Supporting Information

Ru-catalyzed Intermolecular [3+2+1] Cycloaddition of α,β -Unsaturated Ketones with Silylacetylenes and Carbon Monoxide Leading to α -Pyrones

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General information. ^1H NMR spectra were recorded with a JEOL JMN-500 (500 MHz) spectrometer in CDCl_3 . Chemical shifts are reported in parts per million (δ). ^{13}C NMR spectra were recorded with a JEOL JMN ECP-500 (125 MHz) spectrometer. Infrared spectra were obtained on a JASCO FT/IR-4100 spectrometer; absorptions are reported in reciprocal centimeters. Both conventional and high resolution mass spectra were recorded with a JEOL MS700 spectrometer. $\text{Ru}_3(\text{CO})_{12}$ ¹ and $[\text{Ru}(\text{CO})_3\text{Cl}_2]_2$ ² were prepared according to the literatures. Silylacetylenes **1a**, **1b**, and **1h**, were prepared from the corresponding aryl alkynes with trialkylsilyl chloride.³ Acetylenes **1c**, **1d**, **1e**, **1f**, and **1g**, were prepared from iodo arenes and trimethylsilyl acetylene by the Sonogashira coupling reaction.⁴ 2-Phenyl-1-trimethylgermylacetylene was prepared according to a reported procedure.⁵ Products were purified by flash chromatography on silica gel (Nacalai Tesque. Silica Gel 60, 230-400 mesh).

Typical Procedure for the $\text{Ru}_3(\text{CO})_{12}$ -Catalyzed [3+2+1] Cycloaddition

A magnetic stirring bar, 1-(trimethylsilyl)-2-phenylacetylene (**1a**, 84.3 mg, 0.48 mmol), methyl vinyl ketone (**2a**, 67.2 mg, 0.96 mmol), diethylmethylammonium iodide (21.3 mg, 0.10 mmol), triruthenium dodecacarbonyl (20.5 mg, 0.03 mmol) and toluene (2 mL) were placed in a 30 mL stainless steel autoclave. The autoclave was closed, purged three times with carbon monoxide, pressurized with 20 atm of CO, and then heated 160 °C for 8 h. Excess CO was discharged at room temperature. The solvent was removed under reduced pressure. The residue was purified by flash chromatography on silica gel (gradient from hexane/EtOAc = 10/1 to 3/1) to give **3a** (68.4 mg, 52%) and **4a** (8.6 mg, 7%).

Procedure for the Desilylation of **3a**

A mixture of **3a** (88.8 mg, 0.33 mmol), potassium fluoride (87.6 mmol, 1.60 mmol), and tetrabutylammonium chloride (93.0 mg, 0.33 mmol) in acetonitrile (2 mL) was stirred at room temperature for 3 days. The reaction mixture was poured into ether and water. Two layers were separated, and the aqueous layer was extracted with ether. The combined organic layer was washed with brine, dried, and concentrated. The crude product was purified by flash chromatography on silica gel (hexane/EtOAc = 5/1) to give desilylation product (25.4 mg, 39%). Regiochemistry of the cycloaddition product **3a** was confirmed by an NMR analysis of the desilylation product.^{6,7}

5,6-Dimethyl-4-phenyl-3-trimethylsilyl-2H-pyran-2-one (3a)

Colorless solid, Mp = 89-90 °C; (R_f = 0.18, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.14 (s, 9H), 1.56 (s, 3H), 2.26 (s, 3H), 7.04-7.07 (m, 2H), 7.35-7.43 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.41, 13.90, 17.99, 111.27, 121.35, 127.55, 128.03, 128.22, 139.19, 157.44, 164.86, 166.36; IR (KBr) 1623, 1691 cm^{-1} ; MS (EI) m/z (rel intensity) 272 (M^+ , 5), 244 (100), 229 (70), 75 (28); HRMS (EI) m/z calcd for $\text{C}_{16}\text{H}_{20}\text{O}_2\text{Si}$ (M^+) 272.1233, found 272.1231.

6,5-Dimethyl-methyl-4-phenyl-2H-pyran-2-one

White solid Mp = 110-112 °C; (R_f = 0.15, Hexane : EtOAc = 5 : 1). ^1H NMR (500 MHz, CDCl_3) δ -1.84 (s, H), 2.31 (s, 3H), 6.08 (s, 3H), 7.22-7.29 (m, 2H), 7.39-7.48 (m, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ 13.83, 18.11, 110.15, 112.20, 127.58, 128.50, 128.84, 137.36, 158.30, 160.13, 162.59; IR (KBr) 1711, 1735 cm^{-1} ; MS (EI) m/z (rel intensity) 200 (M^+ , 45), 172 (100), 129 (69), 51 (8); HRMS (EI) m/z calcd for $\text{C}_{13}\text{H}_{18}\text{O}_2\text{Si}$ (M^+), 200.0837, found 200.0840.

6-Methyl-5-(2-methyl-3-oxobutyl)-4-phenyl-3-trimethylsilyl-2H-pyran-2-one (4a)

Pale yellow liquid (R_f = 0.20, Hexane : EtOAc = 3 : 1); ^1H NMR (500 MHz, CDCl_3) δ -0.15 (s, 9H), 0.80 (d, J = 6.9 Hz, 3H), 1.71 (s, 3H), 2.06 (dd, J = 14.4, 9.2 Hz, 1H), 2.10-2.18 (m, 1H), 2.27 (s, 3H), 2.51 (dd, J = 14.2, 4.6, 1H), 7.10-7.16 (m, 2H), 7.37-7.46 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.27, 15.23, 18.55, 28.59, 29.86, 46.30, 113.36, 122.82, 128.32, 128.43, 128.58, 138.49, 159.59, 164.52, 165.39, 211.34; IR (neat) 1623, 1697 cm^{-1} ; MS (EI) m/z (rel intensity) 342 (M^+ , 6), 314 (41), 243 (55), 73 (100); HRMS (EI) m/z calcd for $\text{C}_{20}\text{H}_{26}\text{O}_3\text{Si}$ (M^+) 342.1651, found 342.1650.

6-Ethyl-5-methyl-4-phenyl-3-trimethylsilyl-2H-pyran-2-one (3b)

Yellow liquid ($R_f = 0.35$, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.14 (s, 9H), 1.25 (t, $J = 7.6$ Hz, 3H), 1.57 (s, 3H), 2.56 (q, $J = 7.5$ Hz, 2H), 7.04-7.09 (m, 2H), 7.34-7.45 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.43, 11.51, 13.44, 24.92, 110.40, 121.42, 127.54, 127.79, 128.15, 139.22, 161.92, 164.97, 166.55; IR (neat) 1624, 1697 cm^{-1} ; MS (EI) m/z (rel intensity) 286 (M^+ , 8), 271 (56), 258 (78), 243 (100), 75 (41), 73 (34); HRMS (EI) m/z calcd for $\text{C}_{17}\text{H}_{22}\text{O}_2\text{Si}$ (M^+), 286.1389, found. 286.1382.

5-Methyl-6-octyl-4-phenyl-3-trimethylsilyl-2H-pyran-2-one (3c)

Yellow liquid ($R_f = 0.35$, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.14 (s, 9H), 0.87 (t, $J = 6.42$, 3H), 1.20-1.40 (m, 10H), 1.55 (s, 3H), 1.62-1.71 (m, 2H), 2.51 (t, $J = 7.8$ Hz, 2H), 7.03-7.09 (m, 2H), 7.34-7.42 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.42, 13.66, 14.01, 22.55, 27.27, 29.06, 29.21, 29.30, 31.60, 31.75, 110.76, 121.35, 127.52, 127.97, 128.15; 139.25, 161.19, 164.92, 166.43, IR (neat) 1697 cm^{-1} ; MS (EI) m/z (rel intensity) 370 (M^+ , 3), 355 (46), 342 (82), 327 (29), 243 (100), 75 (55), 73 (58); HRMS (EI) m/z calcd for $\text{C}_{23}\text{H}_{34}\text{O}_2\text{Si}$ (M^+), 370.2328, found 370.2327.

4-Phenyl-3-trimethylsilyl-5,6,7,8-tetrahydro-2H-1-benzopyran-2-one (3d)

Pale yellow liquid ($R_f = 0.40$, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.13 (s, 9H), 1.53-1.60 (m, 2H), 1.70-1.77 (m, 2H), 1.83-1.89 (m, 2H), 2.52-2.58 (m, 2H), 7.04-7.11 (m, 2H), 7.33-7.42 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.33, 21.62, 22.43, 24.87, 27.84, 112.98, 121.51, 127.60, 128.07, 128.14, 138.40, 159.38, 164.89, 165.71; IR (neat) 1633, 1722 cm^{-1} ; MS (EI) m/z (rel intensity) 298 (M^+ , 7), 283 (54), 270 (100), 255 (69); HRMS (EI) m/z calcd for $\text{C}_{18}\text{H}_{22}\text{O}_2\text{Si}$ (M^+) 298.1389, found 298.1386.

5,6-Dimethyl-4-octyl-3-trimethylsilyl-2H-pyran-2-one (3e)

Pale yellow liquid (R_f = 0.55, Hexane : EtOAc = 5 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.31 (s, 9H), 0.89 (t, J = 6.9 Hz, 3H), 1.24-1.42 (m, 8H), 1.92 (s, 3H), 2.20 (s, 3H); 2.47 (t, J = 7.8 Hz, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ -1.16, 12.53, 13.99, 18.00, 22.57, 29.51, 30.93, 31.61, 32.82, 111.36, 119.39, 157.57, 165.30, 167.30; IR (neet) 1631, 1695 cm^{-1} ; MS (EI) m/z (rel intensity) 280 (M^+ , 4), 265 (46), 182 (76), 75 (61), 73 (100); HRMS (EI) m/z calcd for $\text{C}_{16}\text{H}_{28}\text{O}_2\text{Si}$ (M^+), 280.1859, found 280.1854.

5,6-Dimethyl-4-(4-methoxyphenyl)-3-trimethylsilyl-2H-pyran-2-one (3f)

Colorless solid Mp = 128-130 $^{\circ}\text{C}$; (R_f = 0.33, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.14 (s, 9H), 1.55 (s, 3H), 2.22 (s, 3H), 3.82 (s, 3H), 6.89 (d, J = 8.7 Hz, 2H), 6.95 (d, J = 8.7 Hz, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.27, 13.90, 17.95, 55.20, 111.65, 113.54, 121.61, 128.81, 131.59, 157.21, 159.36, 164.90, 166.36; IR (KBr) 1628, 1692 cm^{-1} ; MS (EI) m/z (rel intensity) 302 (M^+ , 5), 287 (39), 274 (100), 259 (89); HRMS (EI) m/z calcd for $\text{C}_{17}\text{H}_{22}\text{O}_3\text{Si}$ (M^+), 302.1338, found 302.1337.

5,6-Dimethyl-4-(4-fluorophenyl)-3-trimethylsilyl-2H-pyran-2-one (3g)

Pale yellow solid Mp = 89-91 $^{\circ}\text{C}$; (R_f = 0.33, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.12 (s, 9H), 1.55 (s, 3H), 2.56 (s, 3H), 7.02-7.06 (m, 2H), 7.08-7.13 (m, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.22, 14.03, 18.11, 111.35, 115.44, 122.05, 129.44, 135.30, 157.75, 162.56 (d, J = 247 Hz), 164.79, 165.43; IR (KBr) 1624, 1698 cm^{-1} ; MS (EI) m/z (rel intensity) 290 (M^+ , 7), 275 (47), 262 (100), 247 (88), 75 (38); HRMS (EI) m/z calcd for $\text{C}_{16}\text{H}_{19}\text{FO}_2\text{Si}$ (M^+), 290.1138, found 290.1131.

5,6-Dimethyl-4-(o-tolyl)-3-trimethylsilyl-2H-pyran-2-one (3h)

Pale yellow liquid (R_f = 0.35, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.16 (s, 9H), 1.47 (s, 3H), 2.08 (s, 3H), 2.25 (s, 3H), 6.87-6.92 (m, 2H), 7.17-7.23 (m, 2H), 7.23-7.28 (m, 1H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.75, 13.20, 18.03, 19.47, 111.21, 121.17, 125.81, 127.40, 128.23, 129.99, 134.26, 138.70, 157.83, 165.00, 166.18; IR (neat) 1631, 1694 cm^{-1} ; MS (EI) m/z (rel intensity) 286 (M^+ , 12), 271 (69), 258 (100), 243 (41), 75 (36), 73 (60); HRMS (EI) m/z calcd for $\text{C}_{17}\text{H}_{22}\text{O}_2\text{Si}$ (M^+) 286.1389, found 286.1389.

5,6-Dimethyl-4-(1-naphthyl)-3-trimethylsilyl-2H-pyran-2-one (3i)

Pale yellow solid, Mp = 103-105 $^{\circ}\text{C}$; (R_f = 0.55, Hexane : EtOAc = 5 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.17 (s, 9H), 1.58 (s, 3H), 2.28 (s, 3H), 7.20 (dd, J = 8.3 Hz, 1.9, 1H), 7.52-7.57 (m, 3H), 7.82-7.86 (m, 1H), 7.86-7.91 (m, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.22, 14.00, 18.01, 111.39, 121.66, 125.60, 125.53, 126.58, 126.72, 127.82, 127.95, 132.69, 136.68, 157.54, 164.87, 166.30; IR (KBr) 1628, 1690 cm^{-1} ; MS (EI) m/z (rel intensity) 322 (M^+ , 75), 307 (59), 294 (100), 279 (94), 264 (50), 73 (64); HRMS (EI) m/z calcd for $\text{C}_{20}\text{H}_{22}\text{O}_2\text{Si}$ (M^+), 322.1389, found 322.1390.

5,6-Dimethyl-4-(2-naphthyl)- 3-trimethylsilyl-2H-pyran-2-one (3j)

Pale yellow solid, Mp = 138-140 $^{\circ}\text{C}$; (R_f = 0.15, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.32 (s, 9H), 1.42 (s, 3H), 2.29 (s, 3H), 7.12-7.16 (m, 1H), 7.42-7.56 (m, 4H), 7.82-7.86 (m, 1H), 7.87-7.90 (m, 2H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.74, 13.25, 17.99, 111.97, 122.86, 125.01, 128.44, 131.04, 133.10, 136.71, 157.61, 164.82, 165.10; IR (KBr) 1653, 1691 cm^{-1} ; MS (EI) m/z (rel intensity) 322 (M^+ , 7), 307 (33), 294 (100), 279 (93), 75 (28), 73 (30); HRMS (EI) m/z calcd for $\text{C}_{20}\text{H}_{22}\text{O}_2\text{Si}$ (M^+), 322.1389, found 322.1384.

5,6-Dimethyl-4-phenyl-3-triethylsilyl-2H-pyran-2-one (3k)

Colorless liquid ($R_f = 0.23$, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.36 (q, $J = 8.0$ Hz, 6H), 0.76 (t, $J = 8.0$ Hz, 9H), 1.51 (s, 3H), 2.25 (s, 3H), 7.01-7.06 (m, 2H), 7.35-7.40 (m, 3H), 7.35-7.40; ^{13}C NMR (125 MHz, CDCl_3) δ -2.91, 7.70, 14.04, 18.04, 111.34, 119.16, 127.60, 127.66, 128.06, 139.28, 157.43, 164.89, 167.84; IR (KBr) 1631, 1700 cm^{-1} ; MS (EI) m/z (rel intensity) 314 (M^+ , 0.2), 286 (30), 285 (100), 114 (12); HRMS (EI) m/z calcd for $\text{C}_{19}\text{H}_{26}\text{O}_2\text{Si}$ (M^+), 314.1702, found 314.1709.

5,6-Dimethyl-4-phenyl-3-trimethylgermyl-2H-pyran-2-one (3l)

Pale yellow liquid ($R_f = 0.18$, Hexane : EtOAc = 10 : 1). ^1H NMR (500 MHz, CDCl_3) δ -0.01 (s, 9H), 1.58 (s, 3H), 2.25 (s, 3H), 7.03-7.09 (m, 2H), 7.36-7.43 (m, 3H); ^{13}C NMR (125 MHz, CDCl_3) δ -0.29, 14.00, 17.92, 111.18, 123.96, 127.64, 128.04, 128.35, 139.11, 156.99, 164.56, 165.65; IR (neet) 1629, 1685 cm^{-1} ; MS (EI) m/z (rel intensity) 318 (M^+ , 7), 303 (97), 275 (100), 115 (51); HRMS (EI) m/z calcd for $\text{C}_{16}\text{H}_{20}\text{GeO}_2$ (M^+) 318.0675, found 318.0669.

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18. [Name]	27-000-0022	15:47:02		
19. [Name]	27-000-0023	15:47:03		
20. [Name]	27-000-0024	15:47:04		
21. [Name]	27-000-0025	15:47:05		
22. [Name]	27-000-0026	15:47:06		
23. [Name]	27-000-0027	15:47:07		
24. [Name]	27-000-0028	15:47:08		
25. [Name]	27-000-0029	15:47:09		
26. [Name]	27-000-0030	15:47:10		
27. [Name]	27-000-0031	15:47:11		
28. [Name]	27-000-0032	15:47:12		
29. [Name]	27-000-0033	15:47:13		
30. [Name]	27-000-0034	15:47:14		
31. [Name]	27-000-0035	15:47:15		
32. [Name]	27-000-0036	15:47:16		
33. [Name]	27-000-0037	15:47:17		
34. [Name]	27-000-0038	15:47:18		
35. [Name]	27-000-0039	15:47:19		
36. [Name]	27-000-0040	15:47:20		
37. [Name]	27-000-0041	15:47:21		
38. [Name]	27-000-0042	15:47:22		
39. [Name]	27-000-0043	15:47:23		
40. [Name]	27-000-0044	15:47:24		
41. [Name]	27-000-0045	15:47:25		
42. [Name]	27-000-0046	15:47:26		
43. [Name]	27-000-0047	15:47:27		
44. [Name]	27-000-0048	15:47:28		
45. [Name]	27-000-0049	15:47:29		
46. [Name]	27-000-0050	15:47:30		
47. [Name]	27-000-0051	15:47:31		
48. [Name]	27-000-0052	15:47:32		
49. [Name]	27-000-0053	15:47:33		
50. [Name]	27-000-0054	15:47:34		
51. [Name]	27-000-0055	15:47:35		
52. [Name]	27-000-0056	15:47:36		
53. [Name]	27-000-0057	15:47:37		
54. [Name]	27-000-0058	15:47:38		
55. [Name]	27-000-0059	15:47:39		
56. [Name]	27-000-0060	15:47:40		
57. [Name]	27-000-0061	15:47:41		
58. [Name]	27-000-0062	15:47:42		
59. [Name]	27-000-0063	15:47:43		
60. [Name]	27-000-0064	15:47:44		
61. [Name]	27-000-0065	15:47:45		
62. [Name]	27-000-0066	15:47:46		
63. [Name]	27-000-0067	15:47:47		
64. [Name]	27-000-0068	15:47:48		
65. [Name]	27-000-0069	15:47:49		
66. [Name]	27-000-0070	15:47:50		
67. [Name]	27-000-0071	15:47:51		
68. [Name]	27-000-0072	15:47:52		
69. [Name]	27-000-0073

3d

[illegible]

3d

X : parts per million = 13C

35

[illegible]

45

File Name	Log Sequence	Sequence Number
Amphib	1	14 14-04-1988 1178
Amphib	2	15 15-04-1988 1179
Amphib	3	16 16-04-1988 1180
Amphib	4	17 17-04-1988 1181
Amphib	5	18 18-04-1988 1182
Amphib	6	19 19-04-1988 1183
Amphib	7	20 20-04-1988 1184
Amphib	8	21 21-04-1988 1185
Amphib	9	22 22-04-1988 1186
Amphib	10	23 23-04-1988 1187
Amphib	11	24 24-04-1988 1188
Amphib	12	25 25-04-1988 1189
Amphib	13	26 26-04-1988 1190
Amphib	14	27 27-04-1988 1191
Amphib	15	28 28-04-1988 1192
Amphib	16	29 29-04-1988 1193
Amphib	17	30 30-04-1988 1194
Amphib	18	31 31-04-1988 1195
Amphib	19	32 32-04-1988 1196
Amphib	20	33 33-04-1988 1197
Amphib	21	34 34-04-1988 1198
Amphib	22	35 35-04-1988 1199
Amphib	23	36 36-04-1988 1200
Amphib	24	37 37-04-1988 1201
Amphib	25	38 38-04-1988 1202
Amphib	26	39 39-04-1988 1203
Amphib	27	40 40-04-1988 1204
Amphib	28	41 41-04-1988 1205
Amphib	29	42 42-04-1988 1206
Amphib	30	43 43-04-1988 1207
Amphib	31	44 44-04-1988 1208
Amphib	32	45 45-04-1988 1209
Amphib	33	46 46-04-1988 1210
Amphib	34	47 47-04-1988 1211
Amphib	35	48 48-04-1988 1212
Amphib	36	49 49-04-1988 1213
Amphib	37	50 50-04-1988 1214
Amphib	38	51 51-04-1988 1215
Amphib	39	52 52-04-1988 1216
Amphib	40	53 53-04-1988 1217
Amphib	41	54 54-04-1988 1218
Amphib	42	55 55-04-1988 1219
Amphib	43	56 56-04-1988 1220
Amphib	44	57 57-04-1988 1221
Amphib	45	58 58-04-1988 1222
Amphib	46	59 59-04-1988 1223
Amphib	47	60 60-04-1988 1224
Amphib	48	61 61-04-1988 1225
Amphib	49	62 62-04-1988 1226
Amphib	50	63 63-04-1988 1227
Amphib	51	64 64-04-1988 1228
Amphib	52	65 65-04-1988 1229
Amphib	53	66 66-04-1988 1230
Amphib	54	67 67-04-1988 1231
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Amphib	56	69 69-04-1988 1233
Amphib	57	70 70-04-1988 1234
Amphib	58	71 71-04-1988 1235
Amphib	59	72 72-04-1988 1236
Amphib	60	73 73-04-1988 1237
Amphib	61	74 74-04-1988 1238
Amphib	62	75 75-04-1988 1239
Amphib	63	76 76-04-1988 1240
Amphib	64	77 77-04-1988 1241
Amphib	65	78 78-04-1988 1242
Amphib	66	79 79-04-1988 1243
Amphib	67	80 80-04-1988 1244
Amphib	68	81 81-04-1988 1245
Amphib	69	82 82-04-1988 1246
Amphib	70	83 83-04-1988 1247
Amphib	71	84 84-04-1988 1248
Amphib	72	85 85-04-1988 1249
Amphib	73	86 86-04-1988 1250
Amphib	74	87 87-04-1988 1251
Amphib	75	88 88-04-1988 1252
Amphib	76	89 89-04-1988 1253
Amphib	77	90 90-04-1988 1254
Amphib	78	91 91-04-1988 1255
Amphib	79	92 92-04-1988 1256
Amphib	80	93 93-04-1988 1257
Amphib	81	94 94-04-1988 1258
Amphib	82	95 95-04-1988 1259
Amphib	83	96 96-04-1988 1260
Amphib	84	97 97-04-1988 1261
Amphib	85	98 9

X : parts per Million : 13C

[illegible]

K : parts per Million : 111

[illegible]

43

Cc1cc2cc(C)c3cc(C)c(C)c3cc2cc1C(=O)OSi(C)(C)C

34

X : parts per Million : 13C

--- ACQUISITION PARAMETERS ---
 File Name : 2d_spectra_2
 Author :
 Sample ID : 7
 Concentration : Single Pulse Experiment
 Creation Date : 2-09-2006 11:03:09
 Acquisition Date : 2-09-2006 20:22:14
 Spec Name : 2d_000000
 Spec Type : 1D
 Data Format : 1D
 Channels : 1
 Data Size : 16384
 Data Width : 1
 Data Type : 1
 Data Range : 1
 Data Offset : 1
 Data Scale : 1
 Data Shift : 1
 Data Gain : 1
 Data Loss : 1
 Data Noise : 1
 Data Phase : 1
 Data Amplitude : 1
 Data Frequency : 1
 Data Wavelength : 1
 Data Solvent : 1
 Data Temperature : 1
 Data Pressure : 1
 Data Humidity : 1
 Data pH : 1
 Data Conductivity : 1
 Data Viscosity : 1
 Data Refractive Index : 1
 Data Density : 1
 Data Molar Mass : 1
 Data Molecular Weight : 1
 Data Molecular Formula : 1
 Data Molecular Structure : 1
 Data Molecular Weight : 1
 Data Molecular Formula : 1
 Data Molecular Structure : 1

3f

[illegible]

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X = parts per Million = 13C

[illegible]

5

ॐ

[illegible]

[illegible]

3k

[illegible]

36

XX : parts per Million : 13C

S32

15

HT : 100% red sand : 2%