

Supporting Information

Synthesis, Antifungal Activity, 3D-QSAR and Controlled Release on Hydrotalcite Study of Longifolene-Derived Diphenyl Ether Carboxylic Acid Compounds

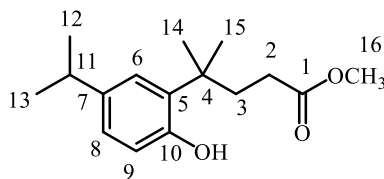
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Intermediate **5**, white solid; yield 97.5%; m. p. 104.3 – 105.2 °C; FT-IR (KBr, cm^{-1}): 3379 (O–H), 3055, 3026 (Ar–H), 2956, 2918, 2865 (C–H), 1716 (C=O), 1607, 1508, 1453, 1423, 1349, 1296, 1236, 1208, 1165 (Ar–C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.01 (d, $J = 2.1$ Hz, 1H, C₆-H), 6.92 (dd, $J = 8.1, 2.1$ Hz, 1H, C₈-H), 6.60 (d, $J = 8.1$ Hz, 1H, C₉-H), 3.59 (s, 3H, C₁₆-H), 2.82 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₁-H), 2.26 – 2.21 (m, 2H, C₂-H), 2.10 – 2.05 (m, 2H, C₃-H), 1.39 (s, 6H, C₁₄-H, C₁₅-H), 1.21 (d, $J = 6.9$ Hz, 6H, C₁₂-H, C₁₃-H); ^{13}C NMR (126 MHz, CDCl_3) δ 175.33, 152.20, 140.59, 132.76, 126.37, 124.57, 116.39, 51.54, 37.49, 35.41, 33.52, 30.60, 27.90, 24.28; ESI-MS m/z : 263.1650 $[\text{M} + \text{H}^+]$.

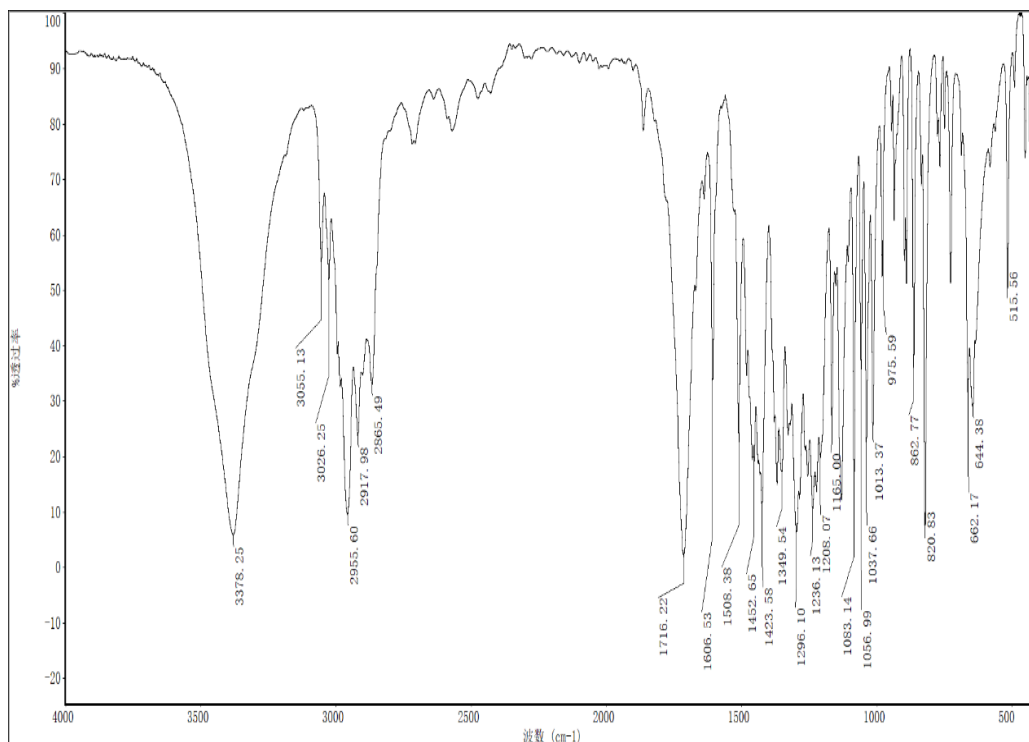


Figure S1. FT-IR spectrum of intermediate **5**.

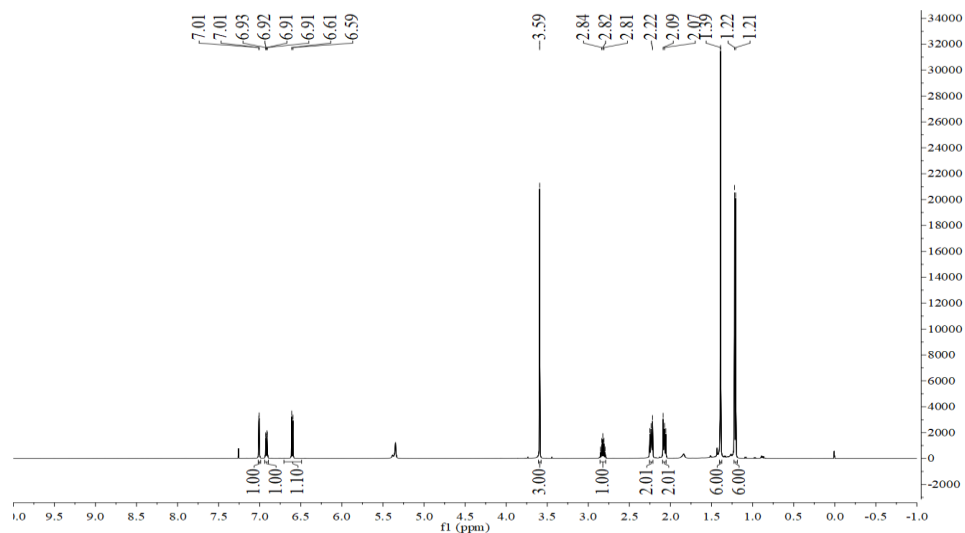


Figure S2. ^1H -NMR spectrum of intermediate **5**.

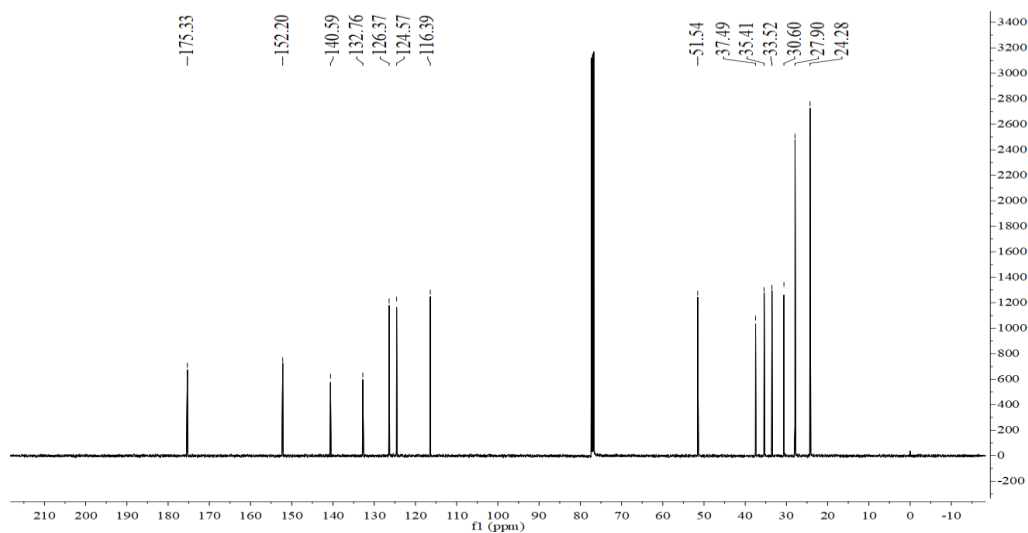


Figure S3. ^{13}C -NMR spectrum of intermediate **5**.

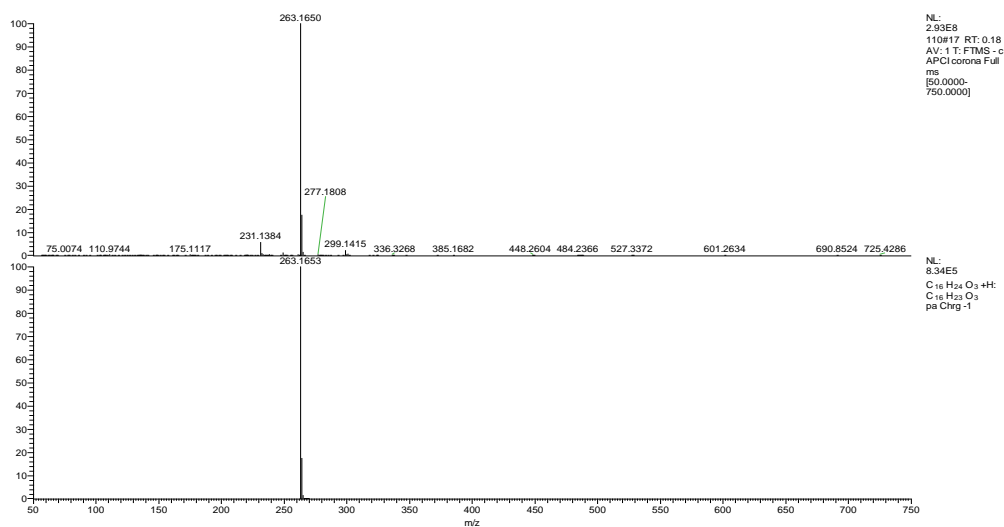
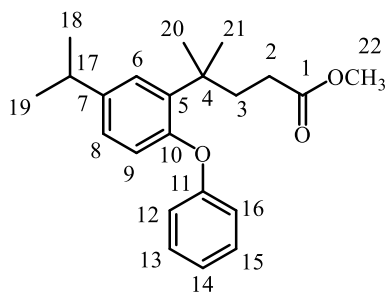


Figure S4. ESI-MS spectrum of intermediate **5**.



Intermediate **6a**, colorless oily liquid; yield 91.3%; FT-IR (KBr, cm^{-1}): 2958, 2926, 2872 (C-H), 1741 (C=O), 1589, 1487, 1454, 1385, 1228, 1163, 1082, 1023 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.33 – 7.28 (m, 2H, C₁₃-H, C₁₅-H), 7.13 (d, J = 2.2 Hz, 1H, C₆-H), 7.05 (t, J = 7.9 Hz, 1H, C₁₄-H), 7.00 – 6.94 (m, 3H, C₈-H C₁₂-H, C₁₆-H), 6.73 (d, J = 8.3 Hz, 1H, C₉-H), 3.57 (s, 3H, C₂₂-H), 2.87 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.19 (dd, J = 10.0, 7.0 Hz, 2H, C₂-H), 2.10 (dd, J = 11.1, 4.3 Hz, 2H, C₃-H), 1.40 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.54, 157.50, 153.42, 143.42, 137.22, 129.55, 126.50, 124.83, 122.49, 119.76, 118.50, 51.37, 37.68, 36.15, 33.70, 30.60, 28.35, 24.16; ESI-MS m/z : 341.2103 $[\text{M} + \text{H}^+]$.

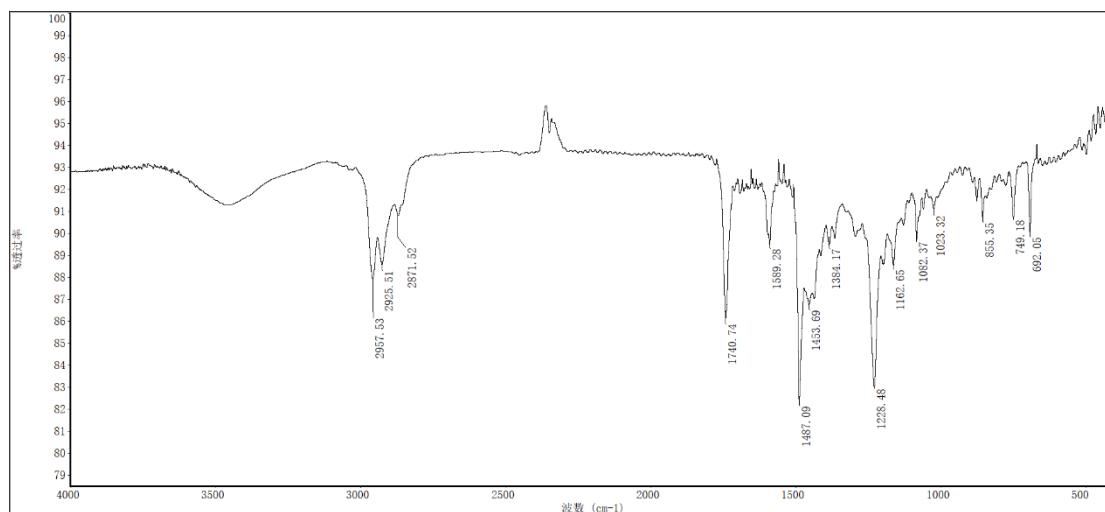
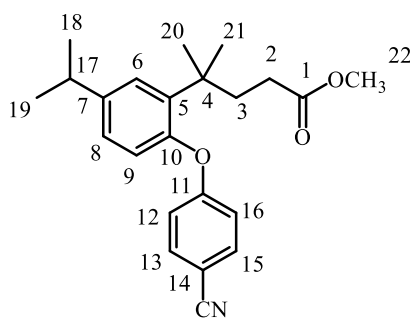


Figure S5. FT-IR spectrum of intermediate **6a**.



Intermediate **6b**, white solid; yield 90.5%; m. p. 76.8– 79.3 °C; FT-IR (KBr, cm^{-1}): 3451 (Ar-H), 2958, 2923, 2876 (C-H), 2223 ($\text{C}\equiv\text{N}$), 1735 (C=O), 1600, 1504, 1487, 1457, 1436, 1294, 1241, 1196 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.61 – 7.58 (m, 2H, C₁₃-H, C₁₅-H), 7.19 (d, J = 2.2 Hz, 1H, C₆-H), 7.08 (d, J = 10.4 Hz, 1H, C₈-H), 7.01 (d, J = 8.9 Hz, 2H, C₁₂-H, C₁₆-H), 6.79 (d, J = 8.2 Hz, 1H, C₉-H), 3.57 (s, 3H, C₂₂-H), 2.91 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.09 (h, J = 5.4 Hz, 4H, C₂-H, C₃-H), 1.35 (s, 6H, C₂₀-H, C₂₁-H), 1.26 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.25, 161.63, 151.26, 145.46, 138.28, 134.10, 127.09, 125.37, 121.34, 118.93, 118.00, 105.43, 51.50, 37.71, 36.41, 33.85, 30.46, 28.47, 24.14; ESI-MS m/z : 364.1916 [$\text{M} + \text{H}^+$].

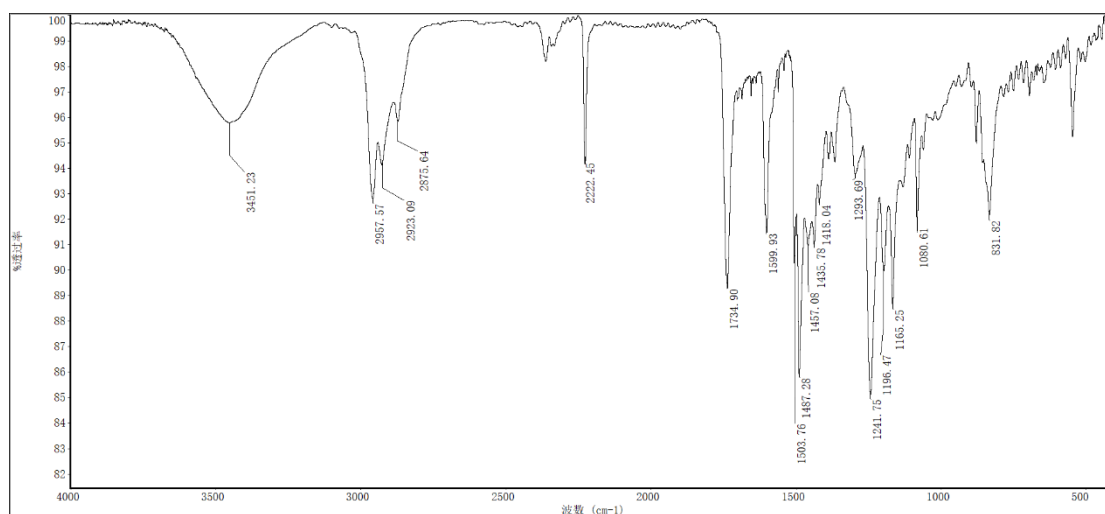


Figure S9. FT-IR spectrum of intermediate **6b**.

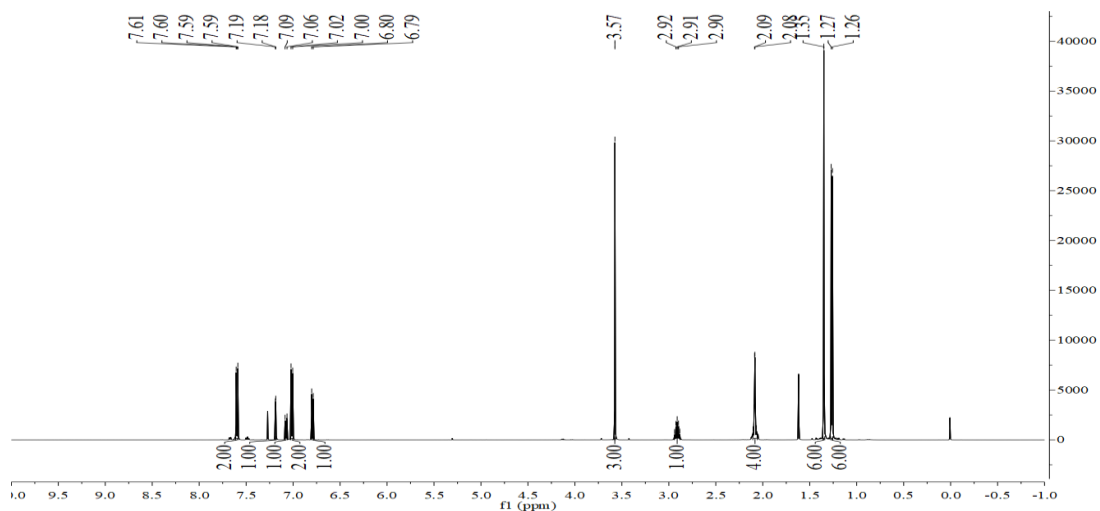


Figure S10. ^1H -NMR spectrum of intermediate **6b**.

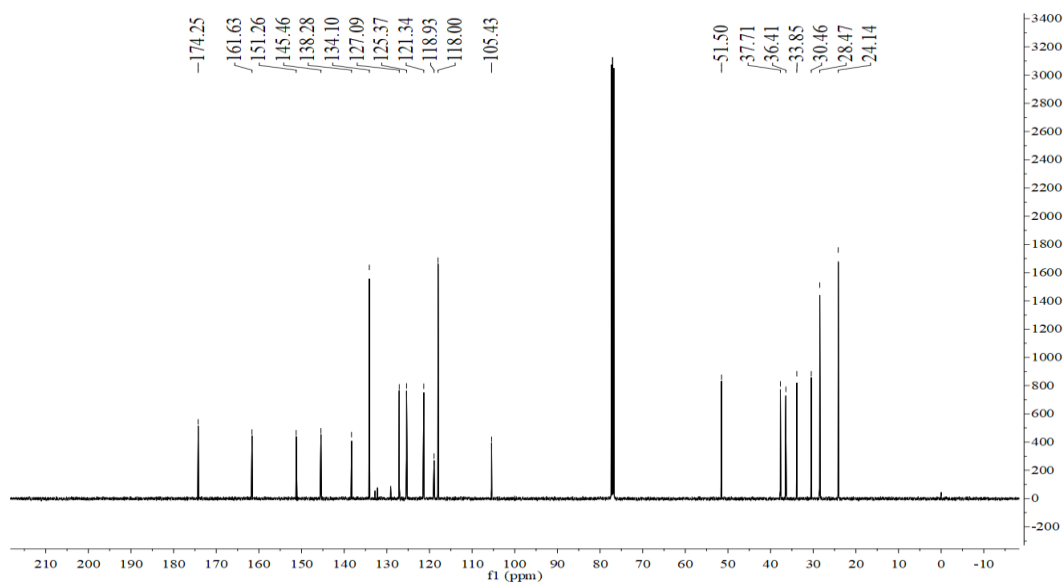


Figure S11. ^{13}C -NMR spectrum of intermediate **6b**.

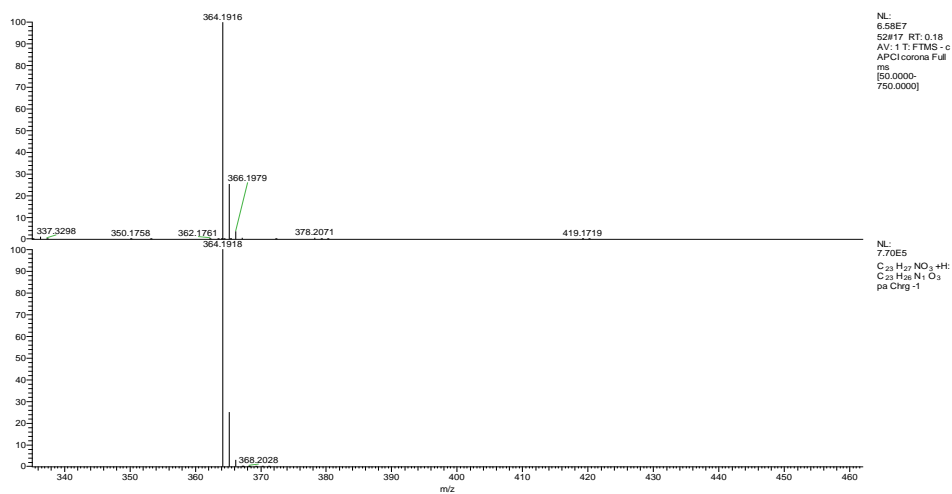
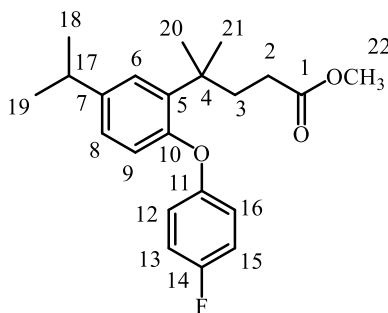


Figure S12. ESI-MS spectrum of intermediate **6b**.



Intermediate **6c**, colorless oily liquid; yield 91.2%; FT-IR (KBr, cm^{-1}): 3452 (Ar-H), 2959, 2929, 2874 (C-H), 1739 (C=O), 1504, 1489, 1457, 1209 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.13 (d, $J = 2.2$ Hz, 1H, C₆-H), 7.02 – 6.97 (m, 3H, C₈-H, C₁₃-H, C₁₅-H), 6.95 – 6.89 (m, 2H, C₁₂-H, C₁₆-H), 6.67 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.58 (s, 3H, C₂₂-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.19 (dd, $J = 10.3, 5.4$ Hz, 2H, C₂-H), 2.11 – 2.07 (m, 2H, C₃-H), 1.40 (s, 6H, C₂₀-H, C₂₁-H), 1.23 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.55, 159.39, 157.48, 153.93, 153.29 (d, $J = 2.4$ Hz), 143.44, 136.96, 126.62, 124.94, 120.00 (d, $J = 8.2$ Hz), 119.09, 116.23, 116.05, 51.44, 37.74, 36.18, 33.73, 30.65, 28.35, 24.20; ESI-MS m/z : 359.2007 [$\text{M} + \text{H}^+$].

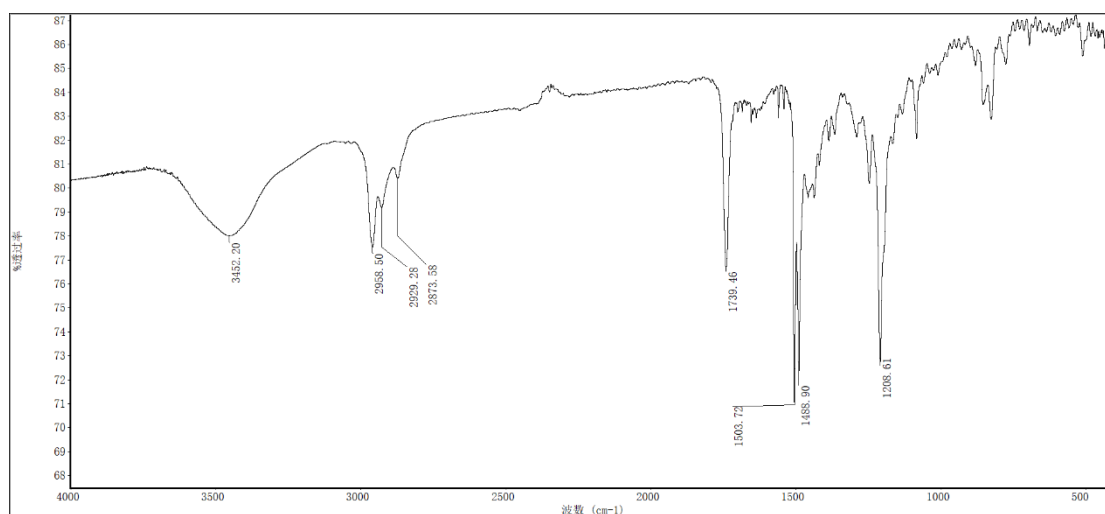


Figure S13. FT-IR spectrum of intermediate **6c**.

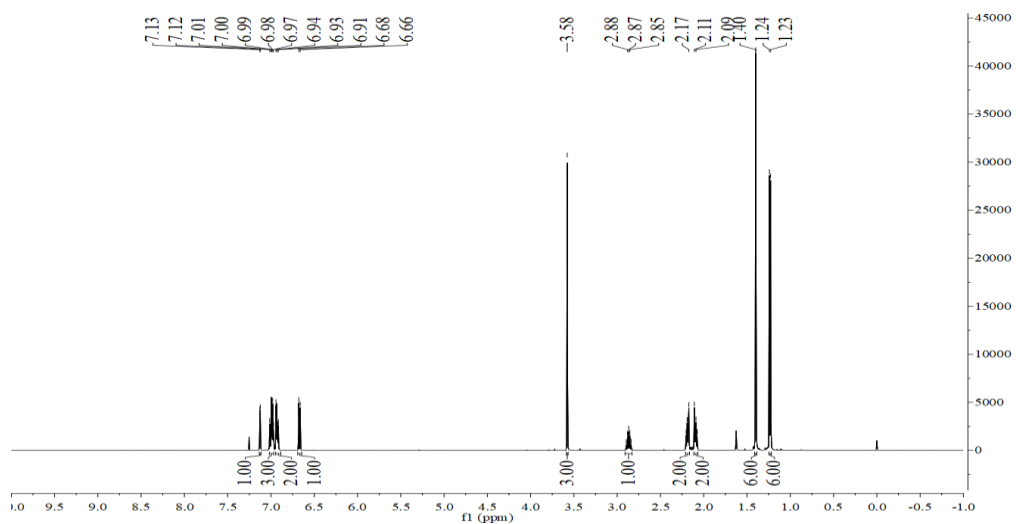


Figure S14. ¹H-NMR spectrum of intermediate **6c**.

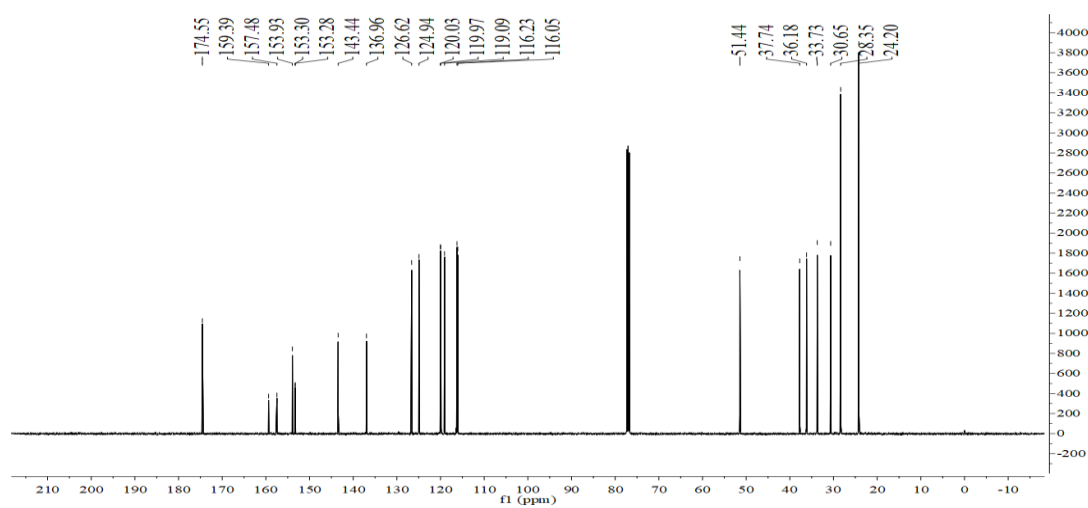


Figure S15. ¹³C-NMR spectrum of intermediate **6c**.

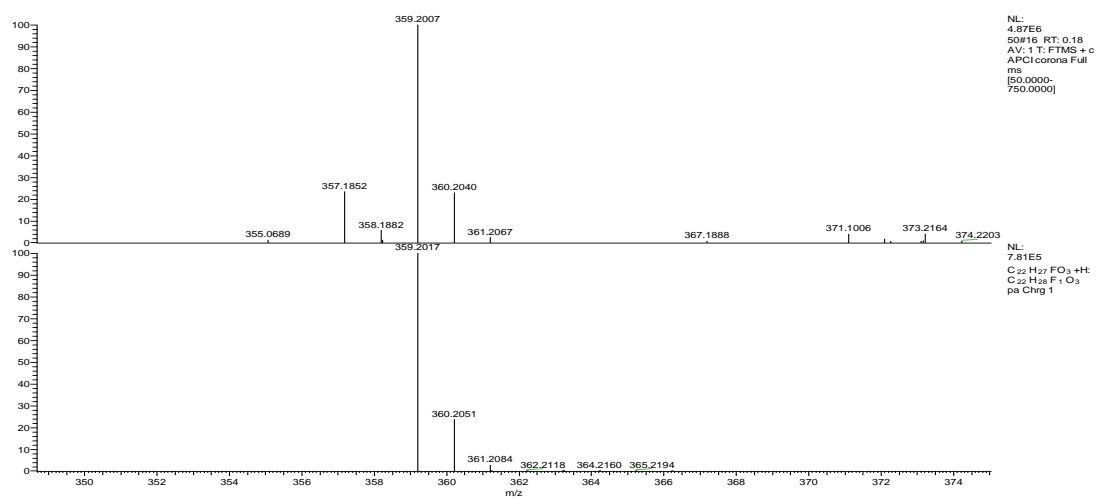
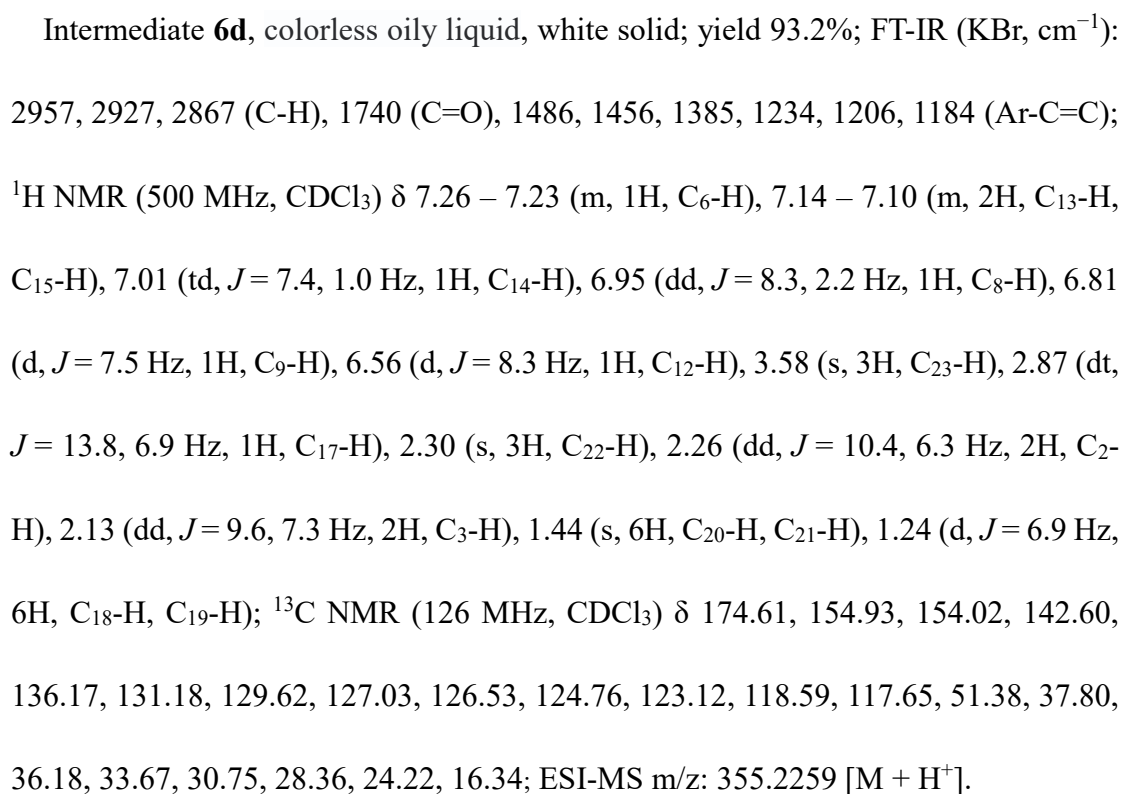


Figure S16. ESI-MS spectrum of intermediate **6c**.



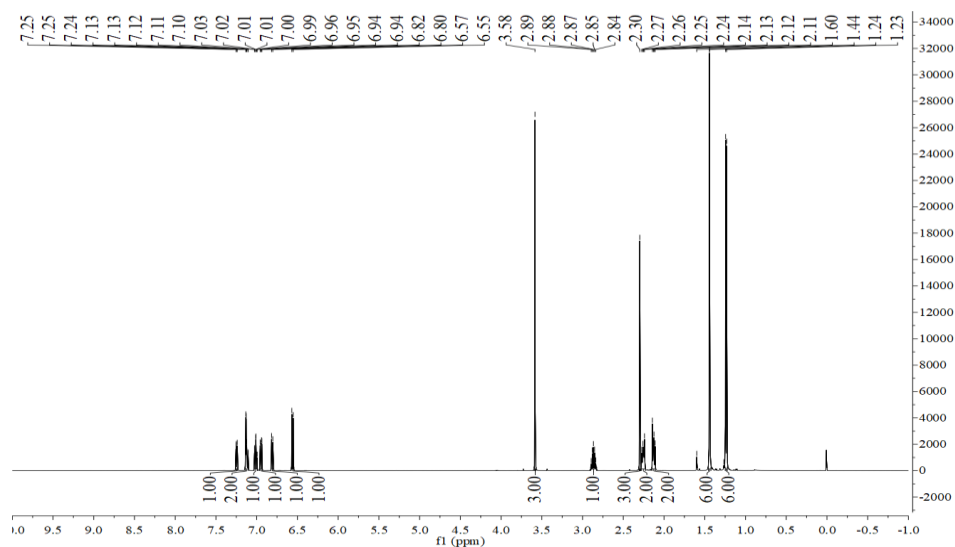


Figure S18. ^1H -NMR spectrum of intermediate **6d**.

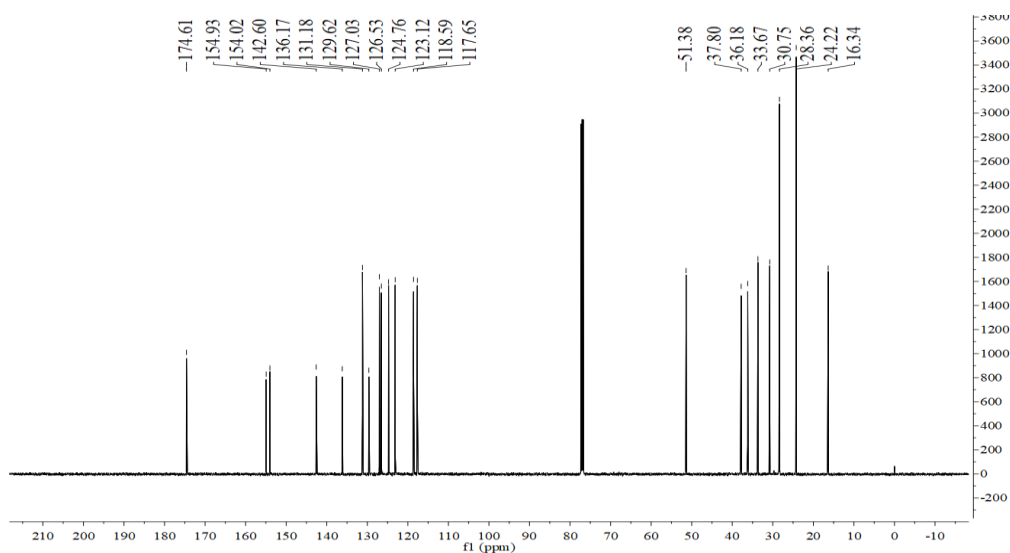


Figure S19. ^{13}C -NMR spectrum of intermediate **6d**.

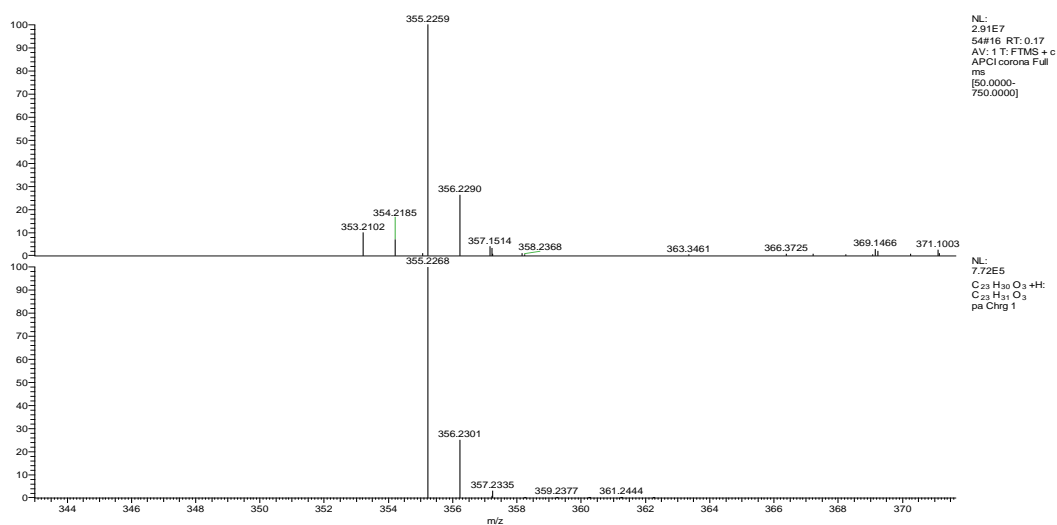
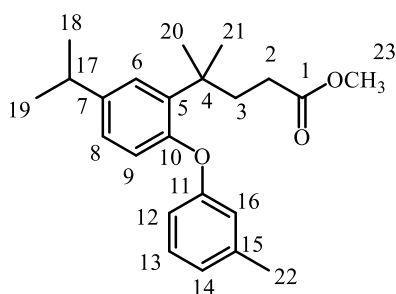


Figure S20. ESI-MS spectrum of intermediate **6d**.



Intermediate **6e**, colorless oily liquid; yield 97.8s%;; FT-IR (KBr, cm^{-1}): 2958, 2925, 2865 (C-H), 1741 (C=O), 1609, 1582, 1485, 1458, 1435, 1255, 1212 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.18 (t, $J = 7.8$ Hz, 1H, C₆-H), 7.13 (d, $J = 2.2$ Hz, 1H, C₈-H), 6.99 (dd, $J = 8.3, 2.2$ Hz, 1H, C₉-H), 6.87 (d, $J = 7.5$ Hz, 1H, C₁₆-H), 6.81 (s, 1H, C₆-H, C₁₂-H), 6.74 (t, $J = 9.1$ Hz, 2H, C₁₃-H, C₁₄-H), 3.58 (s, 3H, C₂₃-H), 2.87 (dd, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.32 (s, 3H, C₂₂-H), 2.23 – 2.18 (m, 2H, C₂-H), 2.13 – 2.08 (m, 2H, C₃-H), 1.40 (s, 6H, C₂₀-H, C₂₁-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.61, 157.47, 153.61, 143.30, 139.78, 137.15, 129.32, 126.51, 124.85, 123.43, 119.71, 119.34, 115.58, 51.41, 37.73, 36.19, 33.75, 30.68, 28.41, 24.23, 21.42; ESI-MS m/z : 355.2258 $[\text{M} + \text{H}^+]$.

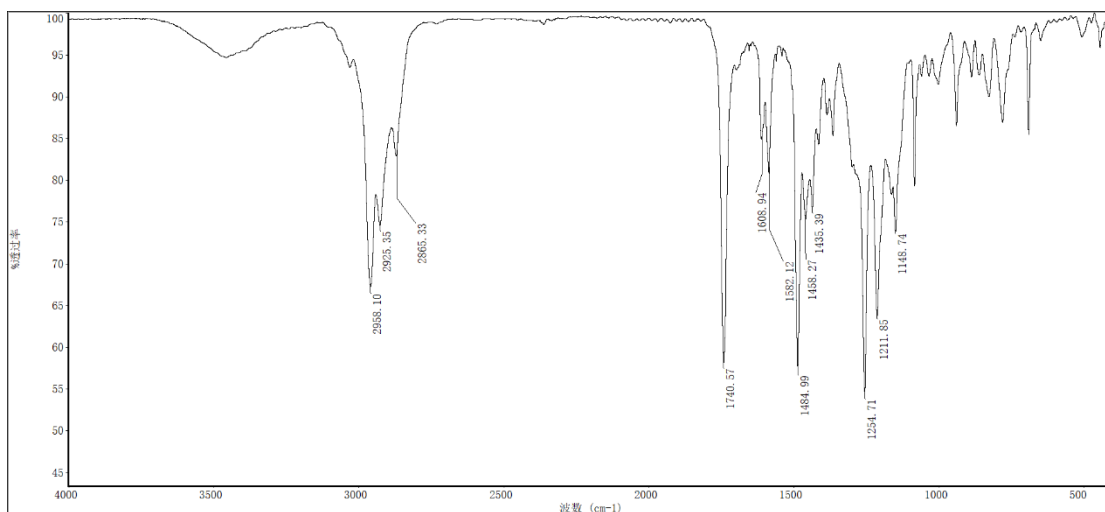


Figure S21. FT-IR spectrum of intermediate **6e**.

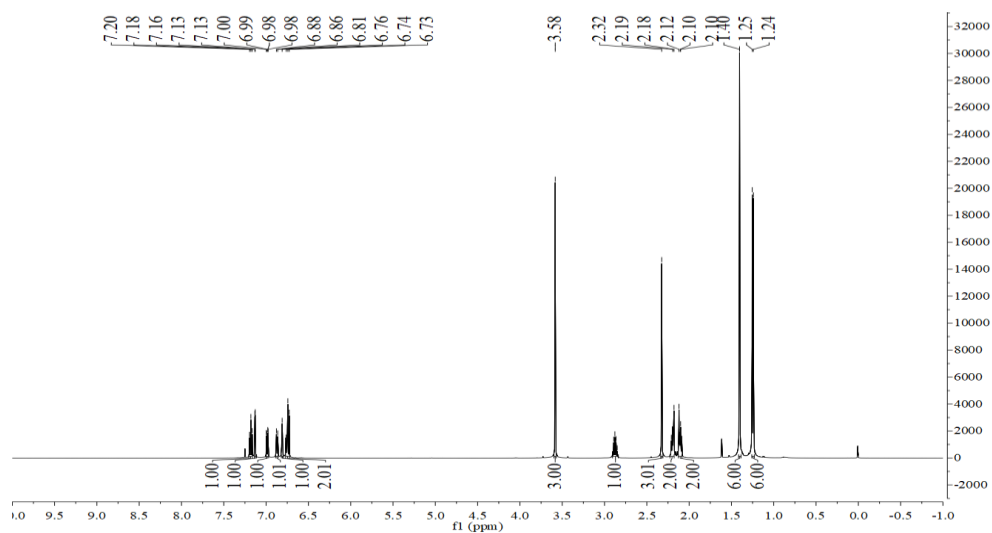


Figure S22. ^1H -NMR spectrum of intermediate **6e**.

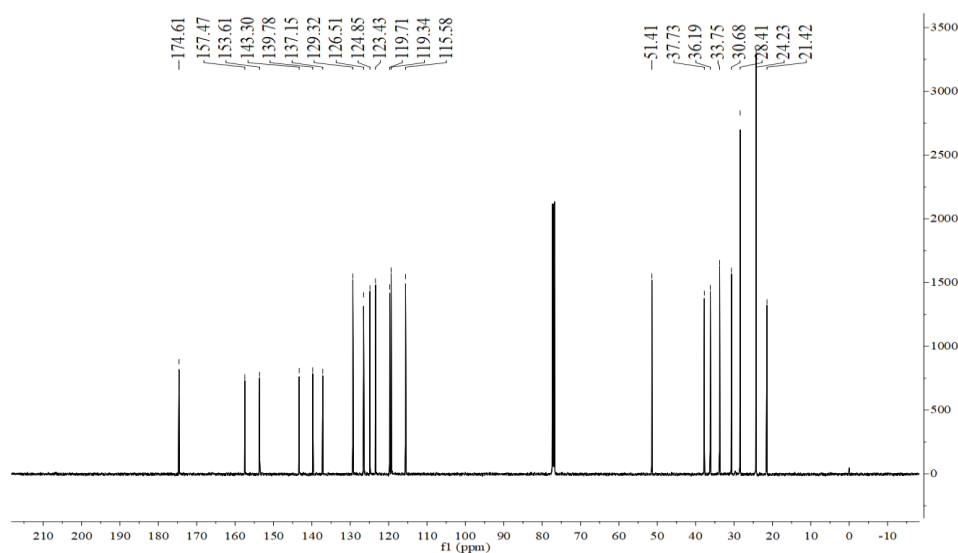


Figure S23. ^{13}C -NMR spectrum of intermediate **6e**.

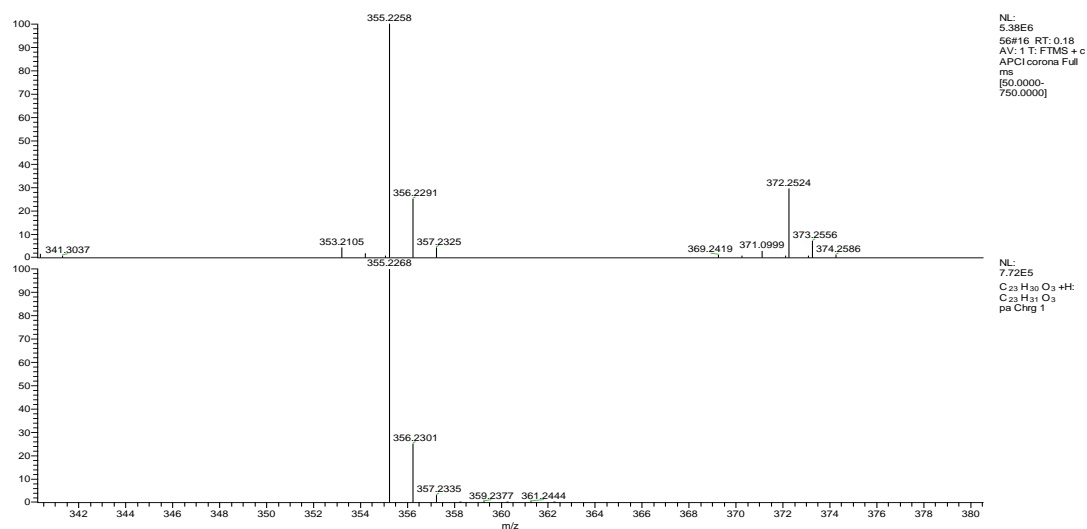
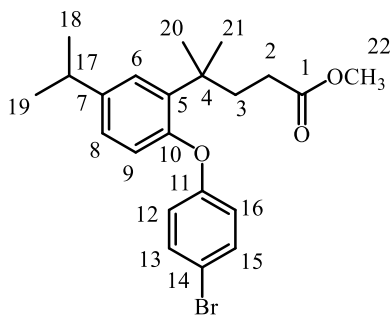


Figure S24. ESI-MS spectrum of intermediate **6e**.



Intermediate **6f**, yellowish oily liquid; yield 95.4%; FT-IR (KBr, cm^{-1}): 2959, 2929, 2871(C-H), 1740(C=O), 1582, 1481, 1435, 1415, 1228, 1234, 1198, 1164, 1082 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.43 – 7.36 (m, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.14 (d, J = 2.2 Hz, 1H, $\text{C}_6\text{-H}$), 7.02 – 6.99 (m, 1H, $\text{C}_8\text{-H}$), 6.87 – 6.83 (m, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.73 (d, J = 8.3 Hz, 1H, $\text{C}_9\text{-H}$), 3.57 (s, 3H, $\text{C}_{22}\text{-H}$), 2.88 (dd, J = 13.8, 6.9 Hz, 1H, $\text{C}_{17}\text{-H}$), 2.17 – 2.12 (m, 2H, $\text{C}_2\text{-H}$), 2.10 – 2.06 (m, 2H, $\text{C}_3\text{-H}$), 1.37 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.24 (d, J = 6.9 Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 174.44, 156.86, 152.89, 144.09, 137.52, 132.54, 126.72, 125.05, 120.03 (d, J = 8.1 Hz), 114.84, 51.45, 37.71, 36.25, 33.76, 30.59, 28.40, 24.17; ESI-MS m/z : 419.1205 [$\text{M} + \text{H}^+$].

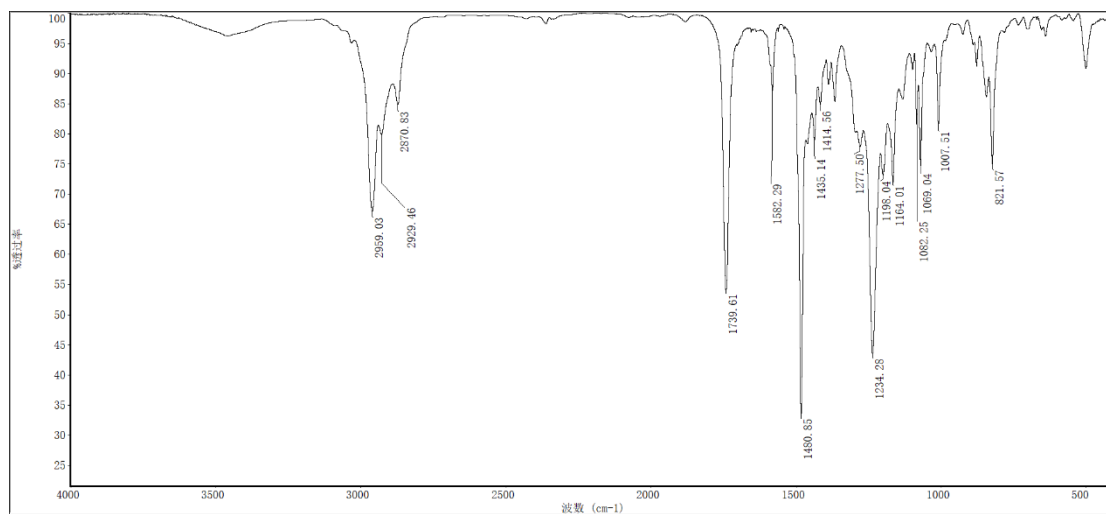


Figure S25. FT-IR spectrum of intermediate **6f**.

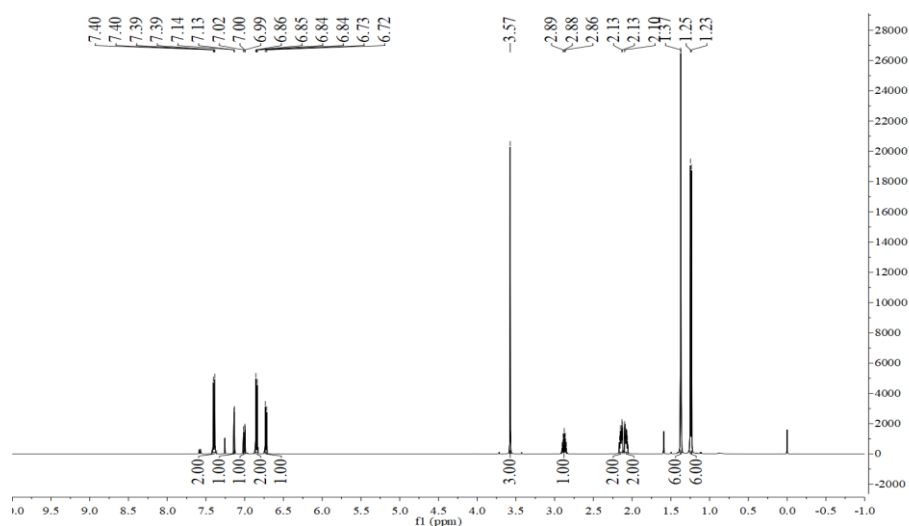


Figure S26. ^1H -NMR spectrum of intermediate **6f**.

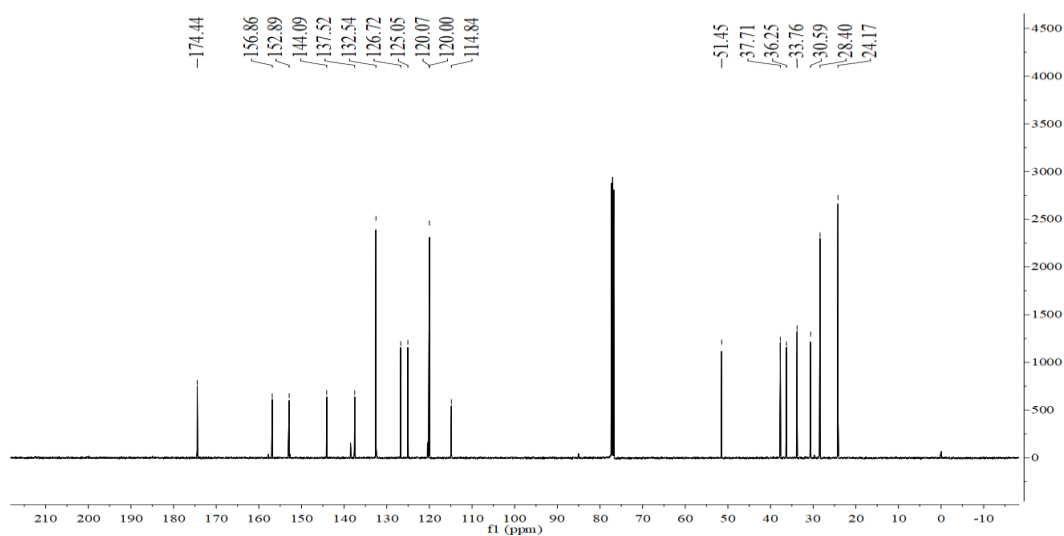


Figure S27. ^{13}C -NMR spectrum of intermediate **6f**.

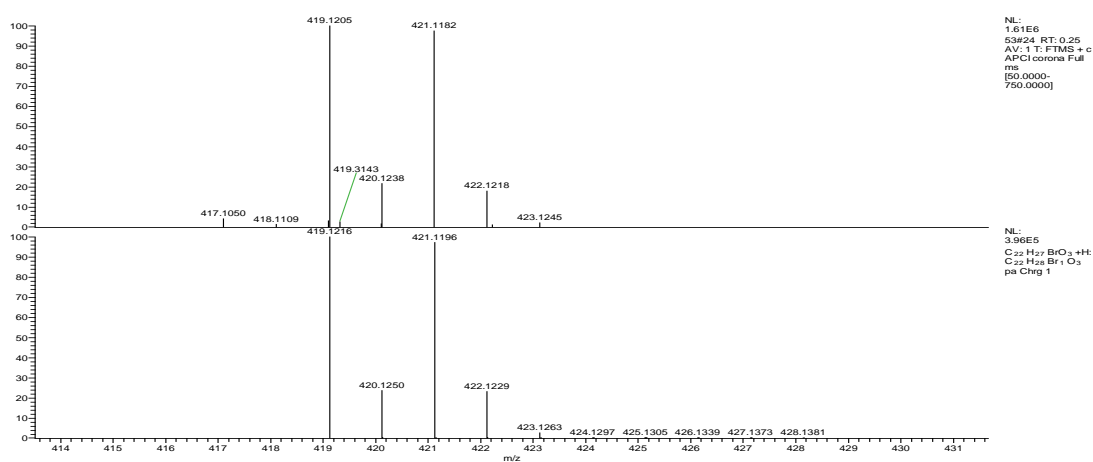
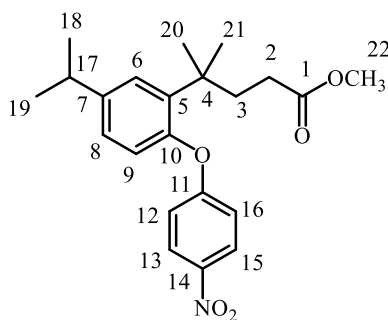


Figure S28. ESI-MS spectrum of intermediate **6f**.



Intermediate **6g**, white solid; yield 96.1%; m. p. 83.8– 86.5 °C; FT-IR (KBr, cm^{-1}): 2958, 2926, 2870 (C-H), 1738 (C=O), 1610, 1589, 1519, 1486, 1365, 1343, 1246, 1196, 1165, 1111 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 8.20 (d, $J = 7.3$ Hz, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.20 (d, $J = 2.0$ Hz, 1H, $\text{C}_6\text{-H}$), 7.09 (dd, $J = 8.2, 2.0$ Hz, 1H, $\text{C}_8\text{-H}$), 7.02 (d, $J = 9.2$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.82 (d, $J = 8.2$ Hz, 1H, $\text{C}_9\text{-H}$), 3.56 (s, 3H, $\text{C}_{22}\text{-H}$), 2.92 (dt, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.09 (s, 4H, $\text{C}_2\text{-H}$, $\text{C}_3\text{-H}$), 1.35 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.27 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 174.21, 163.33, 151.21, 145.76, 142.44, 138.35, 127.17, 125.96, 125.48, 121.51, 117.20, 51.50, 37.72, 36.44, 33.87, 30.44, 28.49, 24.13; ESI-MS m/z : 385.1892 [$\text{M} + \text{H}^+$].

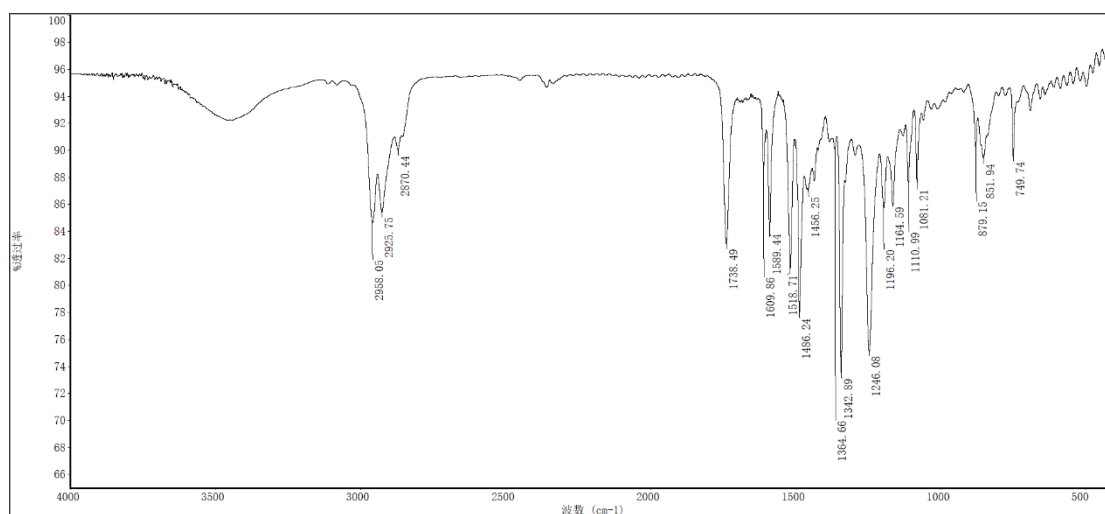


Figure S29. FT-IR spectrum of intermediate **6g**.

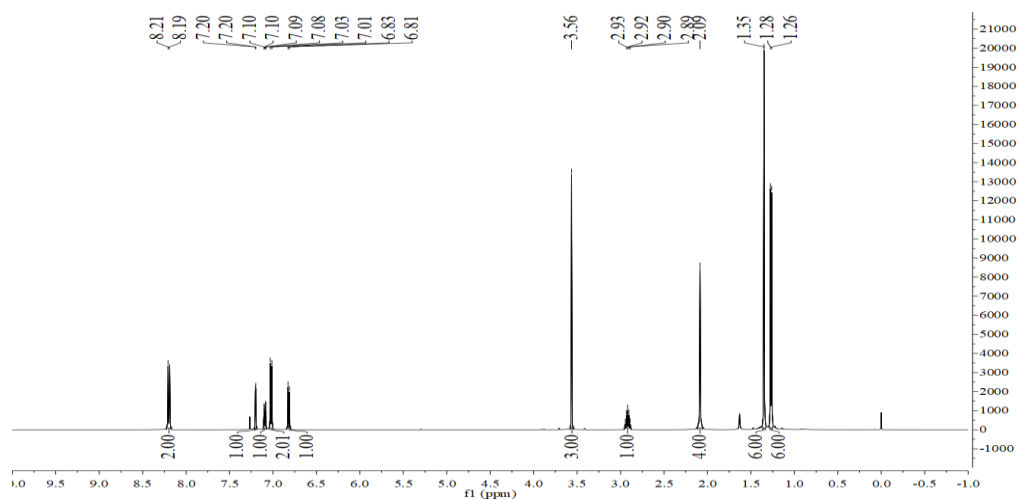


Figure S30. ¹H-NMR spectrum of intermediate **6g**.

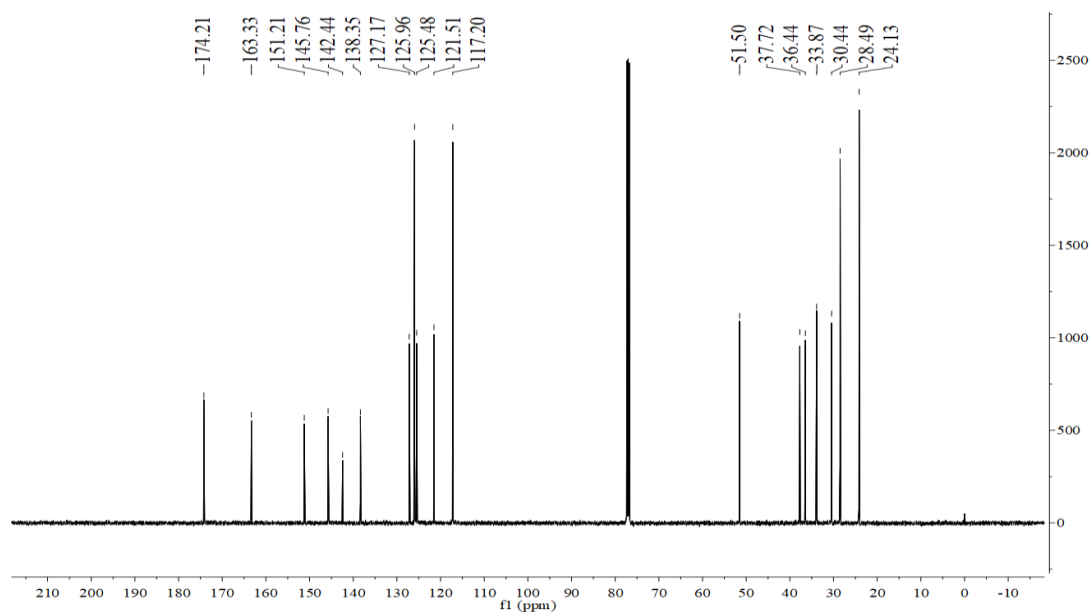


Figure S31. ¹³C-NMR spectrum of intermediate **6g**.

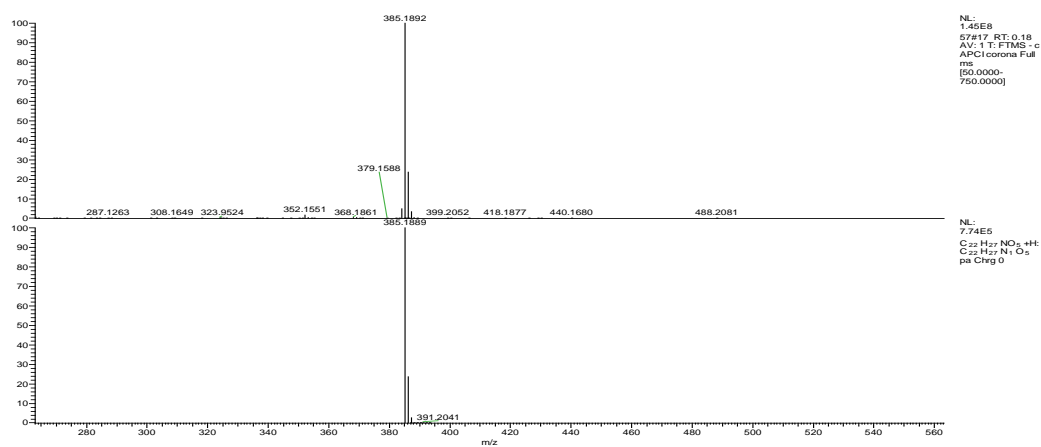
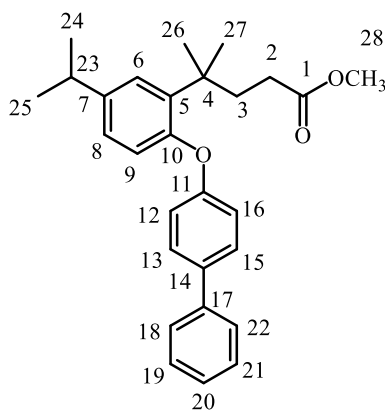


Figure S32. ESI-MS spectrum of intermediate **6g**.



Intermediate **6h**, colorless oily liquid, white solid; yield 94.8%; FT-IR (KBr, cm^{-1}): 3445 (Ar-H), 2957, 2925, 2869 (C-H), 1738 (C=O), 1601, 1515, 1483, 1456, 1435, 1234, 1167, 1082 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.54 (dd, $J = 14.7, 8.6$ Hz, 4H, C₁₃-H, C₁₅-H, C₁₈-H, C₂₂-H), 7.42 (t, $J = 7.7$ Hz, 2H, C₁₉-H, C₂₁-H), 7.31 (t, $J = 7.4$ Hz, 1H, C₂₀-H), 7.15 (d, $J = 2.2$ Hz, 1H, C₆-H), 7.02 (dd, $J = 13.5, 5.4$ Hz, 3H, C₈-H, C₁₂-H, C₁₆-H), 6.81 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.57 (s, 3H, C₂₈-H), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, C₂₃-H), 2.23 – 2.19 (m, 2H, C₂-H), 2.14 – 2.09 (m, 2H, C₃-H), 1.41 (s, 6H, C₂₆-H, C₂₇-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₂₄-H, C₂₅-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.47, 157.06, 153.28, 143.56, 140.55, 137.28, 135.50, 128.64, 128.21, 126.76 (d, $J = 6.5$ Hz), 126.51, 124.85, 119.89, 118.61, 51.34, 37.65, 36.15, 33.67, 30.57, 28.33, 24.11; ESI-MS m/z : 417.2413 $[\text{M} + \text{H}^+]$.

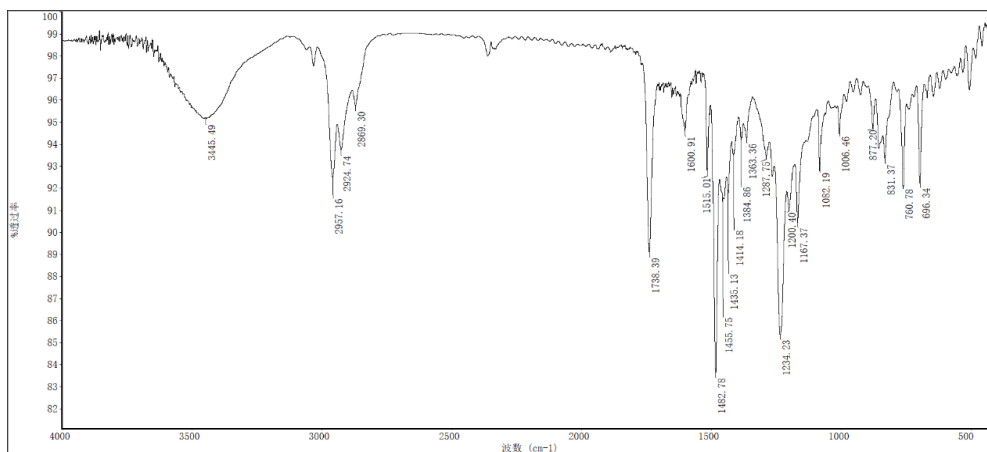
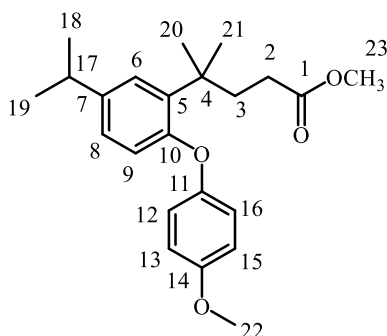


Figure S33. FT-IR spectrum of intermediate **6h**.





Intermediate **6i**, yellowish oily liquid; yield 87.9%; FT-IR (KBr, cm^{-1}): 3451 (Ar-H), 2957, 2926, 2872 (C-H), 1739 (C=O), 1506, 1489, 1440, 1296, 1221, 1180, 1083, 1037 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.10 (s, 1H, C₆-H), 6.93 (dd, J = 14.8, 8.1 Hz, 3H, C₈-H, C₁₃-H, C₁₅-H), 6.86 (d, J = 9.1 Hz, 2H, C₁₂-H, C₁₆-H), 6.64 (d, J = 8.3 Hz, 1H, C₉-H), 3.79 (s, 3H, C₂₂-H), 3.58 (s, 3H, C₂₃-H), 2.85 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.24 – 2.20 (m, 2H, C₂-H), 2.13 – 2.09 (m, 2H, C₃-H), 1.42 (s, 6H, C₂₀-H, C₂₁-H), 1.23 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 174.67, 155.39, 154.76, 150.71, 142.68, 136.43, 126.44, 124.76, 120.30, 118.29, 114.79, 55.65, 51.42, 37.74, 36.09, 33.68, 30.71, 28.32, 24.22; ESI-MS m/z : 371.2208 [$\text{M} + \text{H}^+$].

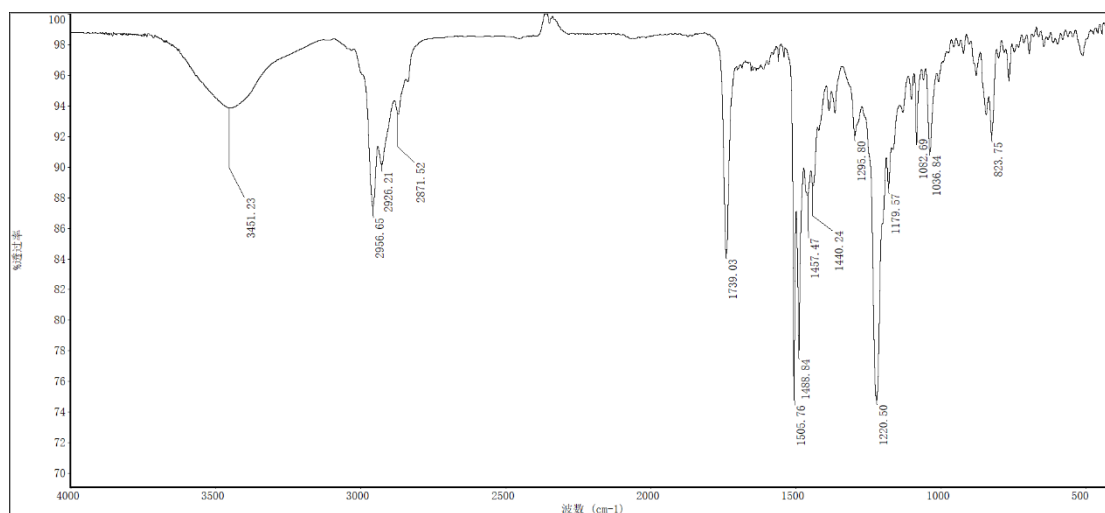


Figure S37. FT-IR spectrum of intermediate **6i**.

Figure S38. ^1H -NMR spectrum of intermediate **6i**.

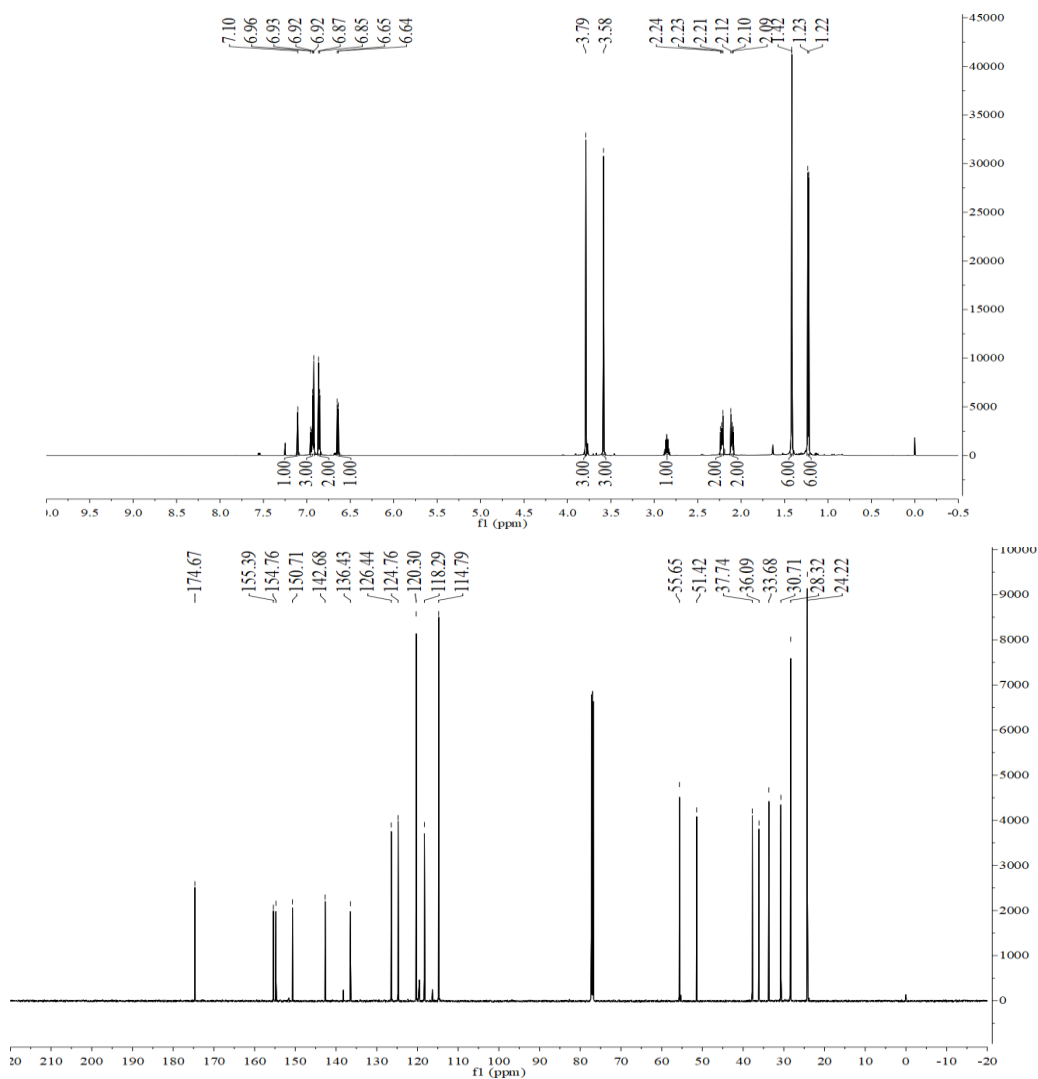


Figure S39. ^{13}C -NMR spectrum of intermediate **6i**.

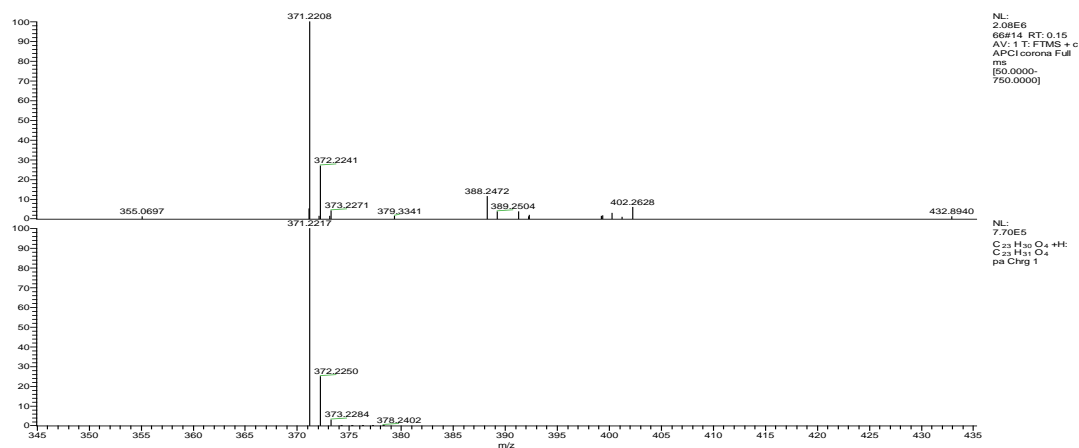
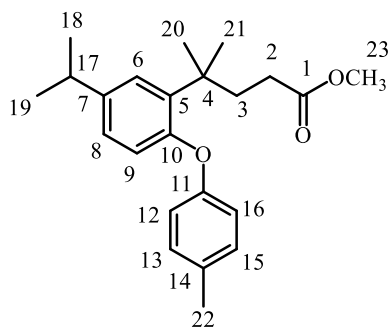


Figure S40. ESI-MS spectrum of intermediate **6i**.



Intermediate **6j**, colorless oily liquid; yield 95.8%; FT-IR (KBr, cm^{-1}): 2958, 2926, 2869 (C-H), 1741 (C=O), 1507, 1489, 1457, 1435, 1288, 1232, 1166, 1083 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.12 (t, $J = 5.3$ Hz, 3H, C₆-H, C₁₃-H, C₁₅-H), 6.98 (d, $J = 2.2$ Hz, 1H, C₈-H), 6.87 (d, $J = 8.5$ Hz, 2H, C₁₂-H, C₁₆-H), 6.71 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.59 (s, 3H, C₂₃-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.32 (s, 3H, C₂₂-H), 2.20 (dd, $J = 10.3, 5.5$ Hz, 2H, C₂-H), 2.11 (dd, $J = 9.4, 6.5$ Hz, 2H, C₃-H), 1.41 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.64, 155.16, 153.98, 143.07, 136.95, 132.05, 130.10, 126.45, 124.80, 119.25, 118.67, 51.40, 37.72, 36.15, 33.72, 30.67, 28.36, 24.21, 20.64; ESI-MS m/z : 355.2258 [$\text{M} + \text{H}^+$].

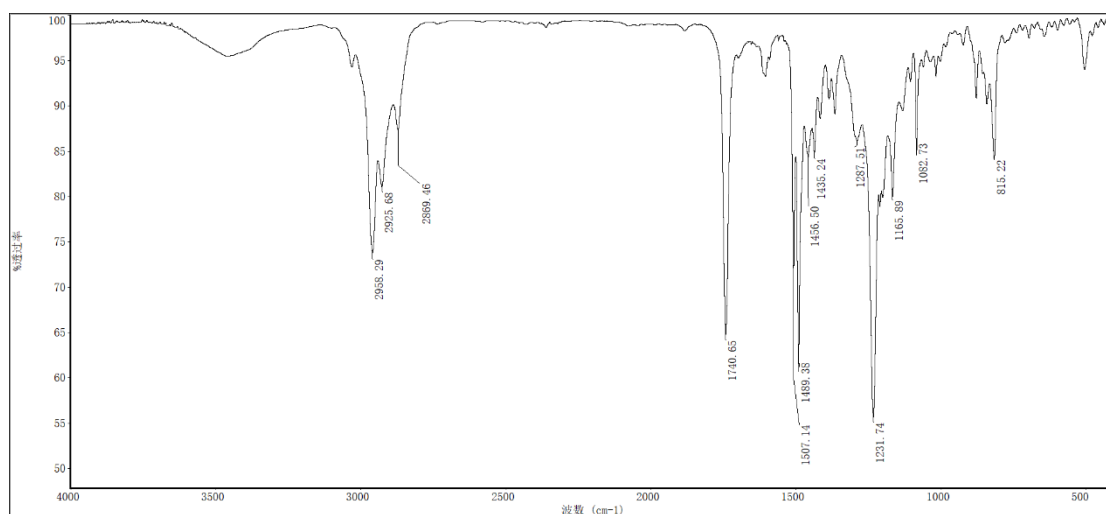


Figure S41. FT-IR spectrum of intermediate **6j**.

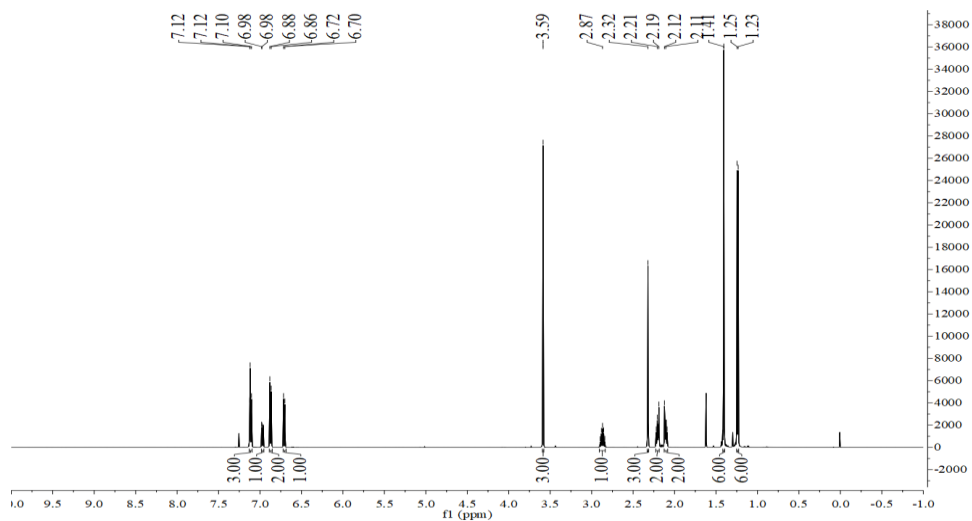


Figure S42. ¹H-NMR spectrum of intermediate **6j**.

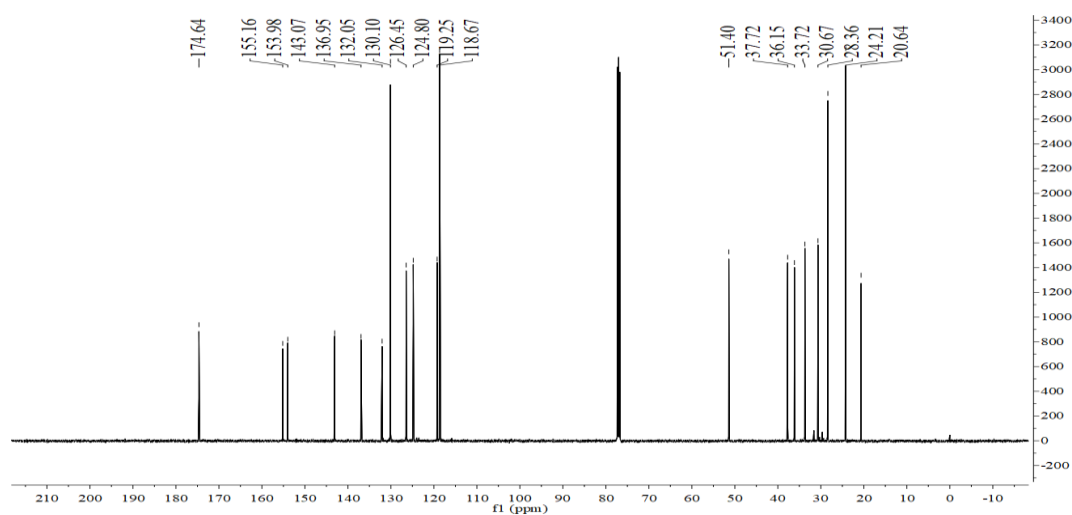


Figure S43. ¹³C-NMR spectrum of intermediate **6j**.

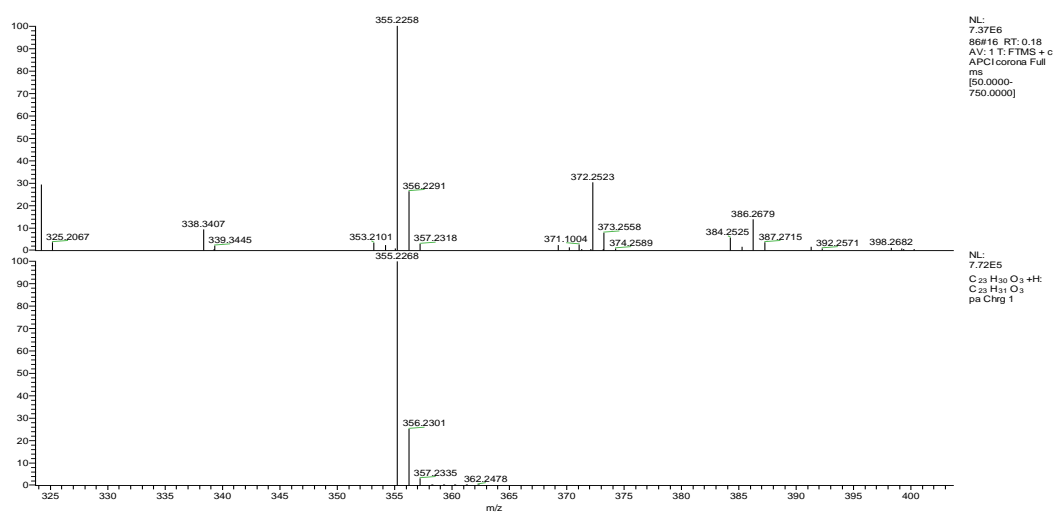
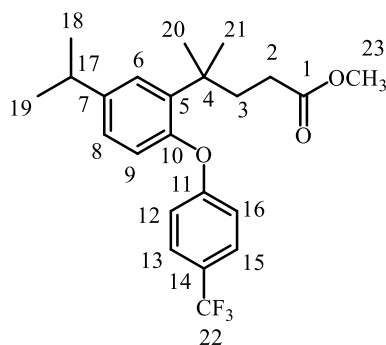


Figure S44. ESI-MS spectrum of intermediate **6j**.



Intermediate **6k**, colorless oily liquid; yield 87.7%; FT-IR (KBr, cm^{-1}): 2959, 2927, 2872 (C-H), 1740 (C=O), 1616, 1514, 1489, 1456, 1324, 1243, 1123, 1083, 1065 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.55 (d, $J = 8.6$ Hz, 2H, C₁₃-H, C₁₅-H), 7.17 (d, $J = 2.2$ Hz, 1H, C₆-H), 7.04 (dd, $J = 16.0, 5.4$ Hz, 3H, C₈-H, C₁₂-H, C₁₆-H), 6.78 (d, $J = 4.7$ Hz, 1H, C₉-H), 3.56 (s, 3H, C₂₃-H), 2.90 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.10 (dd, $J = 23.0, 9.7$ Hz, 4H, C₂-H, C₃-H), 1.37 (s, 6H, C₂₀-H, C₂₁-H), 1.26 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.36, 160.63, 152.04, 144.86, 138.05, 127.42 – 126.79, 125.24, 120.99, 117.69, 51.44, 37.74, 36.38, 33.84, 30.56, 28.47, 24.17; ESI-MS m/z : 307.1836 $[\text{M} + \text{H}^+]$.

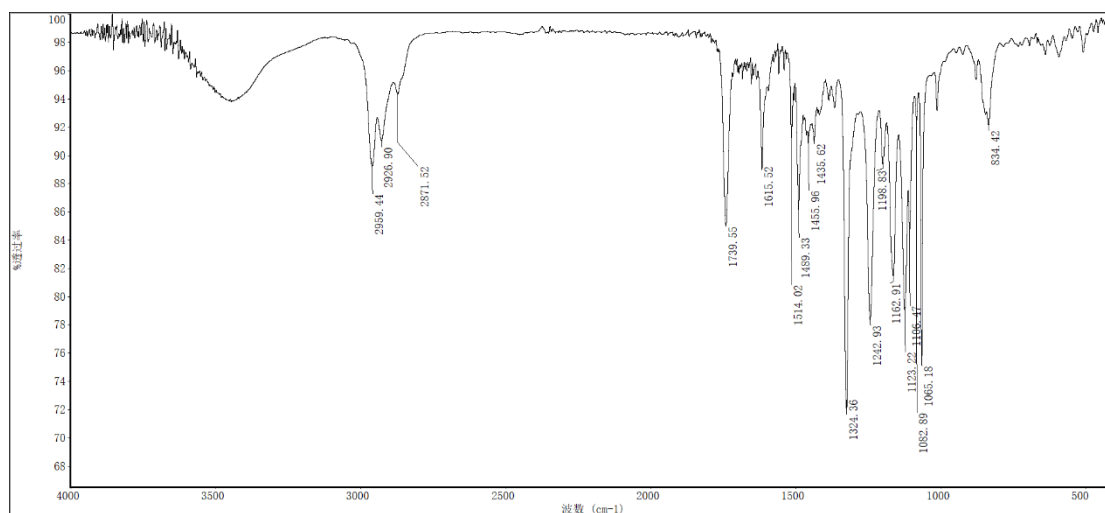
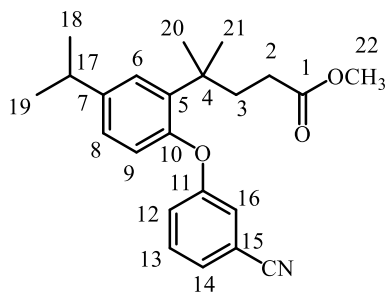


Figure S45. FT-IR spectrum of intermediate **6k**.





Intermediate **6l**, yellowish oily liquid; yield 98.2%; FT-IR (KBr, cm^{-1}): 2959, 2927, 2867 (C-H), 2236 ($\text{C}\equiv\text{N}$), 1739 ($\text{C}=\text{O}$), 1578, 1481, 1432, 1253, 1205, 1165, 1082 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.41 (t, $J = 8.0$ Hz, 1H, $\text{C}_{14}\text{-H}$), 7.33 (d, $J = 7.7$ Hz, 1H, $\text{C}_{13}\text{-H}$), 7.23 (d, $J = 9.8$ Hz, 1H, $\text{C}_{12}\text{-H}$), 7.20 – 7.14 (m, 2H, $\text{C}_6\text{-H}$, $\text{C}_{16}\text{-H}$), 7.06 (dd, $J = 8.3, 2.0$ Hz, 1H, $\text{C}_8\text{-H}$), 6.74 (d, $J = 8.3$ Hz, 1H, $\text{C}_9\text{-H}$), 3.58 (s, 3H, $\text{C}_{22}\text{-H}$), 2.90 (t, $J = 13.8$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.13 – 2.05 (m, 4H, $\text{C}_2\text{-H}$, $\text{C}_3\text{-H}$), 1.37 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.26 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (151 MHz, CDCl_3) δ 174.31, 158.26, 151.92, 145.05, 137.99, 130.64, 127.06, 125.97, 125.39, 122.80, 120.83, 120.64, 118.40, 113.46, 51.51, 37.72, 36.38, 33.83, 30.51, 28.44, 24.15; ESI-MS m/z : 366.2055 [$\text{M} + \text{H}^+$].

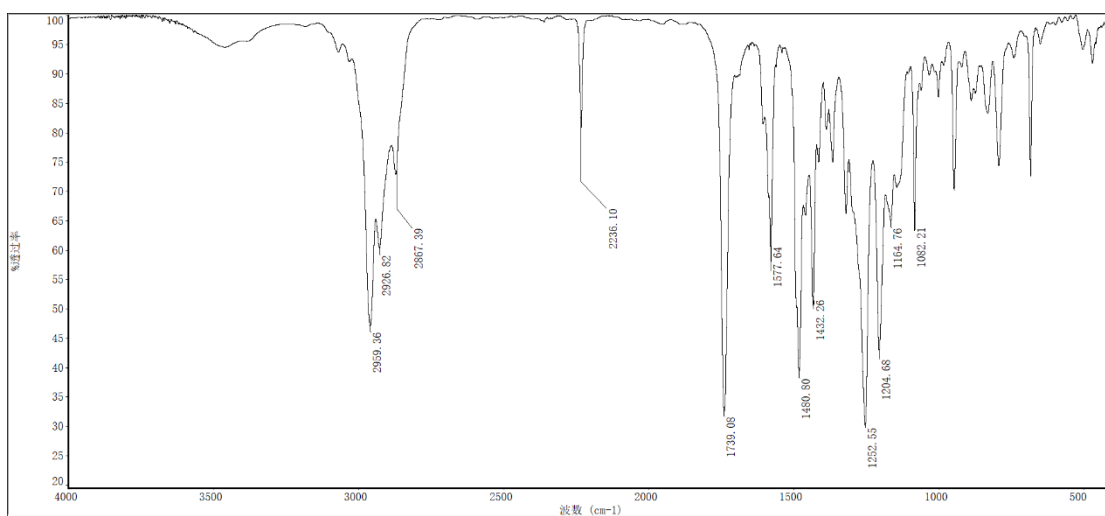


Figure S49. FT-IR spectrum of intermediate **6l**.

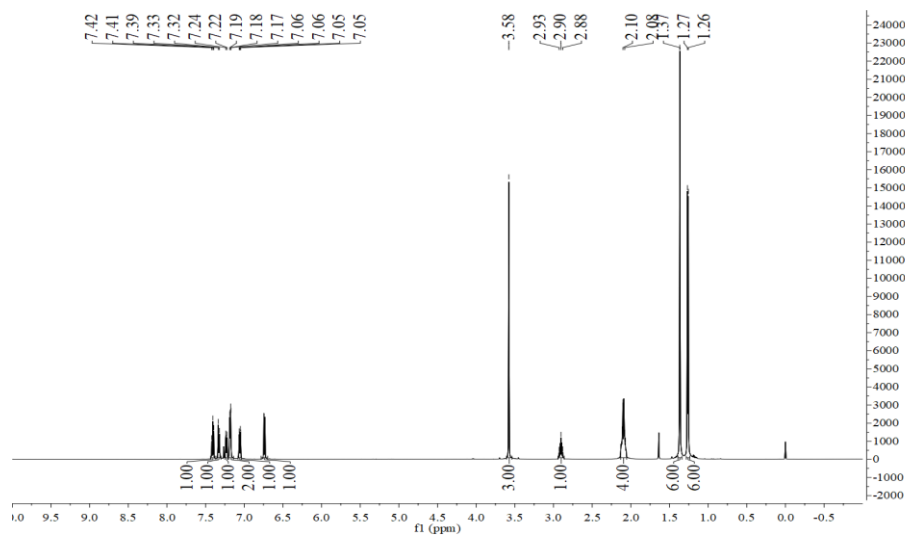


Figure S50. ^1H -NMR spectrum of intermediate **6l**.

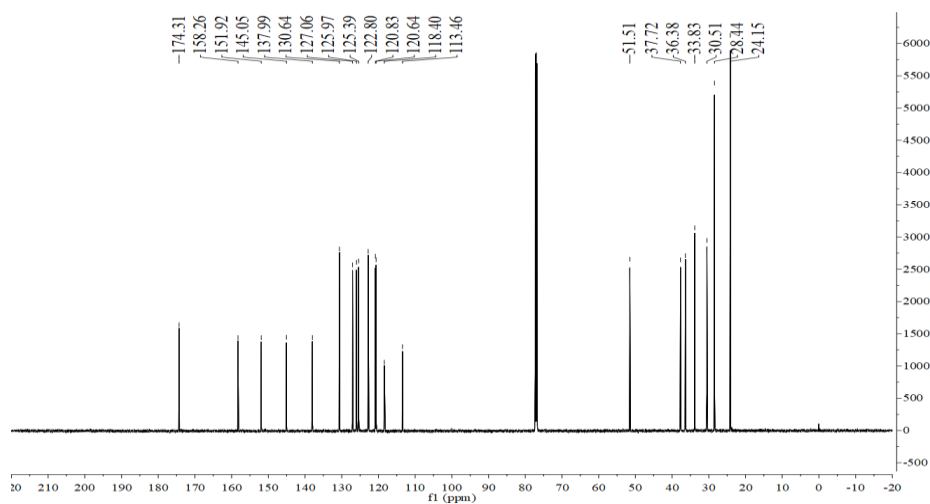


Figure S51. ^{13}C -NMR spectrum of intermediate **6l**.

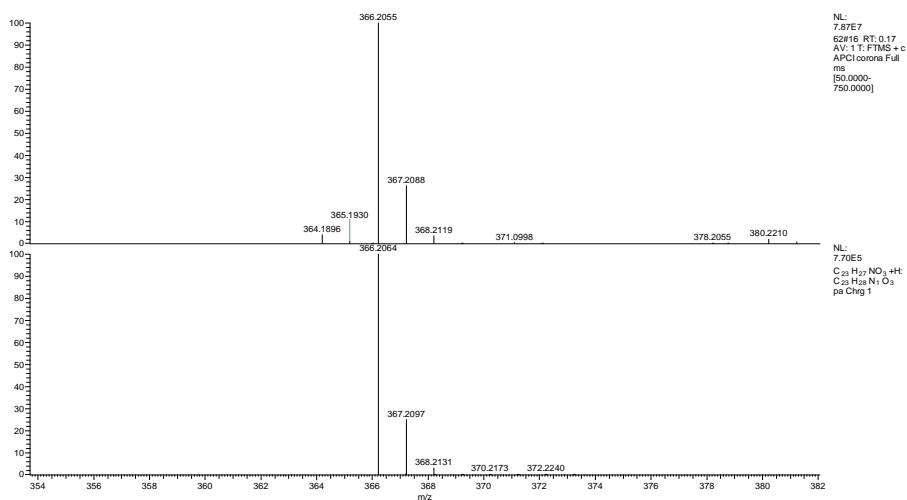
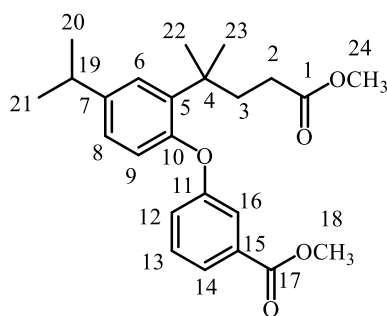


Figure S52. ESI-MS spectrum of intermediate **6l**.



Intermediate **6m**, colorless oily liquid; yield 90.6%; FT-IR (KBr, cm^{-1}): 2957, 2926, 2874 (C-H), 1728 (C=O), 1582, 1484, 1444, 1274, 1226, 1197, 1162, 1098, 1082 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.74 (d, $J = 7.7$ Hz, 1H, C₁₄-H), 7.64 (s, 1H), 7.37 (t, $J = 8.0$ Hz, 1H, C₁₆-H), 7.16 (d, $J = 8.9$ Hz, 2H, C₁₃-H, C₆-H), 7.01 (d, $J = 10.4$ Hz, 1H, C₈-H), 6.72 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.89 (s, 3H, C₁₈-H), 3.57 (s, 3H, C₂₄-H), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₉-H), 2.17 (dd, $J = 14.4, 4.9$ Hz, 2H, C₂-H), 2.11 (dd, $J = 14.4, 4.9$ Hz, 2H, C₃-H), 1.39 (s, 6H, C₂₂-H, C₂₃-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₂₀-H, C₂₁-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.45, 166.60, 157.64, 152.93, 143.99, 137.46, 131.82, 129.63, 126.73, 125.09, 123.70, 122.88, 119.87, 119.31, 52.17, 51.39, 37.70, 36.24, 33.75, 30.58, 28.38, 24.16; ESI-MS m/z : 399.2158 [$\text{M} + \text{H}^+$].

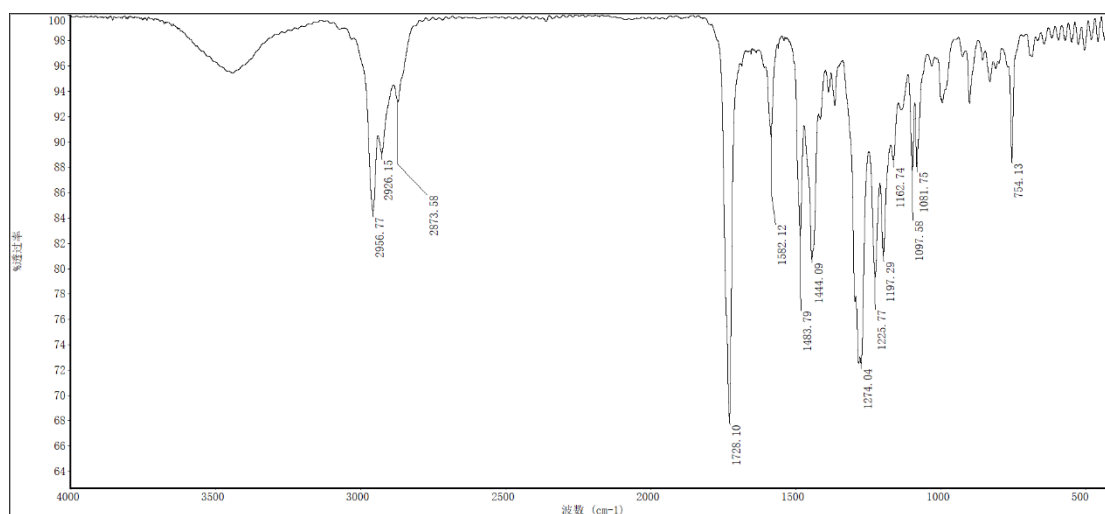


Figure S53. FT-IR spectrum of intermediate **6m**.

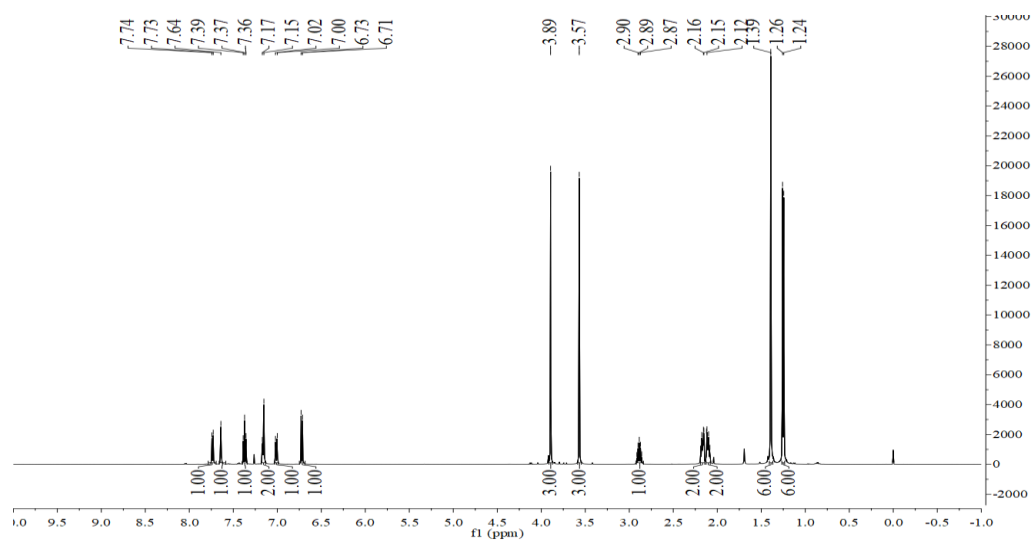


Figure S54. ^1H -NMR spectrum of intermediate **6m**.

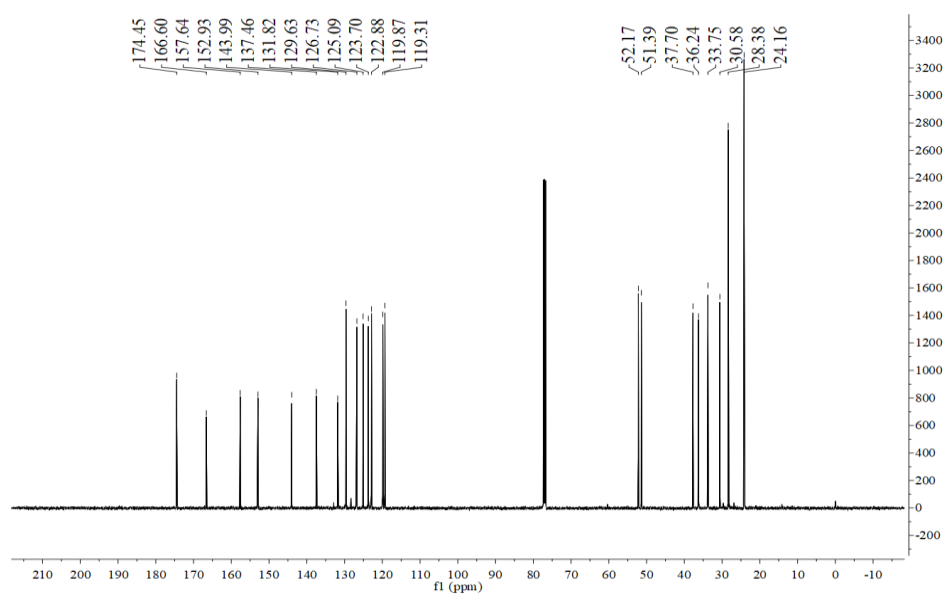


Figure S55. ^{13}C -NMR spectrum of intermediate **6m**.

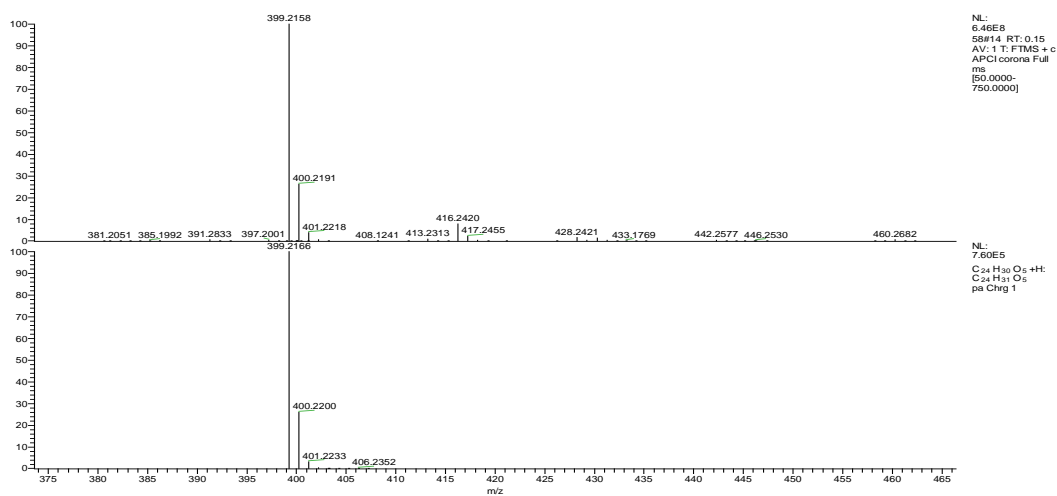
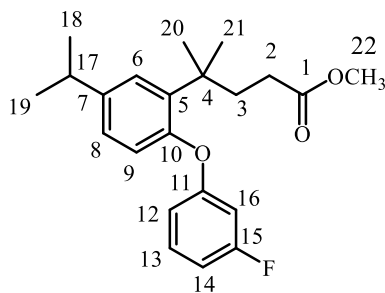


Figure S56. ESI-MS spectrum of intermediate **6m**.



Intermediate **6n**, colorless oily liquid; yield 91.8%; FT-IR (KBr, cm^{-1}): 2959, 2931, 2872 (C-H), 1741 (C=O), 1598, 1483, 1448, 1269, 1208, 1121 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.26 – 7.21 (m, 1H, C₁₃-H), 7.15 (d, J = 2.2 Hz, 1H, C₆-H), 7.03 (dd, J = 8.3, 2.2 Hz, 1H, C₈-H), 6.78 (d, J = 8.3 Hz, 1H, C₉-H), 6.74 (ddd, J = 10.0, 8.2, 2.3 Hz, 2H, C₁₄-H, C₁₆-H), 6.66 (dt, J = 10.5, 2.3 Hz, 1H, C₁₂-H), 3.57 (s, 3H, C₂₂-H), 2.89 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.16 – 2.12 (m, 2H, C₂-H), 2.11 – 2.07 (m, 2H, C₃-H), 1.38 (s, 6H, C₂₀-H, C₂₁-H), 1.25 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 174.45, 164.39, 162.76, 159.14 (d, J = 10.6 Hz), 152.56, 144.35, 137.71, 130.37 (d, J = 9.9 Hz), 126.76, 125.10, 120.60, 113.78 (d, J = 3.0 Hz), 109.29, 109.15, 105.74, 105.57, 51.42, 37.72, 36.32, 33.80, 30.59, 28.43, 24.18; ESI-MS m/z : 359.2007 [$\text{M} + \text{H}^+$].

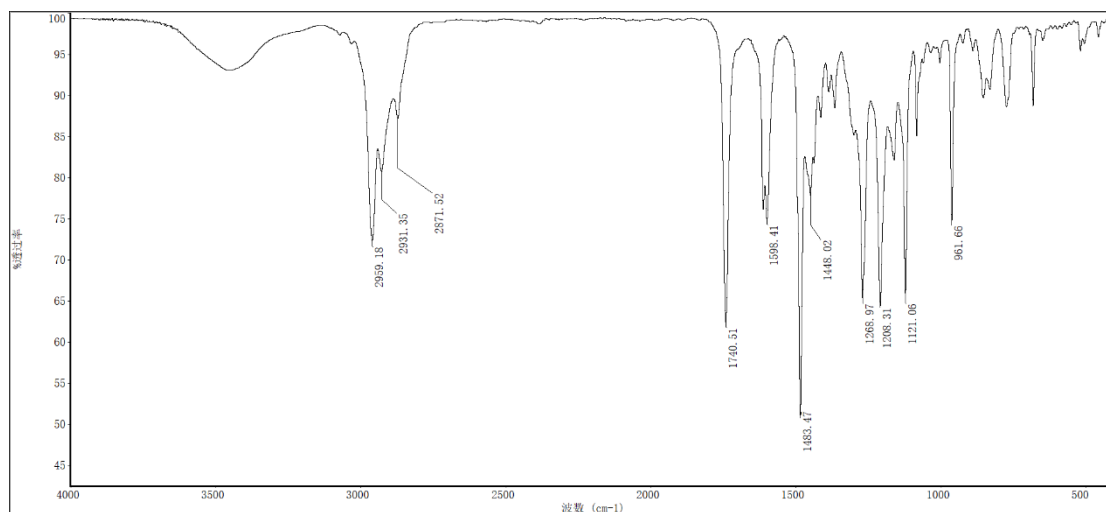


Figure S57. FT-IR spectrum of intermediate **6n**.

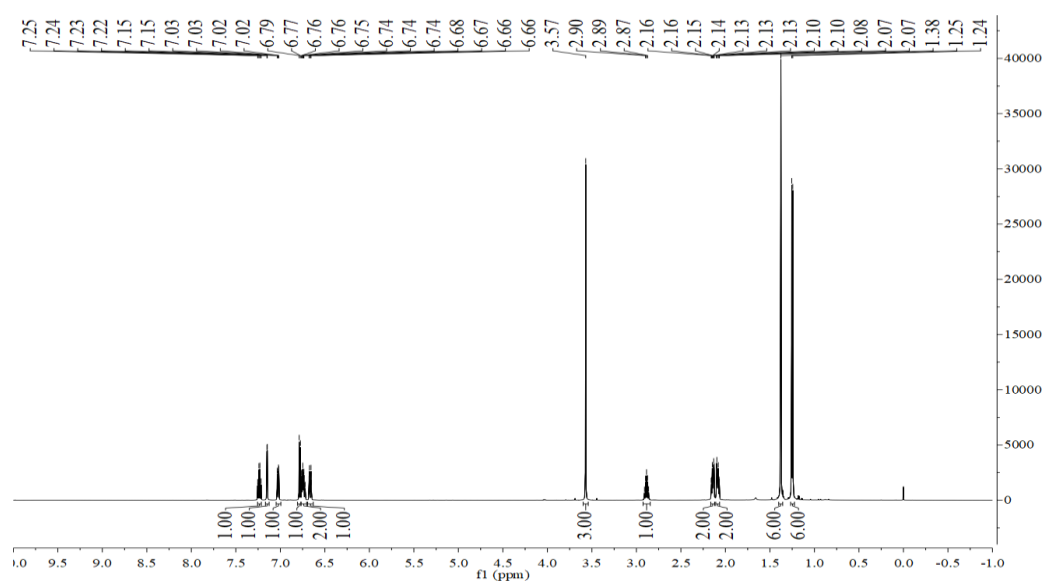


Figure S58. ^1H -NMR spectrum of intermediate **6n**.

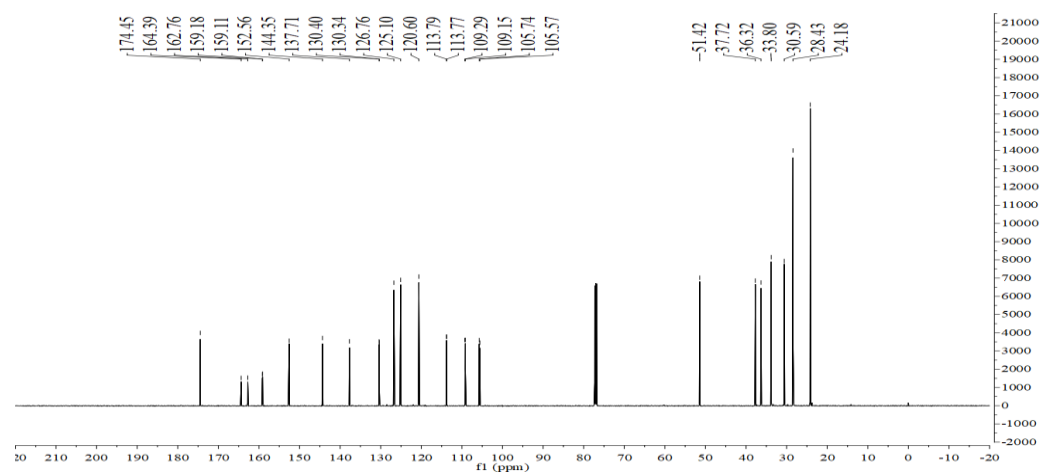


Figure S59. ^{13}C -NMR spectrum of intermediate **6n**.

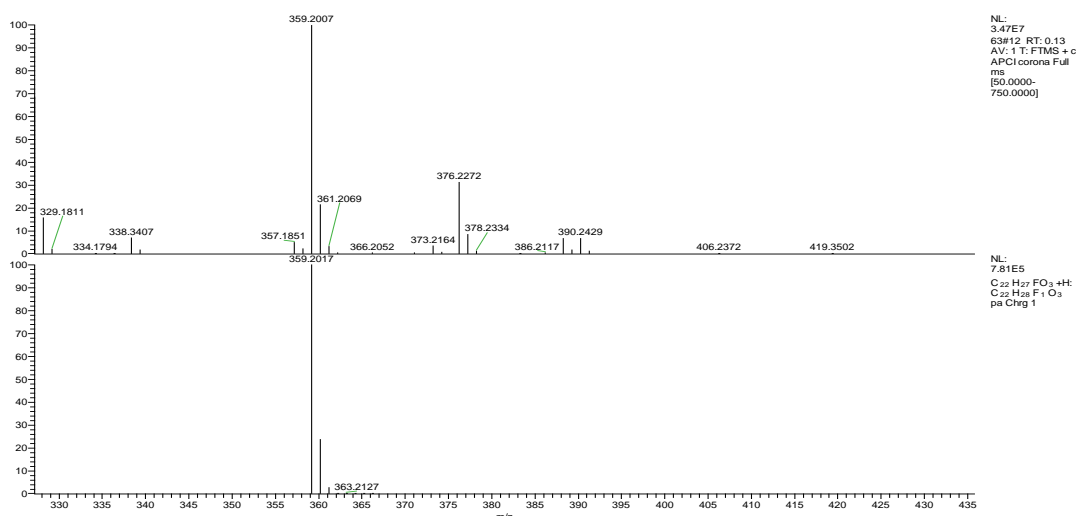
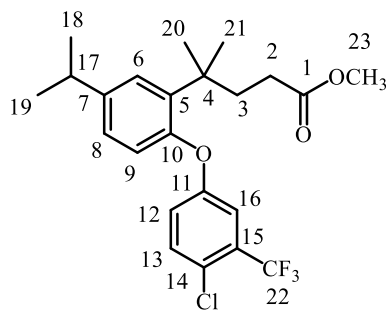


Figure S60. ESI-MS spectrum of intermediate **6n**.



Intermediate **60**, colorless oily liquid; yield 82.7%; FT-IR (KBr, cm^{-1}): 2960, 2925, 2876 (C-H), 1740 (C=O), 1477, 1424, 1315, 1256, 1230, 1172, 1144, 1082 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.40 (d, $J = 8.8$ Hz, 1H, $\text{C}_{13}\text{-H}$), 7.31 (d, $J = 2.9$ Hz, 1H, $\text{C}_{16}\text{-H}$), 7.17 (s, 1H, $\text{C}_6\text{-H}$), 7.04 (d, $J = 5.7$ Hz, 2H, $\text{C}_8\text{-H}$, $\text{C}_9\text{-H}$), 6.72 (d, $J = 8.3$ Hz, 1H, $\text{C}_{12}\text{-H}$), 3.57 (s, 3H, $\text{C}_{23}\text{-H}$), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.12 (d, $J = 8.6$ Hz, 2H, $\text{C}_2\text{-H}$), 2.09 – 2.05 (m, 2H, $\text{C}_3\text{-H}$), 1.37 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.25 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (151 MHz, CDCl_3) δ 174.33, 156.36, 152.25, 144.89, 137.80, 132.61, 127.04, 125.37, 122.04, 120.20, 117.48 (d, $J = 5.4$ Hz), 51.48, 37.73, 36.36, 33.81, 30.55, 28.43, 24.14; ESI-MS m/z : 441.1446 $[\text{M} + \text{H}^+]$.

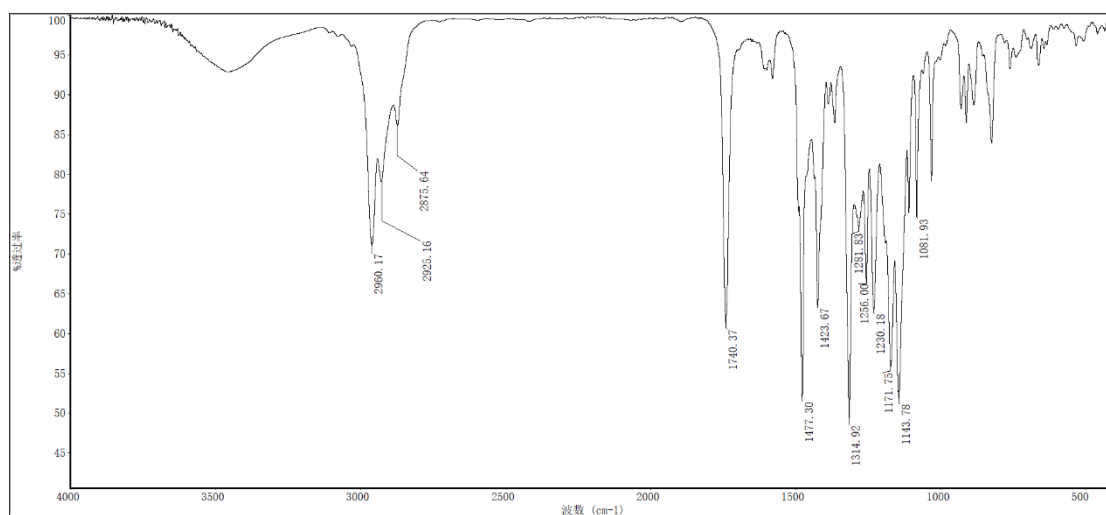


Figure S61. FT-IR spectrum of intermediate **60**.

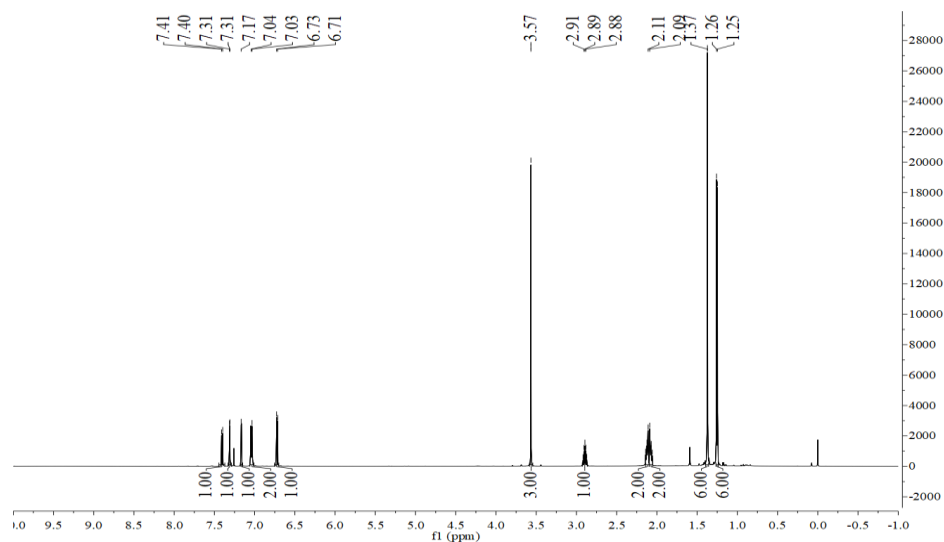


Figure S62. ^1H -NMR spectrum of intermediate **60**.

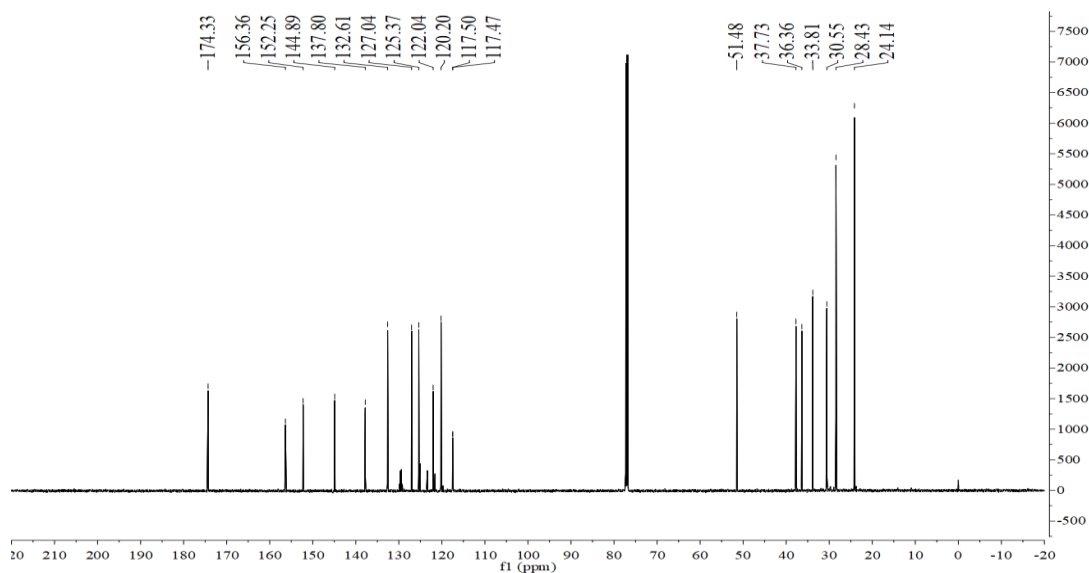


Figure S63. ^{13}C -NMR spectrum of intermediate **60**.

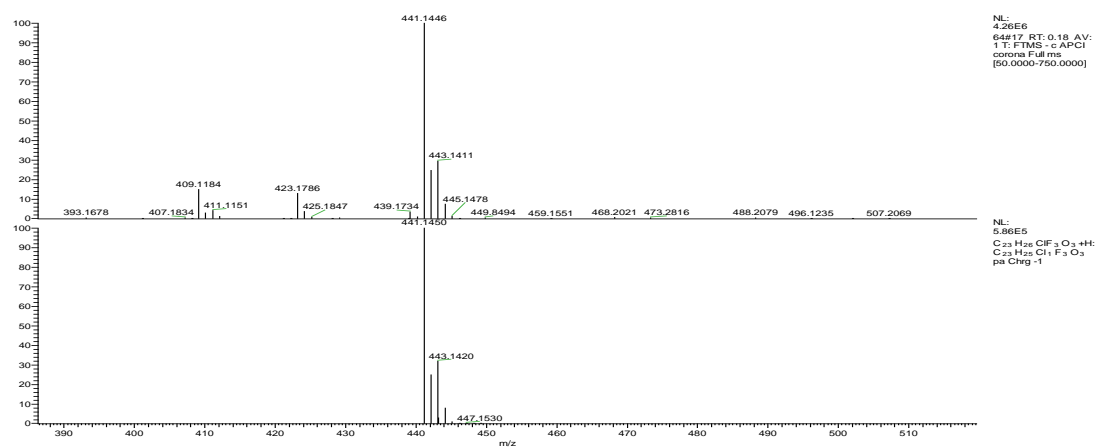
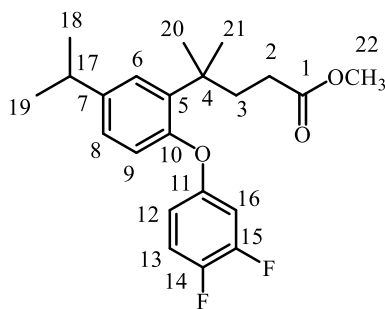


Figure S64. ESI-MS spectrum of intermediate **60**.



Intermediate **6p**, yellowish oily liquid; yield 89.5%; FT-IR (KBr, cm^{-1}): 2959, 2927, 2872 (C-H), 1740 (C=O), 1617 1514, 1489, 1459, 1437, 1301, 1250, 1204, 1146, 1082 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.14 (d, $J = 2.2$ Hz, 1H, C₁₃-H), 7.09 (dd, $J = 18.8, 9.1$ Hz, 1H, C₆-H), 7.02 (dd, $J = 8.3, 2.1$ Hz, 1H, C₈-H), 6.79 (dd, $J = 13.4, 4.8$ Hz, 1H, C₉-H), 6.71 (dd, $J = 14.8, 8.7$ Hz, 2H, C₁₂-H, C₁₆-H), 3.58 (s, 3H, C₂₂-H), 2.88 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.16 – 2.12 (m, 2H, C₂-H), 2.10 – 2.06 (m, 2H, C₃-H), 1.38 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 174.42, 152.95, 144.30, 137.46, 126.83, 125.16, 119.94, 117.59 – 117.30 (m), 113.86 (d, $J = 2.3$ Hz), 107.87, 107.73, 51.45, 37.73, 36.29, 33.78, 30.59, 28.39, 24.17; ESI-MS m/z : 377.1914 $[\text{M} + \text{H}^+]$.

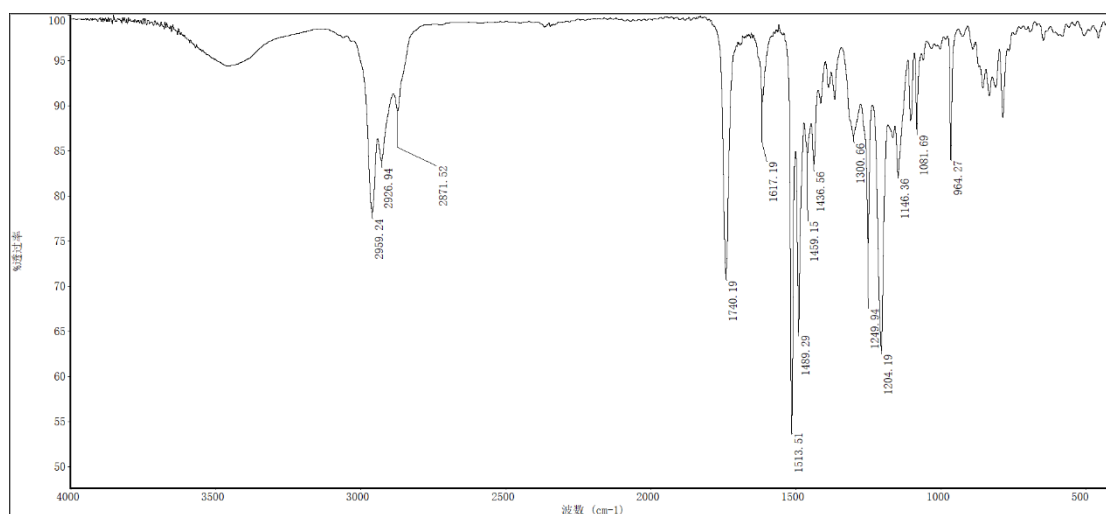


Figure S65. FT-IR spectrum of intermediate **6p**.

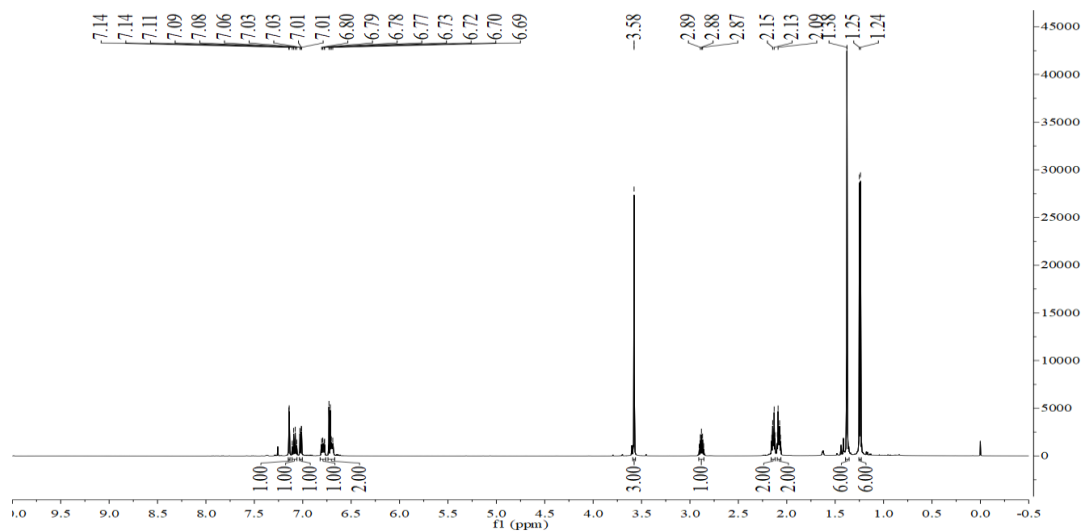


Figure S66. ^1H -NMR spectrum of intermediate **6p**.

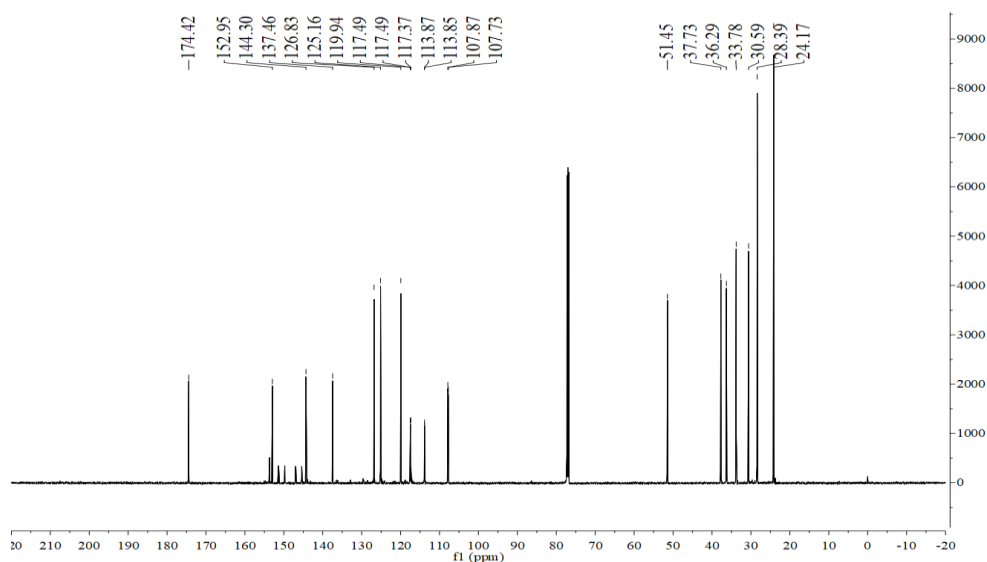


Figure S67. ^{13}C -NMR spectrum of intermediate **6p**.

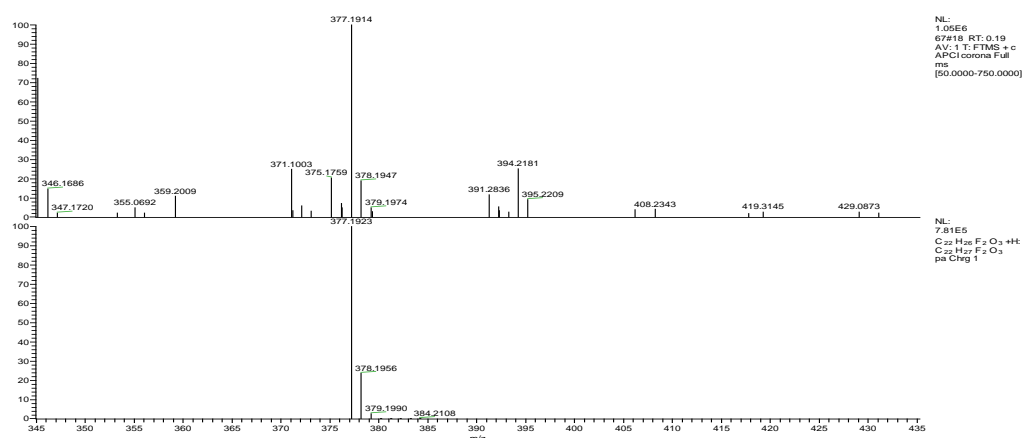
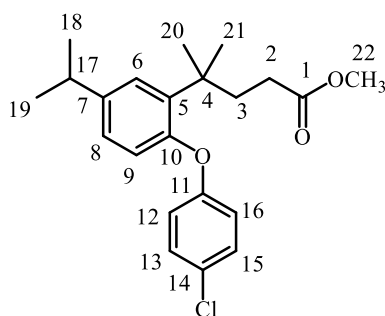


Figure S68. ESI-MS spectrum of intermediate **6p**.



Intermediate **6q**, colorless oily liquid; yield 95.2%; FT-IR (KBr, cm^{-1}): 2960, 2923, 2872 (C-H), 1740 s(C=O), 1588, 1483, 1436, 1366, 1234, 1198, 1163, 1083 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.28 – 7.21 (m, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.14 (d, $J = 2.2$ Hz, 1H, $\text{C}_6\text{-H}$), 7.00 (dd, $J = 8.3, 2.2$ Hz, 1H, $\text{C}_8\text{-H}$), 6.90 (d, $J = 8.9$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.72 (d, $J = 8.3$ Hz, 1H, $\text{C}_9\text{-H}$), 3.57 (s, 3H, $\text{C}_{22}\text{-H}$), 2.92 – 2.82 (m, 1H, $\text{C}_{17}\text{-H}$), 2.14 (q, $J = 7.6$ Hz, 2H, $\text{C}_2\text{-H}$), 2.07 (d, $J = 12.5$ Hz, 2H, $\text{C}_3\text{-H}$), 1.38 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 174.46, 156.26, 153.03, 143.98, 137.43, 129.56, 127.44, 126.69, 125.02, 119.93, 119.57, 51.43, 37.69, 36.22, 33.74, 30.58, 28.37, 24.16; ESI-MS m/z : 375.1712 $[\text{M} + \text{H}^+]$.

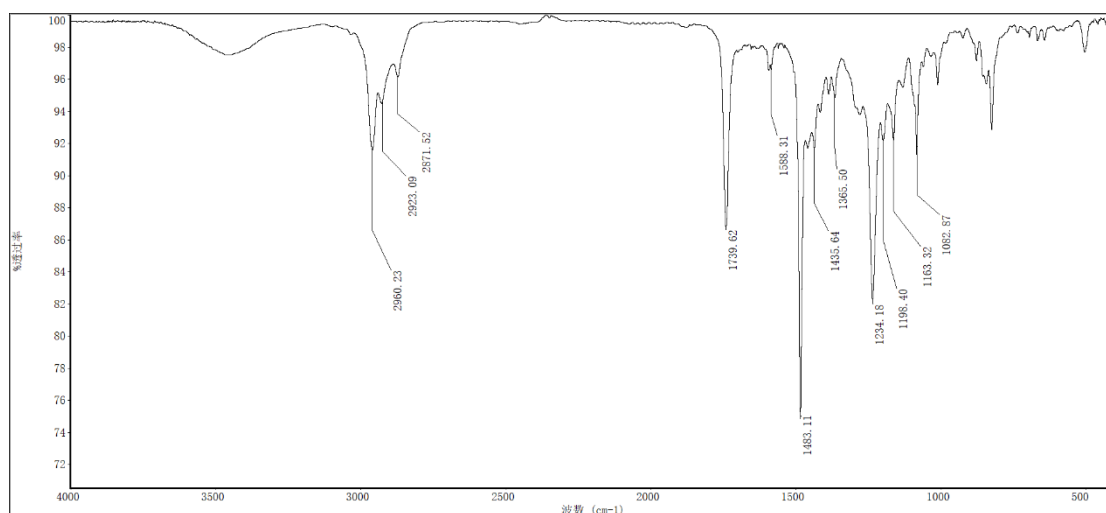


Figure S69. FT-IR spectrum of intermediate **6q**.

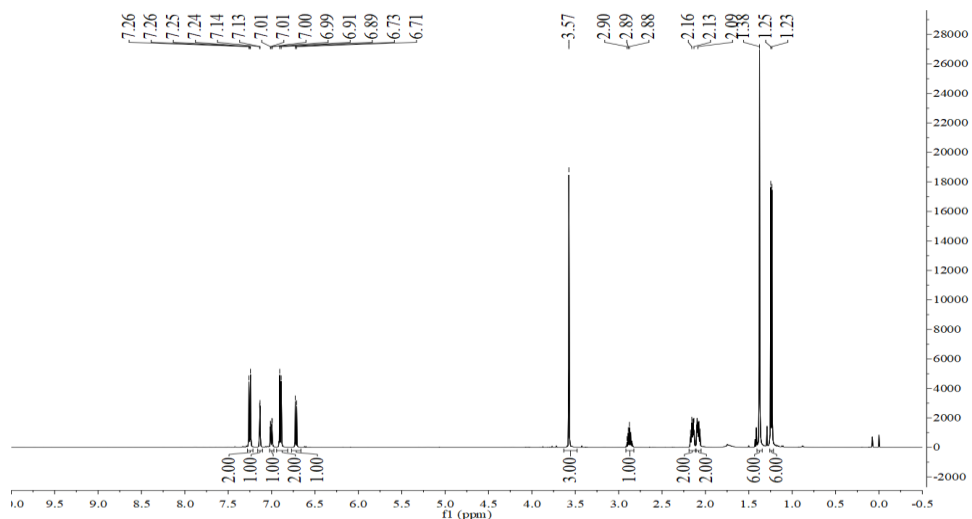


Figure S70. ¹H-NMR spectrum of intermediate **6q**.

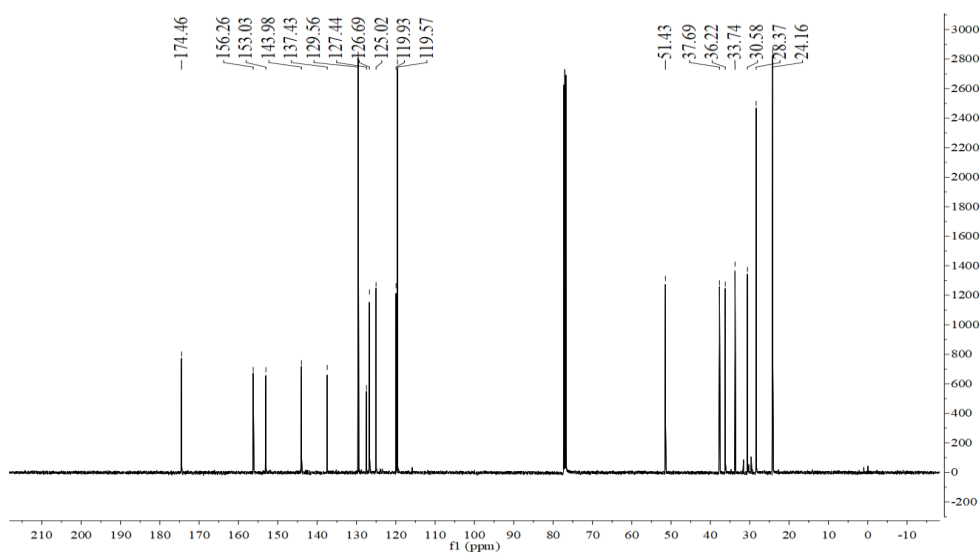


Figure S71. ¹³C-NMR spectrum of intermediate **6q**.

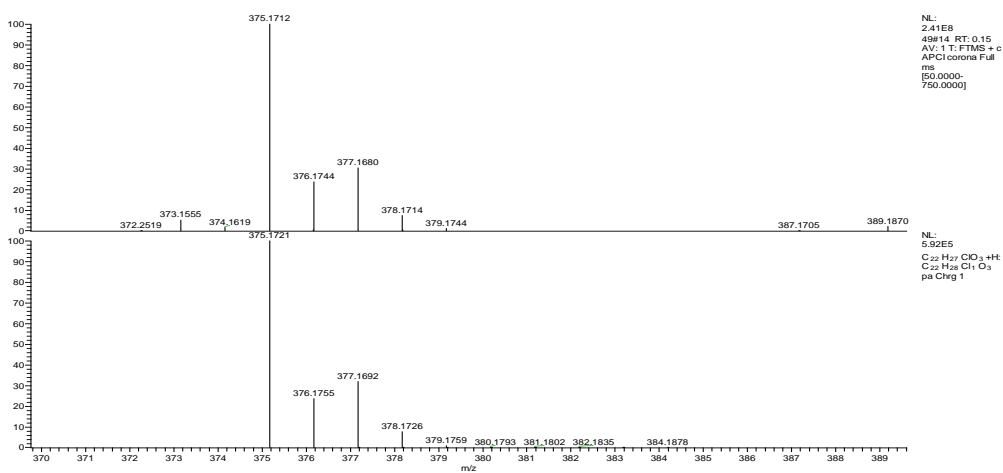
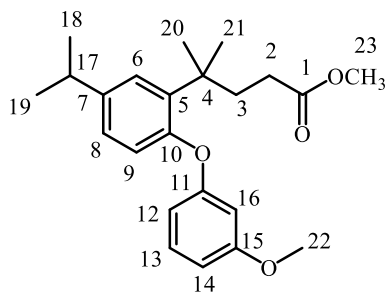


Figure S72. ESI-MS spectrum of intermediate **6q**.



Intermediate **6r**, colorless oily liquid; yield 86.3%; FT-IR (KBr, cm^{-1}): 2958, 2926, 2874 (C-H), 1740 (C=O), 1604, 1486, 1452, 1363, 1282, 1263, 1213, 1141, 1083, 1040 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.19 (t, $J = 8.5$ Hz, 1H, C₁₃-H), 7.12 (d, $J = 2.2$ Hz, 1H, C₆-H), 6.99 (d, $J = 6.1$ Hz, 1H, C₈-H), 6.77 (d, $J = 8.3$ Hz, 1H, C₉-H), 6.60 (dd, $J = 6.6, 4.7$ Hz, 1H, C₁₄-H), 6.57 – 6.47 (m, 2H, C₁₂-H, C₁₆-H), 3.77 (s, 3H, C₂₂-H), 3.57 (s, 3H, C₂₃-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.20 – 2.15 (m, 2H, C₂-H), 2.09 (dd, $J = 9.5, 7.5$ Hz, 2H, C₃-H), 1.39 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 174.58, 160.91, 158.86, 153.17, 143.66, 137.35, 129.99, 126.55, 120.19, 110.68, 108.07, 104.57, 55.32, 51.40, 37.71, 36.24, 33.76, 30.64, 28.42, 24.20; ESI-MS m/z : 371.2209 [$\text{M} + \text{H}^+$].

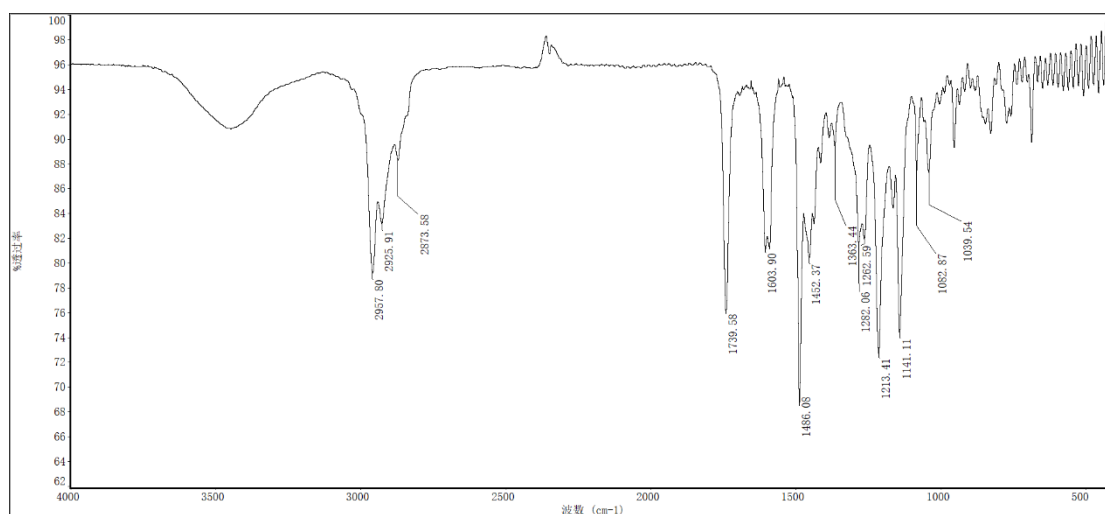


Figure S73. FT-IR spectrum of intermediate **6r**.

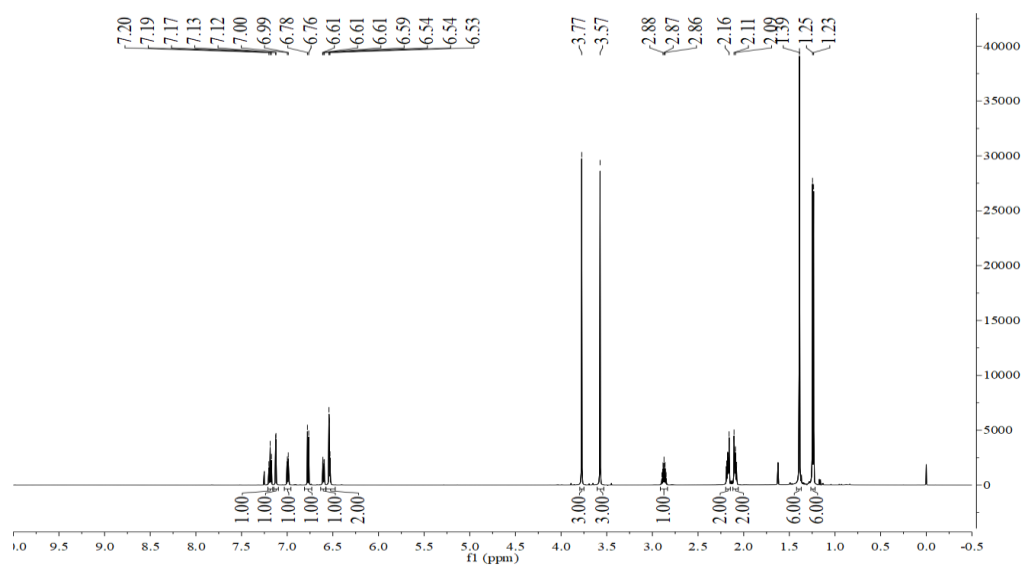


Figure S74. ¹H-NMR spectrum of intermediate **6r**.

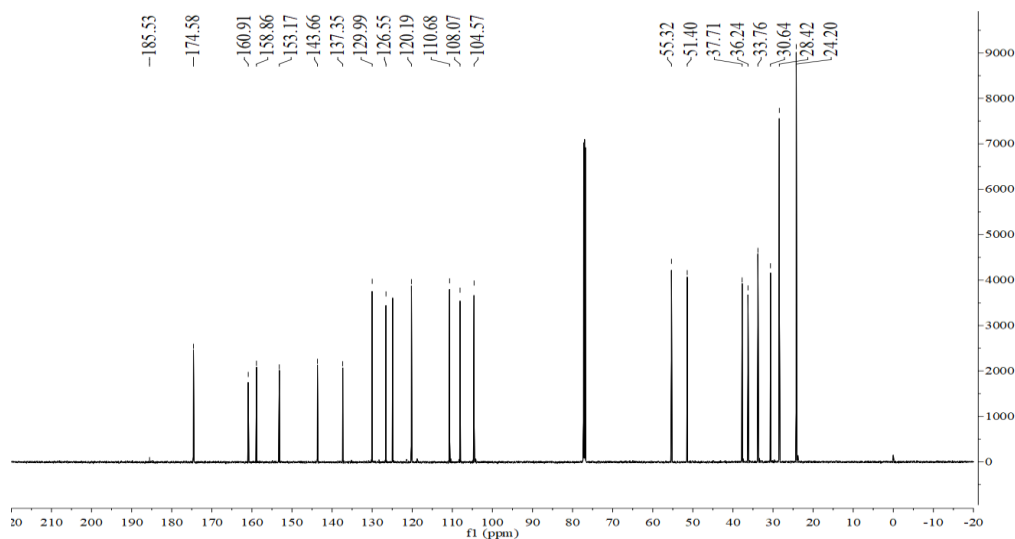


Figure S75. ¹³C-NMR spectrum of intermediate **6r**.

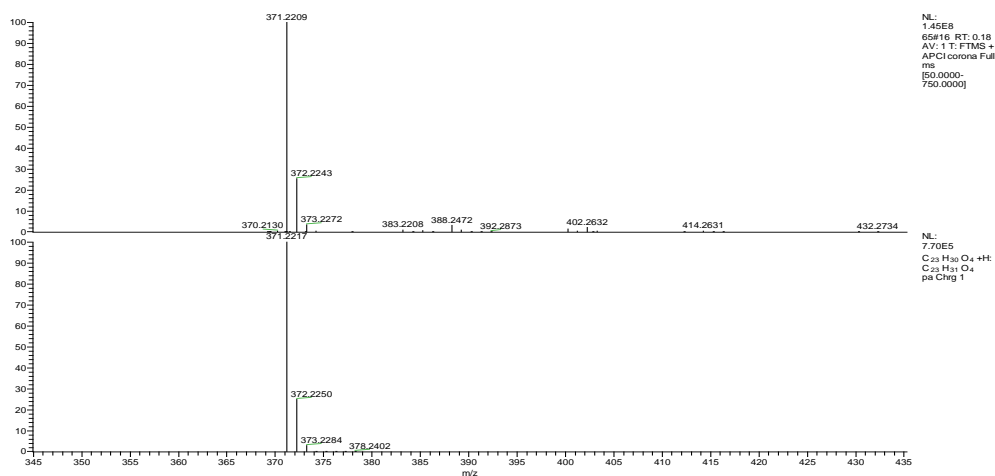
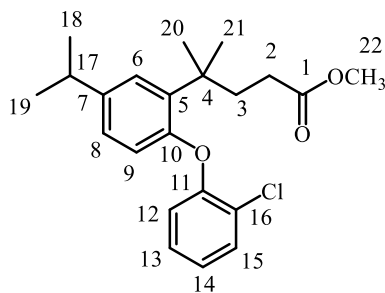


Figure S76. ESI-MS spectrum of intermediate **6r**.



Intermediate **6s**, yellowish oily liquid; yield 87.3%; FT-IR (KBr, cm^{-1}): 2958, 2926, 2872 (C-H), 1740 (C=O), 1582, 1491, 1475, 1446, 1366, 1264, 1239, 1199, 1165, 1082, 1059 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.45 (dd, $J = 8.0, 1.6$ Hz, 1H, C₁₅-H), 7.19 – 7.14 (m, 2H, C₆-H, C₁₃-H), 7.04 – 6.96 (m, 2H, C₈-H, C₁₄-H), 6.92 (d, $J = 8.2$ Hz, 1H, C₁₂-H), 6.60 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.57 (s, 3H, C₂₂-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.27 – 2.21 (m, 2H, C₂-H), 2.12 (dd, $J = 10.4, 6.4$ Hz, 2H, C₃-H), 1.43 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.53, 152.97, 152.60, 143.55, 136.60, 130.64, 127.76, 126.76, 125.54, 124.85, 123.84, 119.70, 118.07, 51.38, 37.80, 36.17, 33.71, 30.69, 28.38, 24.19; ESI-MS m/z : 357.1712 $[\text{M} + \text{H}^+]$.

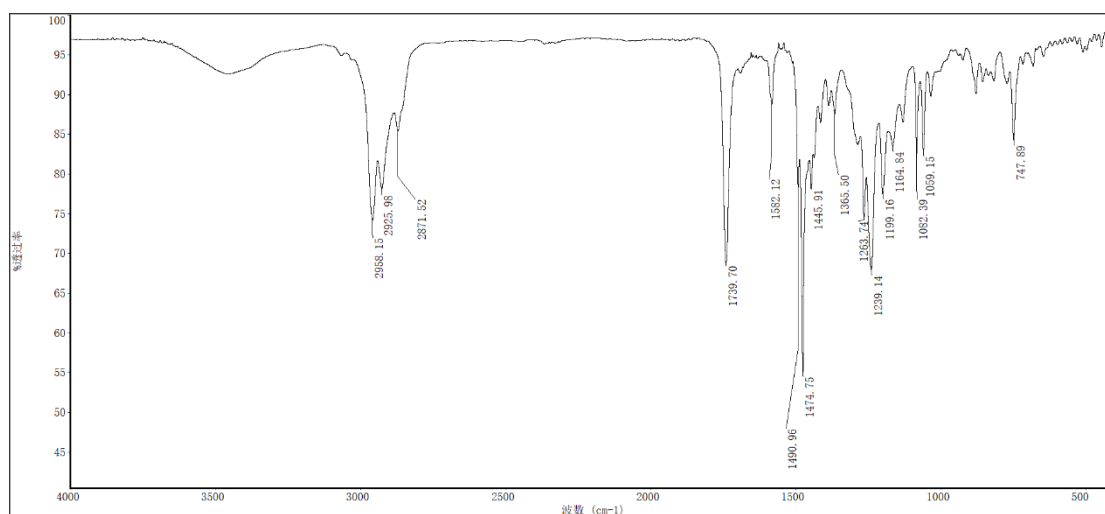


Figure S77. FT-IR spectrum of intermediate **6s**.

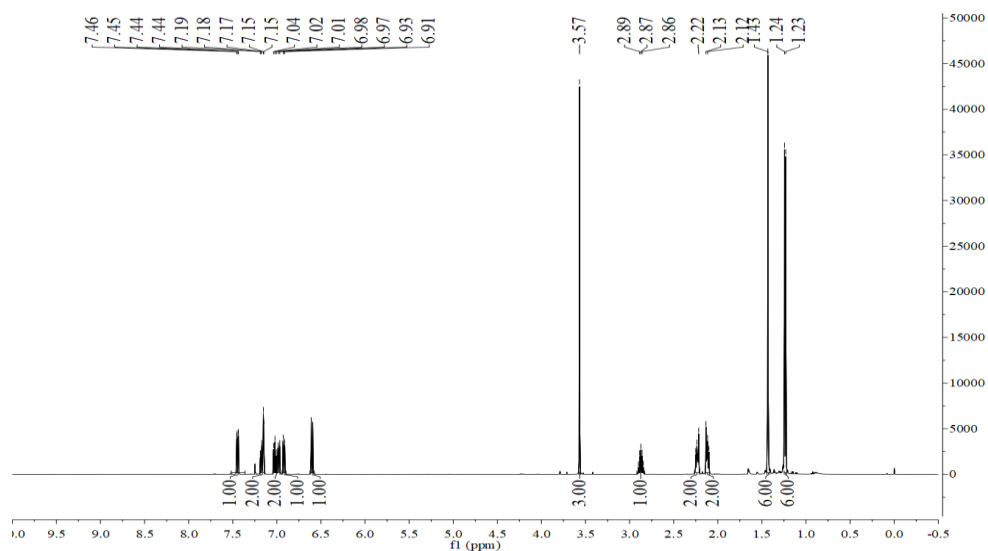


Figure S78. ¹H-NMR spectrum of intermediate **6s**.

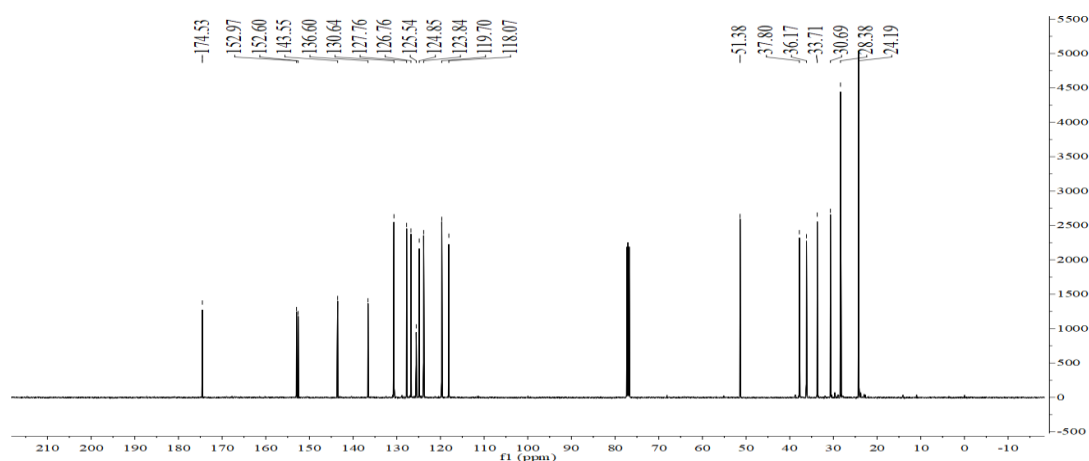


Figure S79. ¹³C-NMR spectrum of intermediate **6s**.

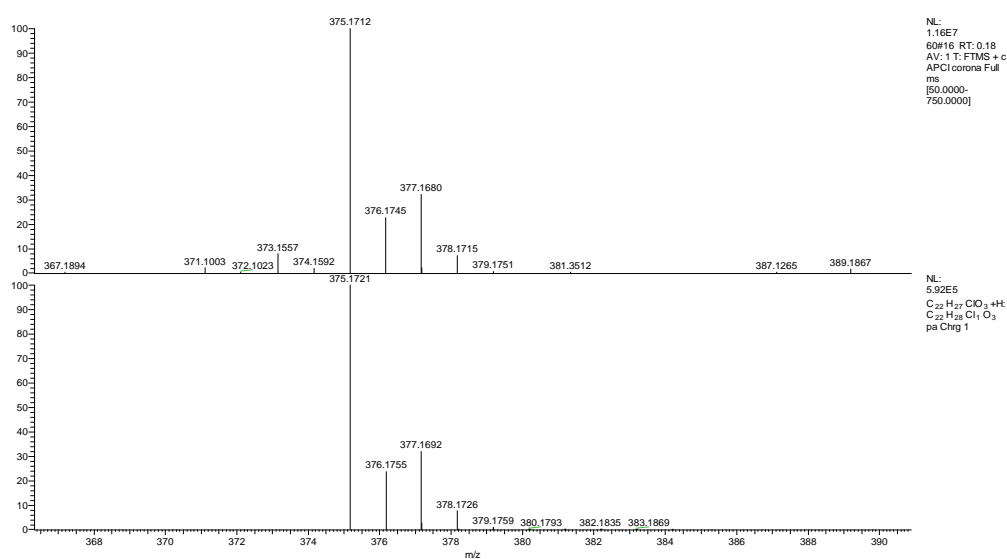
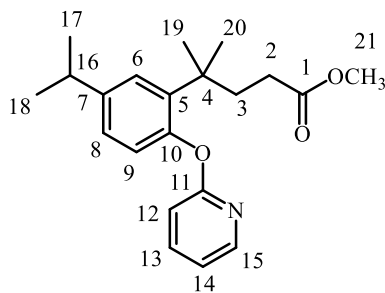


Figure S80. ESI-MS spectrum of intermediate **6s**.



Intermediate **6t**, colorless oily liquid; yield 93.4%; FT-IR (KBr, cm^{-1}): 3447 (Ar-H) 2958, 2925, 2871(C-H), 1736 (C=O), 1593, 1572, 1492, 1466, 1427, 1285, 1264, 1201, 1164, 1082 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 8.18 (dd, $J = 4.7, 1.6$ Hz, 1H, $\text{C}_{15}\text{-H}$), 7.68 – 7.64 (m, 1H, $\text{C}_{13}\text{-H}$), 7.17 (s, 1H, $\text{C}_{13}\text{-H}$), 7.07 (d, $J = 8.3$ Hz, 1H, $\text{C}_8\text{-H}$), 6.97 – 6.94 (m, 1H, $\text{C}_9\text{-H}$), 6.89 (dd, $J = 8.3, 3.4$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{14}\text{-H}$), 3.54 (s, 3H, $\text{C}_{21}\text{-H}$), 2.93 – 2.86 (m, 1H, $\text{C}_{16}\text{-H}$), 2.10 (s, 4H, $\text{C}_2\text{-H}$, $\text{C}_3\text{-H}$), 1.37 (s, 6H, $\text{C}_{19}\text{-H}$, $\text{C}_{20}\text{-H}$), 1.25 (d, $J = 6.9$ Hz, 6H, $\text{C}_{17}\text{-H}$, $\text{C}_{18}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 174.55, 163.76, 150.58, 147.83, 144.64, 139.26, 137.93, 126.61, 124.97, 122.66, 118.08, 111.75, 51.34, 37.63, 36.51, 33.82, 30.43, 28.57, 24.14; ESI-MS m/z : 342.2068 $[\text{M} + \text{H}^+]$.

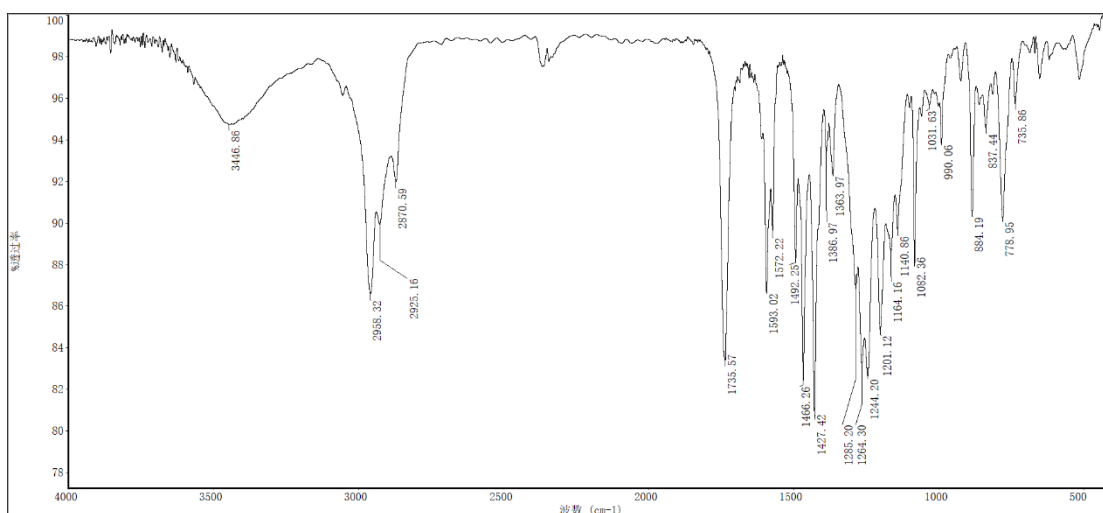


Figure S81. FT-IR spectrum of intermediate **6t**.

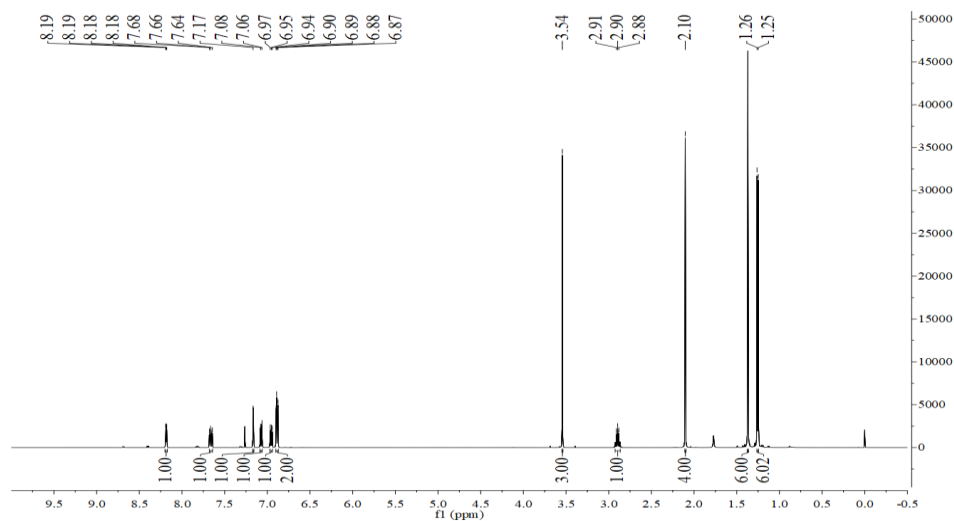


Figure S82. ¹H-NMR spectrum of intermediate **6t**.

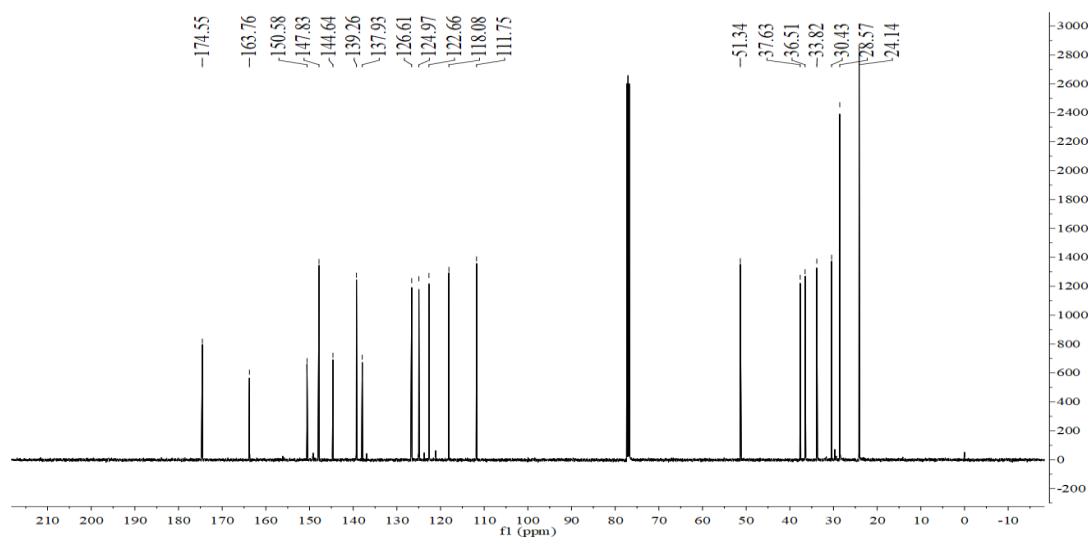


Figure S83. ¹³C-NMR spectrum of intermediate **6t**.

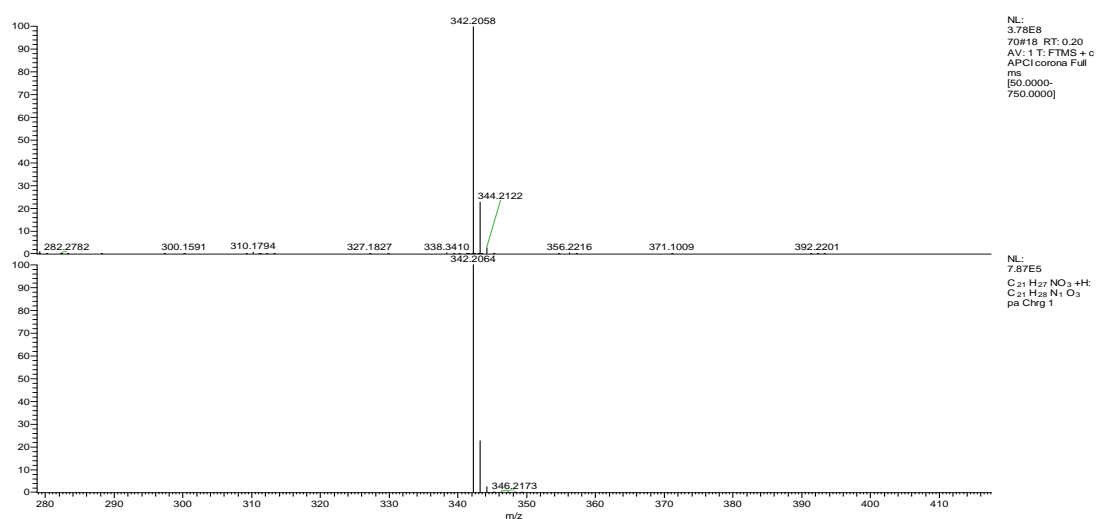
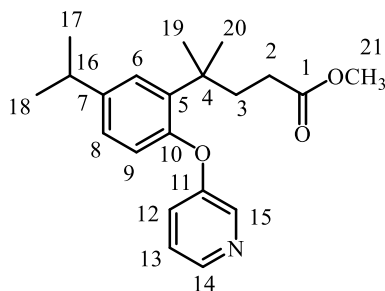


Figure S84. ESI-MS spectrum of intermediate **6t**.



Intermediate **6u**, colorless oily liquid; yield 96.8%; FT-IR (KBr, cm^{-1}): 3447 (Ar-H) 2959, 2929, 2871 (C-H), 1739 (C=O), 1573, 1491, 1475, 1422, 1386, 1242, 1198, 1102, 1082 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 8.38 (d, $J = 2.3$ Hz, 1H, C₁₂-H), 8.32 (dd, $J = 4.3, 1.6$ Hz, 1H, C₆-H), 7.25 (t, $J = 6.9$ Hz, 2H, C₁₄-H, C₁₅-H), 7.16 (d, $J = 2.1$ Hz, 1H, C₁₃-H), 7.02 (dd, $J = 8.3, 2.1$ Hz, 1H, C₈-H), 6.72 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.57 (s, 3H, C₂₁-H), 2.94 – 2.84 (m, 1H, C₁₆-H), 2.19 – 2.14 (m, 2H, C₂-H), 2.12 – 2.07 (m, 2H, C₃-H), 1.39 (s, 6H, C₁₉-H, C₂₀-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₁₇-H, C₁₈-H); ^{13}C NMR (126 MHz, CDCl_3) δ 174.40, 154.16, 152.70, 144.45, 143.78, 141.23, 137.58, 126.88, 125.15 (d, $J = 16.1$ Hz), 124.01, 119.76, 51.48, 37.76, 36.32, 33.78, 30.59, 28.40, 24.1; ESI-MS m/z : 342.2057 [$\text{M} + \text{H}^+$].

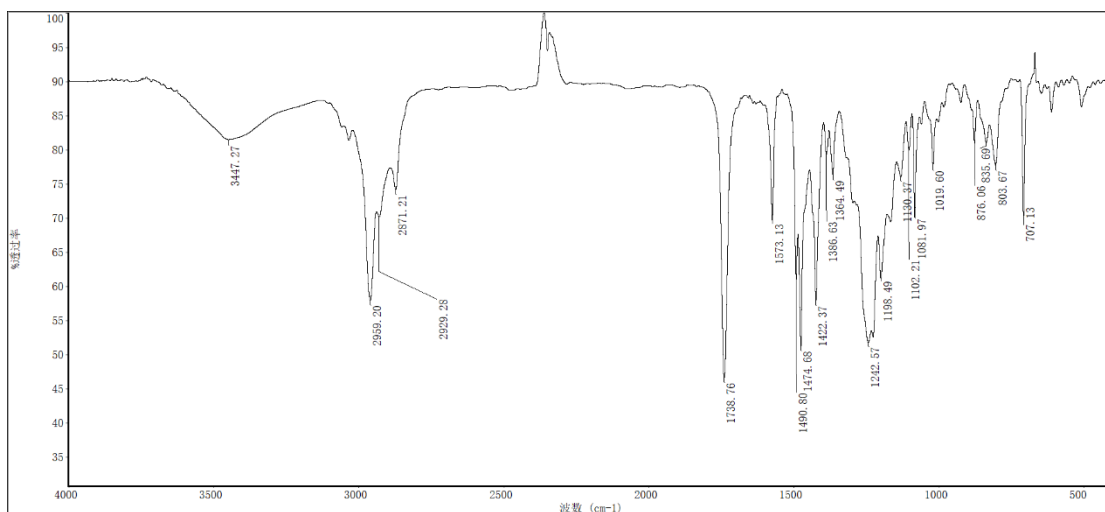


Figure S85. FT-IR spectrum of intermediate **6u**.

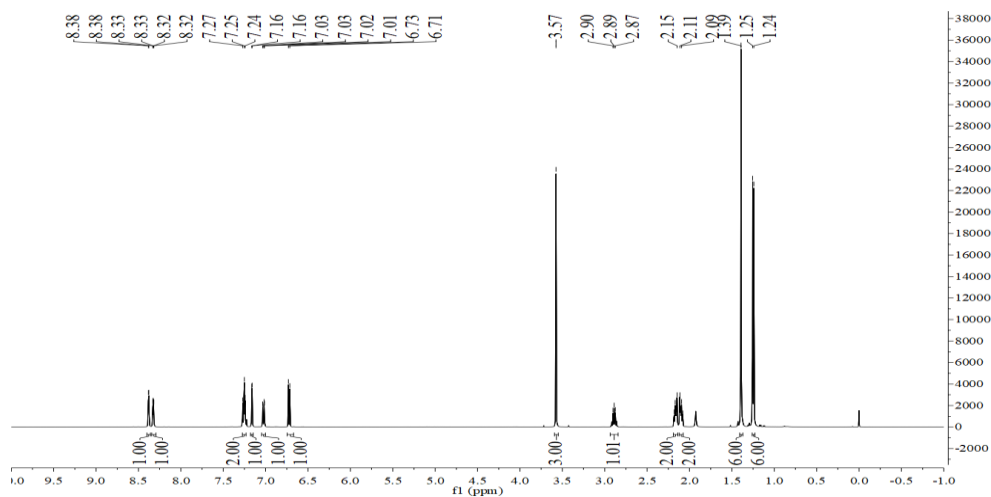


Figure S86. ^1H -NMR spectrum of intermediate **6u**.

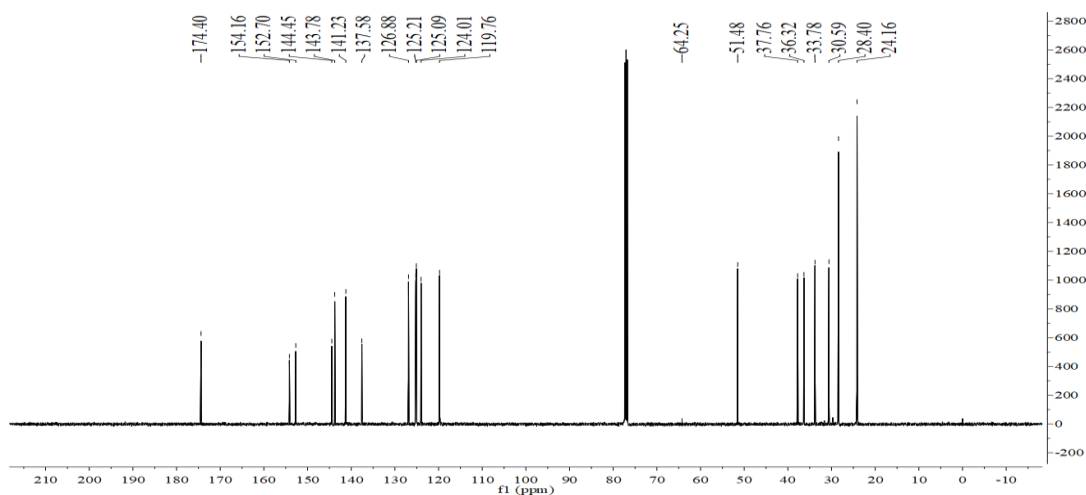


Figure S87. ^{13}C -NMR spectrum of intermediate **6u**.

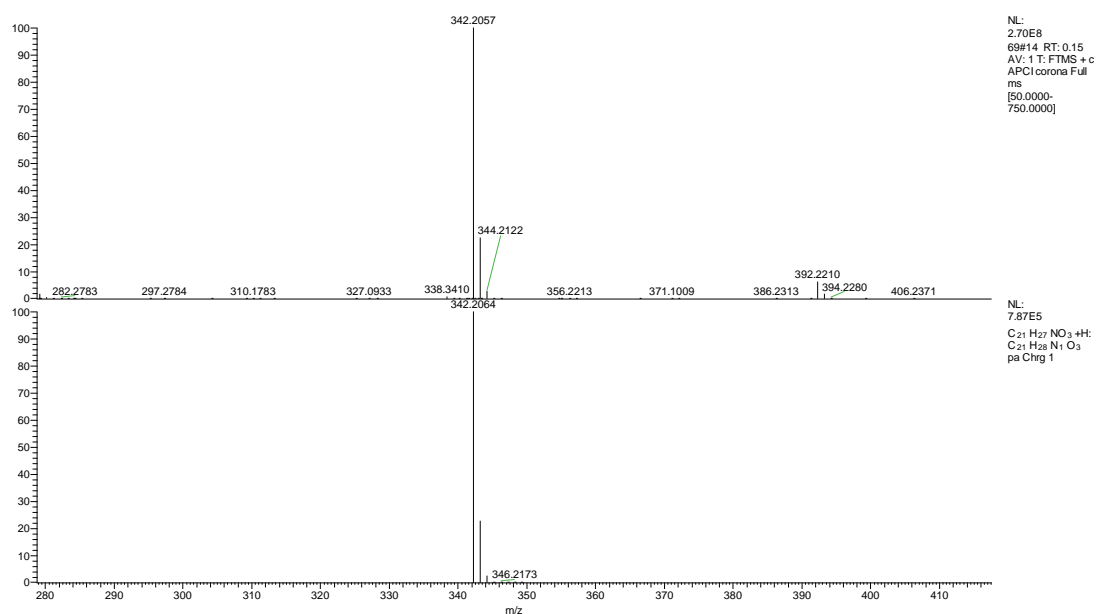
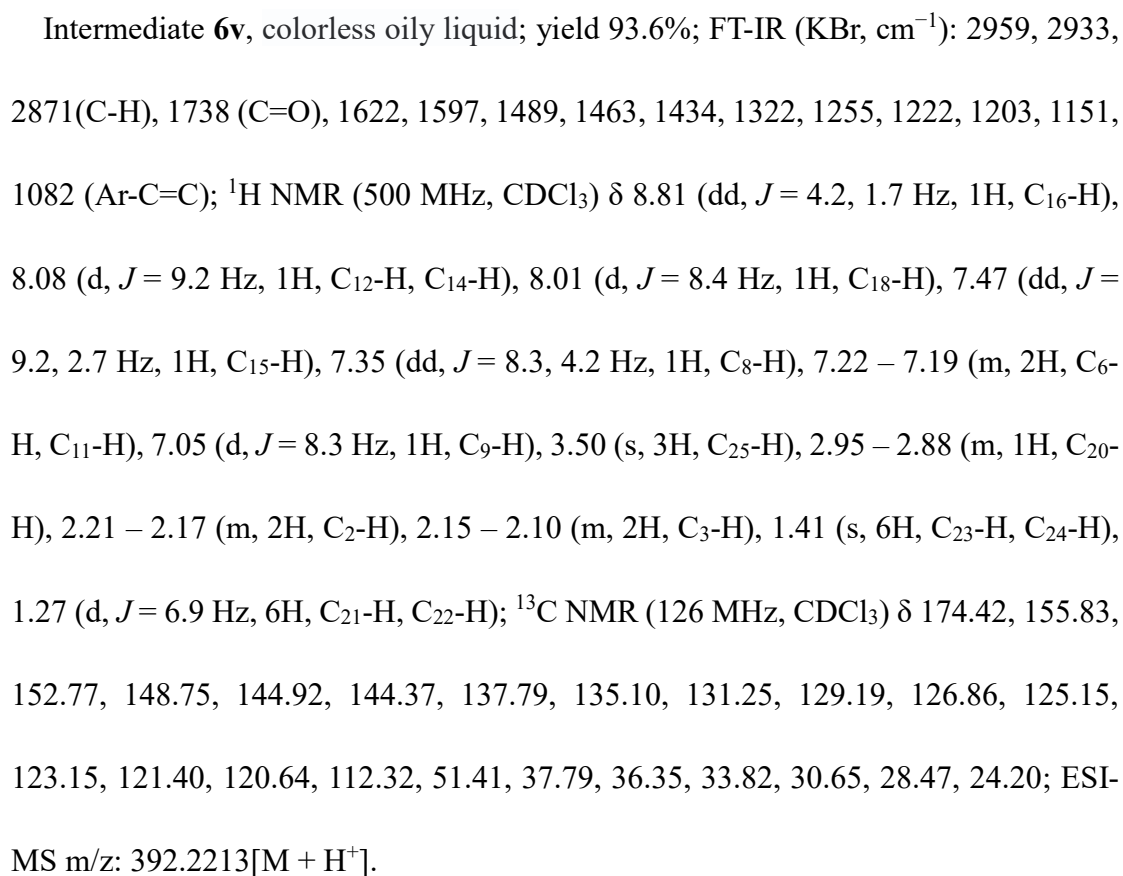


Figure S88. ESI-MS spectrum of intermediate **6u**.



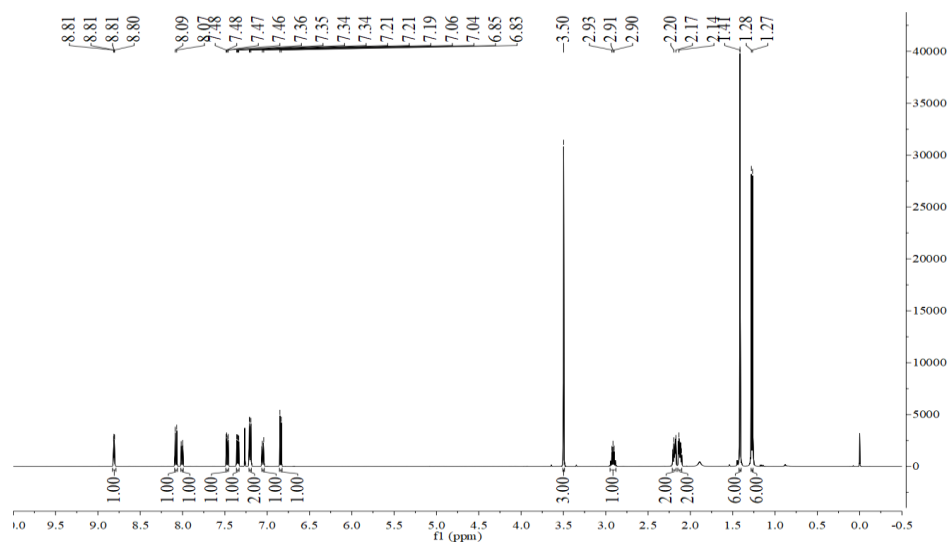


Figure S90. ^1H -NMR spectrum of intermediate **6v**.

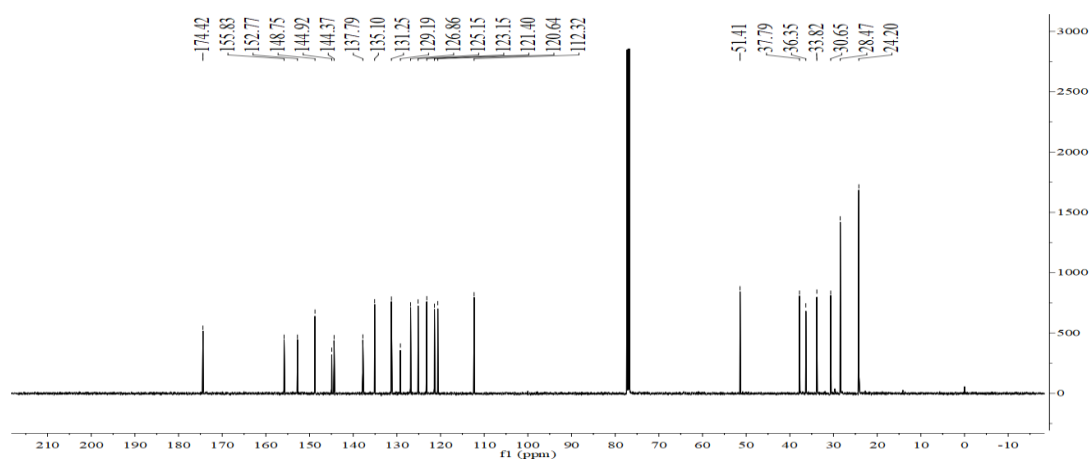


Figure S91. ^{13}C -NMR spectrum of intermediate **6v**.

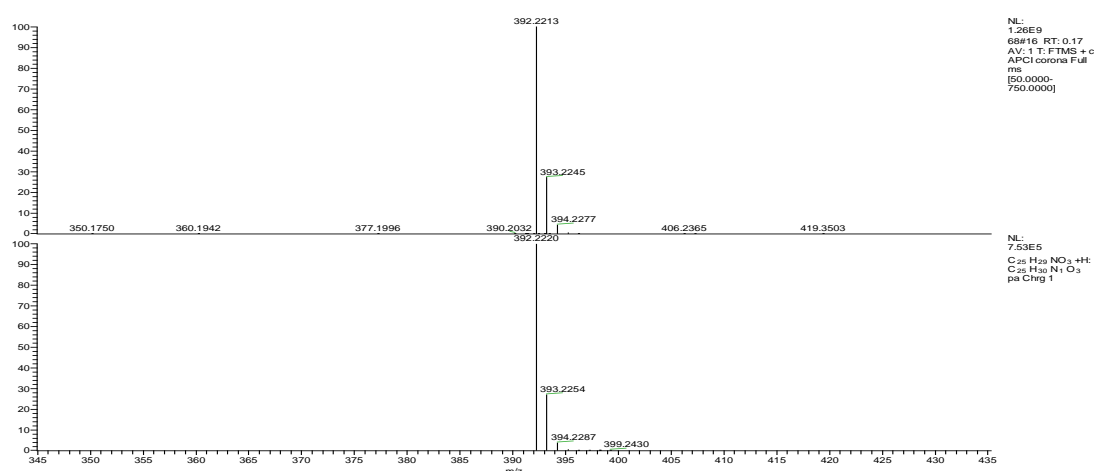
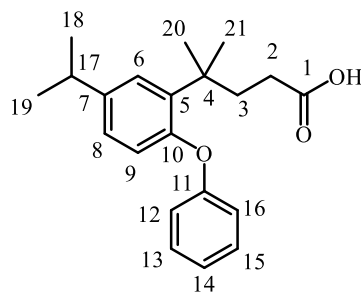


Figure S92. ESI-MS spectrum of intermediate **6v**.



7a, white solid; yield 96.4%; m. p. 110.6 – 111.4 °C; FT-IR (KBr, cm^{-1}): 3039 (Ar-H), 2966, 2926, 2872 (C-H), 1705 (C=O), 1588, 1486, 1456, 1305, 1232 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.38 – 7.25 (m, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.13 (s, 1H, $\text{C}_6\text{-H}$), 7.04 (t, $J = 7.4$ Hz, 1H, $\text{C}_{14}\text{-H}$), 6.97 (dd, $J = 14.5, 9.1$ Hz, 3H, $\text{C}_8\text{-H}$, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.73 (d, $J = 8.3$ Hz, 1H, $\text{C}_9\text{-H}$), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.18 (d, $J = 4.9$ Hz, 2H, $\text{C}_2\text{-H}$), 2.12 (d, $J = 4.9$ Hz, 2H, $\text{C}_3\text{-H}$), 1.40 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 180.36, 157.49, 153.47, 143.50, 137.06, 129.64, 126.52, 124.96, 122.60, 119.79, 118.56, 37.69, 35.91, 33.74, 30.56, 28.41, 24.20; ESI-MS m/z : 325.1808 [$\text{M} + \text{H}^+$].

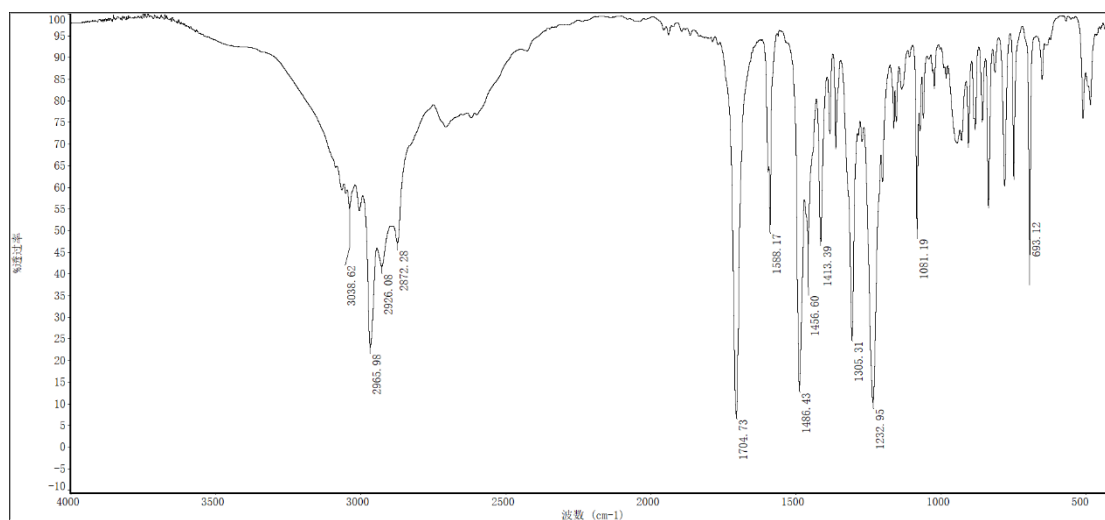
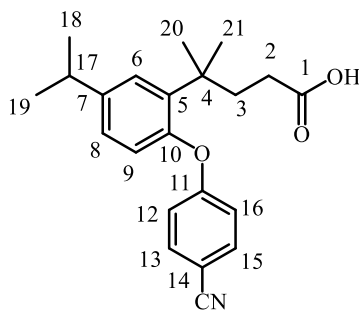


Figure S93. FT-IR spectrum of **7a**.



7b., white solid; yield 98.4%; m. p. 143.6– 144.8 °C; FT-IR (KBr, cm^{-1}): 3042 (Ar-H), 2966 (C-H), 2225 ($\text{C}\equiv\text{N}$), 1707 ($\text{C}=\text{O}$), 1595, 1489, 1457, 1307, 1230 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.58 (d, $J = 11.5$ Hz, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.18 (s, 1H, $\text{C}_6\text{-H}$), 7.07 (d, $J = 10.4$ Hz, 1H, $\text{C}_8\text{-H}$), 6.99 (d, $J = 9.5$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.79 (d, $J = 8.2$ Hz, 1H, $\text{C}_9\text{-H}$), 2.97 – 2.79 (m, 1H, $\text{C}_{17}\text{-H}$), 2.09 (s, 4H, $\text{C}_2\text{-H}$, $\text{C}_3\text{-H}$), 1.35 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.26 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (126 MHz, CDCl_3) δ 179.96, 161.59, 151.20, 145.53, 138.14, 134.13, 127.09, 125.45, 121.41, 118.92, 117.92, 105.45, 37.68, 36.06, 33.85, 30.38, 28.47, 24.13; ESI-MS m/z : 350.1760 [$\text{M} + \text{H}^+$].

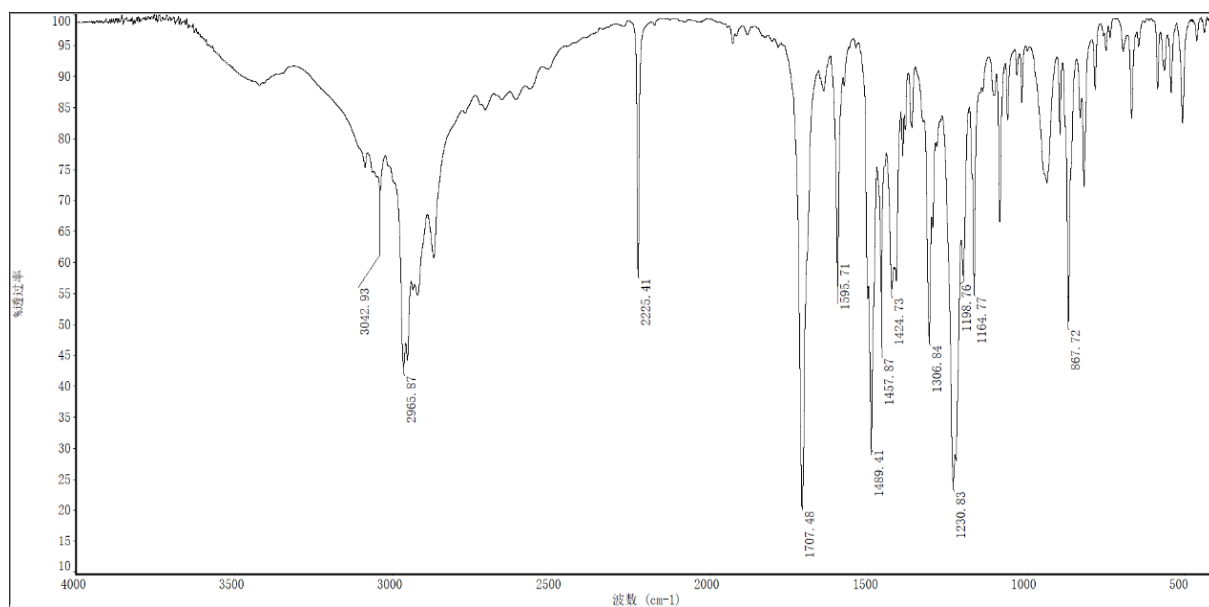
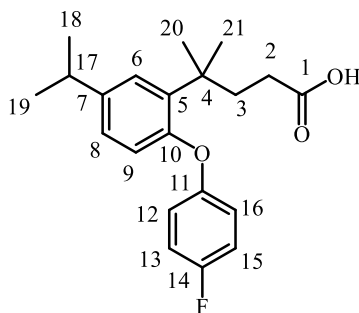


Figure S97. FT-IR spectrum of **7b**.





7c, white solid; yield 97.2%; m. p. 126.5– 127.8 °C; FT-IR (KBr, cm^{-1}): 3080 (Ar-H), 2960, 2872 (C-H), 1709 (C=O), 1504, 1488, 1457, 1293, 1209 (Ar-C=C); ^1H NMR (500 MHz, CDCl_3) δ 7.12 (d, $J = 2.1$ Hz, 1H, C₆-H), 6.98 (d, $J = 8.2$ Hz, 3H, C₈-H, C₁₃-H, C₁₅-H), 6.92 (d, $J = 6.9$ Hz, 2H, C₁₂-H, C₁₆-H), 6.67 (d, $J = 8.3$ Hz, 1H, C₉-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.19 (d, $J = 9.1$ Hz, 2H, C₂-H), 2.12 (d, $J = 9.2$ Hz, 2H, C₃-H), 1.40 (s, 6H, C₂₀-H, C₂₁-H), 1.23 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (126 MHz, CDCl_3) δ 180.27, 159.41, 157.50, 153.90, 153.22, 143.49, 136.76, 126.60, 125.02, 119.98, 119.09, 116.27, 116.08, 37.71, 35.88, 33.72, 30.55, 28.36, 24.19; ESI-MS m/z : 343.1714 $[\text{M} + \text{H}^+]$.

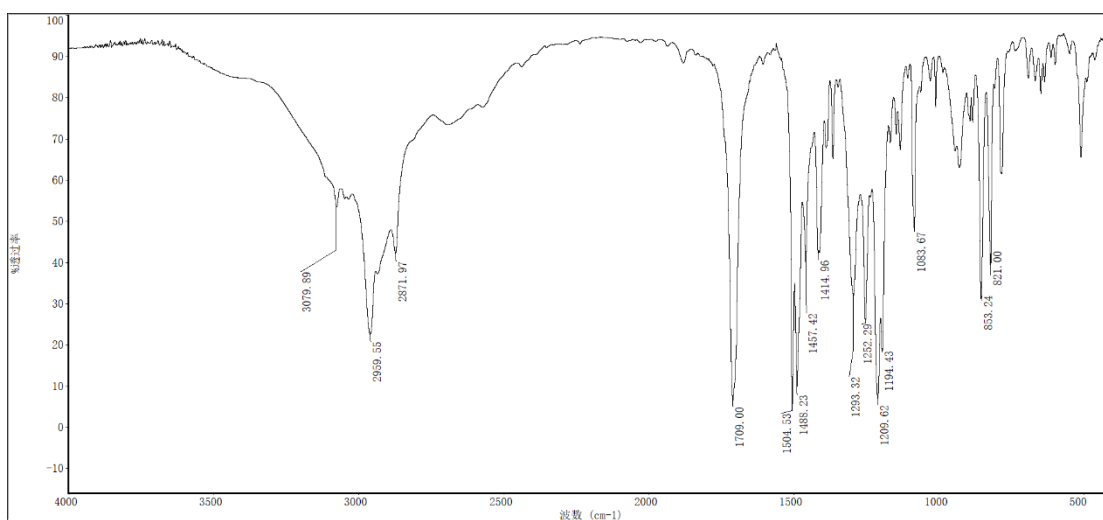


Figure S101. FT-IR spectrum of **7c**.

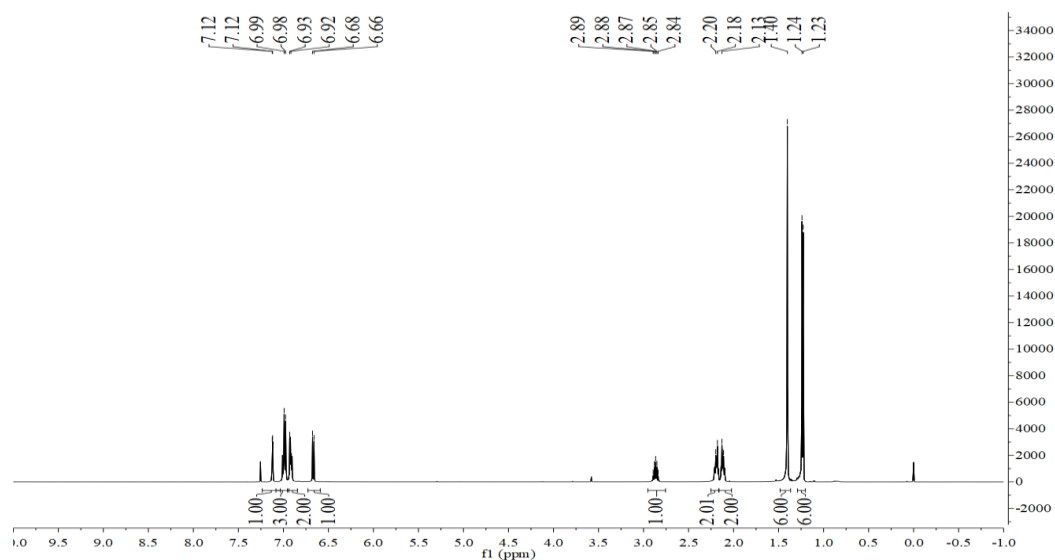


Figure S102. ¹H-NMR spectrum of **7c**.

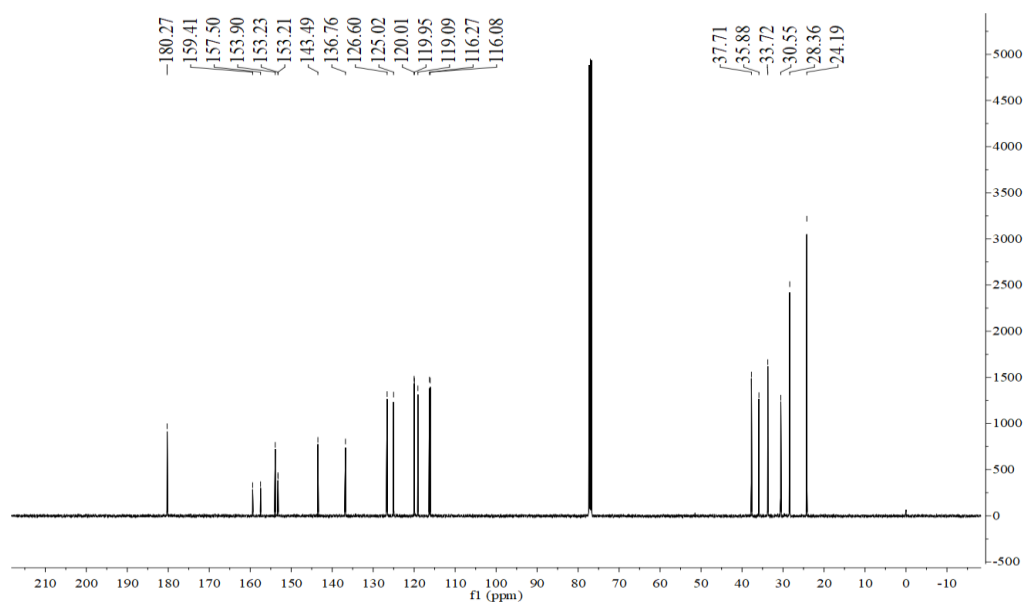


Figure S103. ¹³C-NMR spectrum of **7c**.

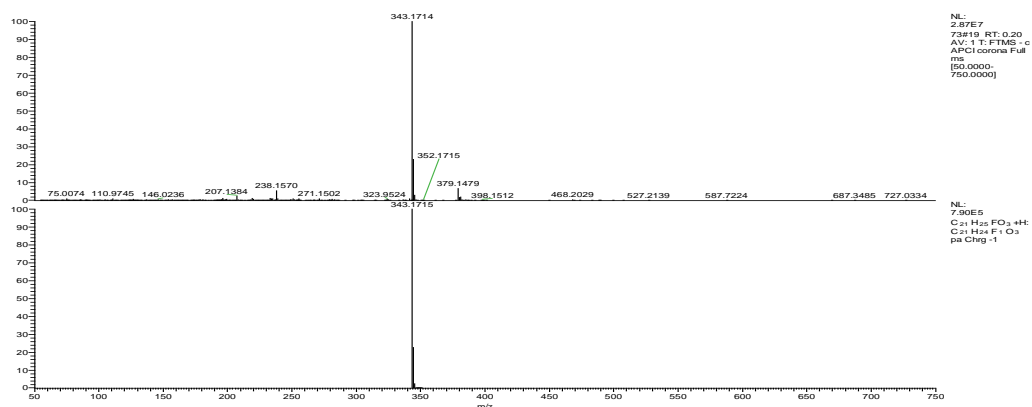
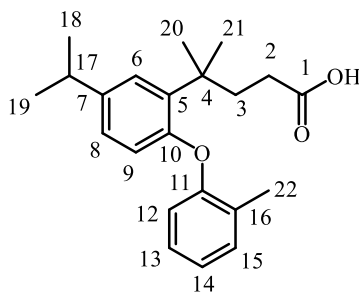


Figure S104. ESI-MS spectrum of **7c**.



7d, white solid; yield 98.1%; m. p. 112.6– 113.9 °C; FT-IR (KBr, cm^{-1}): 3032 (Ar-H), 2954, 2923, 2869 (C-H), 1708 (C=O), 1485, 1460, 1413, 1304, 1237, 1208 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.23 (d, $J = 7.0$ Hz, 1H, C₆-H), 7.13 – 7.10 (m, 2H, C₁₃-H, C₁₅-H), 7.00 (t, $J = 7.8$ Hz, 1H, C₁₄-H), 6.94 (d, $J = 10.4$ Hz, 1H, C₈-H), 6.79 (d, $J = 8.0$ Hz, 1H, C₉-H), 6.54 (d, $J = 8.3$ Hz, 1H, C₁₂-H), 2.86 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.28 (s, 3H, C₂₂-H), 2.25 (d, $J = 8.9$ Hz, 2H, C₂-H), 2.14 (dd, $J = 9.3, 7.3$ Hz, 2H, C₃-H), 1.44 (s, 6H, C₂₀-H, C₂₁-H), 1.23 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.33, 154.88, 154.04, 142.63, 131.21, 127.09, 126.51, 124.86, 123.19, 118.66, 117.62, 37.77, 35.89, 33.67, 30.64, 28.36, 24.22, 16.35; ESI-MS m/z : 339.1964 [$\text{M} + \text{H}^+$].

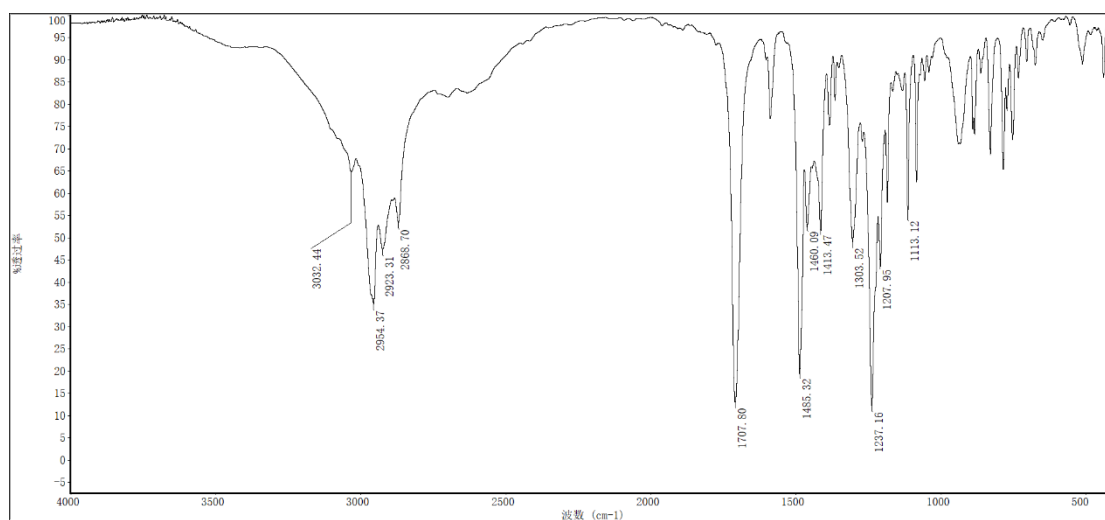
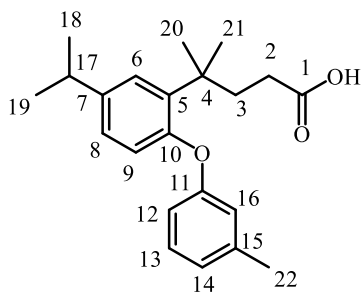


Figure S105. FT-IR spectrum of **7d**.



7e, white solid; yield 95.7%; m. p. 110.5– 112.0 °C; FT-IR (KBr, cm^{-1}): 2961, 2871, 2869 (C-H), 1709 (C=O), 1591, 1485, 1410, 1307, 1259, 1229 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.18 (t, $J = 7.8$ Hz, 1H, C₁₃-H), 7.13 (d, $J = 2.2$ Hz, 1H, C₆-H), 6.99 (dd, $J = 8.3, 2.1$ Hz, 1H, C₈-H), 6.86 (d, $J = 7.5$ Hz, 1H, C₁₆-H), 6.80 (s, 1H, C₁₄-H), 6.74 (t, $J = 10.3$ Hz, 2H, C₉-H C₁₂-H), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.31 (s, 3H, C₂₂-H), 2.22 – 2.18 (m, 2H, C₂-H), 2.15 – 2.10 (m, 2H, C₃-H), 1.41 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.51, 157.40, 153.60, 143.32, 139.83, 136.94, 129.34, 126.48, 124.93, 123.48, 119.69, 119.32, 115.58, 37.69, 35.89, 33.73, 30.5, 28.40, 24.21, 21.38; ESI-MS m/z : 339.1963 $[\text{M} + \text{H}^+]$.

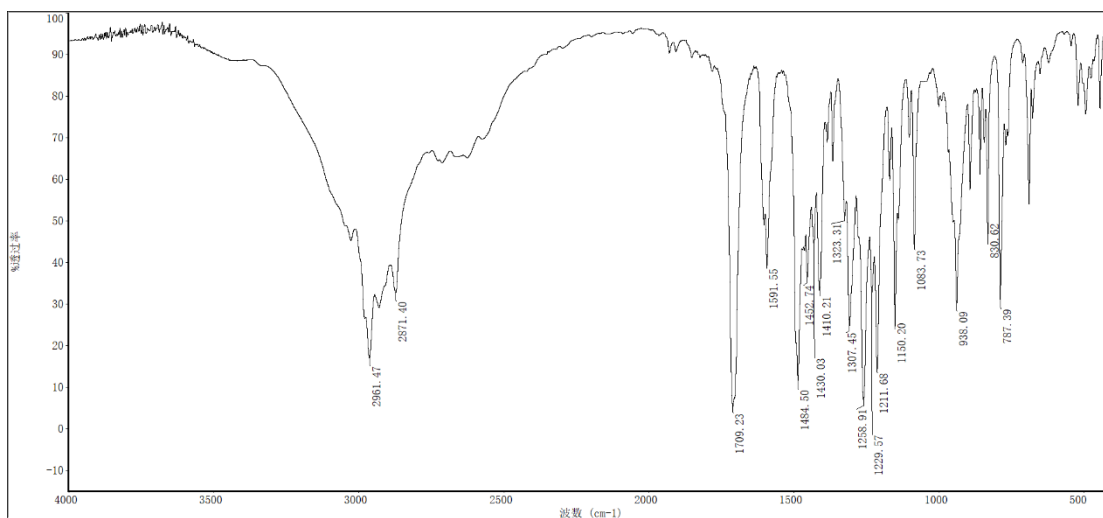


Figure S109. FT-IR spectrum of **7e**.

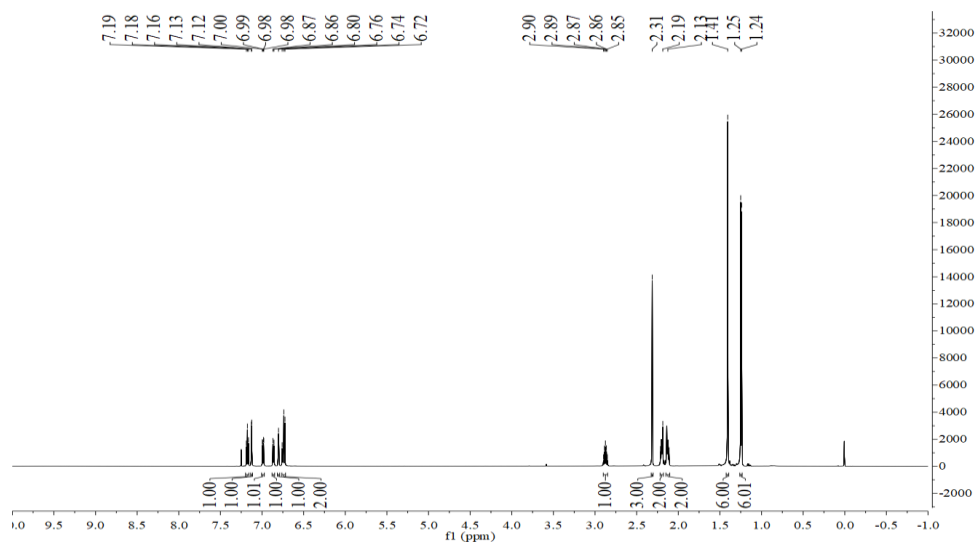


Figure S110. ^1H -NMR spectrum of **7e**.

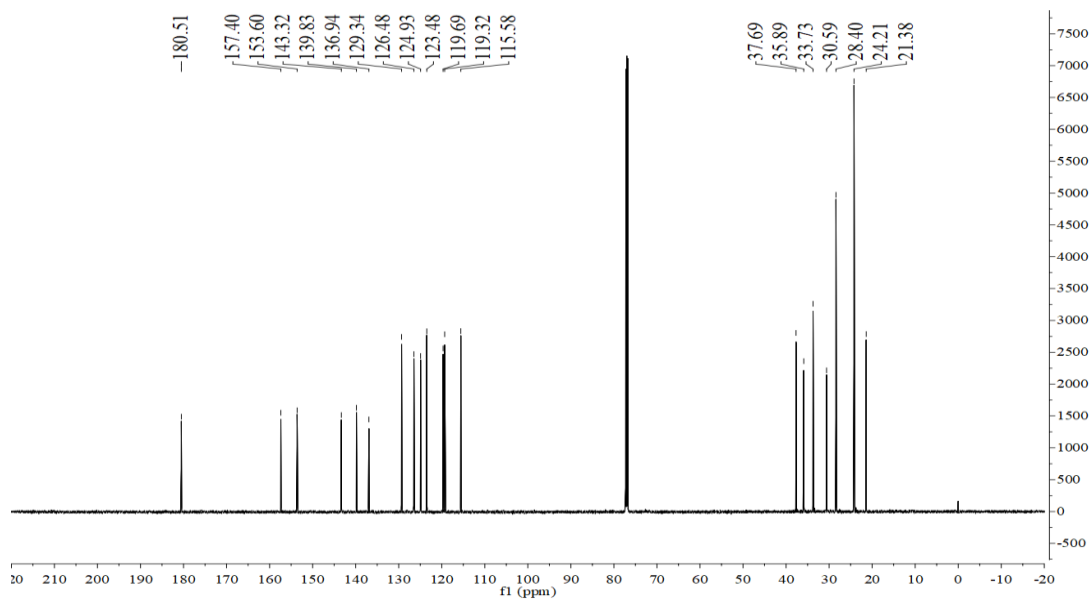


Figure S111. ^{13}C -NMR spectrum of **7e**.

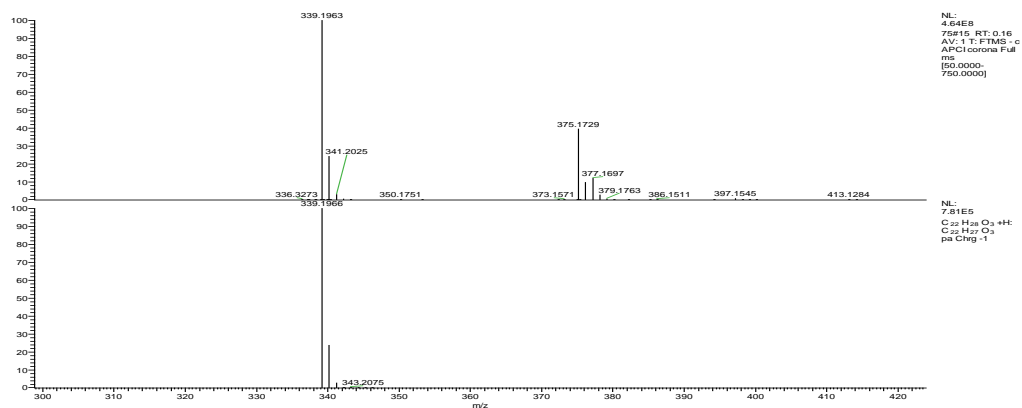
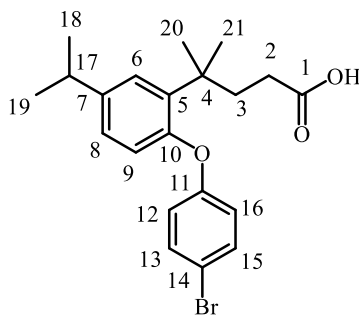


Figure S112. ESI-MS spectrum of **7e**.



7f, white solid; yield 98.2%; m. p. 133.3– 134.6 °C; FT-IR (KBr, cm^{-1}): 2961, 2871, 2869 (C-H), 1708 (C=O), 1481, 1411, 1241, 1215 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.39 (d, $J = 8.9$ Hz, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.13 (s, 1H, $\text{C}_6\text{-H}$), 7.01 (d, $J = 10.4$ Hz, 1H, $\text{C}_8\text{-H}$), 6.84 (d, $J = 2.1$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.73 – 6.71 (m, 1H, $\text{C}_9\text{-H}$), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.15 (d, $J = 9.3$ Hz, 2H, $\text{C}_2\text{-H}$), 2.13 – 2.09 (m, 2H, $\text{C}_3\text{-H}$), 1.38 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (151 MHz, CDCl_3) δ 180.14, 156.82, 152.91, 144.14, 138.56, 137.33, 132.58, 126.71, 125.15, 120.48, 120.04, 114.94, 37.68, 35.93, 33.76, 30.48, 28.41, 24.17; ESI-MS m/z : 403.0910 $[\text{M} + \text{H}^+]$.

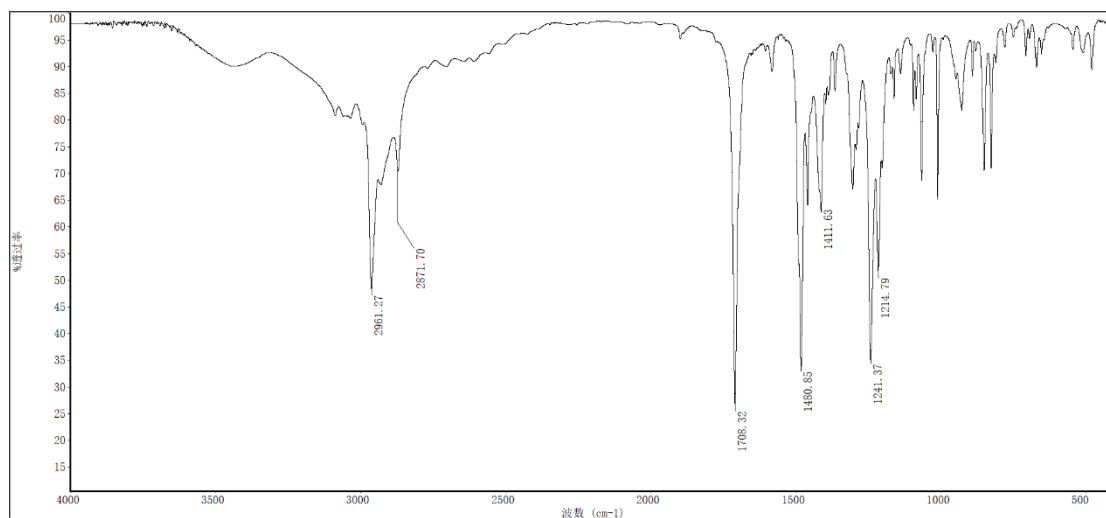
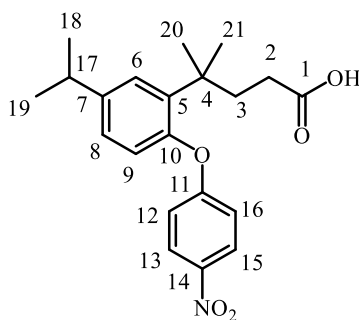


Figure S113. FT-IR spectrum of **7f**.



7g, white solid; yield 94.8%; m. p. 133.6– 134.9 °C; FT-IR (KBr, cm^{-1}): 2961, 2923 (C-H), 1702 (C=O), 1588, 1514, 1487, 1347, 1253 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 8.19 (d, $J = 9.2$ Hz, 2H, C₁₃-H, C₁₅-H), 7.20 (d, $J = 2.0$ Hz, 1H, C₆-H), 7.10 (d, $J = 8.2$ Hz, 1H, C₈-H), 7.01 (t, $J = 6.1$ Hz, 2H, C₁₂-H, C₁₆-H), 6.82 (d, $J = 8.2$ Hz, 1H, C₉-H), 2.92 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.09 (s, 4H, C₂-H, C₃-H), 1.36 (s, 6H, C₂₀-H, C₂₁-H), 1.27 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 179.96, 163.31, 151.13, 145.86, 142.47, 138.21, 127.20, 125.99, 125.57, 121.62, 117.11, 37.70, 36.03, 33.88, 30.30, 28.49, 24.13; ESI-MS m/z : 370.1659 [$\text{M} + \text{H}^+$].

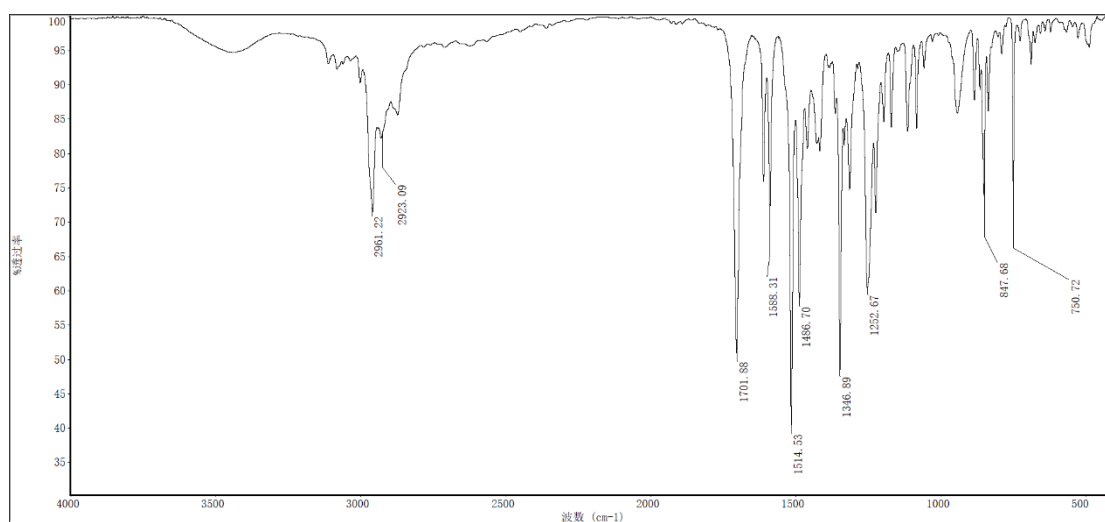


Figure S117. FT-IR spectrum of **7g**.

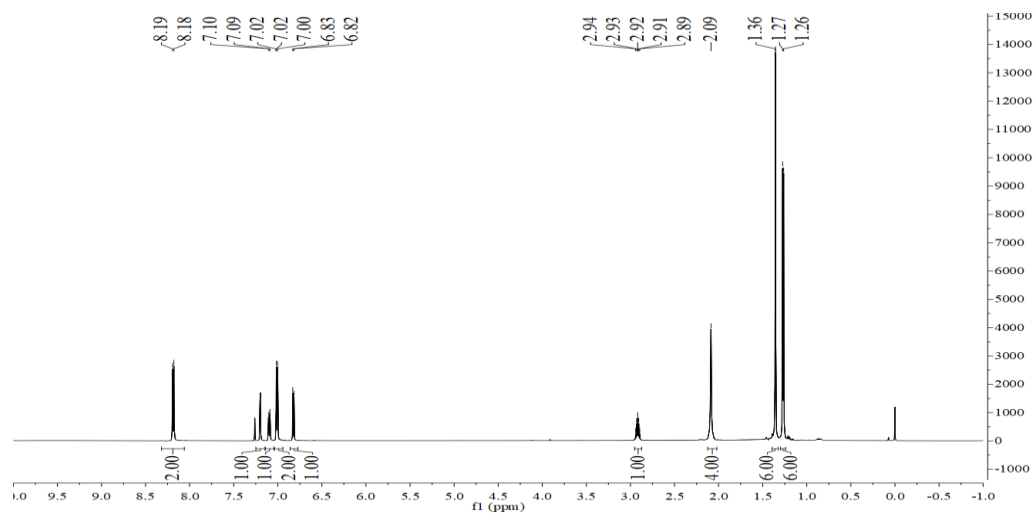


Figure S118. ^1H -NMR spectrum of **7g**.

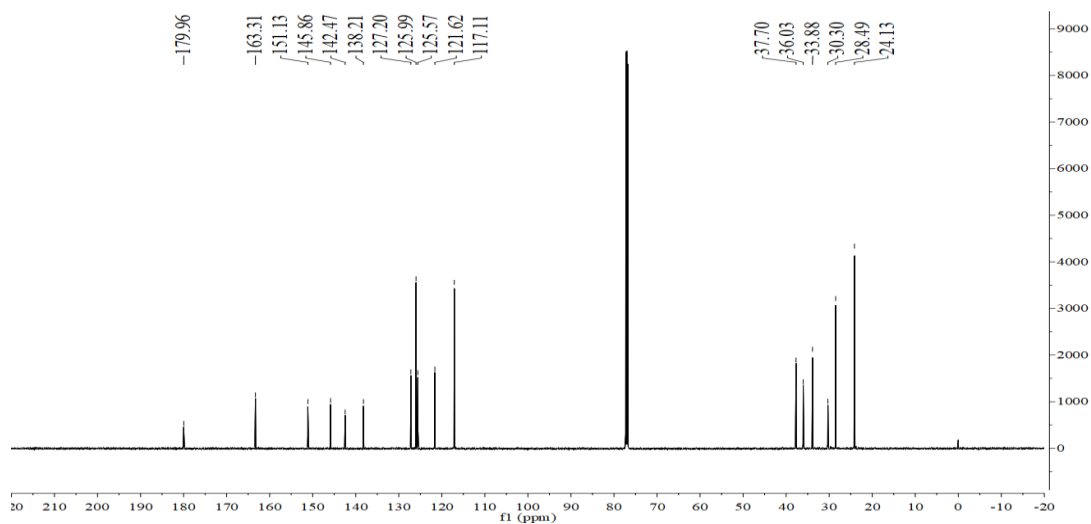


Figure S119. ^{13}C -NMR spectrum of **7g**.

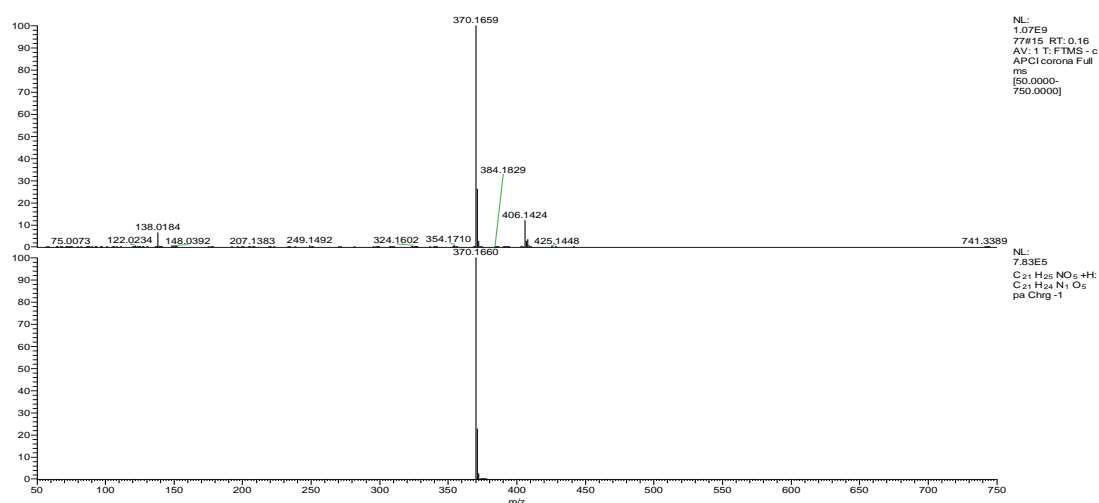
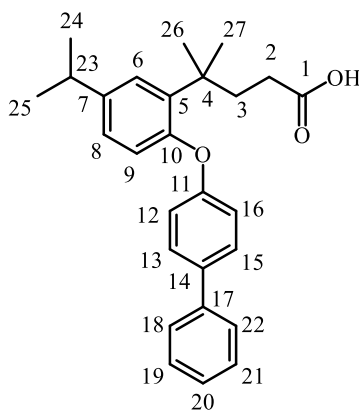


Figure S120. ESI-MS spectrum of **7g**.



7h, white solid; yield 96.5%; m. p. 148.8– 150.2 °C; FT-IR (KBr, cm^{-1}): 3030 (Ar-H), 2960, 2867 (C-H), 1705 (C=O), 1486, 1411, 1299, 1244, 1167 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.53 (dd, $J = 17.8, 8.1$ Hz, 4H, C₁₂-H, C₁₃-H, C₁₅-H, C₁₆-H), 7.40 (t, $J = 7.6$ Hz, 2H, C₁₉-H, C₂₁-H), 7.29 (s, 1H, C₈-H), 7.14 (s, 1H, C₂₀-H), 7.02 (d, $J = 8.5$ Hz, 3H, C₆-H, C₁₈-H, C₂₂-H), 6.80 (d, $J = 8.3$ Hz, 1H, C₉-H), 2.88 (dt, $J = 13.8, 6.9$ Hz, 1H, C₂₃-H), 2.23 – 2.16 (m, 2H, C₂-H), 2.14 – 2.08 (m, 2H, C₃-H), 1.41 (s, 6H, C₂₆-H, C₂₇-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₂₄-H, C₂₅-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.47, 157.15, 153.37, 143.76, 140.67, 137.25, 135.66, 128.75, 128.38, 126.90, 126.63, 125.08, 120.10, 118.69, 37.75, 35.95, 33.81, 30.58, 28.49, 24.25; ESI-MS m/z : 401.2119 $[\text{M} + \text{H}^+]$.

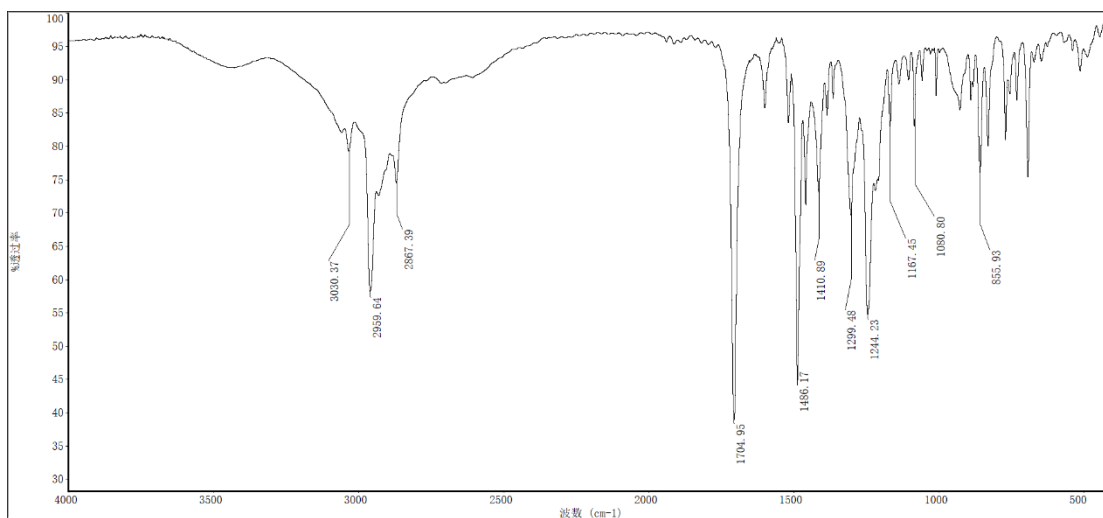
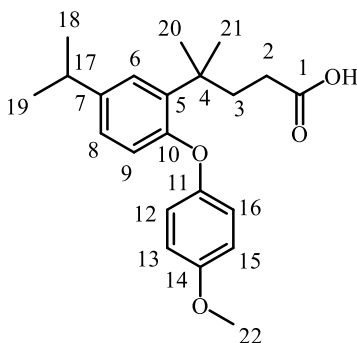


Figure S121. FT-IR spectrum of **7h**.



7i, white solid; yield 90.4%; m. p. 121.5– 123.1 °C; FT-IR (KBr, cm^{-1}): 2959, 2872 (C-H), 1711 (C=O), 1506, 1489, 1455, 1421, 1303, 1249, 1224, 1220 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.10 (d, $J = 2.1$ Hz, 1H, C₆-H), 6.95 (dd, $J = 8.3, 2.1$ Hz, 1H, C₈-H), 6.91 (d, $J = 9.0$ Hz, 2H, C₁₃-H, C₁₅-H), 6.85 (d, $J = 9.1$ Hz, 2H, C₁₂-H, C₁₆-H), 6.64 (d, $J = 8.3$ Hz, 1H, C₉-H), 3.78 (s, 3H, C₂₂-H), 2.85 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.25 – 2.21 (m, 2H, C₂-H), 2.15 – 2.10 (m, 2H, C₃-H), 1.42 (s, 6H, C₂₀-H, C₂₁-H), 1.22 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.50, 155.38, 154.70, 150.64, 142.72, 136.23, 126.41, 124.83, 120.27, 118.28, 114.81, 55.64, 37.71, 33.67, 30.63, 28.33, 24.21; ESI-MS m/z : 355.1913 [$\text{M} + \text{H}^+$].

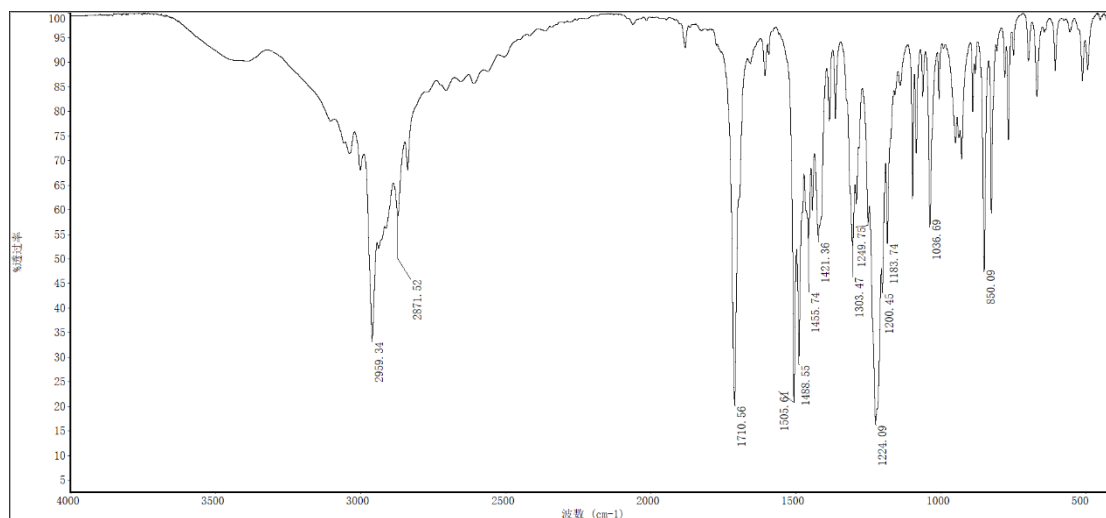


Figure S125. FT-IR spectrum of **7i**.

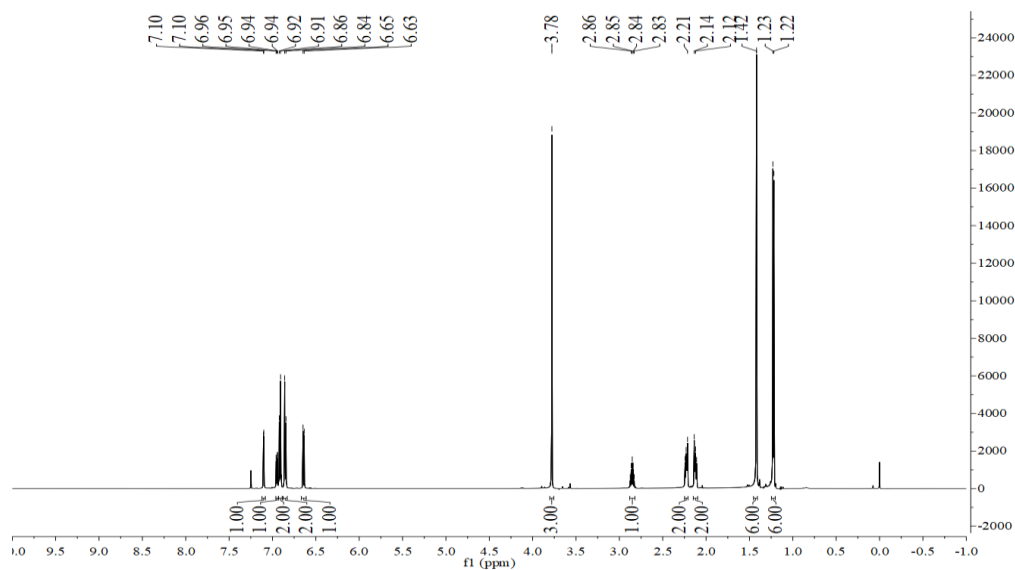


Figure S126. ¹H-NMR spectrum of **7i**.

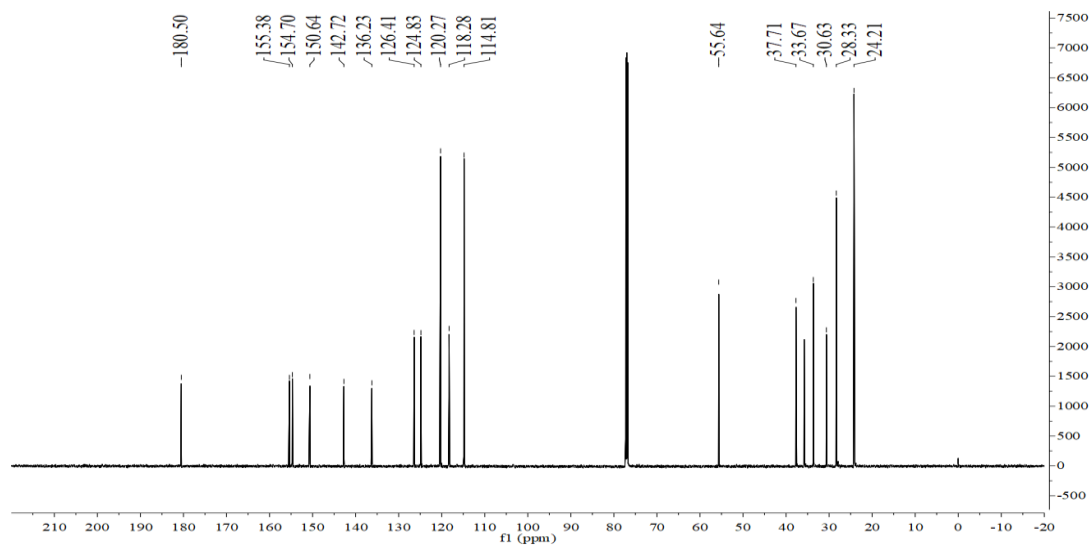


Figure S127. ¹³C-NMR spectrum of **7i**.

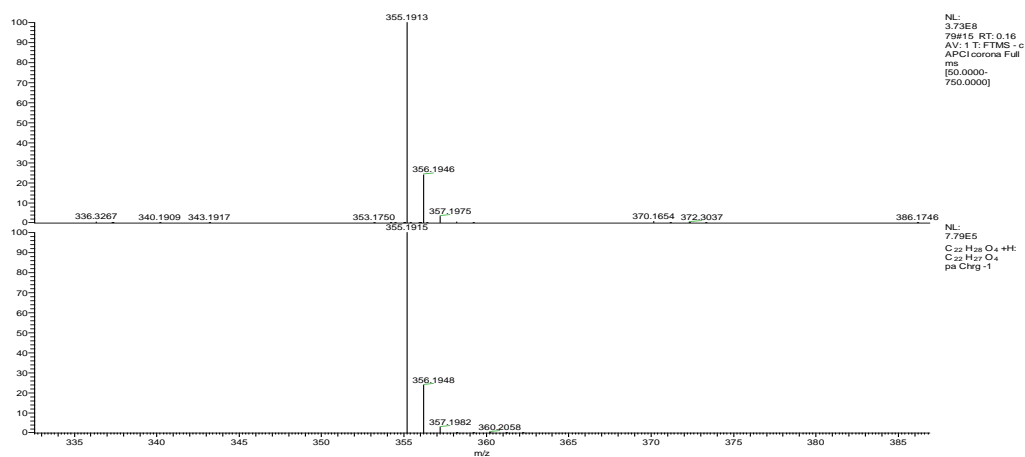
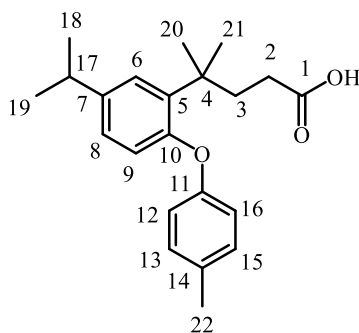


Figure S128. ESI-MS spectrum of **7i**.



7j, white solid; yield 96.3%; m. p. 113.6–114.8 °C; FT-IR (KBr, cm^{-1}): 2959, (C-H), 1701 (C=O), 1506, 1488, 1456, 1413, 1381, 1306, 1232, 1210 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.12 – 6.94 (m, 3H, C₆-H, C₁₃-H, C₁₅-H), 6.89 (d, J = 8.3 Hz, 1H, C₈-H), 6.78 (d, J = 6.6 Hz, 2H, C₁₂-H, C₁₆-H), 6.62 (d, J = 8.3 Hz, 1H, C₉-H), 2.78 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.23 (s, 3H, C₂₂-H), 2.15 – 2.10 (m, 2H, C₂-H), 2.07 – 2.00 (m, 2H, C₃-H), 1.33 (s, 6H, C₂₀-H, C₂₁-H), 1.16 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.57, 155.09, 153.96, 143.11, 136.74, 132.11, 130.13, 126.43, 124.88, 119.24, 118.65, 37.68, 35.85, 33.71, 30.61, 28.38, 24.21, 20.64; ESI-MS m/z : 339.1963 [$\text{M} + \text{H}^+$].

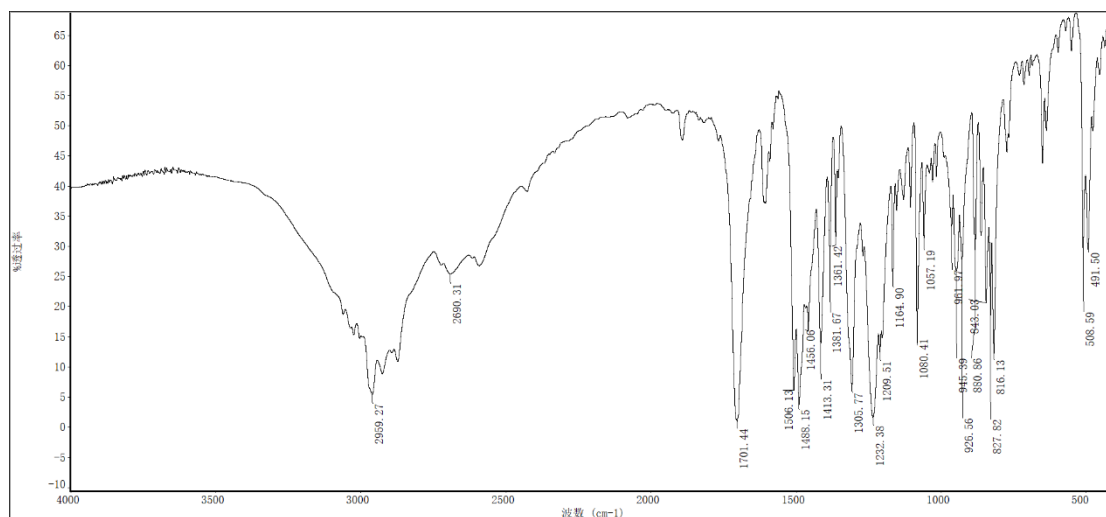


Figure S129. FT-IR spectrum of **7j**.

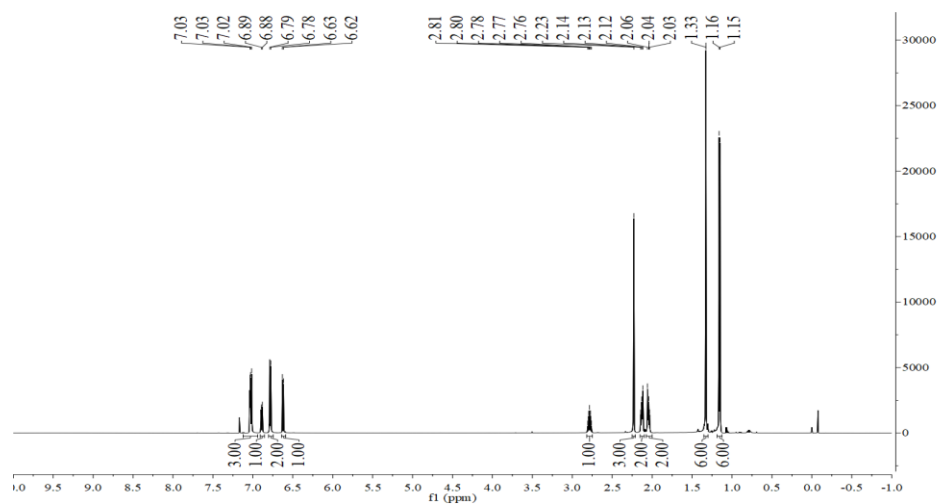


Figure S130. ^1H -NMR spectrum of **7j**.

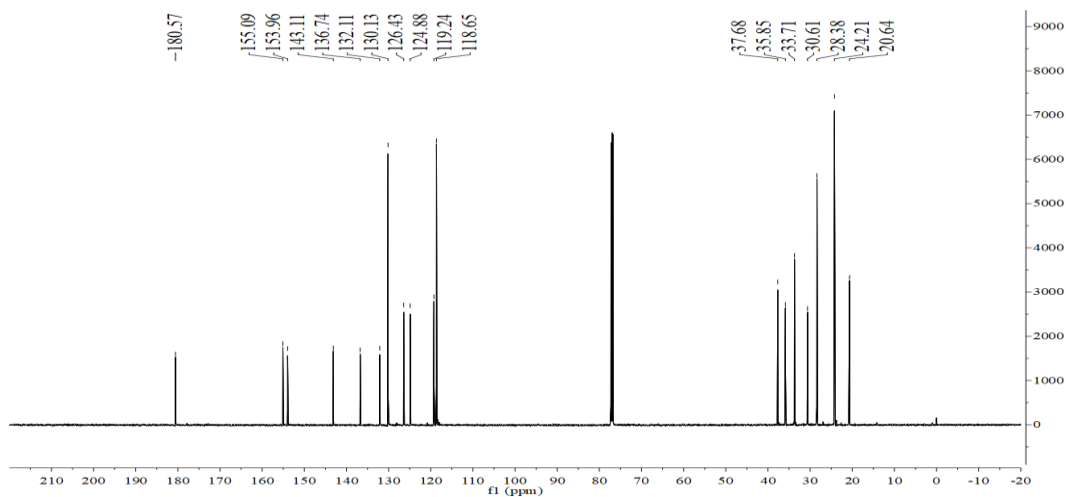


Figure S131. ^{13}C -NMR spectrum of **7j**.

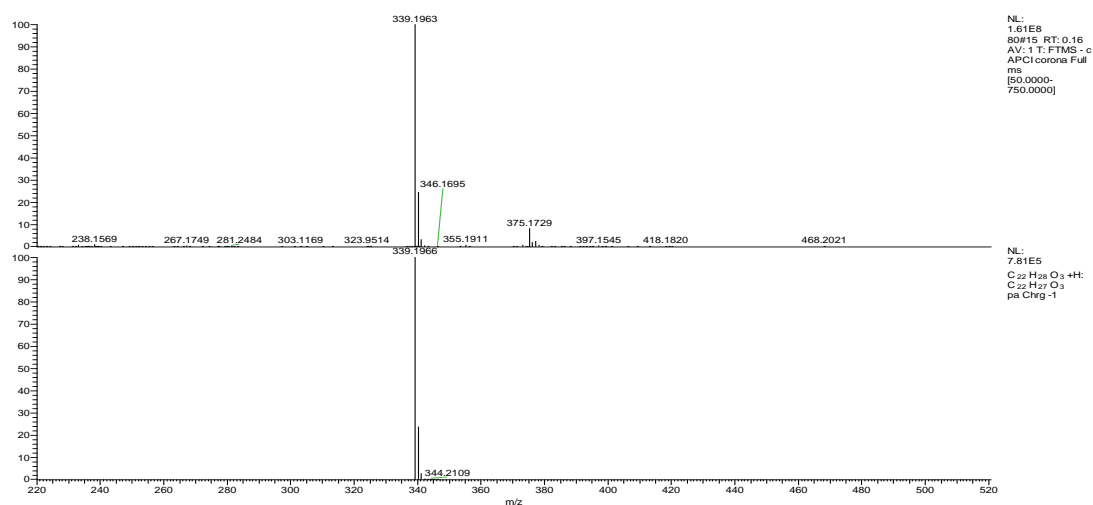
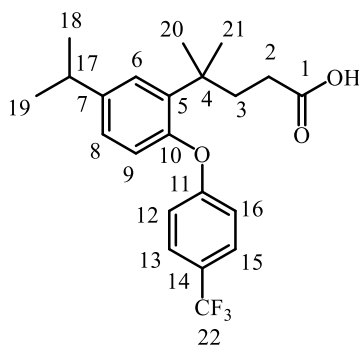


Figure S132. ESI-MS spectrum of **7j**.



7k, white solid; yield 98.3%; m. p. 134.3 – 136.4 °C; FT-IR (KBr, cm^{-1}): 2966, 2876 (C-H), 1709 (C=O), 1490, 1413, 1322, 1215, 1202, 1215, 1134, 1099, 1064 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.54 (d, $J = 8.6$ Hz, 2H, C₁₃-H, C₁₅-H), 7.17 (s, 1H, C₆-H), 7.03 (dd, $J = 21.0, 9.4$ Hz, 3H, C₈-H, C₁₂-H, C₁₆-H), 6.78 (d, $J = 8.3$ Hz, 1H, C₉-H), 2.94 – 2.86 (m, 1H, C₁₇-H), 2.17 – 2.07 (m, 4H, C₂-H, C₃-H), 1.37 (s, 6H, C₂₀-H, C₂₁-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.27, 160.57, 152.03, 144.88, 137.84, 127.40 – 126.82 (m), 125.31, 120.96, 117.68, 37.69, 36.00, 33.83, 30.43, 28.46, 24.15; ESI-MS m/z : 393.1682 [$\text{M} + \text{H}^+$].

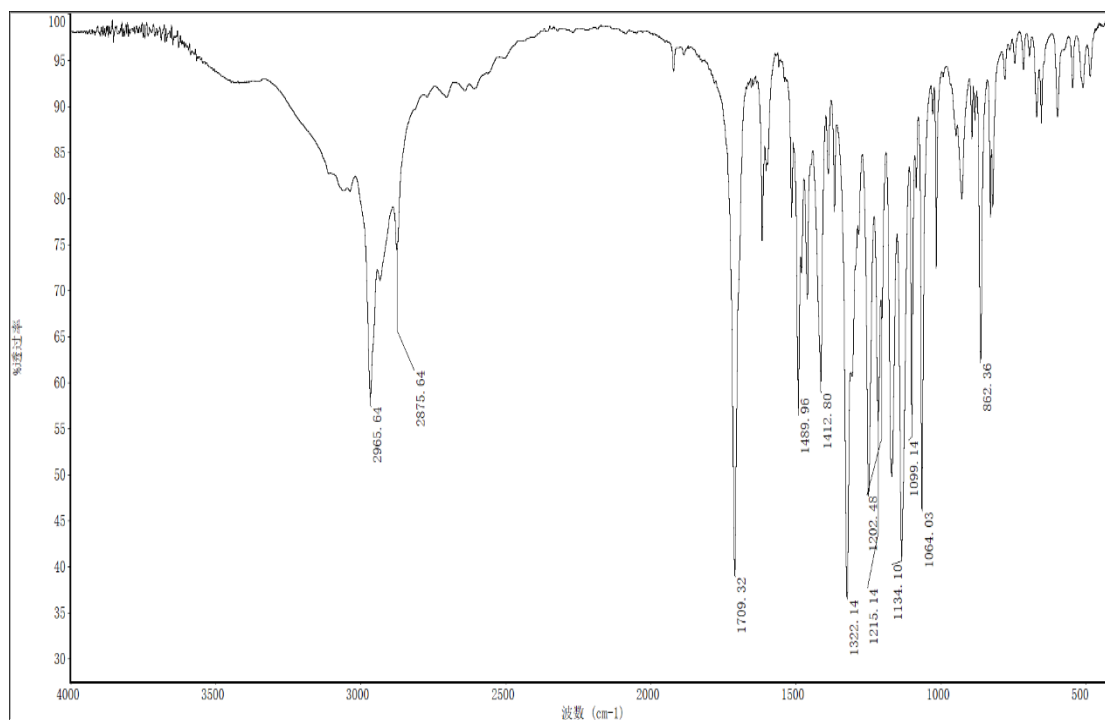


Figure S133. FT-IR spectrum of **7k**.

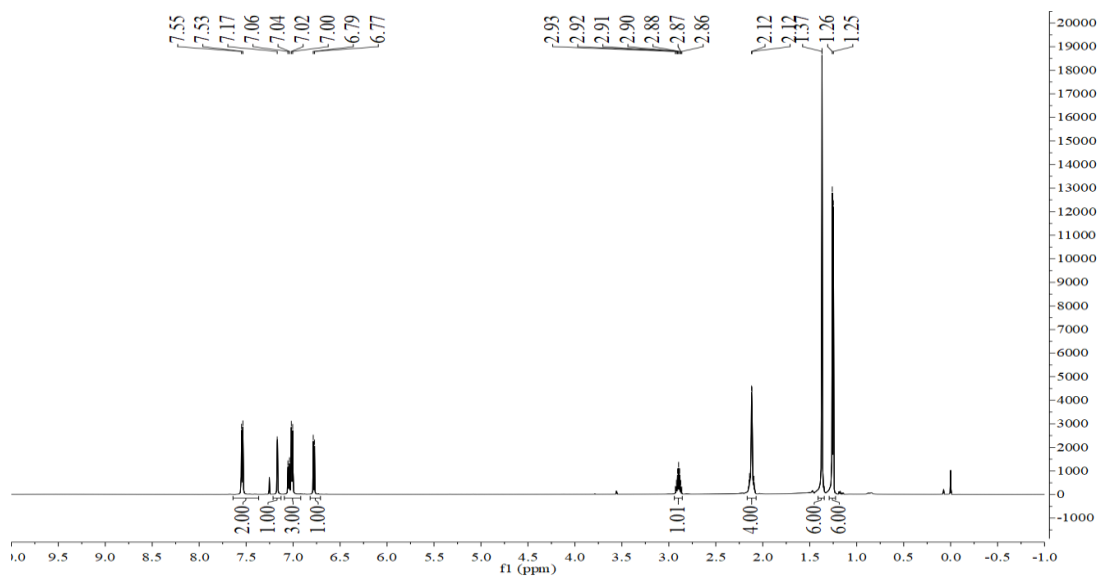


Figure S134. ^1H -NMR spectrum of **7k**.

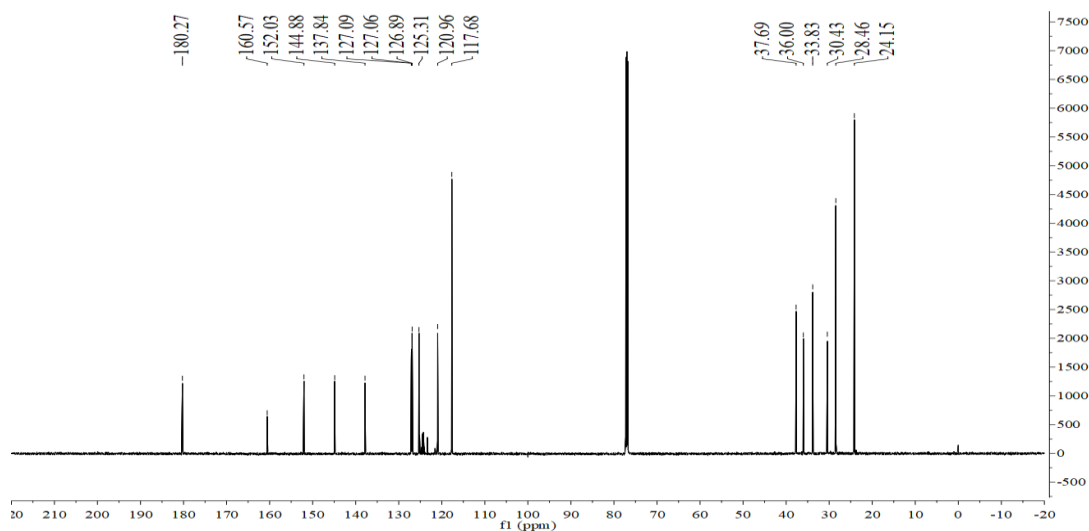


Figure S135. ^{13}C -NMR spectrum of **7k**.

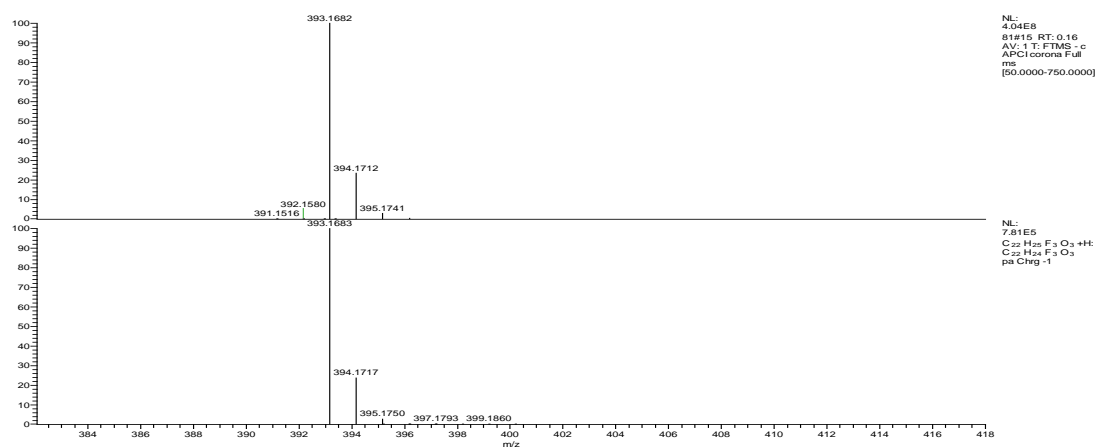
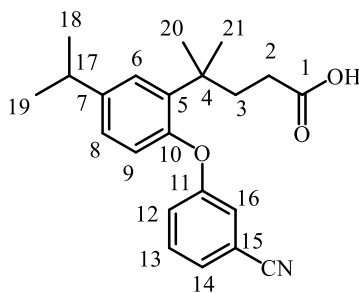


Figure S136. ESI-MS spectrum of **7k**.



7l, white solid; yield 97.7%; m. p. 115.7 – 117.5 °C; FT-IR (KBr, cm^{-1}): 2965, 2933, 2867 (C-H), 2225 ($\text{C}\equiv\text{N}$), 1709 ($\text{C}=\text{O}$), 1586, 1482, 1428, 1412, 1320, 1252, 1225, 1205 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.39 (t, $J = 7.9$ Hz, 1H, C₁₄-H), 7.32 (d, $J = 7.3$ Hz, 1H, C₁₃-H), 7.20 (dd, $J = 16.6, 9.8$ Hz, 3H, C₆-H, C₁₂-H, C₁₆-H), 7.05 (d, $J = 8.2$ Hz, 1H, C₈-H), 6.74 (d, $J = 8.2$ Hz, 1H, C₉-H), 2.94 – 2.84 (m, 1H, C₁₇-H), 2.12 (s, 4H, C₂-H, C₃-H), 1.37 (s, 6H, C₂₀-H, C₂₁-H), 1.26 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.13, 158.20, 151.89, 145.08, 137.82, 130.64, 127.01, 126.01, 125.46, 122.70, 120.88, 120.65, 118.35, 113.48, 37.68, 36.10, 33.82, 30.46, 28.43, 24.14; ESI-MS m/z : 350.1759 [$\text{M} + \text{H}^+$].

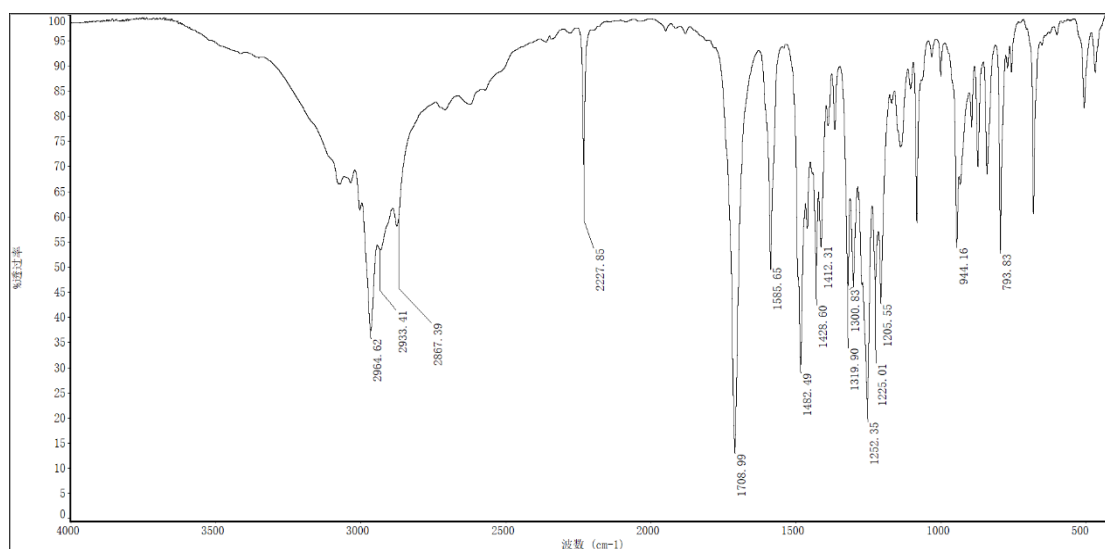
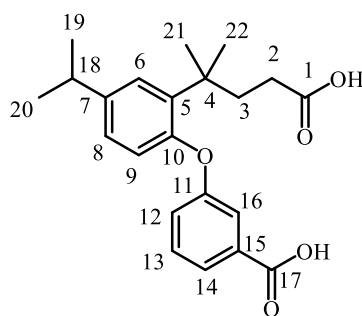


Figure S137. FT-IR spectrum of **7l**.



7m, white solid; yield 95.8%; m. p. 152.5 – 155.7 °C; FT-IR (KBr, cm^{-1}): 2965, 2869 (C-H), 1716 (C=O), 1589, 1485, 1446, 1414, 1300, 1281, 1226 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.75 (d, $J = 7.7$ Hz, 1H, C₁₄-H), 7.46 (d, $J = 37.9$ Hz, 1H, C₁₆-H), 7.42 (t, $J = 7.9$ Hz, 1H, C₁₃-H), 7.31 (d, $J = 9.9$ Hz, 1H, C₈-H), 7.15 (d, $J = 1.9$ Hz, 1H, C₆-H), 7.02 (d, $J = 10.3$ Hz, 1H, C₁₂-H), 6.71 (d, $J = 8.2$ Hz, 1H, C₉-H), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₈-H), 2.14 (d, $J = 7.0$ Hz, 2H, C₂-H), 2.10 (d, $J = 9.7$ Hz, 2H, C₃-H), 1.41 (d, $J = 25.1$ Hz, 6H, C₂₁-H, C₂₂-H), 1.26 (d, $J = 6.9$ Hz, 6H, C₁₉-H, C₂₀-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.93, 171.77, 157.66, 152.87, 144.21, 137.09, 131.11, 129.81, 127.04, 125.41, 124.43, 120.01, 119.04, 37.80, 35.47, 33.76, 30.46, 28.51, 24.16; ESI-MS m/z : 369.1705 [$\text{M} + \text{H}^+$].

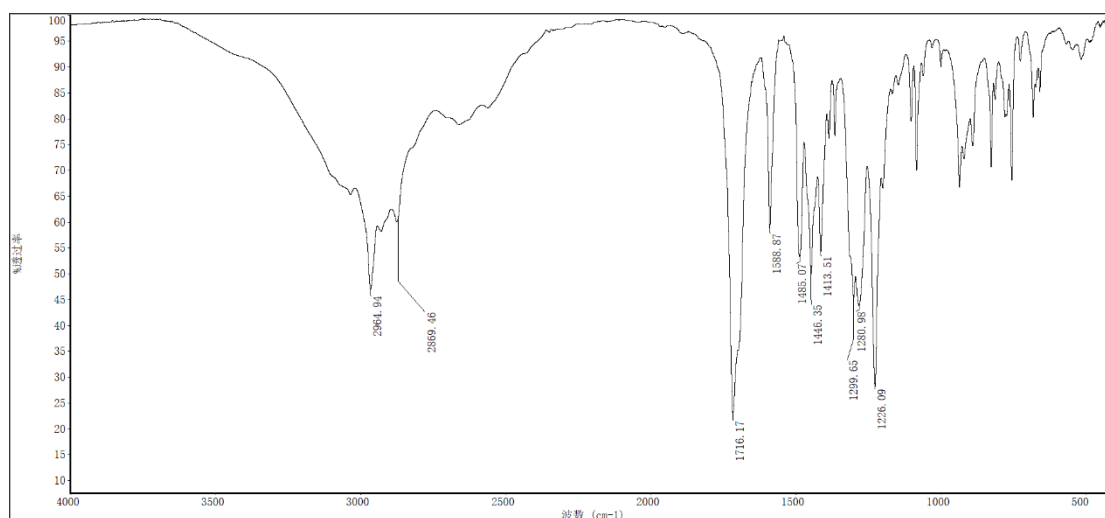
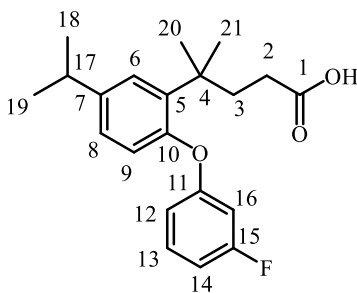


Figure S141. FT-IR spectrum of **7m**.



7n, white solid; yield 97.4%; m. p. 112.7– 113.9 °C; FT-IR (KBr, cm^{-1}): 2962, 2929, 2876 (C-H), 1704 (C=O), 1597, 1482, 1457, 1413, 1305, 1211, 1119 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.25 – 7.21 (m, 1H, C₁₃-H), 7.14 (d, J = 2.2 Hz, 1H, C₆-H), 7.03 (d, J = 6.1 Hz, 1H, C₈-H), 6.78 (d, J = 8.3 Hz, 1H, C₉-H), 6.73 (td, J = 7.9, 2.3 Hz, 2H, C₁₄-H, C₁₆-H), 6.66 (dt, J = 10.4, 2.3 Hz, 1H, C₁₂-H), 2.88 (dt, J = 13.8, 6.9 Hz, 1H, C₁₇-H), 2.12 (dt, J = 18.3, 9.1 Hz, 4H, C₂-H, C₃-H), 1.38 (s, 6H, C₂₀-H, C₂₁-H), 1.25 (d, J = 6.9 Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.22, 164.38, 162.75, 152.53, 144.37, 137.50, 130.39 (d, J = 9.8 Hz), 126.71, 125.17, 120.57, 113.71 (d, J = 2.9 Hz), 109.34, 109.20, 105.77, 105.61, 37.68, 36.00, 33.79, 30.48, 28.43, 24.17; ESI-MS m/z : 343.1712 [$\text{M} + \text{H}^+$].

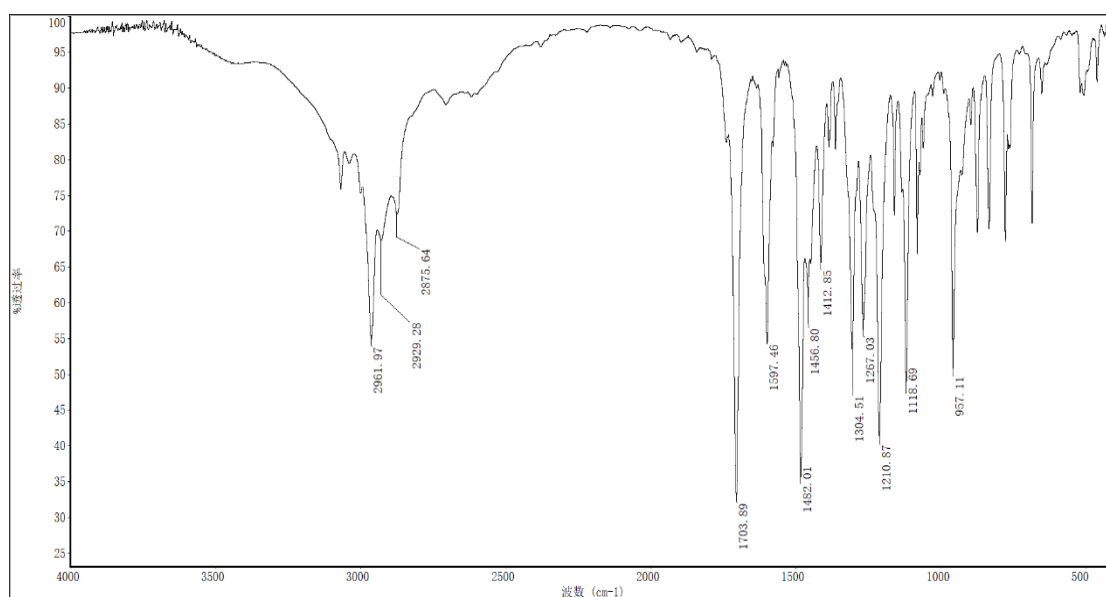


Figure S145. FT-IR spectrum of **7n**.

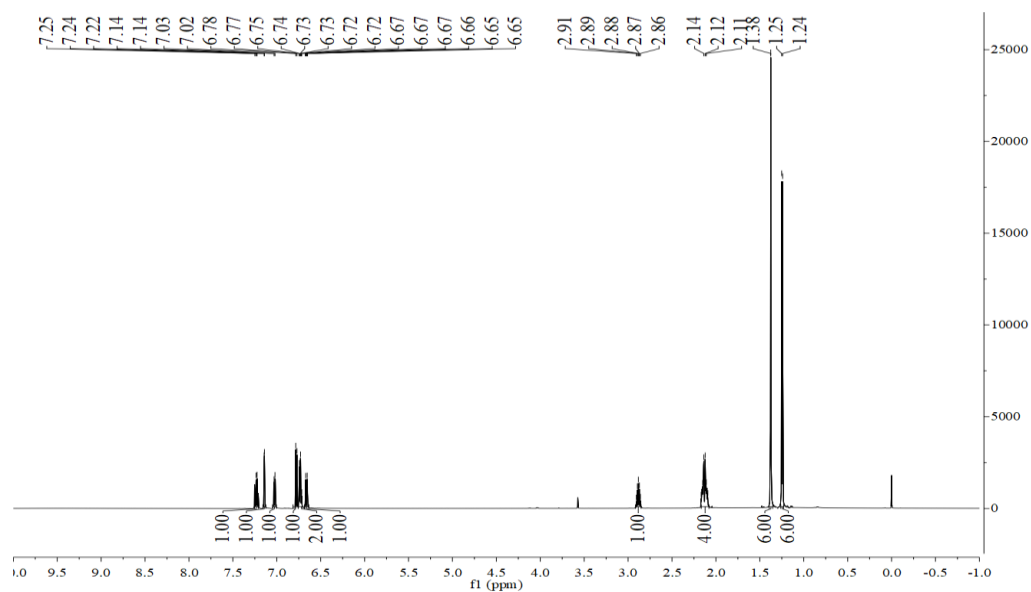


Figure S146. ¹H-NMR spectrum of **7n**.

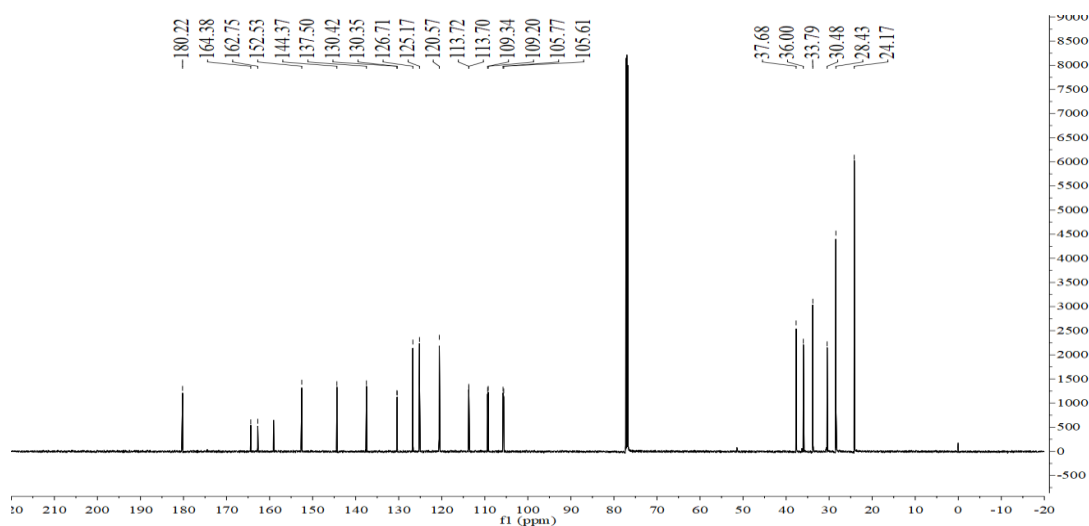


Figure S147. ¹³C-NMR spectrum of **7n**.

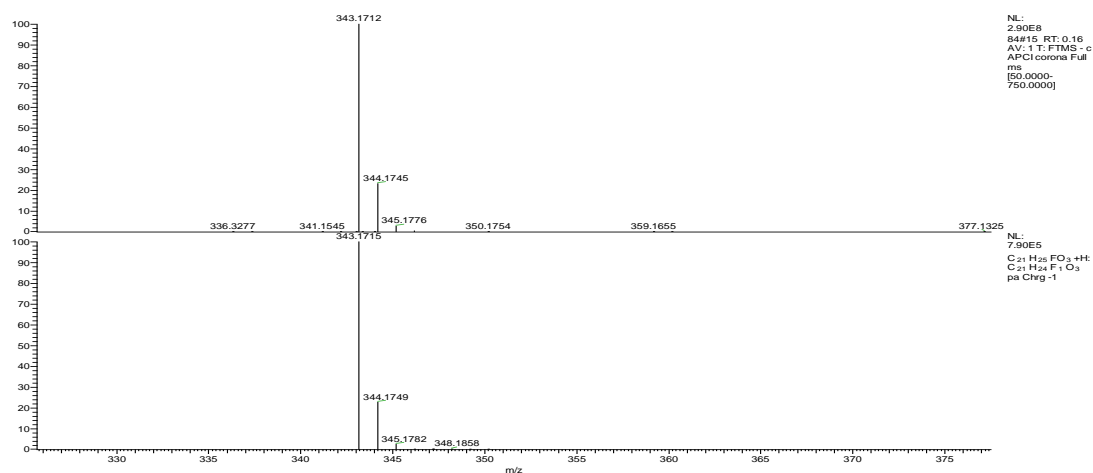
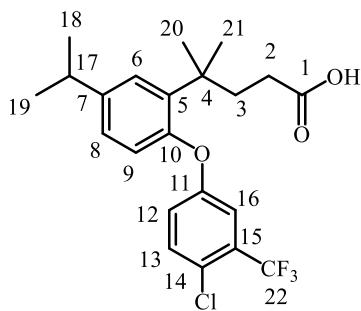


Figure S148. ESI-MS spectrum of **7n**.



7o, white solid; yield 96.7%; m. p. 113.0–114.1 °C; FT-IR (KBr, cm^{-1}): 2962, 2927 (C-H), 1711 (C=O), 1477, 1427, 1328, 1164, 1126, 1108, 1082 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.39 (d, $J = 8.8$ Hz, 1H, C₁₃-H), 7.31 (d, $J = 2.9$ Hz, 1H, C₁₆-H), 7.16 (d, $J = 2.1$ Hz, 1H, C₆-H), 7.05 – 7.01 (m, 2H, C₈-H, C₁₂-H), 6.72 (d, $J = 8.3$ Hz, 1H, C₉-H), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₇-H), 2.15 – 2.09 (m, 4H, C₂-H, C₃-H), 1.37 (s, 6H, C₂₀-H, C₂₁-H), 1.25 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.03, 156.26, 152.19, 144.89, 137.57, 132.57, 126.97, 125.41, 121.95, 120.18, 117.46 (d, $J = 5.4$ Hz), 37.67, 35.99, 33.77, 30.39, 28.38, 24.10; ESI-MS m/z : 427.1289 $[\text{M} + \text{H}^+]$.

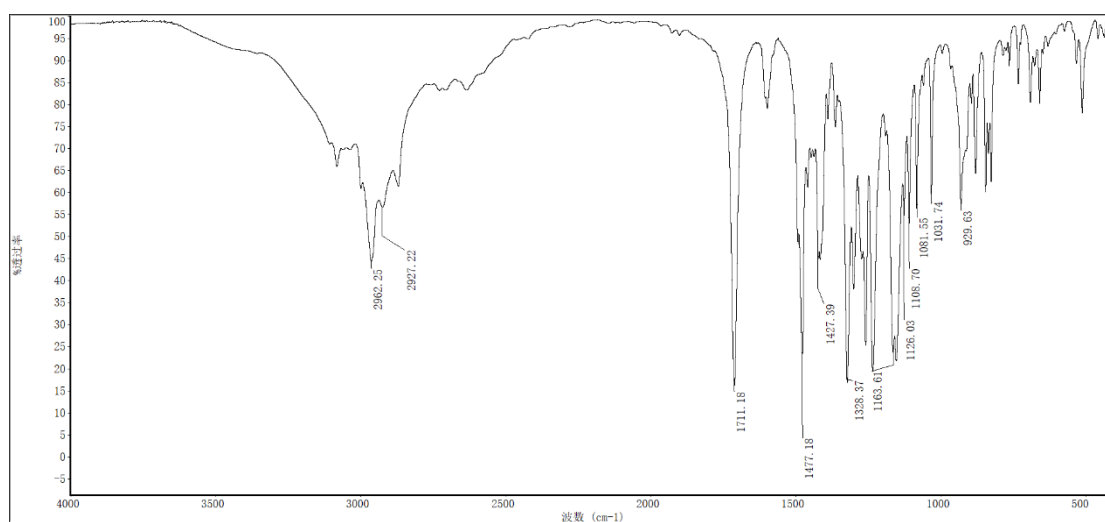


Figure S149. FT-IR spectrum of **7o**.

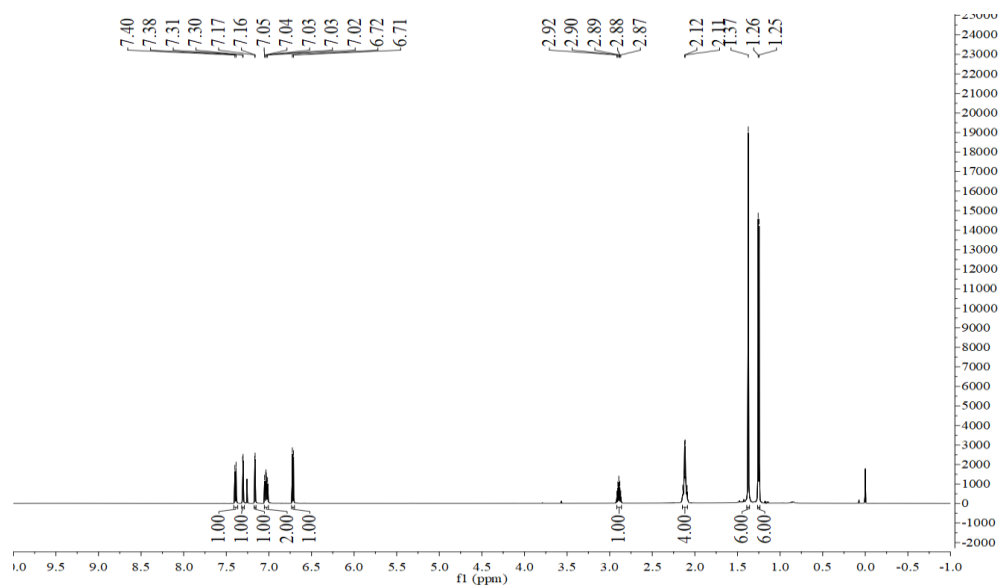


Figure S150. ¹H-NMR spectrum of **7o**.

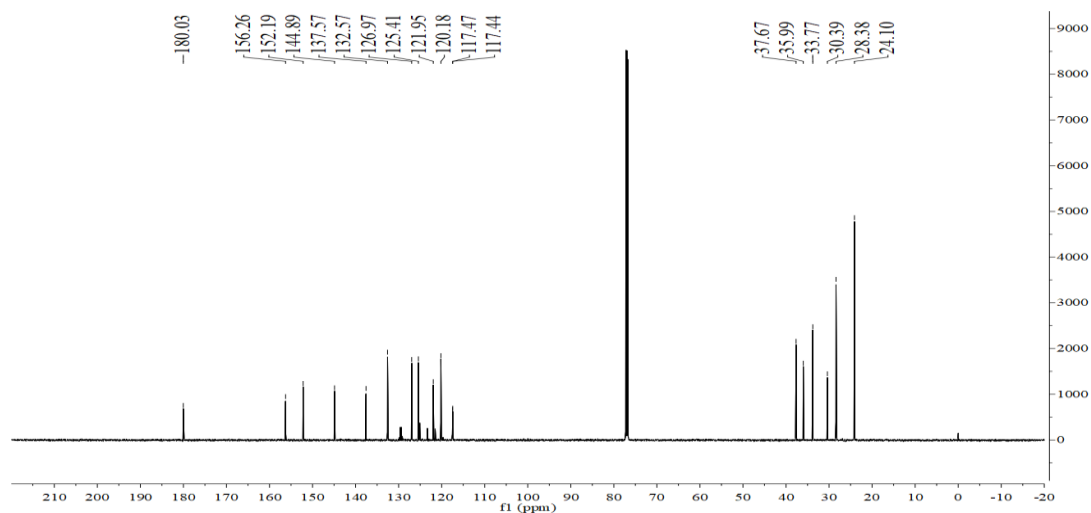


Figure S151. ¹³C-NMR spectrum of **7o**.

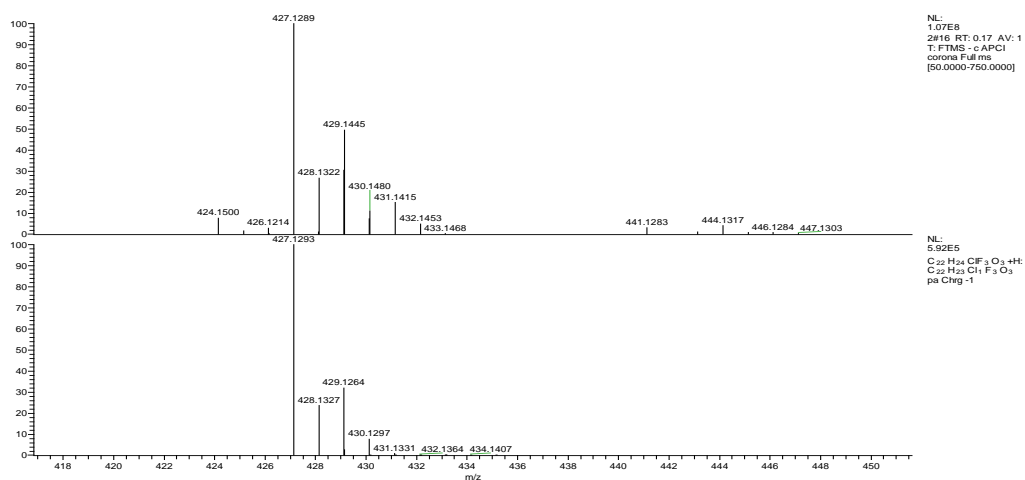
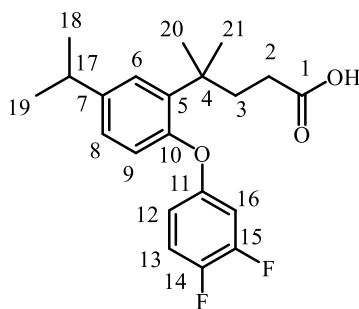


Figure S152. ESI-MS spectrum of **7o**.



7p, white solid; yield 98.8%; m. p. 106.4– 108.2 °C; FT-IR (KBr, cm^{-1}): 3061 (Ar-H), 2962, 2929, 2874 (C-H), 1702 (C=O), 1513, 1489, 1456, 1412, 1303, 1249, 1213, 1145, 1102 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.14 (d, $J = 2.2$ Hz, 1H, $\text{C}_{13}\text{-H}$), 7.10 – 7.05 (m, 1H, $\text{C}_6\text{-H}$), 7.02 (d, $J = 8.3$ Hz, 1H, $\text{C}_8\text{-H}$), 6.79 (dd, $J = 11.5, 6.7$ Hz, 1H, $\text{C}_9\text{-H}$), 6.72 (d, $J = 8.3$ Hz, 1H, $\text{C}_{16}\text{-H}$), 6.69 – 6.65 (m, 1H, $\text{C}_{12}\text{-H}$), 2.87 (dd, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.14 (d, $J = 12.1$ Hz, 2H, $\text{C}_2\text{-H}$), 2.12 – 2.08 (m, 2H, $\text{C}_3\text{-H}$), 1.38 (s, 6H, $\text{C}_{20}\text{-H}, \text{C}_{21}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}, \text{C}_{19}\text{-H}$; ^{13}C NMR (151 MHz, CDCl_3) δ 180.06, 152.89, 144.35, 137.27, 126.79, 125.23, 119.95, 117.44 (d, $J = 19.6$ Hz), 113.77 (dd, $J = 5.8, 3.5$ Hz), 107.87, 107.74, 37.69, 35.97, 33.77, 30.45, 28.39, 24.16; ESI-MS m/z : 361.1619 $[\text{M} + \text{H}^+]$.

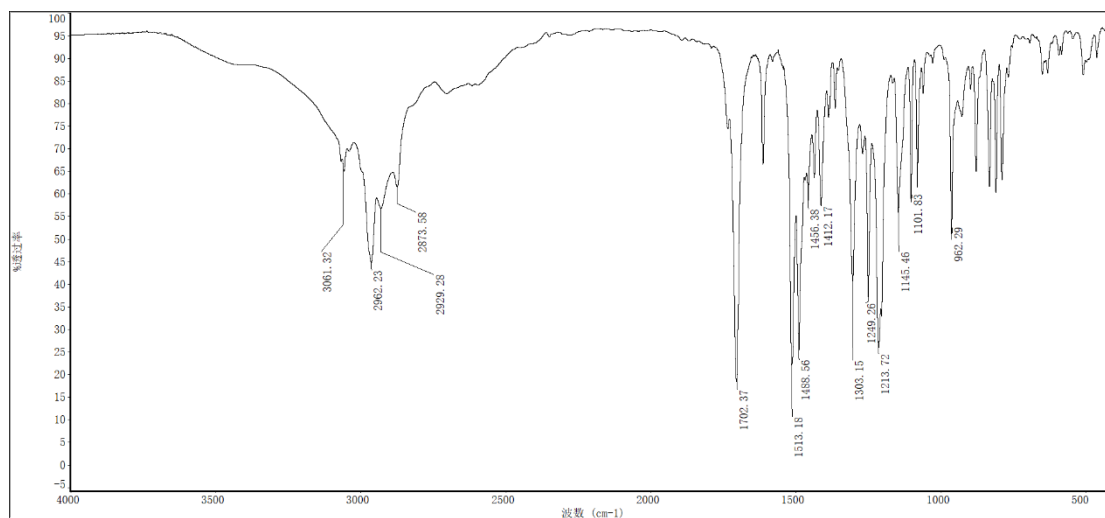


Figure S153. FT-IR spectrum of **7p**.

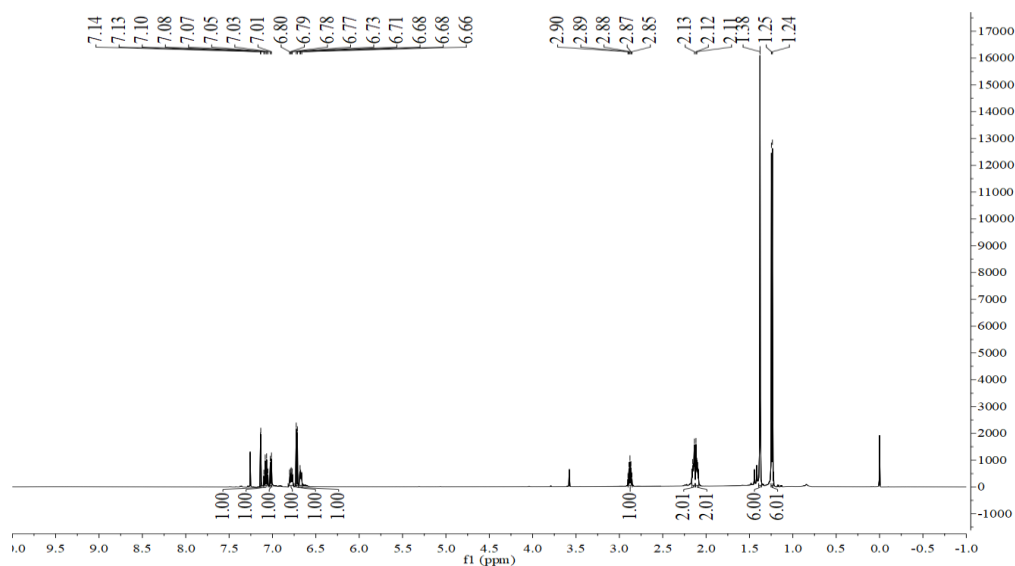


Figure S154. ^1H -NMR spectrum of **7p**.

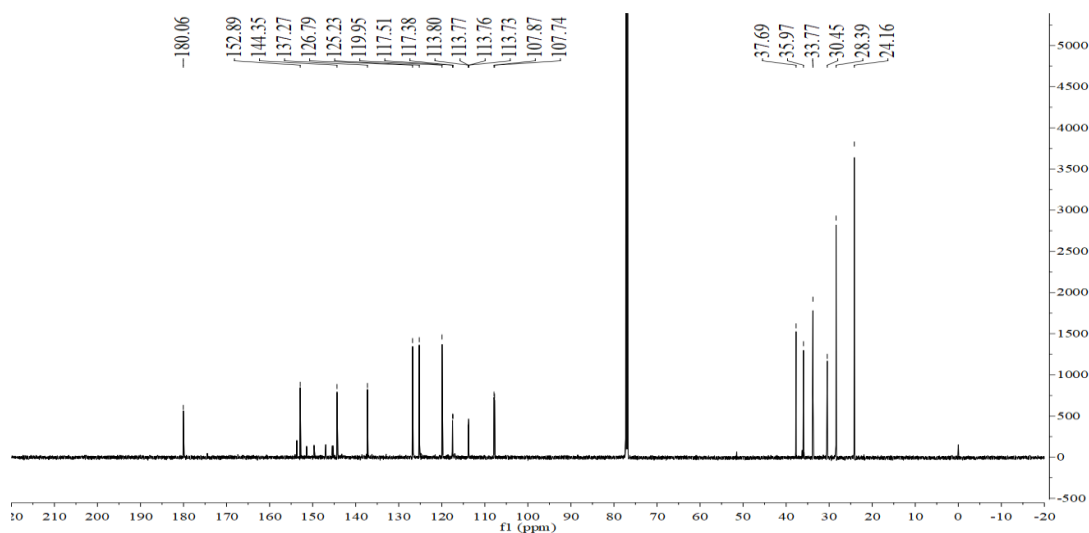


Figure S155. ^{13}C -NMR spectrum of **7p**.

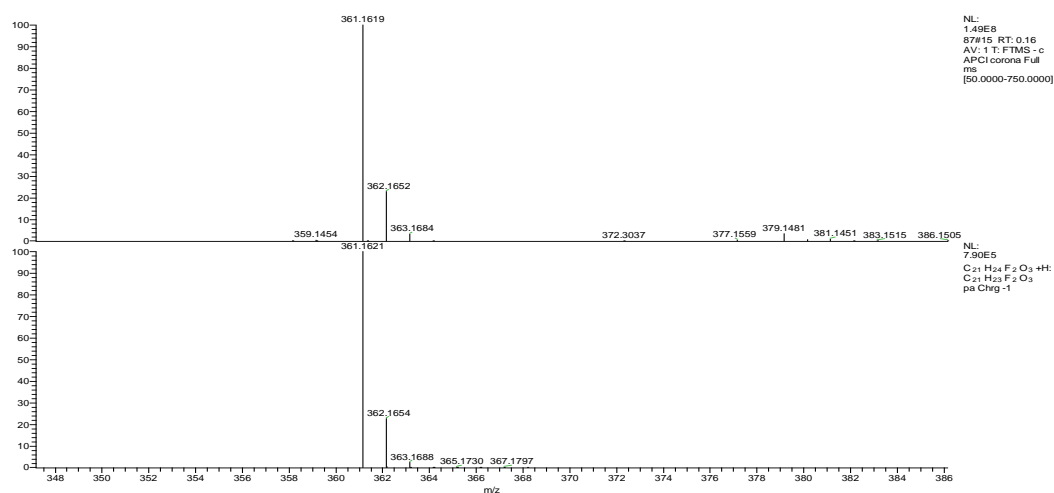
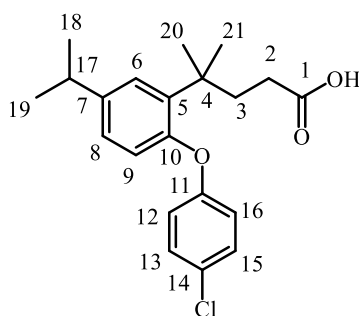


Figure S156. ESI-MS spectrum of **7p**.



7q, white solid; yield 90.8%; m. p. 121.5– 123.8 °C; FT-IR (KBr, cm^{-1}): 2956, 2871 (C-H), 1709 (C=O), 1483, 1456, 1411, 1291, 1244, 1197, 1082 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.25 (d, $J = 9.1$ Hz, 2H, $\text{C}_{13}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.13 (d, $J = 2.2$ Hz, 1H, $\text{C}_6\text{-H}$), 7.00 (d, $J = 6.2$ Hz, 1H, $\text{C}_8\text{-H}$), 6.89 (d, $J = 8.9$ Hz, 2H, $\text{C}_{12}\text{-H}$, $\text{C}_{16}\text{-H}$), 6.71 (d, $J = 8.3$ Hz, 1H, $\text{C}_9\text{-H}$), 2.87 (dt, $J = 13.8, 6.9$ Hz, 1H, $\text{C}_{17}\text{-H}$), 2.20 – 2.14 (m, 2H, $\text{C}_2\text{-H}$), 2.13 – 2.08 (m, 2H, $\text{C}_3\text{-H}$), 1.38 (s, 6H, $\text{C}_{20}\text{-H}$, $\text{C}_{21}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{18}\text{-H}$, $\text{C}_{19}\text{-H}$); ^{13}C NMR (151 MHz, CDCl_3) δ 180.00, 156.22, 153.05, 144.04, 137.25, 129.60 (d, $J = 4.9$ Hz), 127.53, 126.68, 125.12, 119.93, 119.59, 37.68, 35.93, 33.76, 30.46, 28.40, 24.17; ESI-MS m/z : 359.1418 $[\text{M} + \text{H}^+]$.

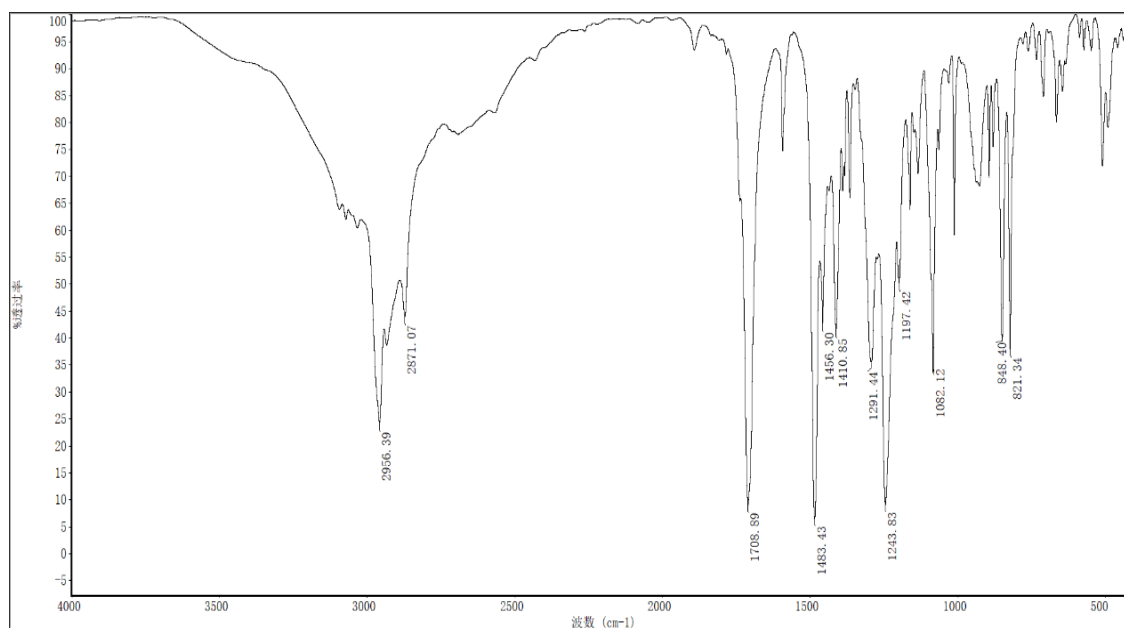


Figure S157. FT-IR spectrum of **7q**.

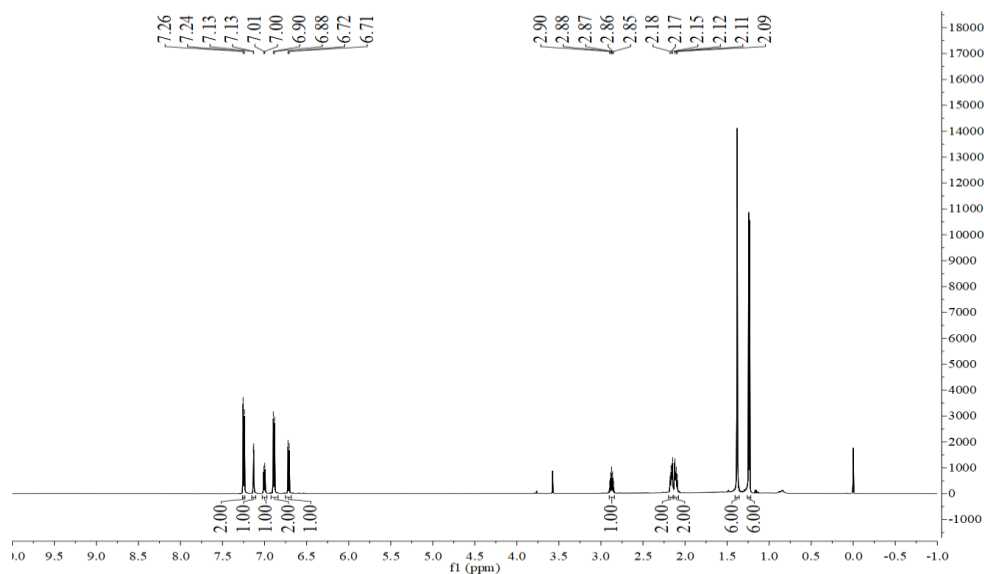


Figure S158. ^1H -NMR spectrum of **7q**.

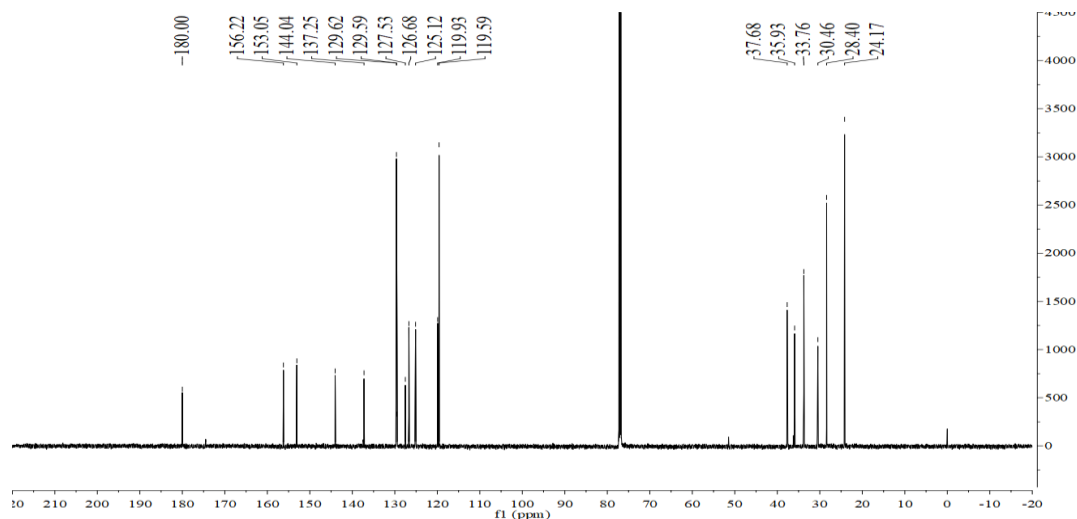


Figure S159. ^{13}C -NMR spectrum of **7q**.

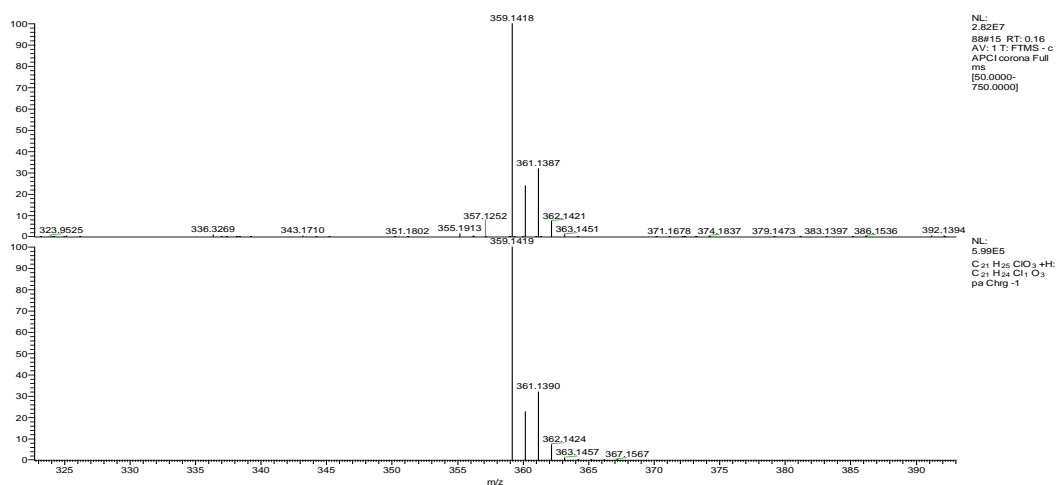
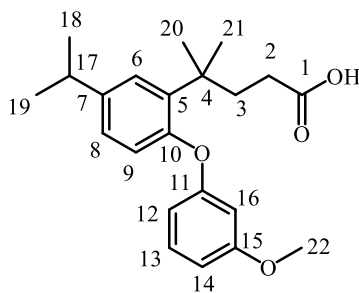


Figure S160. ESI-MS spectrum of **7q**.



7r, white solid; yield 94.2%; m. p. 125.6– 126.9 °C; FT-IR (KBr, cm^{-1}): 2959, 2874 (C-H), 1708 (C=O), 1603, 1486, 1454, 1412, 1386, 1282, 1214, 1162, 1141, 1083, 1043 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.17 (t, $J = 8.1$ Hz, 1H, C₁₃-H), 7.13 (s, 1H, C₆-H), 6.99 (d, $J = 8.3$ Hz, 1H, C₈-H), 6.77 (d, $J = 8.3$ Hz, 1H, C₉-H), 6.59 (d, $J = 8.7$ Hz, 1H, C₁₆-H), 6.53 (d, $J = 8.7$ Hz, 2H, C₁₂-H, C₁₄-H), 3.75 (s, 3H, C₂₂-H), 2.90 – 2.84 (m, 1H, C₁₇-H), 2.22 – 2.17 (m, 2H, C₂-H), 2.12 (dd, $J = 9.1, 7.3$ Hz, 2H, C₃-H), 1.40 (s, 6H, C₂₀-H, C₂₁-H), 1.24 (d, $J = 7.0$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.83, 160.92, 158.76, 153.18, 143.66, 137.11, 130.02, 126.51, 125.00, 120.14, 110.67, 108.30, 104.54, 60.45, 55.27, 38.10, 35.94, 33.95 – 33.56, 30.64, 28.43, 24.13, 14.15; ESI-MS m/z : 355.1912 [$\text{M} + \text{H}^+$].

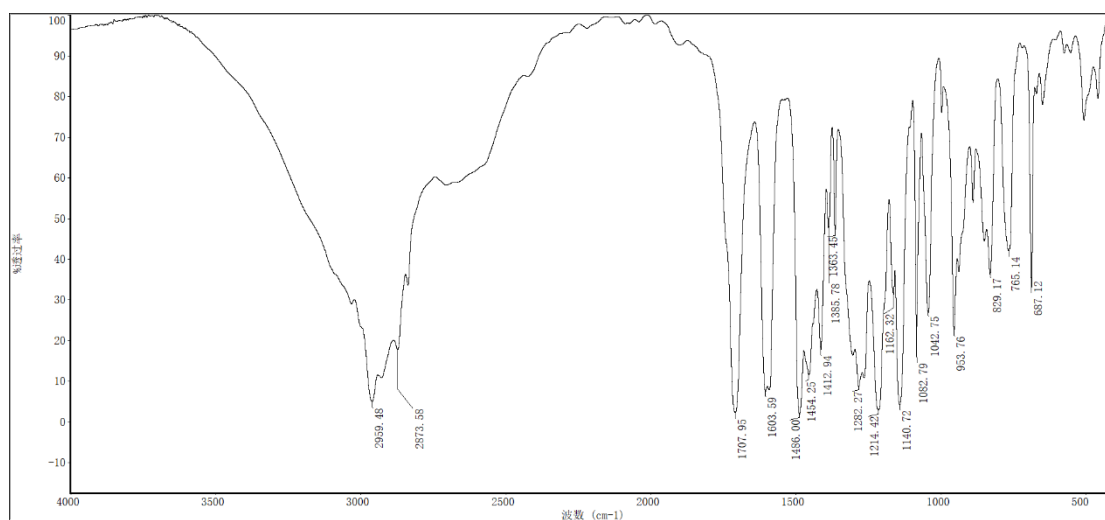


Figure S161. FT-IR spectrum of **7r**.

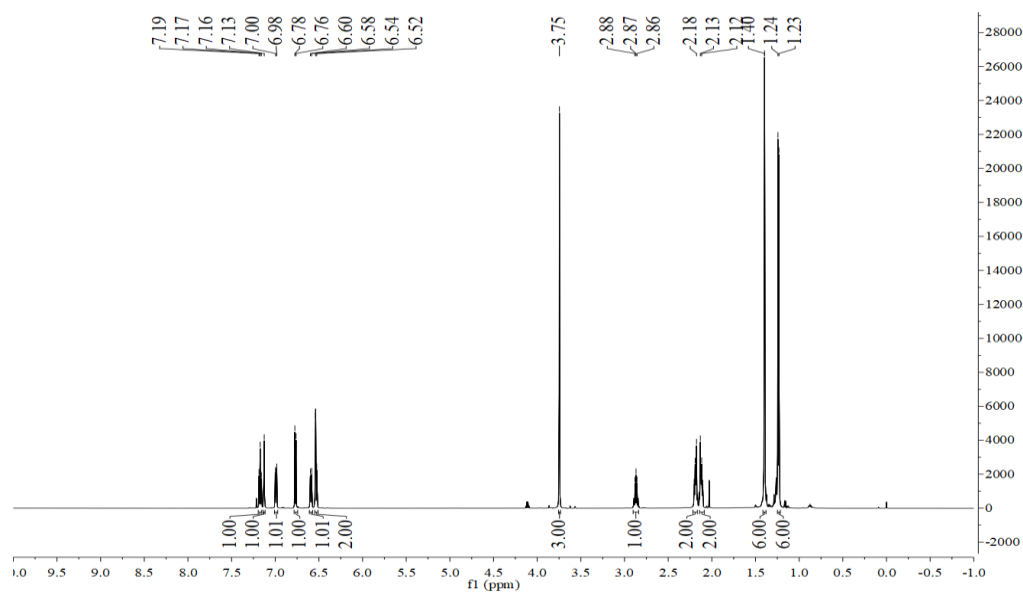


Figure S162. ^1H -NMR spectrum of **7r**.

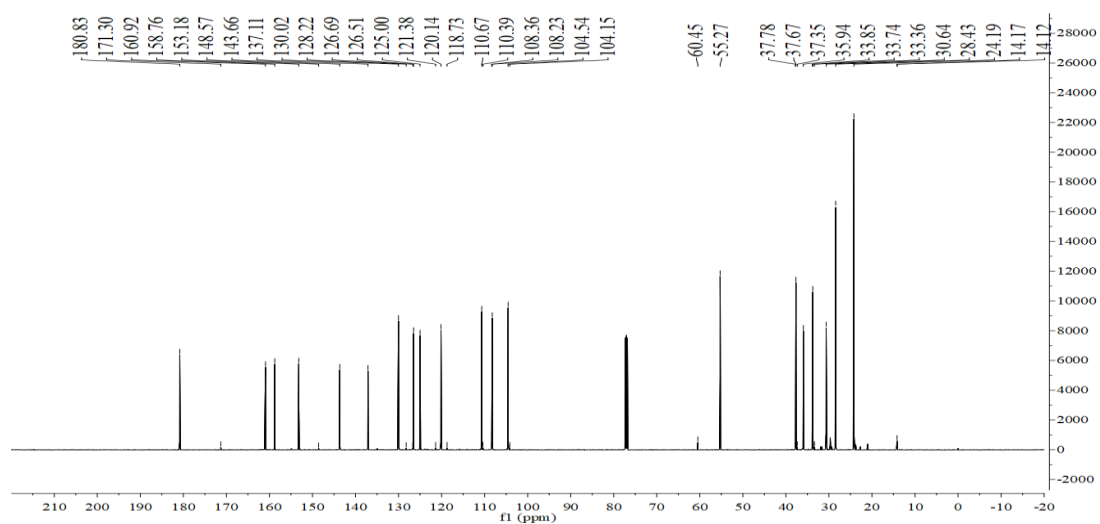


Figure S163. ^{13}C -NMR spectrum of **7r**.

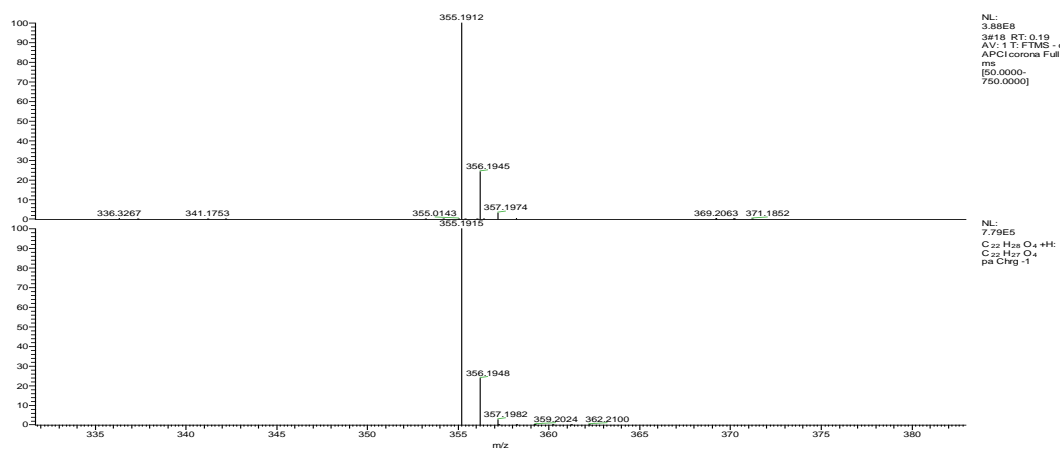
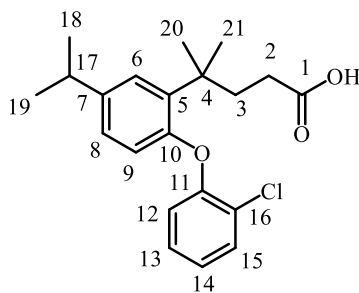


Figure S164. ESI-MS spectrum of **7r**.



7s, white solid; yield 94.9%; m. p. 124.1– 125.8 °C; FT-IR (KBr, cm^{-1}): 3432 (Ar-H), 2959, 2925, 2870 (C-H), 1708 (C=O), 1475, 1446, 1412, 1263, 1238, 1200, 1082, 1059 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 7.44 (d, $J = 6.4$ Hz, 1H, C₁₅-H), 7.18 – 7.12 (m, 2H, C₆-H, C₁₃-H), 7.02 (t, $J = 7.7$ Hz, 1H, C₁₄-H), 6.98 (d, $J = 8.3$ Hz, 1H, C₈-H), 6.91 (d, $J = 9.6$ Hz, 1H, C₁₂-H), 6.59 (d, $J = 8.3$ Hz, 1H, C₉-H), 2.87 (dt, $J = 13.8$, 6.9 Hz, 1H, C₁₇-H), 2.26 – 2.21 (m, 2H, C₂-H), 2.16 – 2.11 (m, 2H, C₃-H), 1.44 (s, 6H, C₂₀-H, C₂₁-H), 1.23 (d, $J = 6.9$ Hz, 6H, C₁₈-H, C₁₉-H); ^{13}C NMR (151 MHz, CDCl_3) δ 180.83, 160.92, 158.76, 153.18, 143.66, 137.11, 130.02, 126.51, 125.00, 120.14, 110.67, 108.23, 104.54, 55.27, 37.67, 35.94, 33.74, 30.64, 28.43, 24.19; ESI-MS m/z : 359.1418 $[\text{M} + \text{H}^+]$.

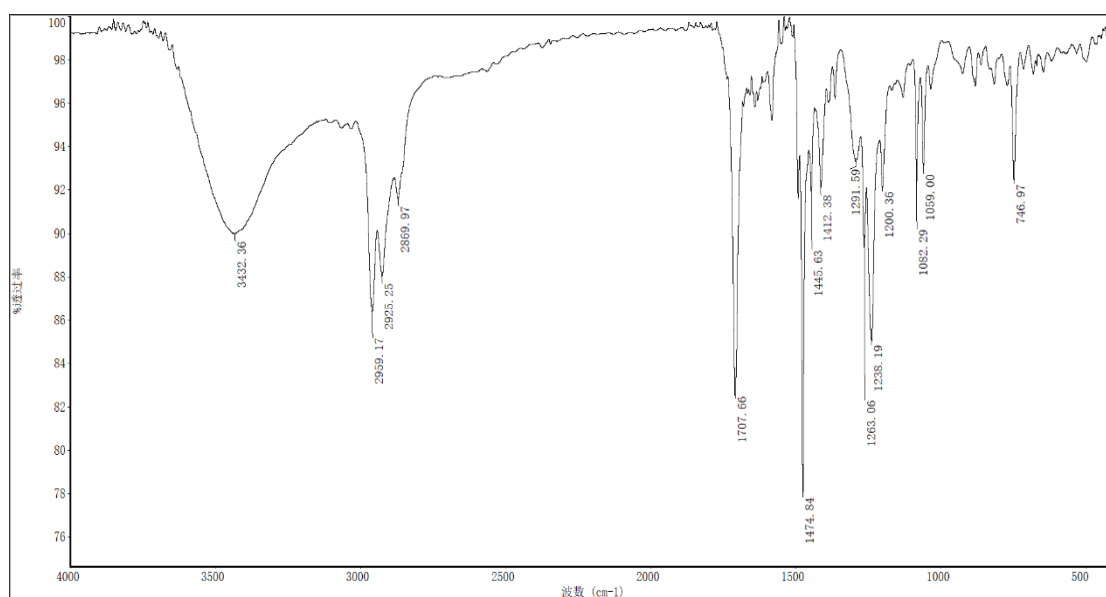
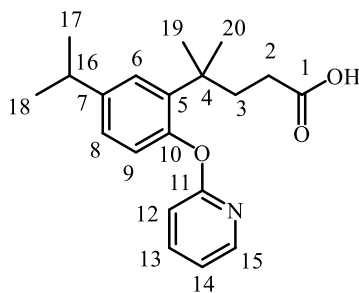


Figure S165. FT-IR spectrum of **7s**.





7t, white solid; yield 97.6%; m. p. 133.2– 134.9 °C; FT-IR (KBr, cm^{-1}): 2960, 2926, 2871 (C-H), 1710 (C=O), 1574, 1490, 1476, 1427, 1245, 1200, 1081 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 8.20 (d, $J = 6.4$ Hz, 1H, C₁₅-H), 7.65 (t, $J = 7.8$ Hz, 1H, C₁₃-H), 7.16 (s, 1H, C₆-H), 7.06 (d, $J = 10.3$ Hz, 1H, C₈-H), 6.96 – 6.93 (m, 1H, C₉-H), 6.88 – 6.84 (m, 2H, C₁₂-H, C₁₄-H), 2.89 (dt, $J = 13.8, 6.9$ Hz, 1H, C₁₆-H), 2.11 (s, 4H, C₂-H, C₃-H), 1.37 (s, 6H, C₁₉-H, C₂₀-H), 1.25 (d, $J = 7.0$ Hz, 6H, C₁₇-H, C₁₈-H); ^{13}C NMR (151 MHz, CDCl_3) δ 179.64, 163.70, 150.62, 147.75, 144.80, 139.56, 137.90, 126.67, 125.07, 122.52, 118.27, 111.71, 37.63, 36.33, 33.83, 30.53, 28.58, 24.16; ESI-MS m/z : 326.1759 $[\text{M} + \text{H}^+]$.

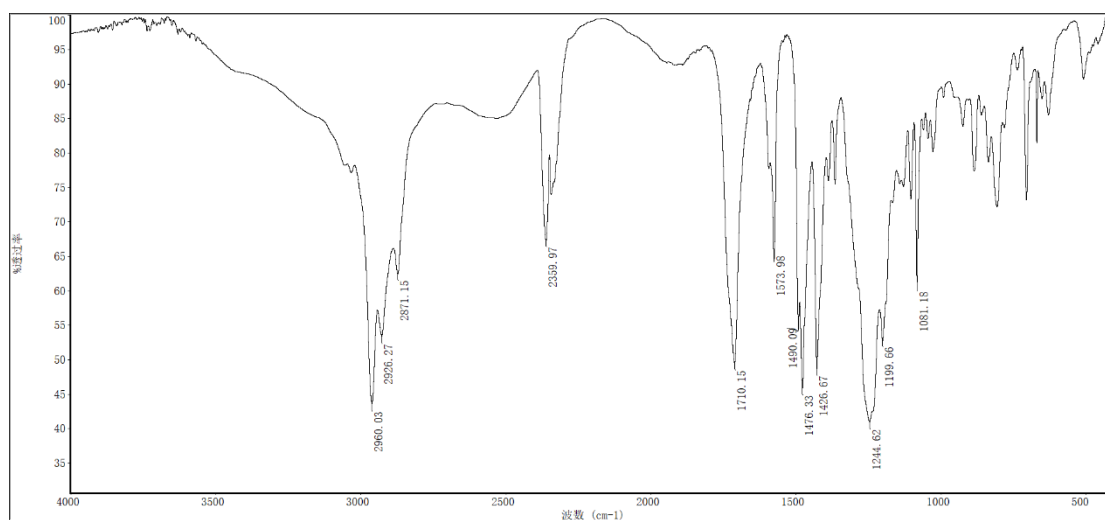


Figure S169. FT-IR spectrum of **7t**.

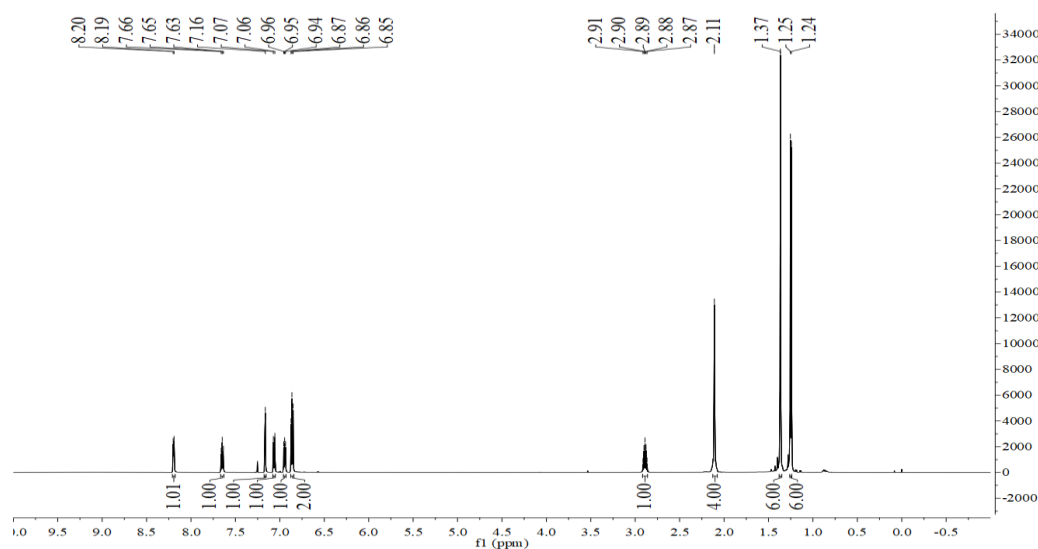


Figure S170. ^1H -NMR spectrum of **7t**.

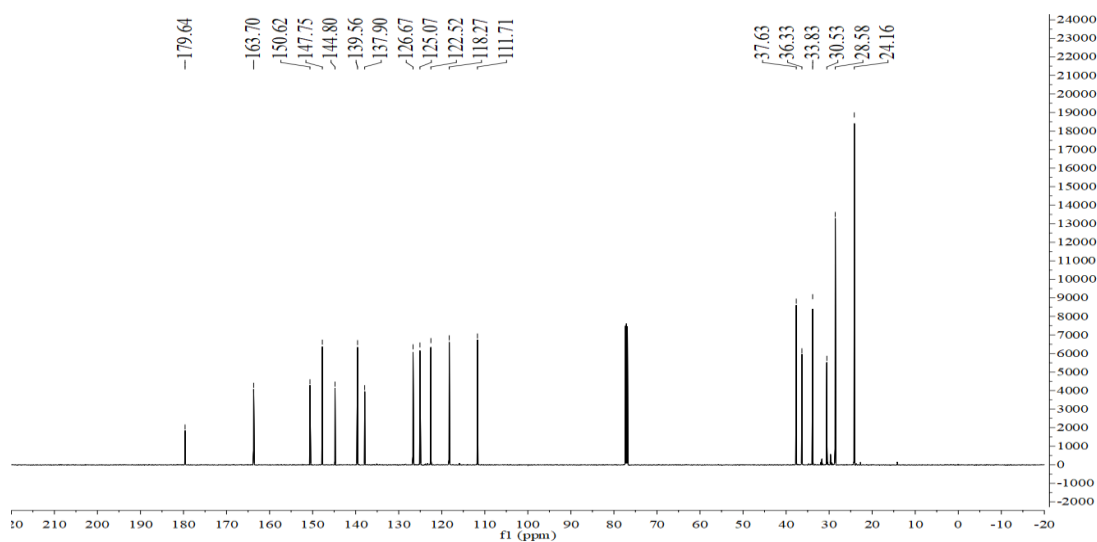


Figure S171. ^{13}C -NMR spectrum of **7t**.

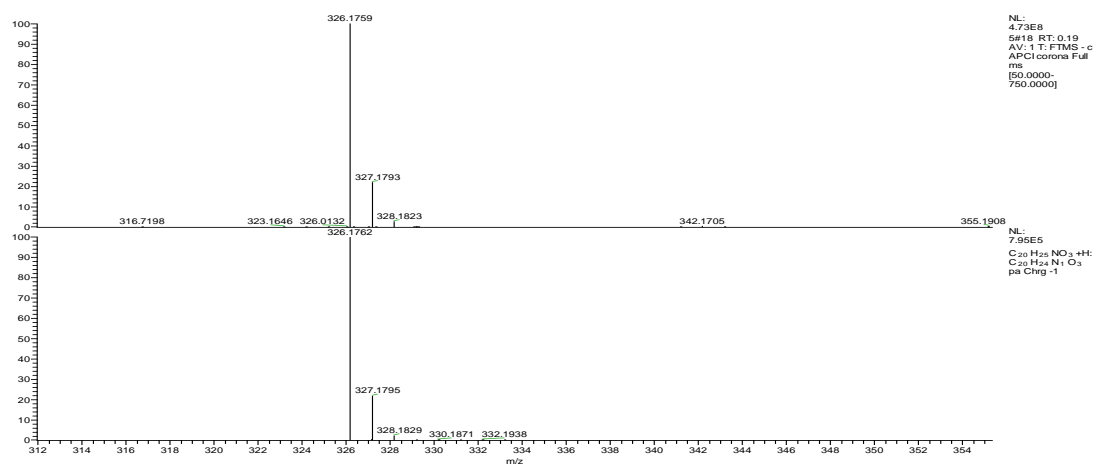
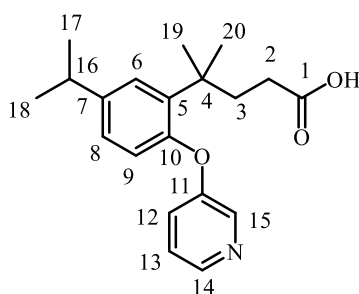


Figure S172. ESI-MS spectrum of **7t**.



7u, white solid; yield 98.2%; m. p. 131.5– 132.6 °C; FT-IR (KBr, cm^{-1}): 2960, 2926, 2871 (C-H), 1710 (C=O), 1574, 1490, 1476, 1427, 1245, 1200, 1081 (Ar-C=C); ^1H NMR (600 MHz, CDCl_3) δ 8.31 (d, $J = 23.2$ Hz, 2H, $\text{C}_{14}\text{-H}$, $\text{C}_{15}\text{-H}$), 7.33 (s, 1H, $\text{C}_{12}\text{-H}$), 7.29 (s, 1H, $\text{C}_6\text{-H}$), 7.17 (s, 1H, $\text{C}_{13}\text{-H}$), 7.02 (d, $J = 10.2$ Hz, 1H, $\text{C}_8\text{-H}$), 6.71 (d, $J = 8.3$ Hz, 1H, $\text{C}_9\text{-H}$), 2.92 – 2.85 (m, 1H, $\text{C}_{16}\text{-H}$), 2.13 (dd, $J = 26.7, 10.2$ Hz, 4H, $\text{C}_2\text{-H}$, $\text{C}_3\text{-H}$), 1.40 (s, 6H, $\text{C}_{19}\text{-H}$, $\text{C}_{20}\text{-H}$), 1.24 (d, $J = 6.9$ Hz, 6H, $\text{C}_{17}\text{-H}$, $\text{C}_{18}\text{-H}$); ^{13}C NMR (151 MHz, CDCl_3) δ 178.01, 152.47, 144.67, 142.74, 139.96, 137.68, 127.03, 126.08, 125.27, 124.45, 119.79, 37.82, 36.32, 33.79, 30.74, 29.70, 28.44, 24.16; ESI-MS m/z : 326.1760 $[\text{M} + \text{H}^+]$.

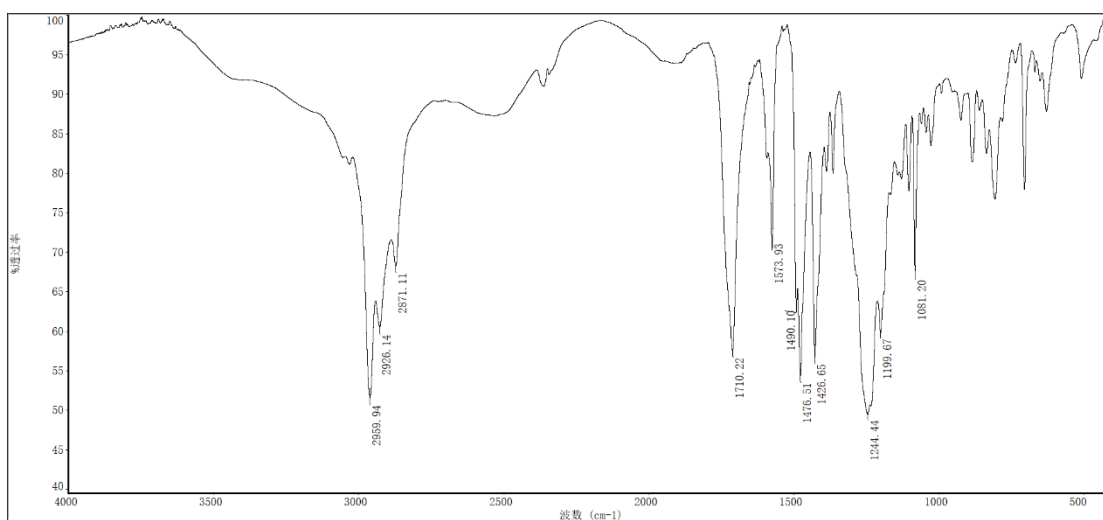


Figure S173. FT-IR spectrum of **7u**.

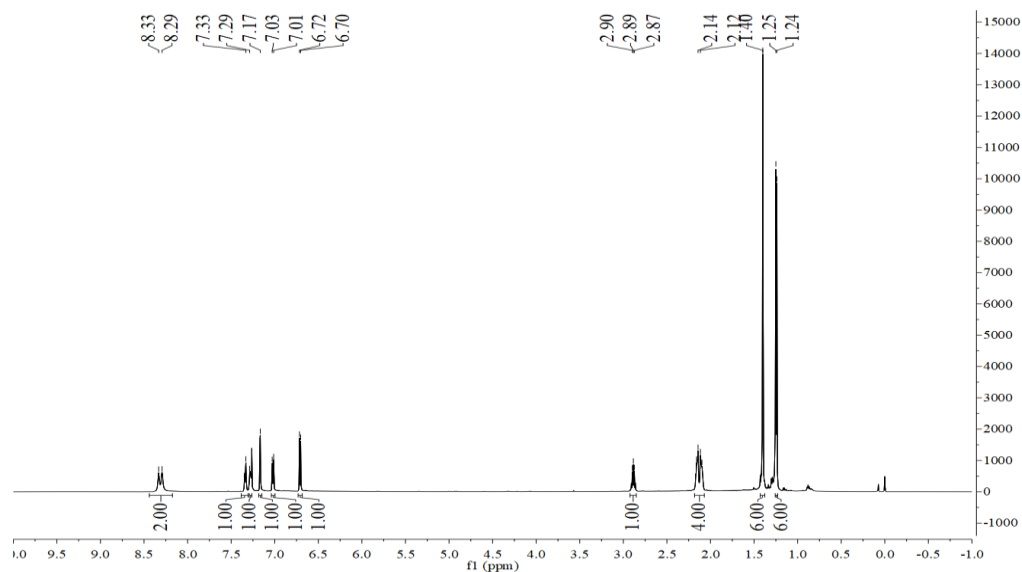


Figure S174. ^1H -NMR spectrum of **7u**.

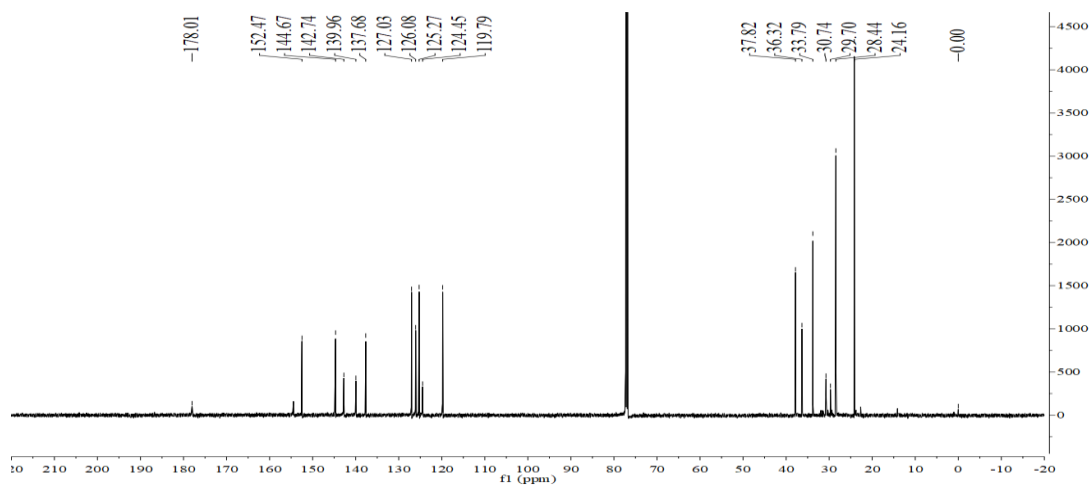


Figure S175. ^{13}C -NMR spectrum of **7u**.

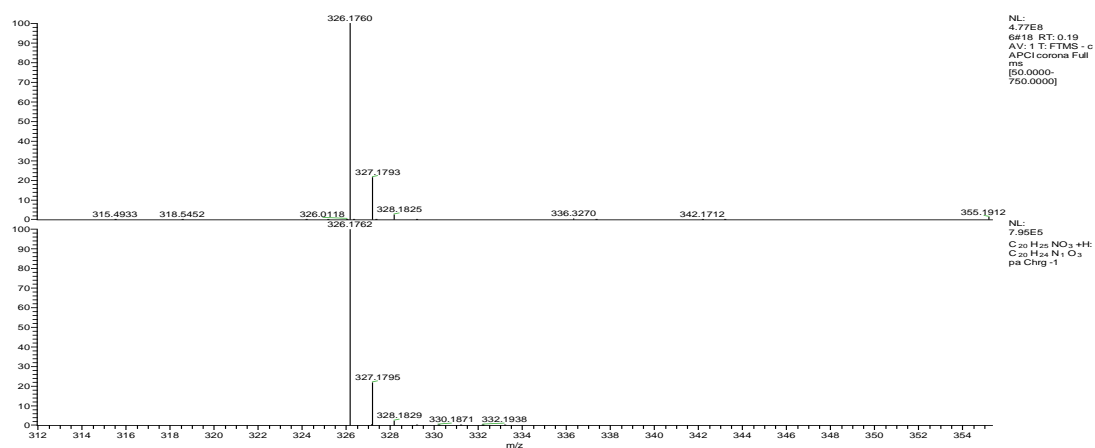
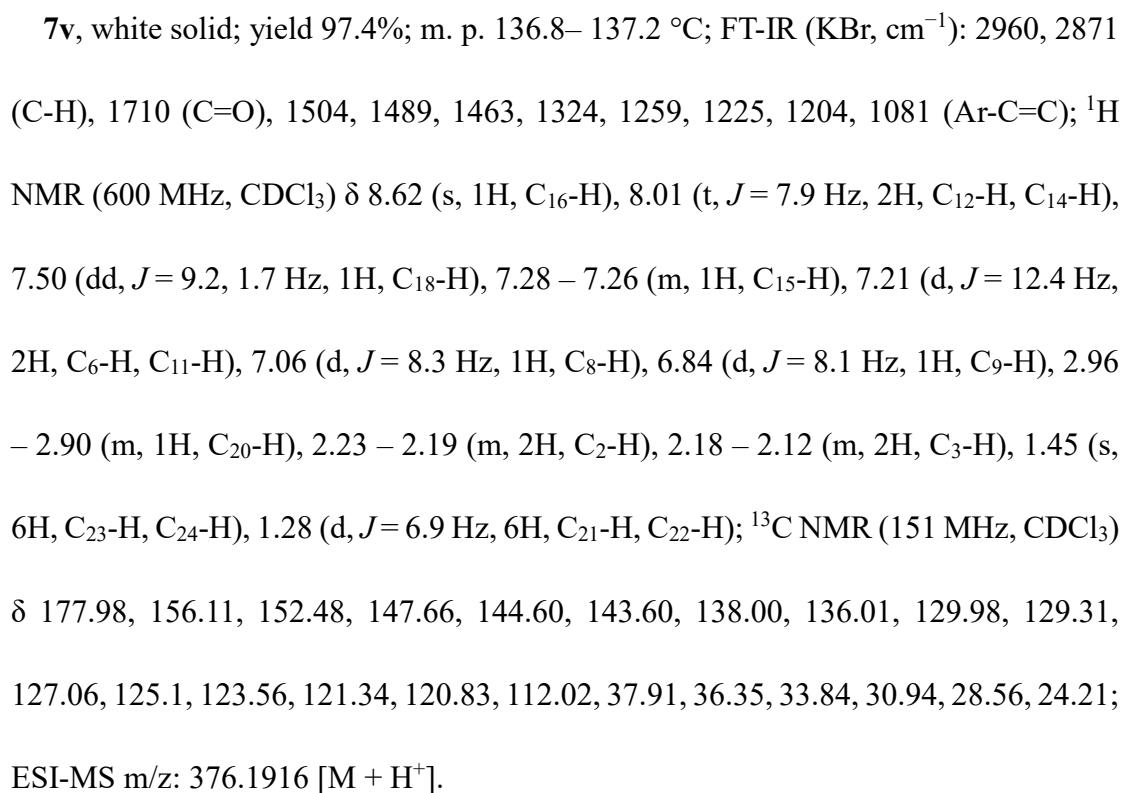


Figure S176. ESI-MS spectrum of **7u**.



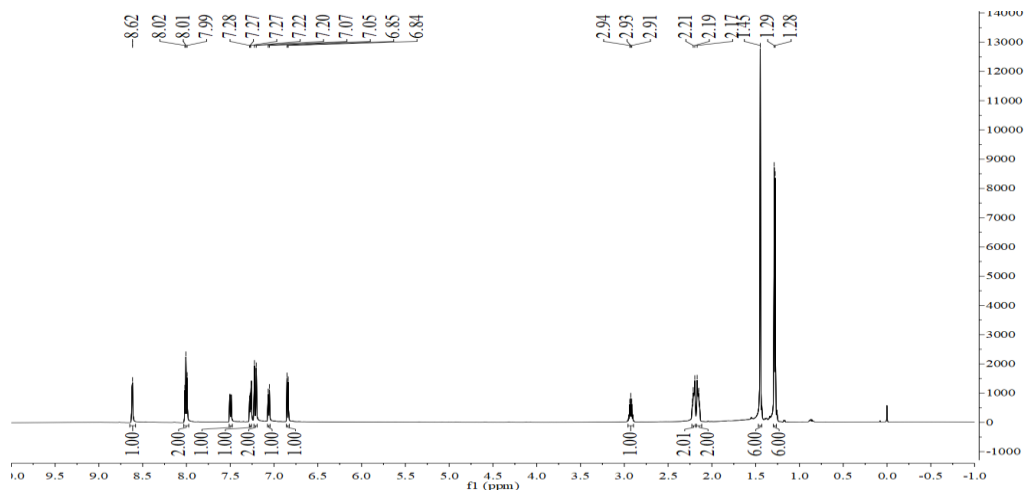


Figure S178. ^1H -NMR spectrum of **7v**.

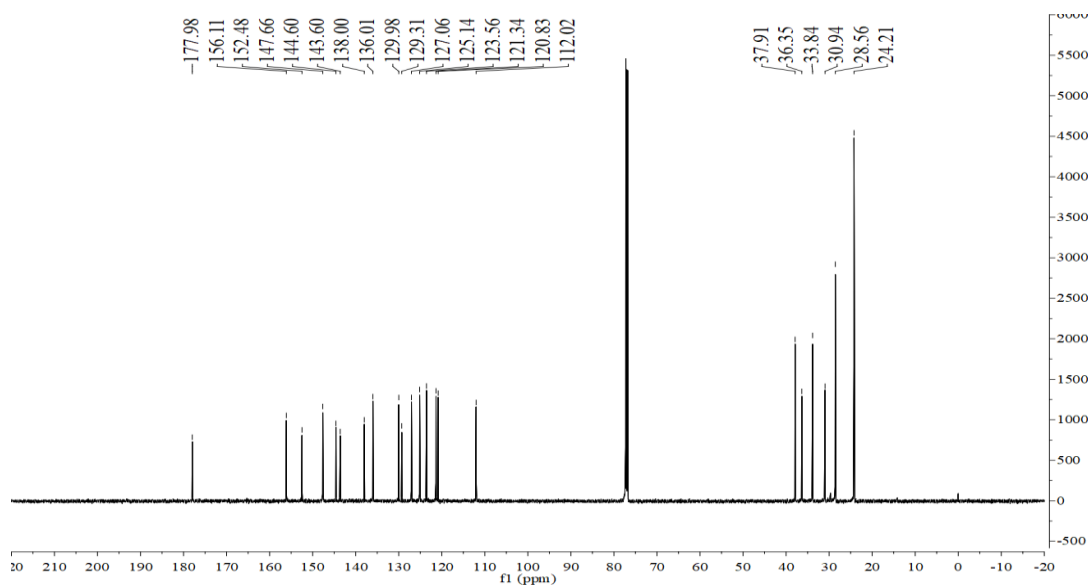


Figure S179. ^{13}C -NMR spectrum of **7v**.

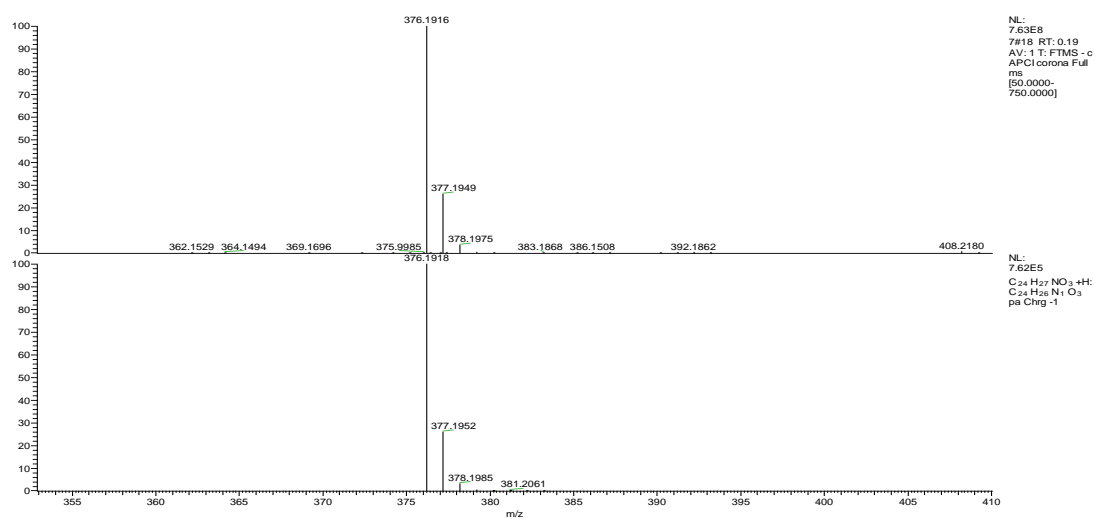


Figure S180. ESI-MS spectrum of **7v**.