Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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Supporting Informations

Arylthioureas with Bromine or its Equivalents Gives No 'Hugerschoff' Reaction Product

Ramesh Yella, Siva Murru, Abdur Rezzak Ali and Bhisma K. Patel*

Department of Chemistry, Indian Institute of Technology Guwahati

Email id: patel@iitg.ernet.in

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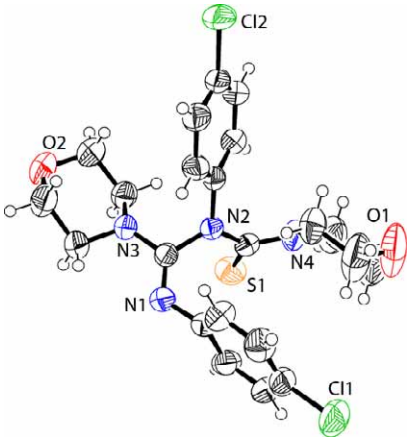


Figure 2. ORTEP molecular diagram of **5b**.

Crystallographic description of 5b: crystal dimension (mm): 0.31 x 0.25 x 0.19; $C_{22}H_{24}Cl_2N_4O_2S$, M_r = 479.42; monoclinic, space group $P2_1/c$; a = 9.1161(6), b = 11.1981(6), c = 22.7023(13) Å; $\alpha = \gamma = 90^o$ $\beta = 90.02$ ^{o}, V = 2317.5(2) Å^3; Z = 4; ρ_{calcd} = 1.374 mg/m^3; μ (mm^{-1}) = 0.397; F(000) = 1000.0; reflection collected / unique = 3718 / 2603; refinement method = full-matrix least-squares on F^2; final R indices [$I > 2\sigma(I)$] R_1 = 0.0396, wR_2 = 0.1186, R indices (all data) R_1 = 0.0587, wR_2 = 0.1319; goodness of fit = 0.842.

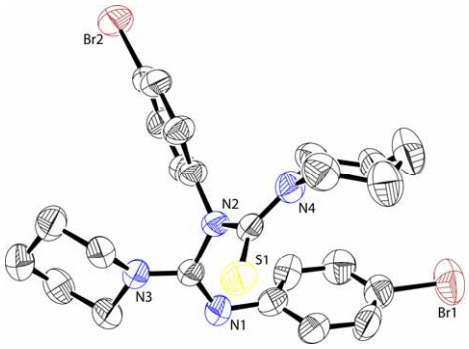


Figure 3. ORTEP molecular diagram of **6a**.

Crystallographic description of 6a: crystal dimension (mm): 0.28 x 0.22 x 0.18; $C_{24}H_{28}Br_2N_4S$, M_r = 564.38; monoclinic, space group $P2_1/c$; a = 9.2041(17), b = 11.356(2), c = 23.799(5) Å; $\alpha = \gamma = 90.00^o$, β = 93.183(12) ^{o}, V = 2483.7(8) Å^3; Z = 4; ρ_{calcd} = 1.509

mg/m^3; μ(mm^{-1}) = 0.367; F(000) = 1144; reflection collected / unique = 6128 / 2368; refinement method = full-matrix least-squares on F^2; final R indices [$I > 2\sigma(I)$] R_1 = 0.0638, wR_2 = 0.1170, R indices (all data) R_1 = 0.1539, wR_2 = 0.1398; goodness of fit = 0.899.

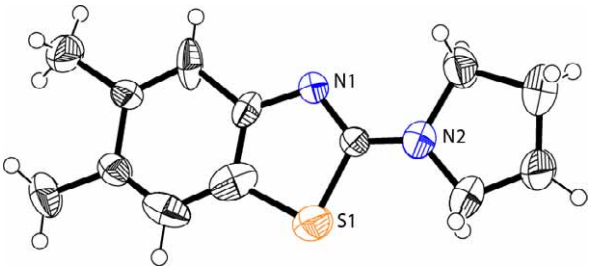


Figure 4. ORTEP molecular diagram with ellipsoid at 50% probability of **10c'**.

Crystallographic description of 10c': crystal dimension (mm): 0.27 x 0.21 x 0.17; $C_{39}H_{47}N_6S_3$, M_r = 696.01; monoclinic, space group P_{32}; a = 13.2914(10), b = 13.2914(10), c = 18.1404(13) Å; $\alpha = \beta = 90^o$, $\gamma = 120^o$, V = 2775.4(4) Å^3; Z = 3; ρ_{calcd} = 1.249 mg/m^3; μ(mm^{-1}) = 0.237; F(000) = 1113; reflection collected / unique = 8763 / 4497; refinement method = full-matrix least-squares on F^2; final R indices [$I > 2\sigma(I)$] R_1 = 0.1343, wR_2 = 0.3239, R indices (all data) R_1 = 0.2032, wR_2 = 0.3631; goodness of fit = 1.099.

CCDC number for compound 5b, 6a and **10c':** CCDC-754858, 754857 and 754861. This data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/datarequest/cif.

Spectral Data

2-(Piperidin-1-yl)benzo[*d*]thiazole (1a').[2,3] mp: 93 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 1.67 (s, 6H), 3.58 (s, 4H), 7.03 (t, *J* = 7.6 Hz,1H), 7.26 (t, *J* = 8.0 Hz,1H), 7.55 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 24.4, 25.5, 49.8, 118.9, 120.7, 121.2, 126.0, 130.8, 153.1, 169.0; IR (KBr): 2961, 2858, 1608, 1562, 1542, 1473, 1443, 1356, 1305, 1270, 1220, 1058, 1038, 868, 838 cm^{-1}; Elemental analysis: $C_{12}H_{14}N_2S$ (218.32): calcd C, 66.02; H, 6.46; N, 12.83; S, 14.69. found: C, 66.08; H, 6.49; N, 12.76; S, 14.74.

***N*-((*E*)-Morpholino(phenylimino)methyl)-*N*-phenylmorpholine-4-carbothioamide (1b).** mp: 150 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 2.62–3.80 (m, 16H), 6.81 (br m, 1H), 6.95–7.10 (m, 4H), 7.13 (t, *J* = 7.6 Hz, 1H), 7.21 (t, *J* = 7.6 Hz, 2H), 7.28–7.48 (br m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 46.8, 50.7, 65.5, 66.2, 120.4, 121.4, 122.2, 122.9, 124.8, 128.8, 129.8, 142.8, 149.3, 185.2; IR (KBr): 2979, 2904, 2894, 2856, 1634, 1586, 1485, 1453, 1351, 1301, 1277, 1239, 1206, 1157, 1109, 1062, 1022, 994, 937, 855, 765, 753 cm^{-1}; MS (ESI): 411.1858 (MH^+).

***N*-Phenyl-*N*-((*E*)-(phenylimino)(pyrrolidin-1-yl)methyl)pyrrolidine-1-carbothioamide (1c).** mp: 152 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 1.05–2.50 (m, 12H), 3.37–3.90 (m, 4H), 6.82 (m, 1H), 6.89 (t, *J* = 7.2 Hz, 1H), 6.96 (m, 1H), 7.04 (t, *J* = 7.6 Hz, 1H), 7.09 (d, *J* = 7.6 Hz, 2H), 7.15 (m, 2H), 7.19–7.36 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 24.3, 25.1, 25.8, 26.2, 47.2, 48.4, 51.9, 53.7, 120.9, 122.2, 123.2, 123.9, 128.4, 129.3, 129.8, 141.8, 150.0, 181.0; IR (KBr): 2962, 2863, 1587, 1488, 1438, 1415, 1330, 1288, 1260, 1233, 1175, 1149, 906, 859, 770, 761 cm^{-1}; Elemental analysis: $C_{22}H_{26}N_4S$ (378.53): calcd C, 69.80; H, 6.92; N, 14.80; S, 8.47. found: C, 69.84; H, 6.89; N, 14.85; S, 8.39.

2-(Pyrrolidin-1-yl)benzo[*d*]thiazole (1c').[2,3] mp: 101 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm). 2.06 (m, 4H), 3.56 (m, 4H), 7.03 (t, *J* = 7.6 Hz, 1H), 7.28 (t, *J* = 7.6 Hz, 1H), 7.58 (d, *J* = 8.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 25.7, 49.6, 118.7, 120.7, 120.8, 126.0, 130.8, 153.4, 165.5; IR (KBr): 2950, 2868, 1604, 1561, 1544, 1442, 1365, 1341, 1317,

1276, 1258, 1175, 1120, 1069, 859, 747, 720 cm^{-1}; Elemental analysis: $C_{11}H_{12}N_2S$ (204.29): calcd C, 64.67; H, 5.92; N, 13.71; S, 15.70. found: C, 64.61; H, 5.89; N, 13.76; S, 15.78.

***N*-Phenyl-*N*-((*E*)-(phenylimino)(dibutylamin-1-yl)methyl)dibutylamine-1-carbothioamide (1d).** Gummy; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 0.07–1.13 (m, 15H), 1.14–1.40 (m, 7H), 1.63 (s, 6H), 2.90–3.10 (m, 4H), 3.36–3.70 (m, 4H), 6.88 (t, *J* = 7.2 Hz, 2H), 7.02 (d, *J* = 7.2 Hz, 2H), 7.08 (t, *J* = 7.6 Hz, 2H), 7.15 (t, *J* = 8.0 Hz, 2H), 7.20–7.36 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 13.7, 14.1, 14.2, 14.4, 20.3, 20.7, 21.2, 27.3, 28.6, 29.8, 48.1, 49.5, 51.2, 51.4, 121.9, 122.2, 122.6, 124.7, 128.6, 129.2, 144.4, 149.4, 150.4, 189.5; IR (KBr): 2958, 2932, 2872, 1626, 1591, 1488, 1462, 1417, 1375, 1314, 1283, 1223, 1139, 943, 913, 768, 751 cm^{-1}; HRMS (ESI) 495.3546 (MH^+).

***N*-((*E*)-(2-Chlorophenylimino)(pyrrolidin-1-yl)methyl)-*N*-(2-chlorophenyl)pyrrolidine-1-carbothioamide (2c).** mp: 154 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 1.70–2.21 (m, 10H), 3.14-4.02 (m, 6H), 6.43–6.86 (m, 3H), 6.90–7.06 (m, 2H), 7.12–7.53 (m, 2H), 7.77 (br s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 24.5, 25.1, 26.1, 26.7, 46.9, 48.1, 51.6, 54.5, 122.3, 123.3, 123.8, 125.3, 126.3, 127.2, 127.5, 128.2, 128.9, 130.9, 138.6, 146.6, 183.2; IR (KBr): 2968, 2949, 2862, 1623, 1580, 1440, 1413, 1330, 1283, 1261, 1205, 1177, 1051, 947, 874, 756 cm^{-1}; Elemental analysis: $C_{22}H_{24}Cl_2N_4S$ (447.42): calcd C, 59.06; H, 5.41; N, 12.52; S, 7.17. found: C, 59.12; H, 5.46; N, 12.48; S, 7.21.

***N*-((*E*)-(2-Bromophenylimino)(morpholino)methyl)-*N*-(2-bromophenyl)morpholine-4-carbothioamide (3b).** mp: 180–182 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 2.23–4.80 (m, 16H), 6.61–7.13 (m, 5H), 7.48–8.02 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 47.3, 51.2, 66.2, 117.8, 119.6, 123.1, 123.9, 127.3, 127.8, 128.1, 128.8, 132.5, 134.5, 141.3, 147.3, 187.6; IR (KBr): 2949, 2894, 2849, 1628, 1575, 1466, 1427, 1400, 1364, 1302, 1272, 1238, 1219, 1205, 1158, 1149, 1109, 1065, 1024, 998, 953, 874, 749 cm^{-1}; Elemental analysis: $C_{22}H_{24}Br_2N_4O_2S$ (568.32): calcd C, 46.49; H, 4.26; N, 9.86; S, 5.64. found: C, 46.55; H, 4.29; N, 9.81; S, 5.58.

***N*-((*E*)-(3-Nitrophenylimino)(piperidin-1-yl)methyl)-*N*-(3-nitrophenyl)piperidine-1-carbothioamide (4a).** mp: 186 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 0.91–1.92 (m, 12H), 3.35 (m, 8H), 7.14-7.41 (m, 3H), 7.50 (t, *J* = 7.6 Hz, 1H), 7.63–7.86 (m, 3H), 7.93 (d, *J* = 7.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 23.7, 24.3, 25.0, 47.9, 52.1, 116.8, 117.1, 119.3, 127.4, 129.3, 130.4, 144.4, 148.7, 148.9, 150.5, 184.1; IR (KBr): 2942, 2925, 2851, 1637, 1606, 1522, 1479, 1444, 1417, 1352, 1299, 1280, 1244, 1206, 1182, 1027, 901, 739 cm^{-1}; Elemental analysis: $C_{24}H_{28}N_6O_4S$ (496.58): calcd C, 58.05; H, 5.68; N, 16.92; S, 6.46. found: C, 57.99; H, 5.72; N, 16.88; S, 6.38.

***N*-((*E*)-(4-Chlorophenylimino)(morpholino)methyl)-*N*-(4-chlorophenyl)morpholine-4-carbothioamide (5b).** mp: 162–164 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 2.81–3.92 (m, 16H), 6.74 (m, 2H), 6.93 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 7.33 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 46.9, 50.9, 65.6, 66.3, 122.3, 123.5, 128.3, 128.9, 130.1, 130.5, 141.2, 147.7, 149.5, 184.9; IR (KBr): 2963, 2889, 2845, 1637, 1584, 1487, 1461, 1416, 1360, 1297, 1273, 1258, 1232, 1207, 1159, 1112, 1094, 1074, 1010, 997, 825 cm^{-1}; Elemental analysis: $C_{22}H_{24}Cl_2N_4O_2S$ (479.42) : calcd C, 55.12; H, 5.05; N, 11.69; S, 6.69. found: C, 55.08; H, 5.09; N, 11.72; S, 6.63.

***N*-((*E*)-(4-Bromophenylimino)(piperidin-1-yl)methyl)-*N*-(4-bromophenyl)piperidine-1-carbothioamide (6a).** mp: 177–179 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 1.01–1.85 (m, 13H), 2.81–3.82 (m, 7H), 6.77 (m, 2H), 6.88 (d, *J* = 8.4 Hz, 2H), 7.26 (d, *J* = 8.4 Hz, 2H), 7.43 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 23.8, 24.5, 24.9, 25.1, 47.7, 51.9, 115.2, 117.4, 123.1, 124.2, 131.5, 132.5, 142.8, 148.8, 150.1, 184.7; IR (KBr): 2936, 2917, 2851, 1630, 1578, 1483, 1423, 1362, 1297, 1270, 1240, 1205, 1185, 1066, 1051, 1026, 1005, 987, 891, 851, 822, 776 cm^{-1}. Elemental analysis: $C_{24}H_{28}Br_2N_4S$ (564.38): calcd C, 51.08; H, 5.00; N, 9.93; S, 5.68. found: C, 51.14; H, 5.03; N, 9.87; S 5.66.

***N*-((*E*)-(4-Bromophenylimino)(morpholino)methyl)-*N*-(4-bromophenyl)morpholine-4-carbothioamide (6b).** mp: 173–175 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ(ppm) 2.60–3.81 (m, 16H), 6.61–7.12 (m, 4H), 7.31 (d, *J* = 8.4 Hz, 2H), 7.49 (brs, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 46.9, 50.9, 65.5, 66.3, 115.8, 118.0, 121.9, 123.9, 131.8, 132.9, 141.7,

148.7, 148.3, 149.3, 184.8; IR (KBr): 2964, 2921, 2853, 1633, 1578, 1485, 1417, 1359, 1296, 1274, 1235, 1156, 1113, 1067, 999, 854, 831, 785 cm^{-1}. Elemental analysis: $C_{22}H_{24}Br_2N_4O_2S$ (568.32): calcd C, 46.49; H, 4.26; N, 9.86; S, 5.64. found: C, 46.43; H, 4.30; N, 9.81; S, 5.68.

***N*-((*E*)-(4-(Trifluoromethyl)phenylimino)(morpholino)methyl)-*N*-(4-(trifluoromethyl) phenyl)morpholine-4-carbothioamide (7b).** mp: 147 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.92–3.95 (m, 16H), 6.90 (br s, 2H), 7.07 (d, J = 8.0 Hz, 2H), 7.47 (d, J = 8.0 Hz, 2H), 7.62 (br s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 46.9, 51.0, 65.4, 66.2, 120.5, 121.1, 122.3, 122.4, 124.9, 125.2, 125.3, 125.9, 126.1, 126.5, 126.8, 127.2, 145.4, 148.9, 152.5, 184.5; IR (KBr): 2965, 2920, 2857, 1640, 1602, 1514, 1475, 1424, 1324, 1292, 1261, 1235, 1159, 1113, 1064, 1035, 1013, 998, 942, 844 cm^{-1}; Elemental analysis: $C_{24}H_{24}F_6N_4O_2S$ (546.53): calcd C, 52.74; H, 4.43; N, 10.25; S, 5.87. found: C, 52.77; H, 4.39; N, 10.28; S, 5.80.

***N*-((*E*)-(4-(Trifluoromethyl)phenylimino)(pyrrolidin-1-yl)methyl)-*N*-(4-(trifluoromethyl) phenyl)pyrrolidine-1-carbothioamide (7c).** mp: 148 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 1.12–2.10 (m, 10H), 2.22–2.61 (m, 2H), 3.53-3.86 (m, 4H), 6.89–6.98 (m, 2H), 7.12 (d, J = 8.0 Hz, 2H), 7.40 (d, J = 8.0 Hz, 2H), 7.52 (m, 2H);^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 24.3, 25.1, 26.1, 47.5, 48.8, 52.3, 54.1, 120.7, 123.3, 124.3, 124.6, 125.6, 126.2, 126.8, 127.1, 144.6, 147.5, 153.2, 180.4; IR (KBr): 2976, 2946, 2867, 1630, 1597, 1516, 1468, 1445, 1413, 1327, 1296, 1258, 1233, 1211, 1177, 1154, 1119, 1064, 1013, 938, 906, 860, 843 cm^{-1}; Elemental analysis: $C_{24}H_{24}F_6N_4S$ (514.53): calcd C, 56.02; H, 4.70; N, 10.89; S, 6.23. found: C, 56.08; H, 4.74; N, 10.84; S, 6.19.

6-Methyl-2-morpholinobenzo[*d*]thiazole (8b'). mp: 133 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.40 (s, 3H), 3.60 (t, J = 5.2 Hz, 4H), 3.83 (t, J = 5.2 Hz, 4H), 7.12 (d, J = 8.0 Hz, 1H), 7.42 (s, 1H), 7.46 (d, J = 8.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.4, 48.7, 66.4, 119.1, 121.0, 127.5, 131.7, 150.5, 168.7; IR (KBr): 2964, 2911, 2857, 1604, 1577, 1466, 1439, 1379, 1352, 1282, 1271, 1237, 1113, 1070, 1027, 945, 914, 840, 812 cm^{-1}; Elemental analysis: $C_{12}H_{14}N_2OS$ (234.32): calcd C, 61.51; H, 6.02; N, 11.96; S, 13.68. found C, 61.55; H, 5.97; N, 11.89; S, 13.61.

***N*-((*E*)-(4-Methoxyphenylimino)(pyrrolidin-1-yl)methyl)-*N*-(4-methoxyphenyl)pyrrolidine -1-carbothioamide (9c).** mp: 172-174 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm) 1.21–3.66 (br m, 16H), 3.71 (s, 3H), 3.76 (s, 3H), 6.71 (d, J = 8.4 Hz, 2H), 6.80 (br s, 4H), 7.05 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 24.5, 25.5, 26.3, 48.1, 52.0, 53.6, 55.5, 55.6, 113.7, 114.6, 114.7, 122.9, 123.9, 135.1, 143.3, 148.6, 155.1, 156.3, 181.4; IR (KBr): 2973, 2942, 2868, 1618, 1504, 1479, 1439, 1413, 1331, 1283, 1237, 1179, 1034, 944, 860, 834 cm^{-1}; Elemental analysis: $C_{24}H_{30}N_4O_2S$ (438.59): calcd C, 65.72; H, 6.89; N,12.77; S, 7.31. found: C, 65.77; H, 6.93; N, 12.71; S, 7.28.

6-Methoxy-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (9c'). mp: 110–111 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.05 (t, J = 6.8 Hz, 4H), 3.55 (t, J = 6.8 Hz, 4H), 3.81 (s, 3H), 6.89 (dd, J_1 = 8.8 Hz, J_2 = 2.6 Hz, 1H), 7.14 (d, J = 2.8 Hz, 1H), 7.48 (d, J = 8.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 25.8, 49.6, 56.1, 105.6, 109.9, 113.6, 119.1, 131.7, 147.7, 154.7; IR (KBr): 2951, 2865, 1604, 1573, 1545, 1455, 1434, 1366, 1305, 1272, 1218, 1065, 1039, 878, 848, 801 cm^{-1}; Elemental analysis: $C_{12}H_{14}N_2OS$ (234.32): calcd C, 61.51; H, 6.02; N, 11.96; S, 13.68. found: C, 61.56; H, 5.98; N, 11.99; S, 13.72.

5,6-Dimethyl-2-morpholinobenzo[*d*]thiazole (10b') + 6,7-dimethyl-2-morpholino benzo[*d*] thiazole (10b''). ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.28 (s, 3H), 2.30 (s, 3H), 2.31 (s, 3H), 2.36 (s, 3H), 3.54–3.64 (m, 8H), 3.74–3.82 (m, 8H), 7.10 (d, J = 8.0 Hz, 1H), 7.33 (d, J = 8.0 Hz, 1H), 7.36 (d, J = 8.8 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 19.2, 19.4, 19.8, 20.2, 48.5, 66.3, 116.6, 120.2, 121.1, 127.8, 128.1, 128.7, 129.3, 130.5, 131.9, 134.8, 150.5, 150.9, 168.2, 168.7; IR (KBr): 2965, 2855, 1532, 1443, 1373, 1339, 1283, 1262, 1227, 1114, 1071, 1042, 1020, 897, 858 cm^{-1}; Elemental analysis: $C_{13}H_{16}N_2OS$ (248.34): calcd C, 62.87; H, 6.49; N, 11.28; S, 12.91. found: C, 62.84; H, 6.53; N, 11.33; S, 12.87.

5,6-Dimethyl-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (10c'). mp: 176 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.05 (t, J = 6.8 Hz, 4H), 2.28 (s, 3H), 2.30 (s, 3H), 3.55 (t, J = 6.8 Hz, 4H), 7.34 (s, 1H), 7.38 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 19.8, 20.3, 25.7, 49.5,

119.6, 121.1, 127.9, 129.4, 134.6, 151.9, 165.1; IR (KBr): 2961, 2928, 2879, 2853, 1612, 1557, 1538, 1482, 1455, 1354, 1305, 1273, 1134, 989, 918, 859 cm^{-1}; MS (ESI): 233.1110 (MH^+).

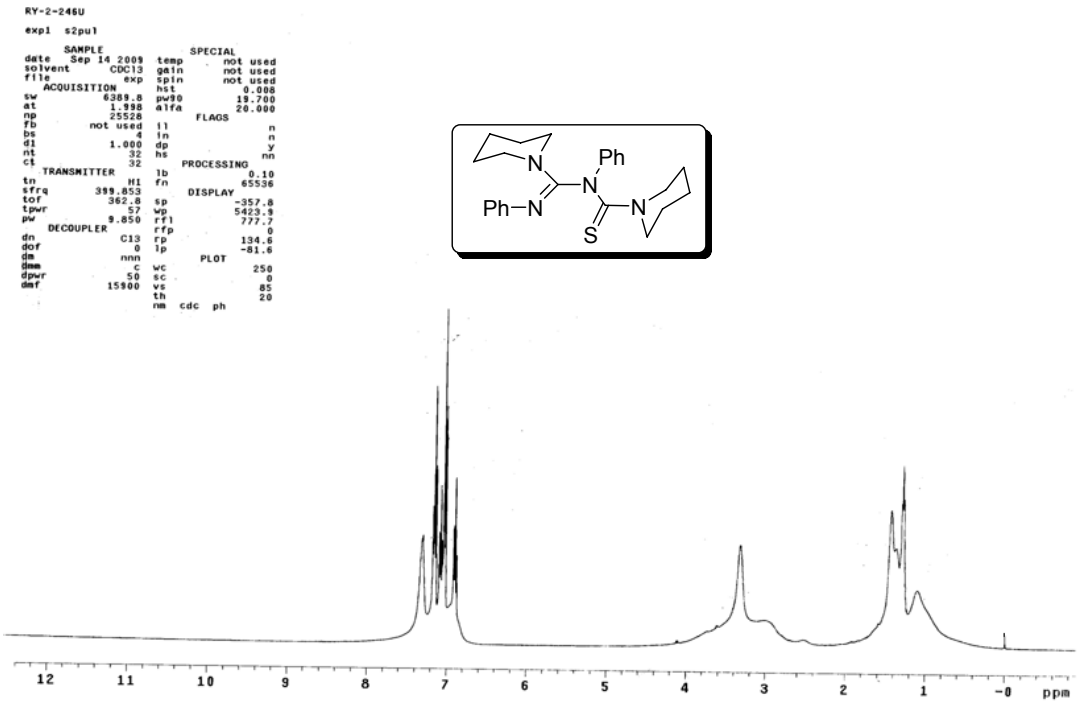
2-Morpholinonaphtho[1,2-*d*]thiazole (11b'). mp: 183–184 ^oC; ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 3.68 (t, *J* = 5.2 Hz, 4H), 3.87 (t, *J* = 5.2 Hz, 4H), 7.59 (m, 3H), 7.98 (s, 1H), 8.23 (m, 1H), 8.57 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 48.7, 66.4, 114.9, 122.4, 124.7, 125.5, 126.8, 126.9, 127.5, 127.9, 130.5, 148.6, 169.7; IR (KBr): 2961, 2844, 1568, 1531, 1496, 1451, 1434, 1393, 1372, 1351, 1336, 1278, 1226, 1183, 1156, 1112, 1080, 1035, 931, 910, 841, 758 cm^{-1}; Elemental analysis: $C_{15}H_{14}N_2OS$ (270.35): calcd C, 66.64; H, 5.22; N, 10.36; S, 11.86. found: C, 66.68; H, 5.19; N, 10.42; S, 11.81.

2-(Pyrrolidin-1-yl)naphtho[1,2-*d*]thiazole (11c'). mp: 143–145 ^oC; ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.08 (t, *J* = 6.8 Hz, 4H), 3.63 (t, *J* = 6.8 Hz, 4H), 7.43–7.55 (m, 3H), 7.67 (d, *J* = 8.8 Hz, 1H), 7.84 (d, *J* = 8.0 Hz,1H), 8.60 (d, *J* = 8.4 Hz,1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 25.8, 49.7, 118.9, 120.8, 124.3, 125.3, 125.7, 126.9, 127.9, 132.4, 149.3, 166.1; IR (KBr): 2928, 2850, 1585, 1550, 1505, 1429, 1397, 1357, 1337, 1306, 1224, 1189, 1077, 936, 901, 799 cm^{-1}; Elemental analysis: $C_{15}H_{14}N_2S$ (254.35): calcd C, 70.83; H, 5.55; N, 11.01; S, 12.61. found: C, 70.88; H, 5.51; N, 11.07; S, 12.56.

Spectra

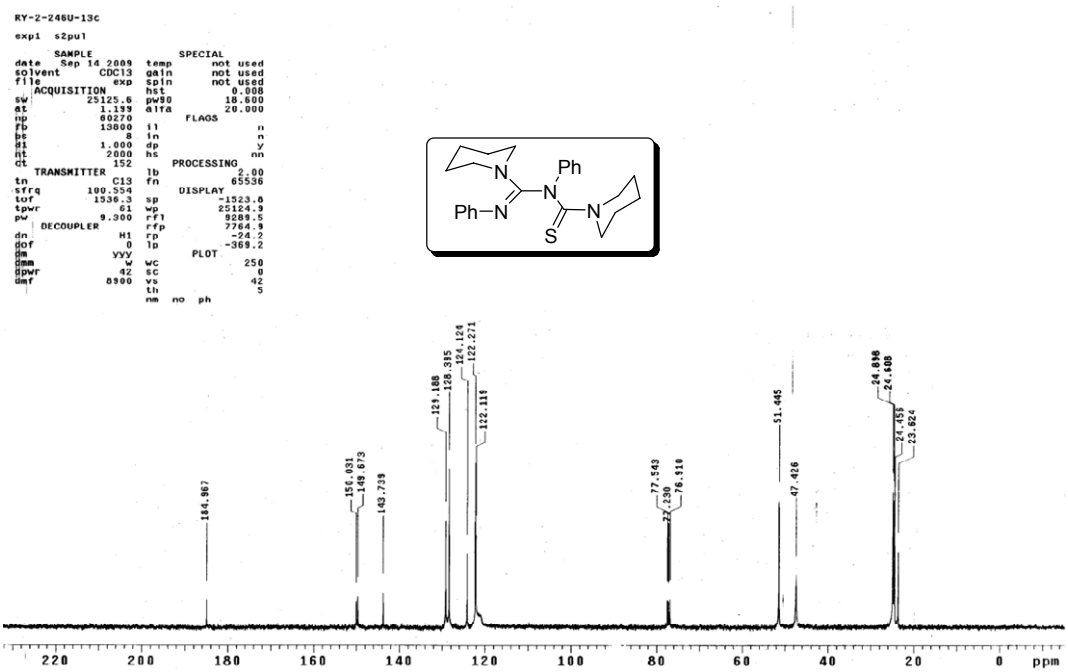
N-Phenyl-N-((E)-(phenylimino)(piperidin-1-yl)methyl)piperidine-1-carbothioamide (1a).

^{1}H NMR (400 MHz, $CDCl_3$):



N-Phenyl-N-((E)-(phenylimino)(piperidin-1-yl)methyl)piperidine-1-carbothioamide (1a).

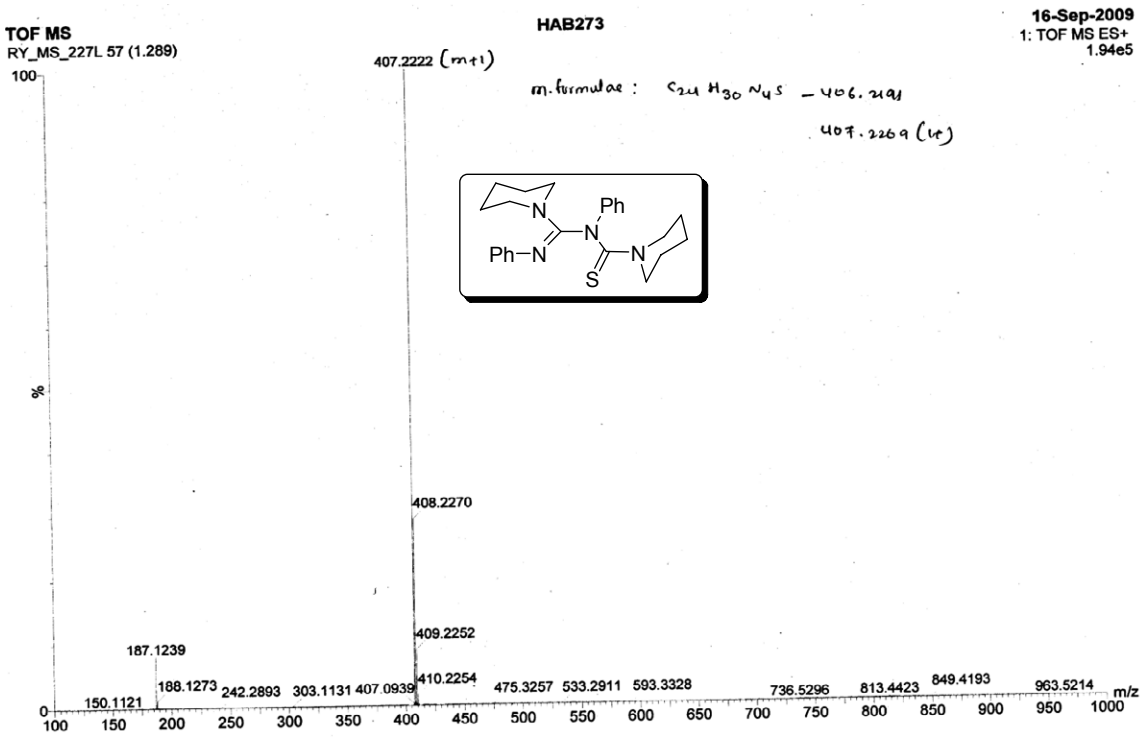
^{13}C NMR (100 MHz, $CDCl_3$):



-S11 -

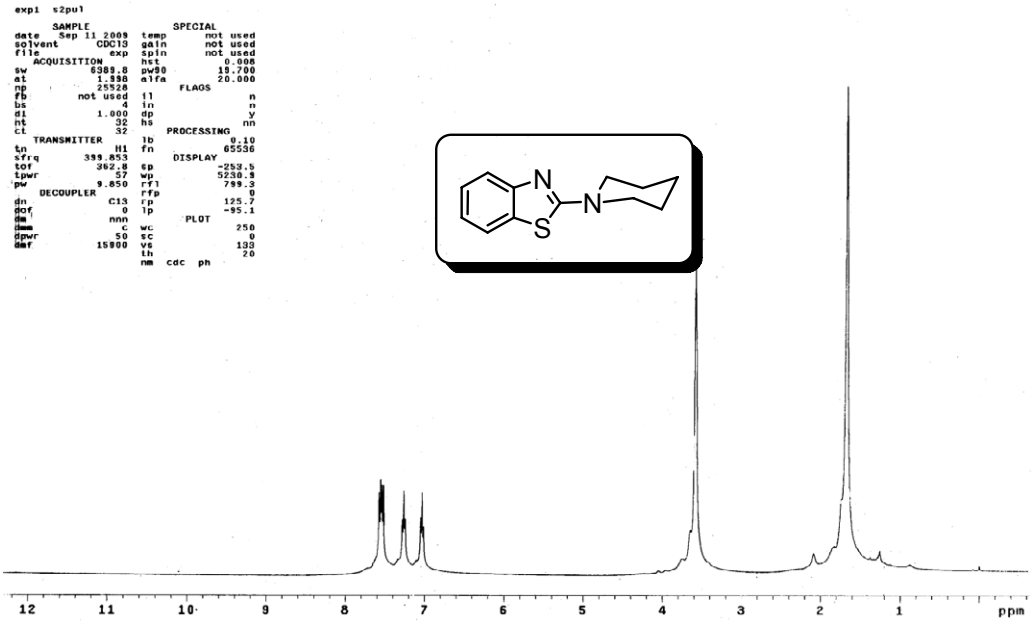
_N_-Phenyl-_N_-((_E_)-(phenylimino)(piperidin-1-yl)methyl)piperidine-1-carbothioamide (1a).

Mass Spectra:

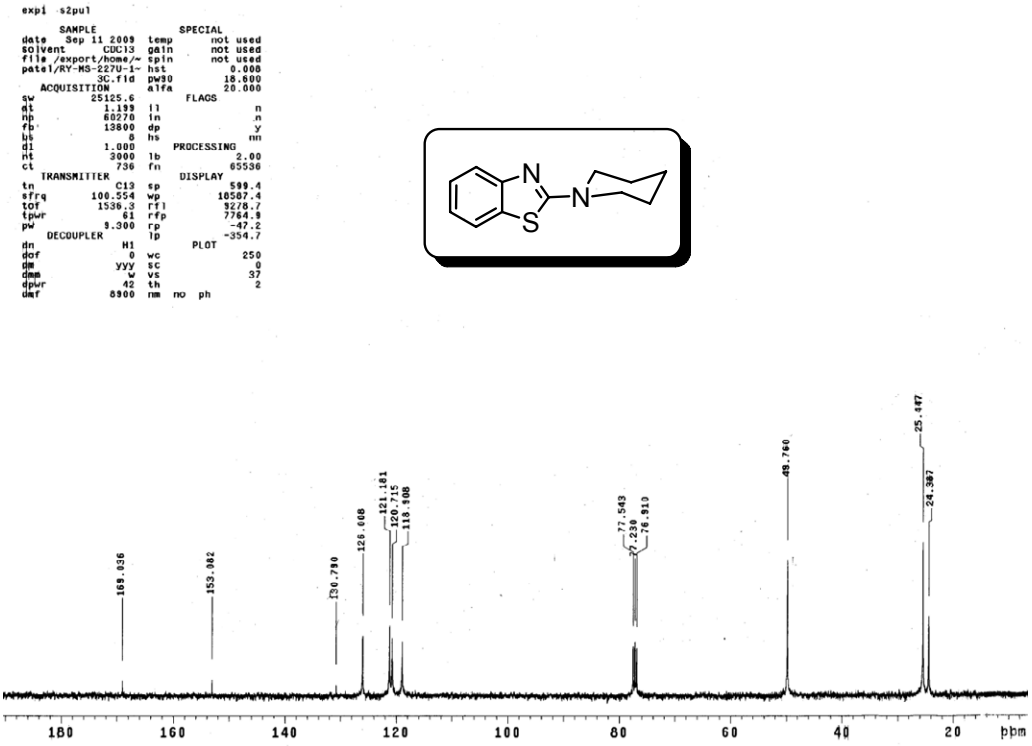


-S12 -

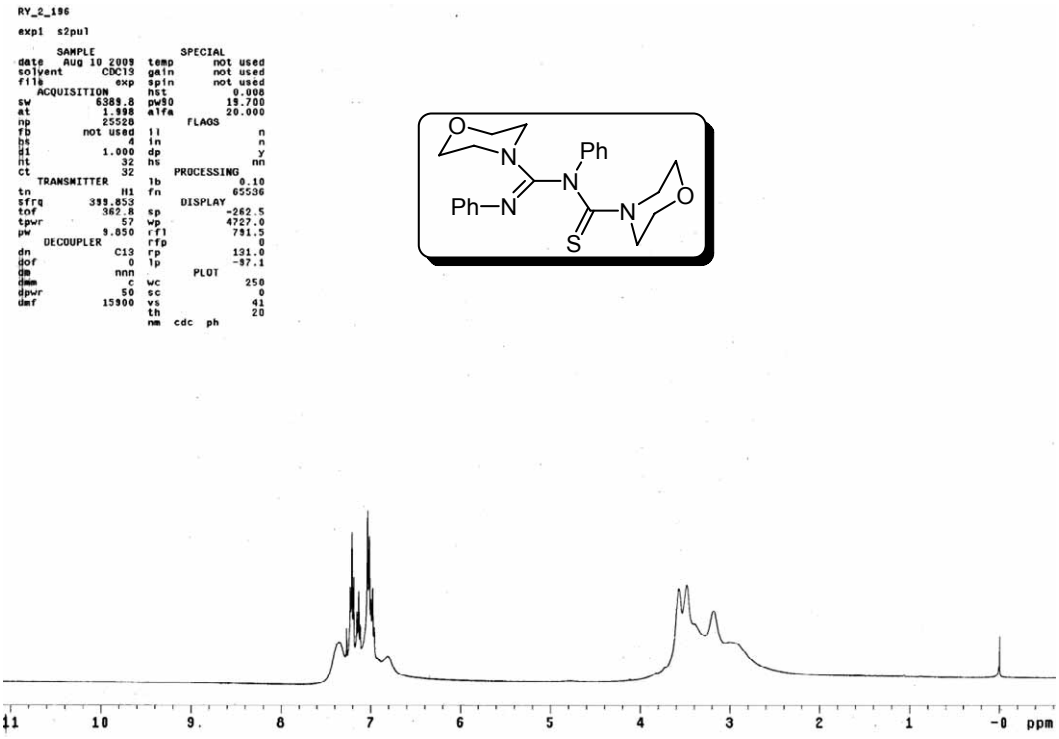
2-(Piperidin-1-yl)benzo[*d*]thiazole (1a'). ^{1}H NMR (400 MHz, $CDCl_3$):



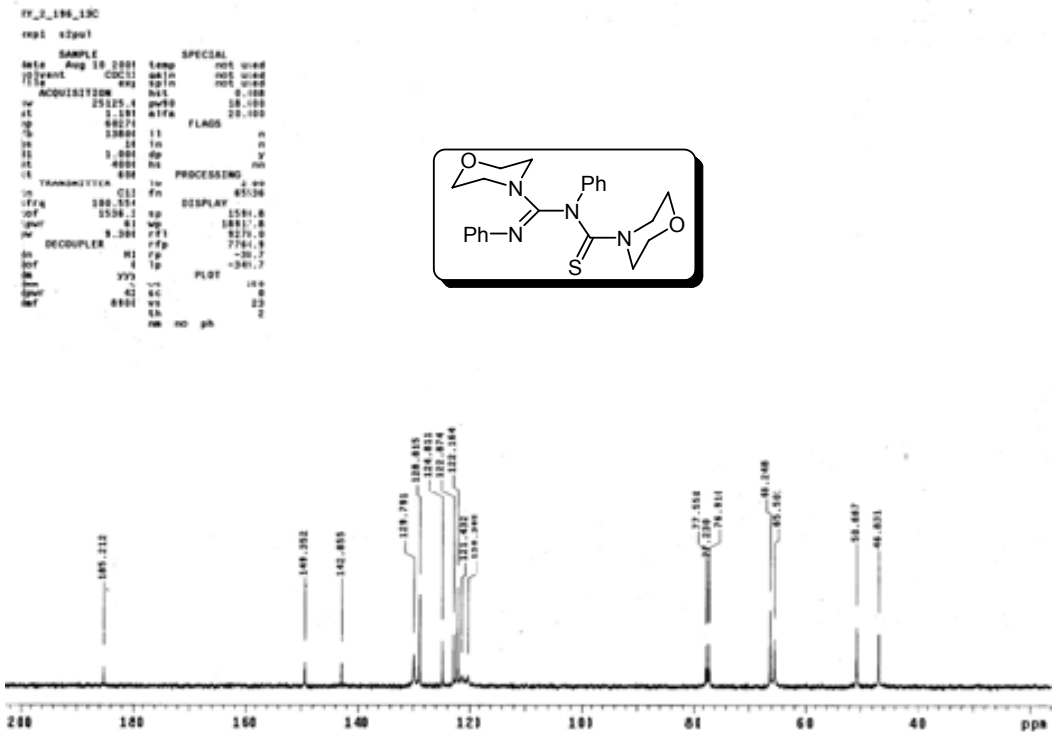
2-(Piperidin-1-yl)benzo[*d*]thiazole (1a'). ^{13}C NMR (100 MHz, $CDCl_3$):



N-((*E*)-Morpholino(phenylimino)methyl)-N-phenylmorpholine-4-carbothioamide (1b). ^{1}H NMR (400 MHz, $CDCl_3$):

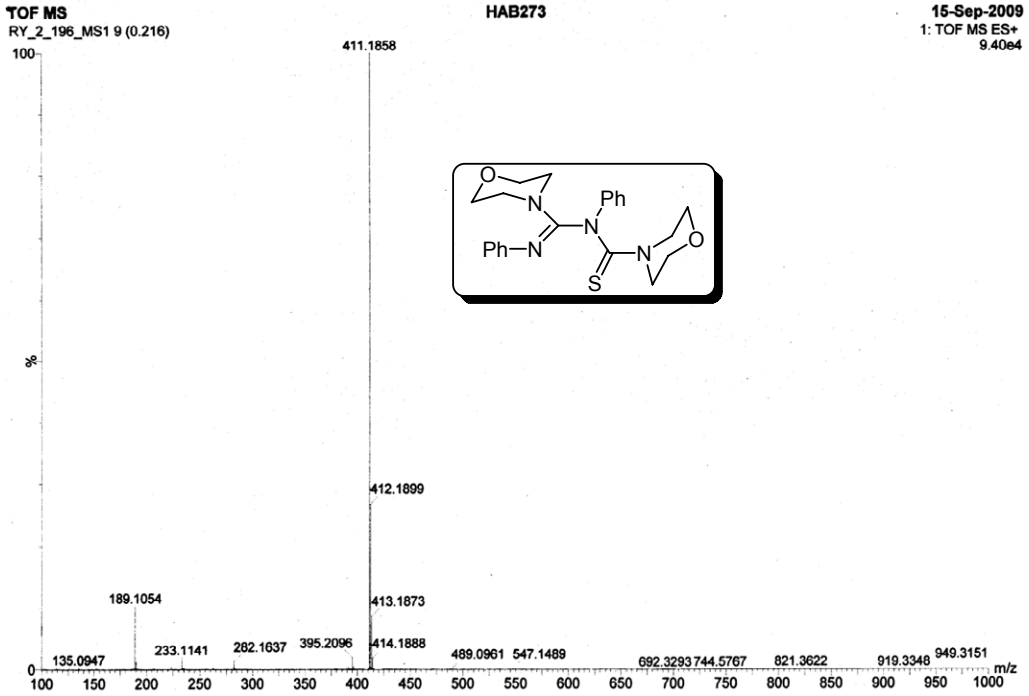


N-((*E*)-Morpholino(phenylimino)methyl)-N-phenylmorpholine-4-carbothioamide (1b). ^{13}C NMR (100 MHz, $CDCl_3$):

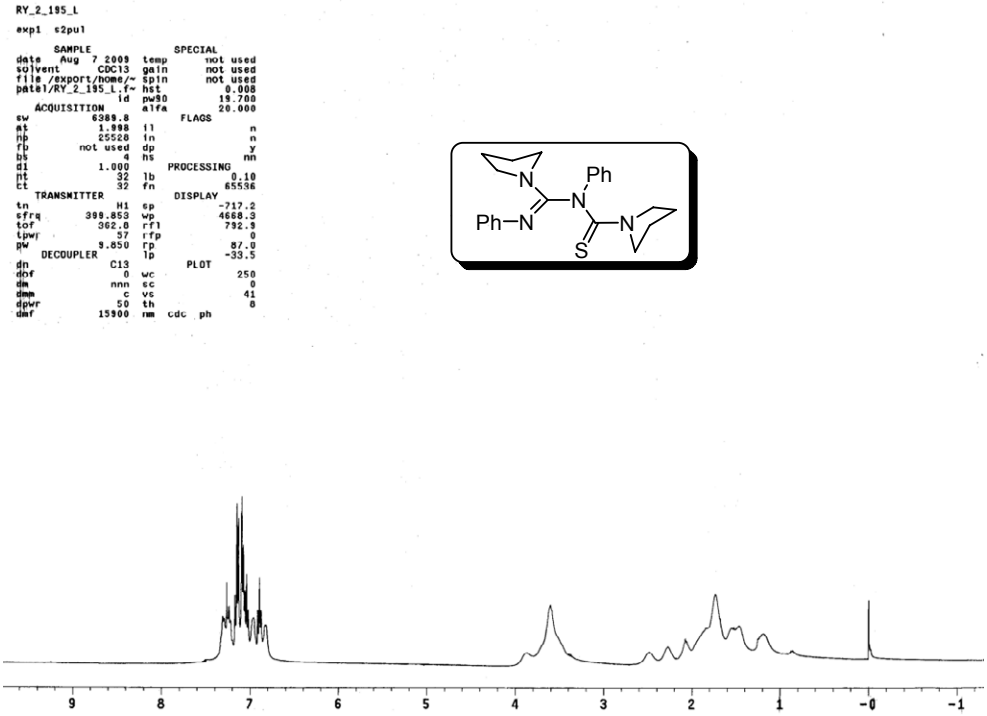


N-((E)-Morpholino(phenylimino)methyl)-N-phenylmorpholine-4-carbothioamide (1b).

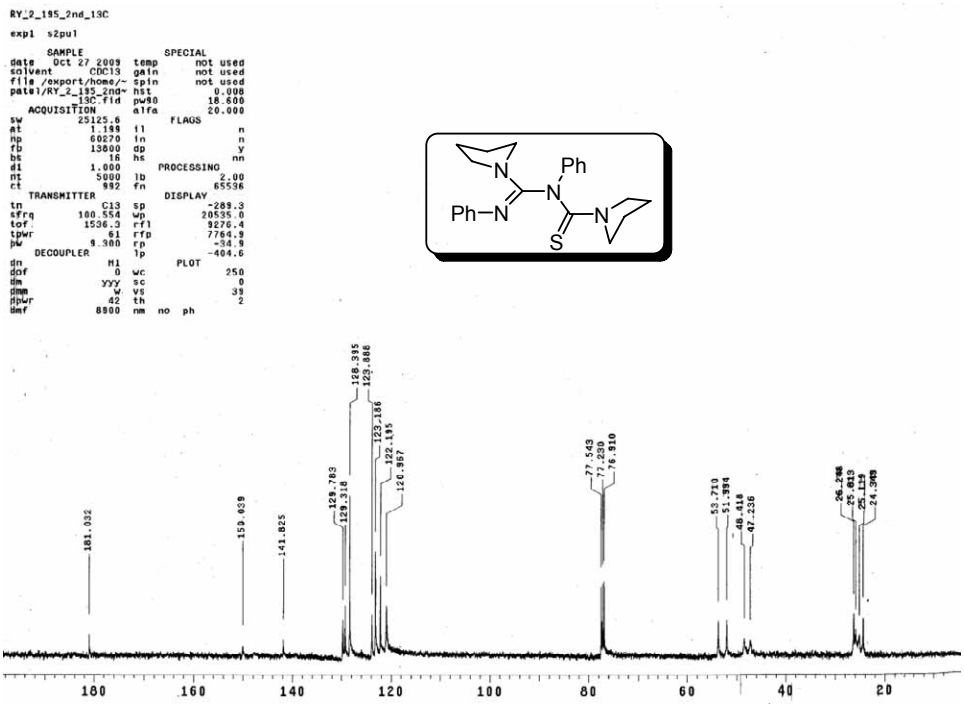
MASS SPECTRA:



N-Phenyl-N-((E)-(phenylimino)(pyrrolidin-1-yl)methyl)pyrrolidine-1-carbothioamide (1c). ^{1}H NMR (400 MHz, $CDCl_3$):

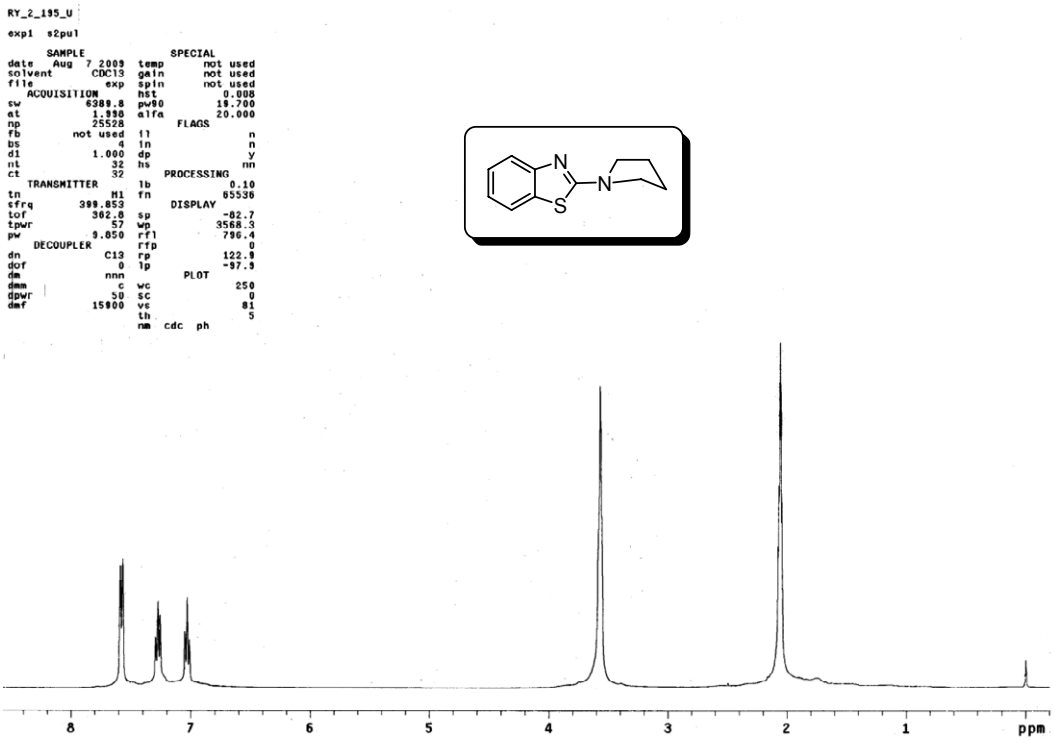


N-Phenyl-N-((E)-(phenylimino)(pyrrolidin-1-yl)methyl)pyrrolidine-1-carbothioamide (1c). ^{13}C NMR (100 MHz, $CDCl_3$):

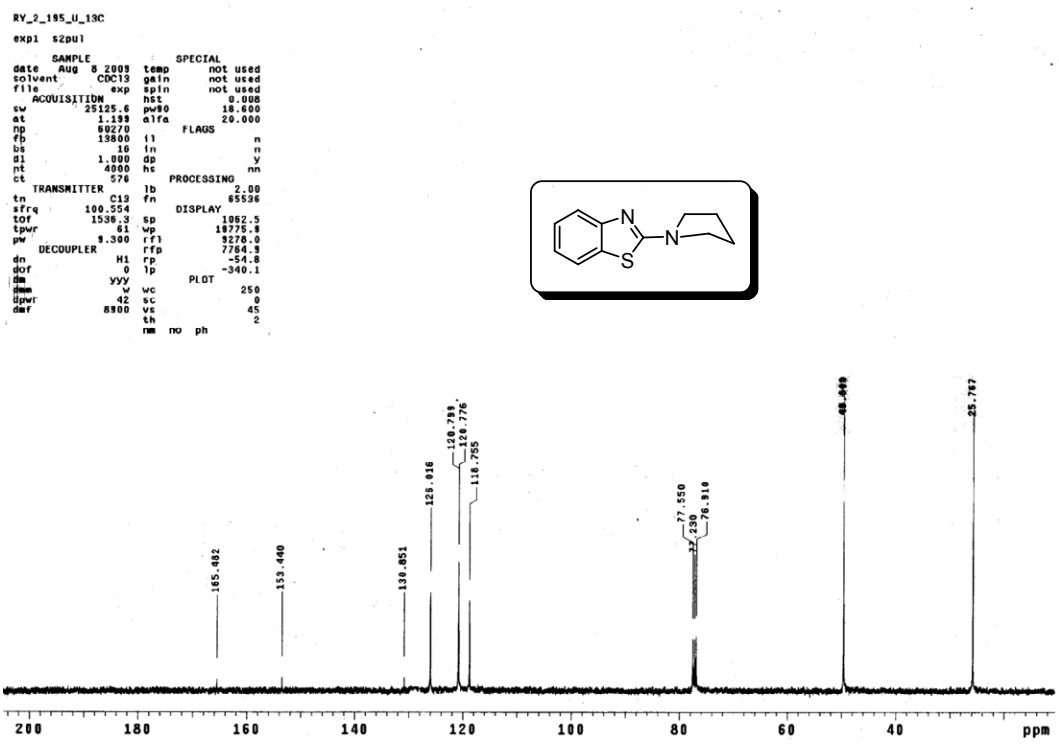


-S16 -

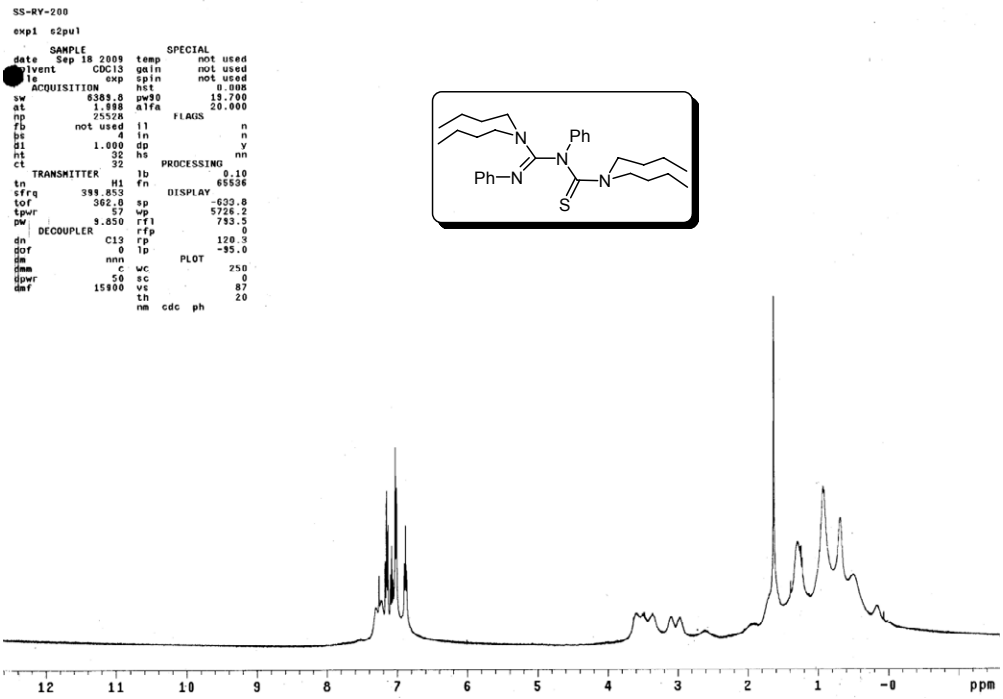
2-(Pyrrolidin-1-yl)benzo[*d*]thiazole (1c') ^{1}H NMR (400 MHz, $CDCl_3$):



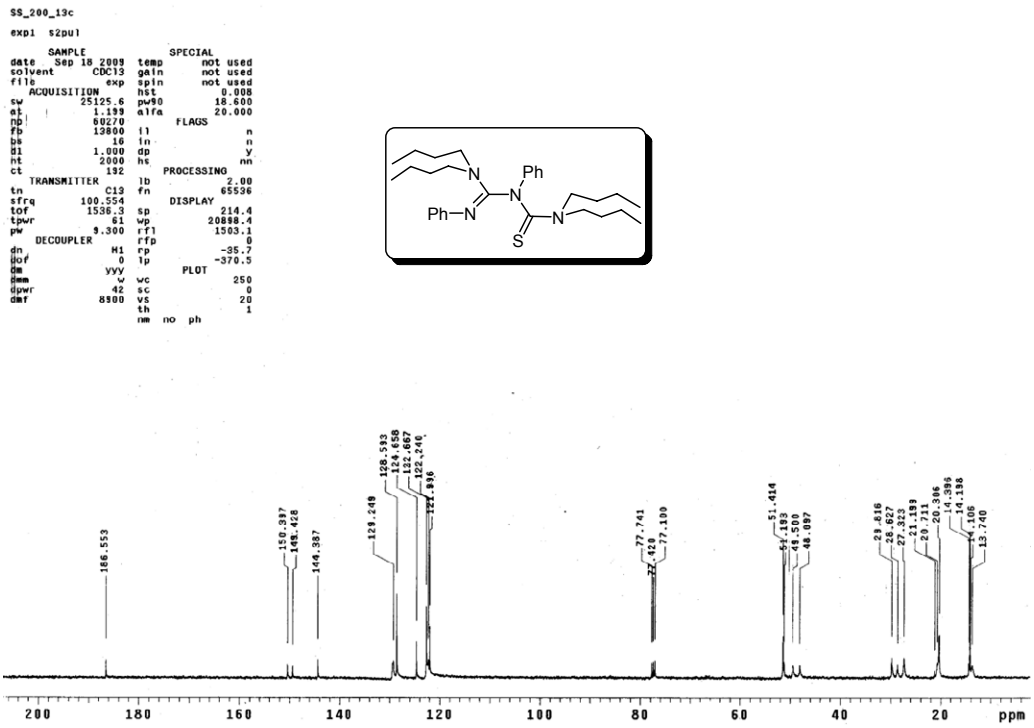
2-(Pyrrolidin-1-yl)benzo[*d*]thiazole (1c') ^{13}C NMR (100 MHz, $CDCl_3$):



N-Phenyl-N-((*E*)-(phenylimino)(dibutylamin-1-yl)methyl)dibutylamine-1-carbothioamide (1d).^{1}H NMR (400 MHz, $CDCl_3$):

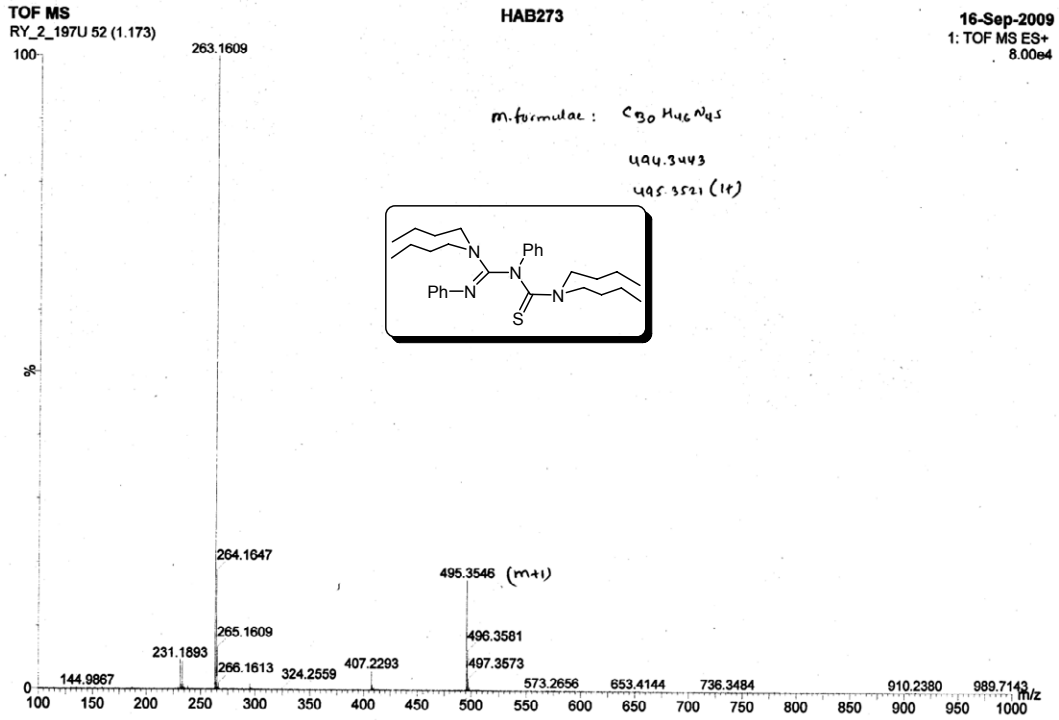


N-Phenyl-N-((*E*)-(phenylimino)(dibutylamin -1-yl)methyl) dibutylamine -1-carbothioamide (1d).^{13}C NMR (100 MHz, $CDCl_3$):

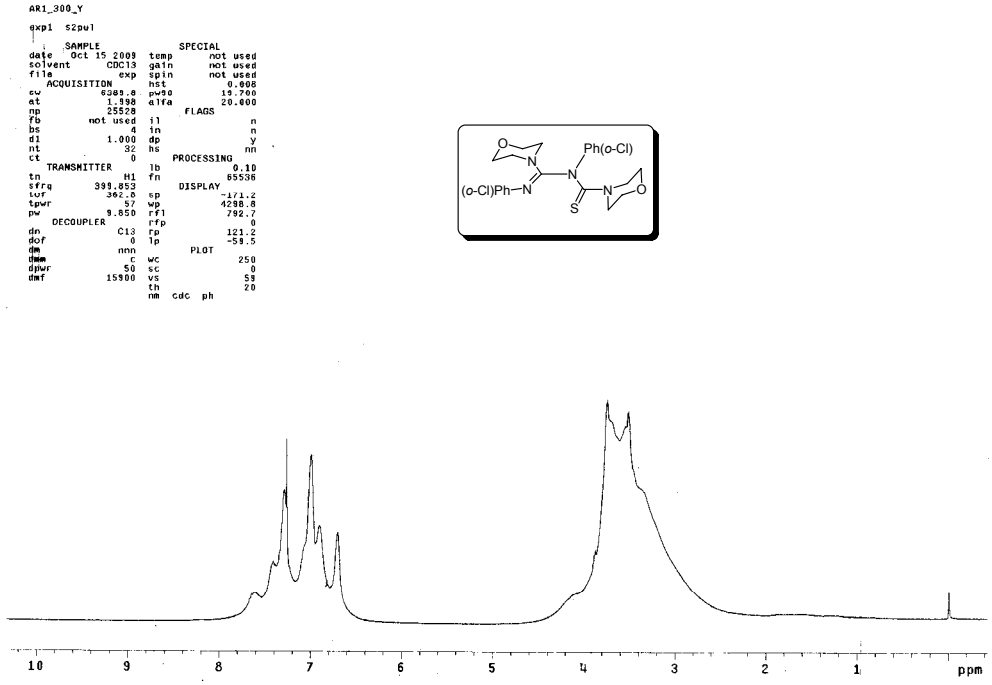


-S18 -

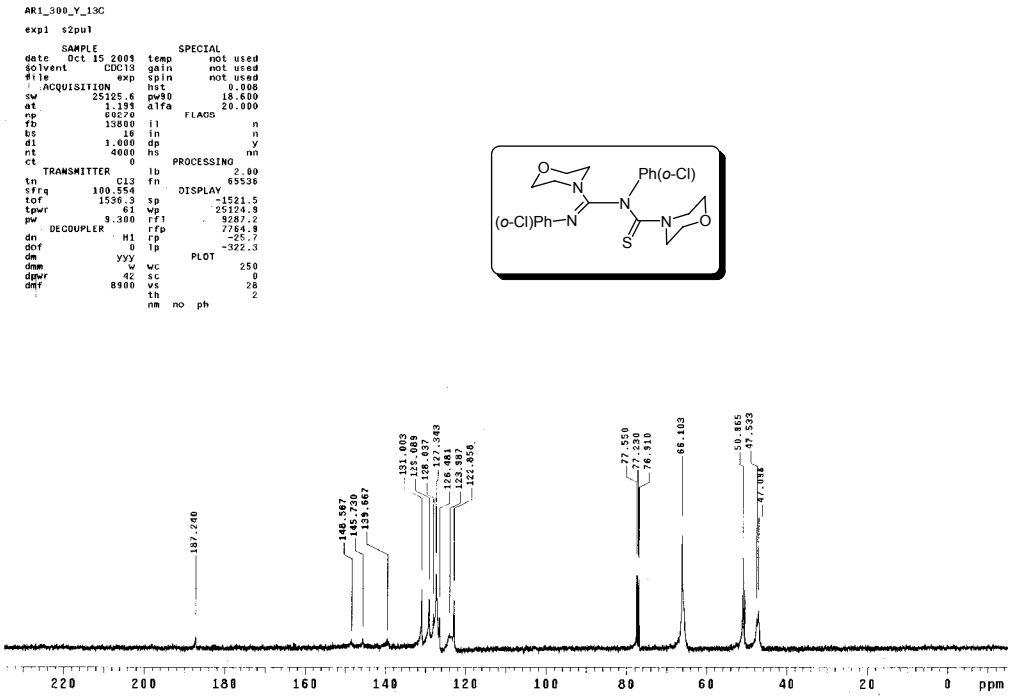
_N_-Phenyl-_N_-((_E_)-(phenylimino)(dibutylamin-1-yl)methyl)dibutylamine -1-carbothioamide (1d). Mass Spectra



N-((*E*)-(2-Chlorophenylimino)(morpholino)methyl)-N-(2-chlorophenyl)morpholine-4-carbothioamide (2b). ^{1}H NMR (400 MHz, $CDCl_3$):

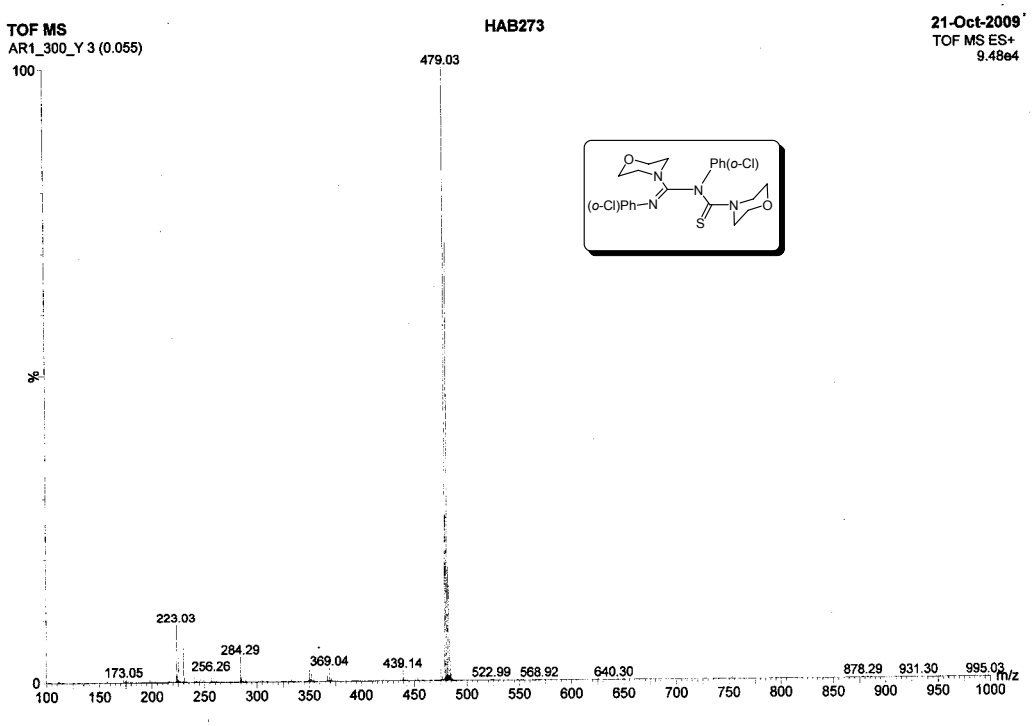


N-((*E*)-(2-Chlorophenylimino)(morpholino)methyl)-N-(2-chlorophenyl)morpholine-4-carbothioamide (2b). ^{13}C NMR (100 MHz, $CDCl_3$):

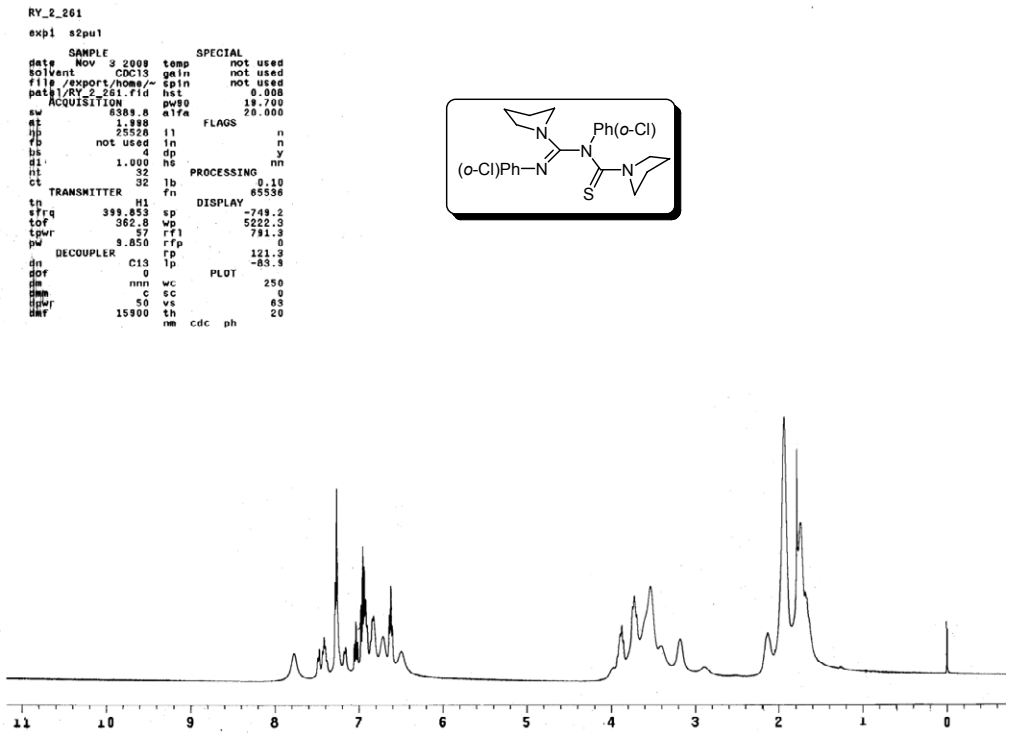


-S20 -

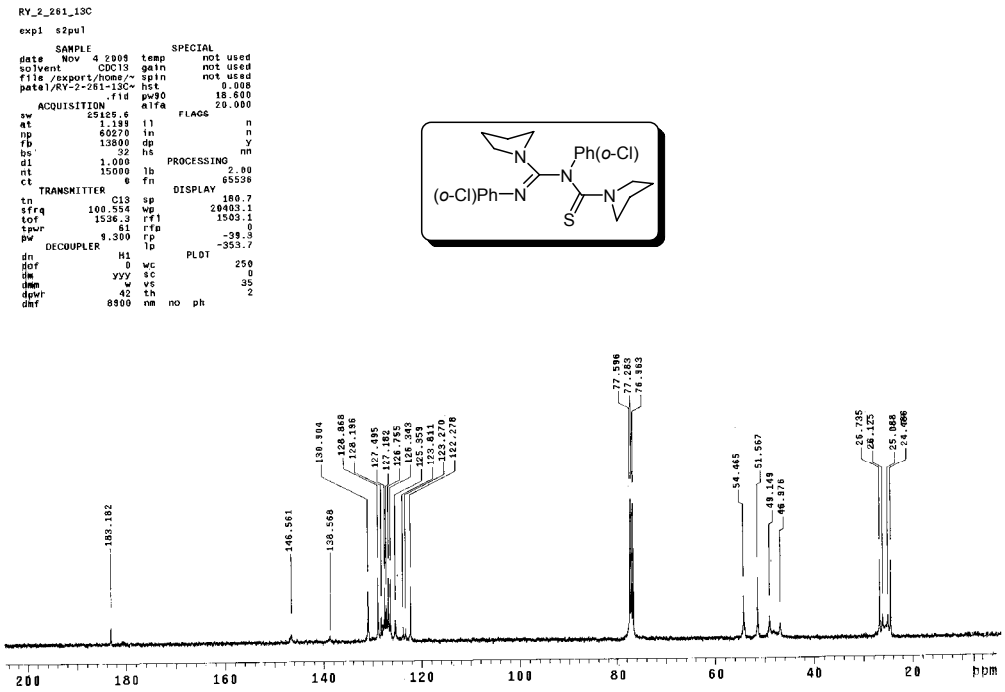
N-((*E*)-(2-Chlorophenylimino)(morpholino)methyl)-N-(2-chlorophenyl)morpholine-4-carbothioamide (2b): Mass Spectra



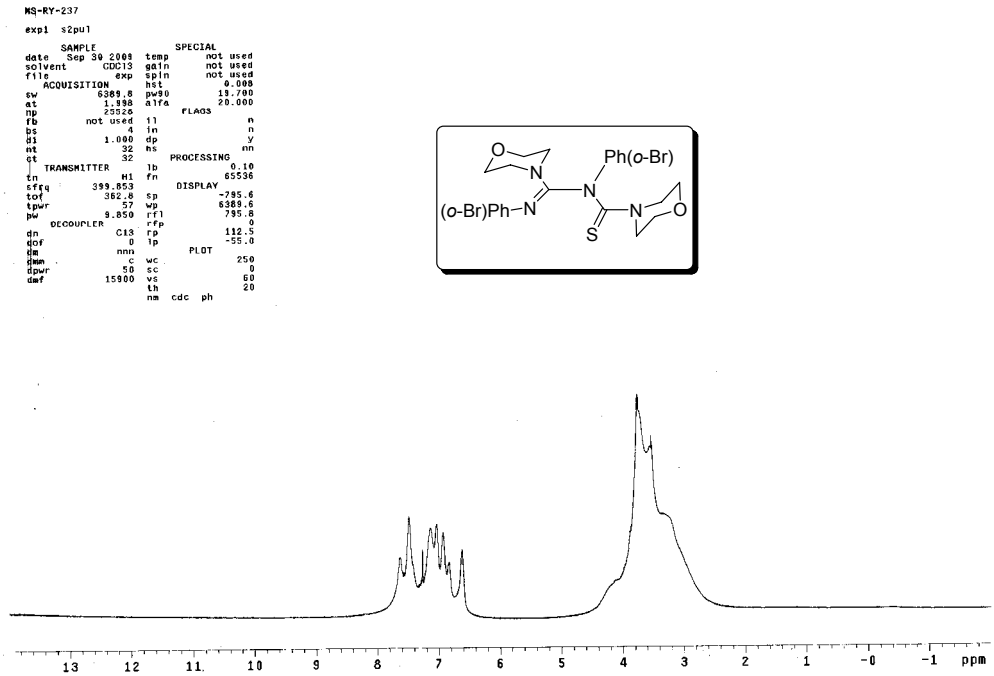
N-((*E*)-(2-Chlorophenylimino)(pyrrolidin-1-yl)methyl)-N-(2-chlorophenyl)pyrrolidine-1-carbothioamide (2c).^{1}H NMR (400 MHz, $CDCl_3$):



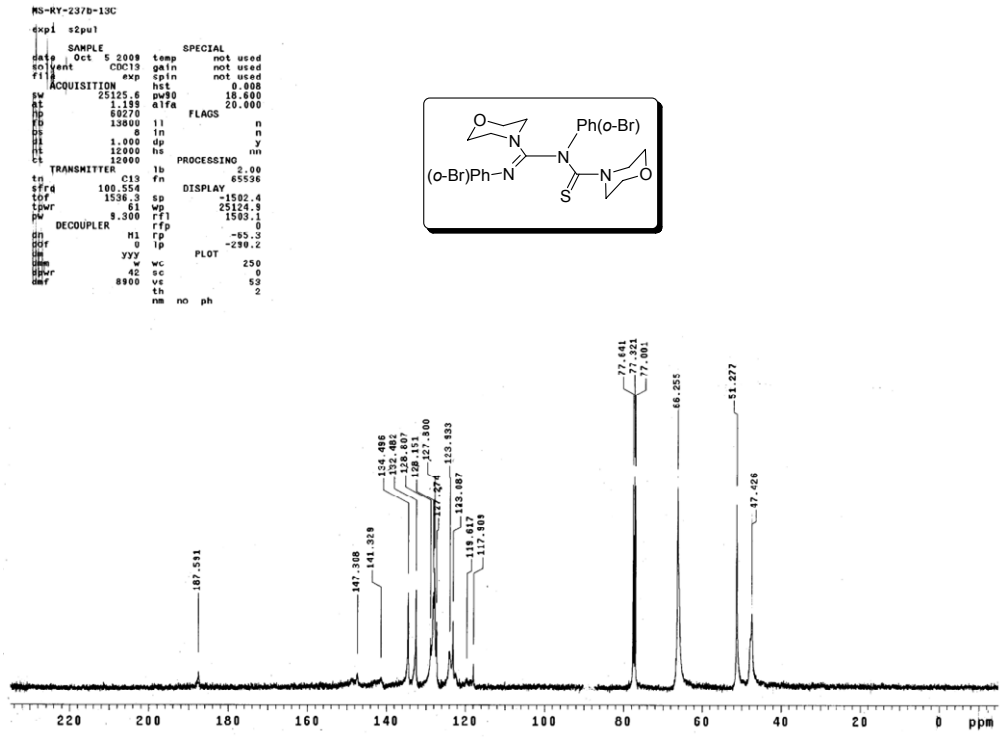
N-((*E*)-(2-Chlorophenylimino)(pyrrolidin-1-yl)methyl)-N-(2-chlorophenyl)pyrrolidine-1-carbothioamide (2c).^{13}C NMR (100 MHz, $CDCl_3$):



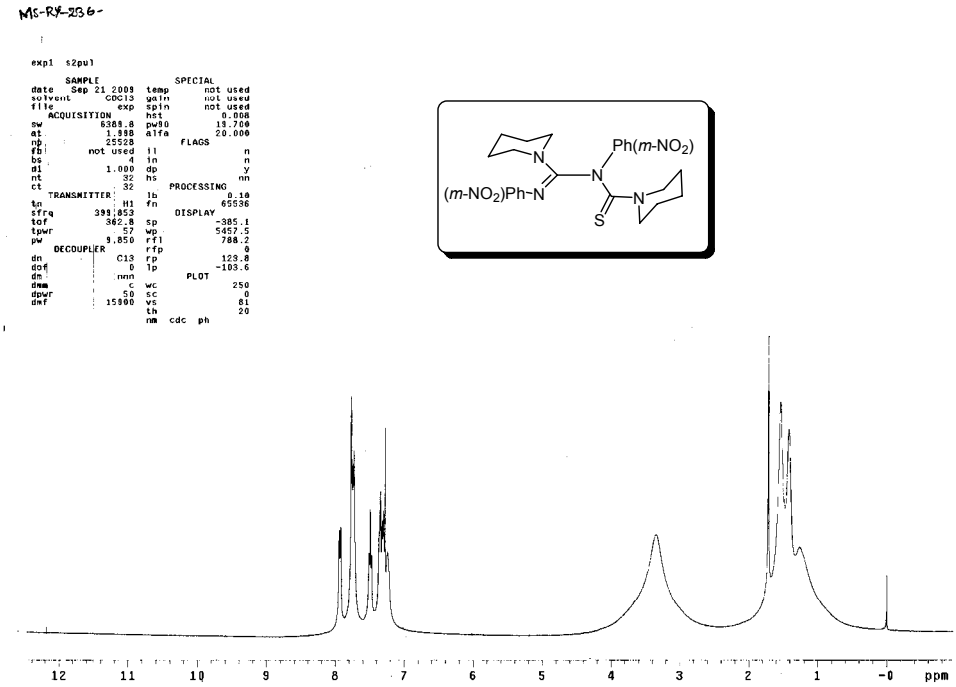
N-((*E*)-(2-Bromoophenylimino)(morpholino)methyl)-N-(2-bromophenyl)morpholine-4-carbothioamide (3b).^{1}H NMR (400 MHz, $CDCl_3$):



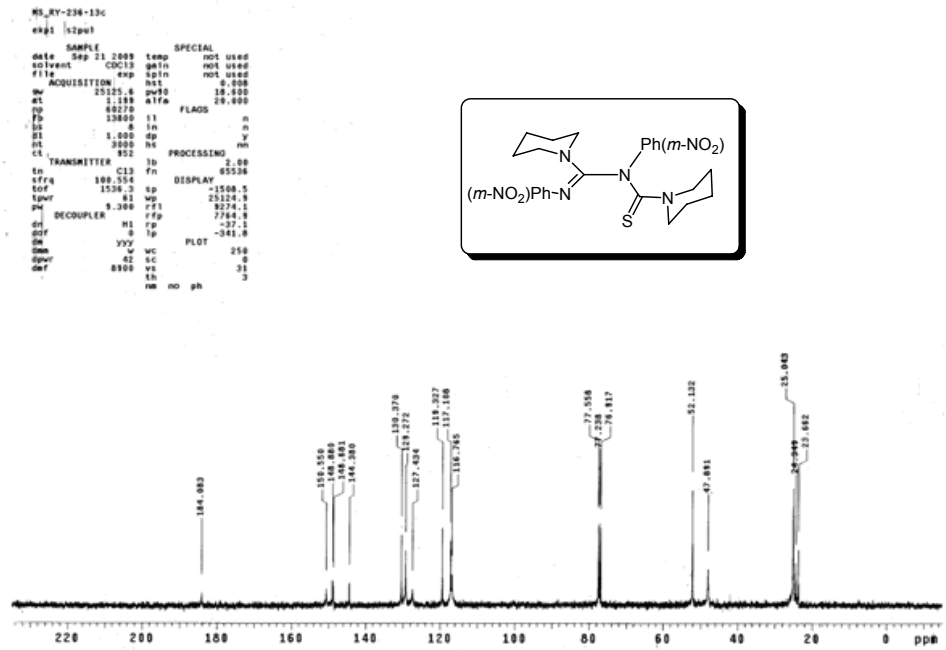
N-((*E*)-(2-Bromoophenylimino)(morpholino)methyl)-N-(2-bromophenyl)morpholine-4-carbothioamide (3b). ^{13}C NMR (100 MHz, $CDCl_3$):



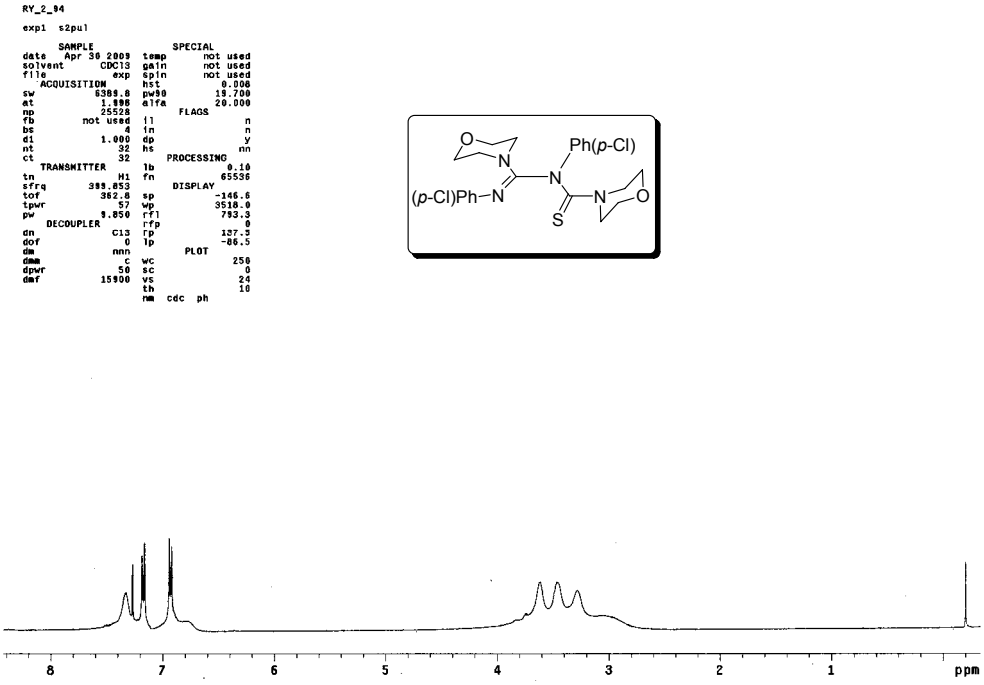
N-((*E*)-(3-Nitrophenylimino)(piperidin-1-yl)methyl)-N-(3-nitrophenyl)piperidine-1-carbothioamide (4a).^{1}H NMR (400 MHz, $CDCl_3$):



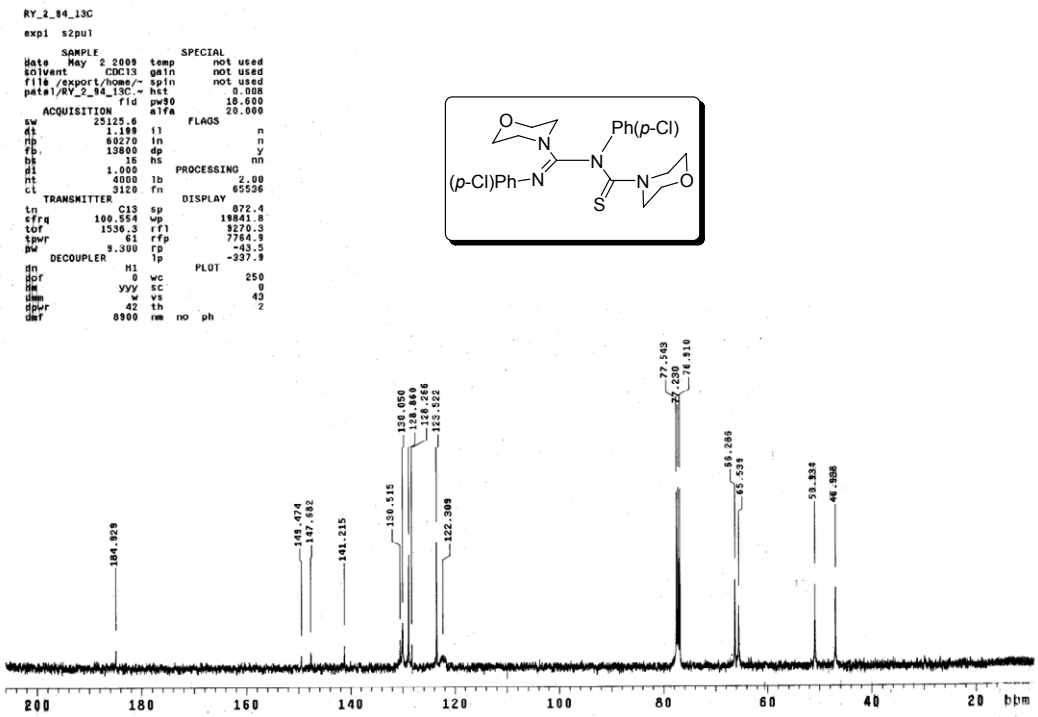
N-((*E*)-(3-Nitrophenylimino)(piperidin-1-yl)methyl)-N-(3-nitrophenyl)piperidine-1-carbothioamide (4a).^{13}C NMR (100 MHz, $CDCl_3$):



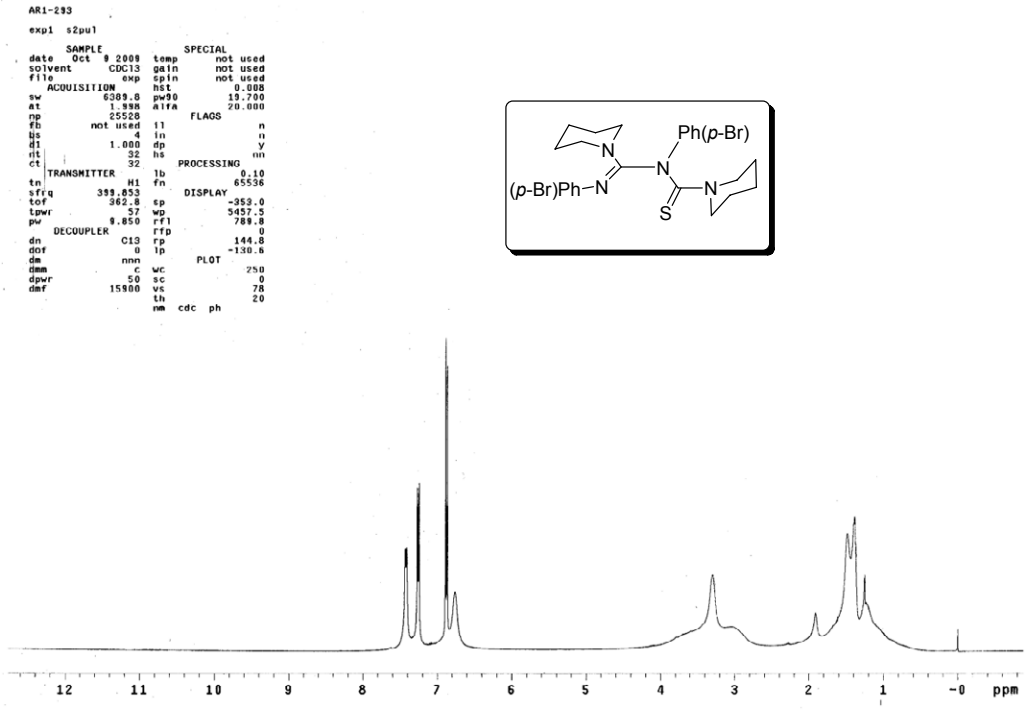
N-((*E*)-(4-Chlorophenylimino)(morpholino)methyl)-N-(4-chlorophenyl)morpholine-4-carbothioamide (5b).^{1}H NMR (400 MHz, $CDCl_3$):



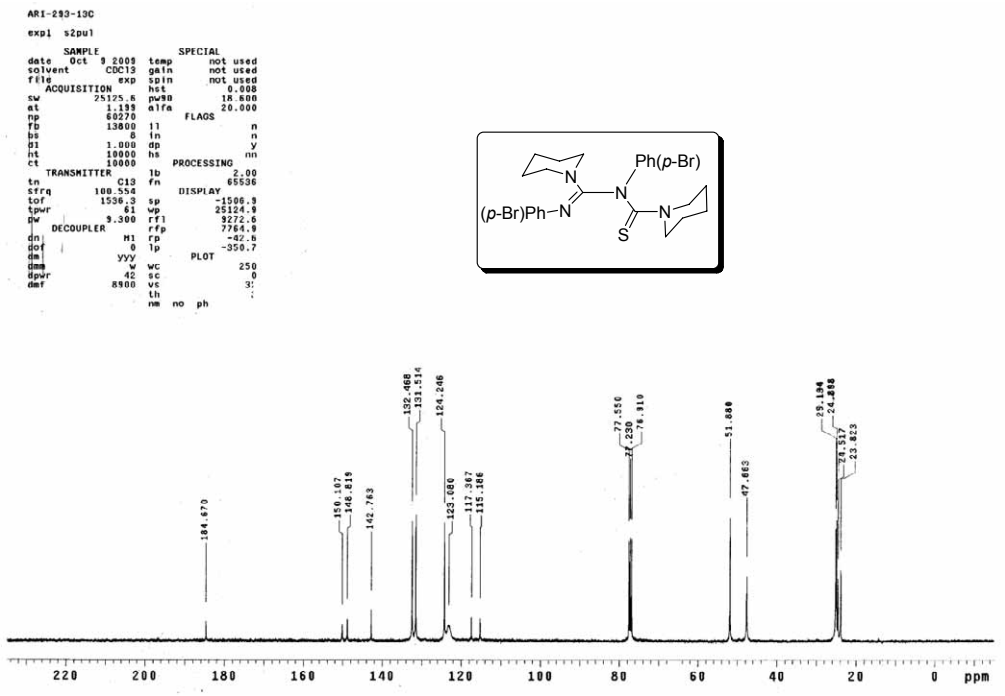
N-((*E*)-(4-Chlorophenylimino)(morpholino)methyl)-N-(4-chlorophenyl)morpholine-4-carbothioamide (5b).^{13}C NMR (100 MHz, $CDCl_3$):



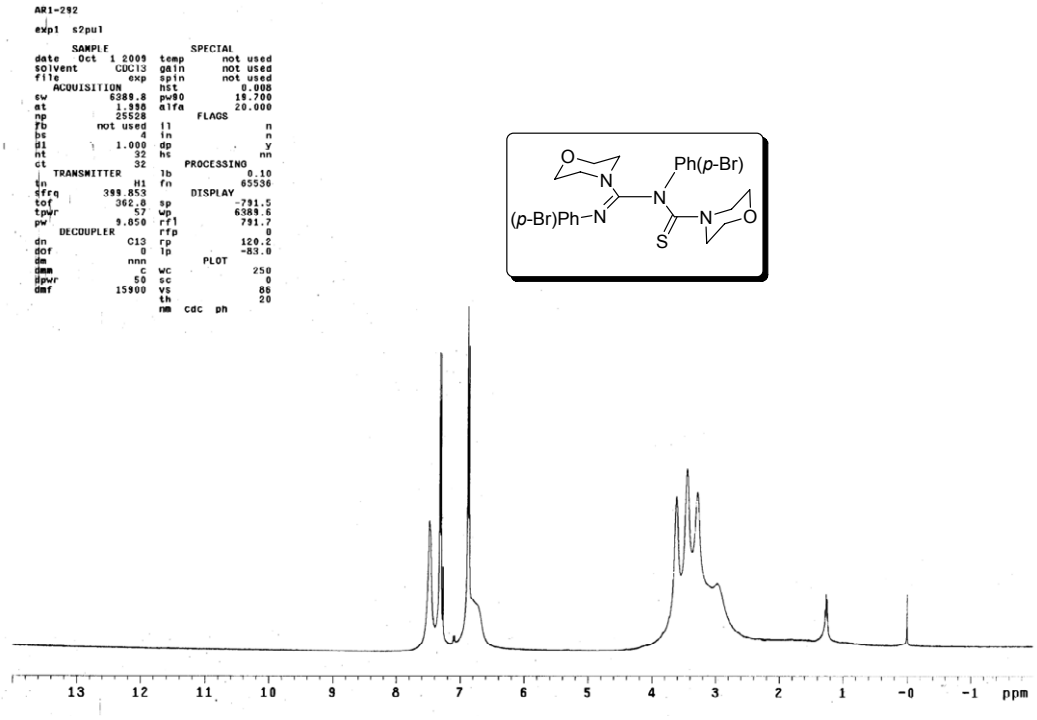
N-((*E*)-(4-Bromophenylimino)(piperidin-1-yl)methyl)-N-(4-bromophenyl)piperidine-1-carbothioamide (6a). ^{1}H NMR (400 MHz, $CDCl_3$):



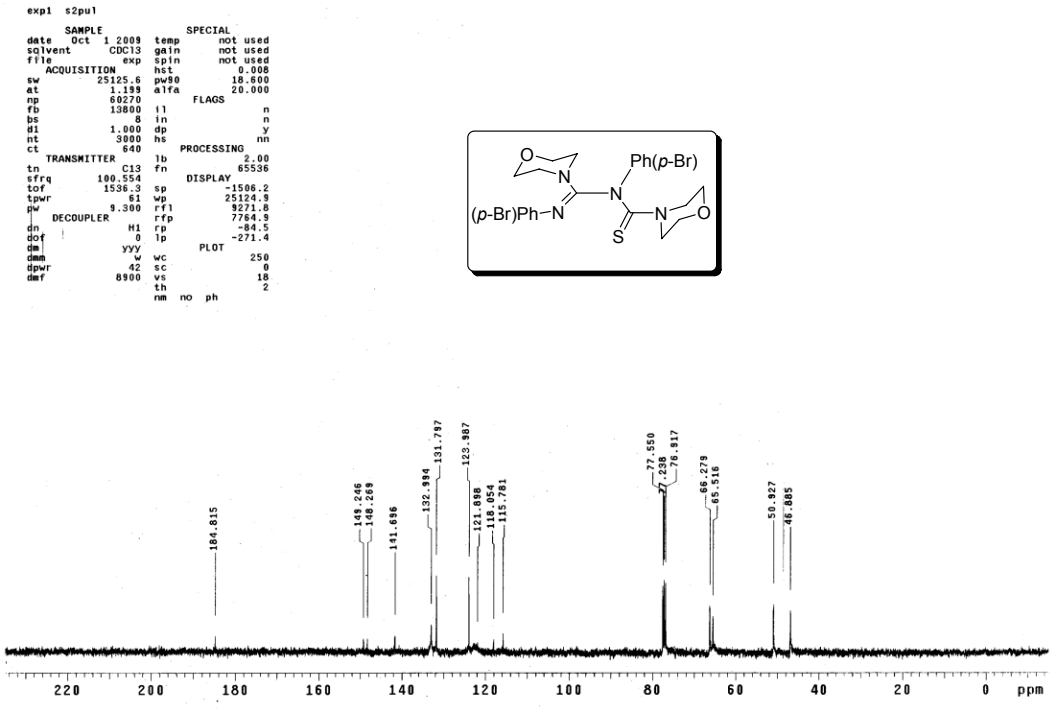
N-((*E*)-(4-Bromophenylimino)(piperidin-1-yl)methyl)-N-(4-bromophenyl)piperidine-1-carbothioamide (6a). ^{13}C NMR (100 MHz, $CDCl_3$):



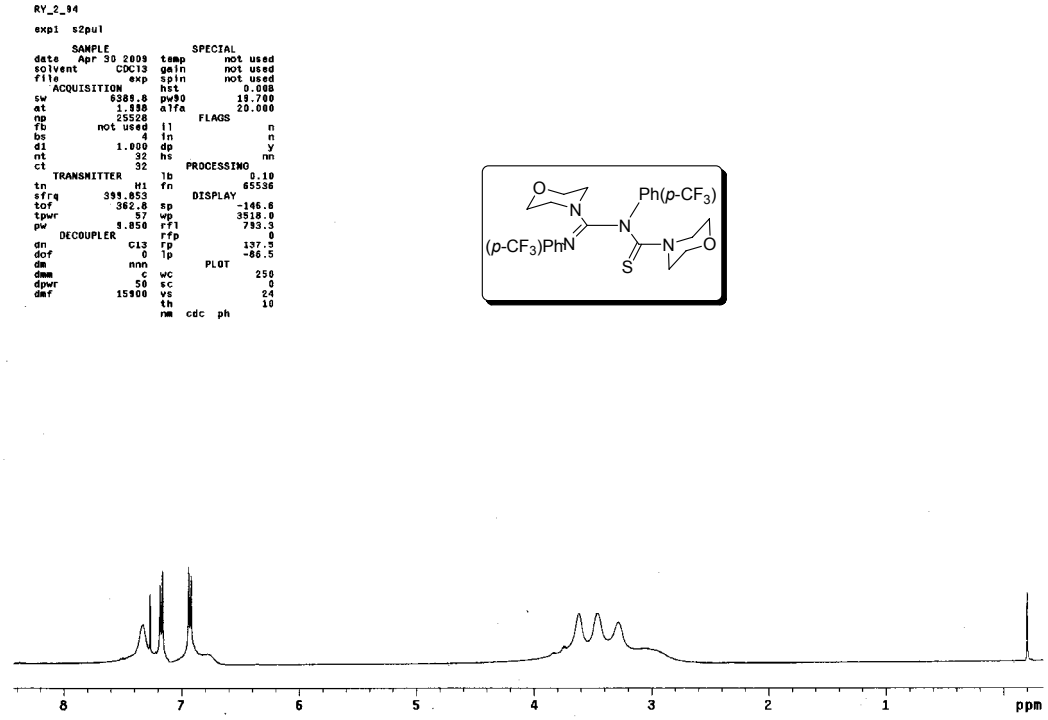
N-((*E*)-(4-Bromophenylimino)(morpholino)methyl)-N-(4-bromophenyl)morpholine-4-carbothioamide (6b). ^{1}H NMR (400 MHz, $CDCl_3$):



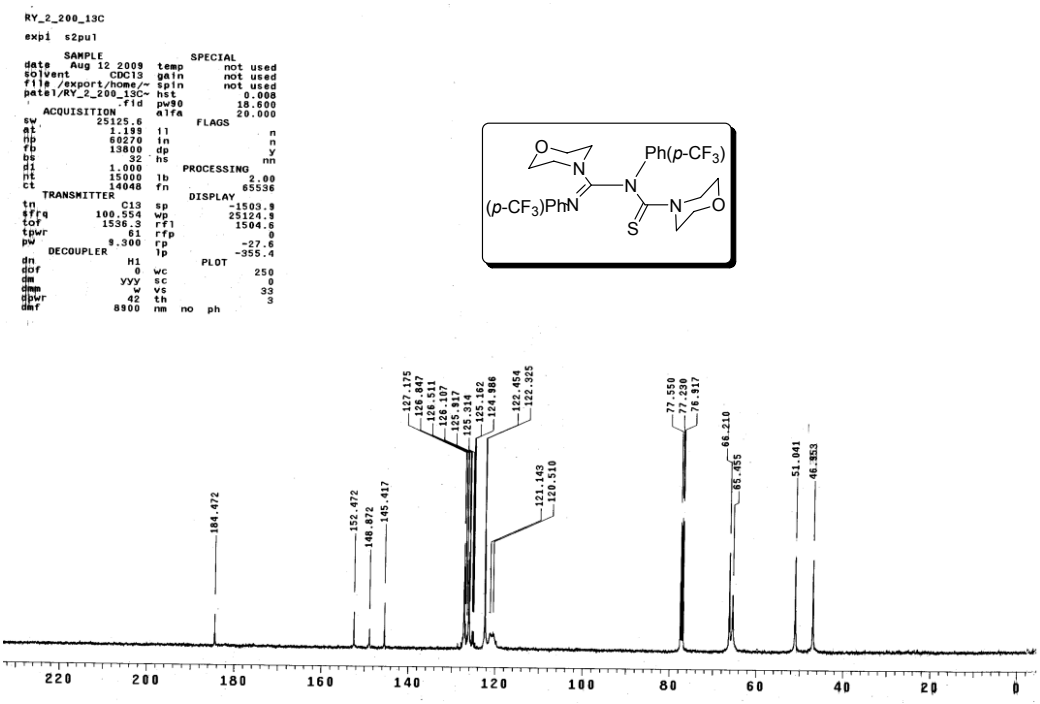
N-((*E*)-(4-Bromophenylimino)(morpholino)methyl)-N-(4-bromophenyl)morpholine-4-carbothioamide (6b).^{13}C NMR (100 MHz, $CDCl_3$):



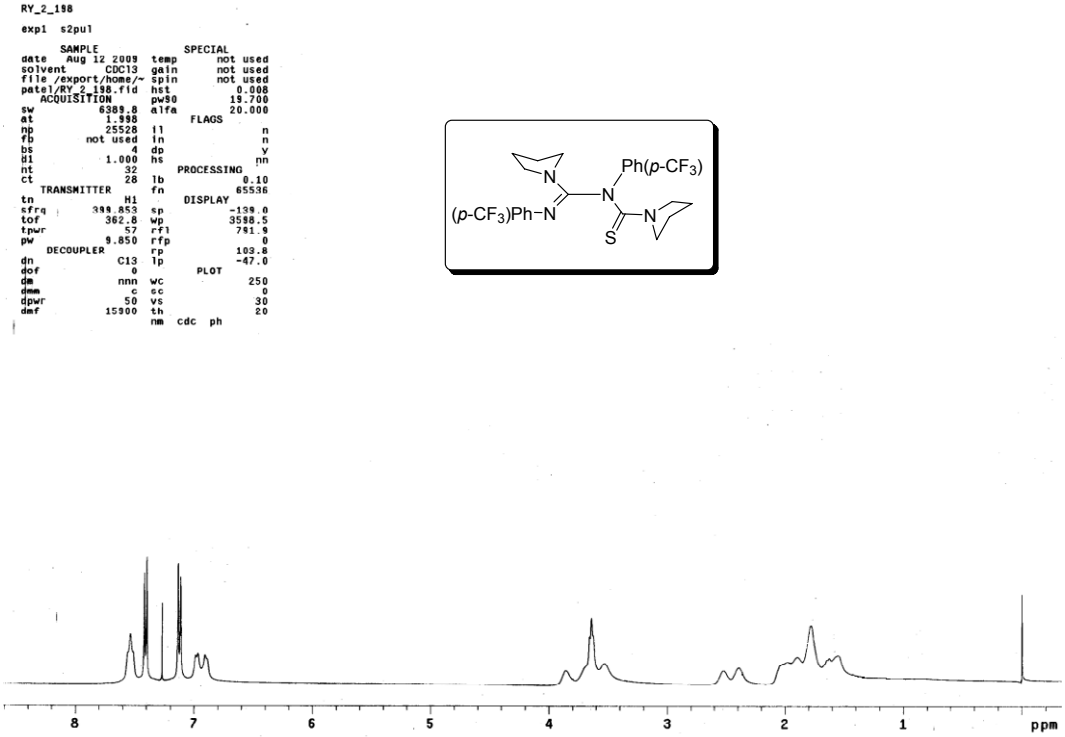
N-((*E*)-(4-(Trifluoromethyl)phenylimino)(morpholino)methyl)-N-(4-(trifluoromethyl)phenyl) morpholine-4-carbothioamide (7b). ^{1}H NMR (400 MHz, $CDCl_3$):



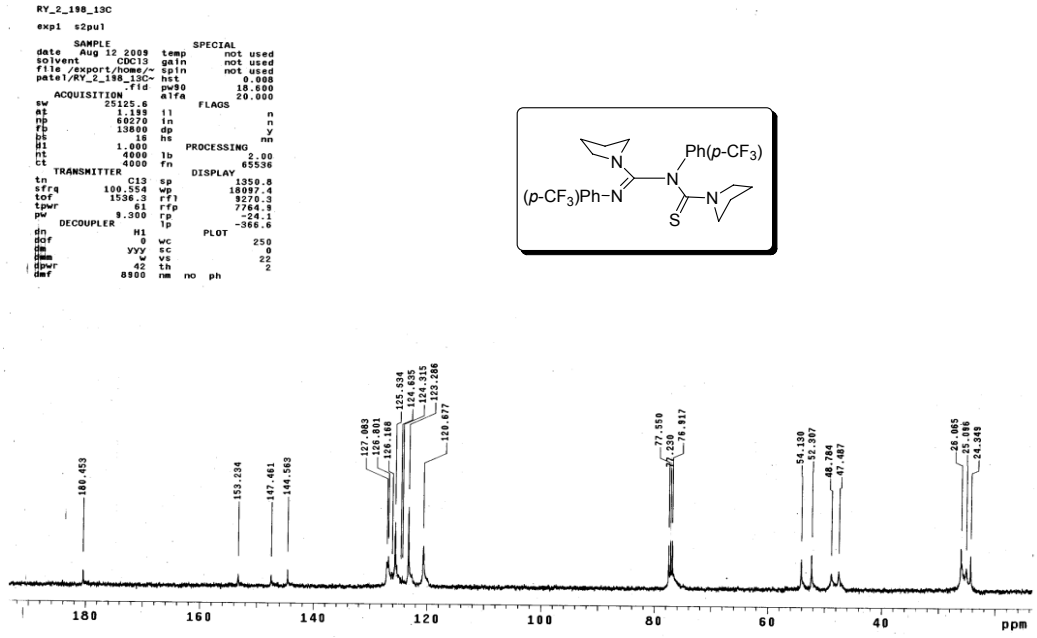
N-((*E*)-(4-(Trifluoromethyl)phenylimino)(morpholino)methyl)-N-(4-(trifluoromethyl) phenyl)morpholine-4-carbothioamide (7b). ^{13}C NMR (100 MHz, $CDCl_3$):



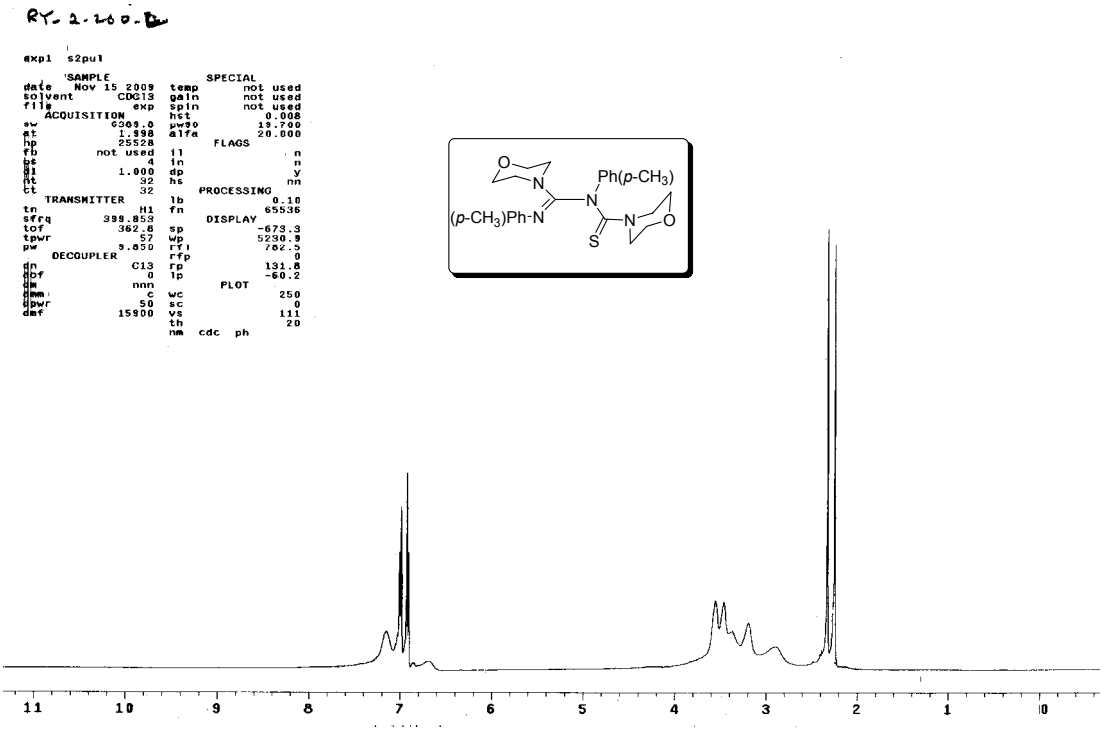
N-((*E*)-(4-(Trifluoromethyl)phenylimino)(pyrrolidin-1-yl)methyl)-N-(4-(trifluoromethyl) phenyl)pyrrolidine-1-carbothioamide (7c). ^{1}H NMR (400 MHz, $CDCl_3$):



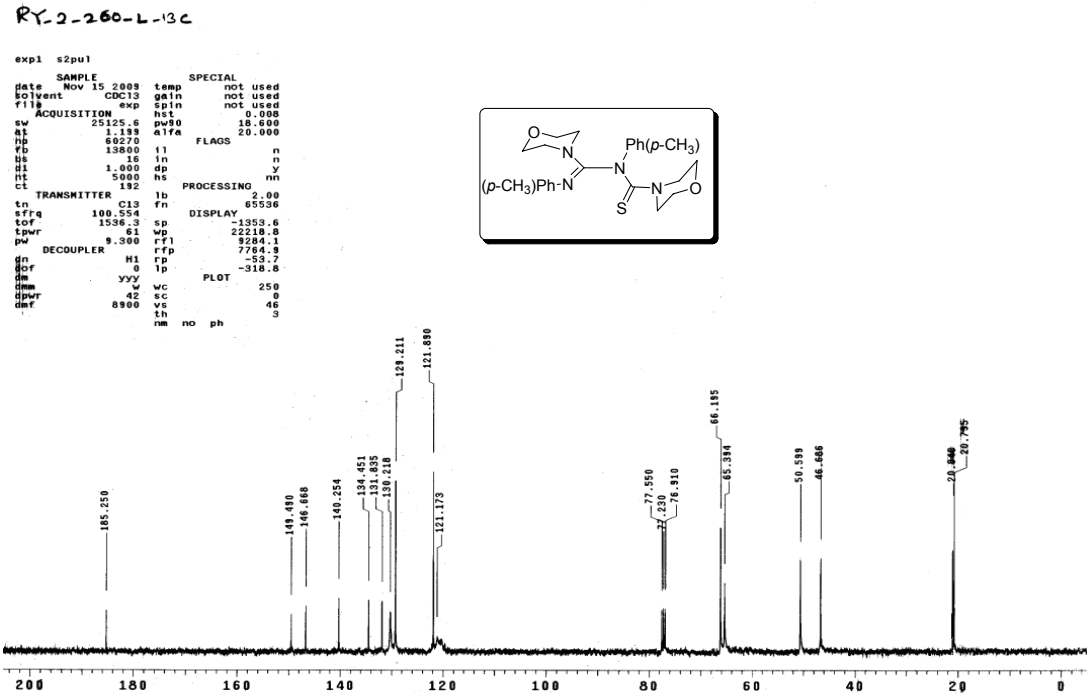
N-((*E*)-(4-(Trifluoromethyl)phenylimino)(pyrrolidin-1-yl)methyl)-N-(4-(trifluoromethyl) phenyl)pyrrolidine-1-carbothioamide (7c). ^{13}C NMR (100 MHz, $CDCl_3$):



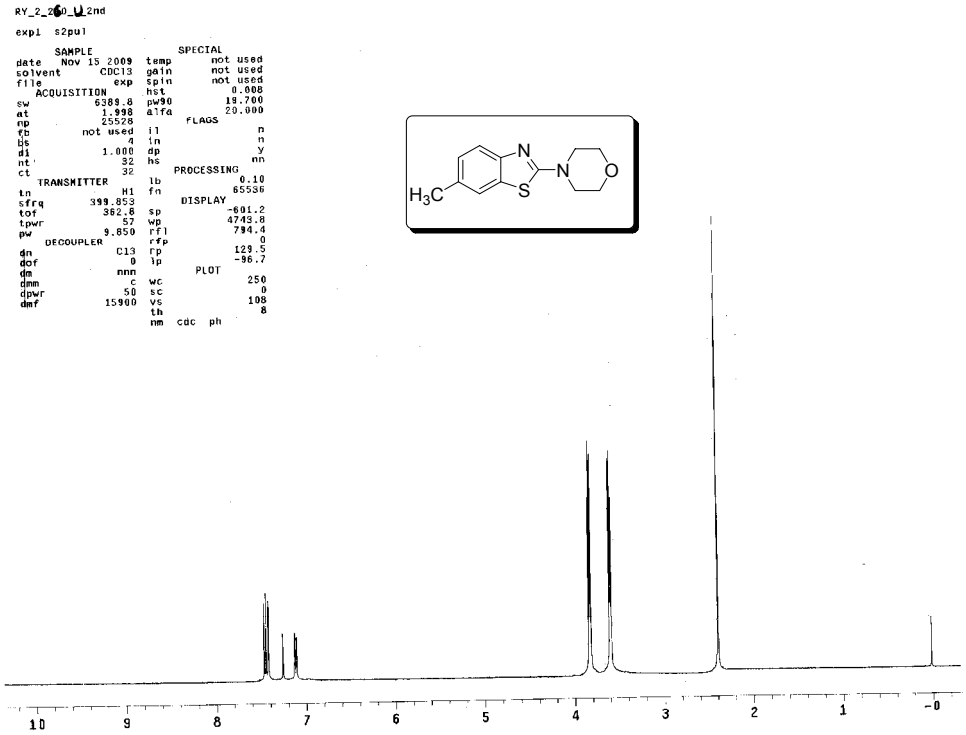
***N*-((*E*)-(*p*-Tolylimino)(morpholino)methyl)-*N*-*p*-tolylmorpholine-4-carbothioamide (8b). ^{1}H NMR (400 MHz, $CDCl_3$):**



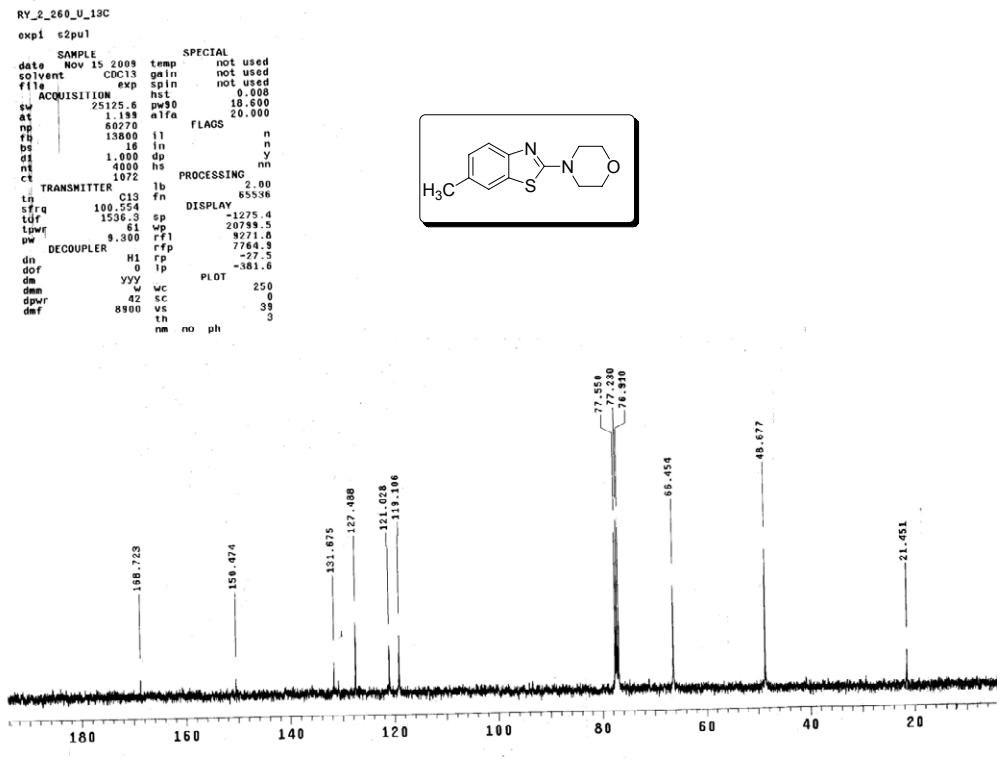
***N*-((*E*)-(*p*-Tolylimino)(morpholino)methyl)-*N*-*p*-tolylmorpholine-4-carbothioamide (8b). ^{13}C NMR (100 MHz, $CDCl_3$):**



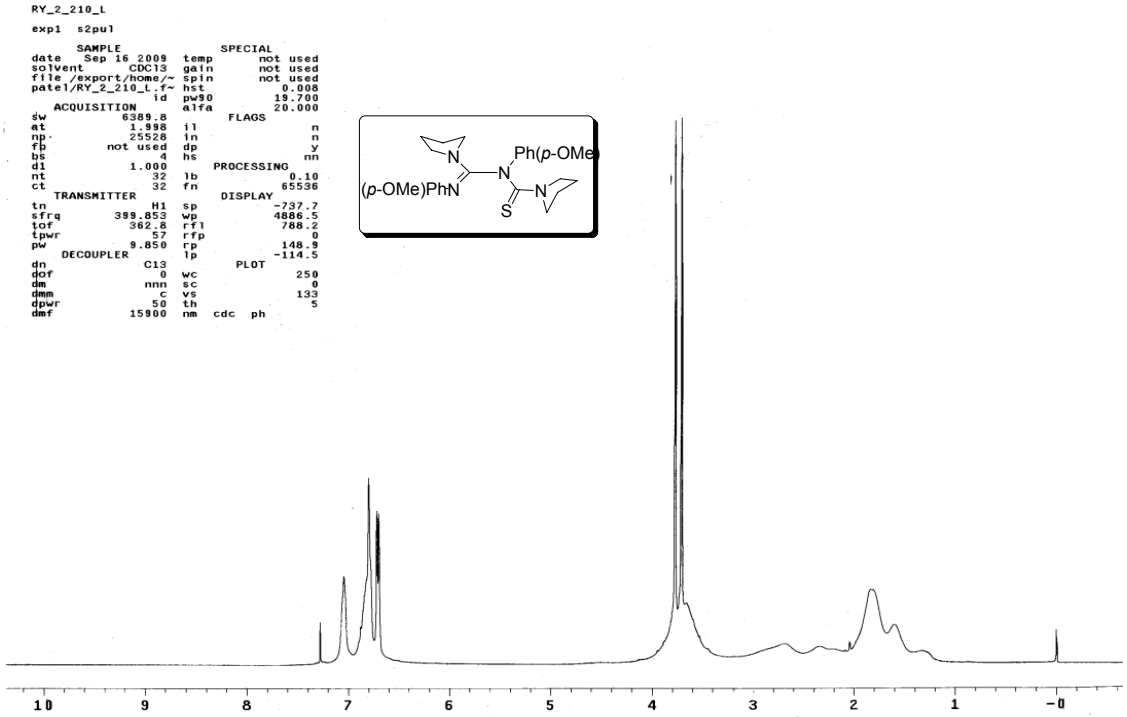
6-Methyl-2-morpholinobenzo[d]thiazole (8b'). ^{1}H NMR (400 MHz, $CDCl_3$):



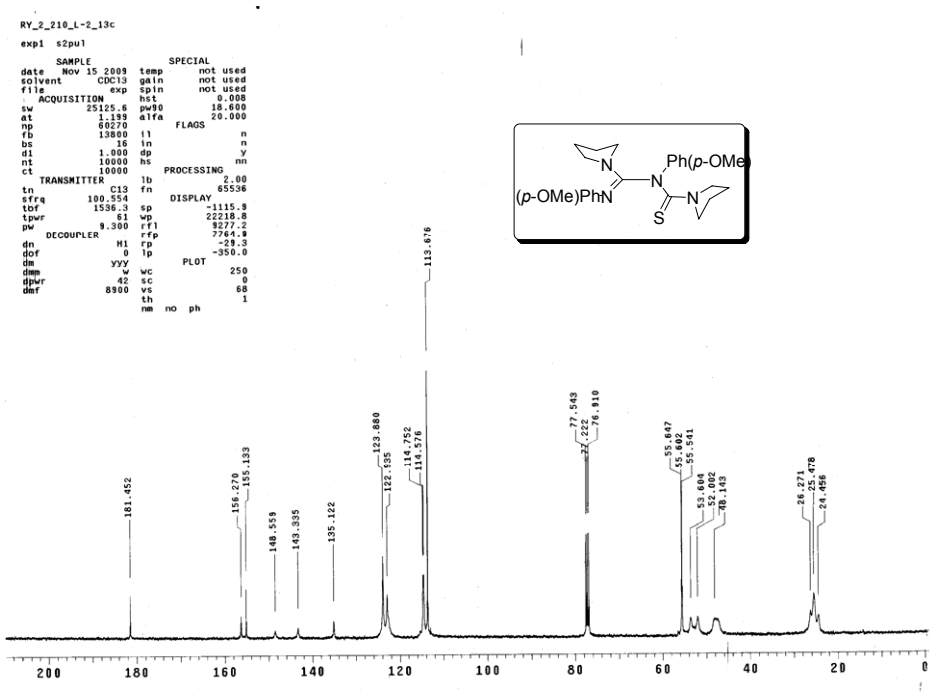
6-Methyl-2-morpholinobenzo[d]thiazole (8b'). 13C NMR (100 MHz, $CDCl_3$):



N-((*E*)-(4-methoxyphenylimino)(pyrrolidin-1-yl)methyl)-N-(4-methoxyphenyl)pyrrolidine-1-carbothioamide (9c). ^{1}H NMR (400 MHz, $CDCl_3$):

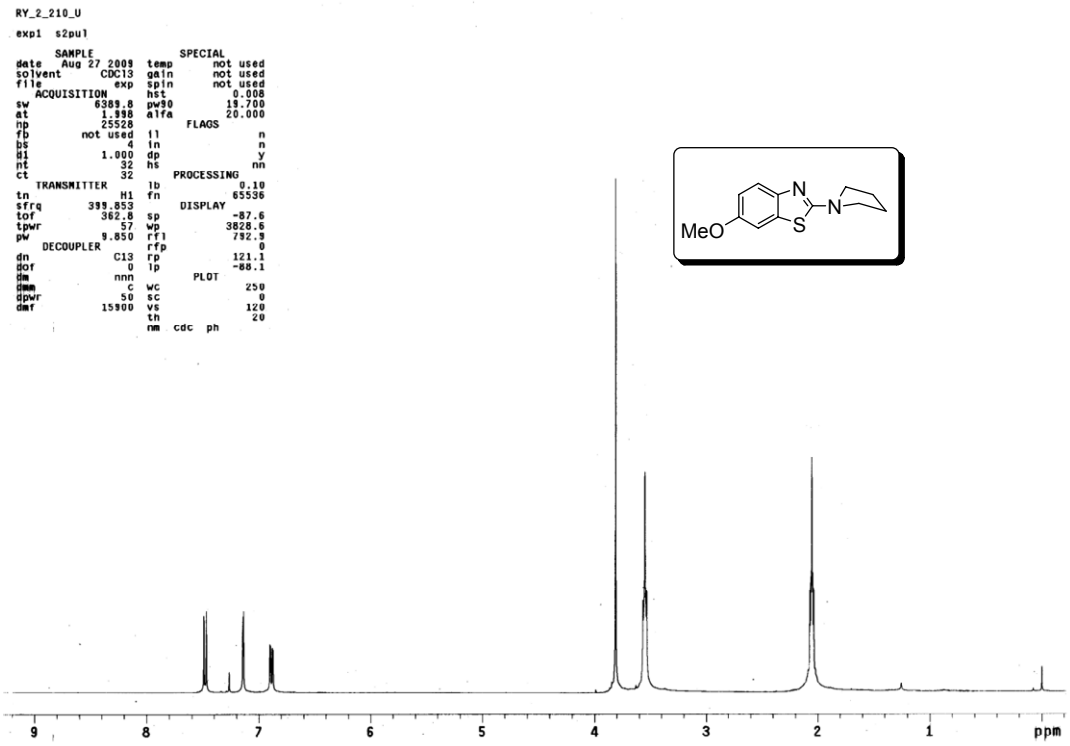


N-((*E*)-(4-Methoxyphenylimino)(pyrrolidin-1-yl)methyl)-N-(4-methoxyphenyl)pyrrolidine-1-carbothioamide (9c). ^{13}C NMR (100 MHz, $CDCl_3$):

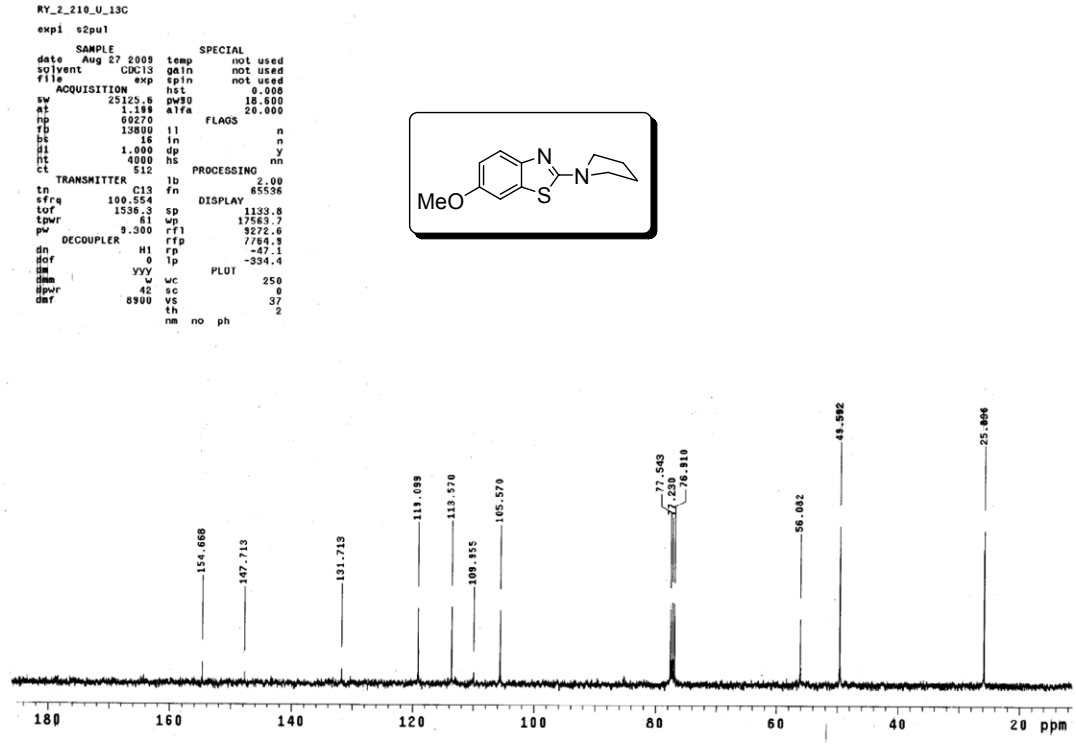


-S32 -

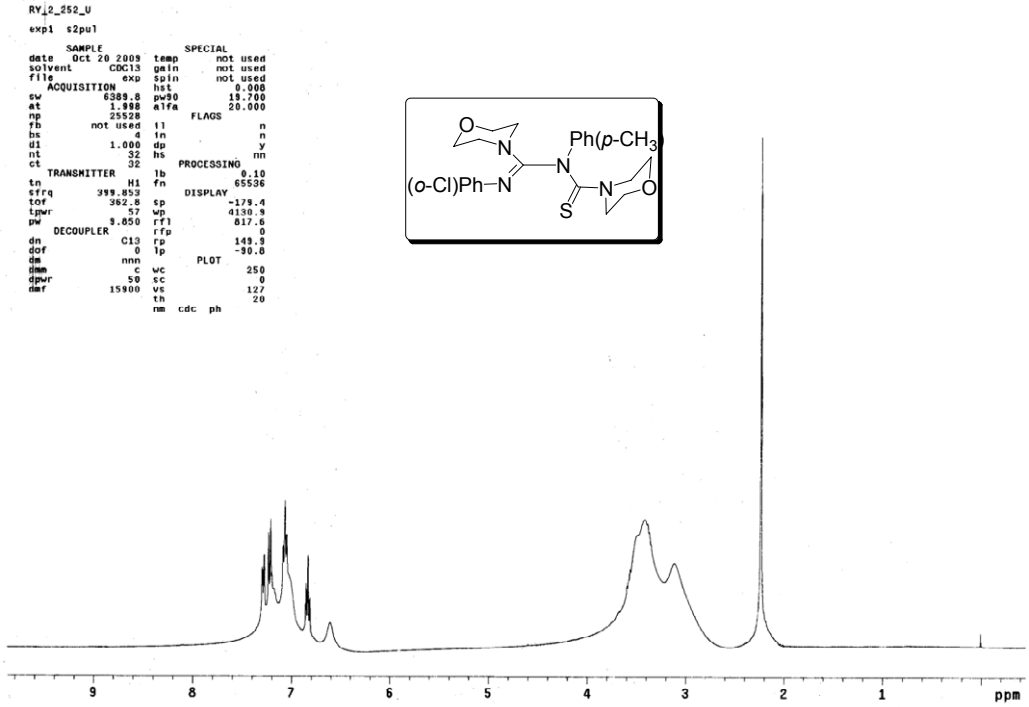
6-Methoxy-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (9c'). ^{1}H NMR (400 MHz, $CDCl_3$):



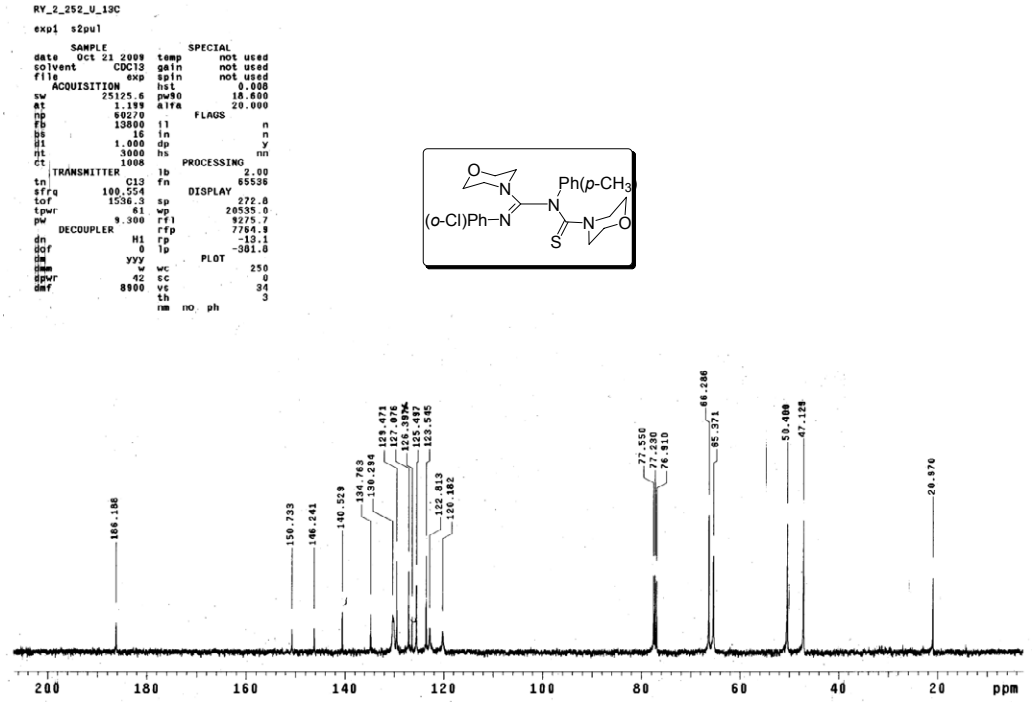
6-Methoxy-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (9c'). ^{13}C NMR (100 MHz, $CDCl_3$):



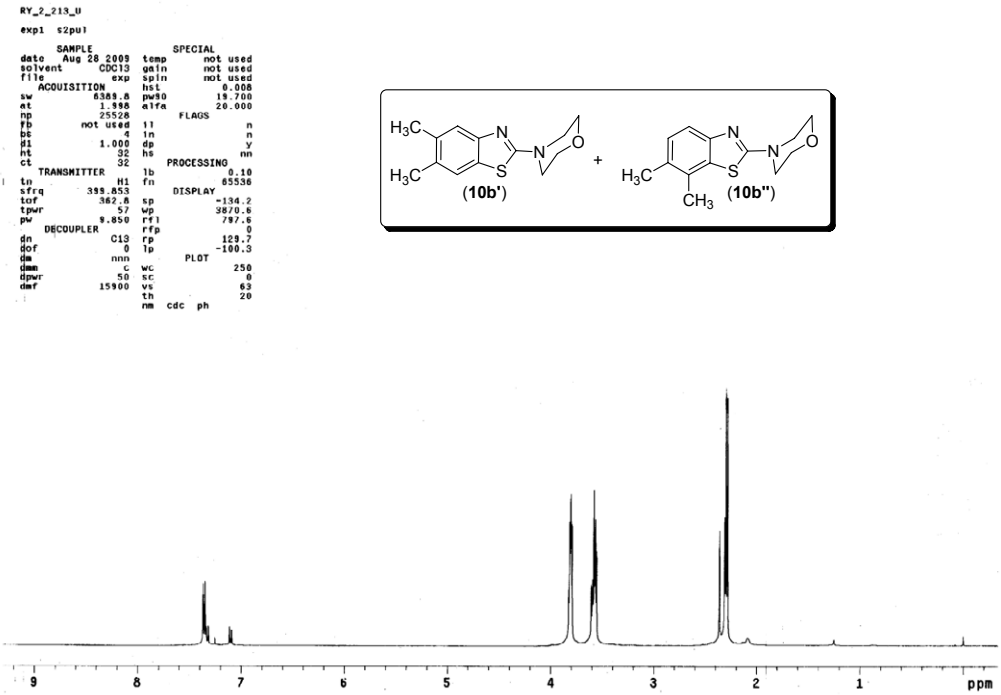
N-((*E*)-(2-Chlorophenylimino)(morpholino)methyl)-N-*p*-tolylmorpholine-4-carbothioamide (2e). ^{1}H NMR (400 MHz, $CDCl_3$):



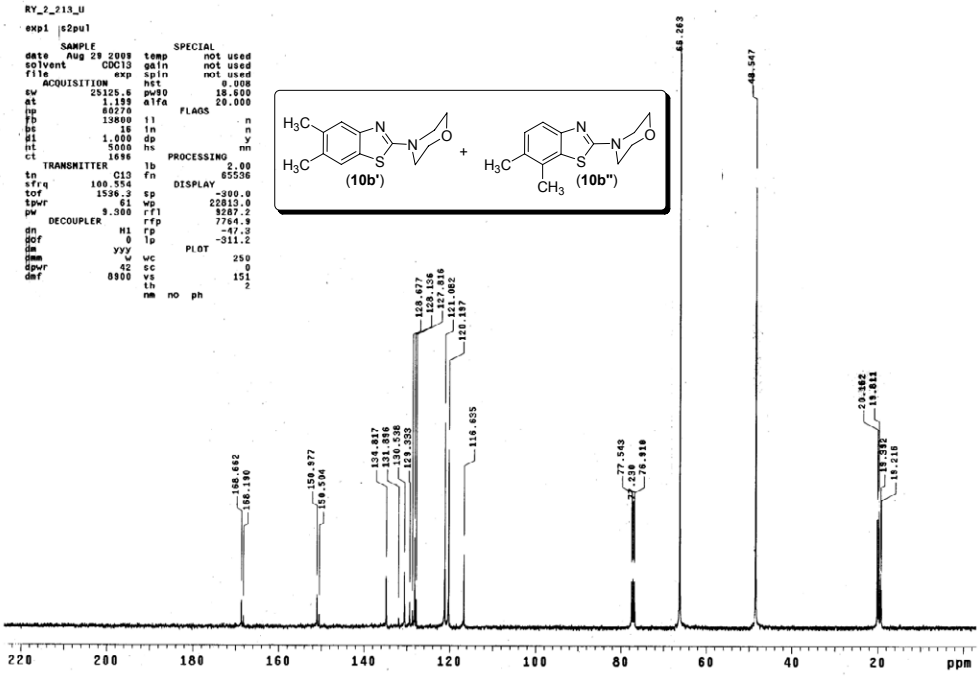
N-((*E*)-(2-Chlorophenylimino)(morpholino)methyl)-N-*p*-tolylmorpholine-4-carbothioamide (2e). ^{13}C NMR (100 Mz,$CDCl_3$):



5,6-Dimethyl-2-morpholinobenzo[*d*]thiazole (10b') & 6,7-dimethyl-2-morpholinobenzo[*d*]thiazole (10b''). ^{1}H NMR (400 MHz, $CDCl_3$):

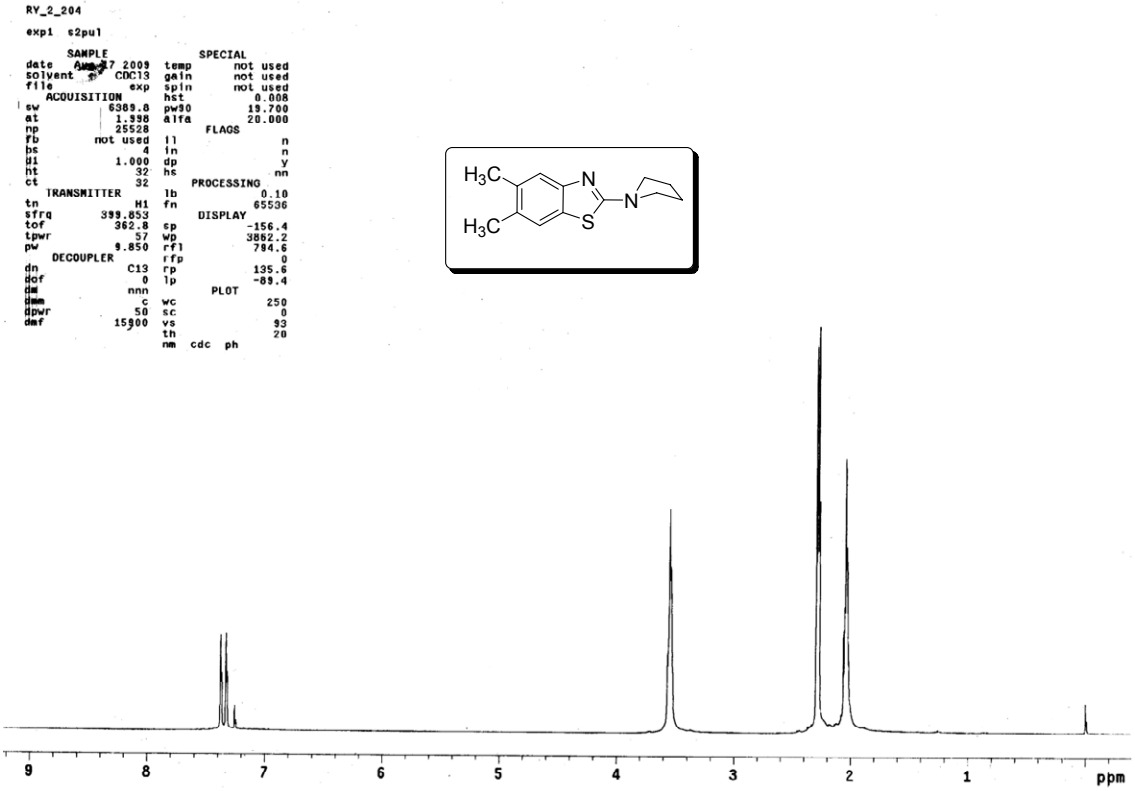


5,6-Dimethyl-2-morpholinobenzo[*d*]thiazole (10b') & 6,7-dimethyl-2-morpholinobenzo[*d*]thiazole (10b''). ^{13}C NMR (100 MHz, $CDCl_3$):

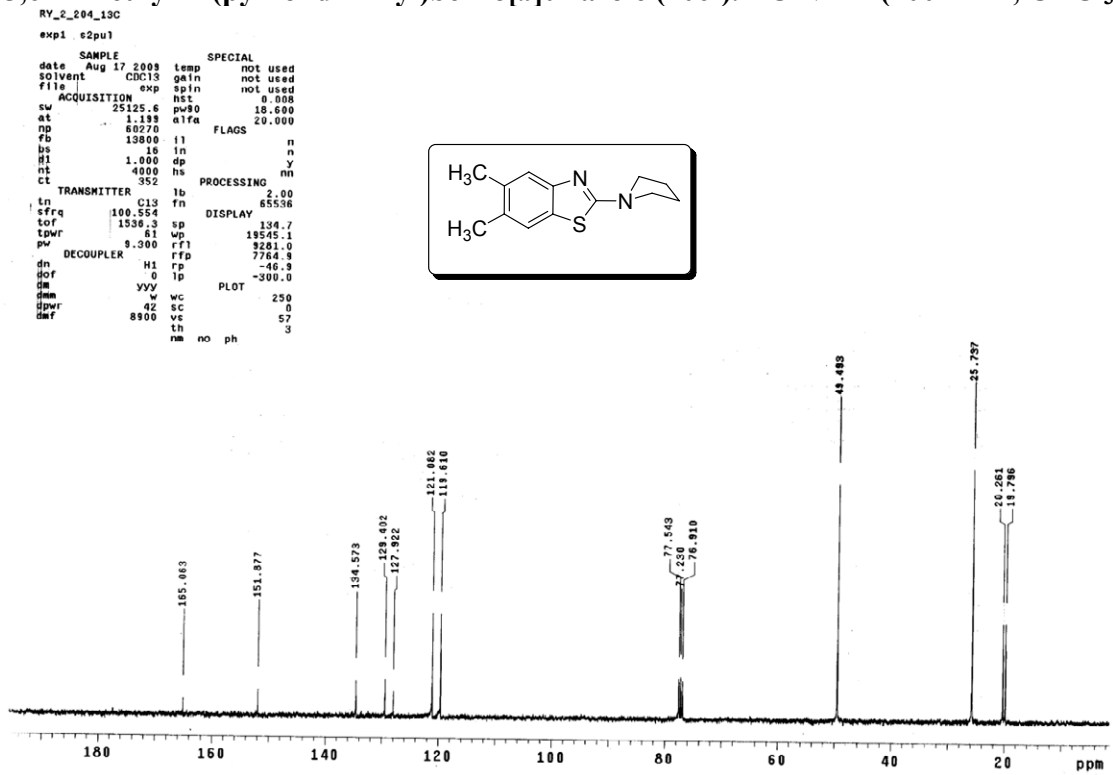


-S35 -

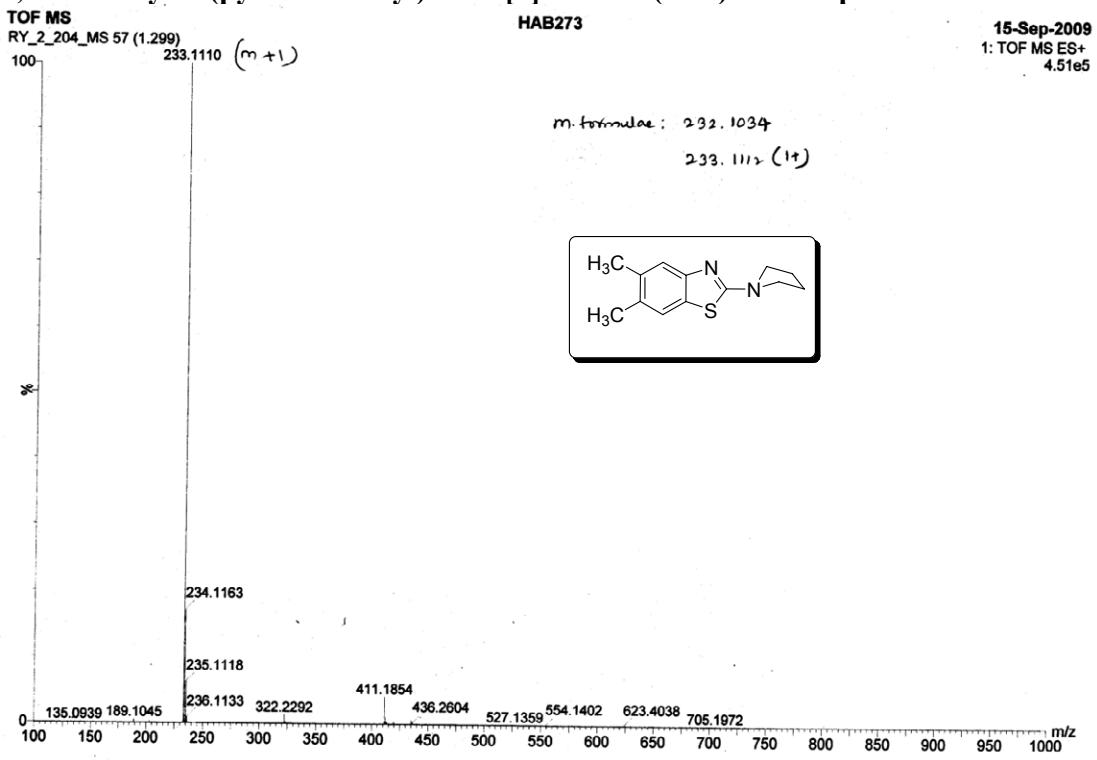
5,6-Dimethyl-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (10c'). ^{1}H NMR (400 MHz, $CDCl_3$):



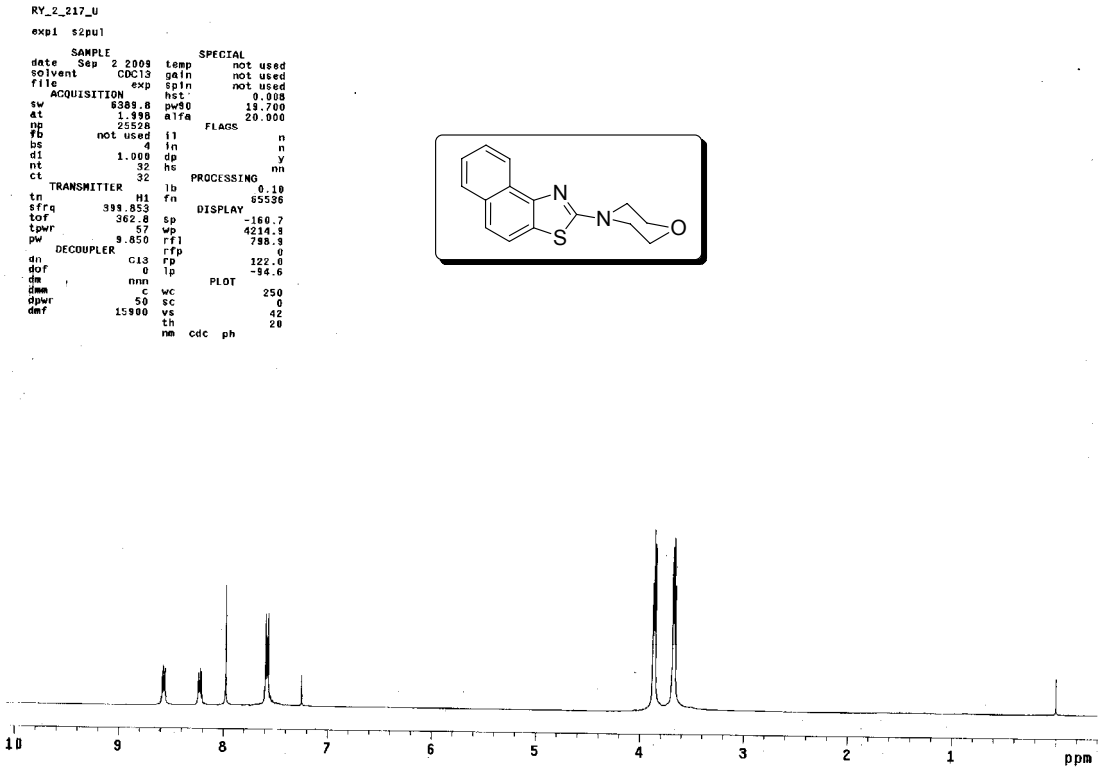
5,6-Dimethyl-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (10c'). ^{13}C NMR (100 MHz, $CDCl_3$):



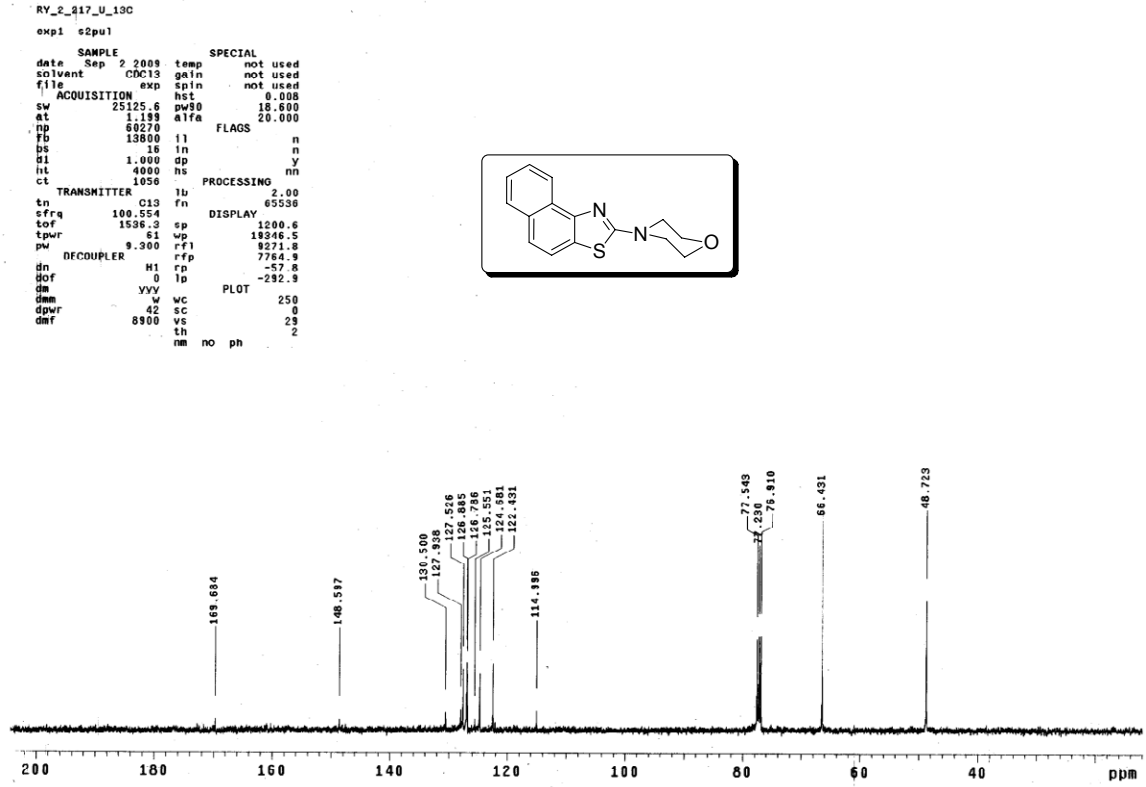
5,6-Dimethyl-2-(pyrrolidin-1-yl)benzo[*d*]thiazole (10c'). Mass Spectra



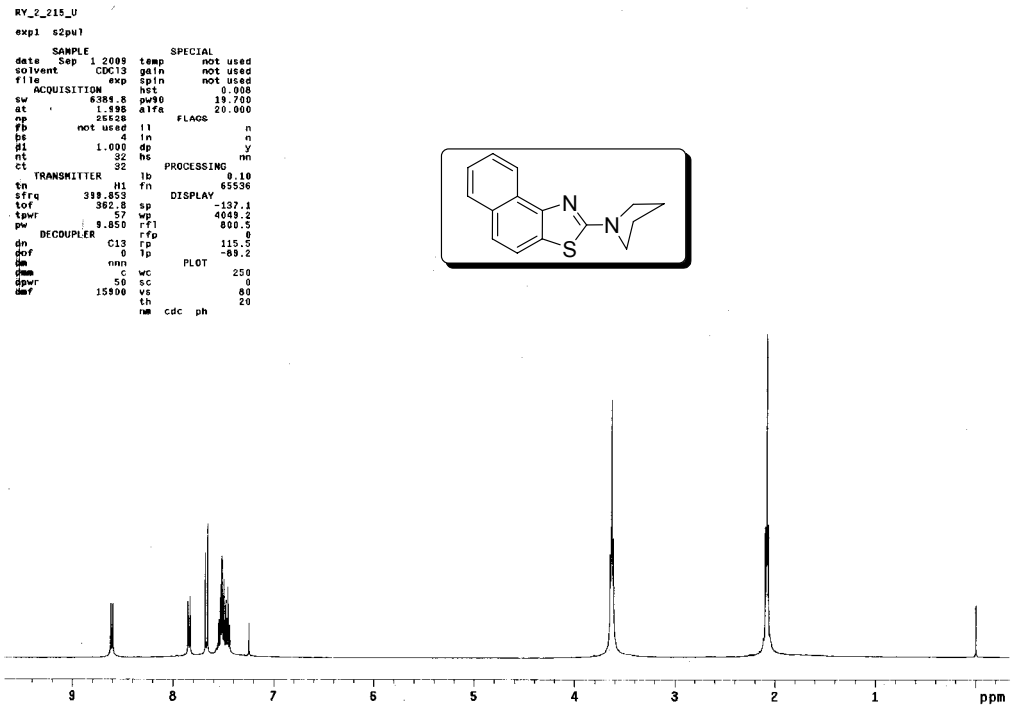
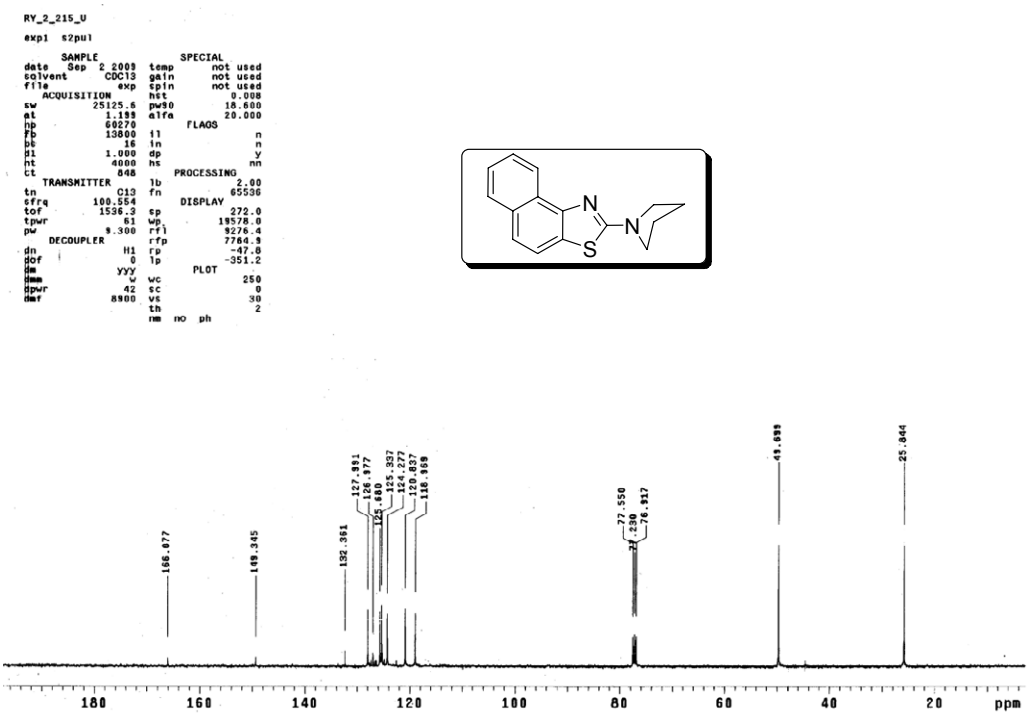
2-Morpholinonaphtho[1,2-*d*]thiazole (11b'). ^{1}H NMR (400 MHz, $CDCl_3$):



2-Morpholinonaphtho[1,2-*d*]thiazole (11b'). ^{13}C NMR (100 MHz, $CDCl_3$):



2-(Pyrrolidin-1-yl)naphtho[1,2-*d*]thiazole (11c'). ^{1}H NMR (400 MHz, $CDCl_3$):



2-(Pyrrolidin-1-yl)naphtho[1,2-*d*]thiazole (11c'). ^{13}C NMR (100 MHz, $CDCl_3$):