Supplementary Material (ESI) for Chemical Communications

Supporting Information

Facile synthesis of sulfonyl amidines via carbon-nitrogen bonds formation mediated by $FeCl_3$

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1. Representative procedure for the $FeCl_3$-mediated synthesis of sulfonyl amidines

To a solution of sulfonyl azide (1.0 mmol) and tertiaryamine (4.0 mmol) in 5.0 mL of CH_2Cl_2 was added $FeCl_3$ (1.0 mmol), and the resulting mixture was reacted under required condition monitored by TLC. Then the system was diluted with 10 mL CH_2Cl_2, following the addition of the EDTA-NaOH solution (20 mmol of EDTA and 20 mmol of NaOH in 15 mL of water). Afterward, the whole mixture was refluxed for five hours and the organic layer was separated. The aqueous layer was extracted with CH_2Cl_2 (10 mL×3) and the combined organic phase was dried over anhydrous Na_2SO_4 powder. The final product was obtained through purification with column chromatography.

2. Crystal data of the product obtained by 4-NO_2-$C_6H_4SO_2N_3$ reacted with Et_3N.

The data collection for the above compound were performed on a Oxford Diffraction Gemini S Ultra CCD diffractometer equipped with mirror CuKα (λ = 1.54184 Å) radiation at room temperature. The structure was solved by direct methods and refined by full-matrix least-squares methods with SHELXL-97 programs. Crystallographic parameters: $C_{11}H_{15}N_3O_4S$, M = 285.32, triclinic, space group P-1, a = 6.366(5), b = 10.293(5), c = 12.008(5) Å, α = 115.154(5) °, β = 102.366(5) °, γ = 92.033(5) °, V = 688.5(7) Å^3, Z = 2, D_c = 1.376 g/cm^3, F(000) = 300, a total of 5886 reflections, of which 2137 were independent (R_{int} = 0.015). Goodness of fit: 1.065, R_1[I> 2σ(I)] = 0.0346, wR_2[I> 2σ(I)] = 0.0984, R_1 (all data) = 0.0369, wR_2 (all data) = 0.1001, residuals (e·Å^{-3}): 0.166, -0.226. CCDC depository number: 733386.

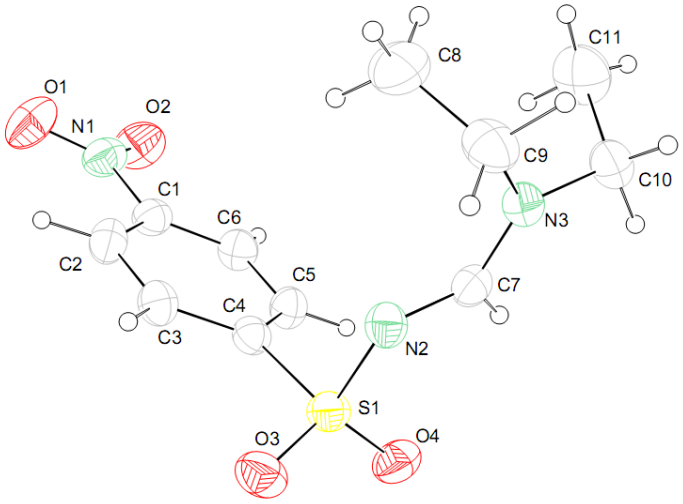
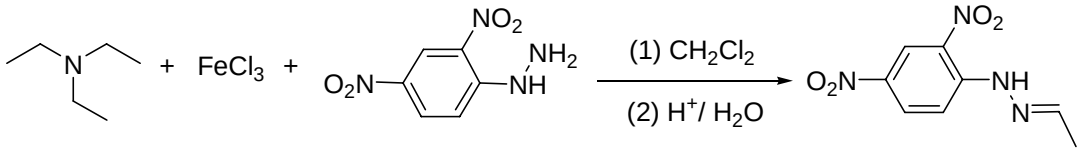
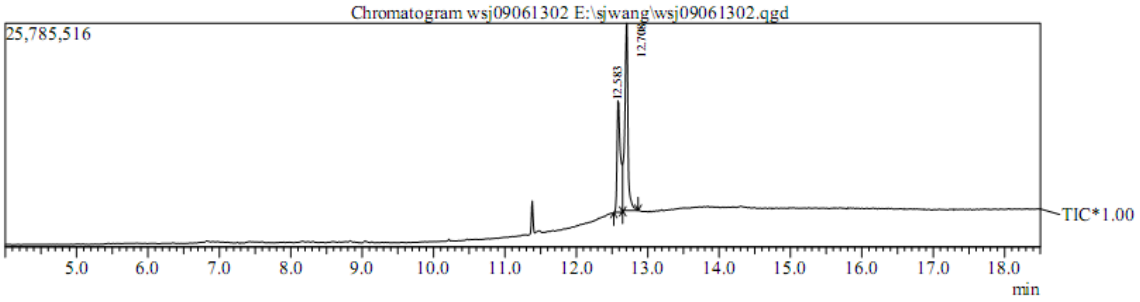


Figure S1 ORTEP draw of the crystal structure of the product obtained by 4-NO_2-$C_6H_4SO_2N_3$ reacted with Et_3N with 30% thermal possibility.

3. Experimental details for the captures of enamine and diazoalkane.

3.1 Procedure for the capture of vinyldiethylamine by (2,4-dinitrophenyl)hydrazine: To a mixture of $FeCl_3$ (810 mg, 5.0 mmol) and CH_2Cl_2 (10 mL) was added CH_2Cl_2 (5.0 mL) solution of triethylamine (1.2 g, 12.0 mmol) dropwise in 5 minutes. The resulting mixture was stirred for 20 minutes at room temperature. Afterward, the mixture was treated with 10 mL of saturated NH_4Cl and (2,4-dinitrophenyl)hydrazine (198 mg, 1.0 mmol) solution (5 mL of EtOH and 5 mL of concentrated H_2SO_4), then extracted with ethyl acetate (3×20 mL), washed with water and brine, dried with anhydrous Na_2SO_4 powder. The final product was obtained as the mixture of the desired product with an unconfirmed compound and determined by GC-MS, ^1H NMR and ^{13}C NMR.





Peak Report TIC

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1	12.583	12.525	12.650	45369418	39.74	12862942	37.35	3.53	MI	
2	12.708	12.650	12.867	68806887	60.26	21577437	62.65	3.19	MI	
				114176304	100.00	34440379	100.00			

Spectrum

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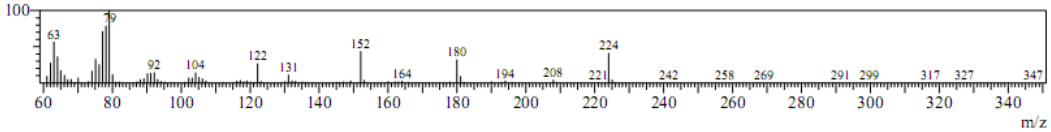

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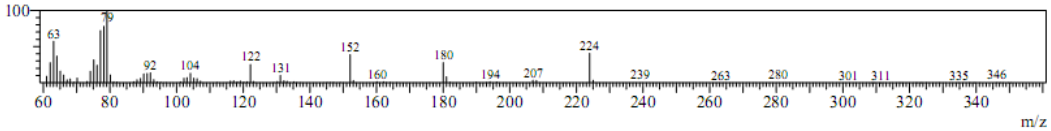
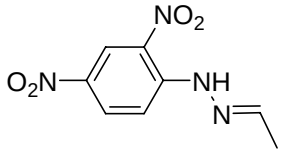
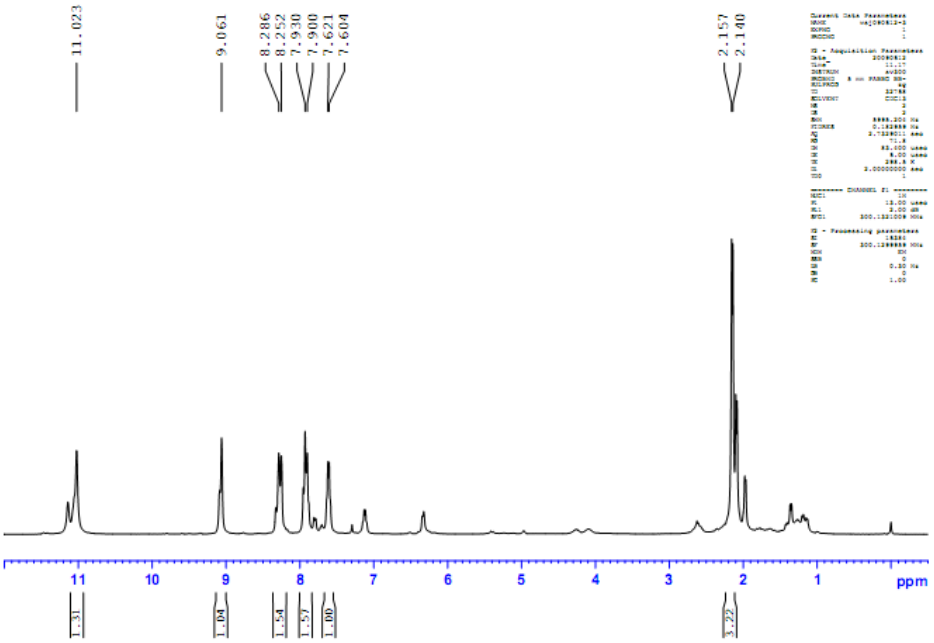
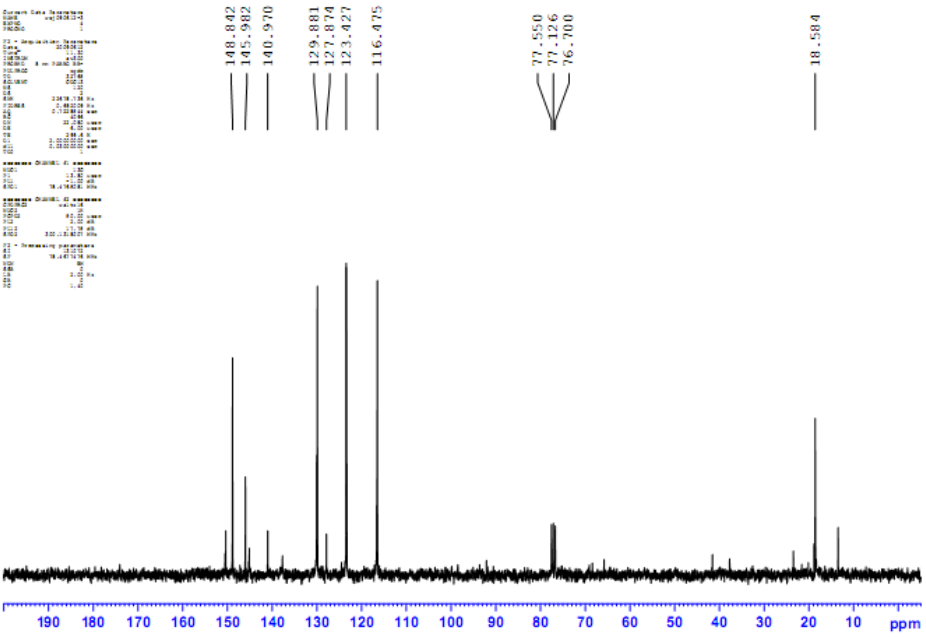




^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 11.02 (s, 1 H), 9.06 (s, 1 H), 8.27 (d, J = 10.2 Hz, 1 H), 7.91 (d, J = 9.0 Hz, 1H), 7.62-7.60 (m, 1 H), 2.15 (m, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 148.8, 145.9, 140.9, 129.9, 127.9, 123.4, 116.5, 18.6.





3.2 Procedure for the capture of diazomethane by benzoic acid: The experiment was carried out with the below equipments. To a CH_2Cl_2 (10 mL) solution of TsN_3 (985 mg, 5.0 mmol) and $FeCl_3$ (810 mg, 5.0 mmol) was added triethylamine (2.0 g, 20 mmol) dropwisely. The generated gas was introduced into the $CHCl_3$ (10 mL) solution of PhCOOH (223 mg, 1.0 mmol). After the reaction of TsN_3 and Et_3N completed, the chloroform solution was treated with NaOH solution. The aqueous solution was extracted with chloroform and the combined organic phase was dried with anhydrous Na_2SO_4 powder. The product of PhCOOMe was obtained and determined by GC-MS, ^1H NMR and ^{13}C NMR.

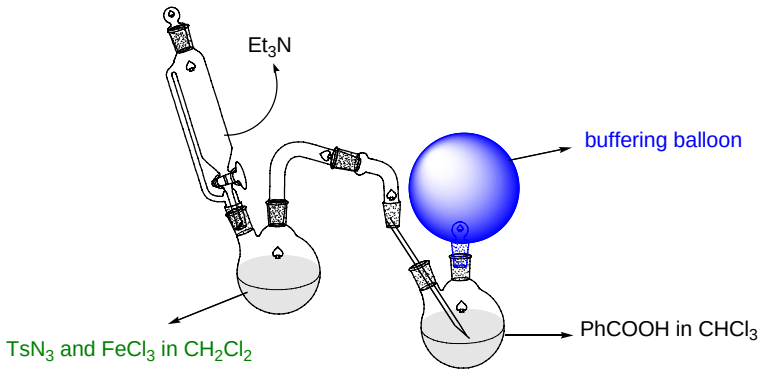
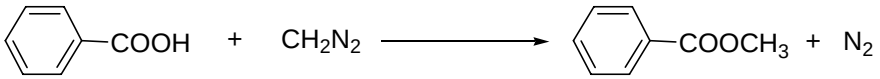
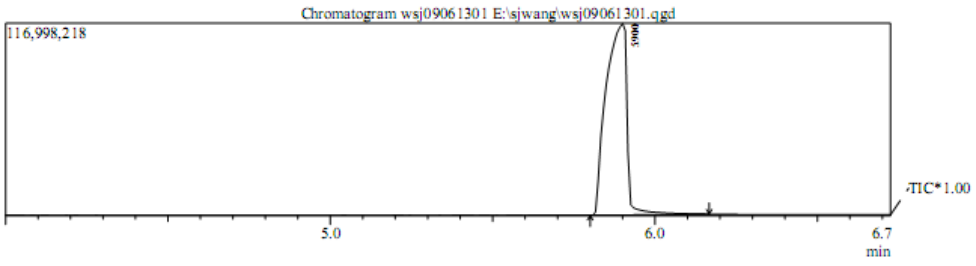
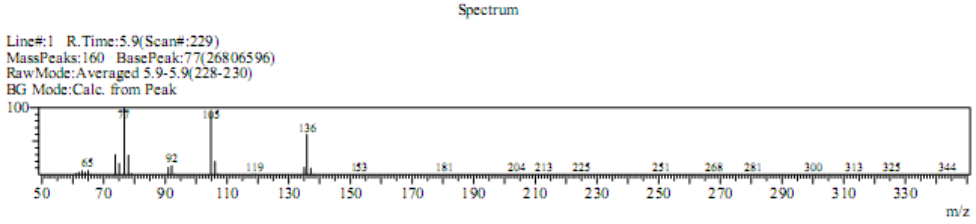
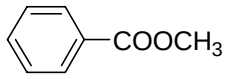


Figure S2 The equipment for the capture of diazomethane by benzoic acid.

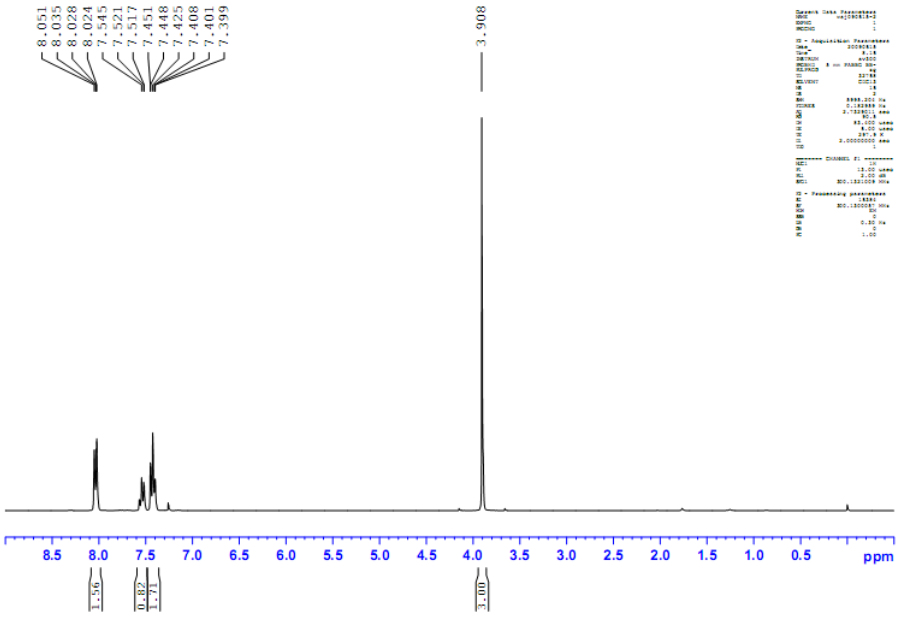


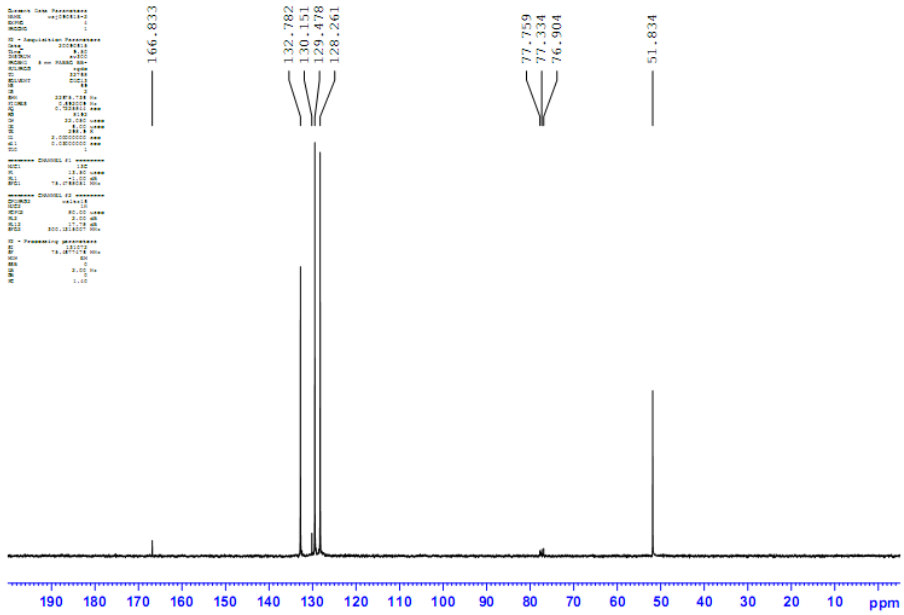




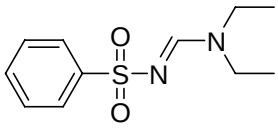


^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.03 (m, 2 H), 7.52 (m, 1 H), 7.42 (m, 2 H), 3.91 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 166.8, 132.8, 130.1, 129.5, 128.3, 51.8.



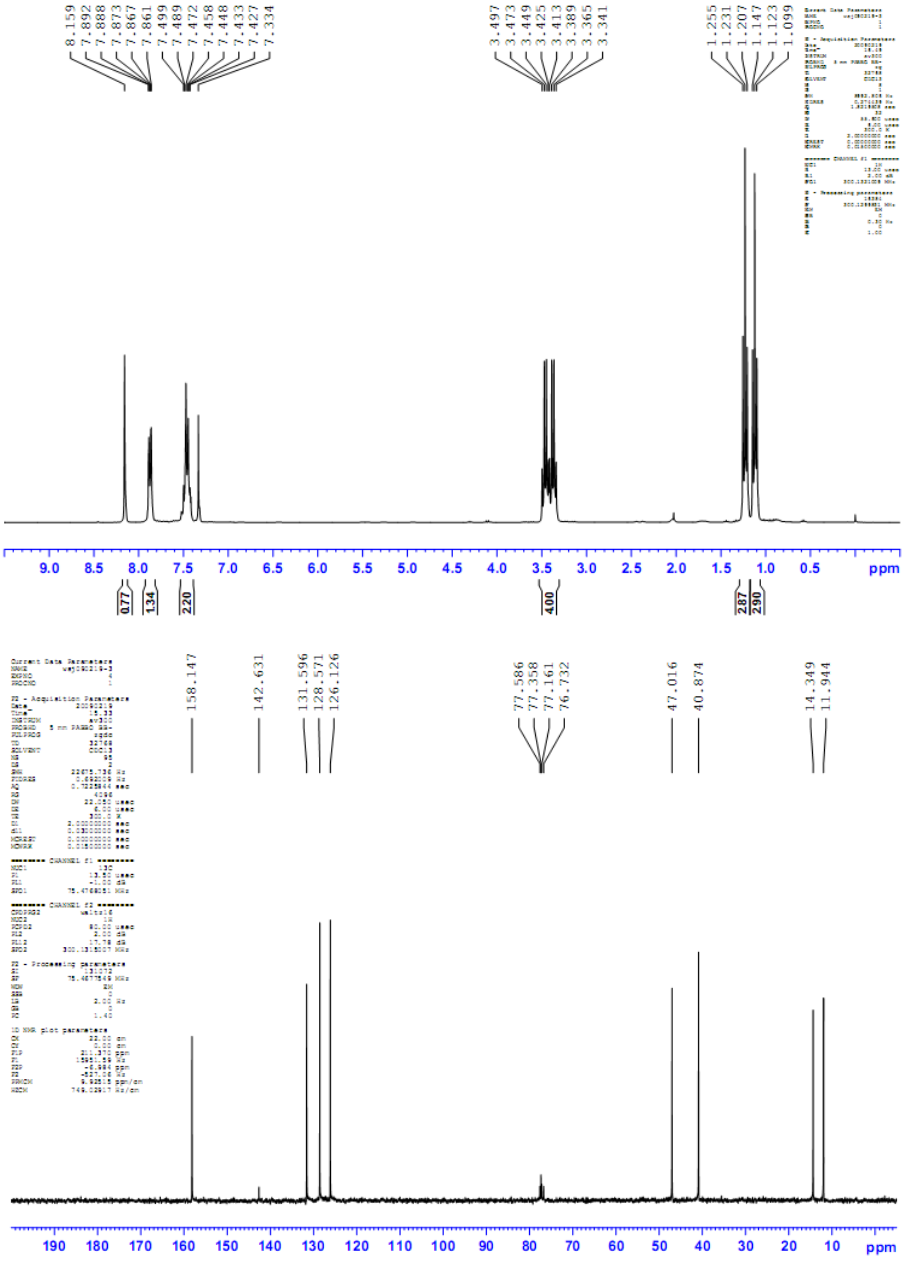


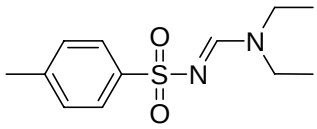
4. Characterization data and NMR spectrums for products



(E)-N,N-diethyl-N'-(phenylsulfonyl)formimidamide

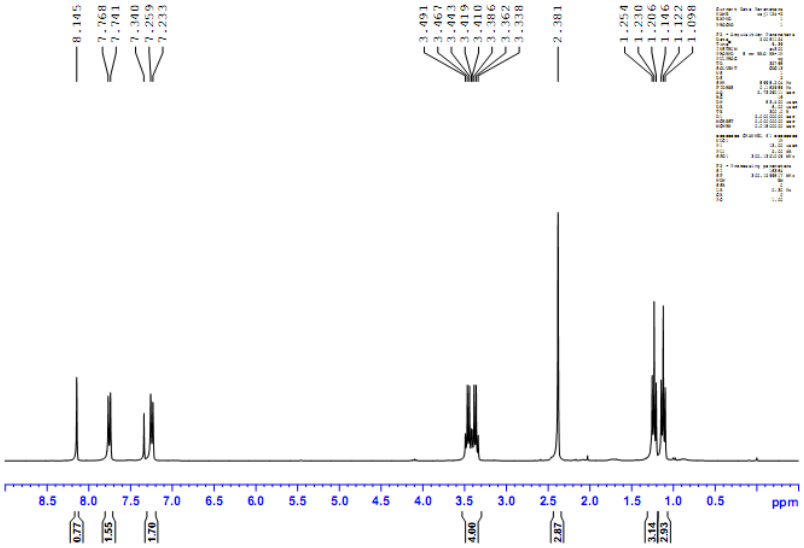
^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.16 (s, 1 H), 7.89-7.86 (m, 2 H), 7.42-7.50 (m, 3 H), 3.50-3.34 (m, 4 H), 1.26-1.21 (t, 3 H, J = 7.2 Hz), 1.15-1.10 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.1, 142.6, 131.6, 128.6, 126.1, 47.0, 40.9, 14.3, 11.9. IR (liquid film, cm^{-1}): v = 2979, 2939, 1612, 1447, 1345, 1299, 1210, 1149, 1089, 956, 876, 770, 723, 691, 607. HRMS calc. $C_{11}H_{16}N_2O_2S$ (M^+): 240.0932. Found: 240.0935.

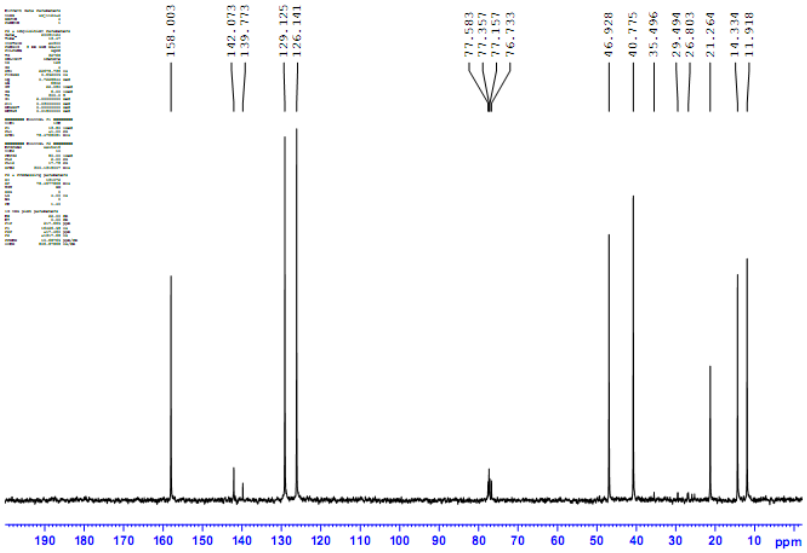


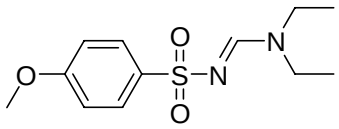


(E)-N,N-diethyl-N'-tosylformimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.14 (s, 1 H), 7.75 (d, 2 H, J = 8.4 Hz), 7.24 (d, 2 H, J = 8.1 Hz), 3.49-3.34 (m, 4 H), 2.38 (s, 3 H), 1.25-1.21 (t, 3 H, J = 7.2 Hz), 1.12-1.08 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.0, 142.0, 139.8, 129.1, 126.1, 46.9, 40.8, 21.3, 14.3, 11.9. IR (liquid film, cm^{-1}): ν = 2979, 2938, 1612, 1451, 1346, 1298, 1211, 1149, 1088, 955, 876, 818, 769, 674, 593, 553. HRMS calc. $C_{12}H_{18}N_2O_2S$ (M^+): 254.1089. Found: 254.1085.

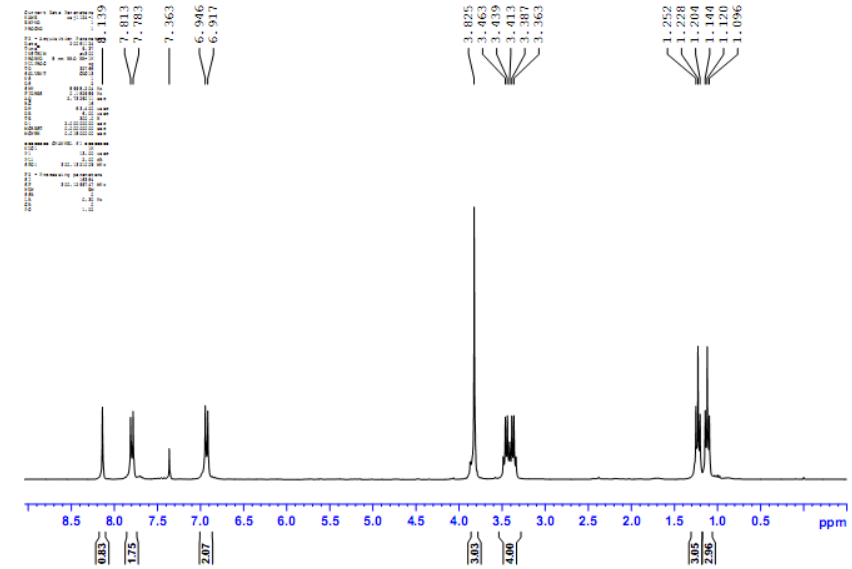


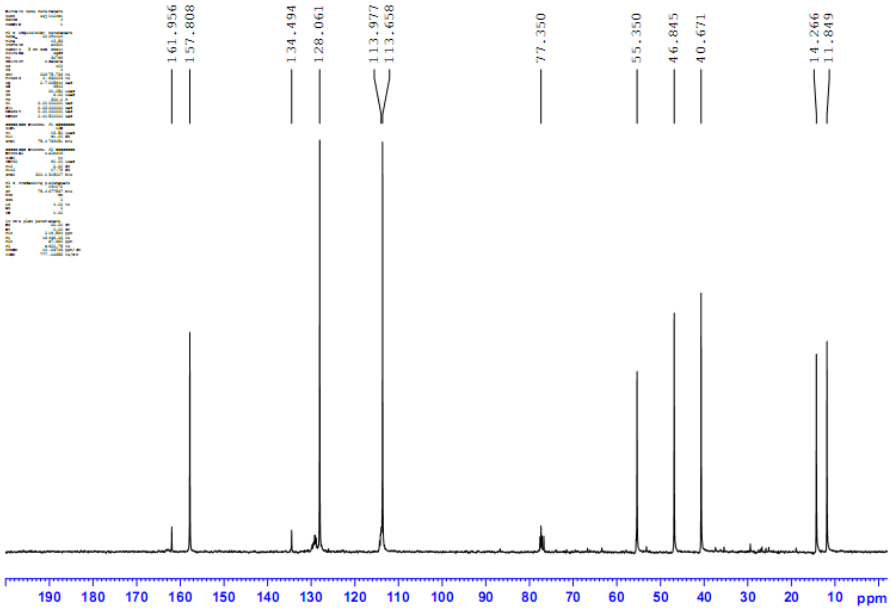


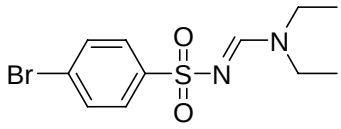


(E)-N,N-diethyl-N'-(4-methoxyphenylsulfonyl)formimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.14 (s, 1 H), 7.79 (d, 2 H, J = 9.0 Hz), 6.93 (d, 2 H, J = 8.7 Hz), 3.79 (s, 3 H), 3.49-3.34 (m, 4 H), 1.25-1.20 (t, 3 H, J = 7.2 Hz), 1.14-1.09 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 162.0, 157.8, 134.5, 128.1, 113.7, 55.4, 46.9, 40.7, 14.3, 11.9. IR (liquid film, cm^{-1}): ν = 2978, 2940, 1612, 1498, 1453, 1346, 1291, 1258, 1211, 1146, 1090, 1025, 955, 876, 835, 769, 677, 594, 573. HRMS calc. $C_{12}H_{18}N_2O_3S$ (M^+): 270.1038, Found: 270.1036.

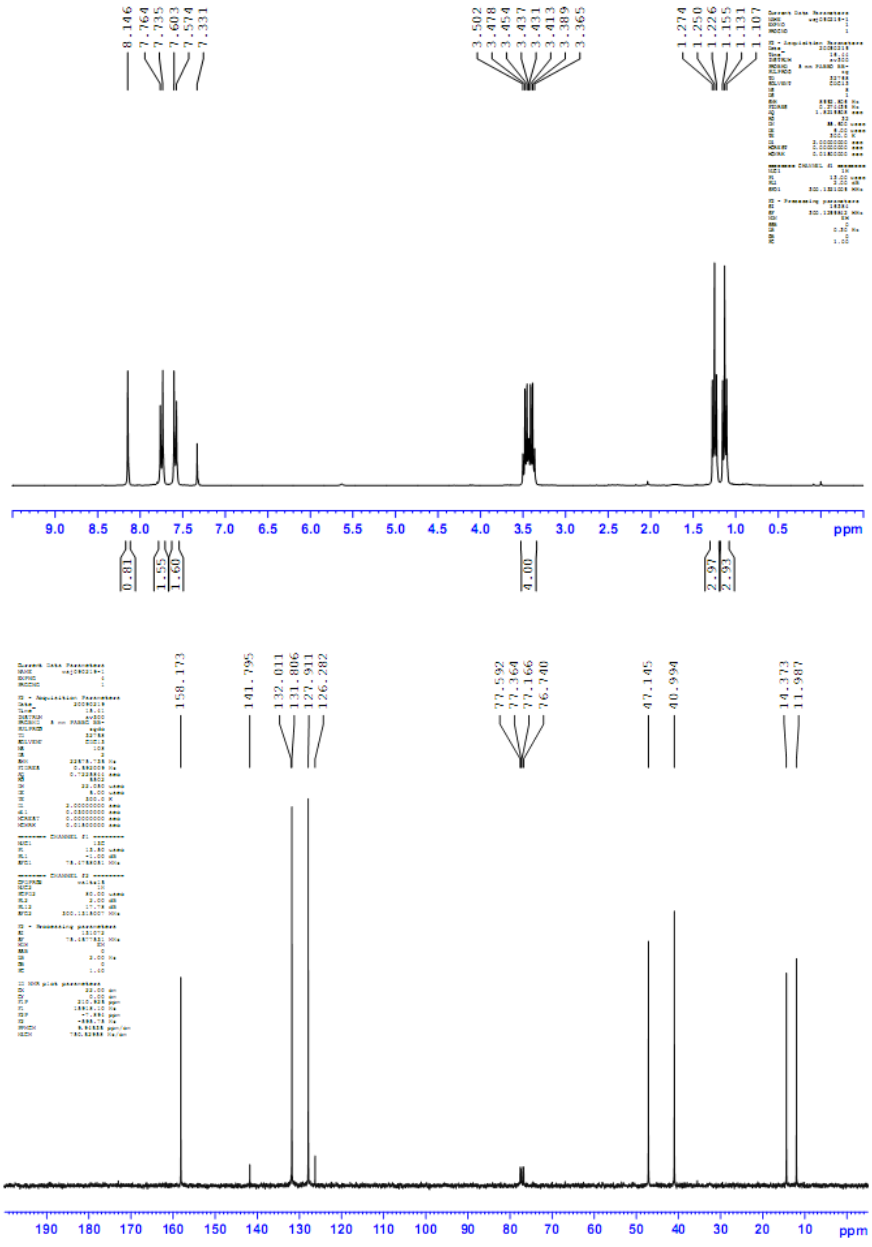


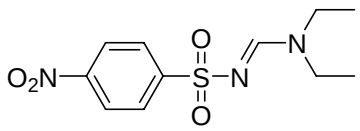




(E)-N'-(4-bromophenylsulfonyl)-N,N-diethylformimidamide

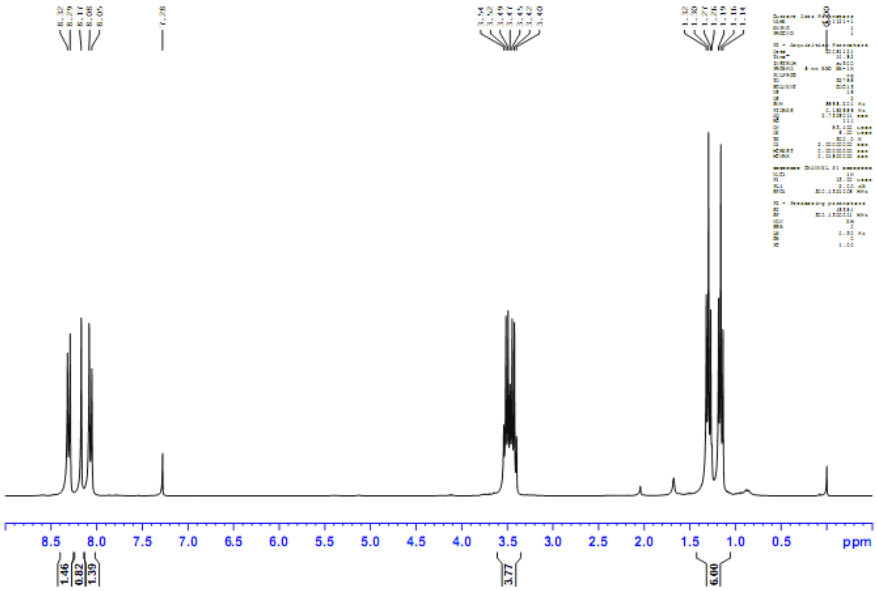
^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.15 (s, 1 H), 7.75 (d, 2 H, J = 8.7 Hz), 7.59 (d, 2 H, J = 8.4 Hz), 3.50-3.37 (m, 4 H), 1.28-1.23 (t, 3 H, J = 7.2 Hz), 1.16-1.11 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.2, 141.8, 131.8, 127.9, 126.3, 47.1, 41.0, 14.4, 12.0. IR (liquid film, cm^{-1}): v = 2979, 1612, 1450, 1344, 1303, 1210, 1148, 1086, 1010, 956, 878, 820, 771, 740, 623, 587. HRMS calc. $C_{11}H_{15}BrN_2O_2S$ (M^+): 318.0038. Found: 318.0032.

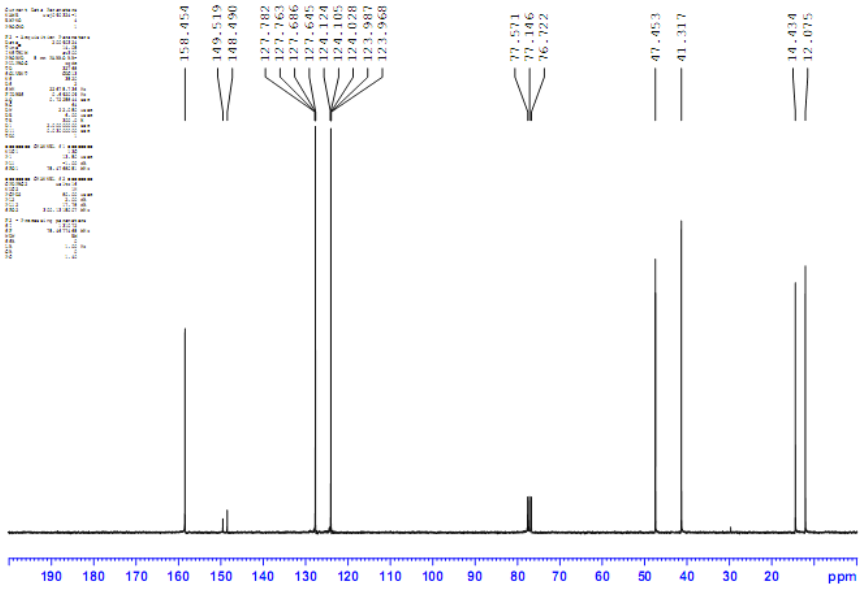


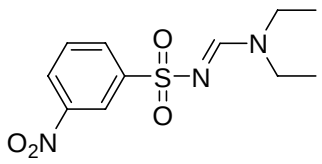


(E)-N,N-diethyl-N'-(4-nitrophenylsulfonyl)formimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.30 (d, 2 H, J = 9.0 Hz), 8.17 (s, 1 H), 8.07 (d, 2 H, J = 9.0 Hz), 3.54-3.40 (m, 4 H), 1.32-1.27 (t, 3 H, J = 7.2 Hz), 1.19-1.14 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.4, 149.5, 148.5, 127.7, 124.1, 47.4, 41.3, 14.4, 12.0. IR (liquid film, cm^{-1}): ν = 2979, 1614, 1528, 1347, 1296, 1209, 1151, 1086, 957, 881, 854, 771, 738, 631, 587. HRMS calc. $C_{11}H_{15}N_3O_4S$ (M^+): 285.0783. Found: 285.0785.

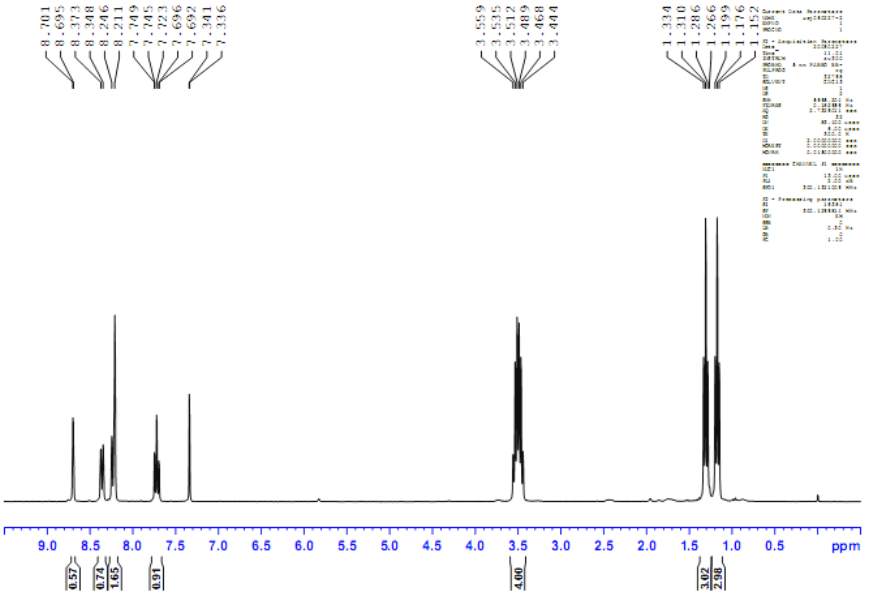


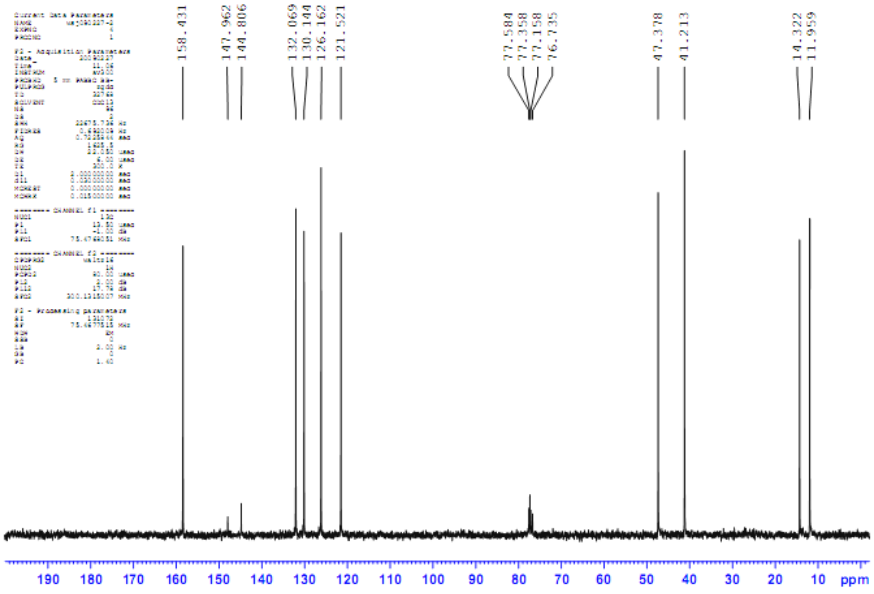


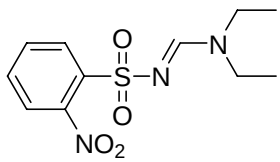


(E)-N,N-diethyl-N'-(3-nitrophenylsulfonyl)formimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.70 (s, 1 H), 8.36 (d, 1 H, J = 7.5 Hz), 8.23 (m, 2 H), 7.75-7.69 (m, 1 H), 3.56-3.44 (m, 4 H), 1.33-1.29 (t, 3 H, J = 7.2 Hz), 1.20-1.15 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.4, 147.9, 144.8, 132.1, 130.1, 126.2, 121.5, 47.4, 41.2, 14.3, 12.0. IR (liquid film, cm^{-1}): v = 2981, 1618, 1532, 1450, 1353, 1299, 1209, 1157, 1119, 1069, 1000, 958, 888, 819, 773, 735, 665, 611, 587. HRMS calc. $C_{11}H_{15}N_3O_4S$ (M^+): 285.0783. Found: 285.0789.

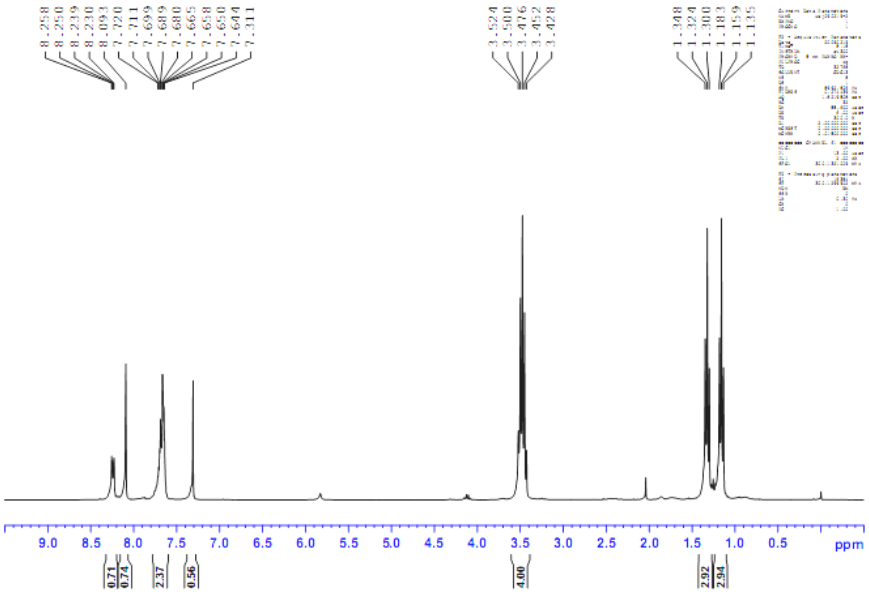


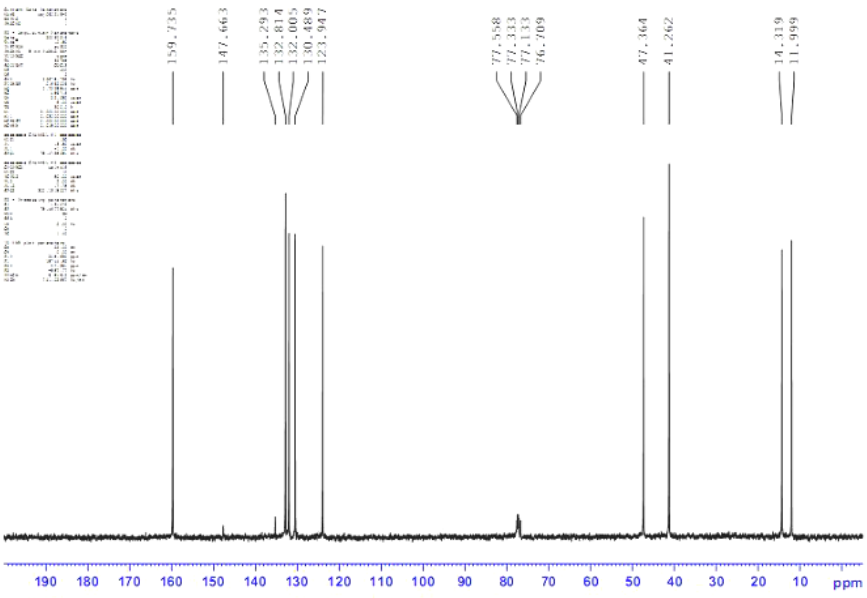


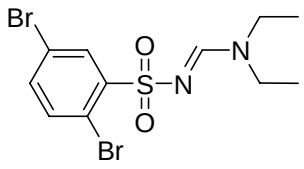


(E)-N,N-diethyl-N'-(2-nitrophenylsulfonyl)formimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.26-8.23 (m, 1 H), 8.09 (s, 1 H), 7.72-7.64(m, 3 H), 3.52-3.43 (m, 4 H), 1.35-1.30 (t, 3 H, J = 7.2 Hz), 1.18-1.14 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 159.7, 147.7, 135.3, 132.8, 132.0, 130.5, 123.9, 47.4, 41.3, 14.3, 12.0. IR (liquid film, cm^{-1}): ν = 2981, 1618, 1541, 1449, 1344, 1310, 1209, 1155, 1122, 1059, 958, 882, 772, 742, 657, 608, 588. HRMS calc. $C_{11}H_{15}N_3O_4S$ (M^+): 285.0783. Found: 285.0780.

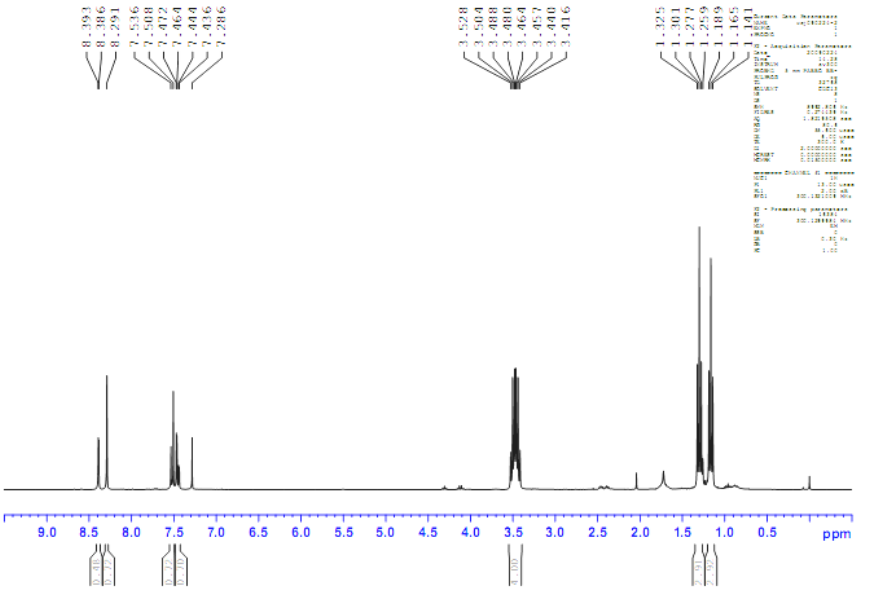


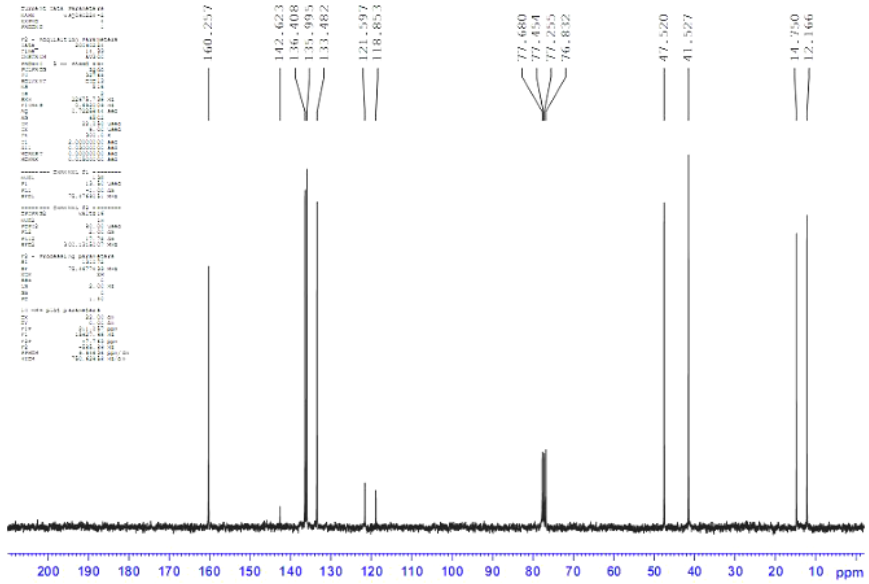


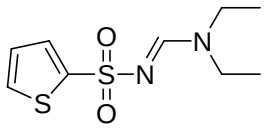


(E)-N'-(2,5-dibromophenylsulfonyl)-N,N-diethylformimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.39 (m, 1 H), 8.29 (s, 1 H), 7.54-7.44(m, 2 H), 3.53-3.42 (m, 4 H), 1.33-1.28 (t, 3 H, J = 7.2 Hz), 1.19-1.14 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 160.2, 142.5, 136.3, 135.9, 133.4, 121.5, 118.8, 47.4, 41.4, 14.7, 12.1. IR (liquid film, cm^{-1}): v = 2978, 1614, 1445, 1344, 1303, 1209, 1154, 1129, 1085, 1023, 957, 881, 822, 766, 670, 611, 592. HRMS calc. $C_{11}H_{14}Br_2N_2O_4S$ (M^+): 397.9122. Found: 397.9127.

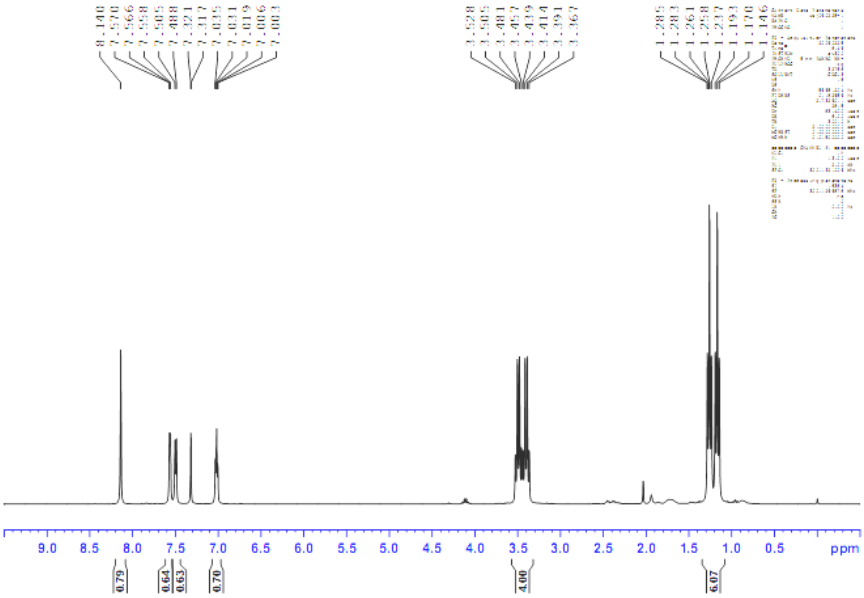


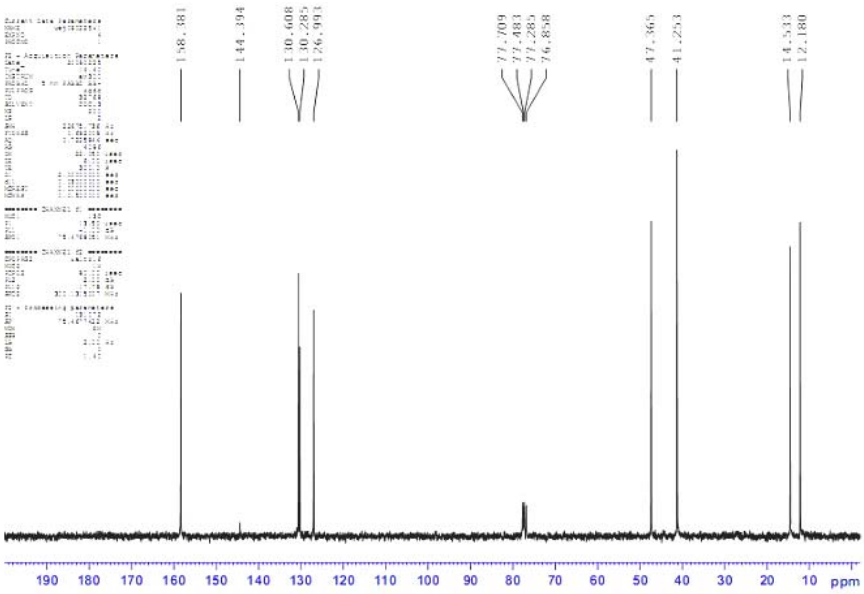


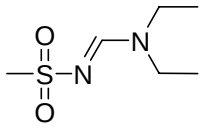


(E)-N,N-diethyl-N'-(thiophen-2-ylsulfonyl)formimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.14 (s, 1 H), 7.57-7.56 (m, 1 H), 7.49 (m, 1 H), 7.00-7.04 (m, 1 H), 3.53-3.37 (m, 4 H), 1.28-1.26 (t, 3 H, J = 7.2 Hz), 1.19-1.15 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.4, 144.4, 130.6, 130.3, 127.0, 47.4, 41.3, 14.5, 12.2. IR (liquid film, cm^{-1}): ν = 2979, 1616, 1449, 1341, 1301, 1224, 1209, 1146, 1089, 1014, 956, 879, 770, 727, 673, 610, 589. HRMS calc. $C_9H_{14}N_2O_2S_2$ (M^+): 246.0497. Found: 246.0499.

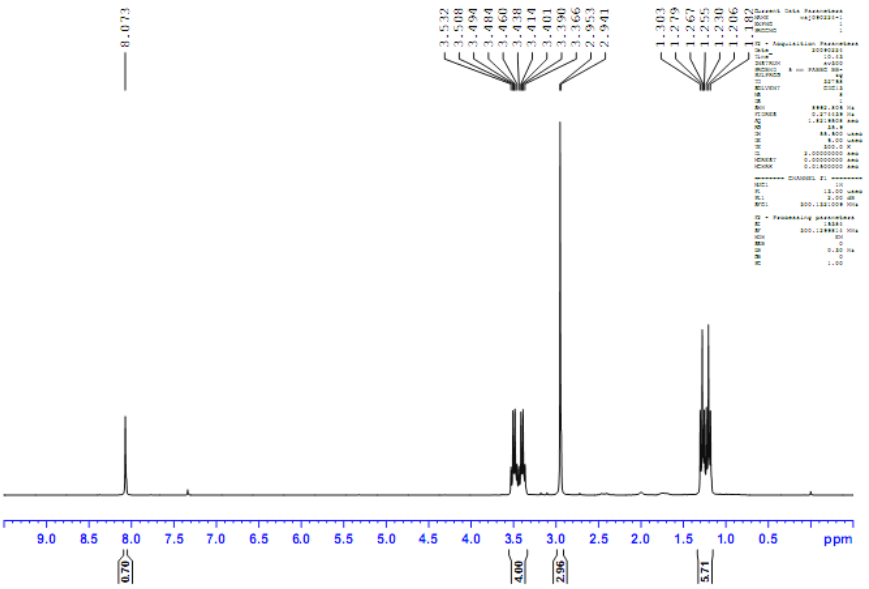


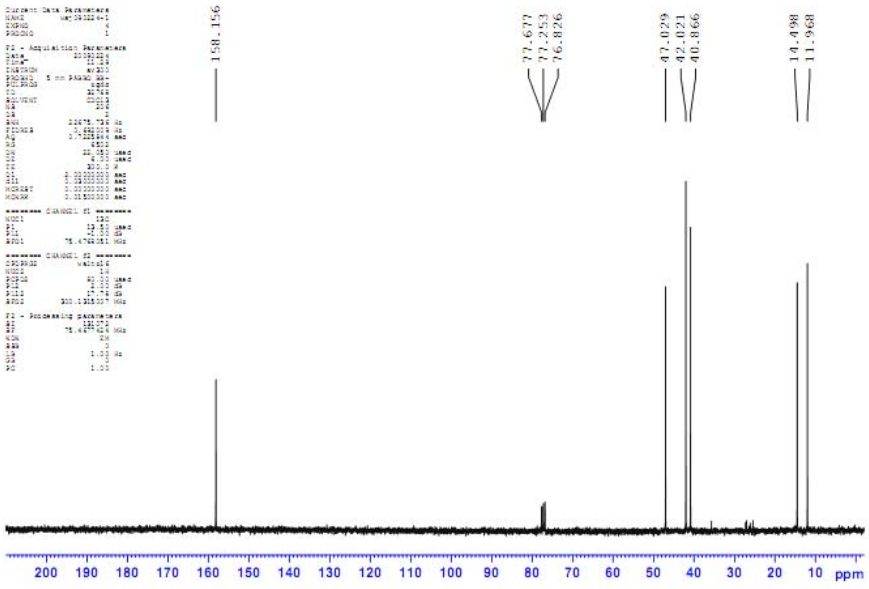


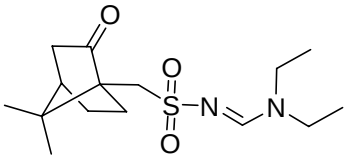


(E)-N,N-diethyl-N'-(methylsulfonyl)formimidamide

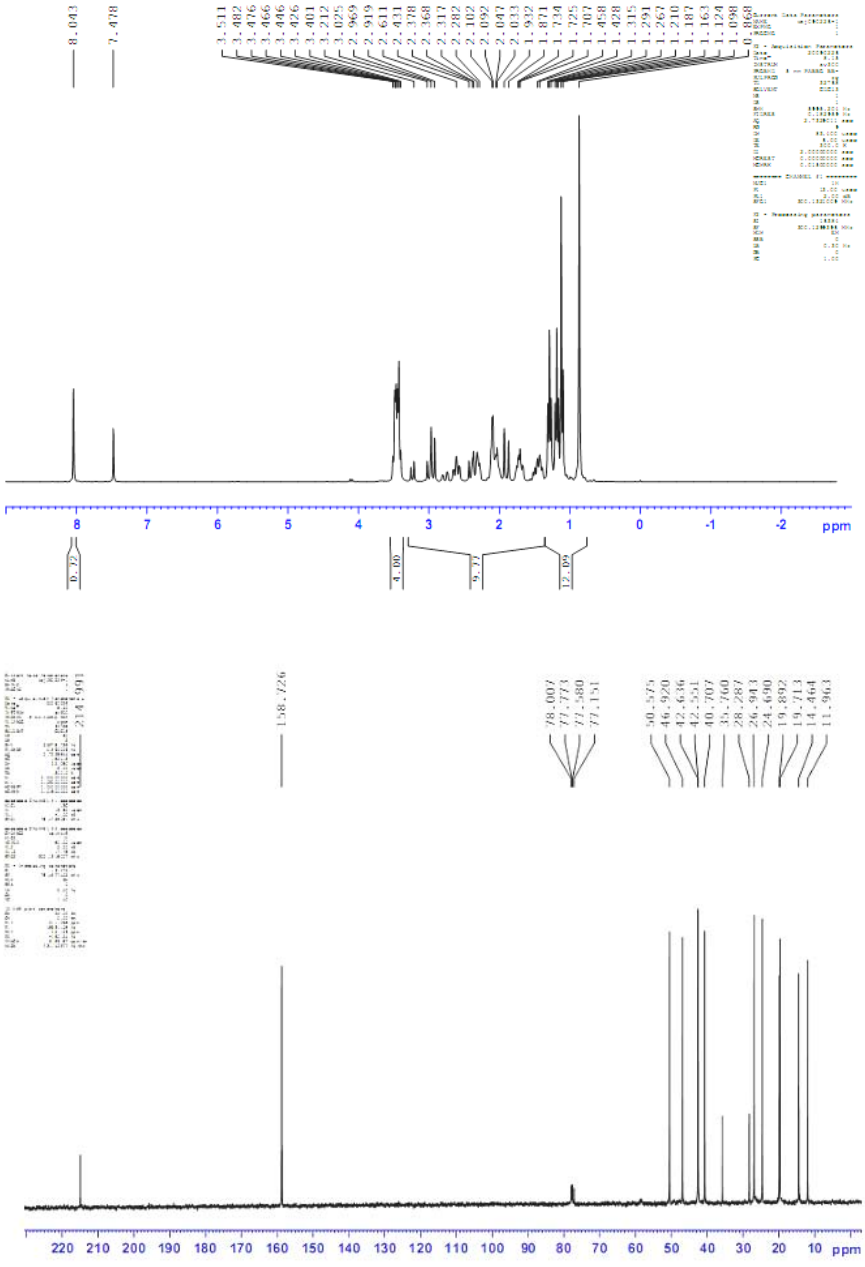
^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.07 (s, 1 H), 3.53-3.37 (m, 4 H), 2.94 (s, 3 H), 1.30-1.18 (m, 6 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 158.2, 47.0, 42.0, 40.9, 14.5, 12.0. IR (liquid film, cm^{-1}): ν = 2979, 1614, 1453, 1356, 1292, 1211, 1130, 968, 875, 823, 778, 577, 553, 527. HRMS calc. $C_6H_{14}N_2O_2S$ (M^+): 178.0776, Found: 178.0773.

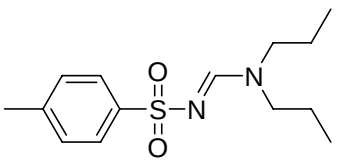






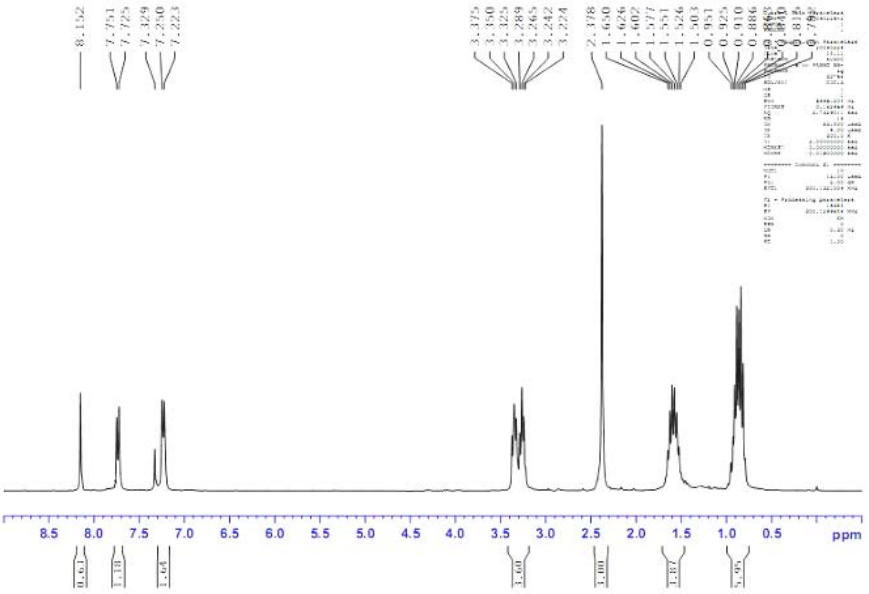
(E)-N'-((7,7-dimethyl-2-oxobicyclo[2.2.1]heptan-1-yl)methylsulfonyl)-N,N-diethylformimidamide ^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.04 (s, 1 H), 3.51-3.40 (m, 4 H), 3.21-1.43 (m, 9 H), 1.32-0.87 (m, 12 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 215.0, 158.7, 50.8, 46.9, 42.6, 42.5, 40.7, 35.8, 28.3, 26.9, 24.7, 19.9, 19.7, 14.5, 12.0. IR (liquid film, cm^{-1}): ν = 2965, 1744, 1614, 1454, 1345, 1304, 1213, 1169, 1129, 1053, 956, 873, 823, 765, 681, 615, 577, 530. HRMS calc. $C_{15}H_{26}N_2O_3S$ (M^+): 314.1664, Found: 314.1659.

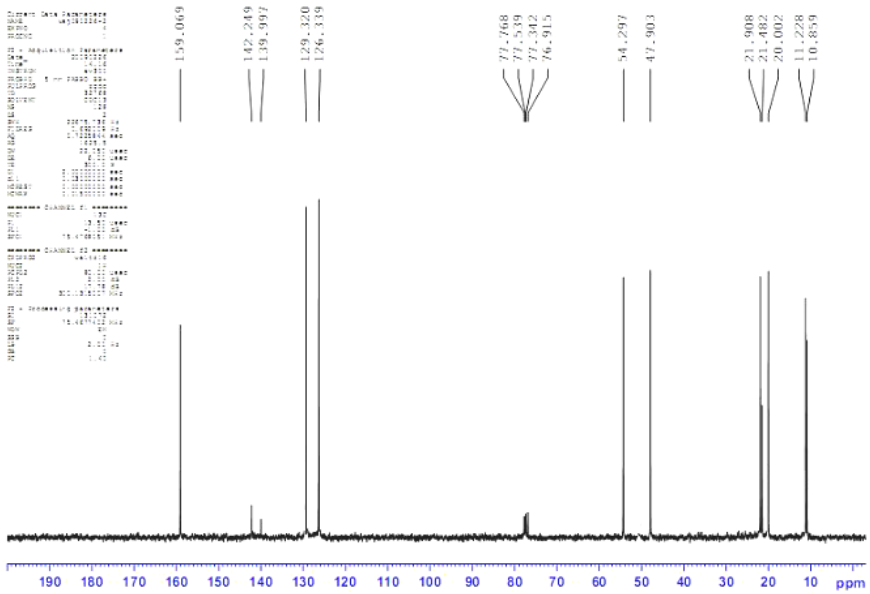


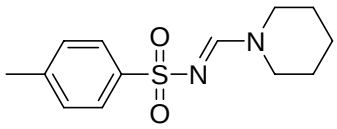


(E)-N,N-dipropyl-N'-tosylformimidamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): δ = 8.15 (s, 1 H), 7.74 (d, 2 H, J = 8.1 Hz), 7.23 (d, 2 H, J = 7.8 Hz), 3.37-3.24 (m, 4 H), 2.38 (s, 3 H), 1.63-1.55 (m, 4 H), 0.91-0.82 (m, 6 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 159.1, 142.2, 140.0, 129.3, 126.3, 54.3, 47.9, 21.9, 21.5, 20.0, 11.2, 10.9. IR (liquid film, cm^{-1}): ν = 2966, 2935, 2876, 1609, 1544, 1454, 1344, 1298, 1148, 1088, 910, 878, 837, 815, 676, 554. HRMS calc. $C_{14}H_{22}N_2O_2S$ (M^+): 282.1402. Found: 282.1404.

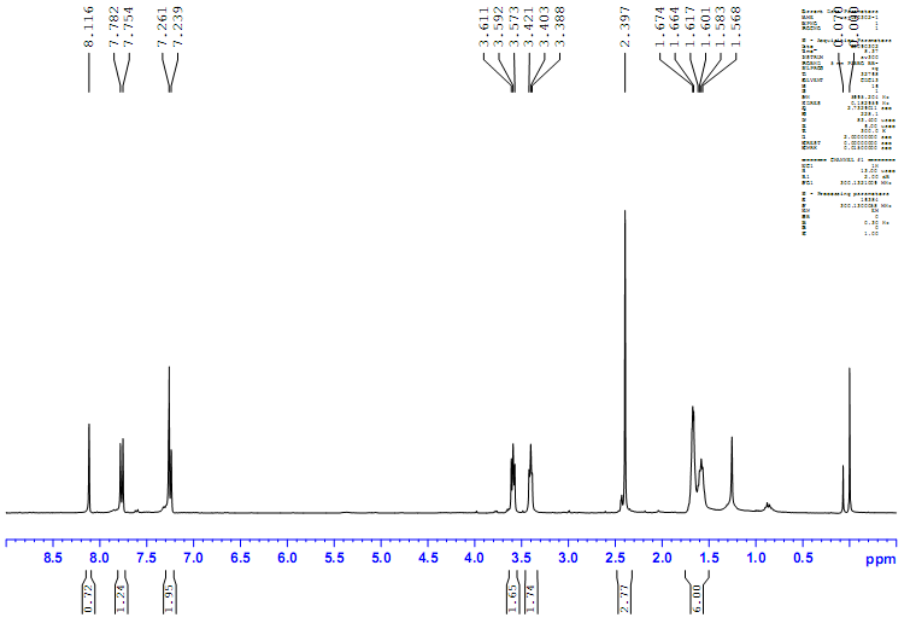


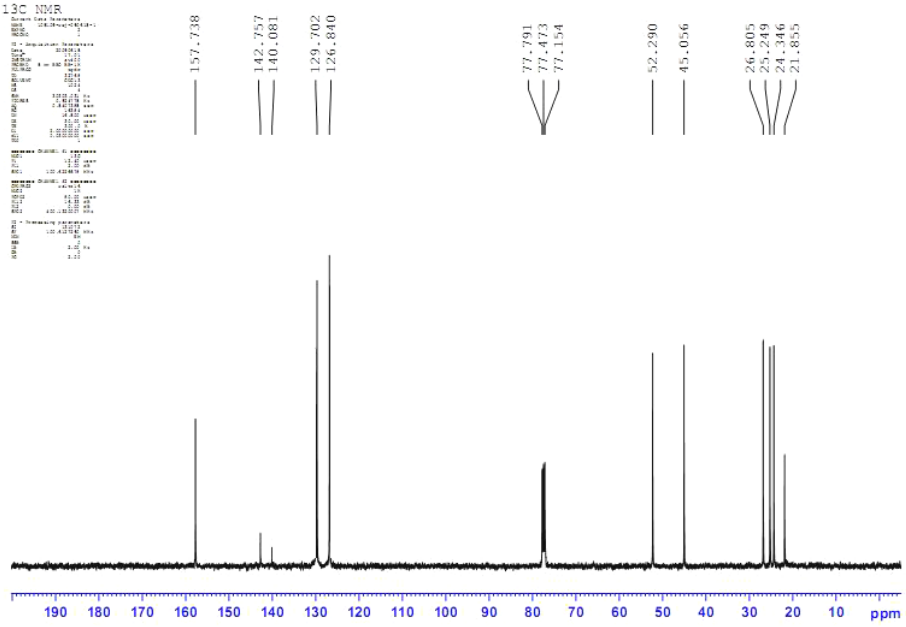


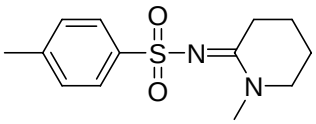


(E)-4-methyl-N-(piperidin-1-ylmethylene)benzenesulfonamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 8.12 (s, 1H), 7.76 (d, 2 H, J = 8.4 Hz), 7.25 (d, 2 H, J = 6.6 Hz), 3.61-3.57 (m, 2 H), 3.42-3.39 (m, 2 H), 2.39 (s, 3 H), 1.67-1.57 (m, 6 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 157.7, 142.8, 140.0, 129.7, 126.8, 52.3, 45.1, 26.8, 25.2, 24.3, 21.9. IR (liquid film, cm^{-1}): v = 2939, 2861, 1611, 1448, 1339, 1298, 1283, 1148, 1089, 927, 873, 851, 784, 675, 607, 562. HRMS calc. $C_{13}H_{18}N_2O_2S$ (M^+): 266.1089. Found: 266.1081.

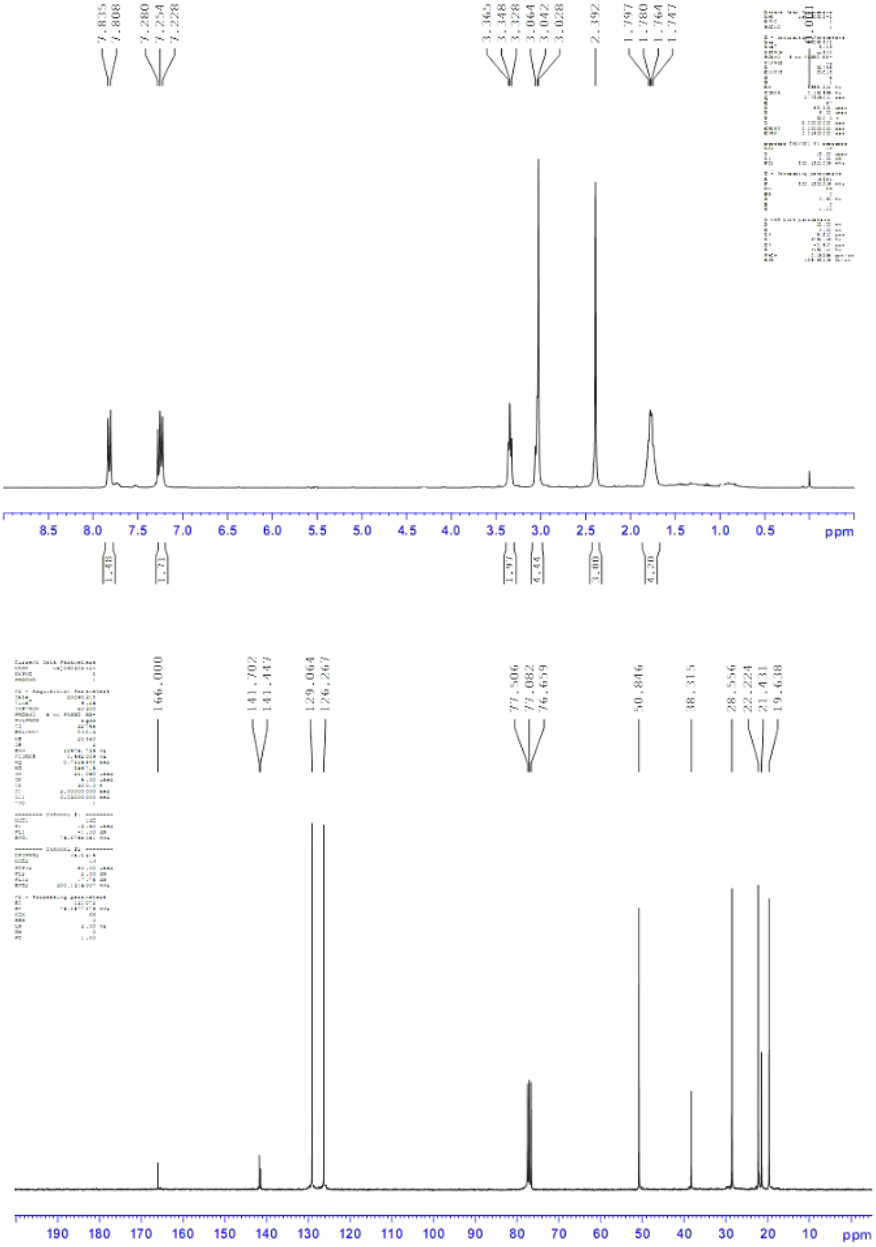


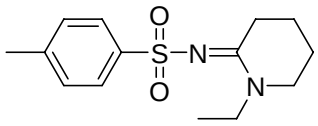




4-methyl-N-(1-methylpiperidin-2-ylidene)benzenesulfonamide

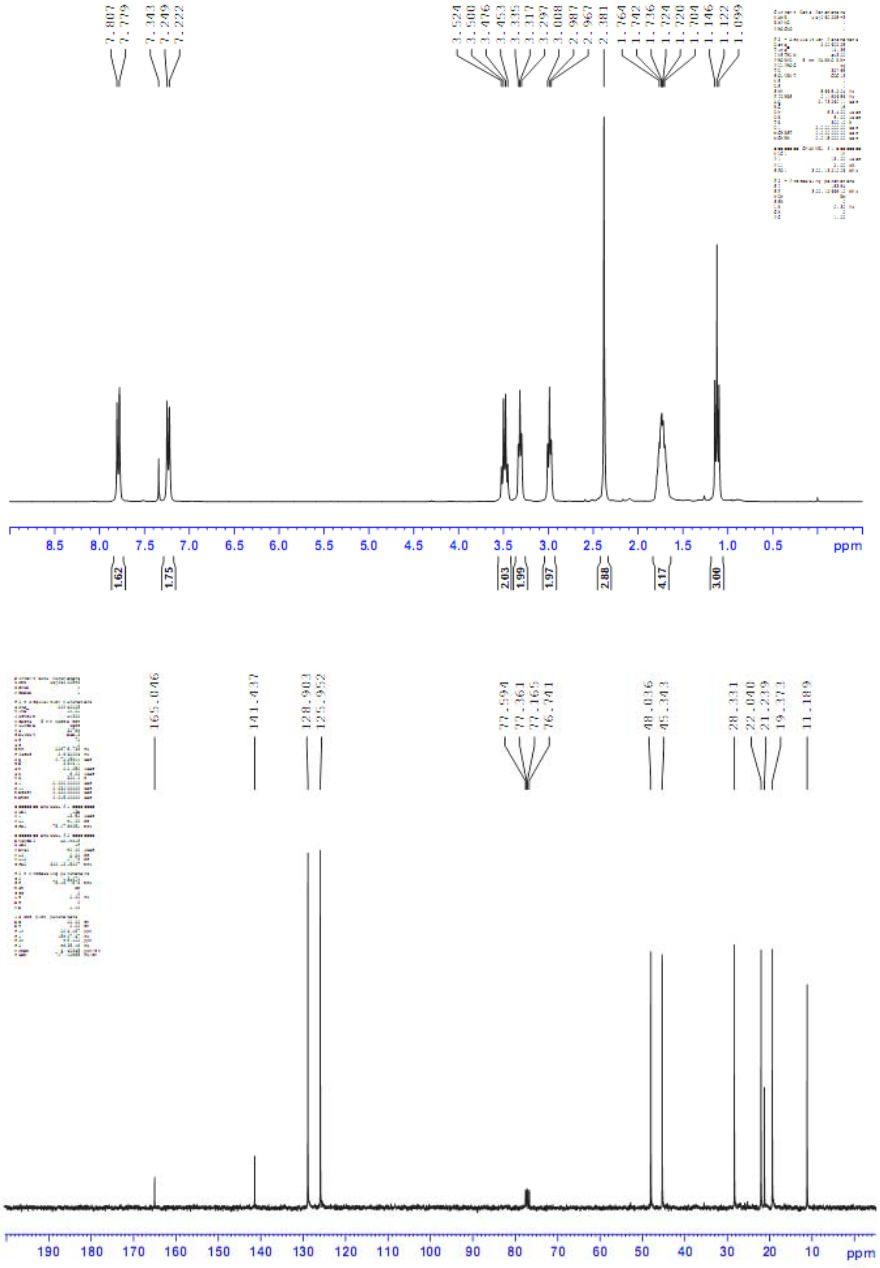
^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.82 (d, 2 H, J = 8.1 Hz), 7.24 (d, 2 H, J = 8.1 Hz), 3.37-3.33 (m, 2 H), 3.07-3.03 (m, 5 H), 2.39 (s, 3 H), 1.80-1.75 (m, 4 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 166.0, 141.7, 141.4, 129.1, 126.3, 50.8, 38.3, 28.6, 22.2, 21.4, 19.6. IR (liquid film, cm^{-1}): ν = 2951, 2870, 1571, 1483, 1404, 1364, 1327, 1273, 1143, 1090, 962, 823, 704, 675, 584, 554. HRMS calc. $C_{13}H_{18}N_2O_2S$ (M^+): 266.1089. Found: 266.1085.

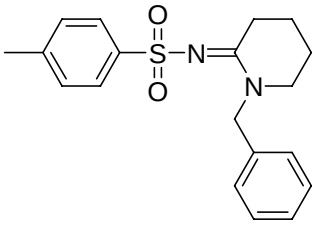




N-(1-ethylpiperidin-2-ylidene)-4-methylbenzenesulfonamide

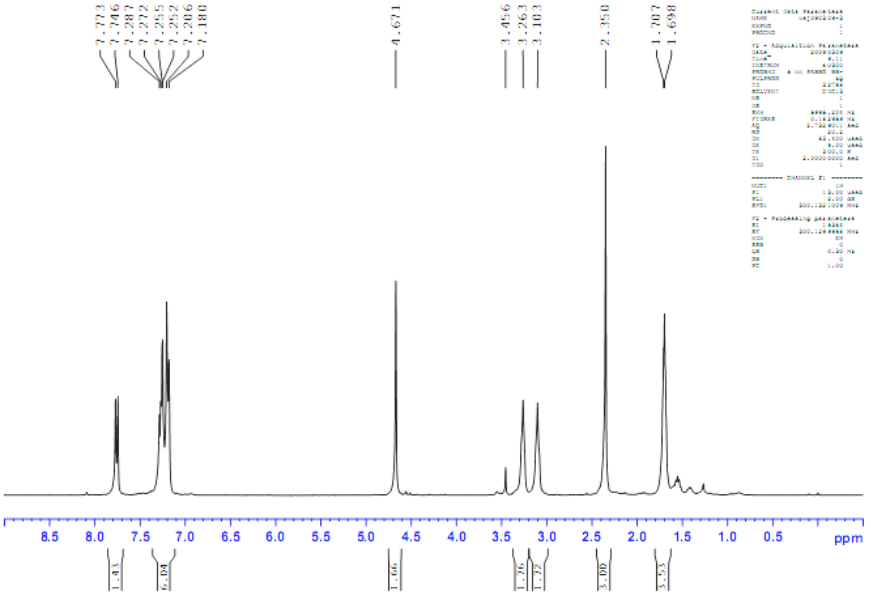
^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.79 (d, 2 H, J = 8.4 Hz), 7.23 (d, 2 H, J = 8.1 Hz), 3.52-3.45 (m, 2 H), 3.33-3.29 (m, 2 H), 3.00-2.96 (m, 2 H), 2.38 (s, 3 H), 1.76-1.70 (m, 4 H), 1.15-1.09 (t, 3 H, J = 7.2 Hz). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 165.0, 141.4, 128.9, 125.9, 48.0, 45.3, 28.3, 22.0, 21.2, 19.4, 11.2. IR (liquid film, cm^{-1}): v = 2942, 2872, 1558, 1484, 1364, 1327, 1273, 1214, 1144, 1094, 1068, 984, 936, 825, 785, 753, 702, 672, 585, 555. HRMS calc. $C_{14}H_{20}N_2O_2S$ (M^+): 280.1245. Found: 280.1248.

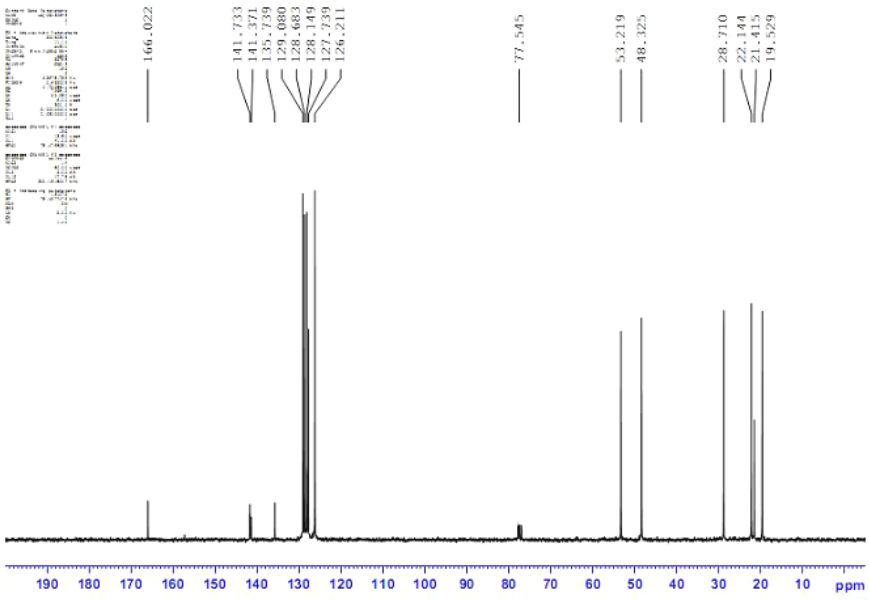


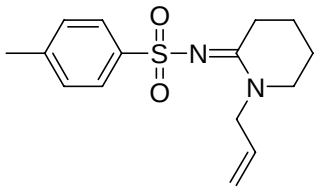


N-(1-benzylpiperidin-2-ylidene)-4-methylbenzenesulfonamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.76 (d, 2 H, J = 7.8 Hz), 7.29-7.18 (m, 7 H), 4.67 (s, 2 H), 3.26-3.10 (m, 4 H), 2.35 (s, 3 H), 1.71-1.69 (m, 4 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 166.0, 141.7, 141.4, 135.7, 129.1, 128.7, 128.1, 127.7, 126.2, 53.2, 48.3, 28.7, 22.1, 21.4, 19.5. IR (liquid film, cm^{-1}): ν = 2948, 2869, 1555, 1486, 1363, 1328, 1274, 1142, 1084, 964, 825, 701, 683, 584, 554. HRMS calc. $C_{19}H_{22}N_2O_2S$ (M^+): 342.1402. Found: 342.1403.

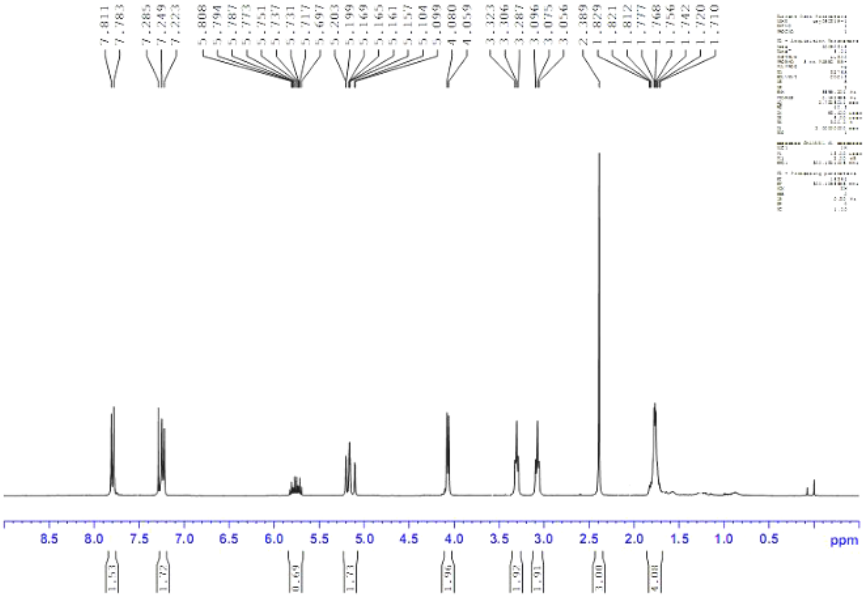


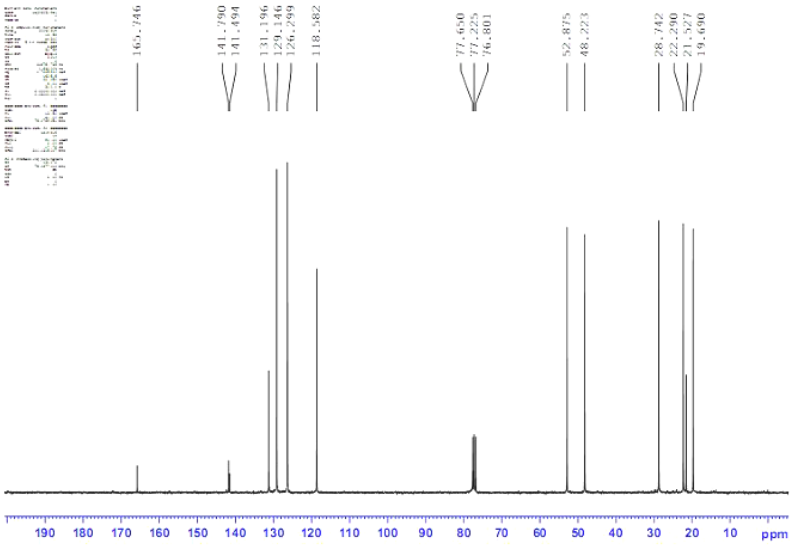


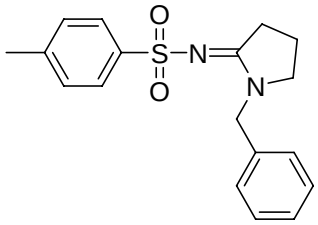


N-(1-allylpiperidin-2-ylidene)-4-methylbenzenesulfonamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.80 (d, 2 H, J = 8.4 Hz), 7.23 (d, 2 H, J = 7.8 Hz), 5.80-5.69 (m, 1 H), 5.20-5.09 (m, 2 H), 4.08-4.05 (m, 2 H), 3.32-3.28 (m, 2 H), 3.09-3.05 (m, 2 H), 2.39 (s, 3 H), 1.82-1.71 (m, 4 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 165.7, 141.8, 141.5, 131.2, 129.1, 126.3, 118.6, 52.9, 48.2, 28.7, 22.3, 21.5, 19.7. IR (liquid film, cm^{-1}): ν = 2949, 2869, 1609, 1557, 1486, 1363, 1327, 1273, 1186, 1144, 1081, 966, 822, 696, 585, 555. HRMS calc. $C_{15}H_{20}N_2O_2S$ (M^+): 292.1245. Found: 292.1249.

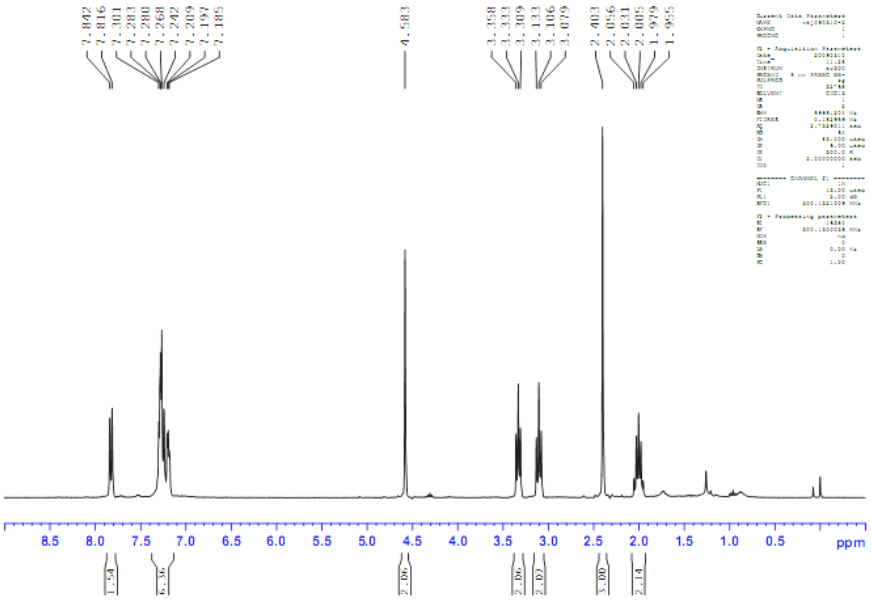


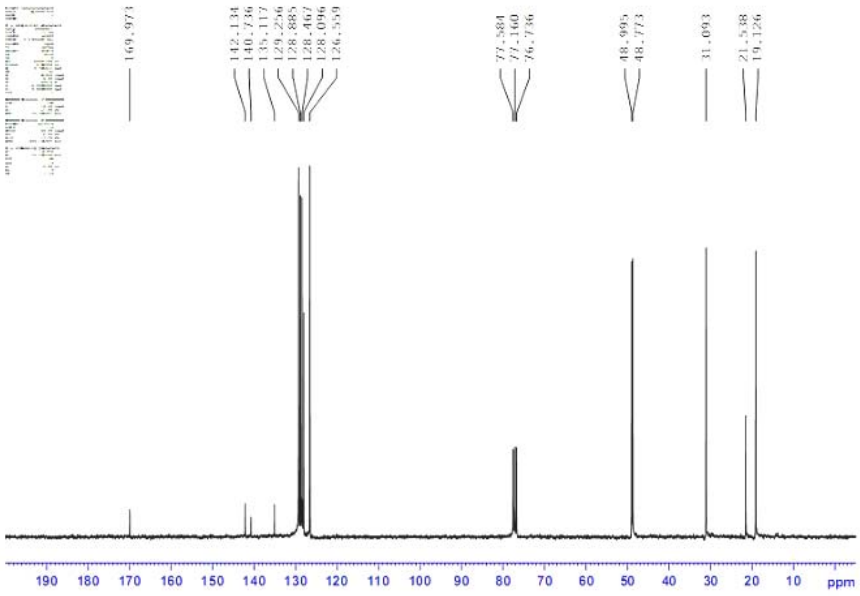


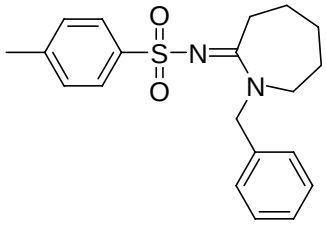


N-(1-benzylpyrrolidin-2-ylidene)-4-methylbenzenesulfonamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.83 (d, 2 H, J = 7.8 Hz), 7.30-7.19 (m, 7 H), 4.58 (s, 2 H), 3.36-3.31 (m, 2 H), 3.13-3.08 (m, 2 H), 2.40 (s, 3 H), 2.06-1.95 (m, 2 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 169.9, 142.1, 140.7, 135.1, 129.2, 128.9, 128.5, 128.1, 126.6, 48.9, 48.8, 31.1, 21.5, 19.1. IR (liquid film, cm^{-1}): ν = 2925, 1572, 1492, 1282, 1145, 1092, 909, 816, 703, 673, 589, 554. HRMS calc. $C_{18}H_{20}N_2O_2S$ (M^+): 328.1245. Found: 328.1241.







N-(1-benzylazepan-2-ylidene)-4-methylbenzenesulfonamide

^{1}H NMR ($CDCl_3$, 300 MHz, ppm): 7.80 (d, 2 H, J = 8.1 Hz), 7.28-7.20 (m, 7 H), 4.70 (s, 2 H), 3.44-3.41 (m, 2 H), 3.19-3.17 (m, 2 H), 2.38 (s, 3 H), 1.67-1.66 (m, 4 H), 1.45 (s, 2 H). ^{13}C NMR ($CDCl_3$, 75 MHz, ppm): δ = 171.4, 141.8, 141.6, 136.2, 129.2, 128.7, 128.4, 127.9, 126.3, 54.0, 50.5, 31.5, 29.2, 26.9, 23.1, 21.5. IR (liquid film, cm^{-1}): ν = 2932, 2861, 1546, 1494, 1453, 1355, 1323, 1264, 1207, 1182, 1148, 1085, 959, 892, 815, 779, 752, 688, 582, 556. HRMS calc. $C_{20}H_{24}N_2O_2S$ (M^+): 356.1558. Found: 356.1553.