Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Electronic Supplementary Information

"**Preparation of reusable Ag-decorated graphene oxide catalysts for decarboxylative cycloaddition"** by Ji Dang Kim, Thiruvengadam Palani, Manian Rajesh Kumar, Sunwoo Lee, and Hyun Chul Choi.

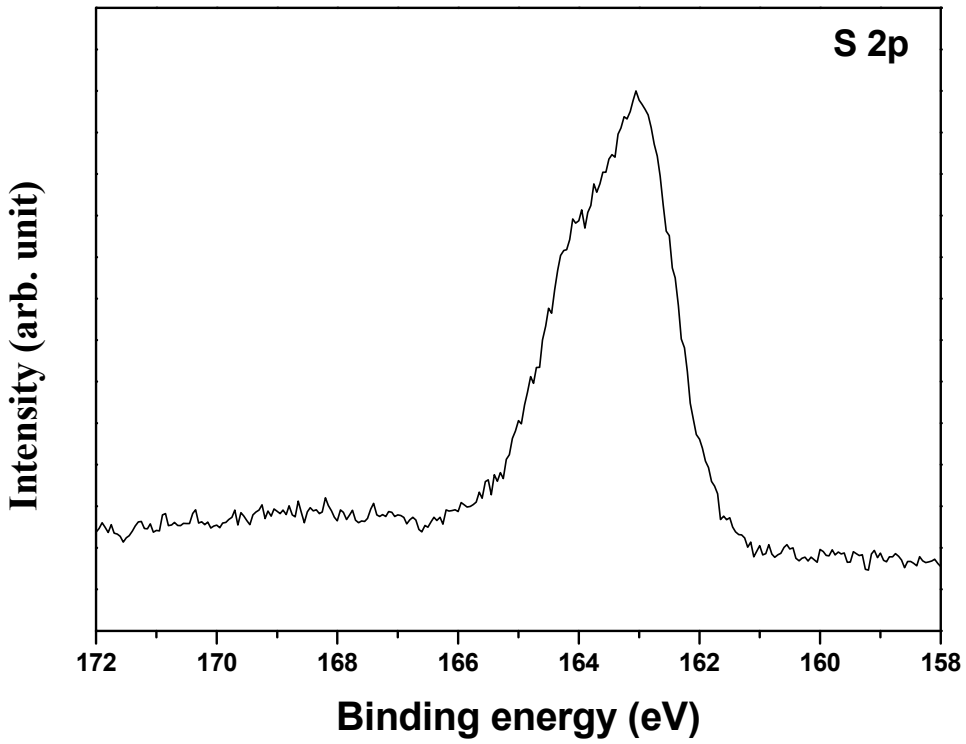


Fig. S1. S 2p core level spectrum for GOSH. An asymmetric peak is detected at 163 eV due to the S 2p photoelectron signal from the thiolate bond.[1,2]

1. C. Médard, M. Morin, *J. Electroanal. Chem.* **2009**, *632*, 120.

2. L. G. Bach, Md. R. Islam, J. T. Kim, S. Seo, K. T. Lim, *Appl. Surf. Sci*. **2012**, *258*, 2959.

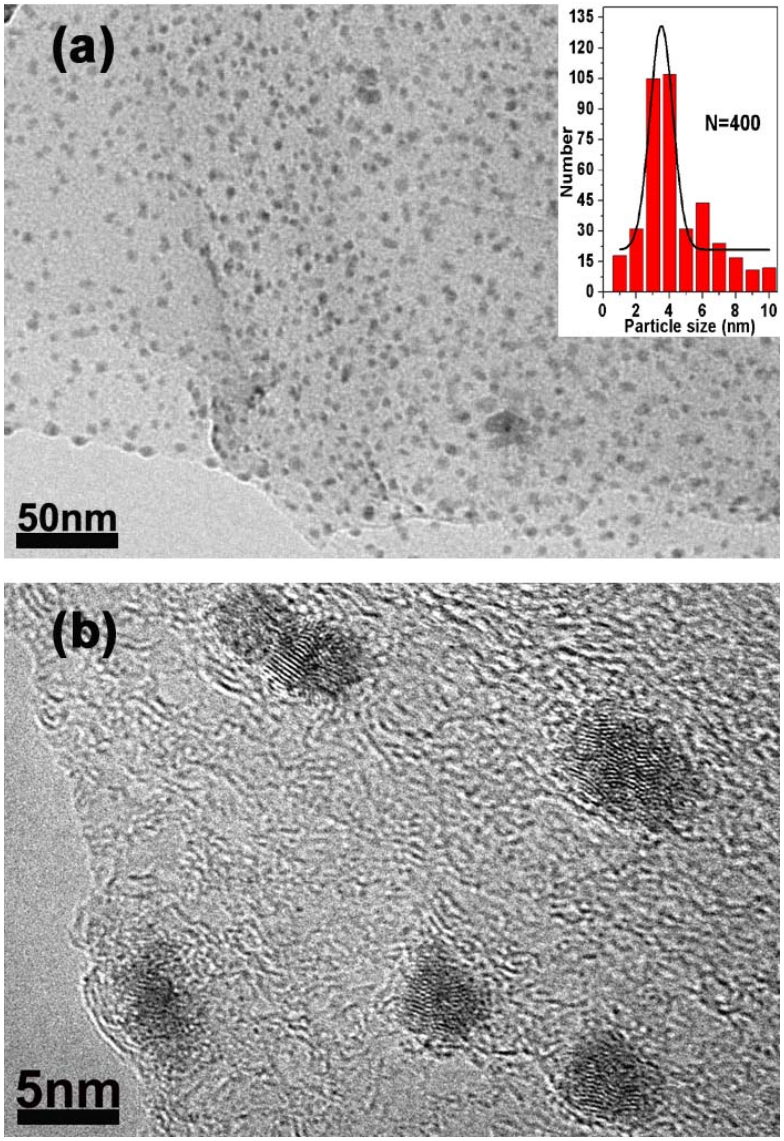


Fig. S2. (a) TEM image of H_2O_2 treated GOSH-Ag. The insert shows the size-distribution histogram of the GOSH-Ag nanoparticles. The solid line on the histogram graph represents a Gaussian fitting curve. The average particle size was about 3.9 nm. (b) HRTEM image of of H_2O_2 treated GOSH-Ag.

4-Phenyl-1*H*-1,2,3-triazole (2a)

Phenyl propiolic acid (3.0 mmol, 438 mg), the white solid afforded 75% yield (326 mg, 2.3 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 14.91 (s, 1H), 8.21 (s, 1H), 7.80 (d, *J* = 8.7 Hz, 2H), 7.03 (d, *J* = 8.8 Hz, 2H), 3.81 (s, 3H); ^{13}C NMR (75 MHz, DMSO) δ 128.9, 128.0, 125.5.

4-*m*-tolyl-1*H*-1,2,3-triazole (2b)

3-*m*-tolyl propiolic acid (3.0 mmol, 481 mg), the yellow solid afforded 73% yield (350 mg, 2.2 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.65 (s, 1H), 7.92-7.83 (m, 1H), 7.44-7.27 (m, 4H), 2.34 (s, 3H); ^{13}C NMR (75 MHz, DMSO) δ 138.4, 131.6, 130.2, 129.0, 128.9, 128.3, 126.8, 123.4, 21.1.

4-*p*-tolyl-1*H*-1,2,3-triazole (2c)

3-*p*-tolyl propiolic acid (3.0 mmol, 481 mg), the yellow solid afforded 75% yield (360 mg, 2.3 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.59 (s, 1H), 7.95 (d, *J* = 8.2 Hz, 1H), 7.51 (d, *J* = 8.1 Hz, 1H), 7.32 (m, 2H), 2.36 (s, 3H); ^{13}C NMR (75 MHz, DMSO) δ 139.3, 131.2, 129.6, 126.1, 20.9.

4-(4-Ethylphenyl)-1*H*-1,2,3-triazole (2d)

3-(4-Ethylphenyl) propiolic acid (3.0 mmol, 523 mg), the yellow solid afforded 71% yield (370 mg, 2.1 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.58 (s, 1H), 7.98 (d, *J* = 8.3 Hz, 1H), 7.53 (m, 1H), 7.35 (m, 2H), 2.66 (q, *J* = 7.6 Hz, 2H), 1.20 (t, 3H); ^{13}C NMR (75 MHz, DMSO) δ 145.5, 144.9, 131.3, 128.4, 126.2, 118.7, 28.0, 15.4.

4-(2-Methoxyphenyl)-1*H*-1,2,3-triazole (2e)

3-(2-Methoxyphenyl) propiolic acid (3.0 mmol, 529 mg), the yellow solid afforded 55% yield (280 mg, 1.6 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.28 (s, 1H), 8.57-7.51 (m, 2H), 7.34 (d, *J* = 7.1 Hz, 1H), 7.20-6.92 (m, 2H), 3.91 (s, 3H); ^{13}C NMR (75 MHz, DMSO) δ 156.2, 133.3, 129.5, 128.7, 127.7, 126.9, 120.7, 111.8, 55.5.

4-(3-Methoxyphenyl)-1*H*-1,2,3-triazole (2f)

3-(3-Methoxyphenyl) propiolic acid (3.0 mmol, 529 mg), the yellow solid afforded 58% yield (305 mg, 1.7 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.13 (s, 1H), 7.65 (m, 1H), 7.43 (m, 1H), 7.18 (m, 1H), 7.05 (m, 1H), 3.81 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 159.5, 130.2, 123.6, 122.3, 118.5, 115.9, 114.8, 111.5, 55.2.

4-(4-Methoxyphenyl)-1*H*-1,2,3-triazole (2g)

3-(4-Methoxyphenyl) propiolic acid (3.0 mmol, 529 mg), the yellow solid afforded 61% yield (320 mg, 1.8 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 14.92 (s, 1H), 8.21 (s, 1H), 7.80 (d, J = 8.7 Hz, 2H), 7.03 (d, J = 8.8 Hz, 2H), 3.81 (s, 3H); ^{13}C NMR (75 MHz, DMSO) δ 159.2, 126.9, 114.3, 55.2.

4-(4-Chlorophenyl)-1*H*-1,2,3-triazole (2h)

3-(4-Chlorophenyl) propiolic acid (3.0 mmol, 542 mg), the yellow solid afforded 57% yield (308 mg, 1.7 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.75 (s, 1H), 8.06 (d, J = 8.7 Hz, 1H), 7.73-7.59 (m, 3H), 7.56 (m, 1H); ^{13}C NMR (75 MHz, DMSO) δ 134.3, 133.7, 133.2, 129.2, 129.1, 128.0.

4-(Naphthalen-1-yl)-1*H*-1,2,3-triazole (2i)

3-(Naphthalen-1-yl) propiolic acid (3.0 mmol, 589 mg), the yellow solid afforded 65% yield (380 mg, 2.0 mmol) after column chromatography. ^{1}H NMR (300 MHz, DMSO) δ 15.33 (s, 1H), 8.39 (d, J = 46.6 Hz, 2H), 8.07-7.87 (m, 2H), 7.77 (d, J = 7.1 Hz, 1H), 7.67-7.34 (m, 3H); ^{13}C NMR (75 MHz, DMSO) δ 133.5, 130.3, 130.3, 128.7, 128.4, 127.1, 126.7, 126.1, 125.5, 125.4. HRMS (ESI) calcd. for $C_{12}H_9N_3$ 195.0796, found 195.0794.

4-(1*H*-1,2,3-triazol-4-yl)benzonitrile (2j)

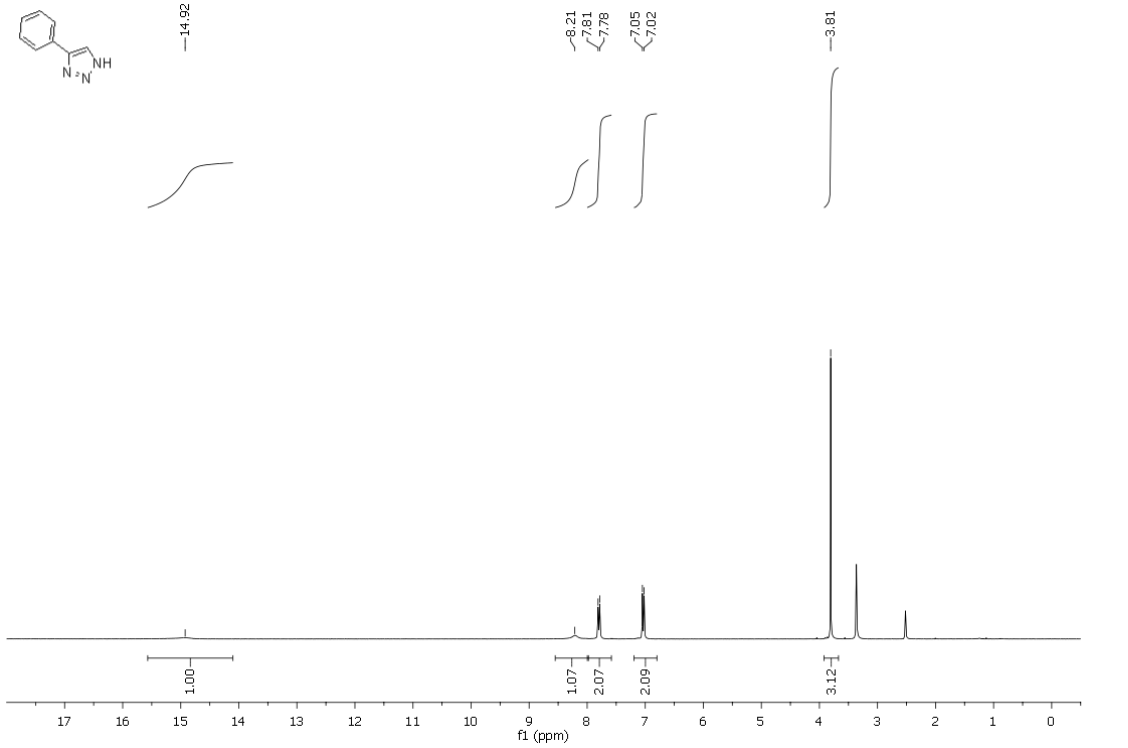
3-(4-Cyanophenyl) propiolic acid (3.0 mmol, 513 mg), the yellow solid afforded 50% yield (255 mg, 1.5 mmol) after column chromatography. ^{1}H NMR (500 MHz, DMSO) δ 8.58 (s, 1H), 8.07 (d, J = 8.3 Hz, 2H), 7.93 (d, J = 8.3 Hz, 2H); ^{13}C NMR (151 MHz, DMSO) δ 135.1,

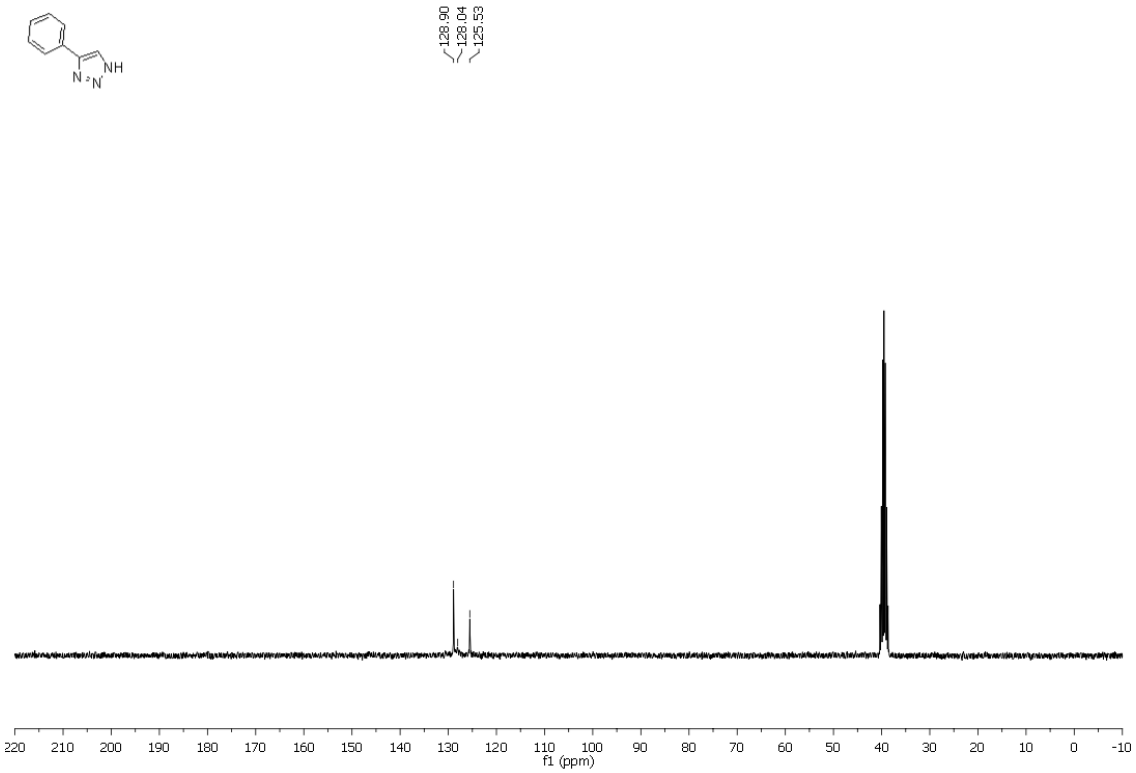
133.0, 130.2, 126.1, 118.8, 110.3.

1-(4-(1*H*-1,2,3-triazol-4-yl)phenyl)ethanone (2k)

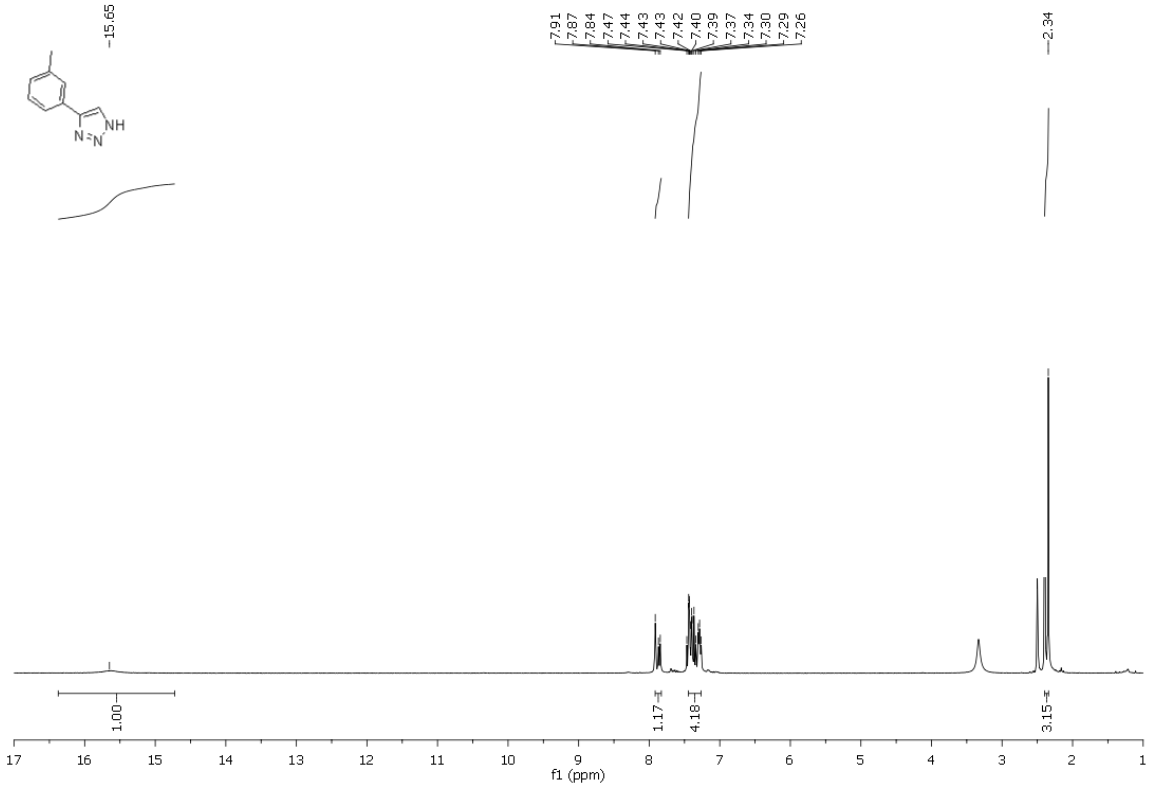
3-(4-Acetylphenyl) propiolic acid (3.0 mmol, 565 mg), the yellow solid afforded 55% yield (309 mg, 1.7 mmol) after column chromatography. ^{1}H NMR (500 MHz, DMSO) δ 8.22 (d, *J* = 8.5 Hz, 1H), 8.15 (d, *J* = 8.5 Hz, 1H), 8.04 (d, *J* = 8.4 Hz, 1H), 7.82 (d, *J* = 8.3 Hz, 1H), 2.62 (s, 3H); 13C NMR (126 MHz, DMSO) δ 197.4, 136.8, 131.7, 129.1, 128.6, 126.3, 125.7, 26.9. HRMS (ESI) calcd. for $C_{10}H_9N_3O$ 187.0746, found 187.0750.

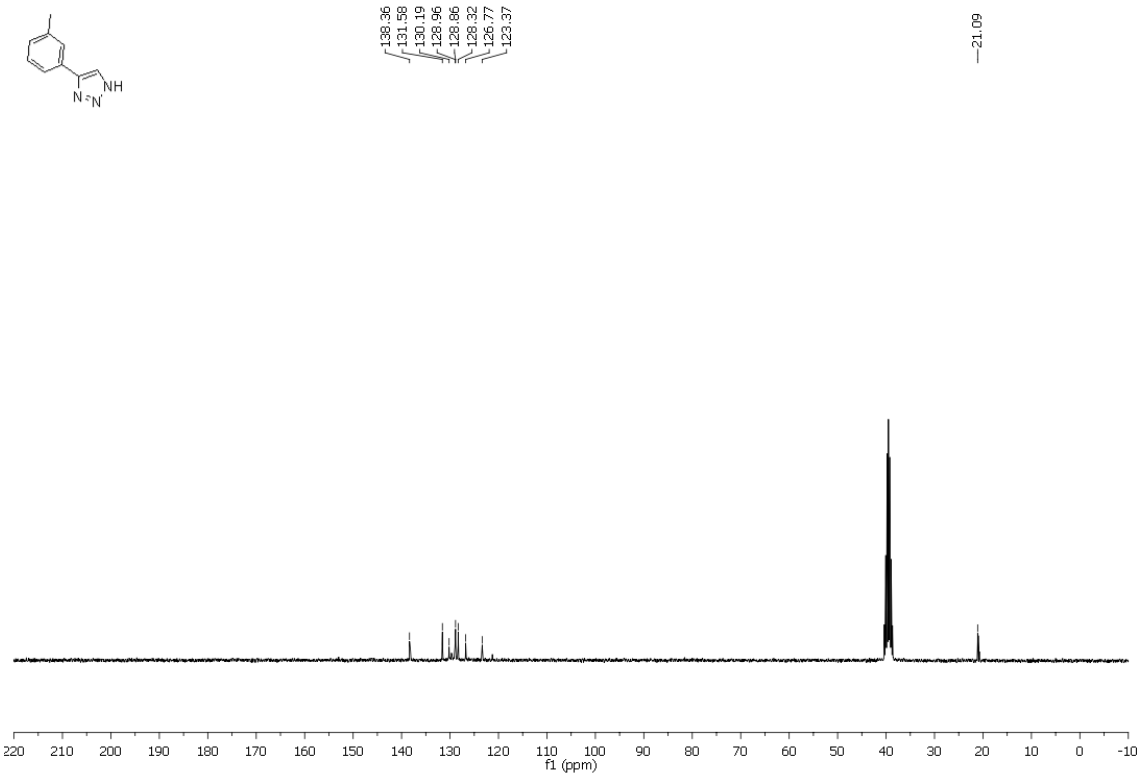
4-Phenyl-1*H*-1,2,3-triazole (2a)



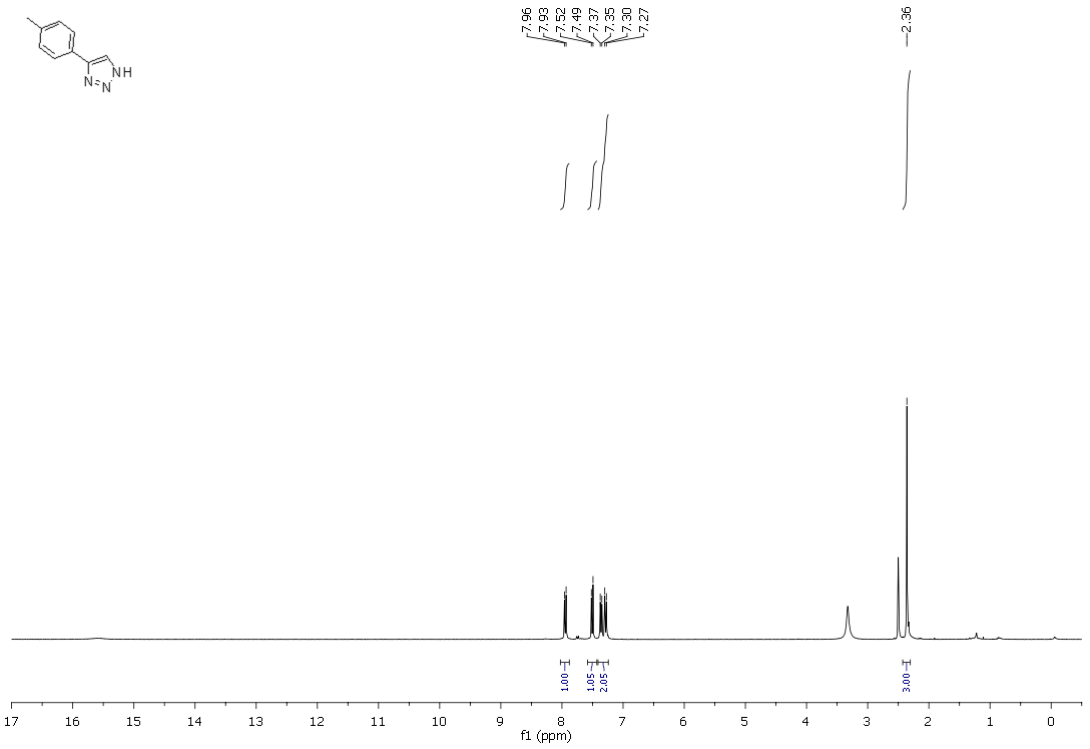


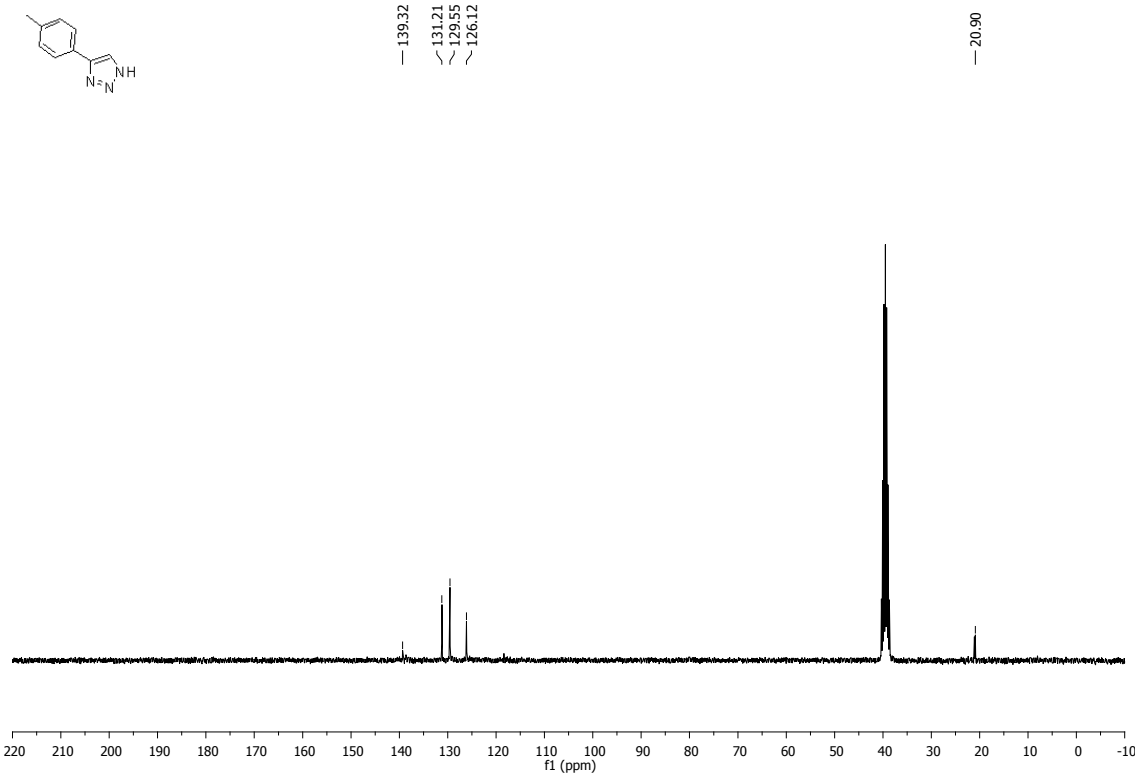
4-*m*-tolyl-1*H*-1,2,3-triazole (2b)



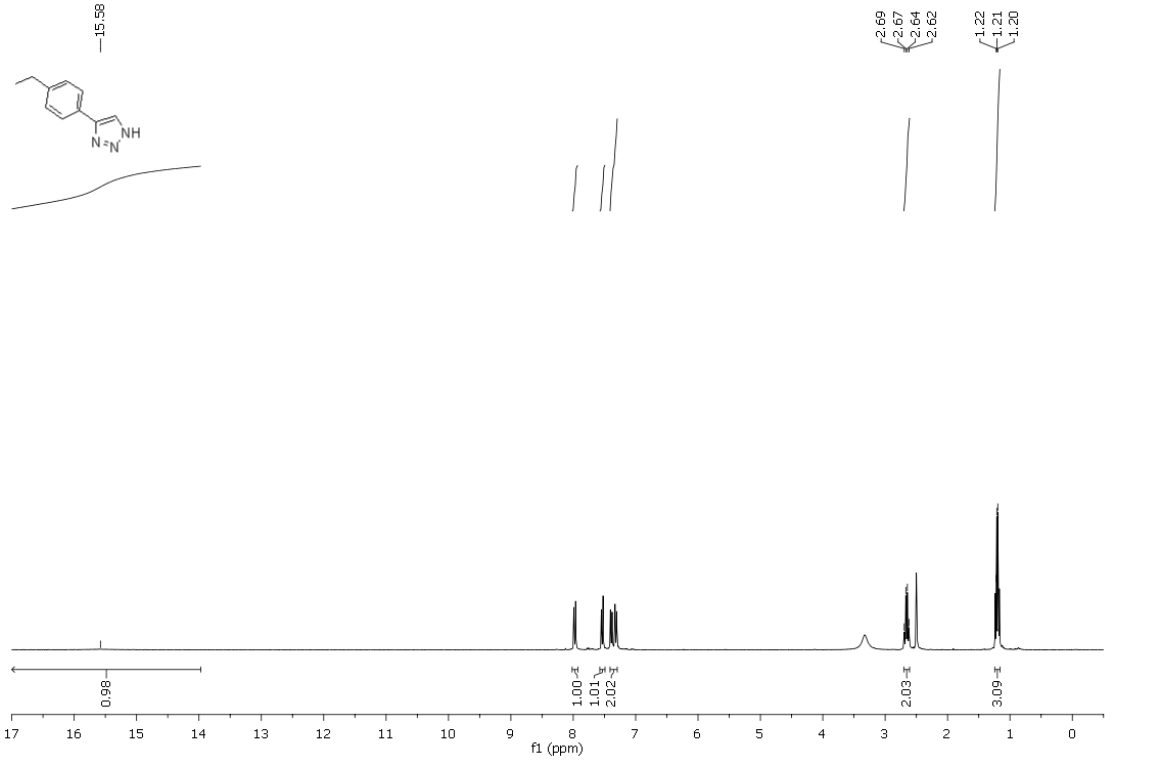


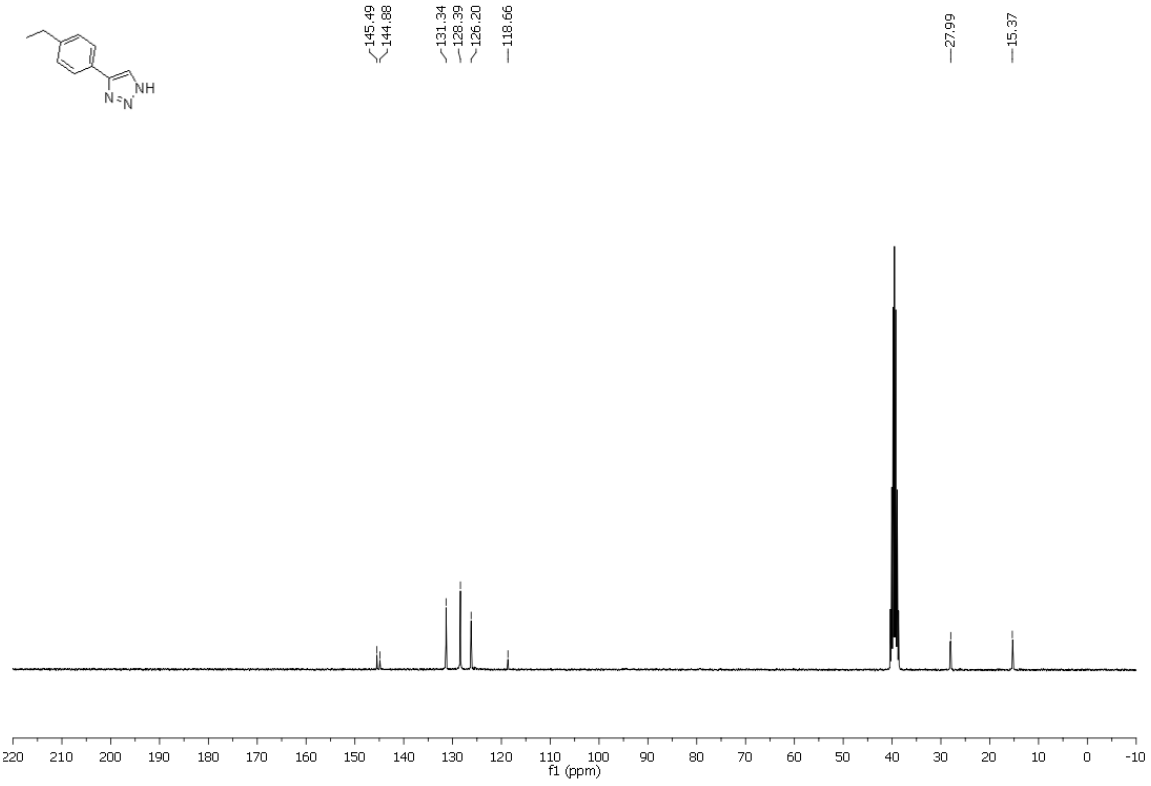
4-*p*-tolyl-1*H*-1,2,3-triazole (2c)



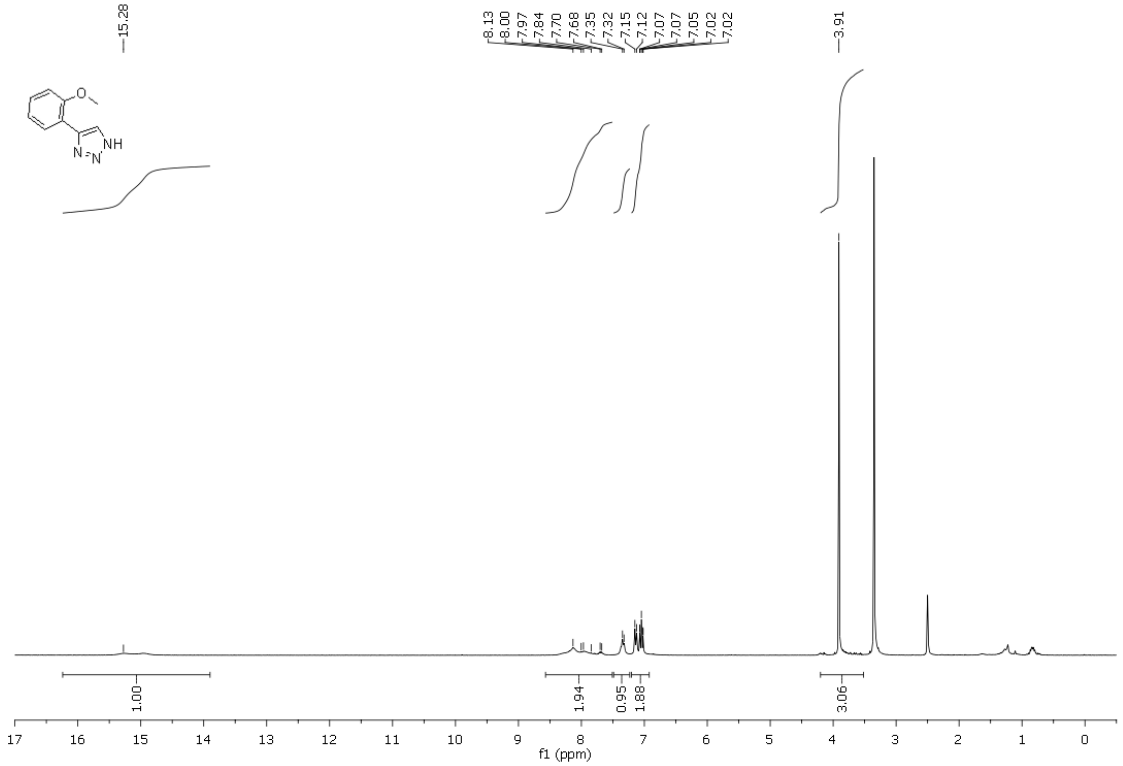


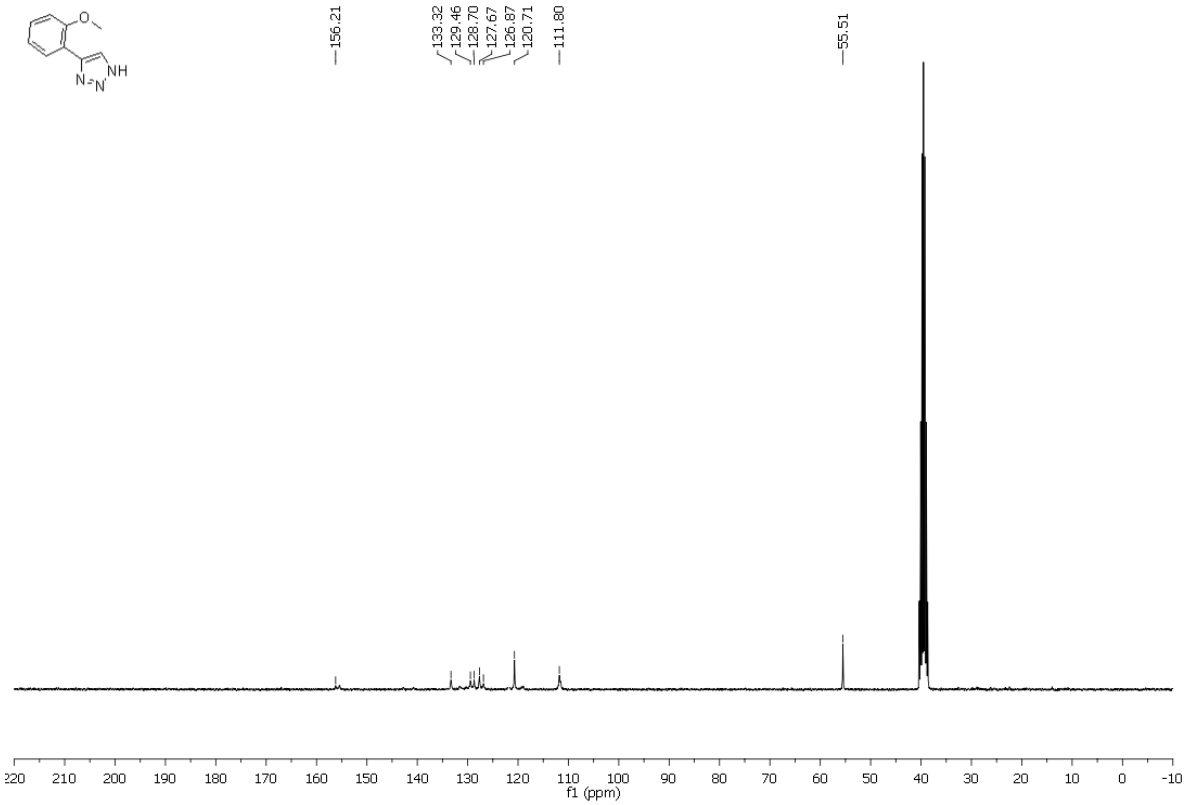
4-(4-Ethylphenyl)-1*H*-1,2,3-triazole (2d)





4-(2-Methoxyphenyl)-1*H*-1,2,3-triazole (2e)





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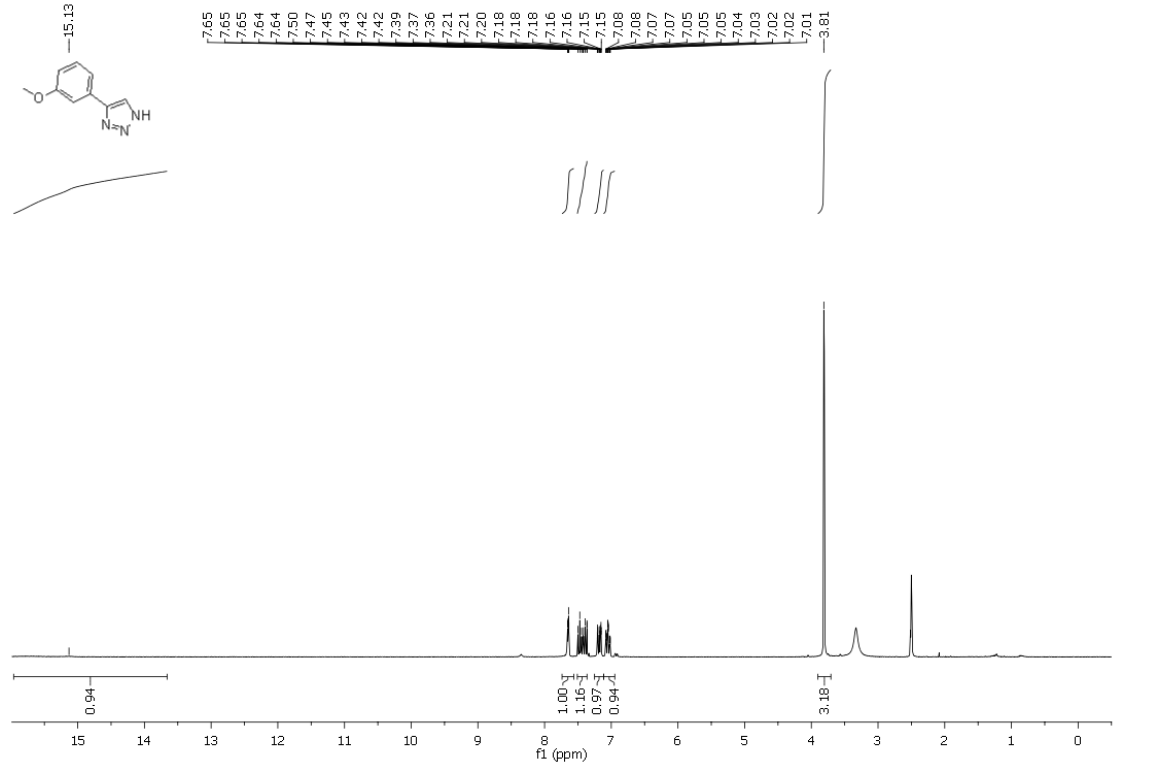
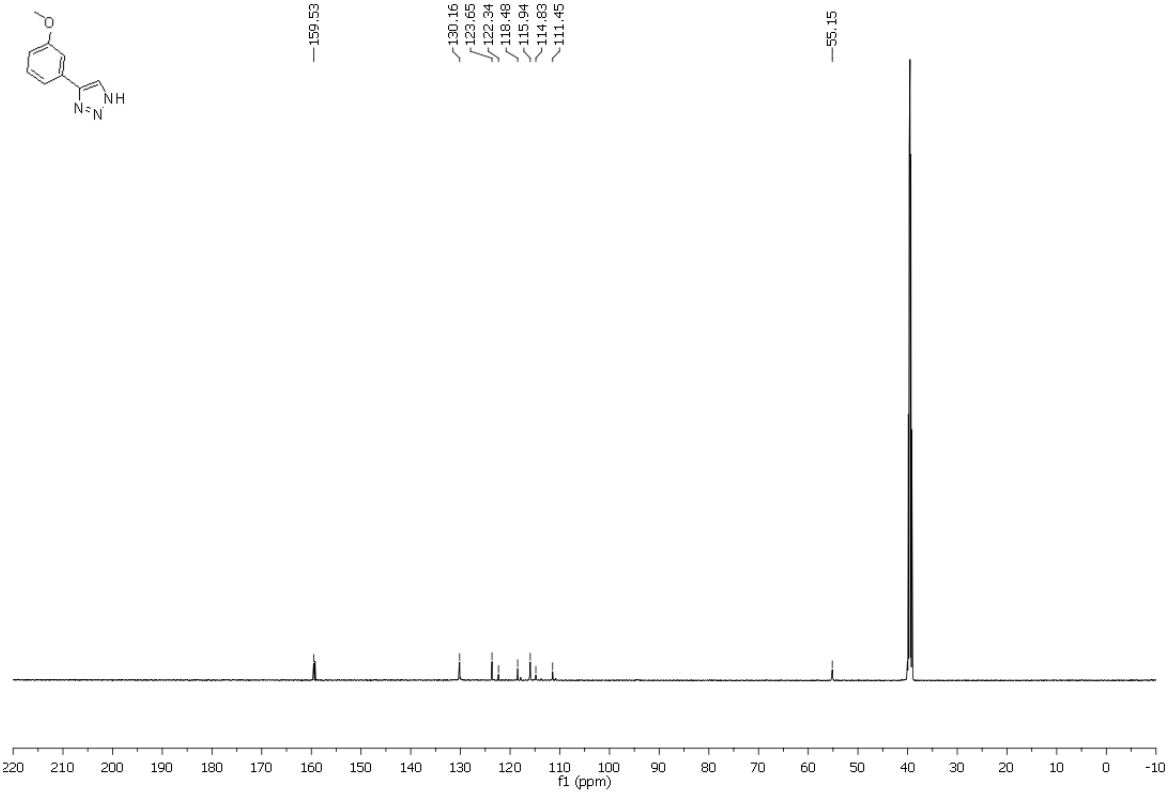
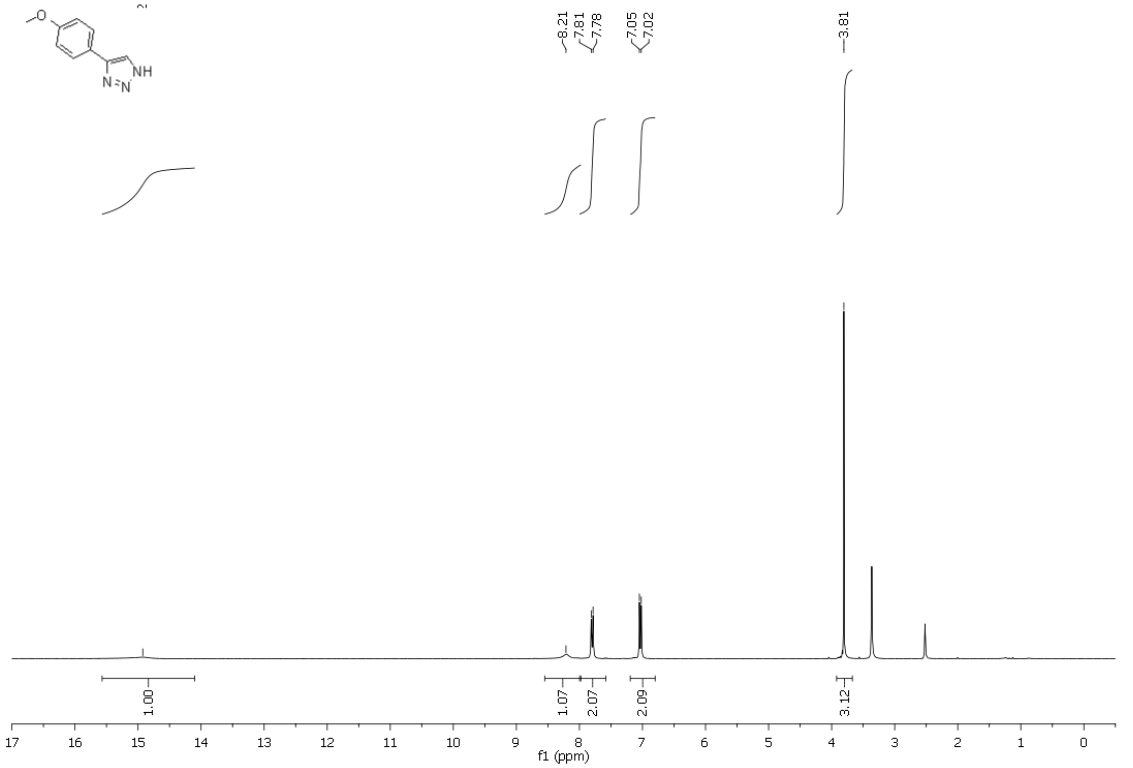
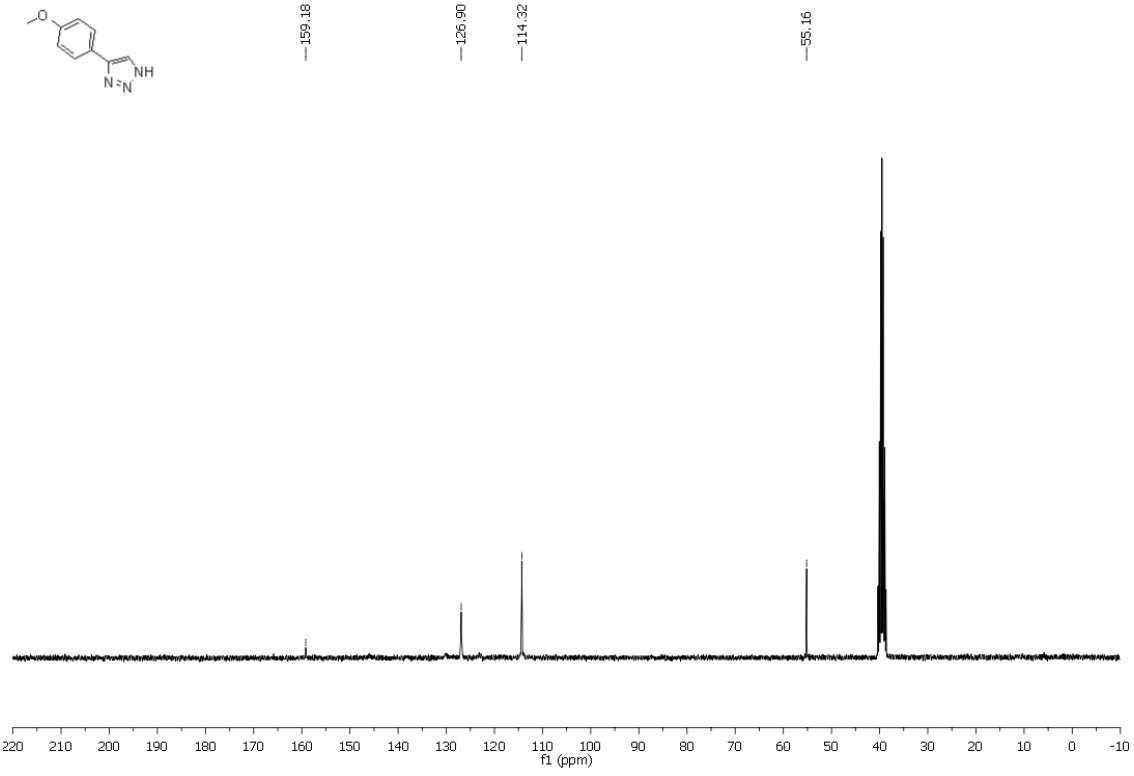


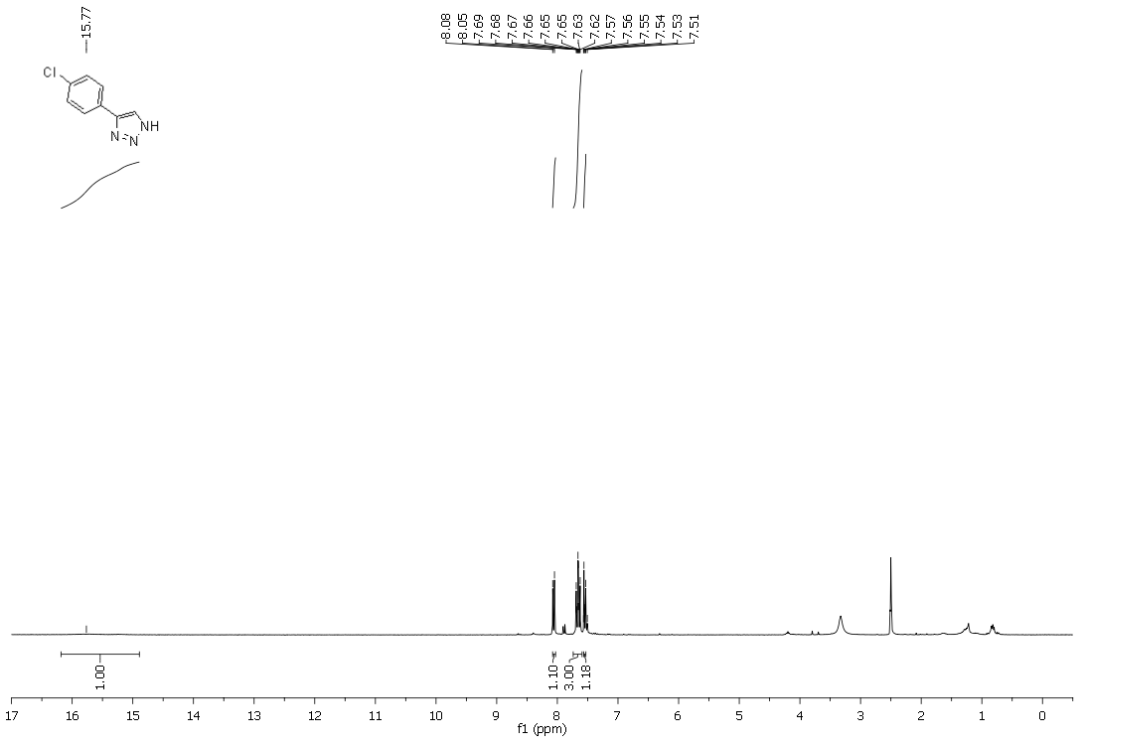


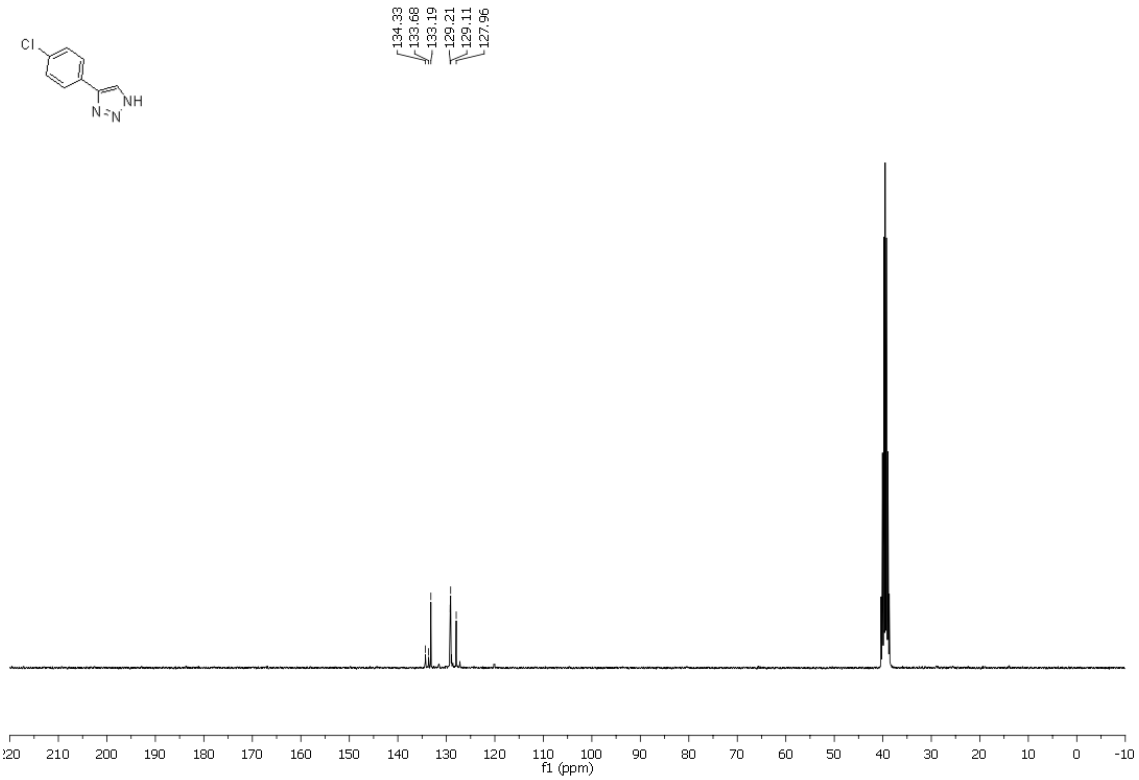
4-(4-Methoxyphenyl)-1*H*-1,2,3-triazole (2g)





4-(4-Chlorophenyl)-1*H*-1,2,3-triazole (2h)





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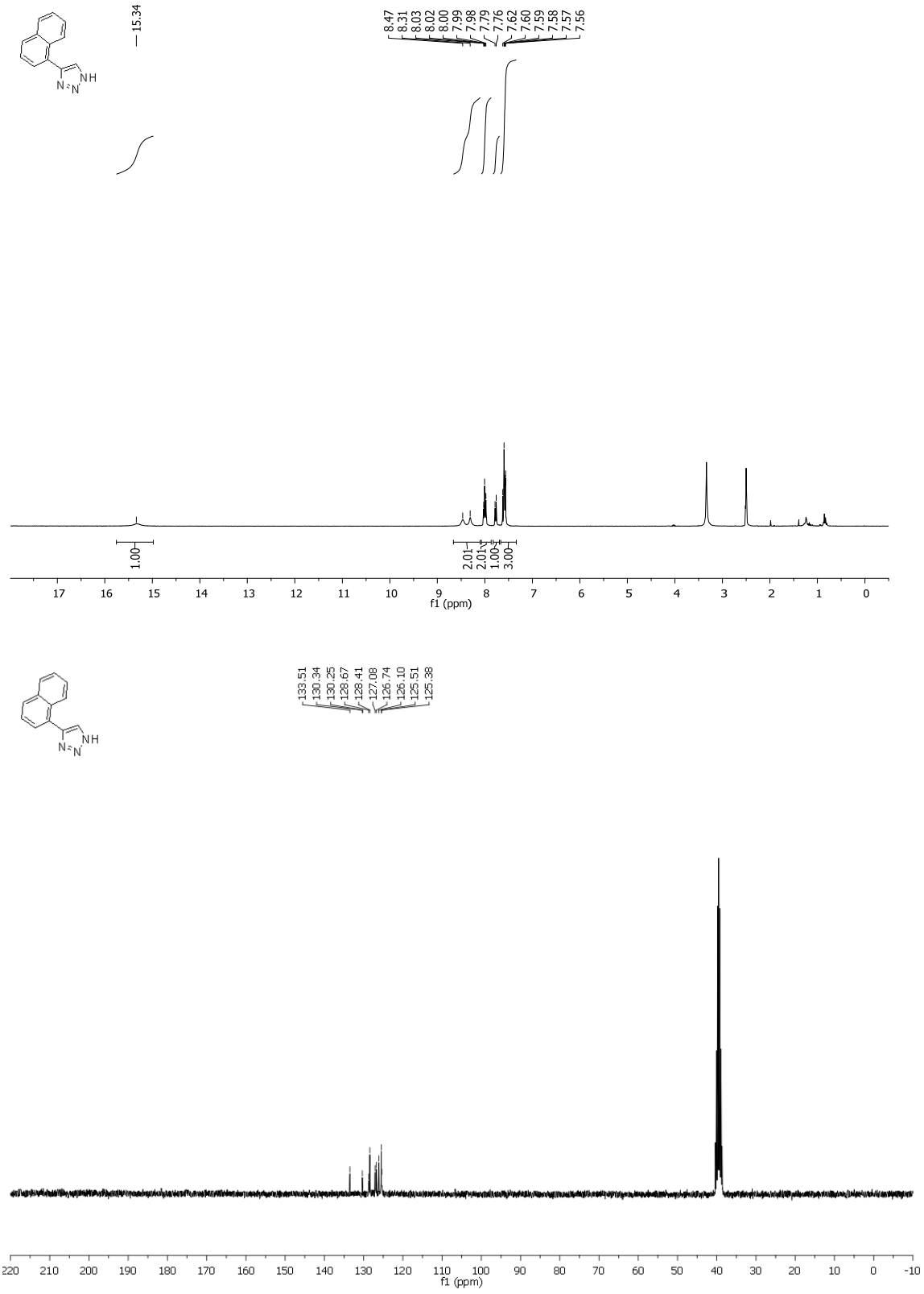
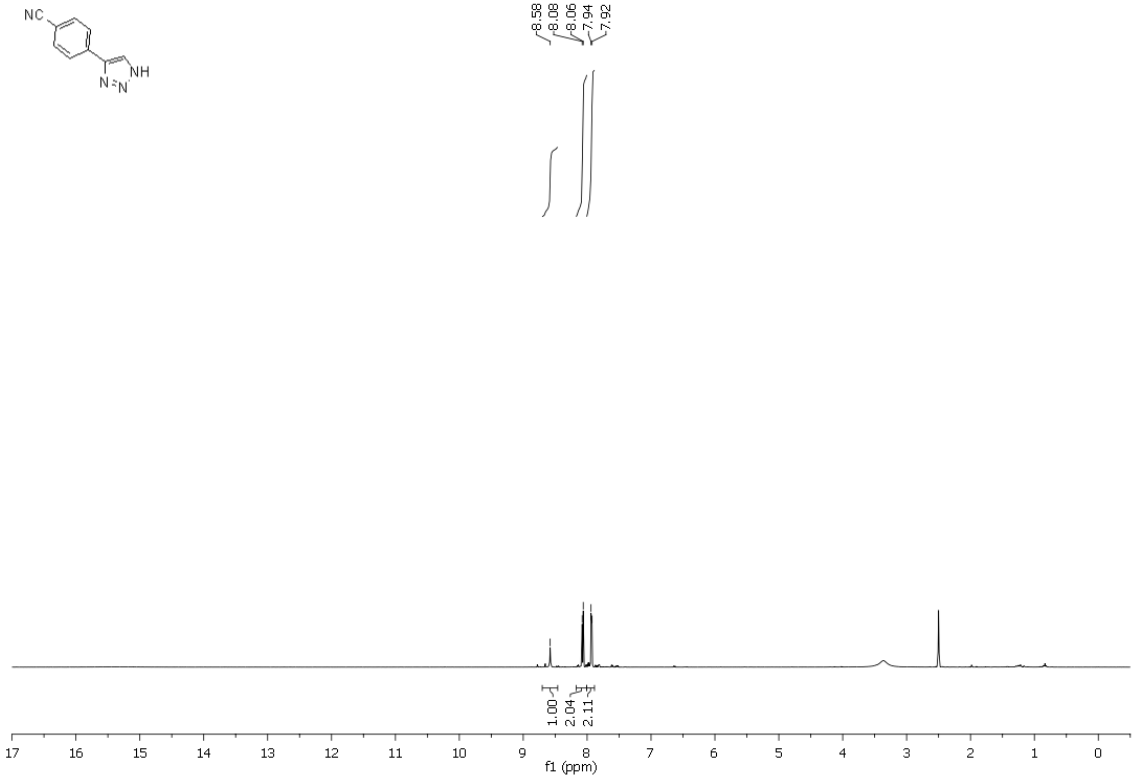
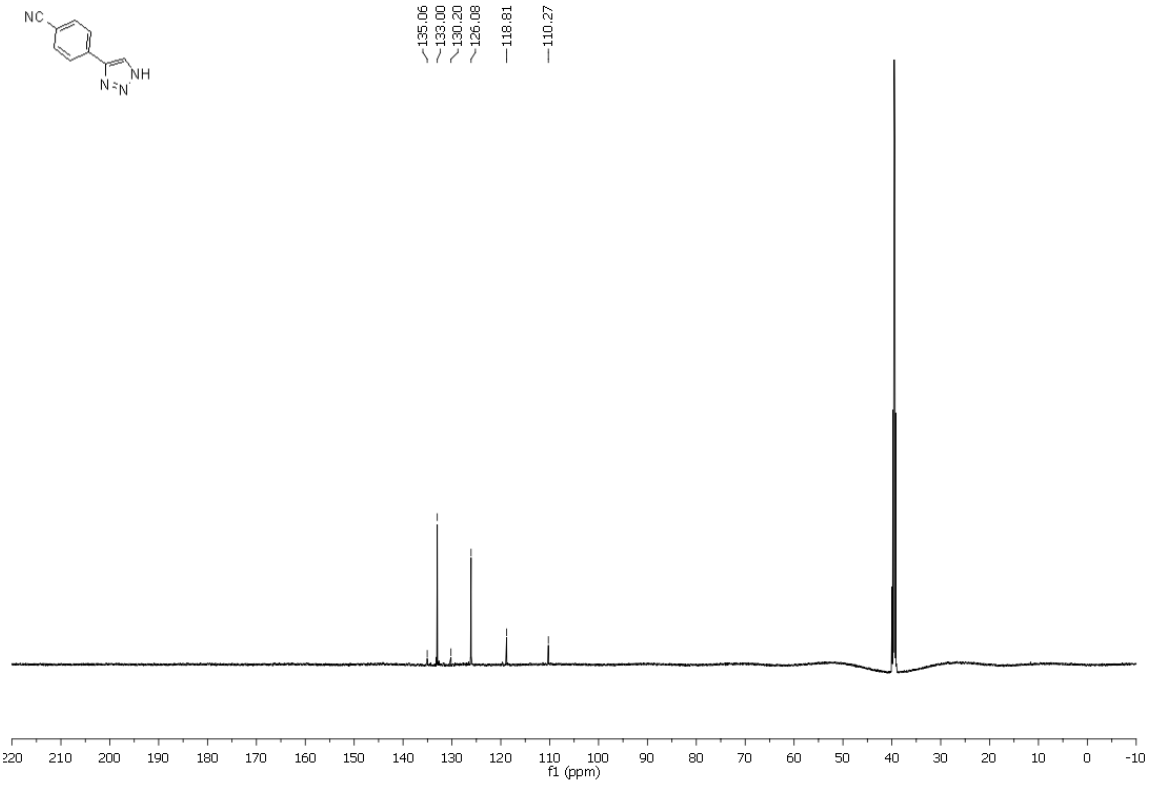


4-(1*H*-1,2,3-triazol-4-yl)benzonitrile (2j)





1-(4-(1*H*-1,2,3-triazol-4-yl)phenyl)ethanone (2k)