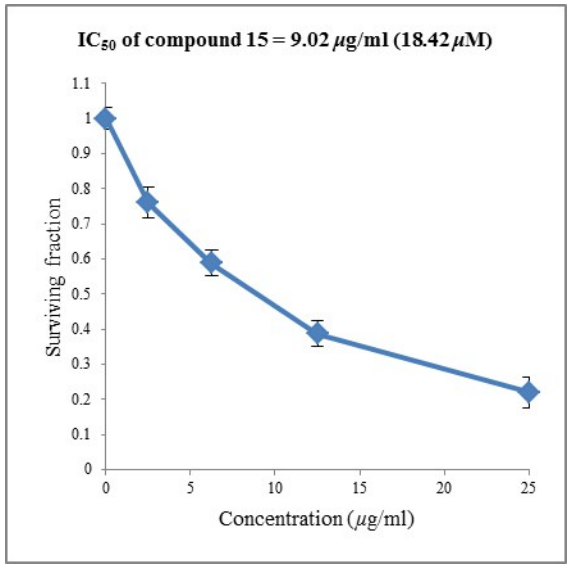
Figure S33. Dose-response curve for the synthesized compounds **11-19** against HeLa (cervical carcinoma) cell line.

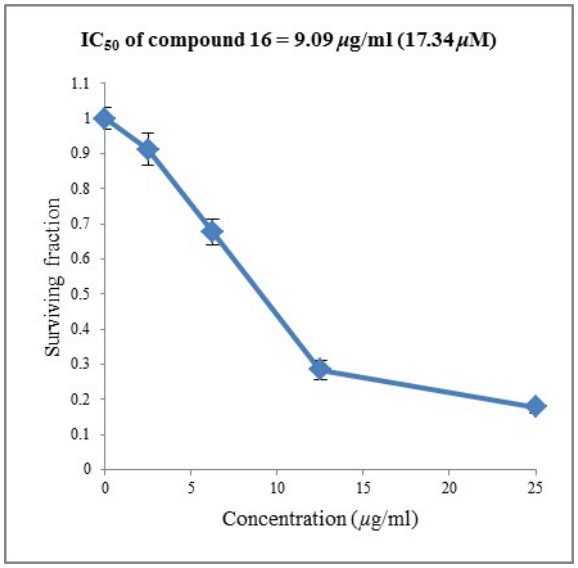

IC50 of compound 11 = 2.17 μg/ml (3.53 μM)
Surviving fraction
Concentration (μg/ml)

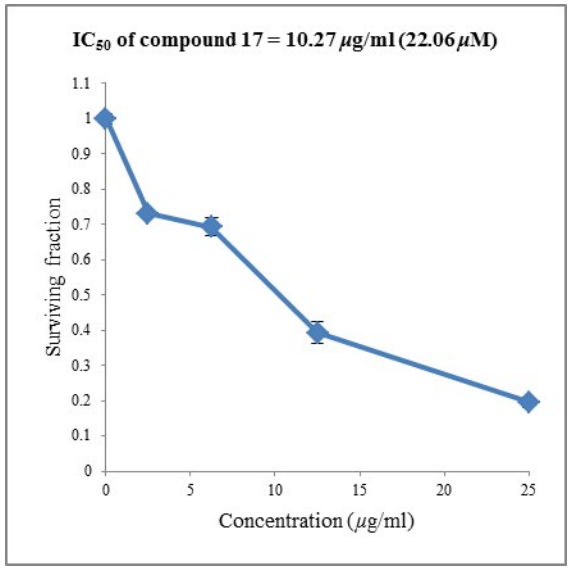

IC50 of compound 12 = 4.68 μg/ml (7.20 μM)
Surviving fraction
Concentration (μg/ml)

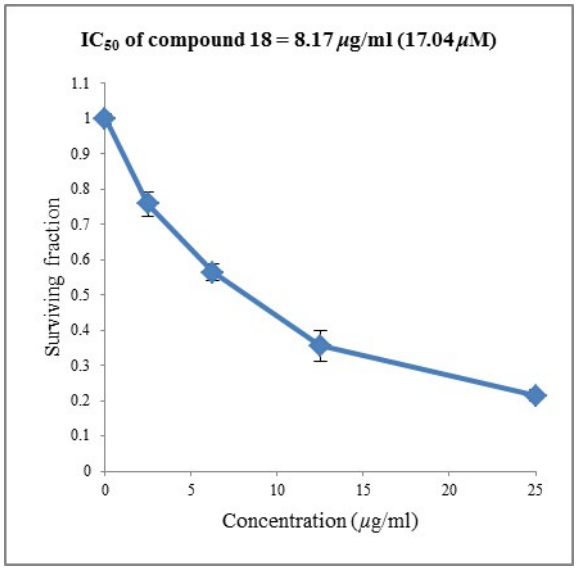

IC50 of compound 13 = 5.60 μg/ml (10.90 μM)
Surviving fraction
Concentration (μg/ml)


IC50 of compound 14 = 6.85 μg/ml (12.50 μM)
Surviving fraction
Concentration (μg/ml)


IC50 of compound 15 = 9.02 μg/ml (18.42 μM)
Surviving fraction
Concentration (μg/ml)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25


IC50 of compound 16 = 9.09 μg/ml (17.34 μM)
Surviving fraction
Concentration (μg/ml)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25


IC50 of compound 17 = 10.27 μg/ml (22.06 μM)
Surviving fraction
Concentration (μg/ml)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25


IC50 of compound 18 = 8.17 μg/ml (17.04 μM)
Surviving fraction
Concentration (μg/ml)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
0
5
10
15
20
25

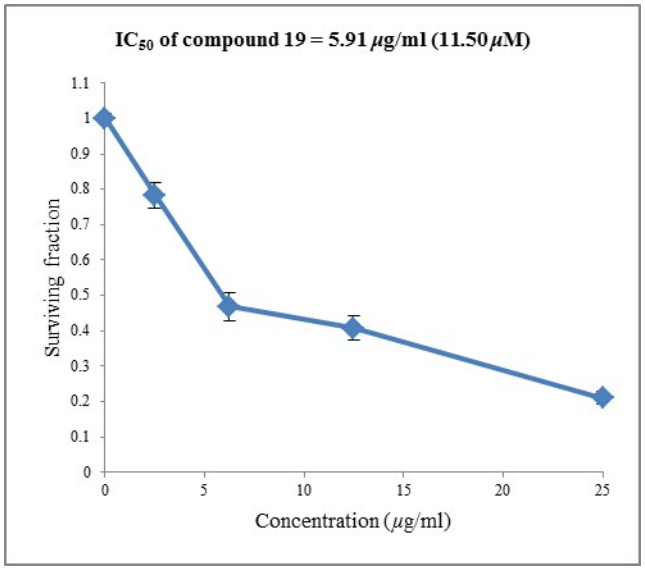
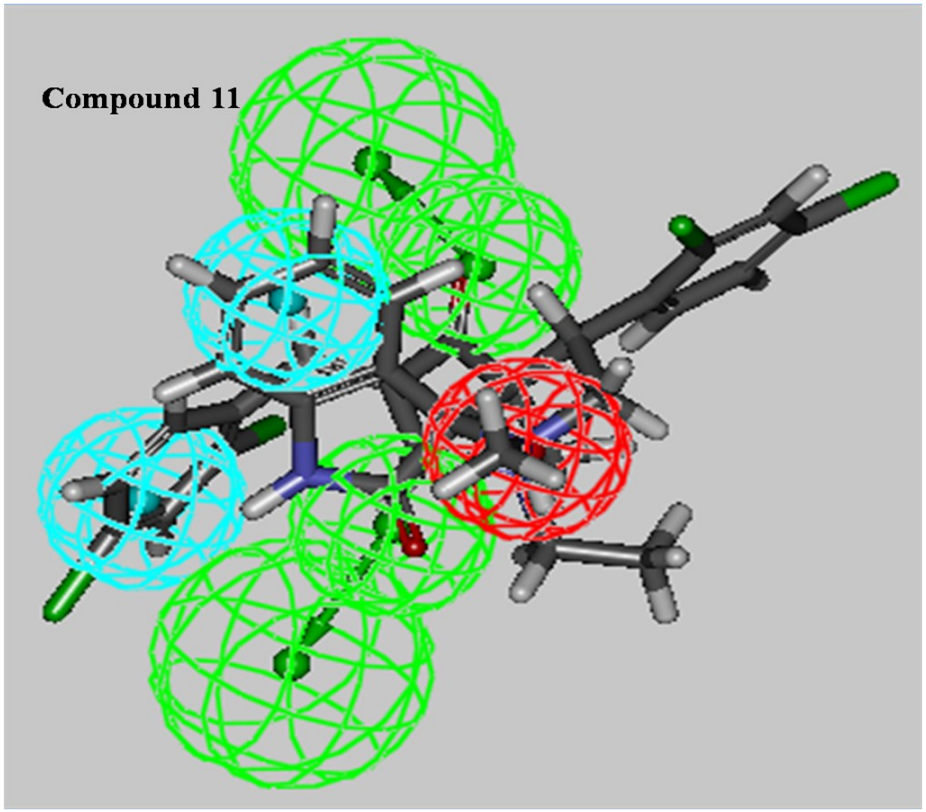
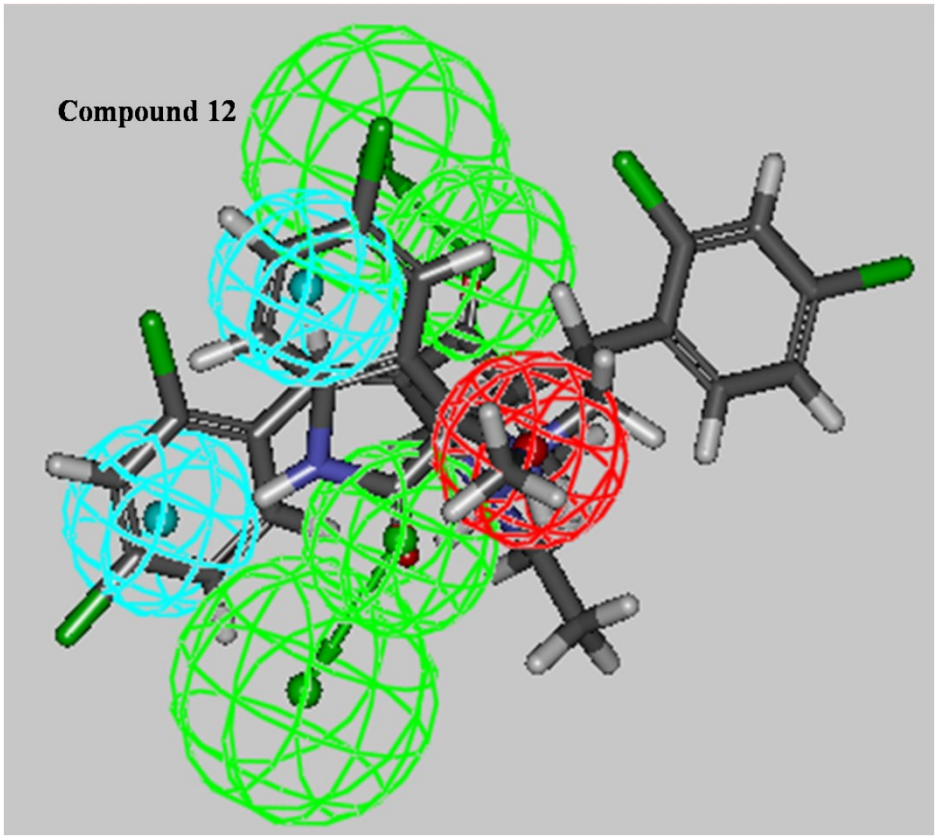
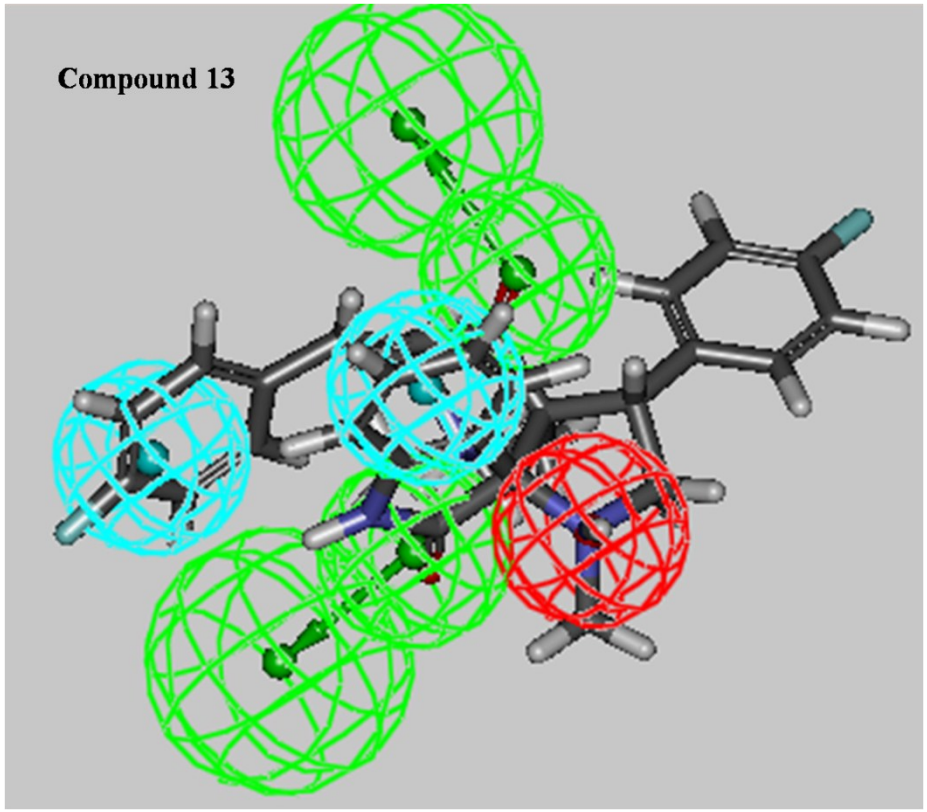
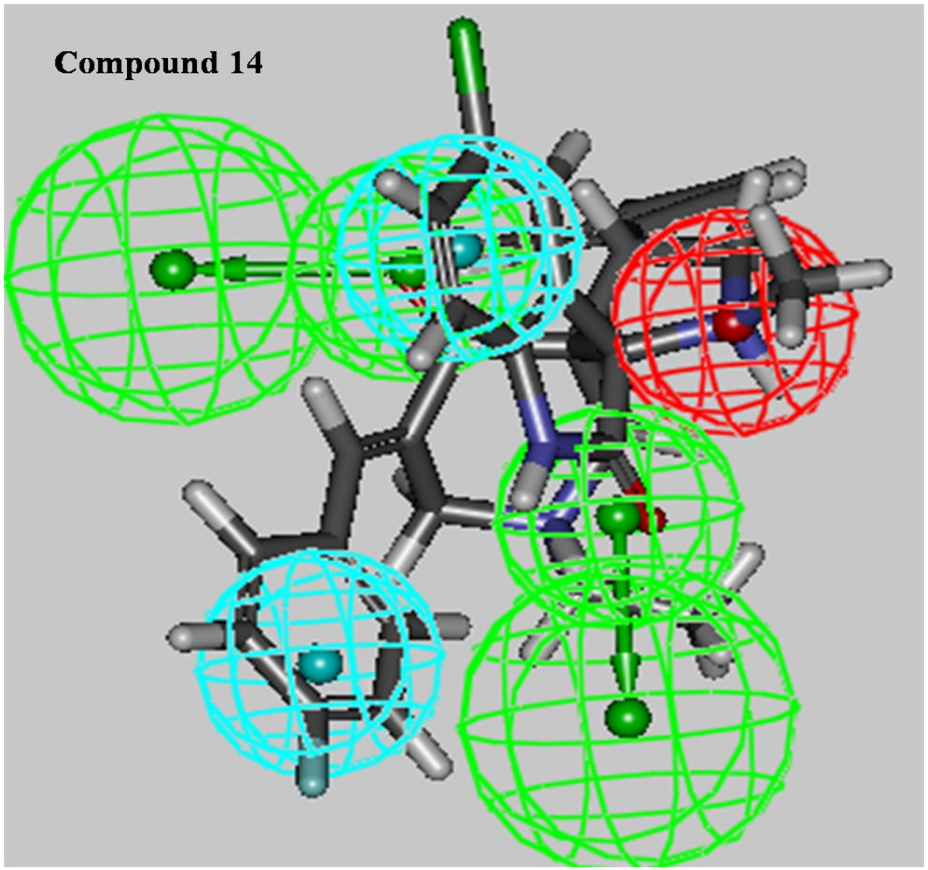


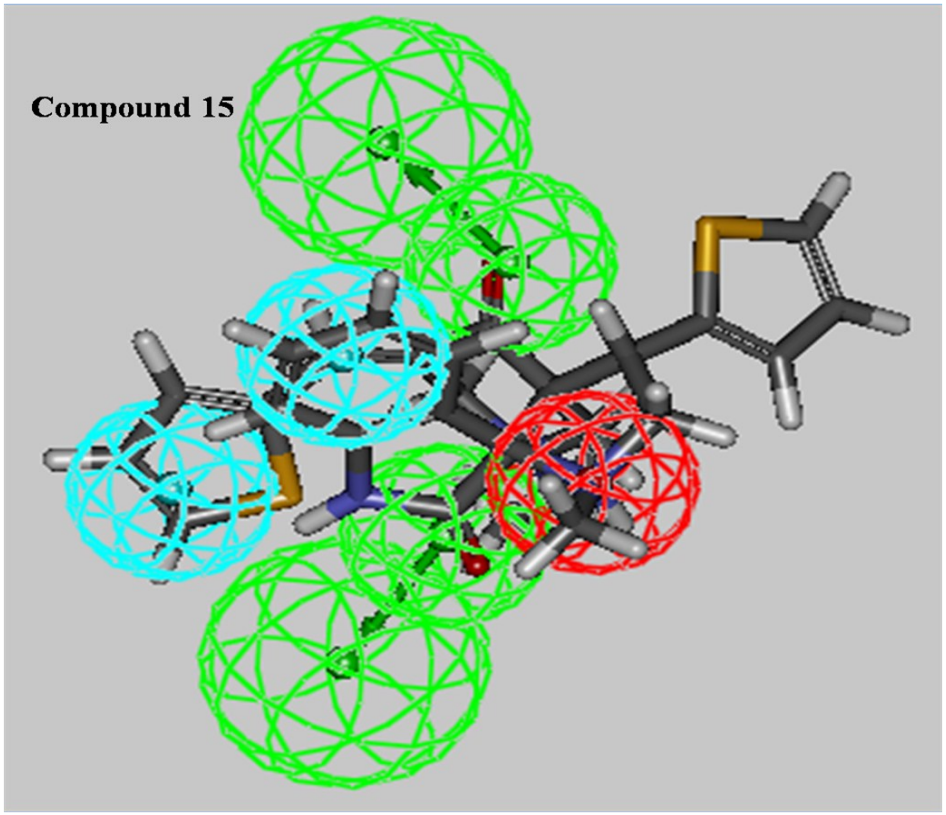
Figure S34. Dose-response curve for the synthesized compounds **11-19** against HepG2 (liver carcinoma) cell line.

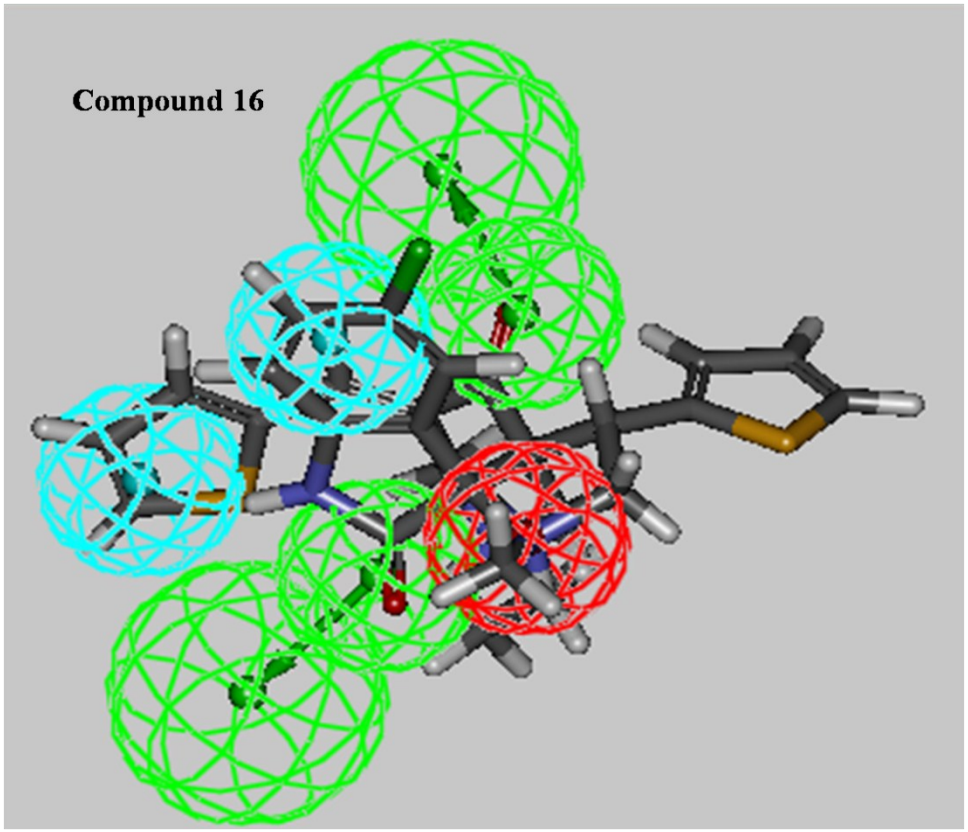

Compound 11

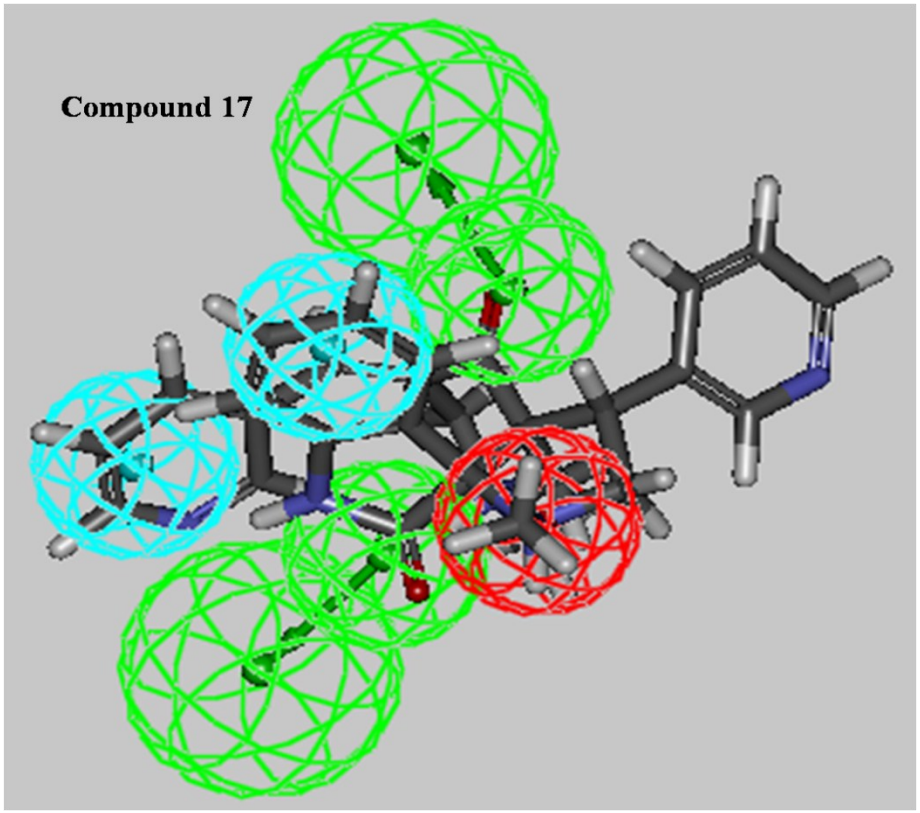

Compound 12

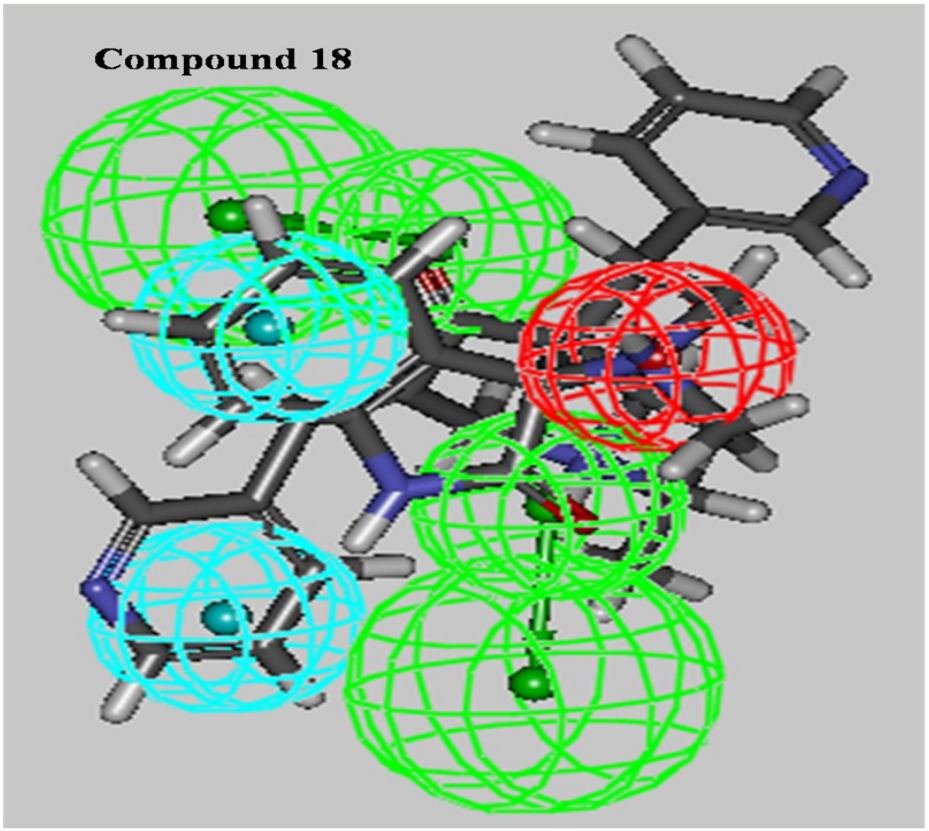

Compound 13


Compound 14


Compound 15


Compound 16


Compound 17


Compound 18

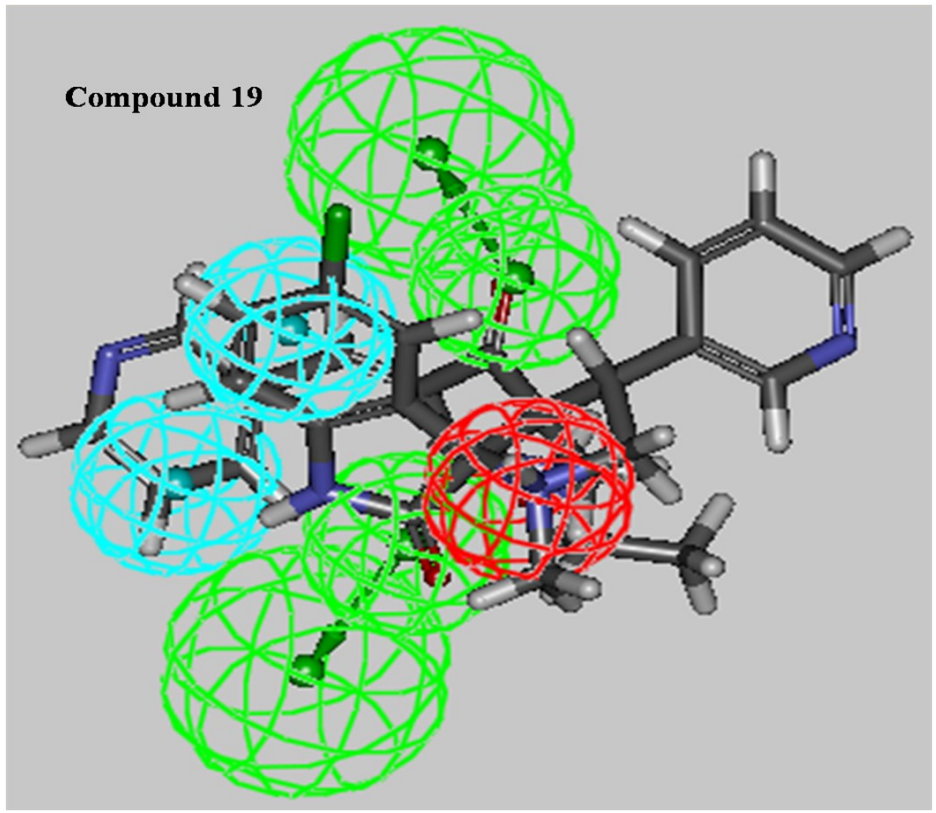
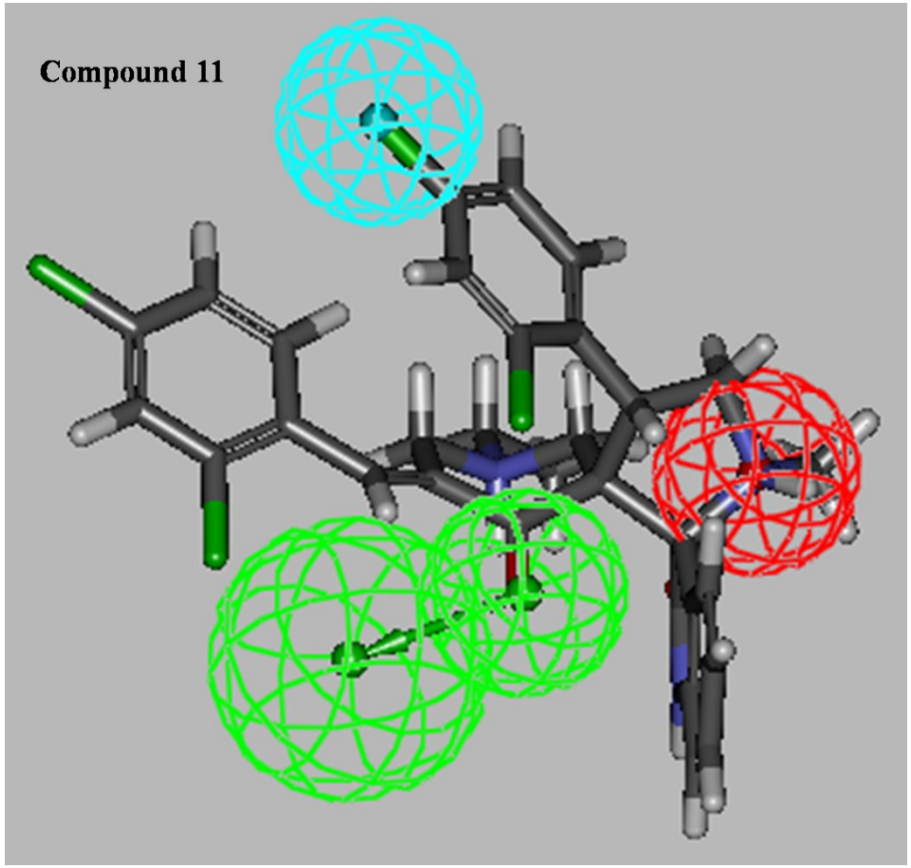
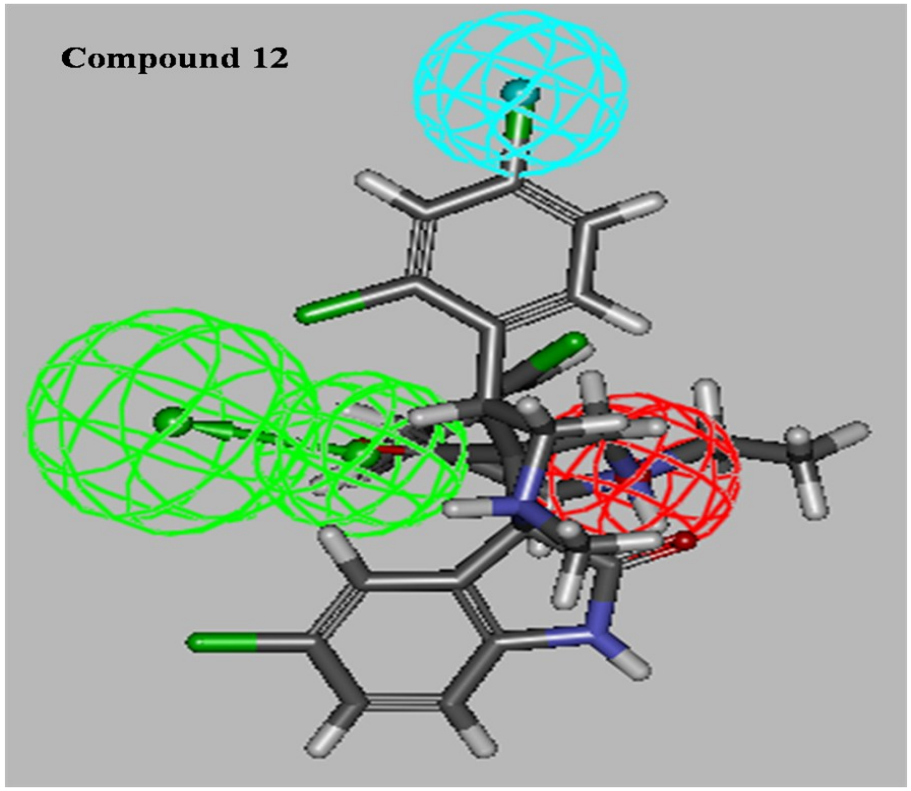
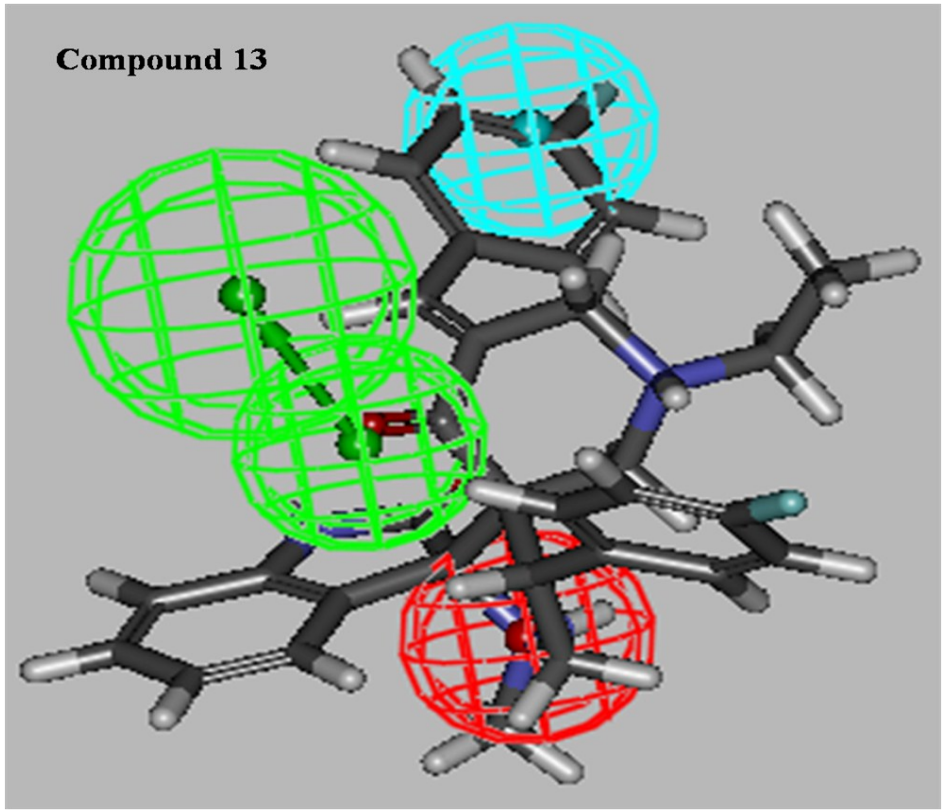
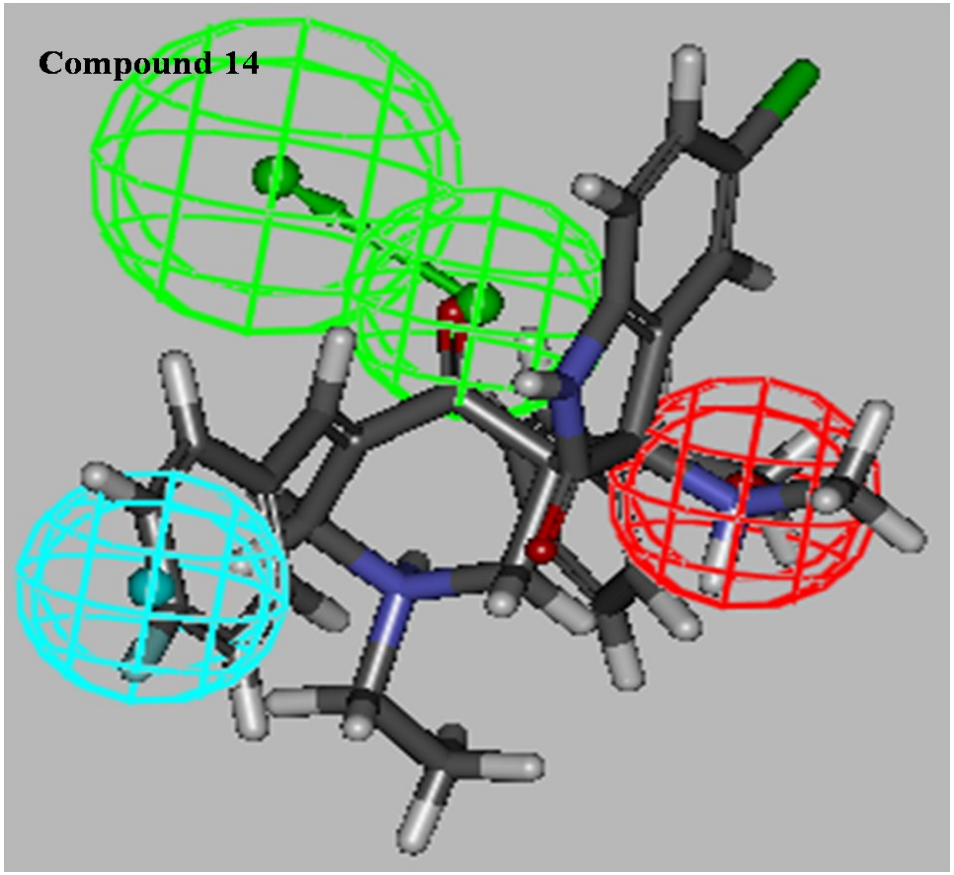


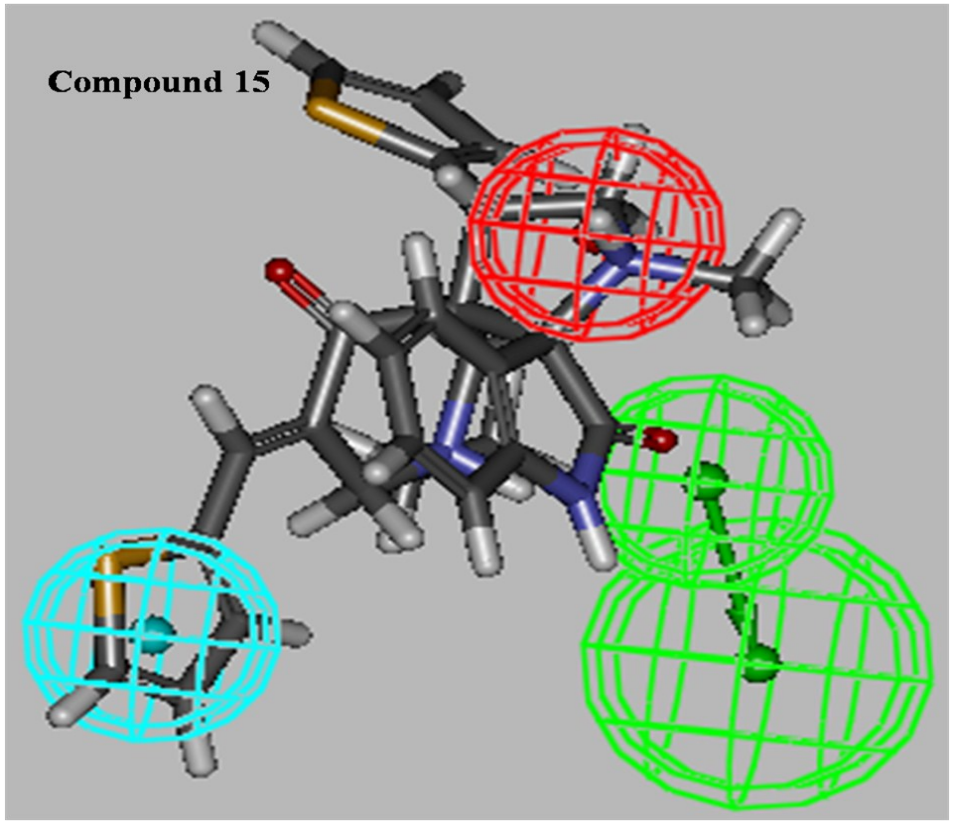
Figure S35. 3D-pharmacophore mapped on the synthesized compounds **11-19** against HeLa (cervical) tumor cell line.

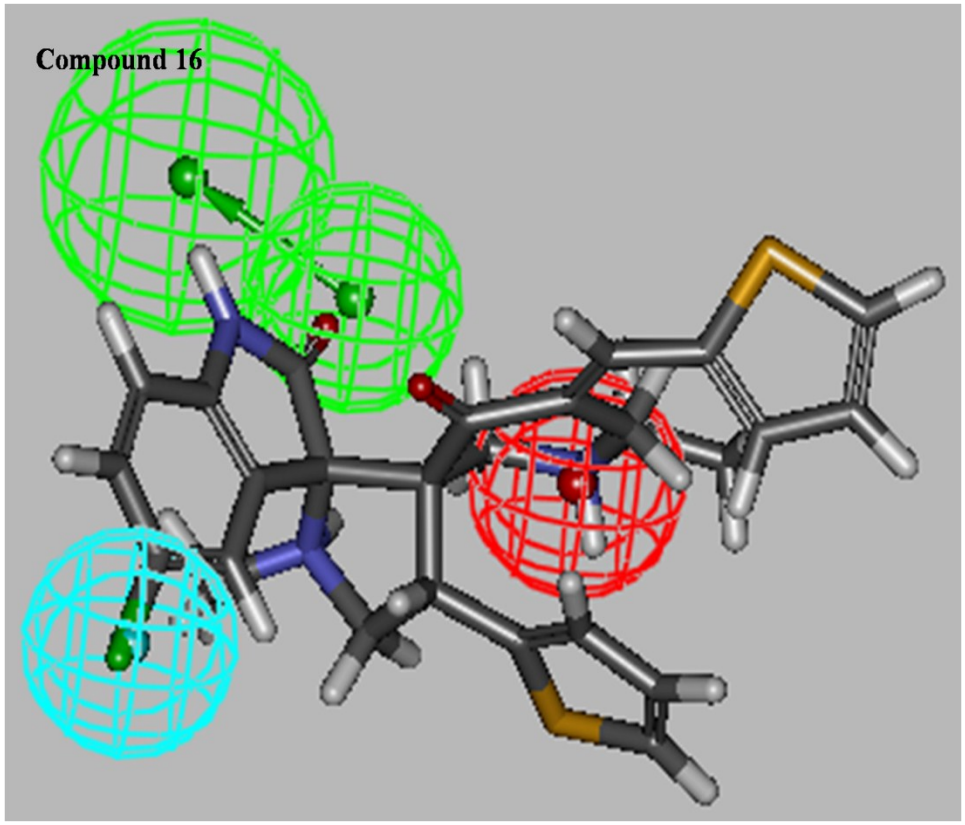

Compound 11

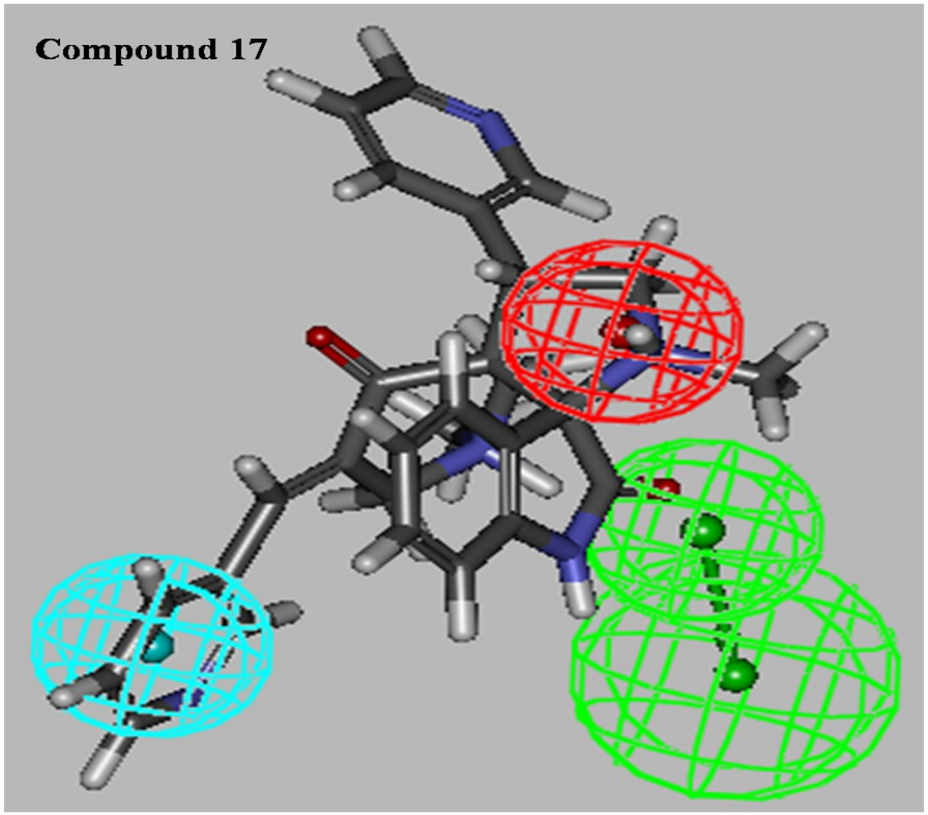

Compound 12

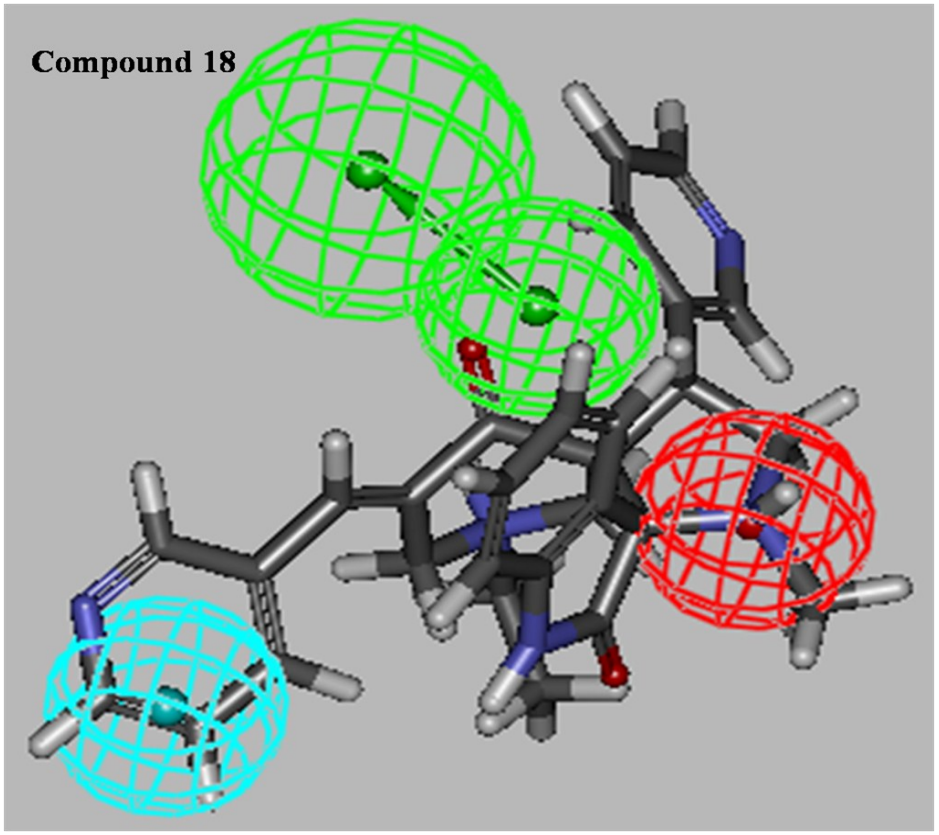

Compound 13


Compound 14


Compound 15


Compound 16


Compound 17


Compound 18

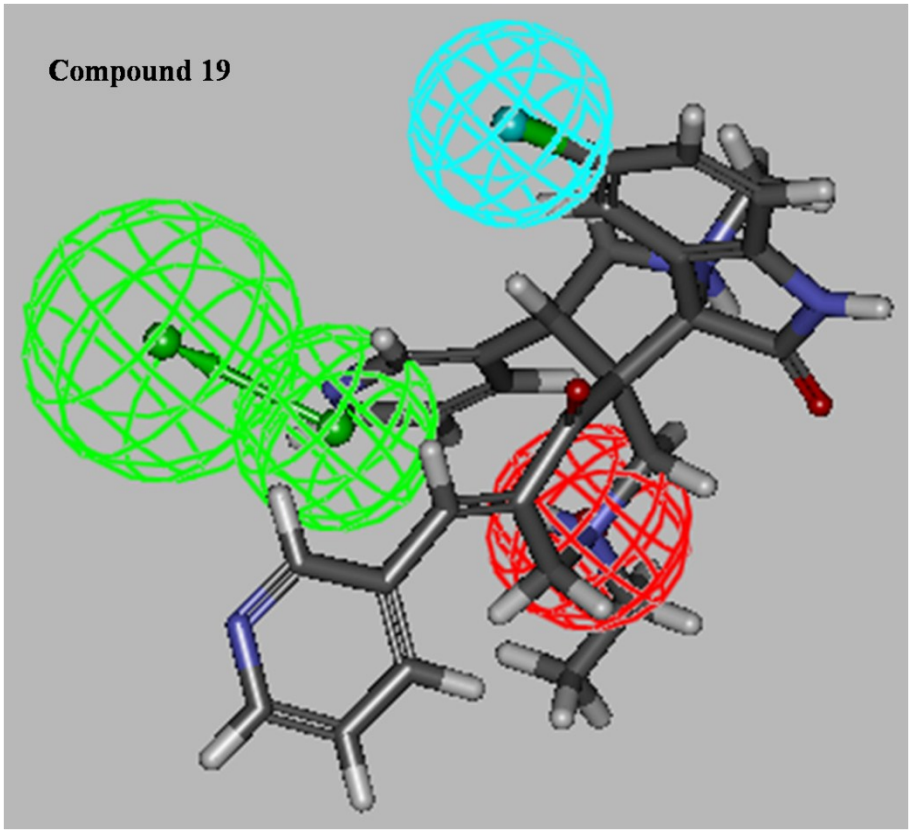


Figure S36. 3D-pharmacophore mapped on the synthesized compounds **11-19** against HepG2 (liver) tumor cell line.