# Facile and Efficient Synthesis of Quinolin-2(1*H*)-ones via Cyclization of Penta-2,4-dienamides Mediated by $H_2SO_4$

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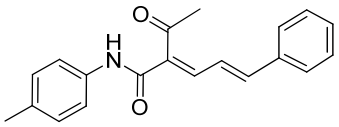
## Supplementary information

# Ⅰ. Synthesis and analytical data of substrates 1

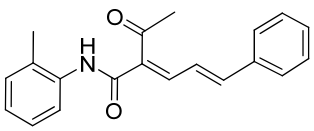
Typical procedure for the synthesis of substituted penta-2,4-dienamides **1** (**1a** as an example): To a 100 mL round-bottomed flask was added 3-oxo-*N*-*p*-tolylbutanamide (0.96 g, 5.0 mmol), cinnamaldehyde (0.66 g, 5.0 mmol), piperidine (0.1 mmol) and ethanol (30 mL). Then the mixture was heated under reflux for 3.5 h, and cooled to room temperature. The resulting mixture was slowly poured into saturated aqueous NaCl (100 mL), and extracted with dichloromethane (3 × 30 mL). The combined organic phase was washed with water (3 × 30 mL) and dried over anhydrous $Na_2SO_4$. The solvent was removed under reduced pressure, and the crude product was purified by flash chromatography (silica gel, petroleum ether: ethyl acetate10:1) to give **1a** as yellow solid (1.25 g, 82%).

Substrate **1b** is known compound, its spectral and analytical data are in good agreement with those reported in the literature (N. Raman, *J. Indian Chem. Soc.* 2007, **84**, 29).



**2-Acetyl-5-phenyl-*N*-*p*-tolylpenta-2,4-dienamide (1a)**

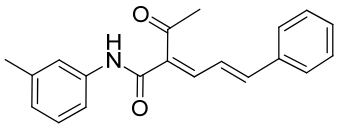
Yellow solid: mp 109-111 °C; $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ 2.33 (s, 3H), 2.54 (s, 3H), 7.12-7.17 (m, 3H), 7.36-7.40 (m, 3H), 7.39 (d, $J$ = 8.4 Hz, 2H), 7.58-7.62 (m, 3H), 8.28-8.35 (dd, $J_1$=8.4 Hz, $J_2$=3.3 Hz, 1H), 10.10 (s, 1H); $^{13}$C NMR (75 MHz, $CDCl_3$): $\delta$ 20.89, 27.57, 120.47, 125.26, 128.29, 128.85, 129.44, 130.16, 131.04, 133.91, 135.46, 135.63, 147.13, 150.70, 162.76, 199.84; IR (KBr, cm$^{-1}$): 3024, 1670, 1574, 1446, 1350, 973, 768, 747; Anal. Calcd for $C_{20}H_{19}NO_2$: C, 78.66; H, 6.27; N, 4.59. Found: C, 78.54; H, 6.34; N, 4.67.



**2-Acetyl-5-phenyl-*N*-*o*-tolylpenta-2,4-dienamide (1c)**

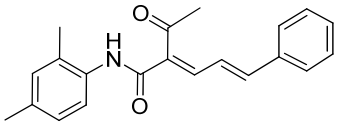
Yellow solid: mp 129-130 °C; $^1$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.38(s, 3H), 2.58 (s, 3H), 7.07 (t, $J$ = 14.7 Hz, 1H), 7.14 (s, 1H), 7.21 (d, $J$ = 9.6 Hz, 2H), 7.38 (t, $J$ =

2.1Hz, 3H), 7.61-7.65 (m, 2H), 7.69 (s, 1H), 8.13 (d, $J$ = 7.8 Hz, 1H), 8.39-8.48 (dd, $J_1$=10.8 Hz, $J_2$=4.5 Hz, 1H), 10.25 (s, 1H); $^{13}$C NMR (75 MHz, $CDCl_3$): $\delta$ 18.02, 27.46, 122.21, 124.50, 125.51, 126.40, 128.24, 128.75, 130.13, 130.29, 135.54, 136.21, 147.48, 152.17, 162.39, 200.49; IR (KBr, cm$^{-1}$): 3183, 3042, 1673, 1585, 1453, 1378, 976, 769, 750; Anal. Calcd for $C_{20}H_{19}NO_2$: C, 78.66; H, 6.27; N, 4.59. Found: C, 78.73; H, 6.41; N, 4.40.



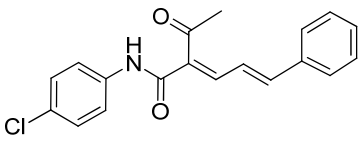
**2-Acetyl-5-phenyl-*N*-(*m*-tolyl)penta-2,4-dienamide (1d)**

Yellow solid: mp 110-112 °C; $^1$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.37(s, 3H), 2.55 (s, 3H), 6.95 (d, $J$ = 6.0 Hz, 1H), 7.16 (d, $J$ = 15.0 Hz, 1H), 7.23 (d, $J$ = 6.0 Hz, 1H), 7.36-7.41 (m, 3H), 7.46 (d, $J$ = 9.0 Hz, 1H), 7.52 (s, 1H), 7.59-7.64 (m, 3H), 8.28-8.37 (dd, $J_1$=12.0 Hz, $J_2$=3.0 Hz, 1H), 10.18 (s, 1H); $^{13}$C NMR (75 MHz, $CDCl_3$): $\delta$ 21.44, 27.56, 117.57, 121.06, 125.14, 125.33, 128.28, 128.71, 128.81, 130.17, 130.71, 1356.58, 137.83, 138.75, 147.34, 151.31, 162.58, 200.07; IR (KBr, cm$^{-1}$): 3447, 1664, 1650, 1591, 1566, 1489, 1375, 972, 754, 690; Anal. Calcd for $C_{20}H_{19}NO_2$: C, 78.66; H, 6.27; N, 4.59. Found: C, 78.24; H, 6.09; N, 4.94.



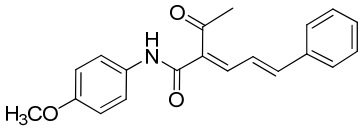
**2-Acetyl-*N*-(2,4-dimethylphenyl)-5-phenylpenta-2,4-dienamide (1e)**

Yellow solid: mp 129-130 °C; $^1$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.31 (s, 3H), 2.34 (s, 3H), 2.57 (s, 3H), 7.06 (d, $J$ = 7.8 Hz, 2H), 7.16 (d, $J$ = 16.2 Hz, 1H), 7.39 (d, $J$ = 3.6 Hz, 3H), 7.62 (t, $J$ = 4.5 Hz, 2H), 7.76 (s, 1H), 7.95 (d, $J$ = 7.5 Hz, 1H), 8.37-8.46 (dd, $J_1$=10.8 Hz, $J_2$=4.5 Hz, 1H), 10.10 (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ 18.02, 20.84, 27.60, 122.61, 125.75, 127.04, 128.35, 128.86, 129.08, 130.19, 130.60, 131.09, 133.62, 134.36, 135.73, 147.36, 152.00, 162.47, 200.59; IR (KBr, cm$^{-1}$): 3179, 3023, 1672, 1594, 1538, 1445, 1378, 976, 742; Anal. Calcd for $C_{21}H_{21}NO_2$: C, 78.97; H, 6.63; N, 4.39. Found: C, 78.74; H, 6.76; N, 4. 51.



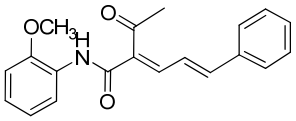
**2-Acetyl-*N*-(4-chlorophenyl)-5-phenylpenta-2,4-dienamide (1f)**

White solid: mp 76-77 °C; $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.56 (s, 3H), 7.18 (d, $J$ = 15.6 Hz, 1H), 7.31 (d, $J$ = 8.7 Hz, 2H), 7.38-7.41 (m, 3H), 7.61-7.68 (m, 5H), 8.35-8.44 (dd, $J_1$=11.4 Hz, $J_2$=4.2 Hz, 1H), 10.45 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 27.64, 121.71, 125.48, 128.44, 128.93, 129.148, 129.68, 130.44, 135.57, 136.60, 148.18, 152.82, 162.47, 200.62; IR (KBr, cm$^{-1}$): 3292, 1718, 1670, 1591, 1537, 1490, 1385, 829, 748, 700; Anal. Calcd for $C_{19}H_{16}ClNO_2$: C, 70.05; H, 4.95; N, 4.30. Found: C, 70.24; H, 4. 82; N, 4. 52.



**2-Acetyl-*N*-(4-methoxyphenyl)-5-phenylpenta-2,4-dienamide (1g)**

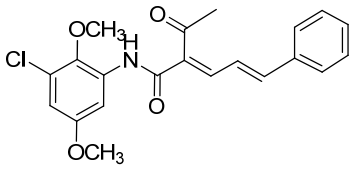
Orange solid: mp 116-118 °C; $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.55 (s, 3H), 3.81 (s, 3H), 6.90 (d, $J$ = 9.0 Hz, 2H), 7.14 (d, $J$ = 15.6 Hz, 1H), 7.37 (d, $J$ = 2.1 Hz, 2H), 7.38 (d, $J$ = 1.5 Hz, 1H), 7.55-7.63 (m, 5H), 8.30-8.39 (dd, $J_1$=11.4 Hz, $J_2$=4.2 Hz, 1H), 10.10 (s, 1H); $^{13}$C NMR ( 100 MHz, $CDCl_3$): $\delta$ 27.45, 55.30, 114.00, 122.02, 125.26, 128.17, 128.74, 130.04, 130.86, 131.07, 135.56, 146.97, 150.69, 156.32, 162.50, 199.85; IR (KBr, cm$^{-1}$): 3121, 3056, 1664, 1579, 1452, 1359, 973, 762, 751; Anal. Calcd for $C_{20}H_{19}NO_3$: C, 74.75; H, 5.96; N, 4.36. Found: C, 74.88; H, 5.86; N, 4. 45.



**2-Acetyl-*N*-(2-methoxyphenyl)-5-phenylpenta-2,4-dienamide (1h)**

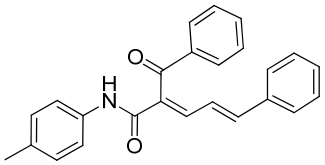
Orange solid: mp 111-112 °C; $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.54 (s, 3H), 3.93 (s, 3H), 6.92 (d, $J$ = 7.2 Hz,1H), 7.02 (d, $J$ = 8.1 Hz,1H), 7.09 (t, $J$ = 8.1 Hz, 1H), 7.17 (s, 1H), 7.59 (d, $J$ = 8.7 Hz, 3H), 8.16(t, $J$ = 12.0 Hz, 1H), 8.52 (d, $J$ = 7.8 Hz, 1H), 10.20 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 27.38, 55.70, 110.05, 120.38, 120.75, 123.93, 125.09, 127.69, 128.09, 128.70, 129.95, 131.62, 135.55, 146.69, 148.69, 149.98, 162.53, 199.26; IR (KBr, cm$^{-1}$): 3176, 3093, 1671, 1575, 1456, 1384, 768,

747; Anal. Calcd for $C_{20}H_{19}NO_3$: C, 74.75; H, 5.96; N, 4.36. Found: C, 74.91; H, 5.88; N, 4. 29.



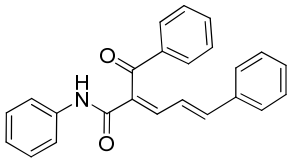

**2-Acetyl-*N*-(3-chloro-2,5-dimethoxyphenyl)-5-phenylpenta-2,4-dienamide (1i)**

Yellow solid: mp 143-144 °C; $^1$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.56 (s, 3H), 3.90 (s, 3H), 3.96 (s, 3H),6.93 (s, 1H), 7.18 (d, $J$=15.0 Hz, 1H), 7.40 (d, $J$ = 6.0 Hz, 3H), 7.61-7.65 (m, 3H), 8.19-8.28 (dd, $J_1$=12.0 Hz, $J_2$=4.0 Hz, 1H), 8.42 (s, 1H), 10.51 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 27.43, 56.51, 56.70, 105.51, 112.33, 115.74, 125.12, 127.29, 128.25, 128.78, 130.19, 130.55, 135.50, 142.85, 147.53, 148.83, 151.40, 162.41, 199.74; IR (KBr, cm$^{-1}$): 3134, 1674, 1593, 1529, 1489, 1398, 1213, 733; Anal. Calcd for $C_{21}H_{20}ClNO_4$: C, 65.37; H, 5.22; N, 3.63. Found: C, 65.14; H, 5.29; N, 3.91.



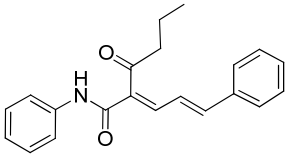

**2-Benzoyl-5-phenyl-*N*-(*p*-tolyl)penta-2,4-dienamide (1j)**

Yellow solid: mp 166-167 °C; $^1$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.34 (s, 3H), 6.95 (d, $J$ = 15.0 Hz, 1H),7.16-7.23 (m, 3H), 7.34-7.37 (m, 3H), 7.48-7.65 (m, 7H), 7.81 (d, $J$ = 1.5 Hz, 1H), 7.84 (s, 1H), 8.27-8.36 (dd, $J_1$=12.0 Hz, $J_2$=3.0 Hz, 1H), 10.36 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 20.86, 120.42, 124.98, 128.18, 128.49, 128.75, 129.41, 129.91, 130.00, 132.90, 133.88, 135.34, 135.65, 137.98, 146.70, 153.24, 162.05, 198.20; IR (KBr, cm$^{-1}$): 3252, 1680, 1593, 1575, 1539, 1514, 1406, 980, 825; Anal. Calcd for $C_{25}H_{21}NO_2$: C, 81.72; H, 5.76; N, 3.81. Found: C, 81.92; H, 5.57; N, 3.62.



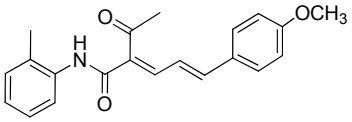

**2-Benzoyl-*N*, 5-diphenylpenta-2,4-dienamide (1k)**

Yellow solid: mp 134-135 °C; $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 6.43-6.52 (dd, $J_1$=12.0 Hz, $J_2$=3.0 Hz, 1H), 7.04 (d, $J$ = 9.3 Hz, 1H), 7.10-7.15 (m, 3H), 7.35 (t, $J$=7.5Hz, 3H), 7.53 (t, $J$ = 7.5 Hz, 2H), 7.63-7.67 (m, 2H), 7.97 (d, $J$ = 7.2 Hz, 2H), 8.06 (d, $J$ = 1.5 Hz, 1H), 9.48 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 120.20, 123.84, 124.38, 127.56, 128.81, 128.97, 129.06, 129.74, 129.90, 131.21, 134.19, 135.52, 137.93, 138.61, 143.81, 146.21, 161.88, 198.17; IR (KBr, cm$^{-1}$): 3292, 2923, 1672, 1629, 1603, 1546, 1499, 974, 748, 686; Anal. Calcd for $C_{24}H_{19}NO_2$: C, 81.56; H, 5.42; N, 3.96. Found: C, 81.83; H, 5.28; N, 4.05.



**3-Oxo-*N*-phenyl-2-(3-phenylallylidene)hexanamide (1l)**

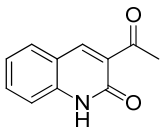
Yellow oil: $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 0.97 (t, $J$ = 9.0 Hz, 3H), 1.65-1.73 (m, 2H), 2.75-2.80 (m, 2H), 7.04-7.13 (m, 2H), 7.30-7.36 (m, 5H), 7.50-7.53 (m, 3H), 7.68 (d, $J$ = 9.0 Hz, 2H), 8.08-8.17 (dd, $J_1$=12.0 Hz, $J_2$=6.0 Hz, 1H), 10.19 (s, 1H); $^{13}$C NMR (150 MHz, $CDCl_3$): $\delta$ 13.63, 17.97, 41.02, 46.33, 120.34, 124.23, 125.08, 128.10, 128.73, 128.82, 129.98, 135.54, 137.89, 146.69, 149.33, 162.91, 202.14; IR (KBr, cm$^{-1}$): 3288, 1670, 1597, 1578, 1537, 1497, 974, 750, 690; Anal. Calcd for $C_{21}H_{21}NO_2$: C, 78.97; H, 6.63; N, 4.39. Found: C, 79.45; H, 6.39; N, 4.52.



**2-Acetyl-5-(4-methoxyphenyl)-*N*-*o*-tolylpenta-2,4-dienamide (1m)**

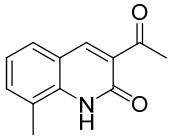
Orange solid: m.p 133-135 °C; $^{1}$H NMR (300 MHz, $CDCl_3$): $\delta$ 2.38 (s, 3H), 2.56 (s, 3H), 3.85 (s, 3H), 6.91 (d, $J$ = 9.0 Hz, 2H), 7.04-7.10 (m, 2H), 7.15-7.24 (m, 1H), 7.58 (d, $J$ = 9.0 Hz, 2H), 7.67 (d, $J$ = 12.0 Hz, 1H), 8.14 (d, $J$ = 6.0 Hz, 1H), 8.32-8.40 (dd, $J_1$=9.0 Hz, $J_2$=6.0 Hz, 1H), 10.40 (s, 1H)； $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ 18.12, 27.56, 55.33, 114.35, 122.24, 123.64, 124.42, 126.46, 128.53, 128.63, 128.73, 129.74, 130.20, 130.32, 136.42, 148.01, 153.56, 161.53, 162.70, 200.62; IR (KBr, cm$^{-1}$): 3447, 1666, 1609, 1585, 1379, 1263, 822, 752; Anal. Calcd for $C_{21}H_{21}NO_3$: C, 75.20; H, 6.31; N, 4.18. Found: C, 75.71; H, 6.25; N, 4. 33.

## Ⅱ. Analytical data of products 2b-k



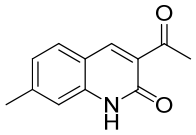
**3-Acetylquinolin-2(1*H*)-one (2b)**

White solid: mp 236-238 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.62 (s, 3H), 7.23 (t, $J$ = 7.5 Hz, 1H), 7.35 (d, $J$ = 8.1 Hz, 1H), 7.62 (t, $J$ = 7.5 Hz, 1H), 7.87 (d, $J$ = 8.1 Hz, 1H), 8.46 (s, 1H), 12.12 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 30.60, 114.97, 118.04, 122.28, 129.28, 130.07, 132.82, 140.44, 142.99, 160.42, 197.30; IR (KBr, cm$^{-1}$): 3421, 3003, 1684, 1661, 1601, 1551, 1489, 1352, 758; Anal. Calcd for $C_{11}H_9NO_2$: C, 70.58; H, 4.85; N, 7.48. Found: C, 71.03; H, 4.79; N, 7.56.



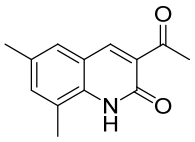
**3-Acetyl-8-methylquinolin-2(1*H*)-one (2c)**

White solid: mp 218-219 °C; $^{1}$H NMR (400 MHz, DMSO): $\delta$ 2.45 (s, 3H), 2.62 (s, 3H), 7.14 (t, $J$ = 7.6 Hz, 1H), 7.46 (d, $J$ = 7.6 Hz, 1H), 7.71 (d, $J$ = 7.6 Hz, 1H), 8.43 (s, 1H), 11.21 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 17.11, 30.57, 118.15, 122.13, 123.46, 128.21, 129.02, 133.98, 138.87, 143.54, 160.84, 197.33; IR (KBr, cm$^{-1}$): 3171, 2924, 2854, 1654, 1475, 1380, 765, 656; Anal. Calcd for $C_{12}H_{11}NO_2$: C, 71.63; H, 5.51; N, 6.96. Found: C, 71.34; H, 5.61; N, 6. 72.



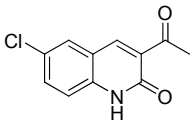
**3-Acetyl-7-methylquinolin-2(1*H*)-one (2d)**

White solid: mp 159-162 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.40 (s, 3H), 2.61 (s, 3H), 7.07 (d, $J$ = 8.1 Hz, 1H), 7.13 (s, 1H), 7.76 (d, $J$ = 8.1 Hz, 1H), 8.43 (s, 1H), 12.06 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 21.65, 30.61, 114.56, 116.00, 123.95, 128.08, 129.95, 140.69, 142.99, 143.65, 160.62, 197.16; IR (KBr, cm$^{-1}$): 3446, 2925, 1685, 1662, 1597, 1560, 1500, 804; Anal. Calcd for $C_{12}H_{11}NO_2$: C, 71.63; H, 5.51; N, 6.96. Found: C, 71.94; H, 5.12; N, 7. 32.



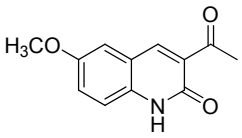
**3-Acetyl-6,8-dimethylquinolin-2(1*H*)-one (2e)**

White solid: mp 239-240 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.31 (s, 3H), 2.42 (s, 3H), 2.62 (s, 3H), 7.32 (s, 1H), 7.50 (s, 1H), 8.36 (s, 1H), 11.20 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 15.68, 19.21, 29.24, 117.74, 122.63, 126.51, 128.96, 130.51, 134.55, 136.38, 141.88, 159.83, 196.40; IR (KBr, cm$^{-1}$): 3157, 2923, 2854, 1685, 1649, 1569, 1468, 774, 596; Anal. Calcd for $C_{13}H_{13}NO_2$: C, 72.54; H, 6.09; N, 6.51. Found: C, 72.39; H, 6.26; N, 6.36.



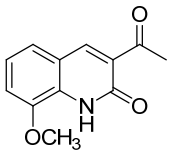
**3-Acetyl-6-chloroquinolin-2(1*H*)-one (2f)**

White solid: mp 121-122 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.61 (s, 3H), 7.36 (d, $J$ = 8.7 Hz, 1H), 7.64-7.68 (dd, $J_1$ = 8.7 Hz, $J_2$ = 2.4 Hz, 1H), 8.02 (d, $J$ = 2.1 Hz, 1H), 8.43 (s, 1H), 12.24 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 30.15, 52.25, 116.94, 120.59, 126.92, 128.62, 132.58, 137.79, 141.81, 165.16, 202.62; IR (KBr, cm$^{-1}$): 3445, 1683, 1660, 1500, 1351, 1213, 775, 603; Anal. Calcd for $C_{11}H_8ClNO_2$: C, 59.61; H, 3.64; N, 6.32. Found: C, 59.93; H, 3.85; N, 6.51.



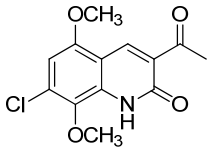
**3-Acetyl-6-methoxyquinolin-2(1*H*)-one (2g)**

White solid: mp 233-234 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.62 (s, 3H), 3.83 (s, 3H), 7.26 (d, $J$ = 8.8 Hz, 1H), 7.33 (d, $J$ = 8.0 Hz, 2H), 8.30 (s, 1H), 11.54-11.55 (m, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 30.60, 55.48, 110.52, 116.34, 118.59, 122.75, 129.53, 135.22, 142.48, 154.33, 160.01, 197.41; IR (KBr, cm$^{-1}$): 3138, 2924, 2854, 1683, 1654, 1505, 1459, 598; Anal. Calcd for $C_{12}H_{11}NO_3$: C, 66.35; H, 5.10; N, 6.45. Found: C, 66.63; H, 5.21; N, 6.29.



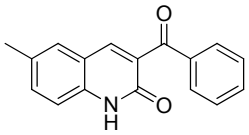
**3-Acetyl-8-methoxyquinolin-2(1*H*)-one (2h)**

White solid: mp 171-172 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.45 (s, 3H), 2.63 (s, 3H), 7.15 (t, $J$ = 7.5 Hz, 1H), 7.47 (d, $J$ = 7.2 Hz, 1H), 7.72 (d, $J$ = 7.5 Hz, 1H), 8.44 (s, 1H), 11.23 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 30.56, 56.12, 113.04, 118.42, 121.44, 122.30, 129.99, 130.50, 142.90, 145.43, 160.02, 197.48; IR (KBr, cm$^{-1}$): 3184, 2924, 2853, 1683, 1654, 1521, 1484, 728; Anal. Calcd for $C_{12}H_{11}NO_3$: C, 66.35; H, 5.10; N, 6.45. Found: C, 66.15; H, 5.19; N, 6.51.



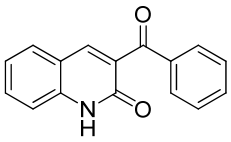
**3-Acetyl-7-chloro-5,8-dimethoxyquinolin-2(1*H*)-one (2i)**

White solid: mp 123-125 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.62 (s, 3H), 3.86 (s, 3H), 3.91 (s, 3H),7.34 (s, 1H), 8.35 (s, 1H), 11.59 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 30.55, 56.78, 62.21, 113.36, 114.41, 118.07, 130.45, 130.67, 136.43, 142.47, 146.28, 159.63, 197.35; IR (KBr, cm$^{-1}$): 3446, 1682, 1654, 1602, 1489, 1234, 764, 752; Anal. Calcd for $C_{13}H_{12}ClNO_4$: C, 55.43; H, 4.29; N, 4.97. Found: C, 56.05; H, 4.18; N, 5.11.



**3-Benzoyl-6-methylquinolin-2(1*H*)-one (2j)**

White solid: mp 279-281 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 2.36 (s, 3H), 7.29 (d, $J$ = 6.0 Hz, 1H), 7.46 (d, $J$ = 9.0 Hz, 1H), 7.52 (t, $J$ = 6.0 Hz, 2H), 7.58 (s, 1H), 7.66 (t, $J$ = 6.0 Hz, 1H), 7.82 (d, $J$ = 6.0 Hz, 2H), 8.13 (s, 1H), 12.07 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 20.33, 115.16, 118.26, 128.33, 128.59, 129.20, 131.34, 131.84, 133.15, 133.43, 136.66, 137.64, 140.32, 159.70, 194.16; IR (KBr, cm$^{-1}$): 3447, 3028, 1654, 1600, 1566, 1477, 806, 755; Anal. Calcd for $C_{17}H_{13}NO_2$: C, 77.55; H, 4.98; N, 5.32.. Found: C, 77.71; H, 4.79; N, 5.51.

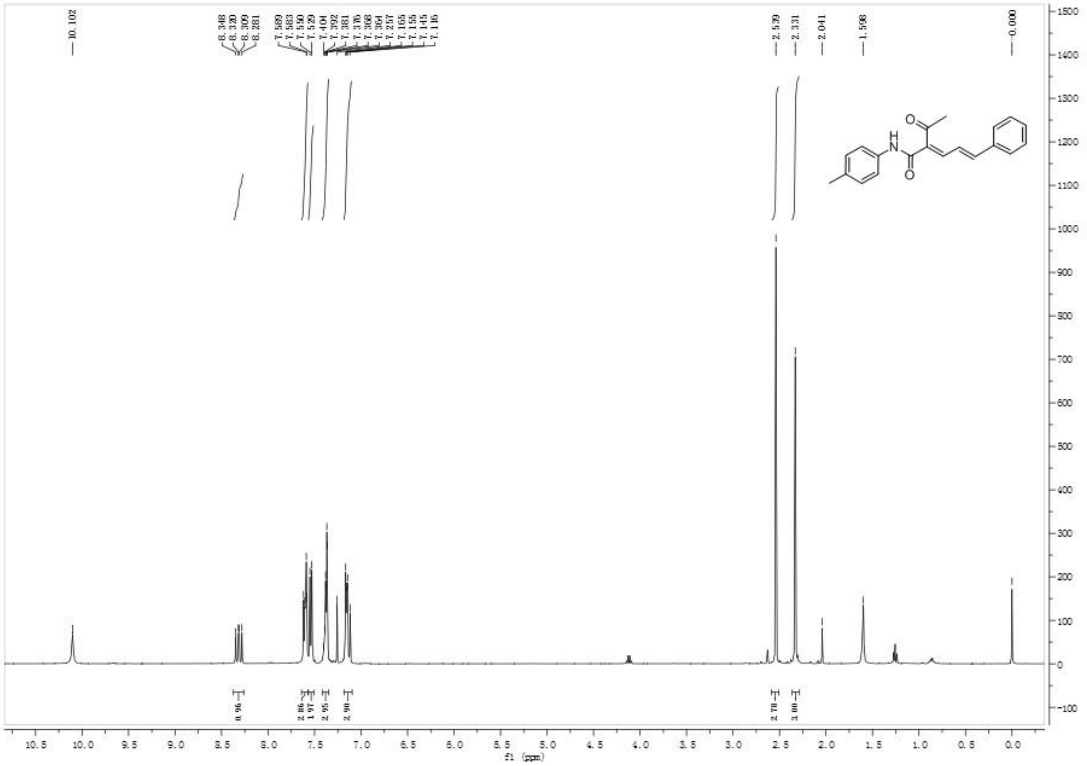


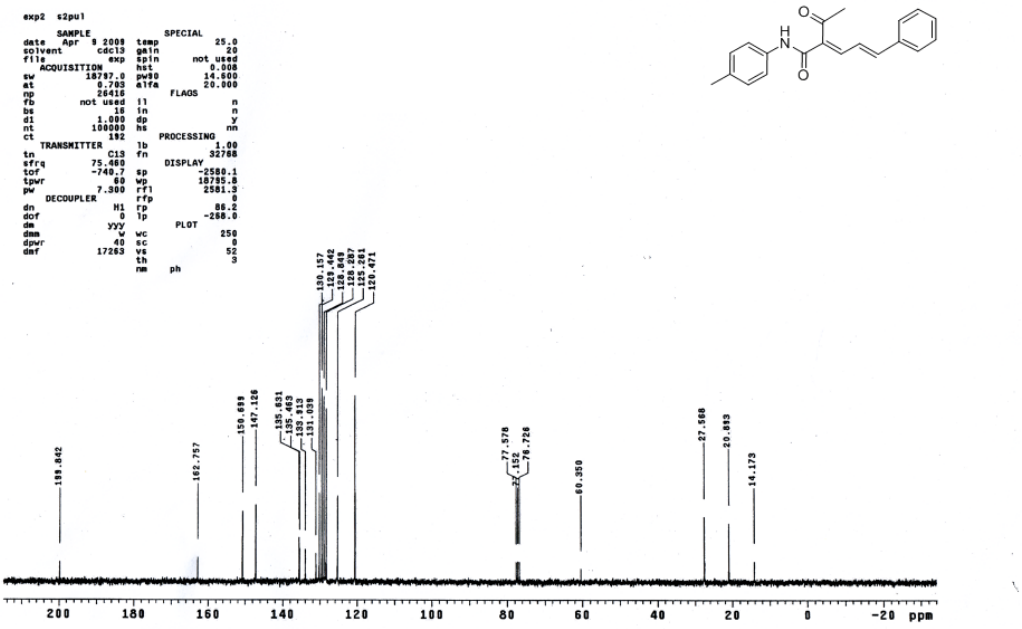
**3-Benzoylquinolin-2(1*H*)-one (2k)**

White solid: mp 246-247 °C; $^{1}$H NMR (300 MHz, DMSO): $\delta$ 7.25 (t, $J$ = 7.5 Hz, 1H), 7.38 (d, $J$ = 8.1 Hz, 1H), 7.55 (t, $J$ = 7.5 Hz, 2H), 7.59-7.69 (m, 2H), 7.78-7.85 (m, 3H), 8.21 (s, 1H), 12.12 (s, 1H); $^{13}$C NMR (100 MHz, DMSO): $\delta$ 115.22, 118.29, 122.27, 128.58, 129.00, 129.20, 131.82, 133.43, 136.61, 139.59, 140.56, 159.78, 194.04; IR (KBr, cm$^{-1}$): 3157, 2923, 2851, 1661, 1581, 1500, 754, 600; Anal. Calcd for $C_{16}H_{11}NO_2$: C, 77.10; H, 4.45; N, 5.62. Found: C, 77.65; H, 4.62; N, 5.71.

# III. Copies of NMR spectra for substrates **1**

**1a**



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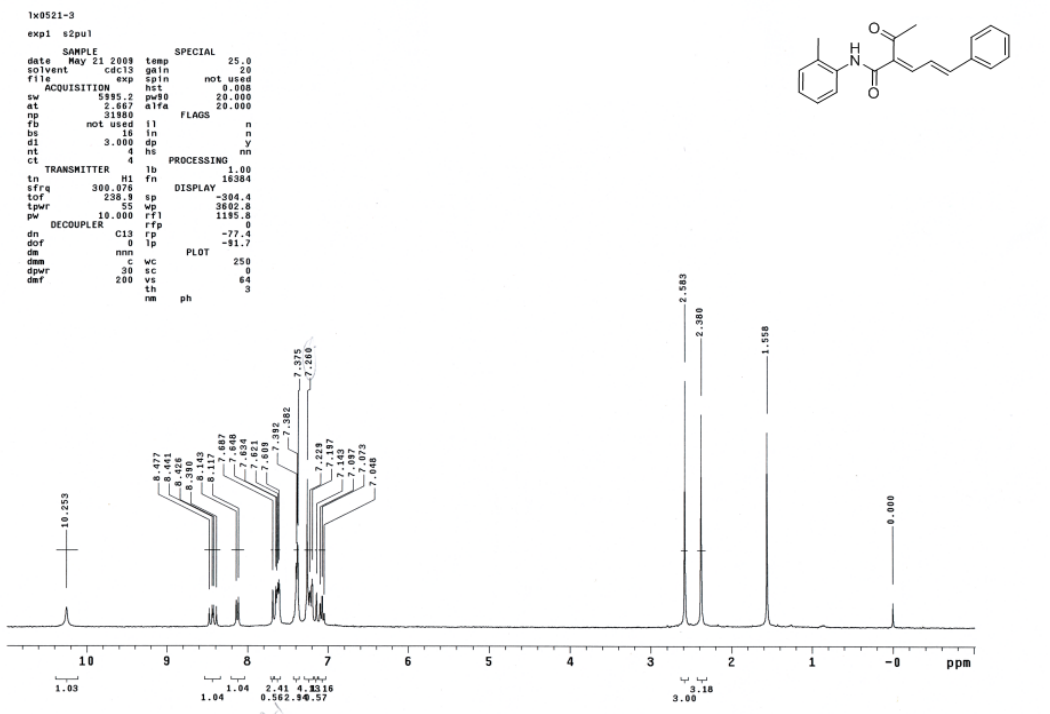
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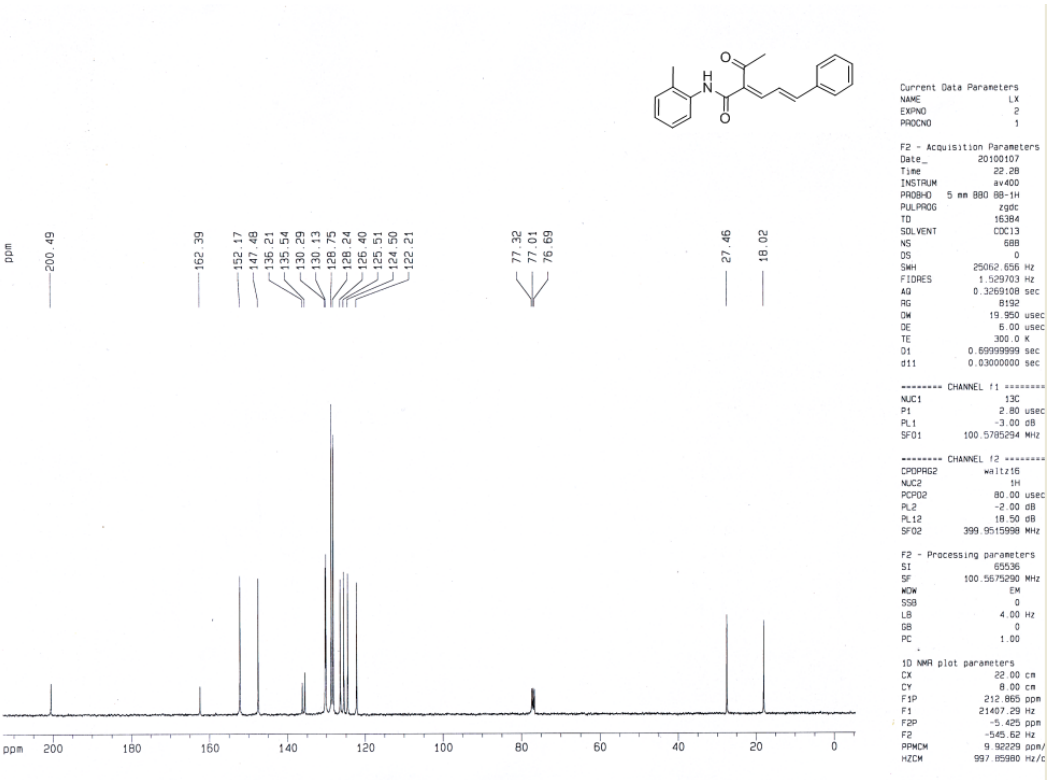
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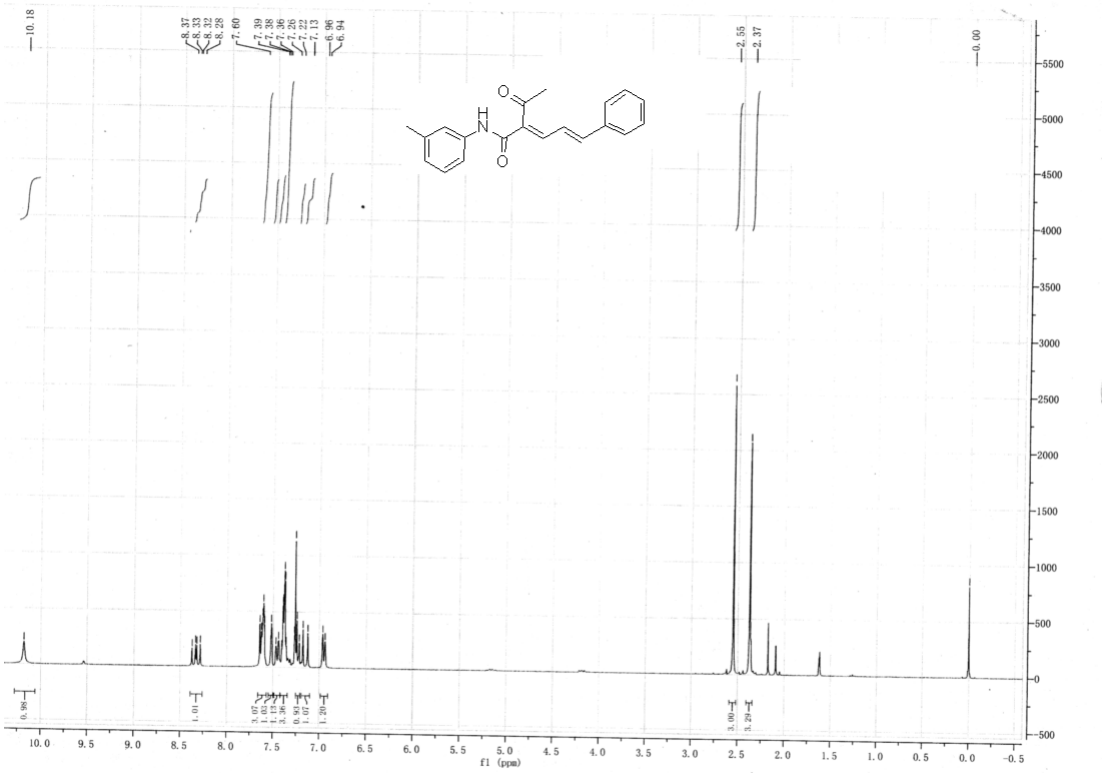


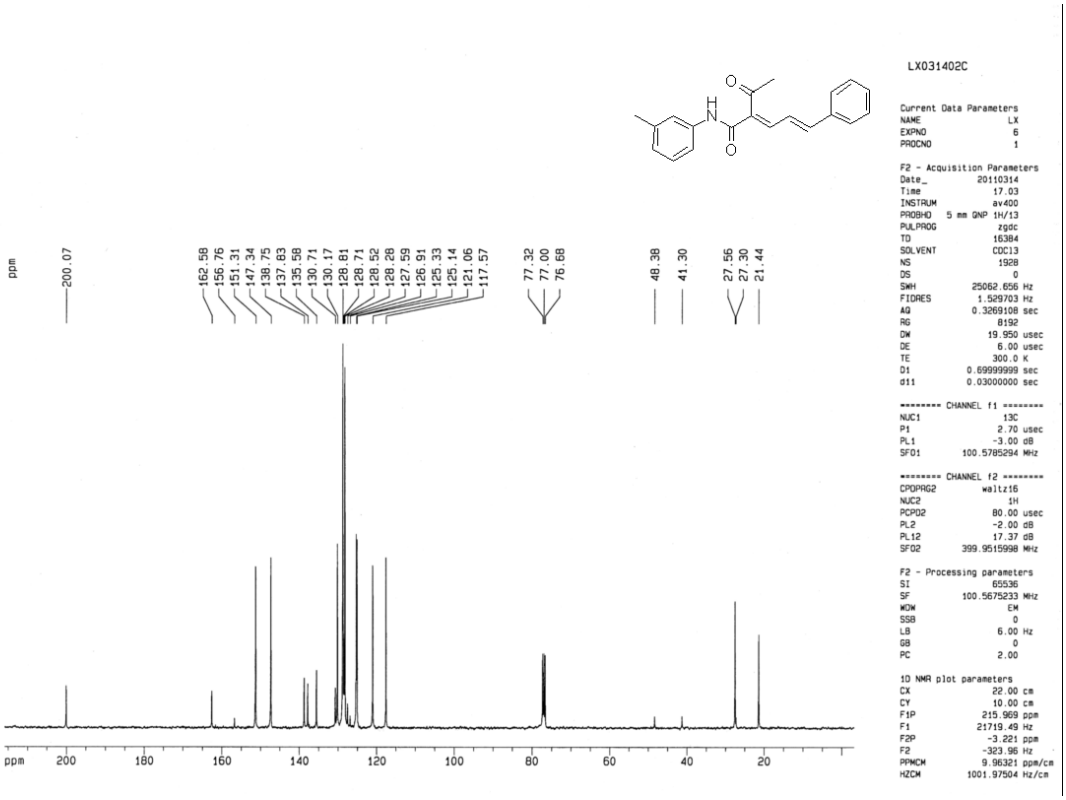

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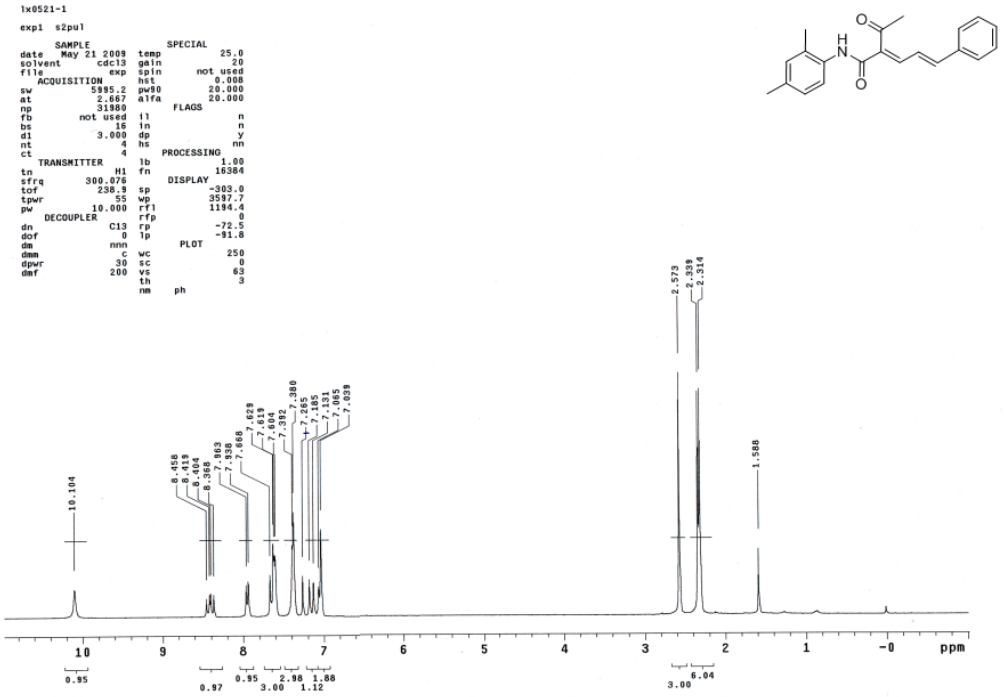
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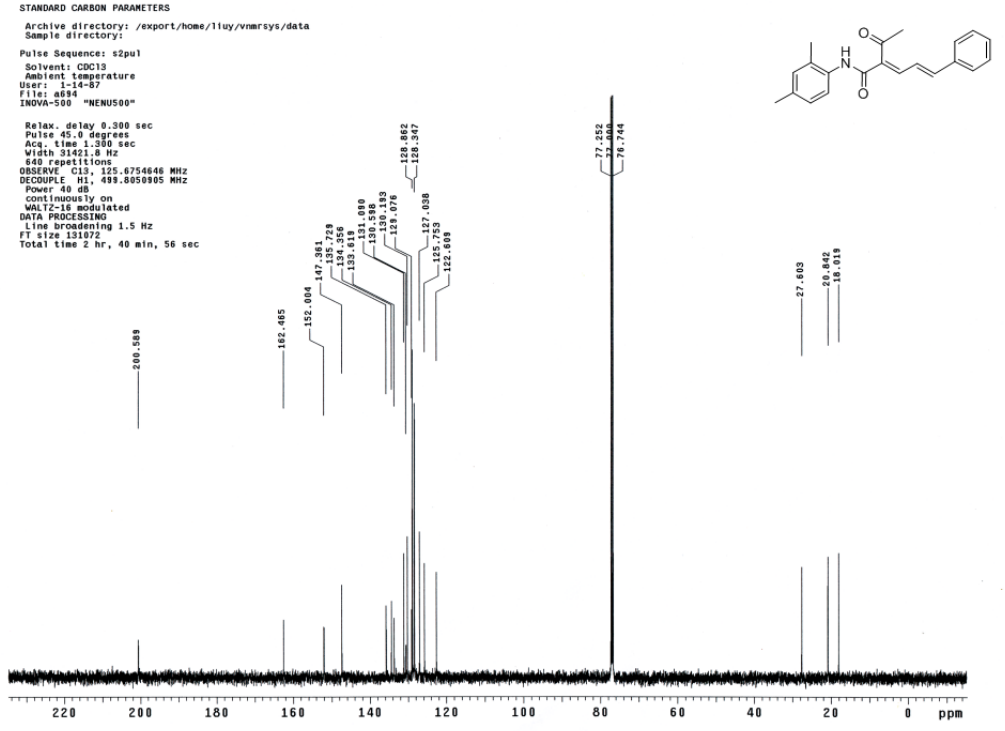
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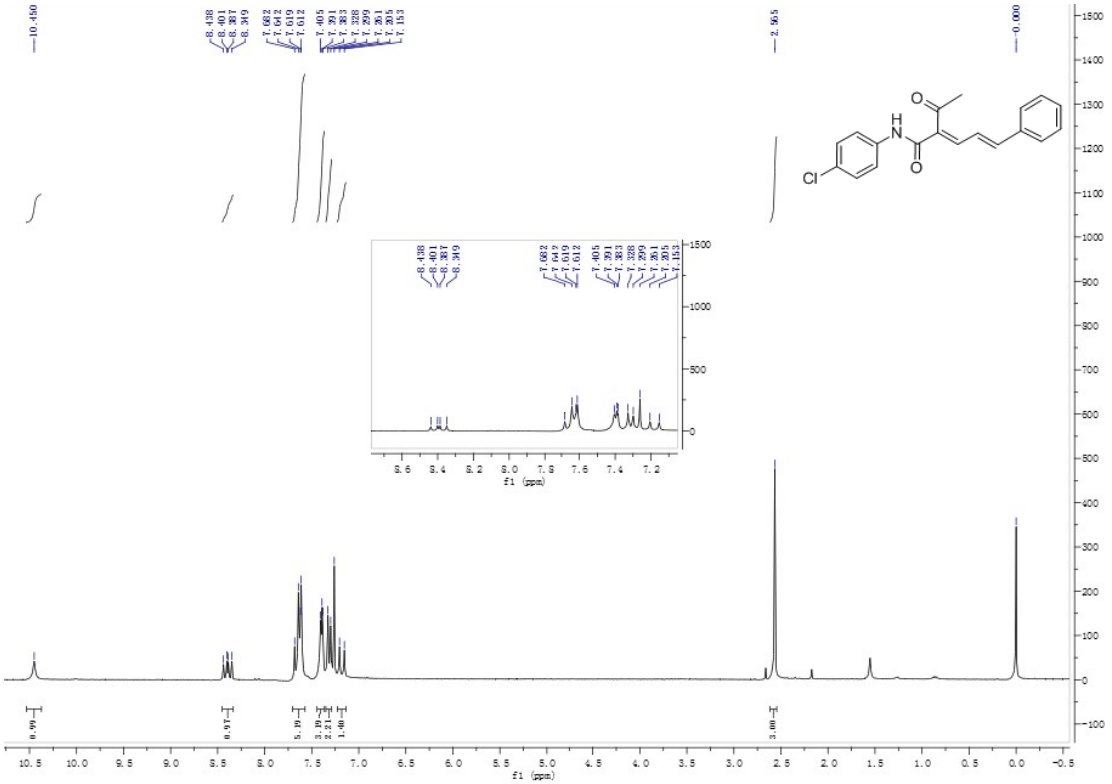


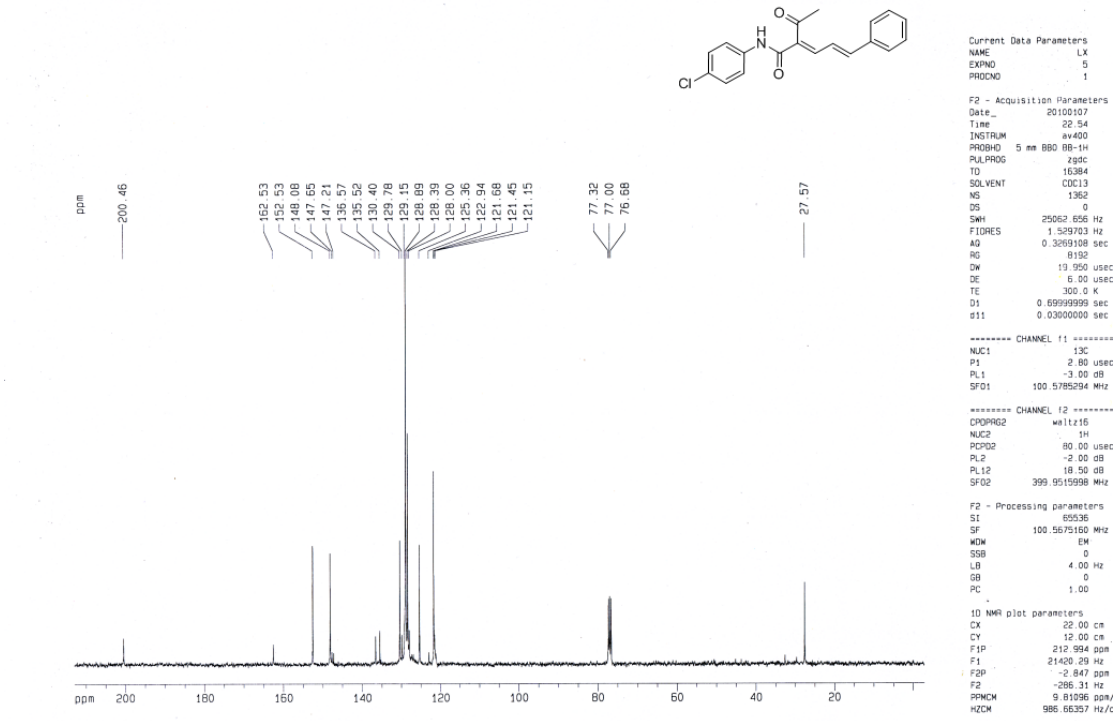


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P1 2.80 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz

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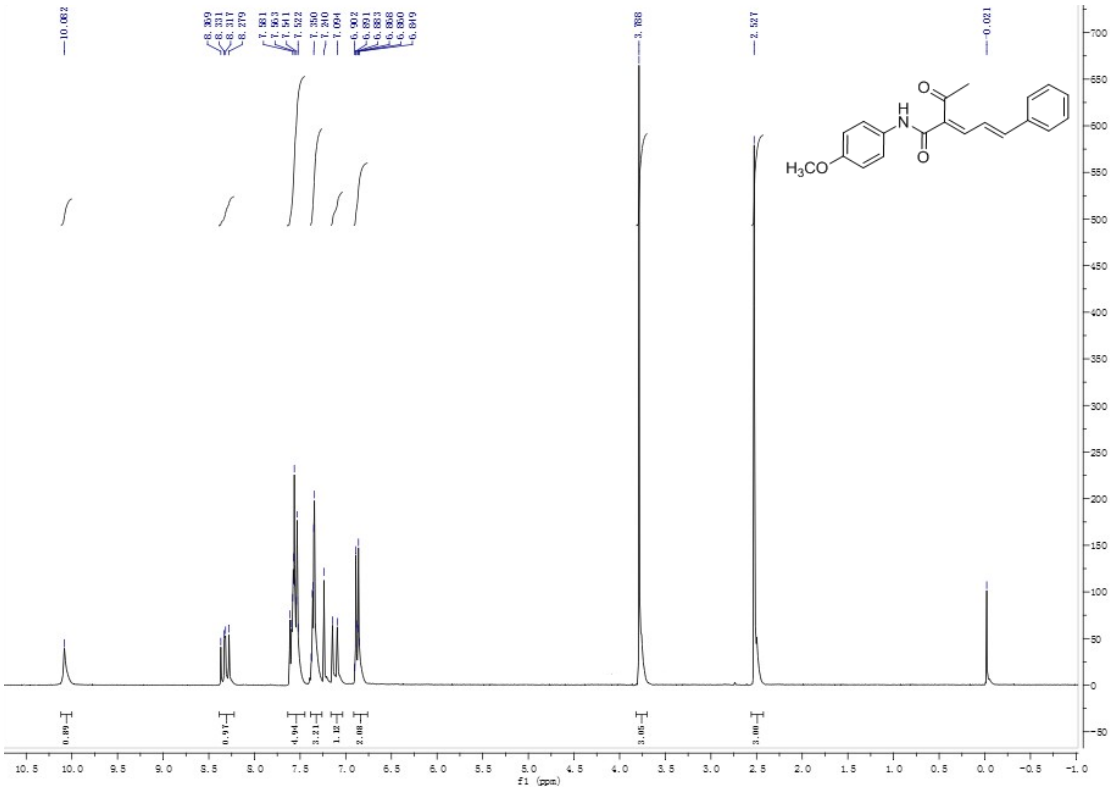
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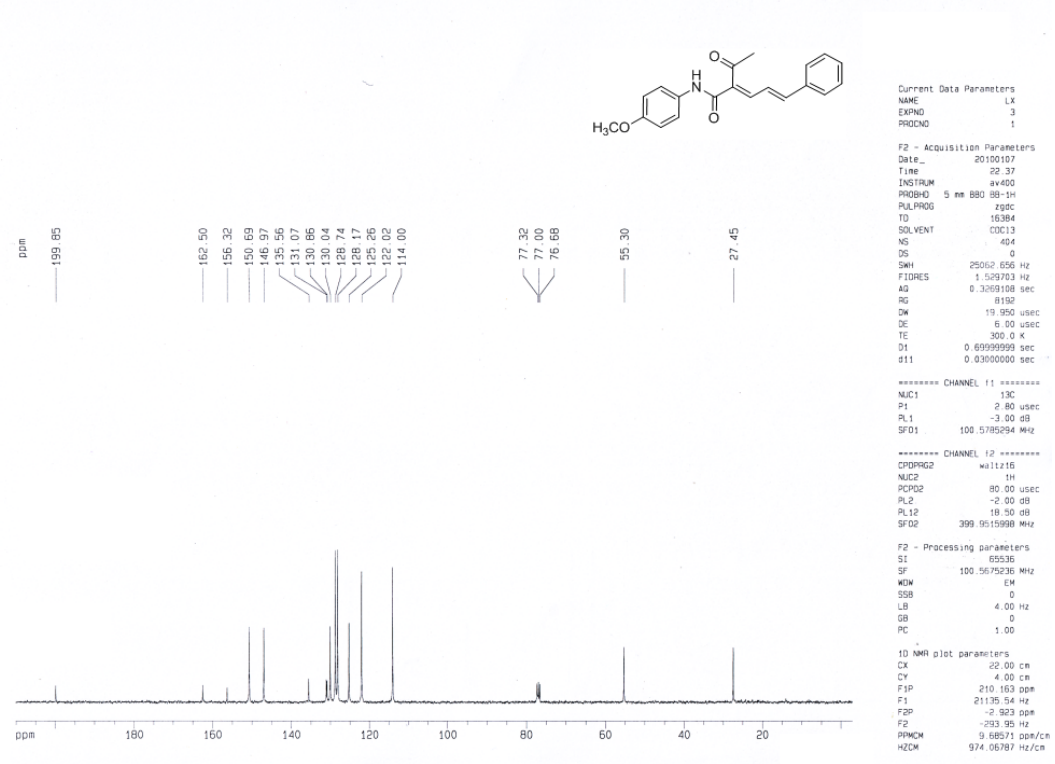
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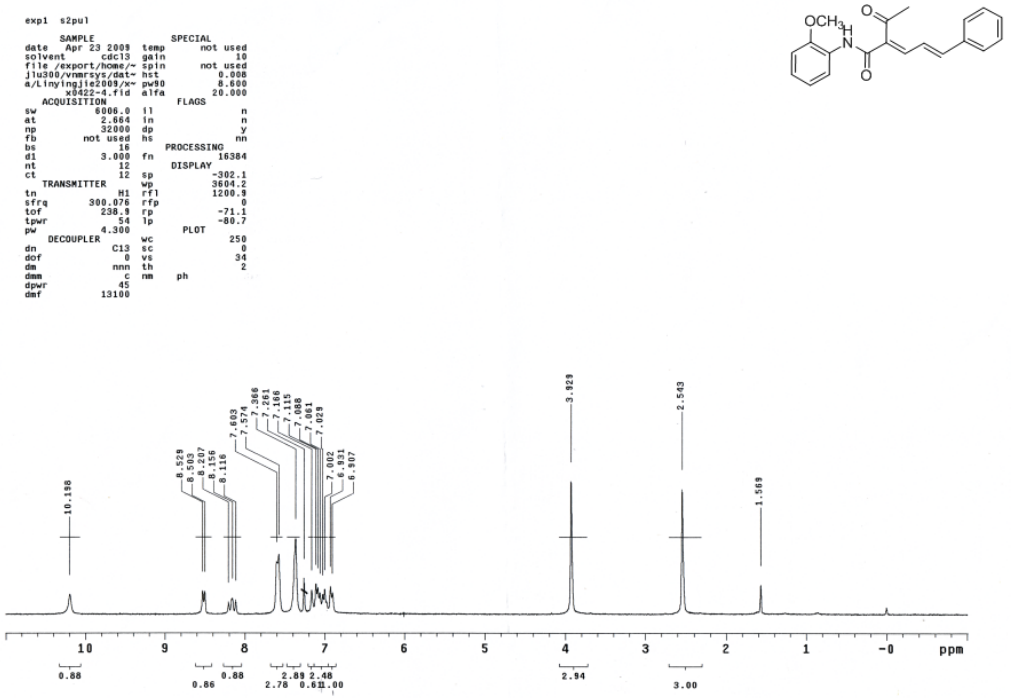
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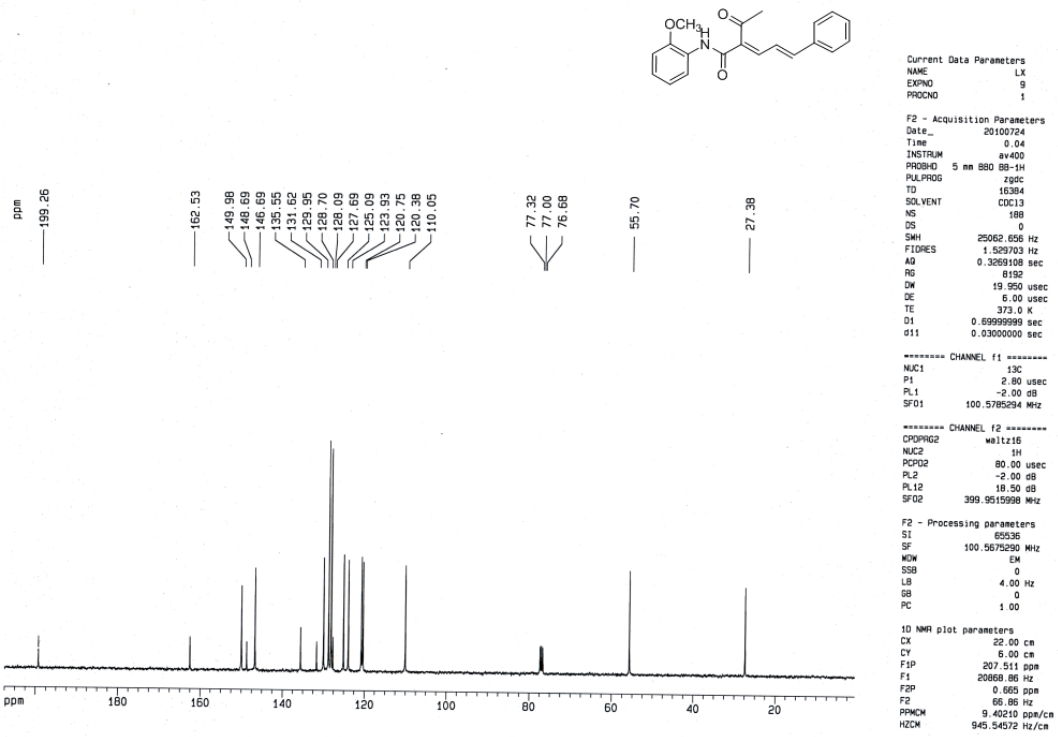
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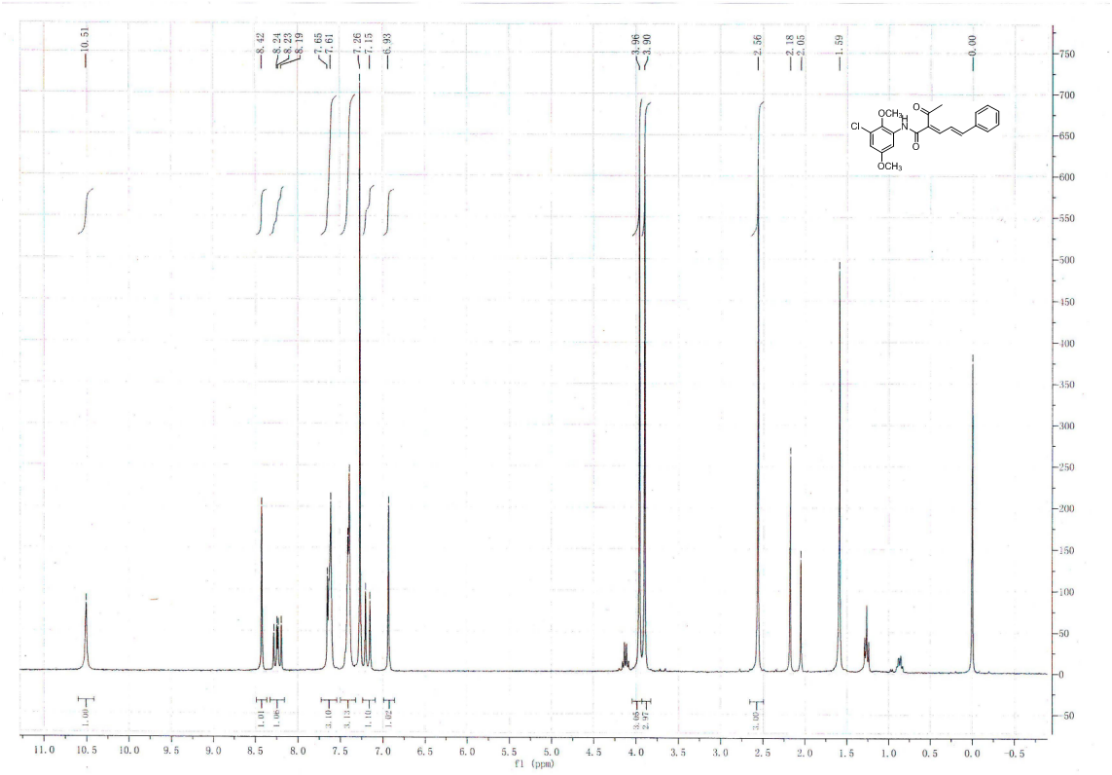
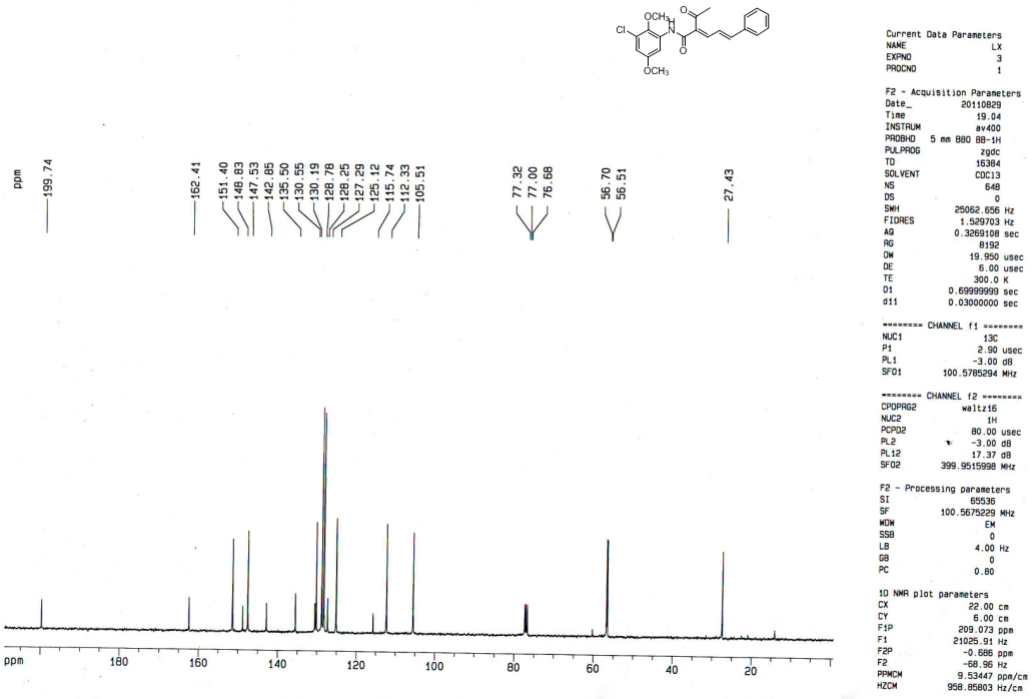
EXPNO 9
PROCNO 1
F2 - Acquisition Parameters
Date_ 20100724
Time 0.04
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT CDCl3
NS 188
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 373.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.80 usec
PL1 -2.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -2.00 dB
PL12 18.50 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675290 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 6.00 cm
F1P 207.511 ppm
F1 20868.86 Hz
F2P 0.665 ppm
F2 66.86 Hz
PPMCM 9.40210 ppm/cm
HZCM 945.54572 Hz/cm

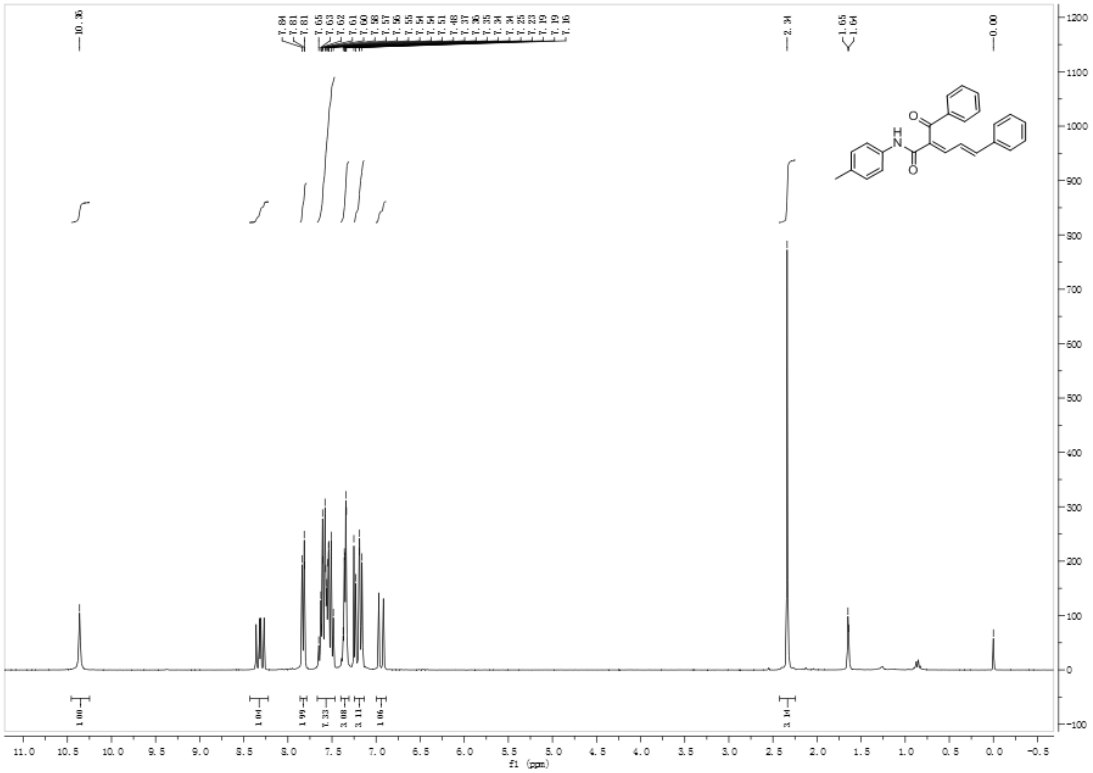
**1i**

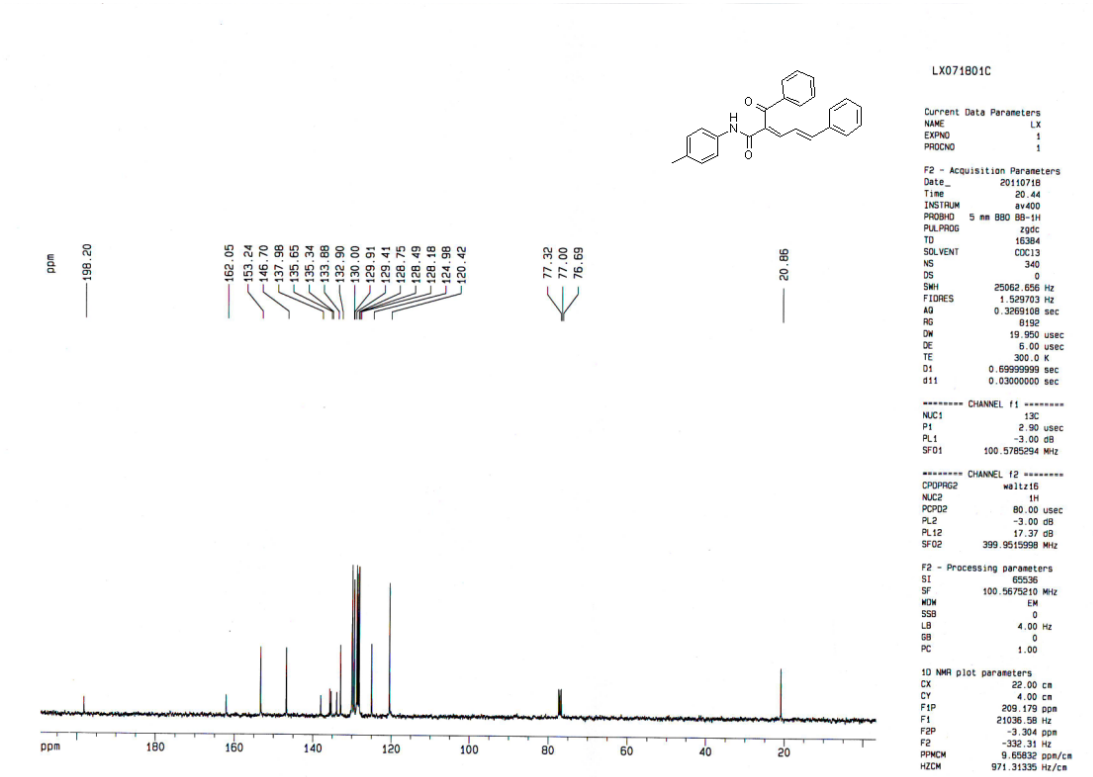


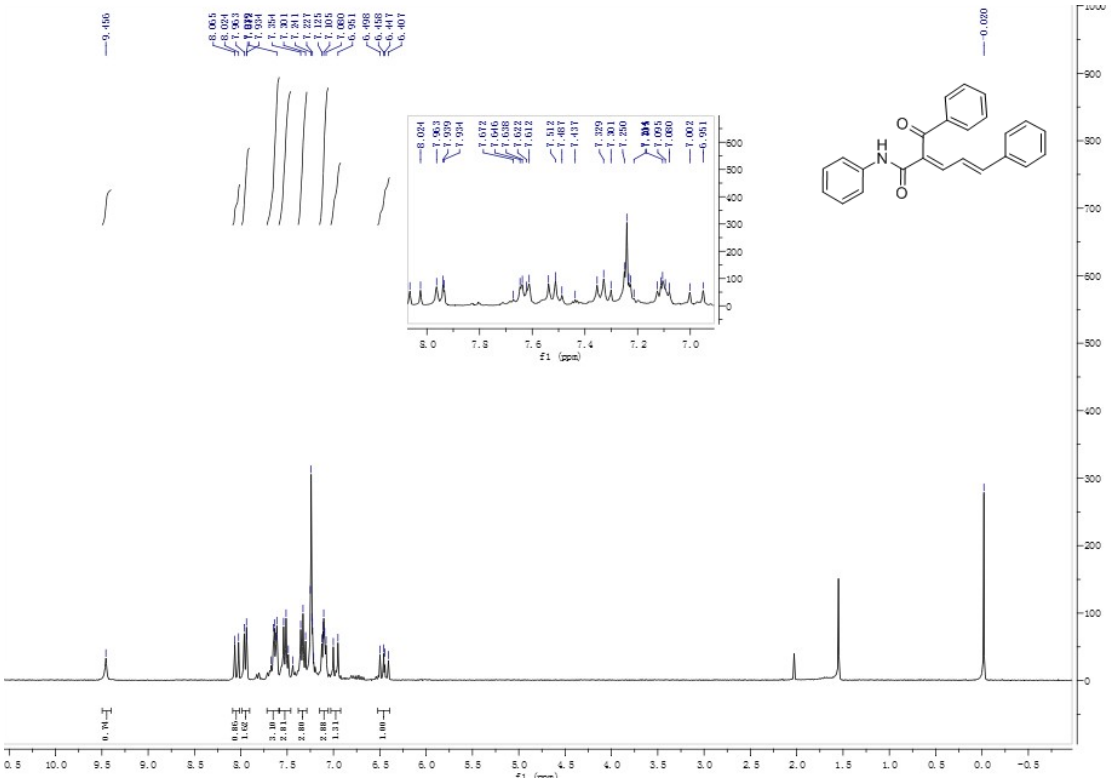

```
Current Data Parameters
NAME                  LX
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20110829
Time               19.04
INSTRUM           av400
PROBHD  5 mm BBO BB-1H
PULPROG            zgdc
TD                16384
SOLVENT           CDCl3
NS                  648
DS                    0
SWH           25062.656 Hz
FIDRES         1.529703 Hz
AQ             0.3269108 sec
RG                 8192
DW                19.950 usec
DE                 6.00 usec
TE                300.0 K
D1             0.69999999 sec
d11            0.03000000 sec

======== CHANNEL f1 ========
NUC1                13C
P1                2.90 usec
PL1               -3.00 dB
SFO1          100.5785294 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                1H
PCPD2             80.00 usec
PL2               -3.00 dB
PL12              17.37 dB
SFO2          399.9515998 MHz

F2 - Processing parameters
SI                  65536
SF            100.5675229 MHz
WDW                 EM
SSB                    0
LB                4.00 Hz
GB                     0
PC                  0.80

1D NMR plot parameters
CX                 22.00 cm
CY                  6.00 cm
F1P              209.073 ppm
F1             21025.91 Hz
F2P               -0.686 ppm
F2               -68.96 Hz
PPMCM          9.53447 ppm/cm
HZCM          958.85803 Hz/cm
```

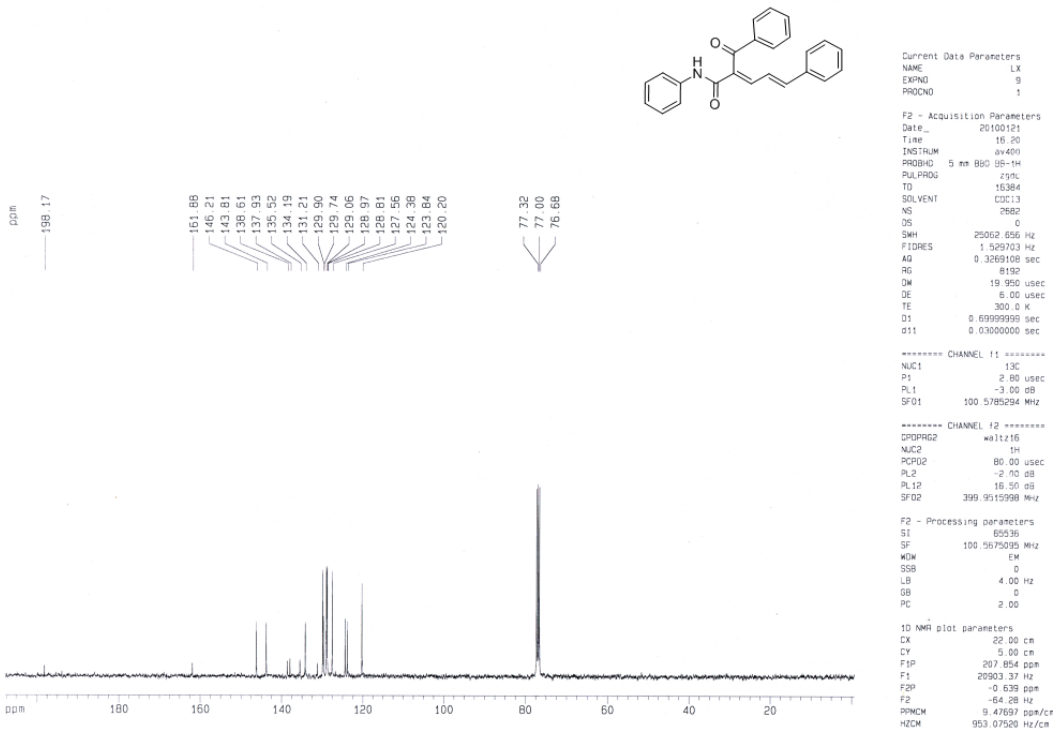
**1j**


10.36
7.84
7.81
7.65
7.63
7.62
7.61
7.60
7.58
7.57
7.56
7.55
7.54
7.51
7.48
7.37
7.36
7.35
7.34
7.34
7.25
7.23
7.19
7.19
7.16
2.34
1.65
1.64
0.00
1.00
1.04
1.99
7.33
3.08
3.11
1.06
3.14
f1 (ppm)

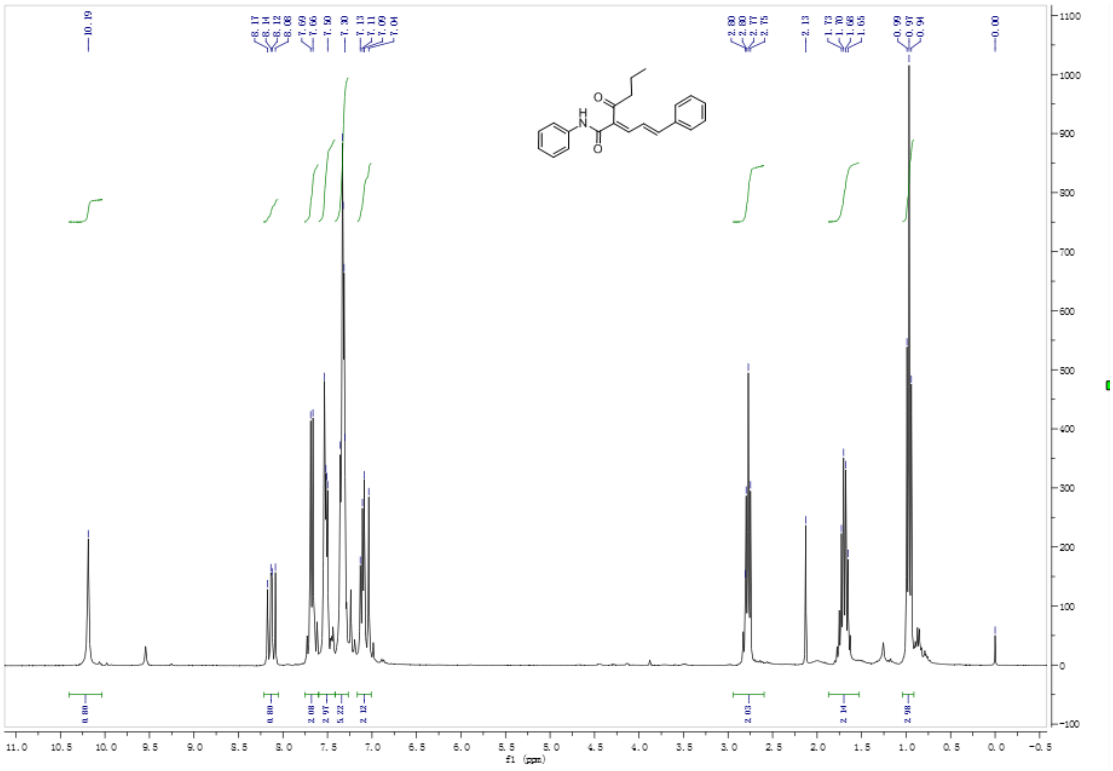

LX071B01C
Current Data Parameters
NAME LX
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110718
Time 20.44
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT CDCl3
NS 340
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.326910B sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.90 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -3.00 dB
PL12 17.37 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675210 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 4.00 cm
F1P 209.179 ppm
F1 21036.58 Hz
F2P -3.304 ppm
F2 -332.31 Hz
PPMCM 9.65832 ppm/cm
HZCM 971.31335 Hz/cm
ppm
198.20
162.05
153.24
146.70
137.98
135.65
135.34
133.88
132.90
130.00
129.91
129.41
128.75
128.49
128.18
124.98
120.42
77.32
77.00
76.69
20.86
ppm

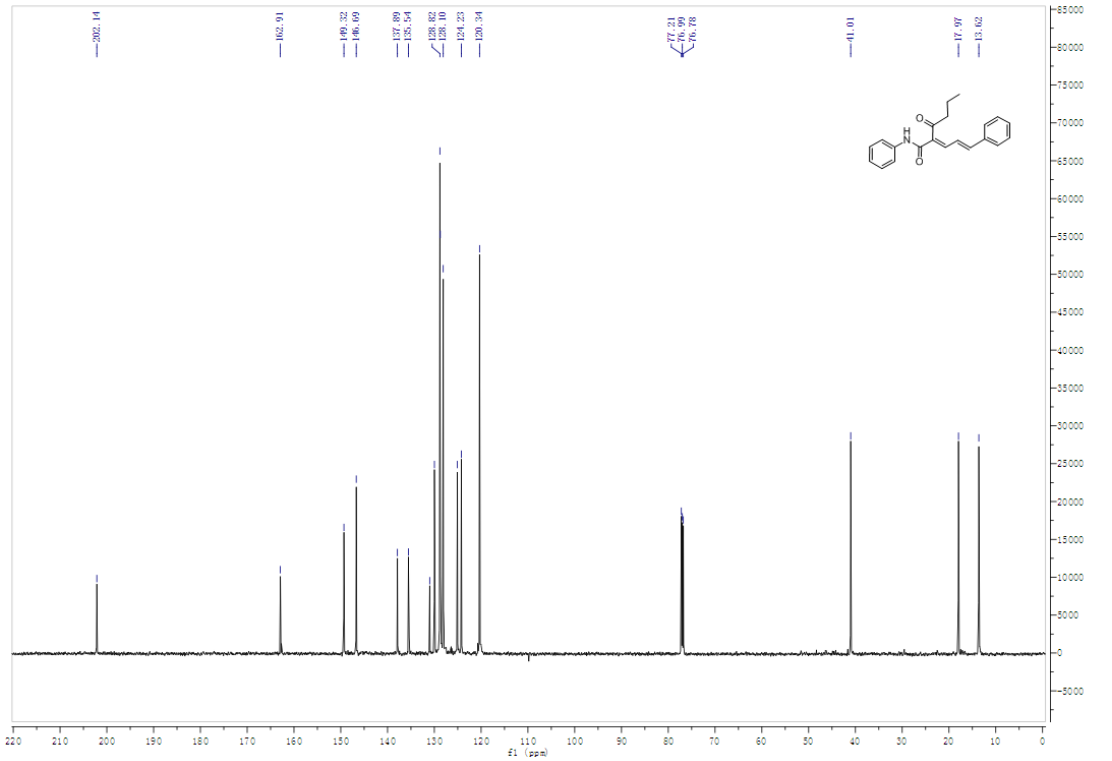
**1k**



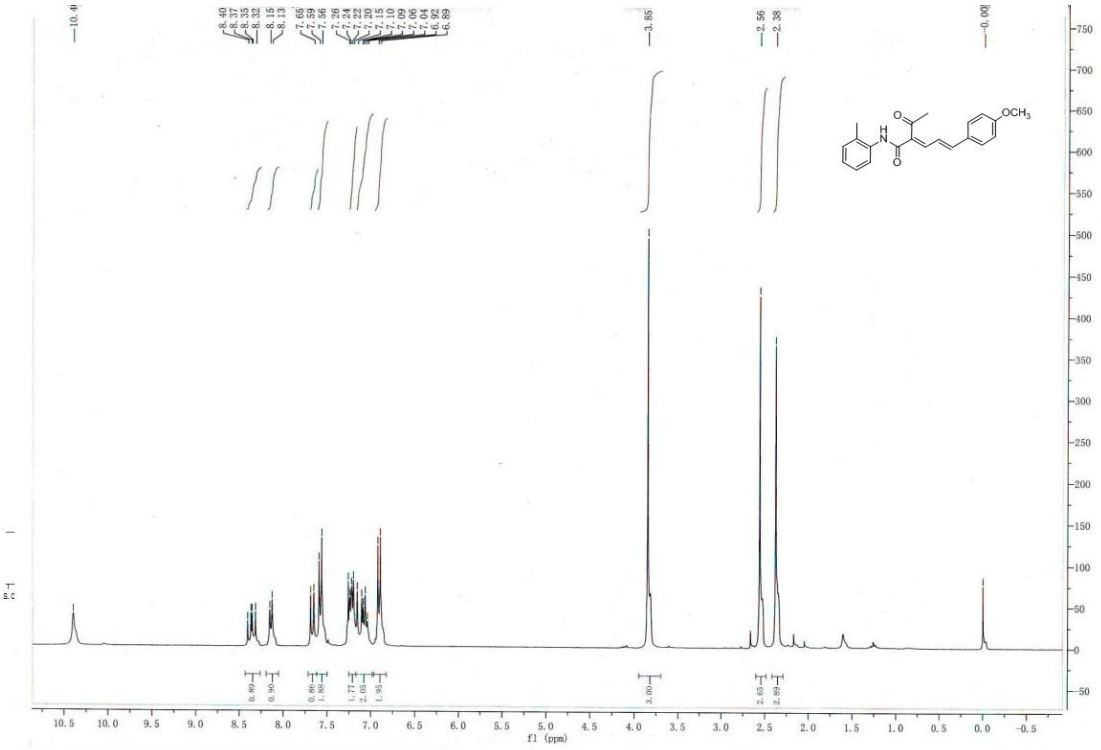


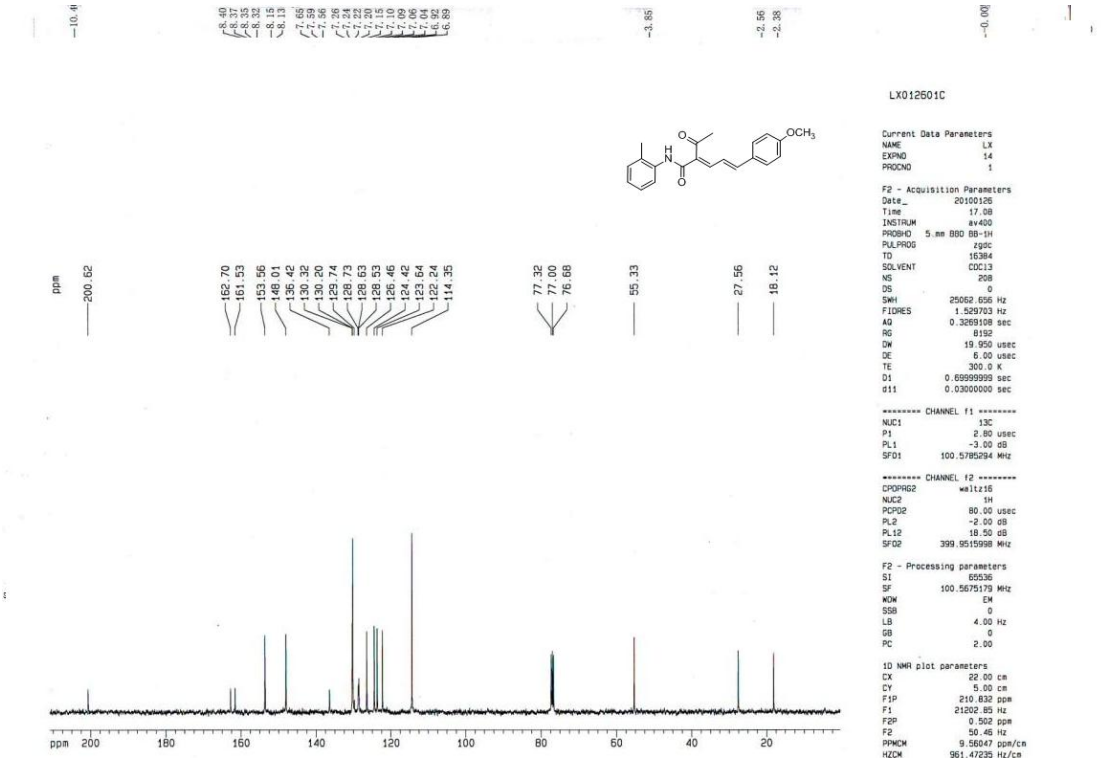
**1l**





**1m**




LX012501C

Current Data Parameters
NAME LX
EXPNO 14
PROCNO 1

F2 - Acquisition Parameters
Date_ 20100126
Time 17.08
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT CDCl3
NS 208
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec

======== CHANNEL f1 ========
NUC1 13C
P1 2.80 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz

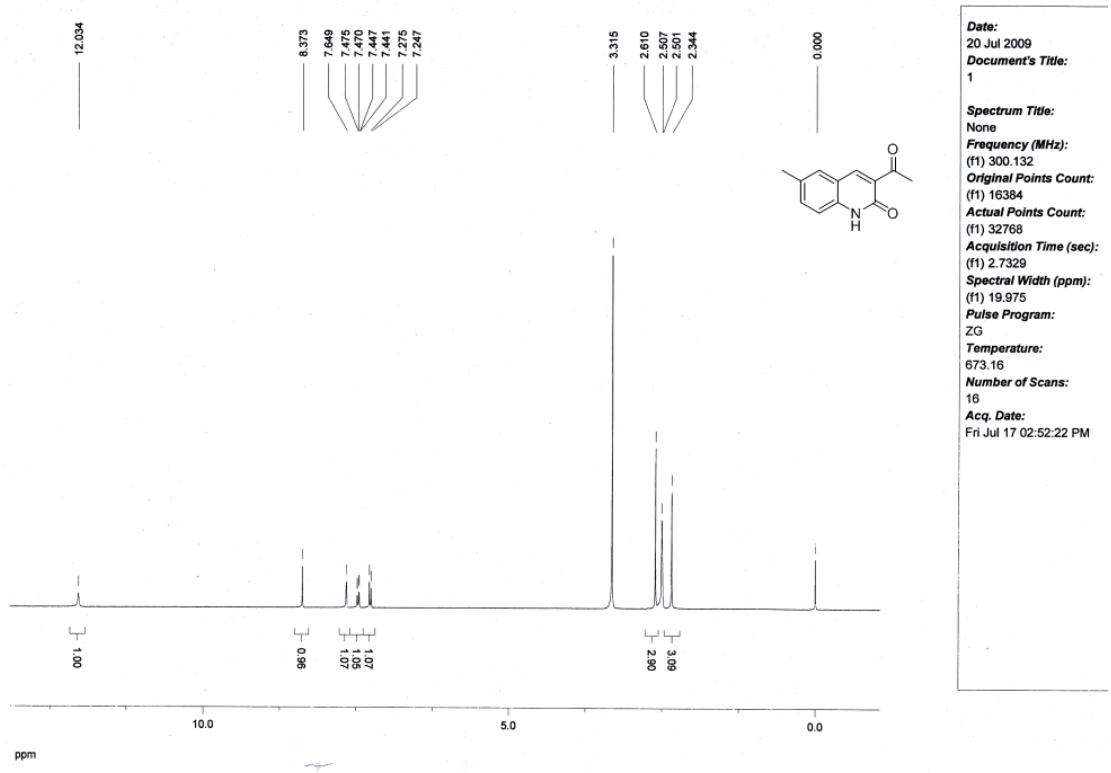
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -2.00 dB
PL12 18.50 dB
SFO2 399.9515998 MHz

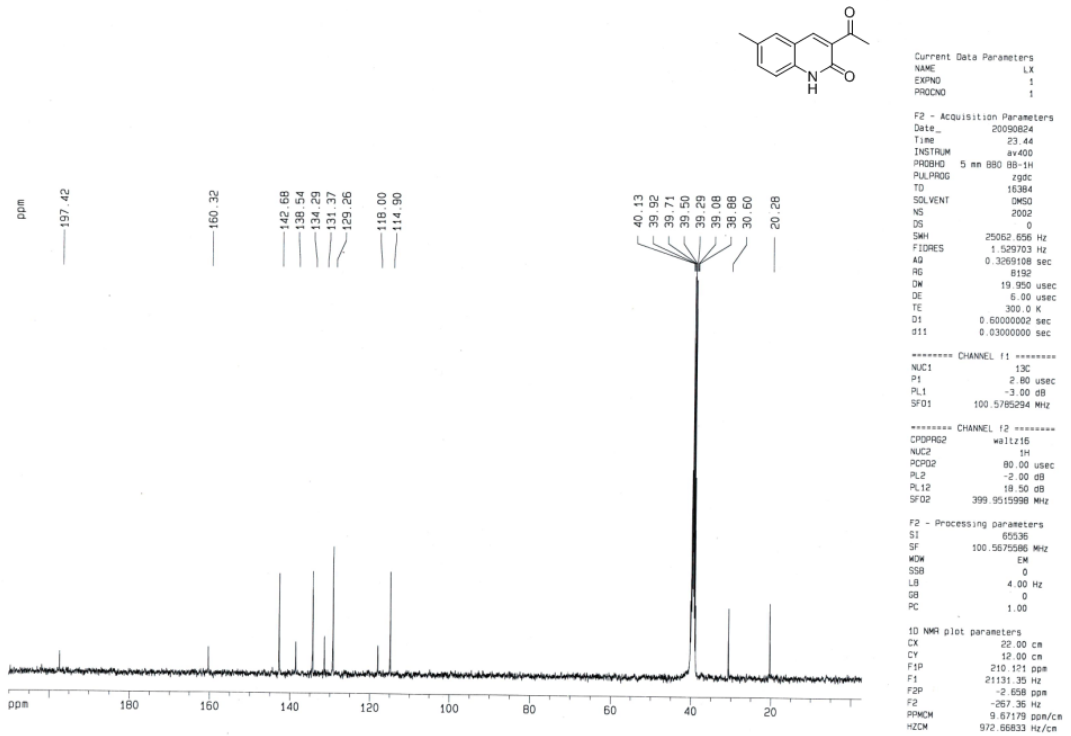
F2 - Processing parameters
SI 65536
SF 100.5675179 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 2.00

1D NMR plot parameters
CX 22.00 cm
CY 5.00 cm
F1P 210.832 ppm
F1 21202.85 Hz
F2P 0.502 ppm
F2 50.46 Hz
PPMCM 9.56047 ppm/cm
HZCM 961.47235 Hz/cm

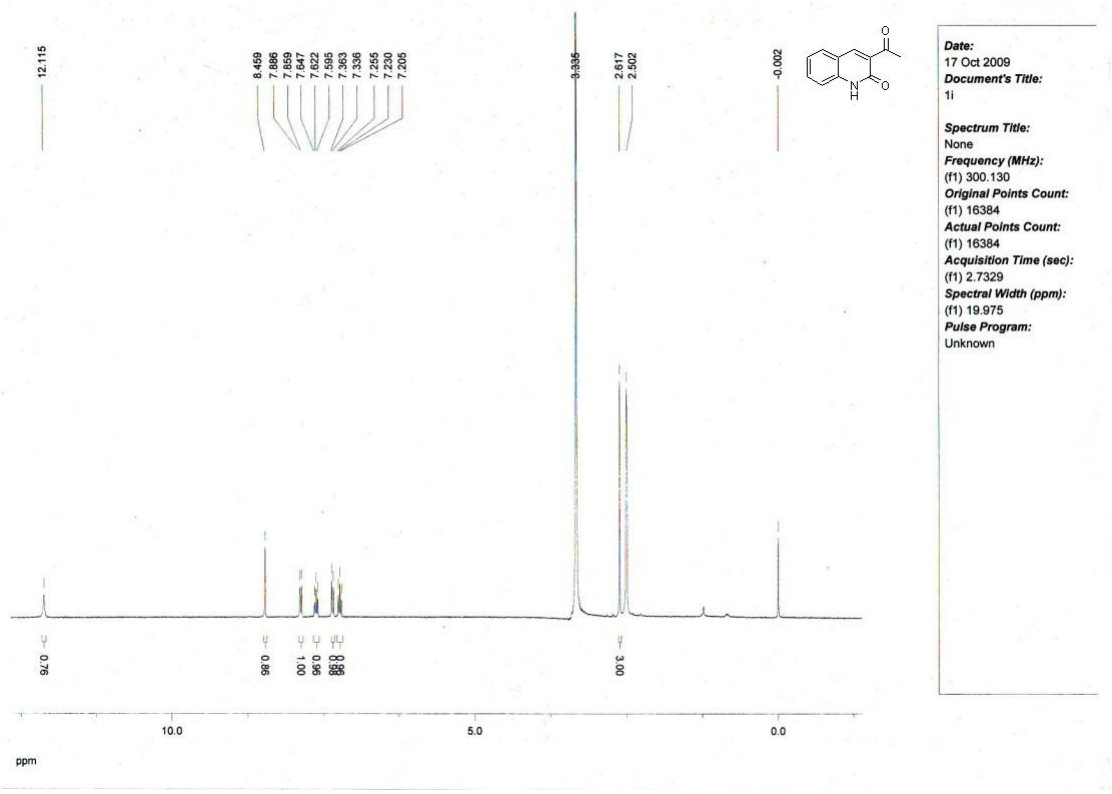
# Ⅳ.Copies of NMR spectra for products **2**

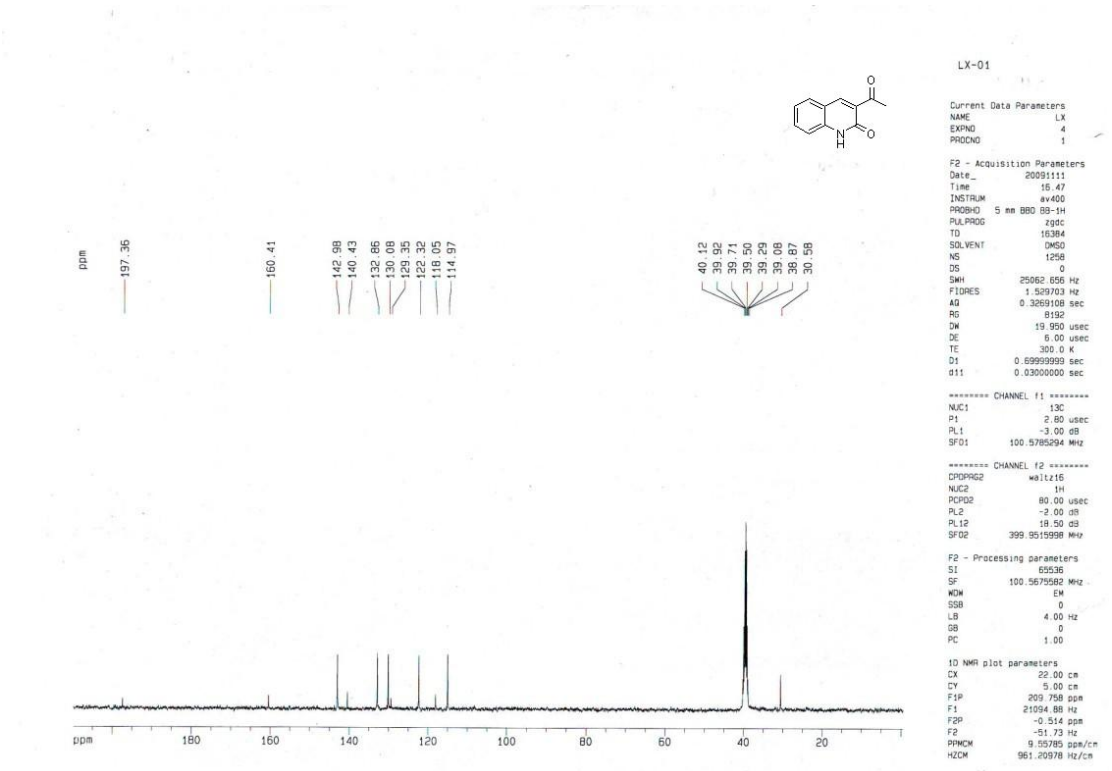
**2a**



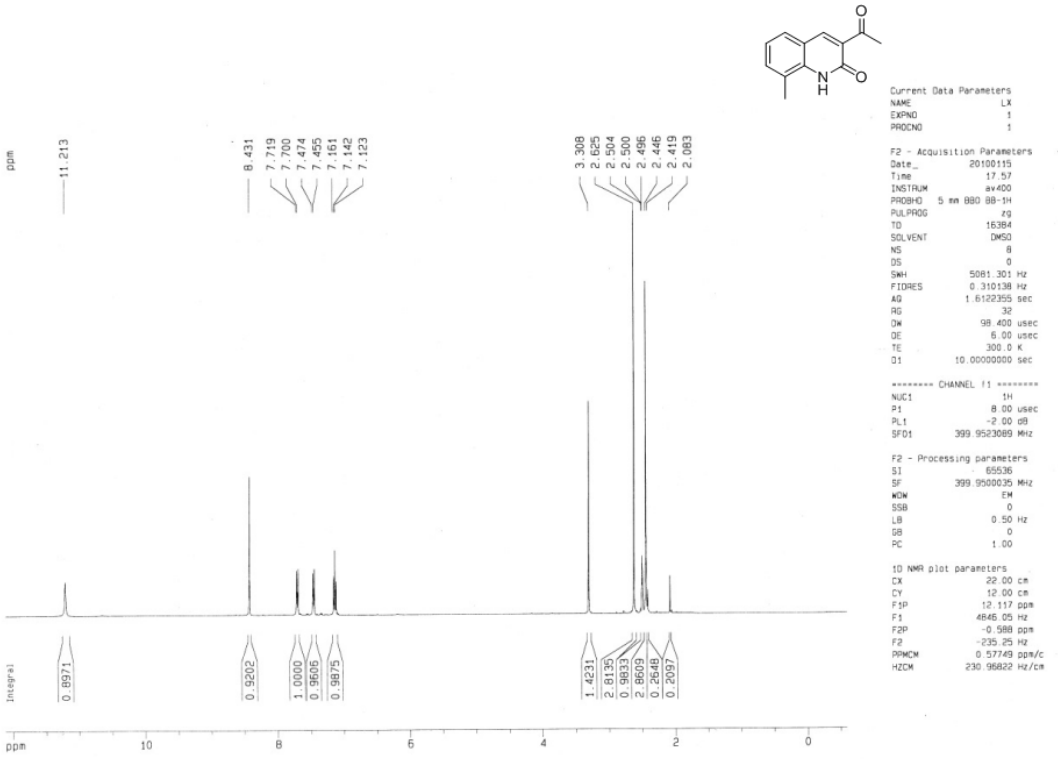



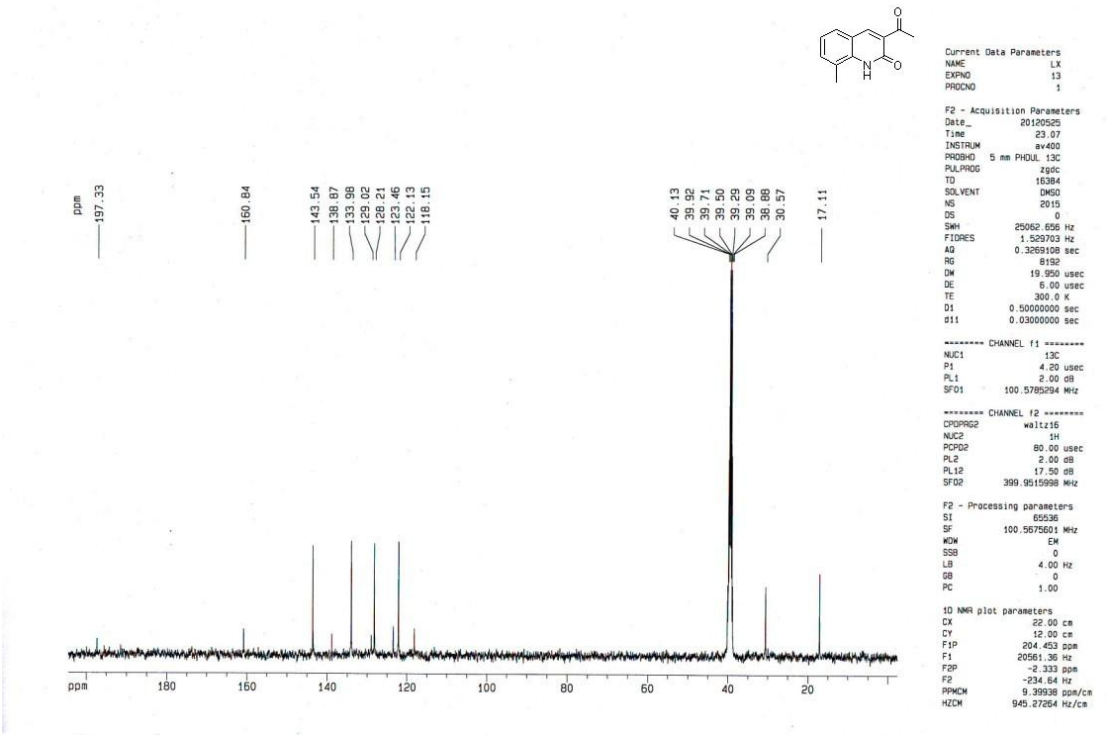
**2b**


12.115
8.459
7.886
7.859
7.647
7.622
7.595
7.363
7.336
7.255
7.230
7.205
3.335
2.617
2.502
-0.002
0.76
0.86
1.00
0.96
0.98
0.98
3.00
10.0
5.0
0.0
ppm
Date:
17 Oct 2009
Document's Title:
1i
Spectrum Title:
None
Frequency (MHz):
(f1) 300.130
Original Points Count:
(f1) 16384
Actual Points Count:
(f1) 16384
Acquisition Time (sec):
(f1) 2.7329
Spectral Width (ppm):
(f1) 19.975
Pulse Program:
Unknown

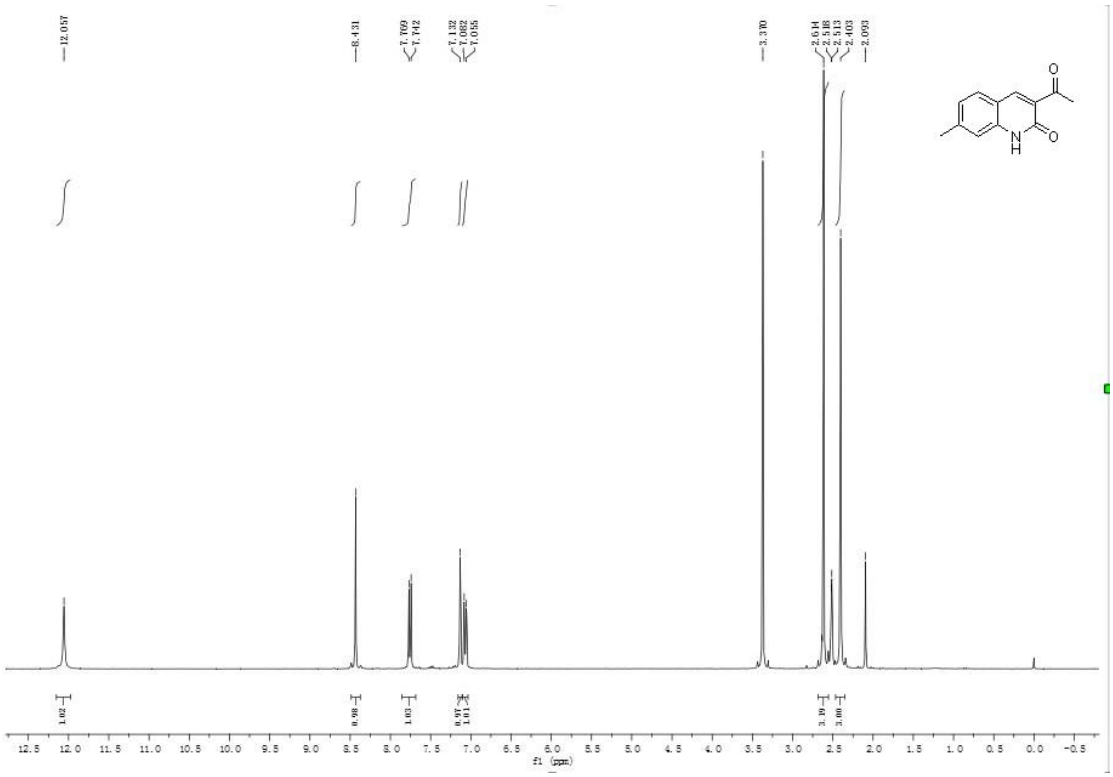

ppm
197.36
160.41
142.98
140.43
132.86
130.08
129.35
122.32
118.05
114.97
40.12
39.92
39.71
39.50
39.29
39.08
38.87
30.58
180
160
140
120
100
80
60
40
20
LX-01
Current Data Parameters
NAME LX
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20091111
Time 16.47
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT DMSO
NS 1258
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.326908 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.80 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -2.00 dB
PL12 18.50 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675582 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 5.00 cm
F1P 209.758 ppm
F1 21094.88 Hz
F2P -0.514 ppm
F2 -51.73 Hz
PPMCM 9.55785 ppm/cm
HZCM 961.20978 Hz/cm

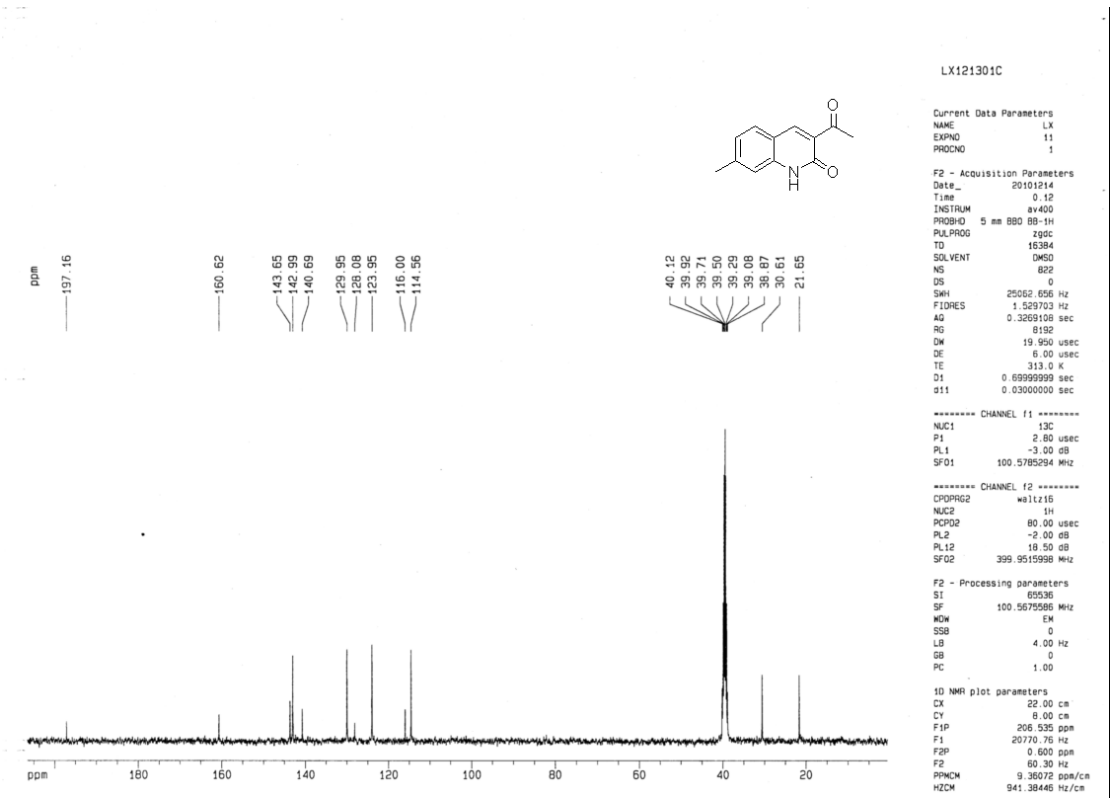
**2c**


11.213
8.431
7.719
7.700
7.474
7.455
7.161
7.142
7.123
3.308
2.625
2.504
2.500
2.496
2.446
2.419
2.083
0.8971
0.9202
1.0000
0.9606
0.9875
1.4231
2.8135
0.9833
2.8609
0.2648
0.2097
Current Data Parameters
NAME LX
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20100115
Time 17.57
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zg
TD 16384
SOLVENT DMSO
NS 8
DS 0
SWH 5081.301 Hz
FIDRES 0.310138 Hz
AQ 1.6122355 sec
RG 32
DW 98.400 usec
DE 6.00 usec
TE 300.0 K
D1 10.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 8.00 usec
PL1 -2.00 dB
SFO1 399.9523089 MHz
F2 - Processing parameters
SI 65536
SF 399.9500035 MHz
WDW EM
SSB 0
LB 0.50 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 12.00 cm
F1P 12.117 ppm
F1 4846.05 Hz
F2P -0.588 ppm
F2 -235.25 Hz
PPMCM 0.57749 ppm/c
HZCM 230.96822 Hz/cm
ppm
Integral

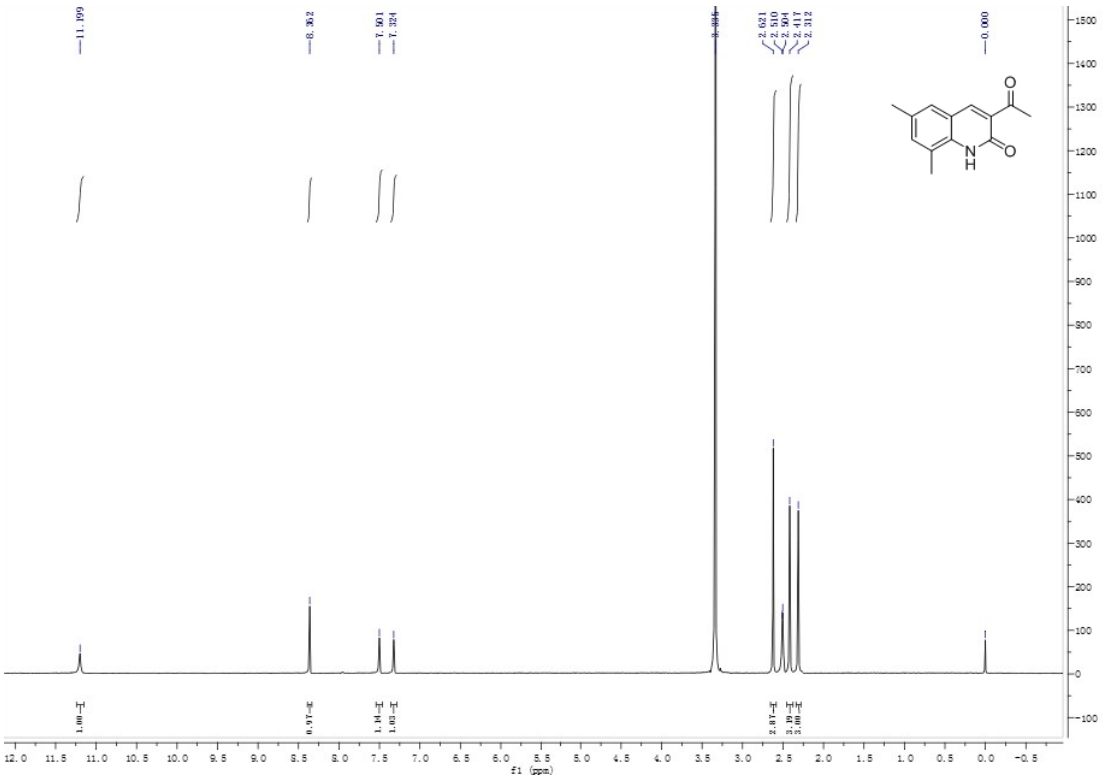

197.33
160.84
143.54
138.87
133.98
129.02
128.21
123.46
122.13
118.15
40.13
39.92
39.71
39.50
39.29
39.09
38.88
30.57
17.11
Current Data Parameters
NAME LX
EXPNO 13
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120525
Time 23.07
INSTRUM av400
PROBHD 5 mm PHOUL 13C
PULPROG zgpg
TD 16384
SOLVENT DMSO
NS 2015
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.50000000 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 4.20 usec
PL1 2.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.00 dB
PL12 17.50 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675601 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 12.00 cm
F1P 204.453 ppm
F1 20561.36 Hz
F2P -2.333 ppm
F2 -234.64 Hz
PPMCM 9.39938 ppm/cm
HZCM 945.27264 Hz/cm
ppm

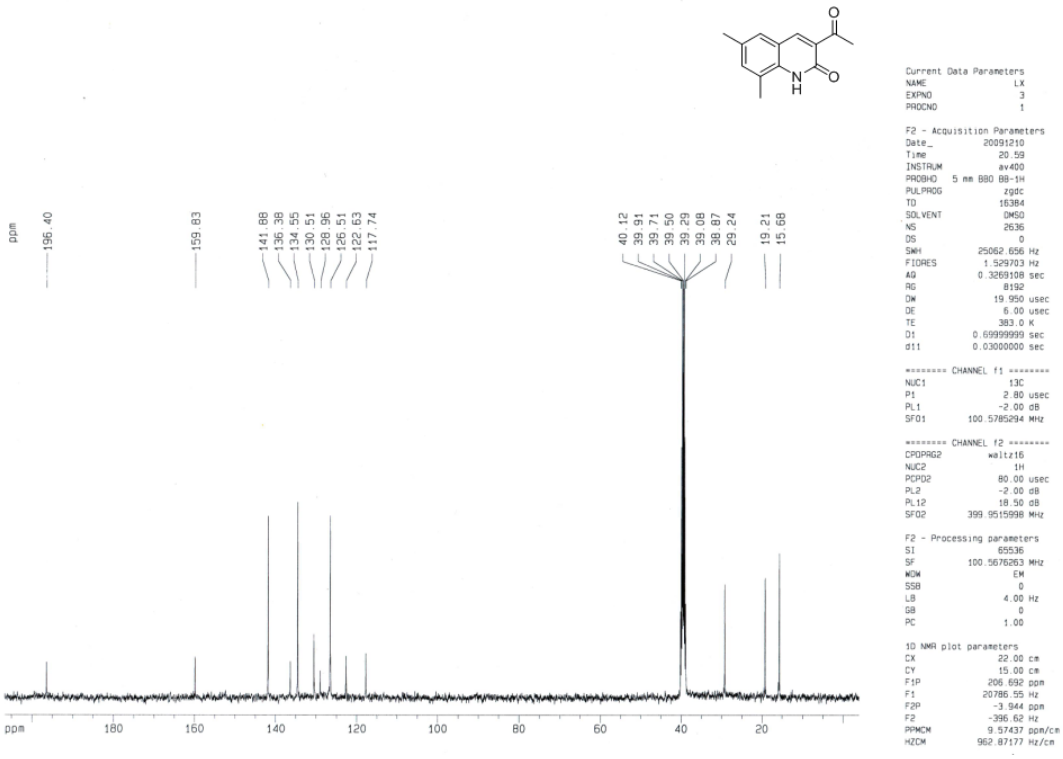
**2d**


12.057
8.431
7.769
7.742
7.132
7.082
7.058
3.370
2.614
2.583
2.513
2.403
2.093
1.02
0.98
1.03
0.97
1.01
3.19
3.00
f1 (ppm)

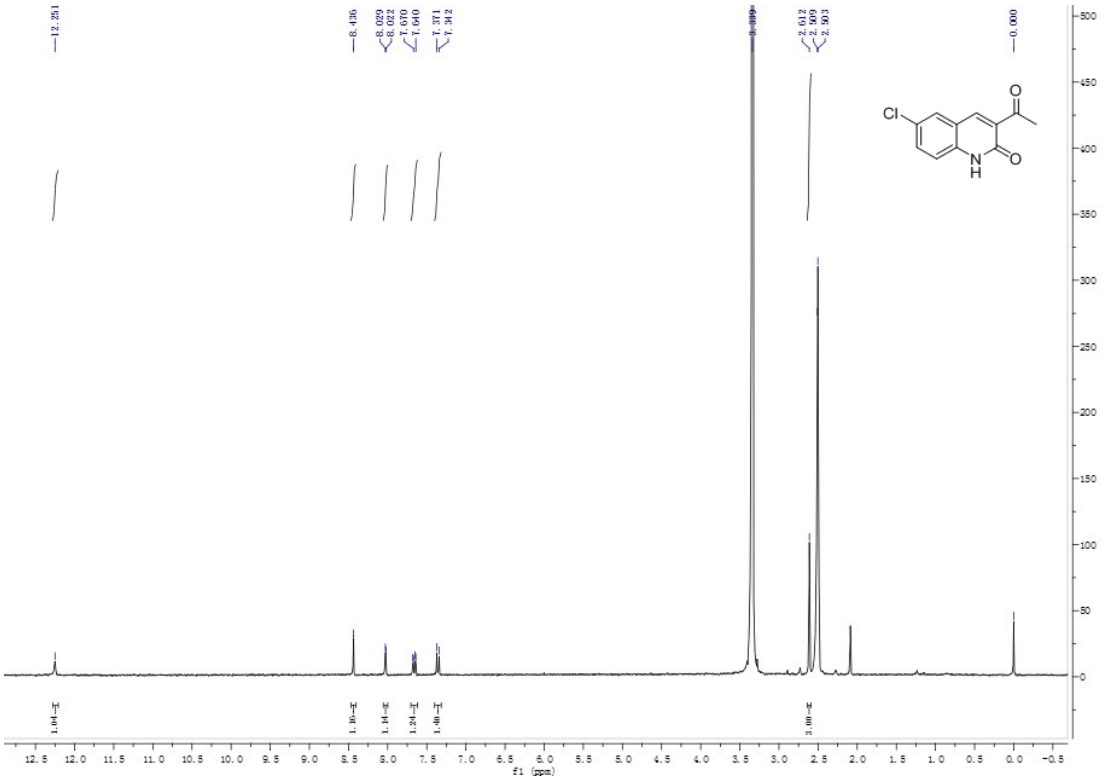

LX121301C
ppm
197.16
160.62
143.65
142.99
140.69
129.95
128.08
123.95
116.00
114.56
40.12
39.92
39.71
39.50
39.29
39.08
38.87
30.61
21.65
Current Data Parameters
NAME LX
EXPNO 11
PROCNO 1
F2 - Acquisition Parameters
Date_ 20101214
Time 0.12
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT DMSO
NS 822
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 313.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.80 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -2.00 dB
PL12 18.50 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675586 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 8.00 cm
F1P 206.535 ppm
F1 20770.76 Hz
F2P 0.600 ppm
F2 60.30 Hz
PPMCM 9.36072 ppm/cm
HZCM 941.38446 Hz/cm

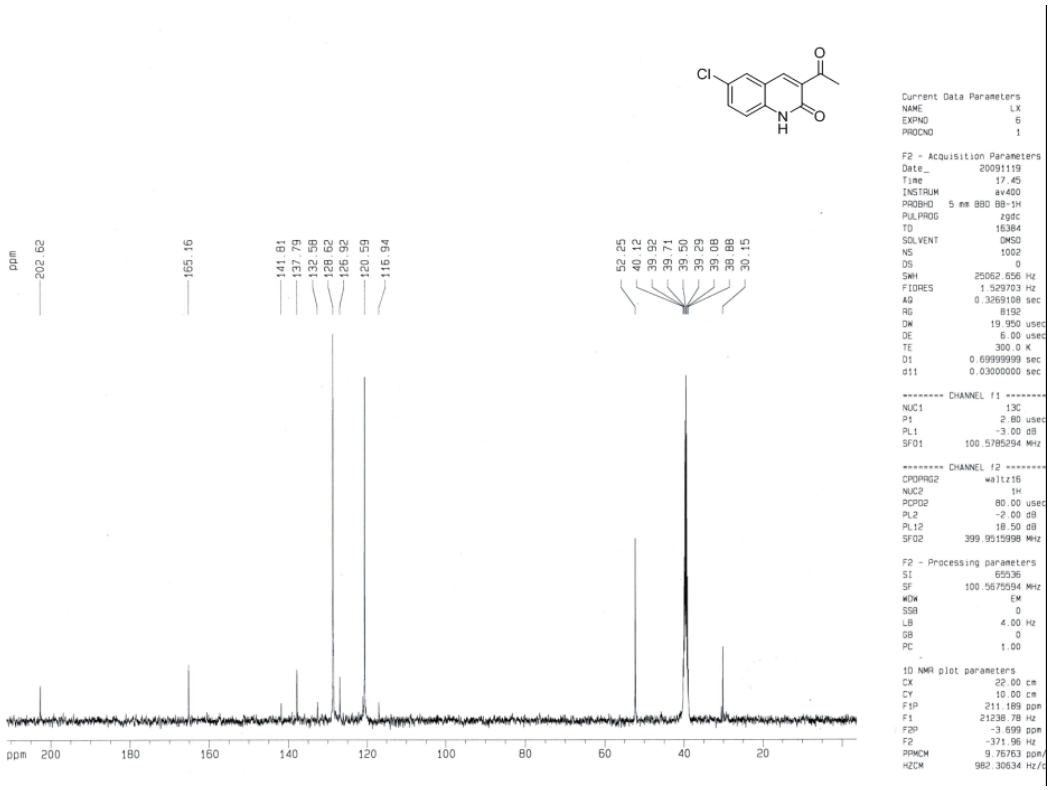
**2e**


11.199
8.362
7.901
7.324
2.621
2.510
2.464
2.417
2.312
0.000
1.00
0.97
1.14
1.03
2.87
3.19
3.00
f1 (ppm)


196.40
159.83
141.88
136.38
134.55
130.51
128.96
126.51
122.63
117.74
40.12
39.91
39.71
39.50
39.29
39.08
38.87
29.24
19.21
15.68
ppm

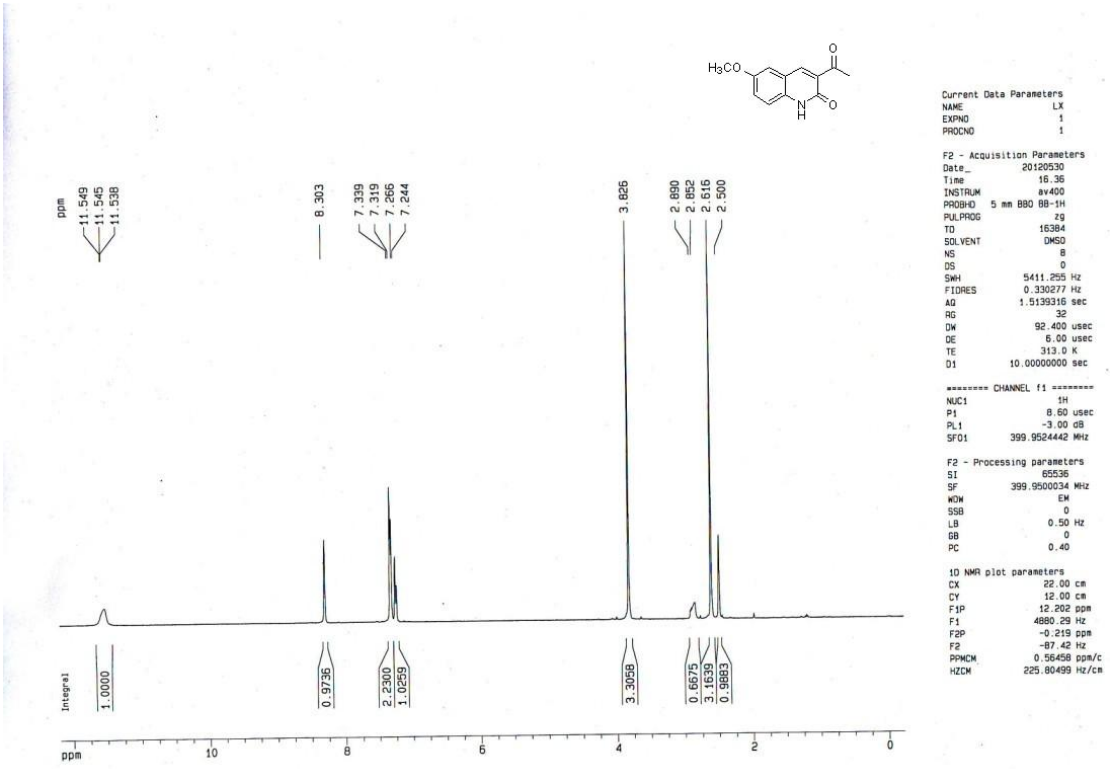
**2f**

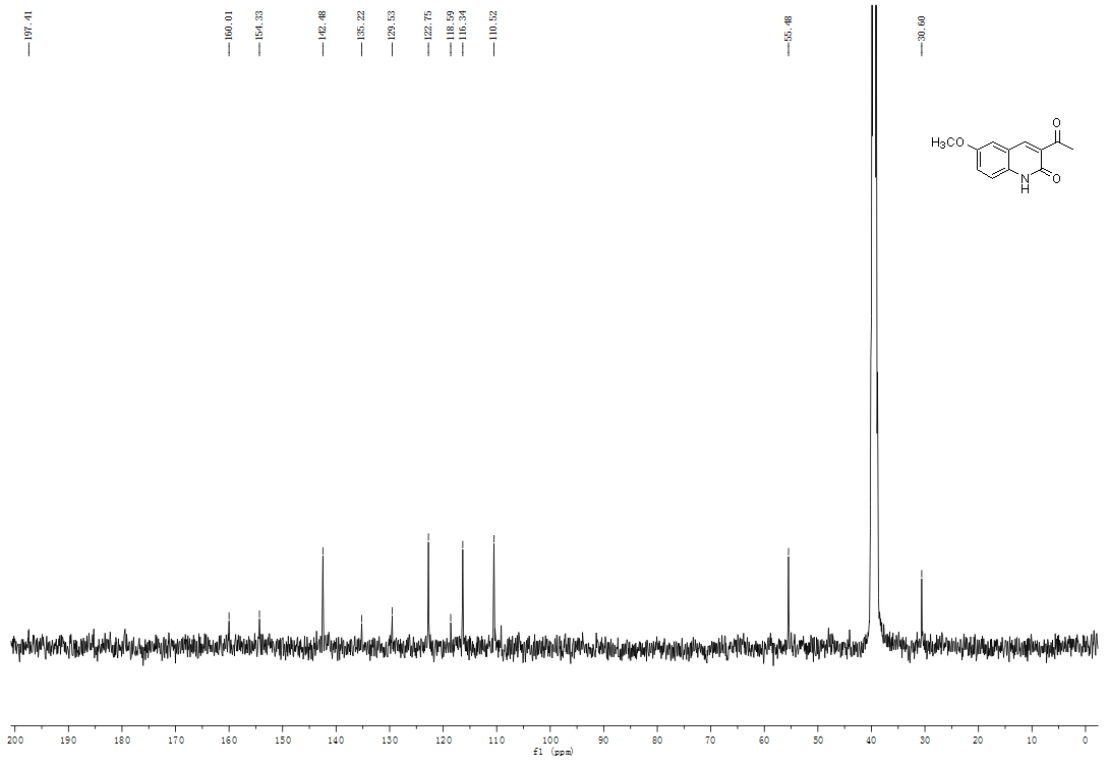


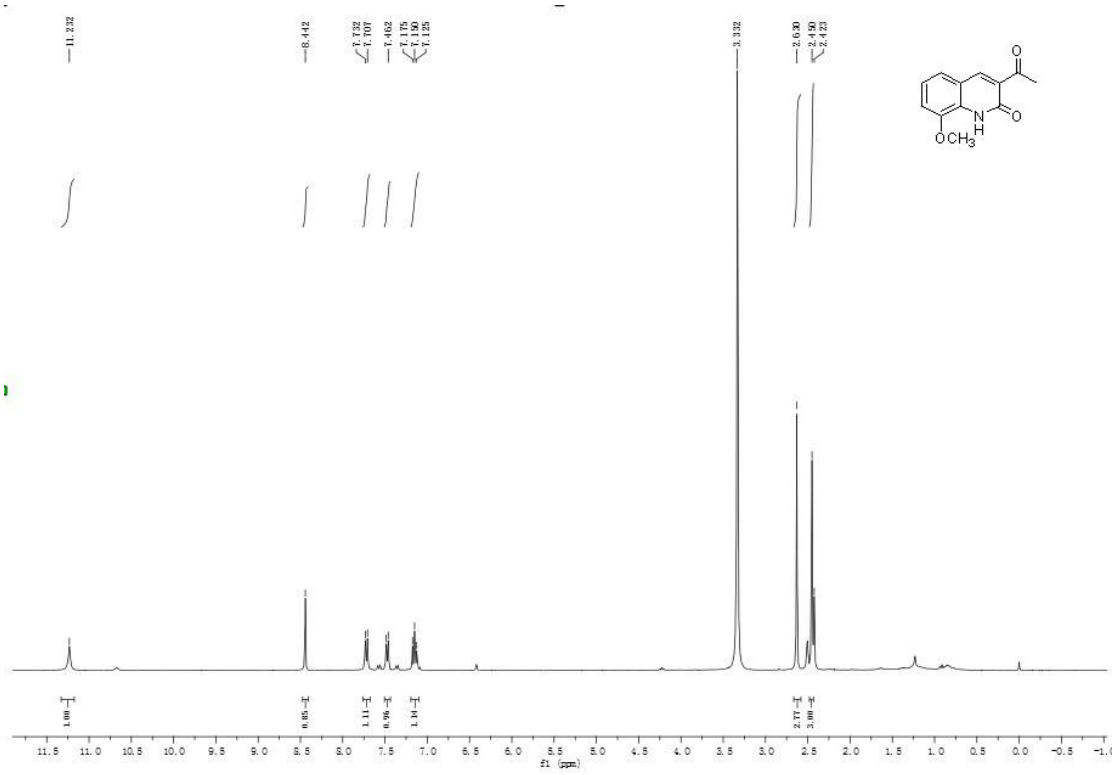

```
Current Data Parameters
NAME                  LX
EXPNO                  6
PROCNO                 1

F2 - Acquisition Parameters
Date_           20091119
Time                17.45
INSTRUM             av400
PROBHD   5 mm BBO BB-1H
PULPROG             zgdc
TD                 16384
SOLVENT             DMSO
NS                   1002
DS                      0
SWH           25062.656 Hz
FIDRES         1.529703 Hz
AQ             0.3269108 sec
RG                   8192
DW                19.950 usec
DE                 6.00 usec
TE                300.0 K
D1             0.69999999 sec
d11            0.03000000 sec

======== CHANNEL f1 ========
NUC1                  13C
P1                 2.80 usec
PL1                -3.00 dB
SFO1         100.5785294 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                  1H
PCPD2             80.00 usec
PL2                -2.00 dB
PL12               18.50 dB
SFO2         399.9515998 MHz

F2 - Processing parameters
SI                   65536
SF           100.5675594 MHz
WDW                  EM
SSB                   0
LB                 4.00 Hz
GB                    0
PC                 1.00

1D NMR plot parameters
CX                22.00 cm
CY                10.00 cm
F1P              211.189 ppm
F1               21238.78 Hz
F2P               -3.699 ppm
F2               -371.96 Hz
PPMCM             9.76763 ppm/
HZCM            982.30634 Hz/
```

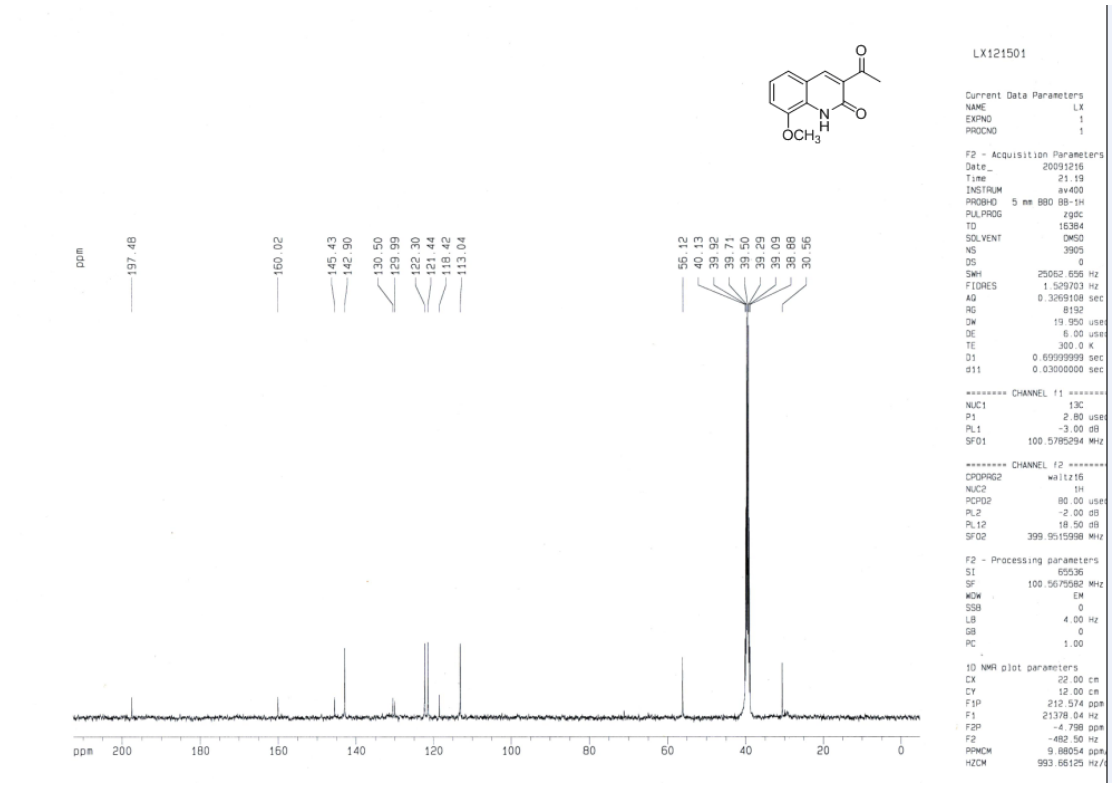
**2g**


H3CO
O
N
H
O
ppm
11.549
11.545
11.538
8.303
7.339
7.319
7.266
7.244
3.826
2.890
2.852
2.616
2.500
Integral
1.0000
0.9736
2.2300
1.0259
3.3058
0.6675
3.1639
0.9883
ppm
10
8
6
4
2
0
Current Data Parameters
NAME LX
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120530
Time 16.36
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zg
TD 16384
SOLVENT DMSO
NS 8
DS 0
SWH 5411.255 Hz
FIDRES 0.330277 Hz
AQ 1.5139316 sec
RG 32
DW 92.400 usec
DE 6.00 usec
TE 313.0 K
D1 10.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 8.60 usec
PL1 -3.00 dB
SFO1 399.9524442 MHz
F2 - Processing parameters
SI 65536
SF 399.9500034 MHz
WDW EM
SSB 0
LB 0.50 Hz
GB 0
PC 0.40
1D NMR plot parameters
CX 22.00 cm
CY 12.00 cm
F1P 12.202 ppm
F1 4880.29 Hz
F2P -0.219 ppm
F2 -87.42 Hz
PPMCM 0.56458 ppm/c
HZCM 225.80499 Hz/cm

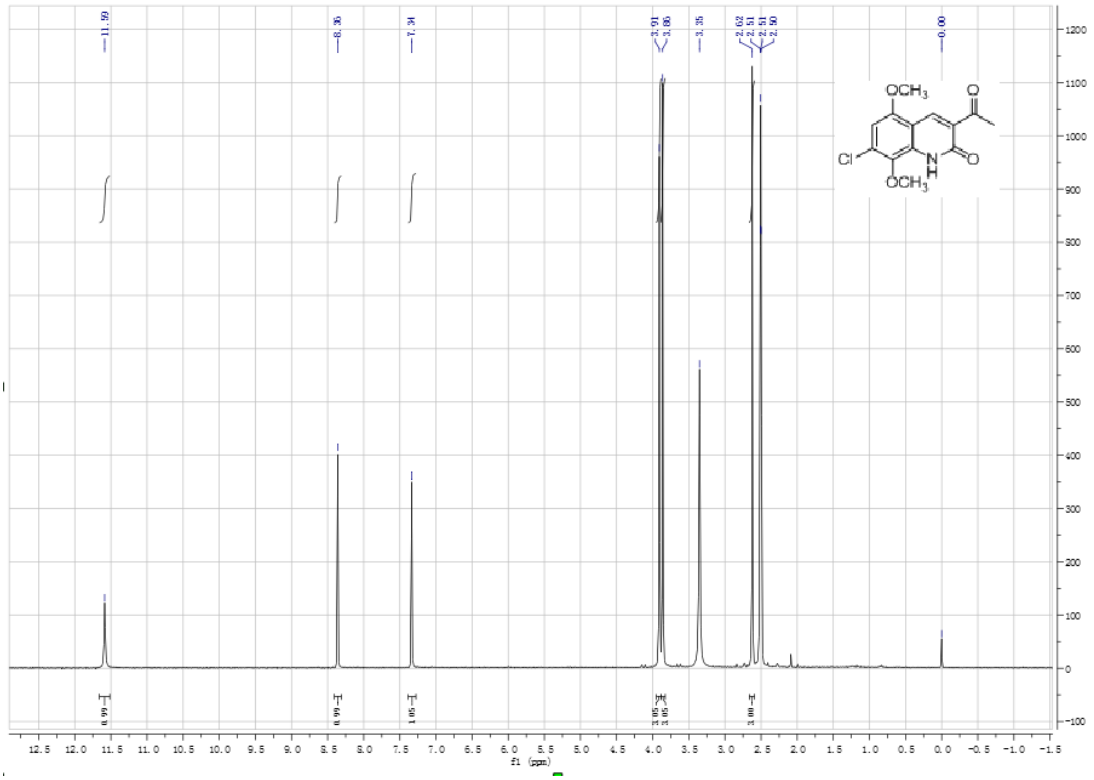

197.41
160.01
154.33
142.48
135.22
129.53
122.75
118.59
116.34
110.52
55.48
30.60
H3CO
O
N
H
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

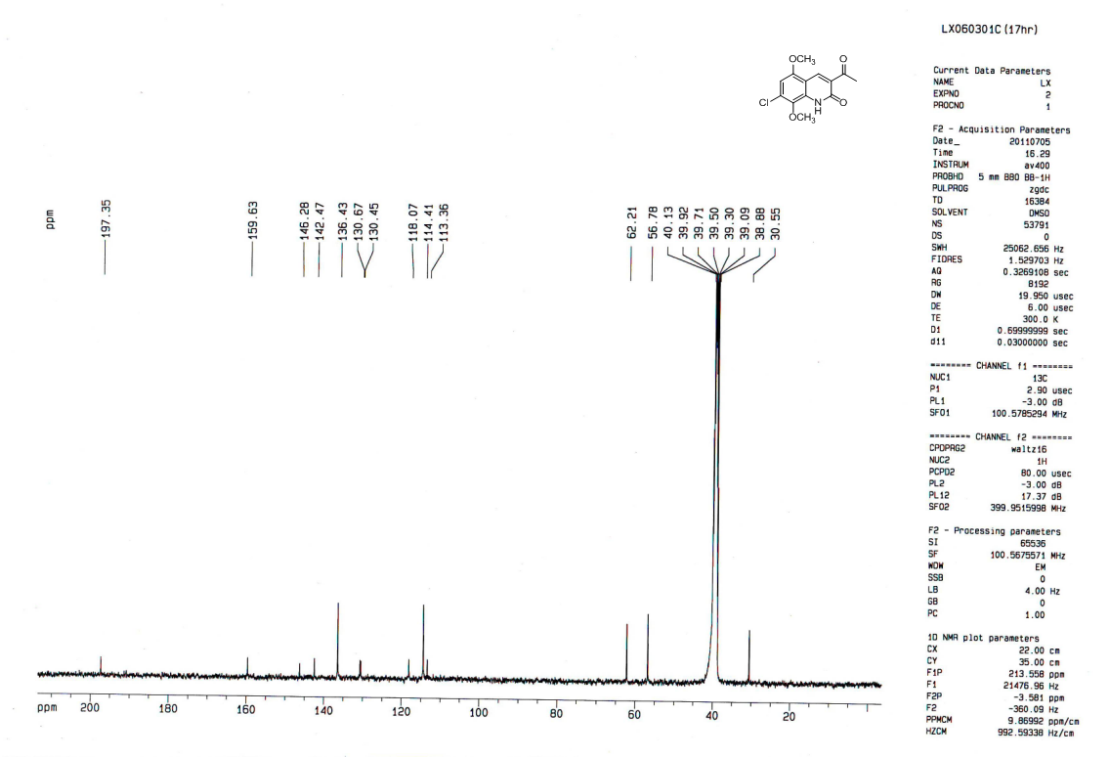
**2h**



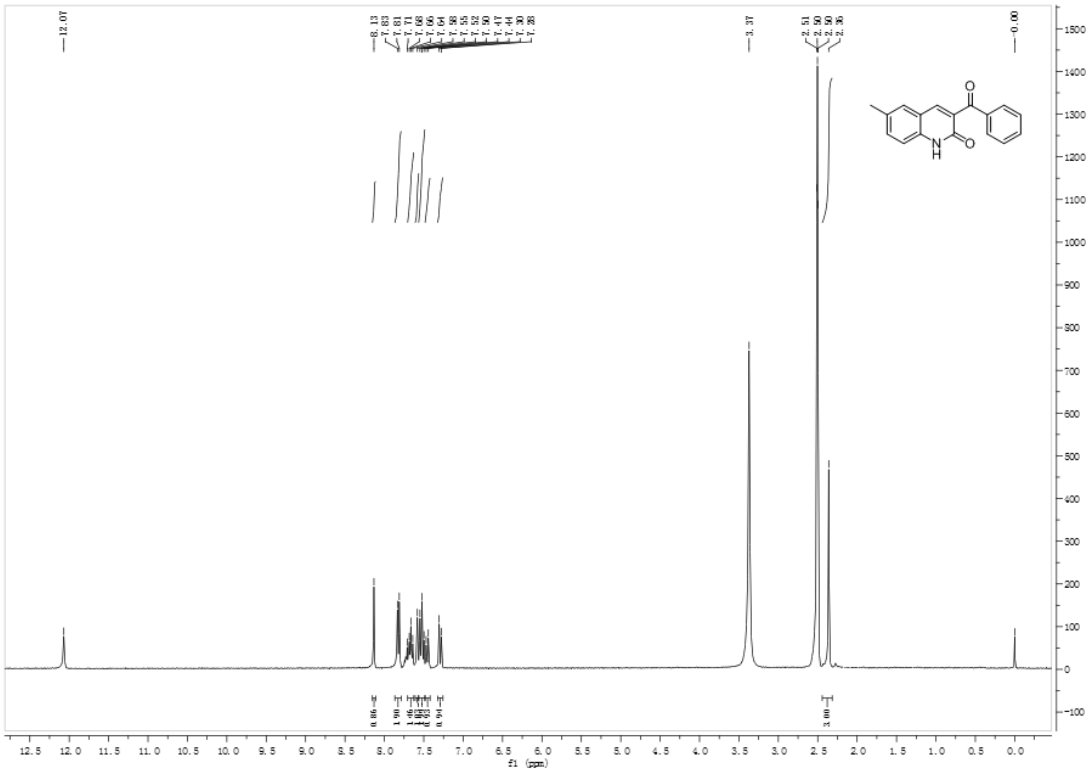



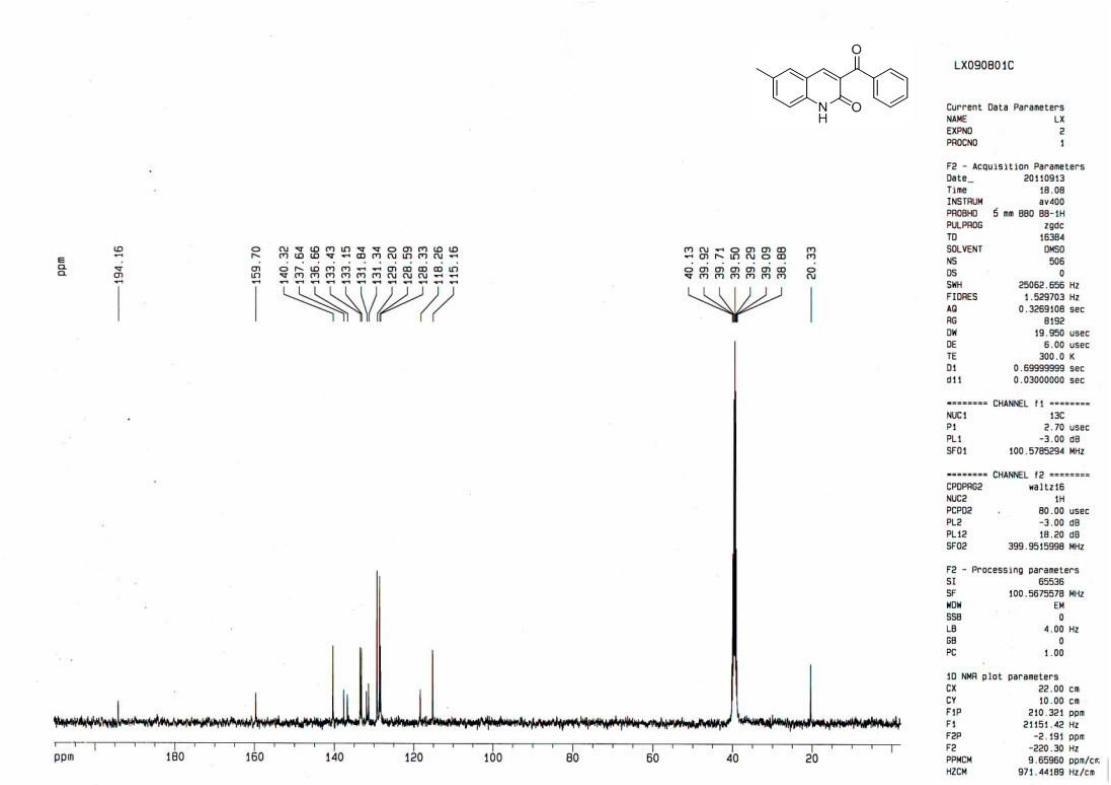
**2i**


11.99
8.36
7.34
3.91
3.86
3.35
2.62
2.51
2.51
2.50
0.00
OCH3
O
Cl
N
H
O
OCH3
4.99
4.99
1.05
3.05
3.05
1.00
f1 (ppm)

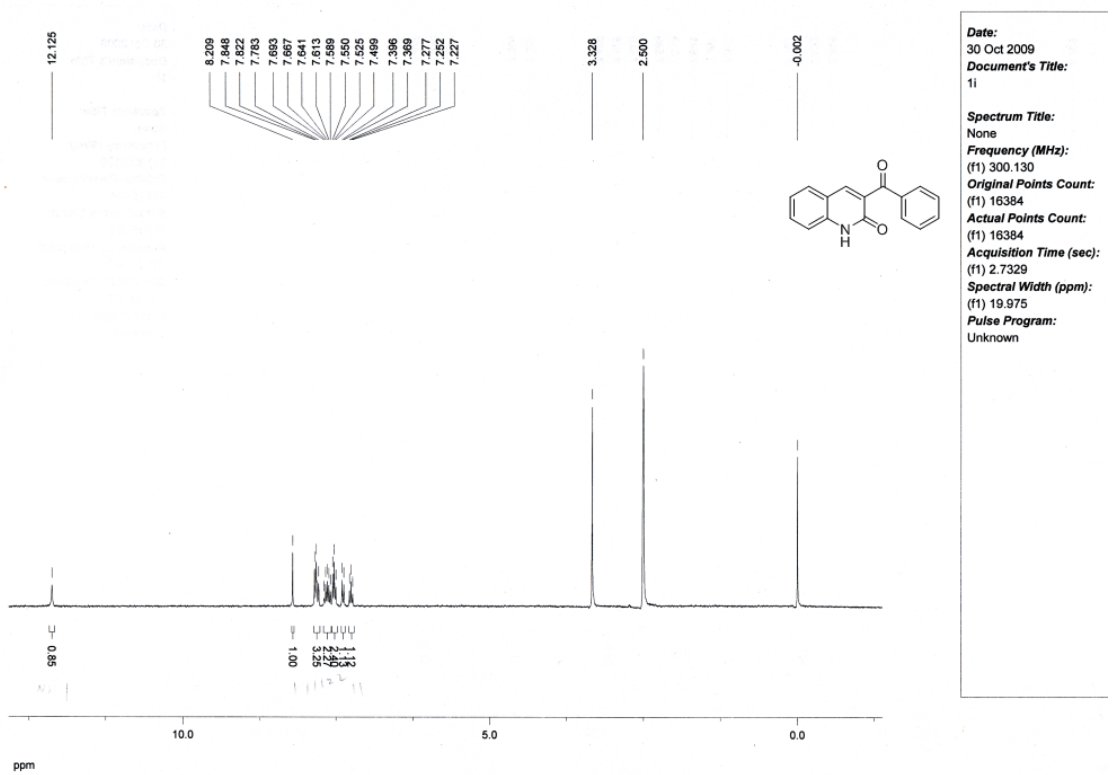

LX060301C (17hr)
OCH3
O
Cl
N
H
O
OCH3
ppm
197.35
159.63
146.28
142.47
136.43
130.67
130.45
118.07
114.41
113.36
62.21
56.78
40.13
39.92
39.71
39.50
39.30
39.09
38.88
30.55
ppm
Current Data Parameters
NAME LX
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110705
Time 16.29
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT DMSO
NS 53791
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.90 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -3.00 dB
PL12 17.37 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675571 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 35.00 cm
F1P 213.558 ppm
F1 21476.96 Hz
F2P -3.581 ppm
F2 -360.09 Hz
PPMCM 9.86992 ppm/cm
HZCM 992.59338 Hz/cm

**2j**


12.07
8.13
7.83
7.81
7.71
7.66
7.64
7.58
7.55
7.52
7.50
7.47
7.44
7.30
7.28
3.37
2.51
2.50
2.50
2.36
0.00
f1 (ppm)

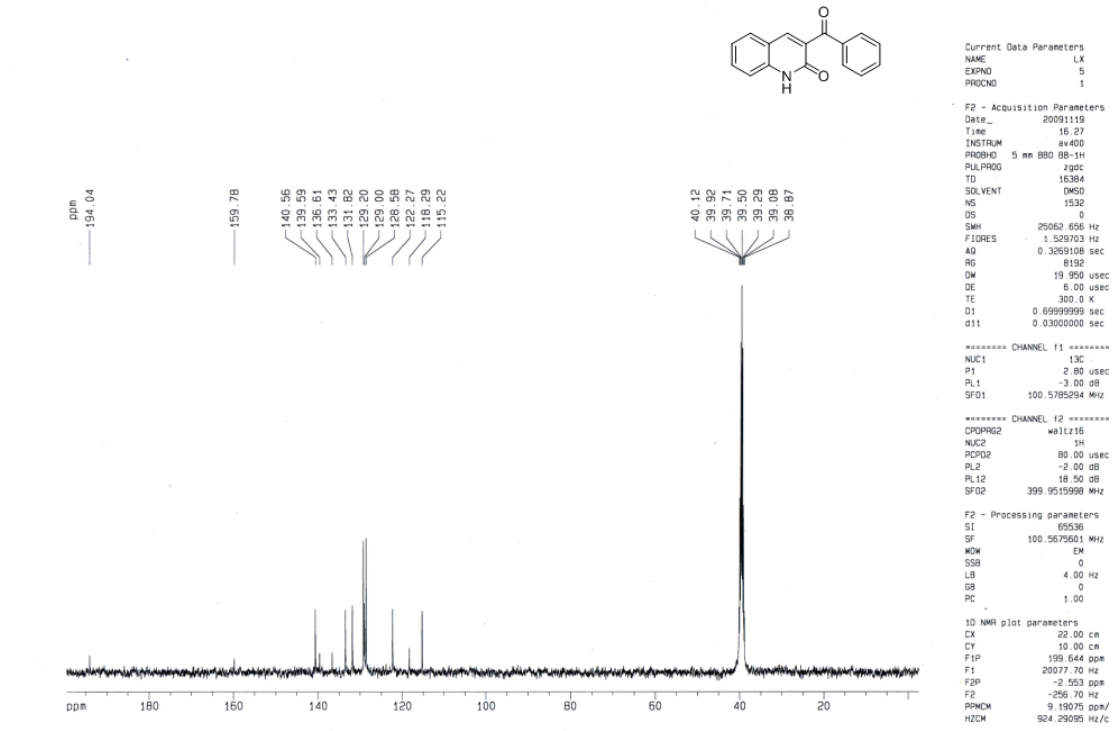

LX090801C
Current Data Parameters
NAME LX
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110913
Time 18.08
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT DMSO
NS 506
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.70 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -3.00 dB
PL12 18.20 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675578 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 10.00 cm
F1P 210.321 ppm
F1 21151.42 Hz
F2P -2.191 ppm
F2 -220.30 Hz
PPMCM 9.65960 ppm/cm
HZCM 971.44189 Hz/cm
ppm
194.16
159.70
140.32
137.64
136.66
133.43
133.15
131.84
131.34
129.20
128.59
128.33
118.26
115.16
40.13
39.92
39.71
39.50
39.29
39.09
38.88
20.33

**2k**



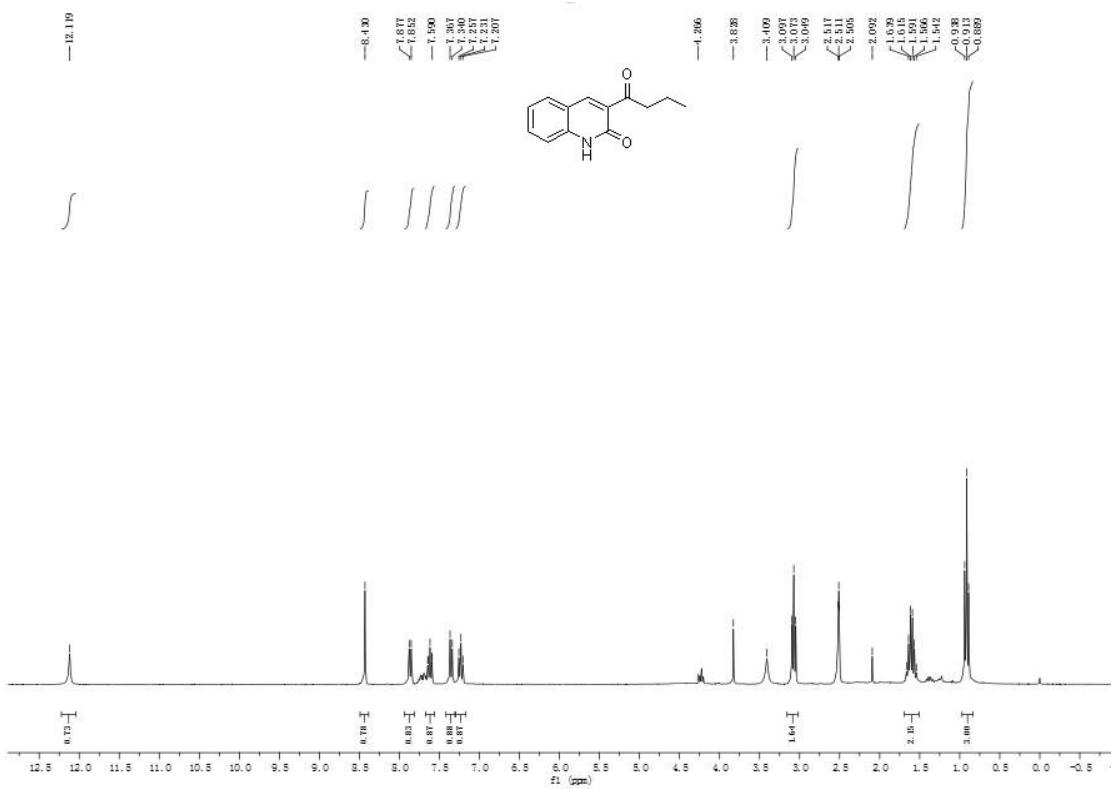

***Date:***
30 Oct 2009
***Document's Title:***
1i

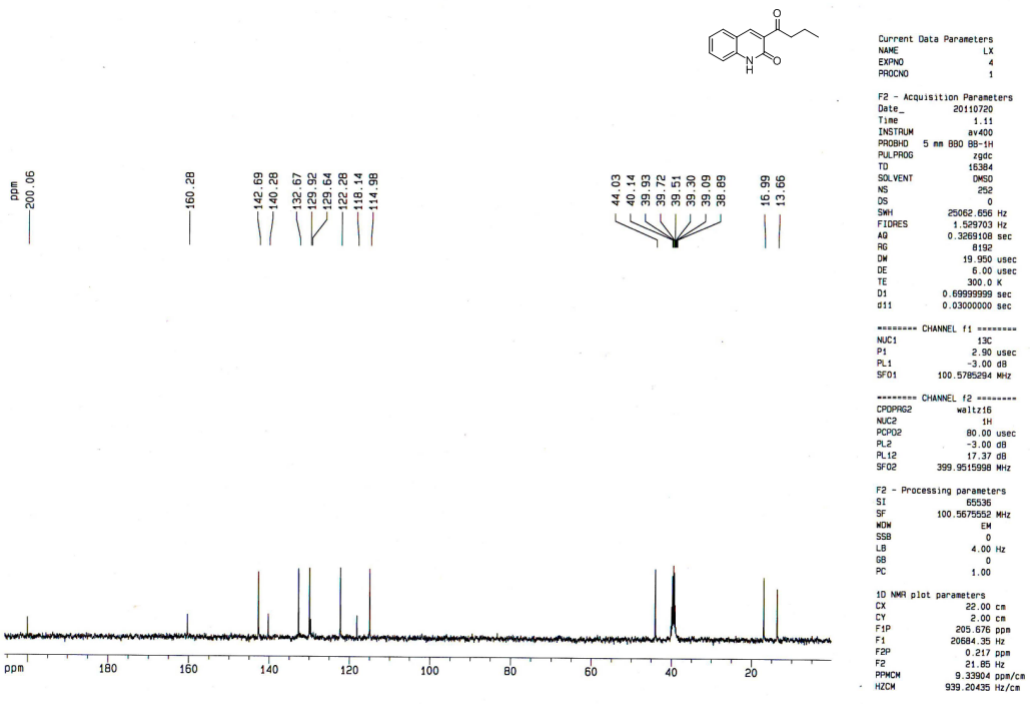
***Spectrum Title:***
None
***Frequency (MHz):***
(f1) 300.130
***Original Points Count:***
(f1) 16384
***Actual Points Count:***
(f1) 16384
***Acquisition Time (sec):***
(f1) 2.7329
***Spectral Width (ppm):***
(f1) 19.975
***Pulse Program:***
Unknown




```
Current Data Parameters
NAME                  LX
EXPNO                  5
PROCNO                 1

F2 - Acquisition Parameters
Date_           20091119
Time                16.27
INSTRUM           av400
PROBHD   5 mm BBO BB-1H
PULPROG             zgdc
TD                 16384
SOLVENT             DMSO
NS                  1532
DS                     0
SWH           25062.656 Hz
FIDRES         1.529703 Hz
AQ             0.3269108 sec
RG                  8192
DW               19.950 usec
DE                6.00 usec
TE               300.0 K
D1            0.69999999 sec
d11           0.03000000 sec

======== CHANNEL f1 ========
NUC1                13C
P1                 2.80 usec
PL1               -3.00 dB
SFO1         100.5785294 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                1H
PCPD2             80.00 usec
PL2               -2.00 dB
PL12              18.50 dB
SFO2         399.9515998 MHz

F2 - Processing parameters
SI                 65536
SF           100.5675601 MHz
WDW                   EM
SSB                    0
LB                  4.00 Hz
GB                     0
PC                  1.00

1D NMR plot parameters
CX                 22.00 cm
CY                 10.00 cm
F1P              199.644 ppm
F1             20077.70 Hz
F2P               -2.553 ppm
F2              -256.70 Hz
PPMCM             9.19075 ppm/
HZCM            924.29095 Hz/c
```

**2l**


12.119
8.400
7.877
7.852
7.590
7.367
7.340
7.257
7.231
7.207
4.206
3.838
3.409
3.097
3.073
3.049
2.517
2.511
2.505
2.092
1.679
1.615
1.591
1.566
1.542
0.938
0.913
0.889
0.73
0.78
0.83
0.87
0.88
0.97
1.64
2.15
3.00
f1 (ppm)

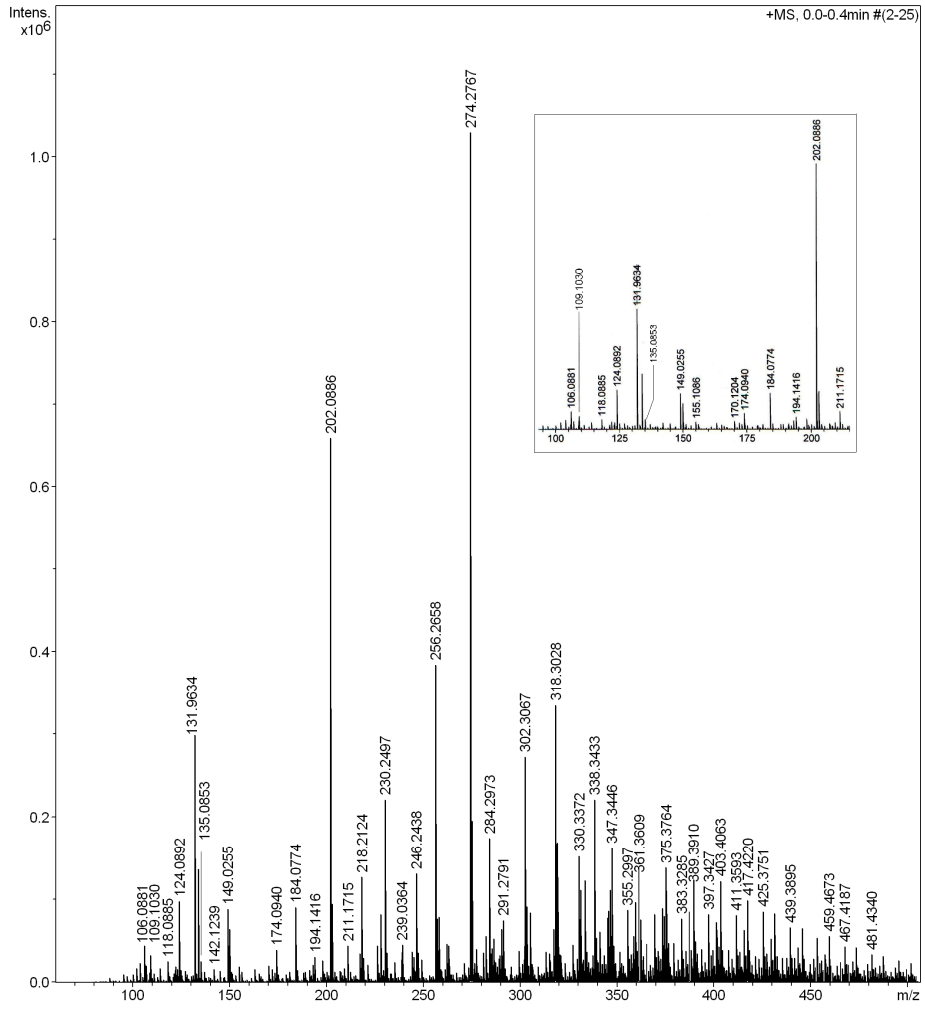

ppm
200.06
160.28
142.69
140.28
132.67
129.92
129.64
122.28
118.14
114.98
44.03
40.14
39.93
39.72
39.51
39.30
39.09
38.89
16.99
13.66
Current Data Parameters
NAME LX
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110720
Time 1.11
INSTRUM av400
PROBHD 5 mm BBO BB-1H
PULPROG zgdc
TD 16384
SOLVENT DMSO
NS 252
DS 0
SWH 25062.656 Hz
FIDRES 1.529703 Hz
AQ 0.3269108 sec
RG 8192
DW 19.950 usec
DE 6.00 usec
TE 300.0 K
D1 0.69999999 sec
d11 0.03000000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 2.90 usec
PL1 -3.00 dB
SFO1 100.5785294 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -3.00 dB
PL12 17.37 dB
SFO2 399.9515998 MHz
F2 - Processing parameters
SI 65536
SF 100.5675552 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 22.00 cm
CY 2.00 cm
F1P 205.676 ppm
F1 20684.35 Hz
F2P 0.217 ppm
F2 21.85 Hz
PPMCM 9.33904 ppm/cm
HZCM 939.20435 Hz/cm
ppm
180
160
140
120
100
80
60
40
20

# Ⅴ. Copy of mass spectra for the extract of reaction mixture (entry 13, Table 2)

Generic Display Report

**Analysis Info**

| | | | |
|---|---|---|---|
| Analysis Name | D:\Data\other\20110921\DEW.d | Acquisition Date | 9/23/2011 1:57:20 PM |
| Method | Pos_Low_50-700.m | Operator | zhang |
| Sample Name | standby | Instrument | micrOTOF |
| Comment | | | |




Bruker Compass DataAnalysis 4.0 printed: 11/28/2011 2:54:24 PM Page 1 of 1