Supporting Information

Magnetic AgNPs/Fe_3O_4@Chitosan/PVA Nanocatalyst for Fast One-pot Green Synthesis of Propargylamine and Triazole Derivatives

Kousar Ghasemi [a], Mahdieh Darroudi [b,c], Marjan Rahimi [d], Hossein Rouh [e], Anju R. Gupta [f], Chun Cheng [g], Abbas Amini [h, i*]

[a] Department of Organic Chemistry, Faculty of Chemistry, University of Mazandaran, Babolsar, Iran

[b] Department of Energy Science and Technology, Faculty of Science, Turkish-Germen University, Istanbul, Turkey

[c] Department of Medical Biotechnology and Nanotechnology, School of Science, Mashhad University of Medical Science, Mashhad, Iran

[d] Department of Chemistry, Mashhad Branch, Islamic Azad University, Mashhad, Iran

[e] Department of Chemistry and Biochemistry, Texas Tech University, Lubbock, Texas, United States

[f] Department of Mechanical Engineering, Industrial and Manufacturing Engineering, The University of Toledo, Ohio, USA

[g] Department of Materials Science and Engineering, Southern University of Science and Technology, Shenzhen, People's Republic of China

[h] Department of Mechanical Engineering, Australian College of Kuwait, Safat 13015, Kuwait

[i] Centre for Infrastructure Engineering, Western Sydney University, Penrith 2751, NSW, Australia

* Corresponding Author: a.amini@westernsydney.edu.au, a.amini@ack.edu.kw (A. Amini)

Contents

S1. Materials

All the chemicals were purchased from Merck and Sigma-Aldrich, and used without further purifications.

S2. Instruments

The reactions were monitored by thin layer chromatography (TLC). Melting points were measured on an Electrothermal 9100 apparatus. NMR spectra were recorded with Bruker DRX-400 AVANCE instrument (400.1 MHz for ^{1}H, 100.6 MHz for ^{13}C) and Varian - INOVA 500MHz instrument BRUKER-AVANCe 300 NMR-300MHz Spectrometry (300.1 MHz for ^{1}H, 75.1 MHz for ^{13}C) using $CDCl_3$ and DMSO as solvents. Fourier transform infrared spectra (FT-IR) were recorded by FT-IR Burker Tensor 27 instrument, using the KBr pellet mode in the region of 4000-400 cm^{-1}. X-ray diffraction (XRD) patterns were recorded on a Philips PW1730 diffractometer using Cu Kα radiation of wavelength 1.54056 A°. Scanning Electron Microscopy (SEM) was recorded using a Tescan MIRA III. Thermogravimetric analysis (TGA) was recorded on a Q600 (TA, USA). Transmission electron microscopy (TEM) pictures were taken using a Hitachi (H-7500) instrument. The magnetic properties of the nanoparticles were measured at room temperature in a vibrating sample magnetometer (VSM) (Meghnatis Daghigh KavirCo.; Kashan Kavir; Iran).

S3. Experimental

S3.1. General procedure for one-pot A^3-coupling reaction catalyzed by AgNPs/Fe_3O_4@Chitosan/PVA nanocatalyst

In a general procedure, amines (1.1 mmol), aldehydes (1.0 mmol), alkynes (1.1 mmol), and AgNPs/Fe_3O_4@Chitosan/PVA (10 mol%) were added to 5 mL EtOH in a 10 mL-flask, and the mixture was sonicated for 20 min at 40 ℃. The progress of reaction was monitored through TLC. Upon the completion of reaction, the magnetic nanocatalyst was removed by using an external magnet, while the solvent was extracted through the rotary evaporation. The resultant pure product was obtained after purification through column chromatography on silica gel using EtOAc/n-hexane.

***N*-(1,3-Diphenylprop-2-yn-1-yl)piperidine (4a) (Table 2, Entry 1):** ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 7.71 – 7.69 (m, 2H), 7.59 – 7.56 (m, 2H), 7.41 (t, J = 7.7 Hz, 3H), 7.34 (d, J = 6.1 Hz, 4H), 4.85 (s, 1H), 2.63 – 2.61 (m, 4H), 1.72 – 1.58 (m, 4H), 1.51 – 1.48 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$); δ (ppm): 138.73, 131.95, 128.67, 128.42, 128.21, 127.60, 123.49, 88.03, 86.20, 62.54, 50.85, 26.33, 24.59 (Fig. S2).

***N*-[3-(2-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidine (4b) (Table 2, Entry 2):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.70 (d, *J* = 7.3 Hz, 2H), 7.49 (dd, *J* = 7.5, 1.6 Hz, 1H), 7.40 – 7.33 (m, 2H), 7.32 – 7.28 (m, 2H), 6.97 – 6.87 (m, 2H), 4.87 (s, 1H), 3.91 (s, 3H), 2.60 (t, *J* = 5.2 Hz, 4H), 1.65 – 1.56 (m, 4H), 1.46 (q, *J* = 5.5 Hz, 2H) (Fig. S3). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 160.40, 138.91, 133.70, 129.52, 128.80, 128.10, 127.51, 120.51, 112.80, 110.93, 90.41, 84.20, 62.71, 56.01, 50.70, 26.41, 24.60 (Fig. S4).

1-(1-phenyl-3-(p-tolyl)prop-2-yn-1-yl)piperidine (4c) (Table 2, Entry 3): ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.61 (d, *J* = 6.7 Hz, 2H), 7.35 (t, *J* = 7.6 Hz, 2H), 7.29 (d, *J* = 7.1 Hz, 1H), 4.65 (s, 1H), 2.55 (s, 4H), 2.33 (td, *J* = 7.0, 2.1 Hz, 3H), 1.64 – 1.54 (m, 4H), 1.50 – 1.45 (m, 4H), 0.94 (t, *J* = 7.3 Hz, 4H) (Fig. S5). ^{13}C NMR (101 MHz, $CDCl_3$); δ (ppm): 128.90, 128.10, 127.70, 87.00, 62.00, 50.50, 31.10, 25.60, 24.20, 22.10, 18.50, 13.60 (Fig. S6).

***N*-[3-(4-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidin (4d) (Table 2, Entry 4):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.64 (d, *J* = 7.0 Hz, 2H), 7.46 (d, *J* = 8.8 Hz, 2H), 7.39 – 7.34 (m, 2H), 7.30 (d, *J* = 7.0 Hz, 1H), 6.87 (d, *J* = 8.8 Hz, 2H), 4.80 (s, 1H), 3.83 (s, 3H), 2.57 (t, *J* = 5.2 Hz, 4H), 1.56– 1.65 (m, 4H), 1.46 (q, 5.4 Hz, 2H) (Fig. S7). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 159.40, 138.70, 133.20, 128.60, 128.00, 127.40, 115.50, 113.90, 87.60, 84.50, 62.40, 55.30, 50.70, 26.10, 24.40 (Fig. S8).

***N*-[1-(2-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (4e) (Table 2, Entry 5):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.65 (dd, *J* = 7.6, 1.7 Hz, 1H), 7.49 – 7.45 (m, 2H), 7.31 – 7.28 (m, 4H), 6.98 (td, *J* = 7.5, 1.0 Hz, 1H), 6.92 (dd, *J* = 8.2, 0.7 Hz, 1H), 5.21 (s, 1H), 2.69 – 2.63 (m, 2H), 2.62 – 2.55 (m, 2H),

1.62 – 1.56 (m, 4H), 1.41 (q, *J* = 5.7 Hz, 2H) (Fig. S9). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 157.60, 132.10, 130.80, 129.10, 128.50, 128.20, 127.10, 123.90, 120.50, 111.70, 88.20, 86.20, 56.40, 55.50, 51.20, 26.40, 24.80 (Fig. S10).

***N*-[1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (4f) (Table 2, Entry 6):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.58 – 7.47 (m, 4H), 7.36 – 7.31 (m, 3H), 6.90 (d, *J* = 8.7 Hz, 2H), 4.77 (s, 1H), 3.83 (s, 3H), 2.57 (t, *J* = 5.1 Hz, 4H), 1.67 – 1.56 (m, 4H), 1.46 (q, *J* = 5.1 Hz, 2H) (Fig. S11). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 159.00, 131.80, 130.60, 129.70, 128.30, 128.00, 123.40, 113.40, 87.60, 86.40, 61.80, 55.30, 50.60, 26.10, 24.40. (Fig. S12).

***N*-[1-(2-Bromophenyl)-3-phenylprop-2-yn-1-yl]piperidine (4g) (Table 2, Entry 7):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.89 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.74 (dd, *J* = 7.7, 1.6 Hz, 1H), 7.56 – 7.49 (m, 2H), 7.39 – 7.32 (m, 4H), 6.99 (td, *J* = 7.6, 1.7 Hz, 1H), 4.84 (s, 1H), 2.70 – 2.49 (m, 4H), 1.66 – 1.39 (m, 6H) (Fig. S13). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 140.80, 140.00, 131.80, 130.10, 129.10, 128.30, 128.10, 127.50, 123.20, 101.40, 88.60, 85.40, 65.70, 50.40, 26.10, 24.50 (Fig. S14).

1-(1-phenylnon-1-yn-3-yl)-dihydroquinoline (4h) (Table 2, Entry 8): ^{1}H NMR (500 MHz, $CDCl_3$); δ (ppm): 7.44 – 7.41 (m, 2H), 7.31 – 7.28 (m, 2H), 7.15 – 7.12 (m, 3H), 7 .09 – 7.07 (m, 1H), 3.97 (d, *J* = 14.7 Hz, 1H), 3.83 (d, *J* = 14.7 Hz, 1H), 3.78 (t, *J* = 7.5 Hz, 1H), 3.08 – 3.03 (m, 1H), 3.01 – 2.92 (m, 2H), 2.86 – 2.80 (m, 1H), 1.86 (q, *J* = 7.5 Hz, 2H), 1.65 – 1.57 (m, 1H), 1.56 – 1.48 (m, 1H), 1.41 – 1.37 (m, 2H), 1.36 – 1.32 (m, 4H), 0.91 (t, *J* = 6.8 Hz, 3H) (Fig. S15). ^{13}C NMR (126 MHz, $CDCl_3$); δ (ppm): 135.30, 134.60, 132.00, 128.90, 128.50, 128.20, 127.00, 126.30, 125.90, 123.50, 87.40, 86.40, 58.20, 52.20, 47.70, 33.80, 32.00, 29.80, 29.30, 27.00, 22.90, 14.40 (Fig. S16).

***N*,*N*-Dibenzyl-1,3-diphenylprop-2-yn-1-amine (4i) (Table 2, Entry 9):** ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.75 (d, *J* = 7.7 Hz, 2H), 7.65 (dd, *J* = 6.6, 3.1 Hz, 2H), 7.50 – 7.39 (m, 8H), 7.39 – 7.30 (m, 6H), 7.28 – 7.25 (m, 2H), 4.96 (s, 1H), 3.82 (d, *J* = 13.5 Hz, 2H), 3.56 (d, *J* = 13.5 Hz, 2H) (Fig. S17). ^{13}C NMR (75

MHz, $CDCl_3$) δ 139.70, 139.30, 132.10, 129.10, 128.50, 128.40, 128.30, 127.60, 127.20, 123.40, 88.80, 84.90, 56.20, 54.80 (Fig. S18).

***N*-(1,3-Diphenylprop-2-yn-1-yl) morpholine (4j) (Table 2, Entry 10):** ^{1}H NMR (300 MHz, $CDCl_3$); δ (ppm): 7.65 (d, *J* = 7.2 Hz, 2H), 7.56 – 7.50 (m, 2H), 7.43 – 7.30 (m, 6H), 4.81 (s, 1H), 3.79 – 3.71 (m, 4H), 2.65 (t, *J* = 4.5 Hz, 4H) (Fig. S19). ^{13}C NMR (75 MHz, $CDCl_3$); δ (ppm): 137.90, 131.90, 128.70, 128.50, 128.40, 127.90, 123.10, 88.60, 85.20, 67.30, 62.20, 50.00 (Fig. S20).

***N*,*N*-Diethyl-1,3-diphenylprop-2-yn-1-amine (4k) (Table 2, Entry 11):** ^{1}H NMR (400 MHz, CDCl3); δ (ppm): 7.39-7.41 (m, 2H), 7.29 – 7.38 (m, 3H), 7.15 –7.27 (m, 4H), 5.19 (s, 1H), 2.36-2.62 (m, 4H), 1.04 (m, 6H) (Fig. S21). ^{13}C NMR (101 MHz, $CDCl_3$); δ (ppm): 131.80, 128.40, 57.30, 44.80, 13.00 (Fig. S22).

S3.2. General procedure for one-pot multicomponent click reaction using AgNPs/Fe3O4@Chitosan/PVA nanocatalyst

Alkynes (1 mmol), benzyl bromide derivatives (1 mmol), sodium azide (0.065 g, 1 mmol), and AgNPs/Fe_3O_4@Chitosan/PVA nanocatalyst (10 mol%) were dissolved in EtOH medium at 45 ℃ in a 10 mL-flask, while monitored with TLC. Upon the completion of reaction, the magnetic nanocatalyst was easily removed by a permanent external magnet, and then the solvent was evaporated in a vacuum to achieve the pure product.

1-benzyl-4-phenyl-1H-1,2,3-triazole (7a) (Table 4, Entry 1): ^{1}H NMR (400MHz, $CDCl_3$); δ (ppm): 7.68 (s, 1 H), 7.78 (d, *J* = 7.2Hz, 2 H), 7.28-7.40 (m, 8 H), 5.50 (s, 2 H) (Fig. S23). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 148.13, 134.51, 130.38, 129.14, 128.81, 128.79, 128.21, 128.06, 125.65, 119.64, 54.28 (Fig. S24).

1-(3,4-dichlorobenzyl)-4-phenyl-1H-1,2,3-triazole (7b) (Table 4, Entry 2): ^{1}H NMR (400MHz, DMSO); δ (ppm): 8.66 (s, 1 H), 7.85-7.33 (m, 8 H), 5.68 (s, 1H) (Fig. S25). ^{13}C NMR (100 MHz, DMSO); δ (ppm): 147.19, 137.37, 131.79, 131.52, 131.44, 131.00, 130.65, 129.36, 128.58, 128.48, 125.65, 122.19, 52.10 (Fig. S26).

1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl) ethan-1-one (7c) (Table 4, Entry 3): ^{1}H NMR (400MHz, $CDCl_3$); δ (ppm): 7.68 (s, 1 H), 7.78 (d, *J* = 7.2Hz, 2 H), 7.28-7.40 (m, 8 H), 5.50 (s, 2 H) (Fig. S27). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 190.29, 148.24, 134.65, 130.51, 129.21, 128.84, 128.73, 128.22, 128.20, 125.84, 121.46, 54.48 (Fig. S28).

4-phenyl-1-(m-tolyl)-1H-1,2,3-triazole (7d) (Table 4, Entry 4): ^{1}H NMR (400MHz, $CDCl_3$); δ (ppm): 8.34 (s, 1 H), ,8.20 (d *J* = 9.2 Hz, 4 H), 7.25 (d, *J* = 9.2 Hz, 4 H), 7.45 (d, *J* = 8.4 Hz, 4 H), 7.35 (d, *J* = 8.4 Hz, 4 H), 5.63 (s, 2 H), 5.31 (s, 2 H) (Fig. S29). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 163.72, 142.57, 141.52,135.37,133.39, 130.43, 129.25, 126.32, 125.58, 115.79, 62.35, 52.54 (Fig. S30).

2-(4-((4-nitrophenoxy)methyl)-1H-1,2,3-triazol-1-yl)-1-phenylethan-1-one (7e) (Table 4, Entry 5): ^{1}H NMR (400MHz, DMSO); δ (ppm): 8.26 (s, 1 H), 8.24 (d, 4 H *J* = 9.2Hz), 7.30 (d, *J*= 9.2Hz, 4 H), 7.60-8.09 (m, 5 H), 6.23 (s, 2 H), 5.39 (s, 2 H) (Fig. S31). ^{13}C NMR (100 MHz, DMSO); δ (ppm): 192.58, 161.10, 142.12, 141.51, 134.73, 134.55, 129.45, 128.64, 127.17, 126.34, 115.82. 62.34, 56.41 (Fig. S32).

1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl) ethenone (7f) (Table 4, Entry 6): Colorless solid; ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 8.06 (d, J = 7.2 Hz, 2H), 8.04 (s, 1H), 8.01 (d, J = 7.2 Hz, 2H),7.36-7.90 (m, 6H), 5.93 (s, 2H) (Fig. S33). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 190.29, 148.24, 134.65, 133.95, 130.51, 129.21, 128.81, 128.20, 125.83, 121.47, 55.48 (Fig. S34).

Ethyl 2-(4-phenyl-1H-1,2,3-triazol-1-yl) acetate (7g) (Table 4, Entry 7): ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): δ: 7.92 (s, 1H), 7.85 (d, J = 6.8 Hz, 2H), 7.44 (d, J = 8.0 Hz, 2H), 7.35 (d, J = 7.6 Hz, 1H), 4.29 (q, J = 7.2 Hz, 2H), 1.32 (t, J = 7.2 Hz, 3H) (Fig. S35). ^{13}C NMR (100MHz, $CDCl_3$); δ (ppm): 166.31, 148.19, 130.34, 128.86, 128.30, 125.82, 121.09, 62.47, 50.97, 14.08 (Fig. S36).

1-(4-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (7h) (Table 4, Entry 8): 1H NMR (400 MHz, $CDCl_3$); δ (ppm): 1.33 (3H, t, J =7.6 Hz), 4.26 (2H, q, J =7.6 Hz), 5.20 (2H, s), 7.34-7.46 (3H, m), 7.85-7.87 (2H, m, Ar), 7.93 (1H, s) (Fig. S37). ^{13}C NMR (100MHz, $CDCl_3$); δ (ppm): 145.8, 133.71, 132.34, 130.34, 129.86, 128.96, 128.31, 25.71, 122.96, 119.48, 53.53 (Fig. S38).

1-(4-bromobenzyl)-4-pentyl-1H-1,2,3-triazole (7i) (Table 4, Entry 9): ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 7.46 (2H, d, J = 6.3 Hz), 7.21 (1H, s), 7.09 (2H, d, J = 6.3 Hz), 5.41 (2H, s), 2.65 (2H, t, J = 7.4 Hz), 1.59-1.63 (2H, m), 1.27-1.30 (4 H, m), 0.85 (3H, t, J= 6.9 Hz) (Fig. S39). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 134.09, 132.15, 129.54, 122.65, 120.59, 31.41, 53.20, 29.05, 25.64, 22.37, 13.99 (Fig. S40).

4-phenyl-1-propyl-1H-1,2,3-triazole (7j) (Table 4, Entry 10): White solid, m.p.: 62-64 ℃, ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 0.88 (t, J = 6.9 Hz, 3H), 1.41-1.36 (m, 2H), 2.78 (t, J = 7.7 Hz, 2H), 7.40 (t, J = 7.4 Hz, 1H), 7.49 (t, J = 7.8 Hz, 2H), 7.71-7.70 (m, 2H), 7.72 (s, 1H) (Fig. S41). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 149.21, 137.31, 129.66, 128.38, 120.38, 118.77, 31.59, 22.57, 14.07 (Fig. S42).

1-Naphthale-4-p-tolyl-1H-1,2,3-triazole (7k) (Table 4, Entry 11): ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 7.81-7.86 (m, 3 H) , 7.77 (s, 1 H), 7.68 (d, J = 8.0 Hz, 2 H) , 7.63 (s, 1 H), 7.52 (dd, J = 2.85, 6.9 Hz, 2 H), 7.39 (dd, J = 2.3, 8.6 Hz, 1 H), 7.19 (d, J = 8.05 Hz, 2 H), 5.71 (s, 2 H), 2.34 (s, 3 H) (Fig. S43). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 148.33, 137.98, 133.21,132.05, 129.45, 129.17, 127.92, 127.78, 127.33, 126.73, 125.57, 125.33, 119.19, 54.37, 21.23 (Fig. S44).

4-butyl-1-(6-methoxynaphthalen-2-yl)-1H-1,2,3-triazole (7l) (Table 4, Entry 12): ^{1}H NMR (400 MHz, $CDCl_3$); δ (ppm): 8.08 (d, *J* = 1.6 Hz,1 H), 7.87-7.90 (m, 2 H), 7.81-7.85 (m, 2 H), 7.25 (dd, *J* = 2.4, 9.0 Hz,1 H), 7.21 (d, *J* = 2.4 Hz, 1 H), 3.97 (s, 3 H), 2.85 (t, *J* = 7.6 Hz, 2 H), 1.77 (quin, *J* = 7.6 Hz, 2 H), 1.47 (six, *J* = 7.6 Hz, 2 H), 0.99 (t, *J* = 7.6 Hz, 3 H) (Fig. S45). ^{13}C NMR (100 MHz, $CDCl_3$); δ (ppm): 158.38, 149.16, 134.96, 134.11, 129.65, 128.57, 128.46, 120.35, 119.59, 118.96, 118.29, 105.80, 55.42, 31.56, 25.42, 22.36, 13.87 (Fig. S46).

NMR Spectra

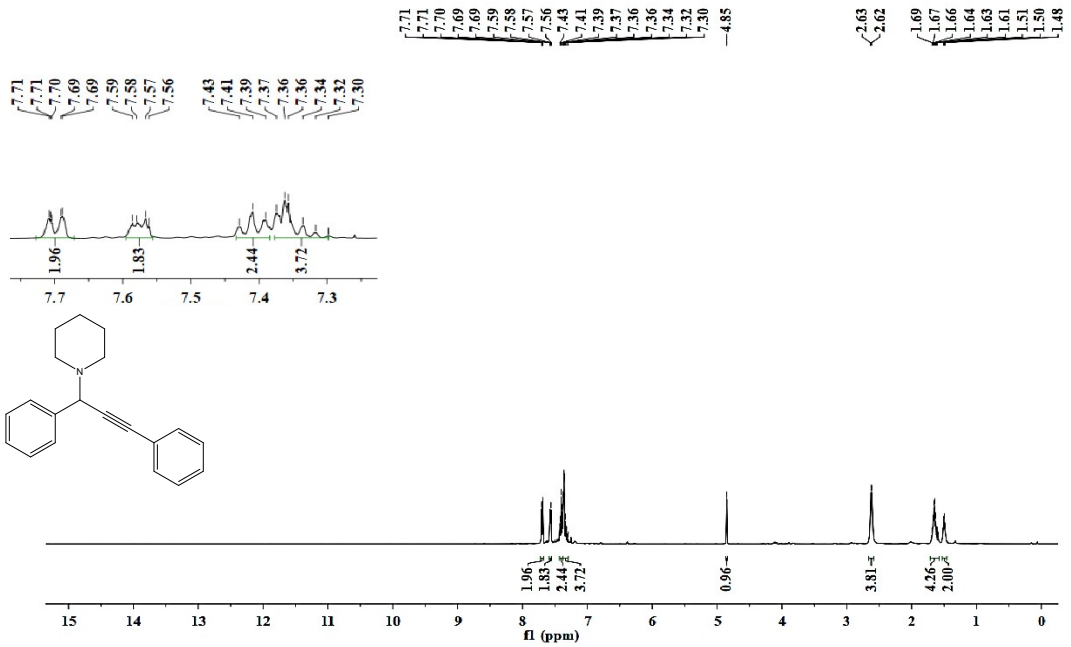

Fig. S1. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of N-(1,3-Diphenylprop-2-yn-1-yl)piperidine (**4a**)

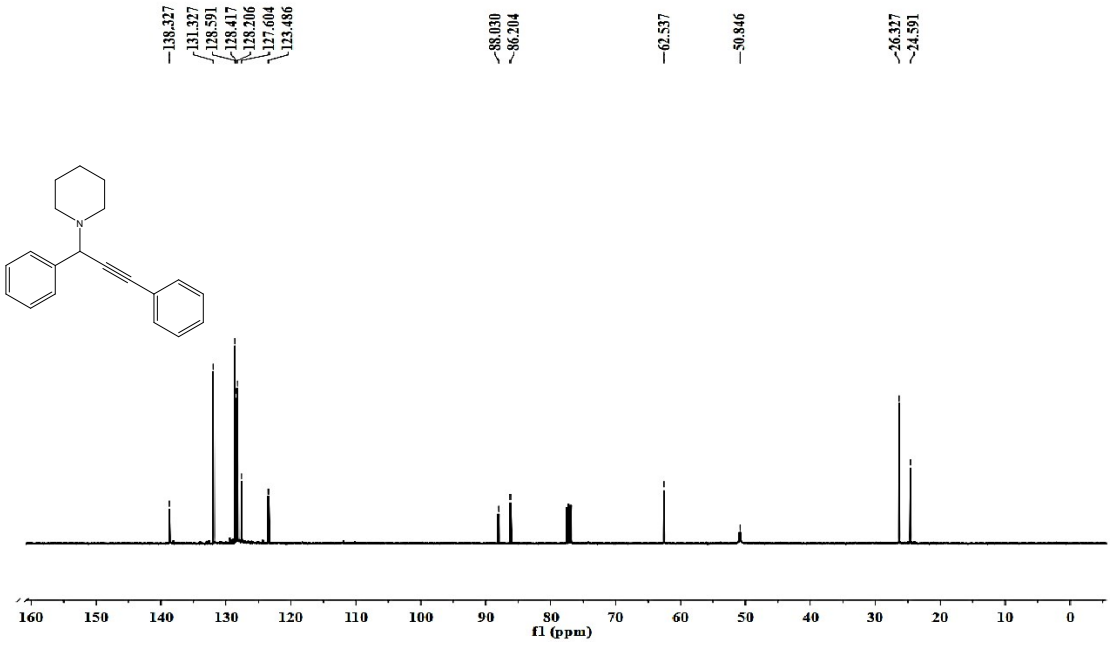

Fig. S2. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of N-(1,3-Diphenylprop-2-yn-1-yl)piperidine (**4a**)

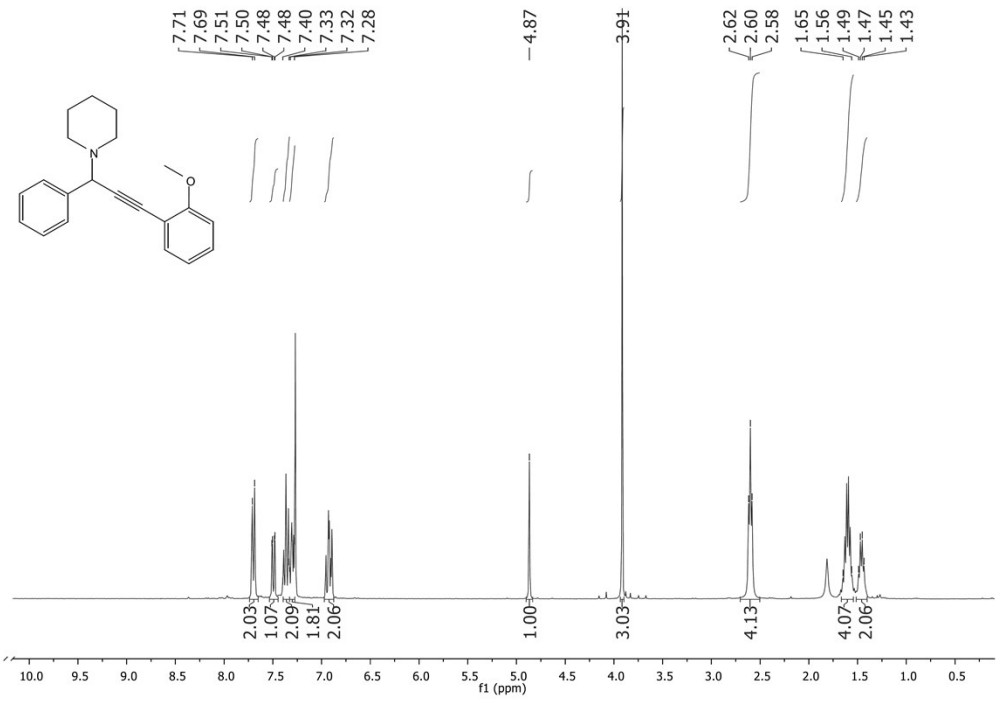

Fig. S3. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-[3-(2-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidine (**4b**)

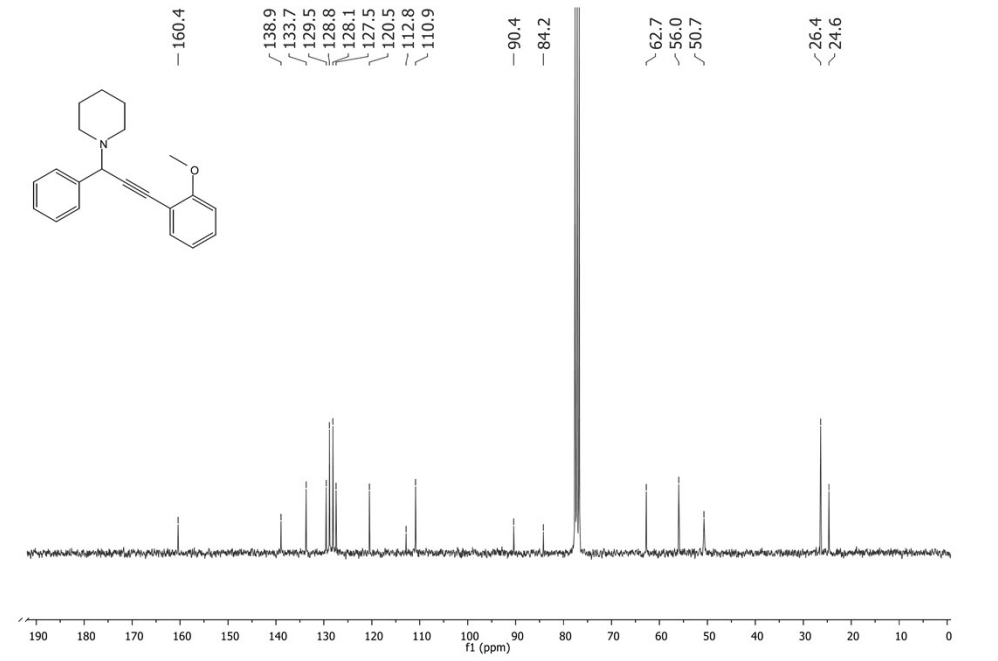

Fig. S4. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-[3-(2-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidine (**4b**)

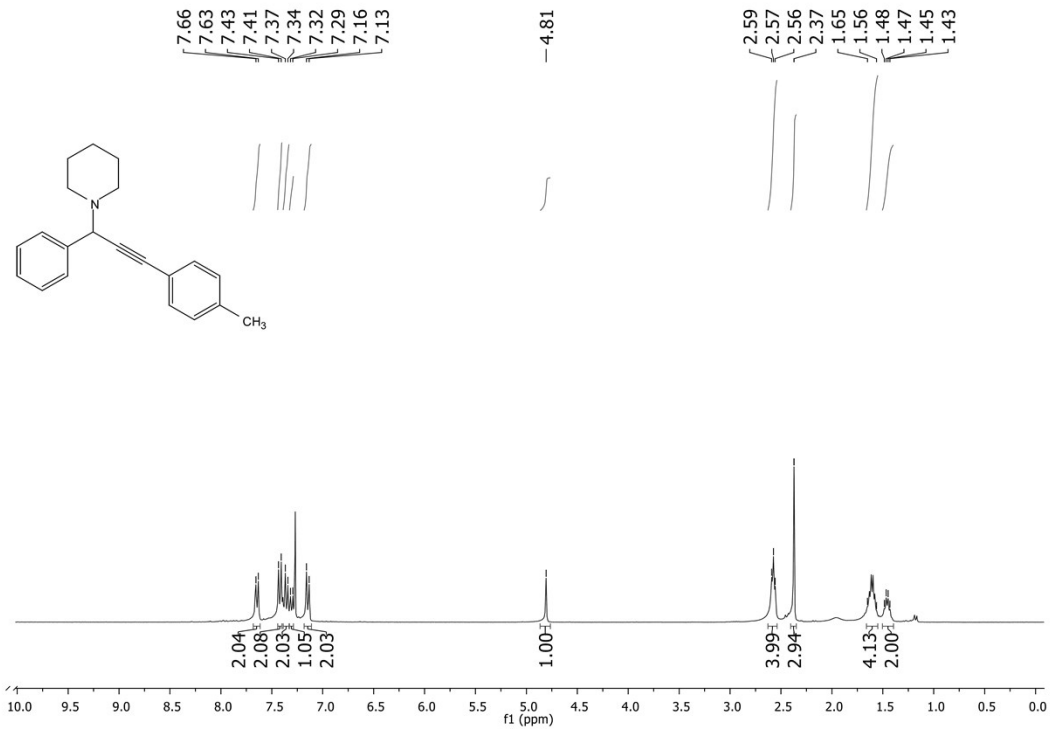

Fig. S5. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of 1-(1-phenyl-3-(p-tolyl)prop-2-yn-1-yl)piperidine (**4c**)

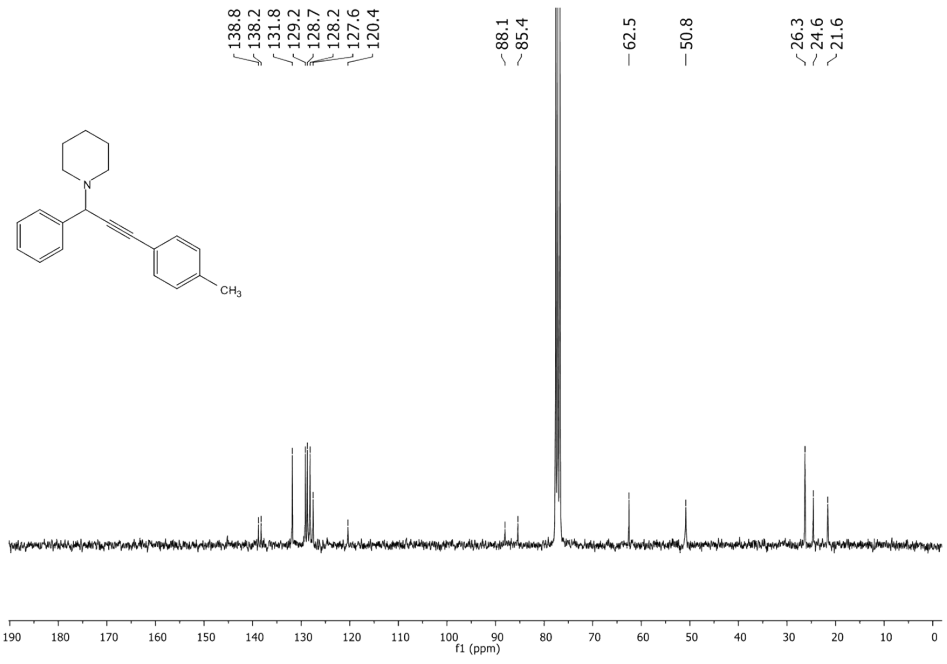

Fig. S6. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of 1-(1-phenyl-3-(p-tolyl)prop-2-yn-1-yl)piperidine (**4c**)

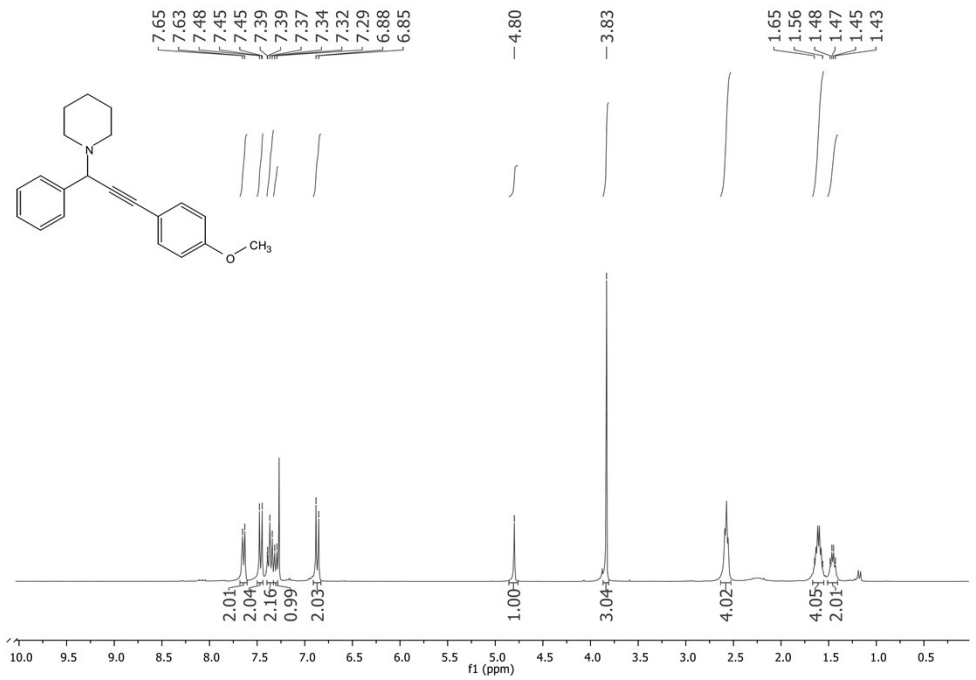

Fig. S7. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-[3-(4-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidin (**4d**)

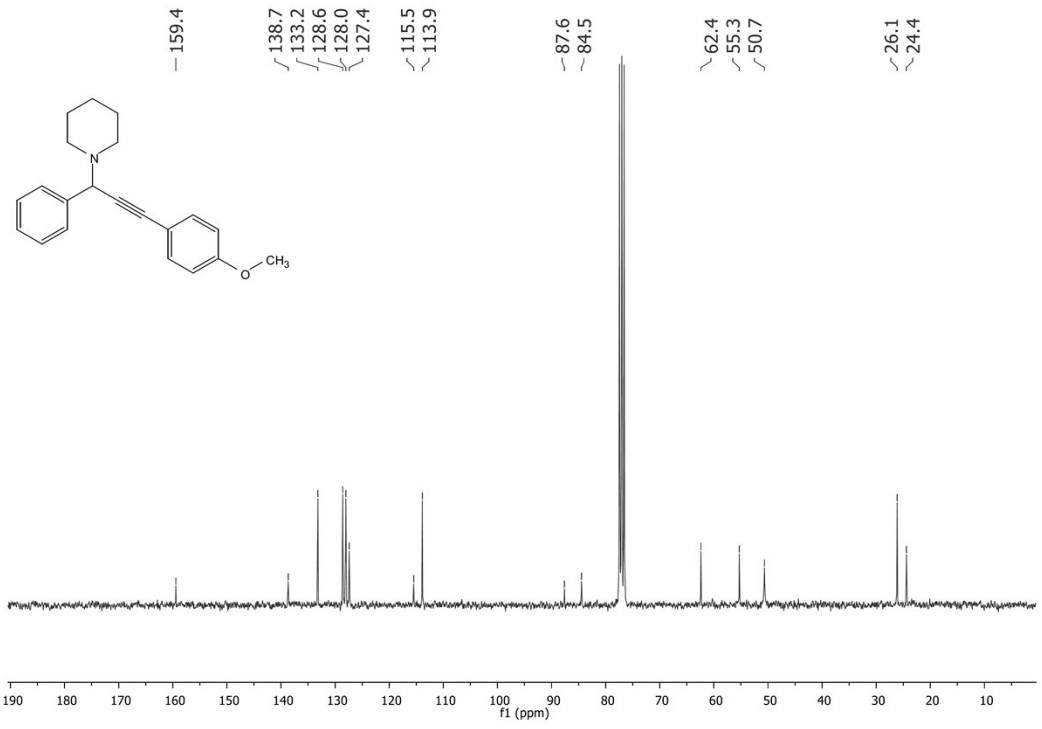

Fig. S8. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-[3-(4-Methoxyphenyl)-1-phenylprop-2-yn-1-yl]piperidin (**4d**)

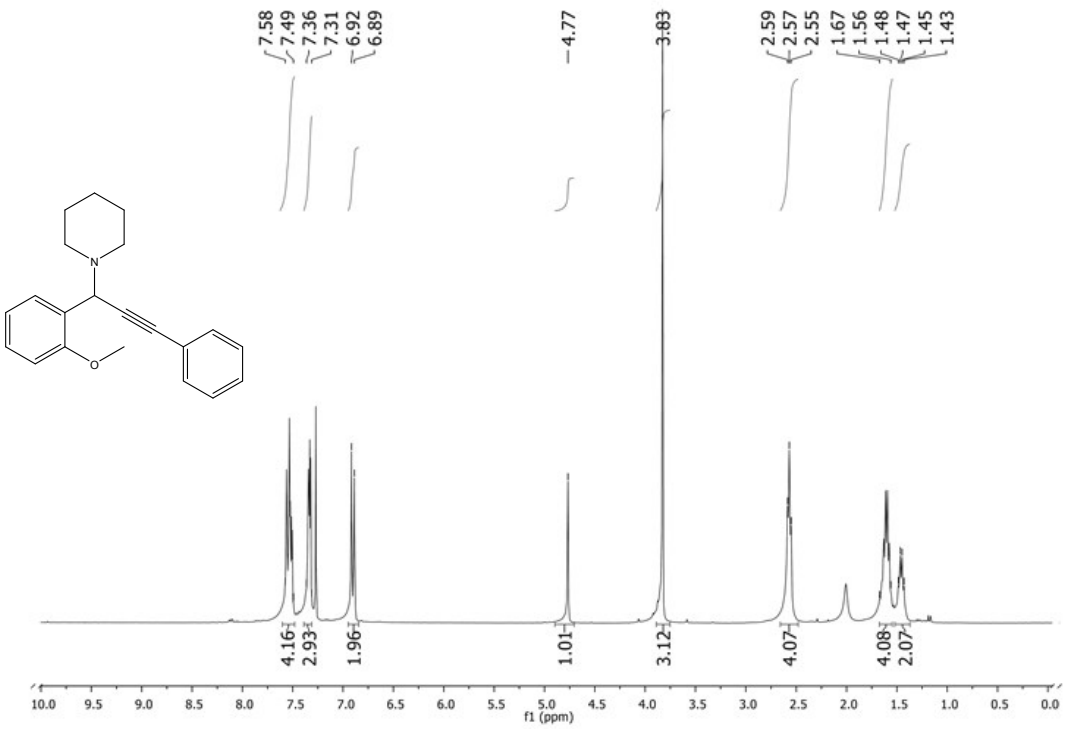

Fig. S9. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-[1-(2-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4e**)

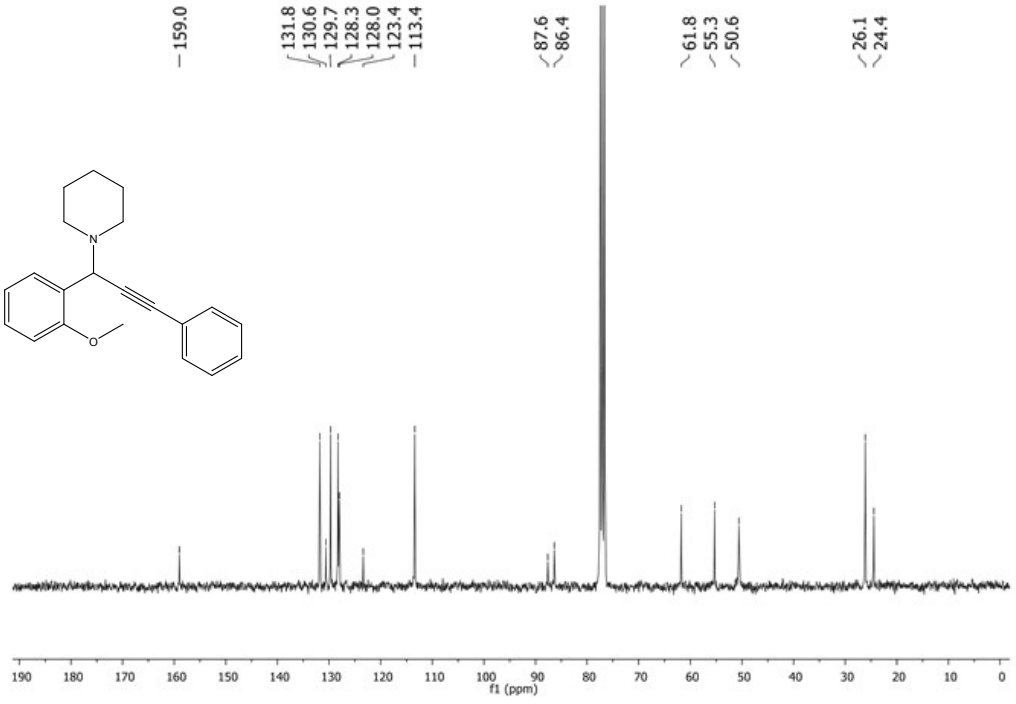

Fig. S10. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-[1-(2-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4e**)

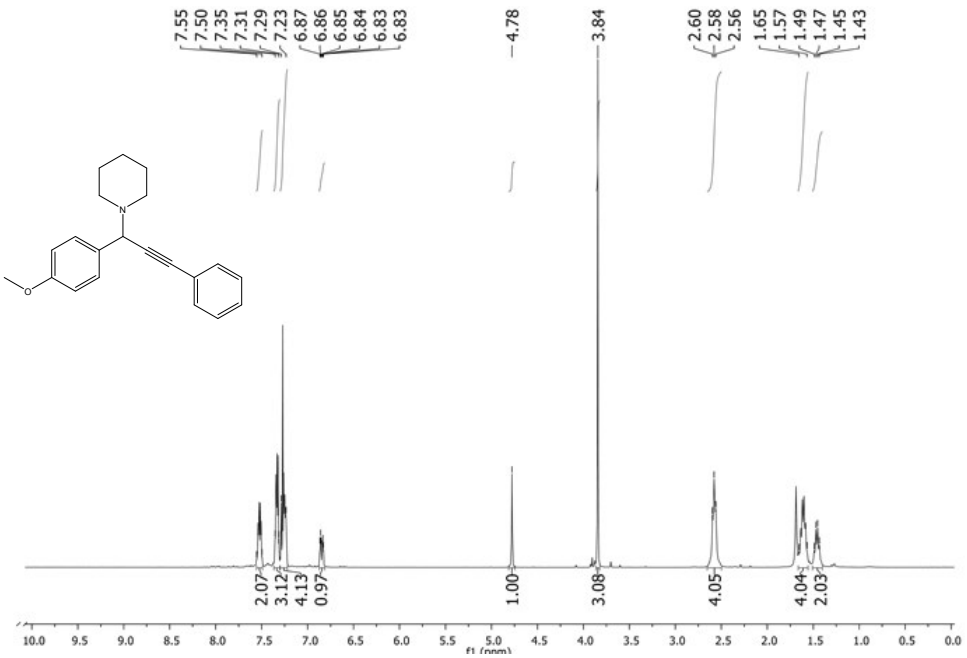

Fig. S11. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-[1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4f**)

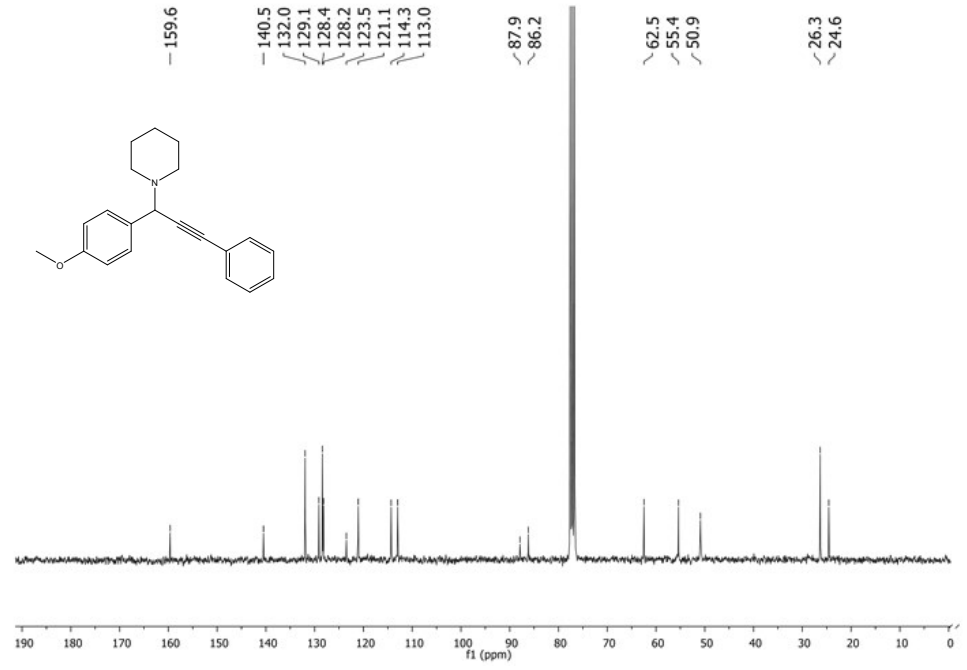

Fig. S12. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-[1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4f**)

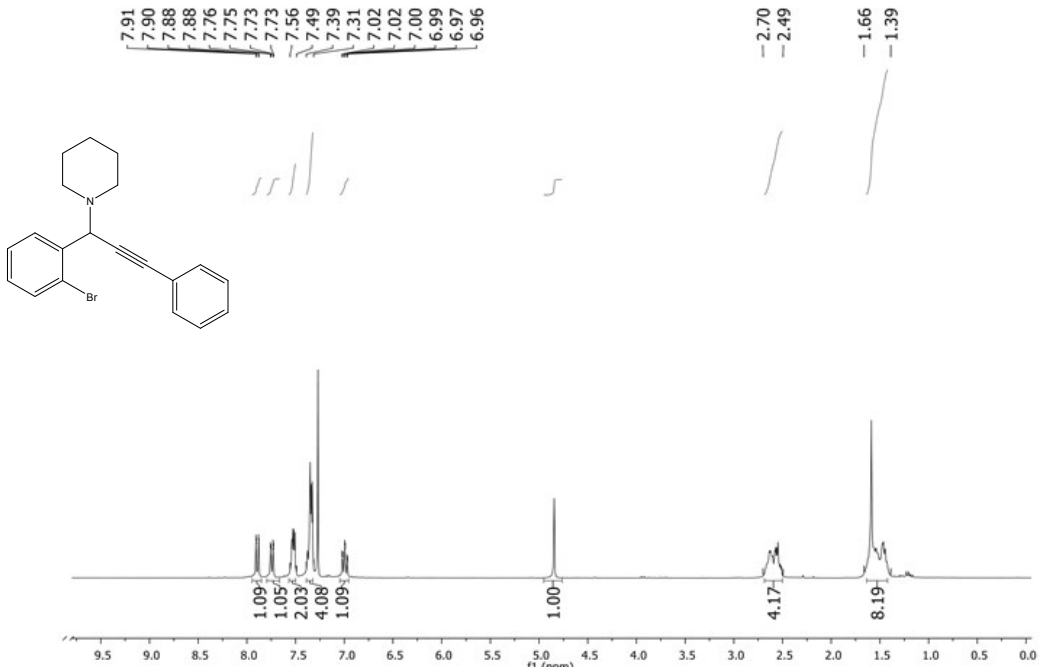

Fig. S13. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-[1-(2-Bromophenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4g**)

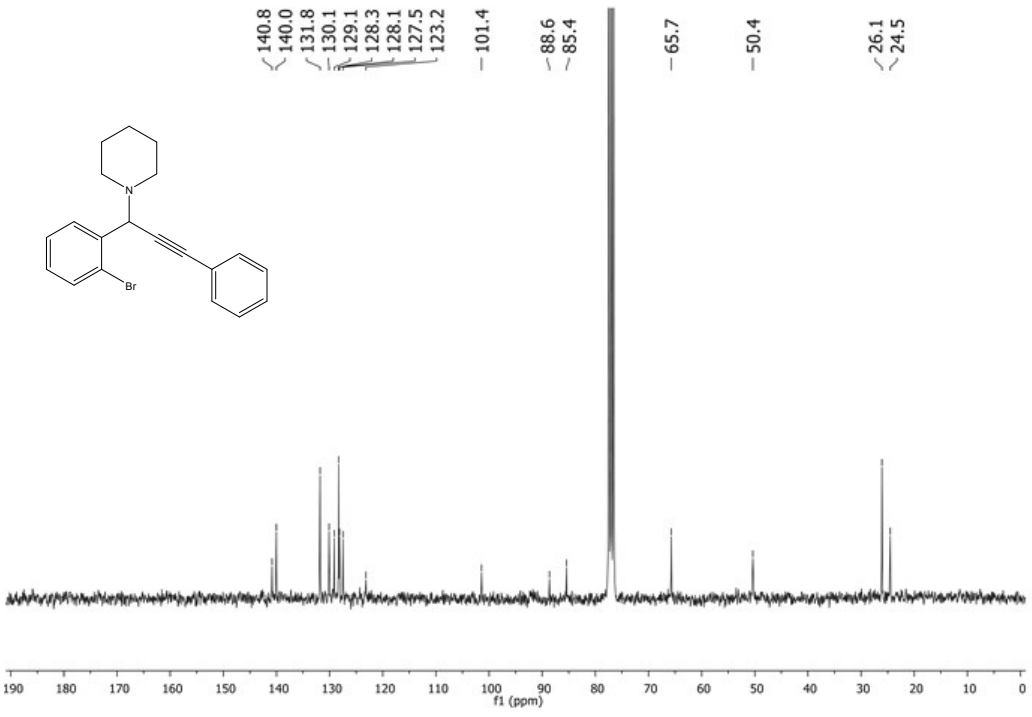

Fig. S14. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-[1-(2-Bromophenyl)-3-phenylprop-2-yn-1-yl]piperidine (**4g**)

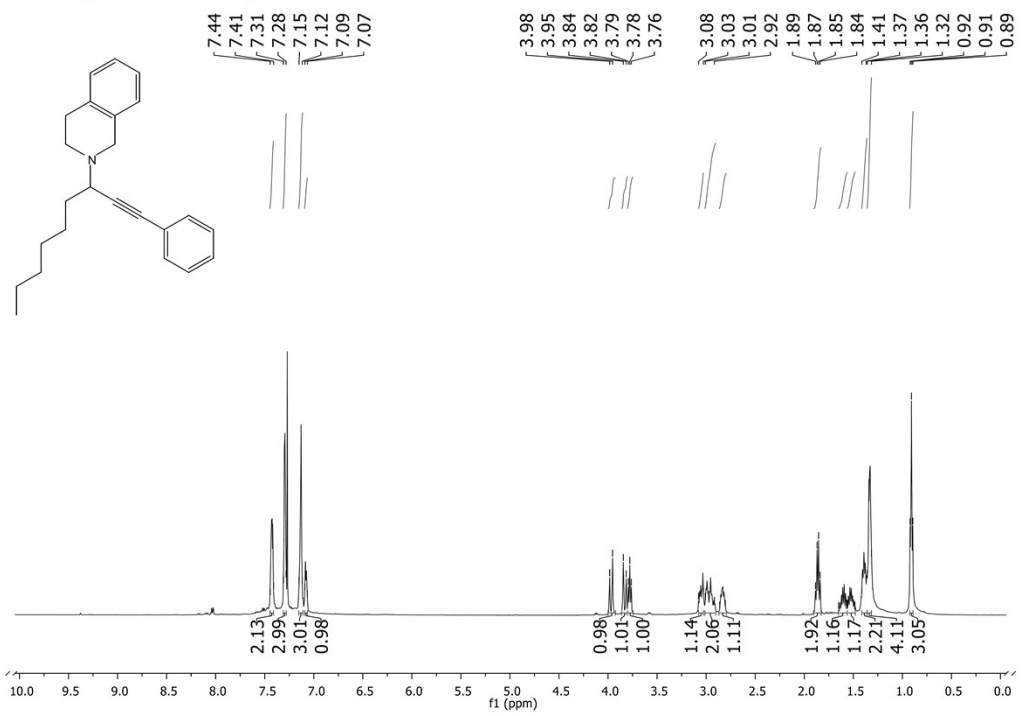

Fig. S15. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1-(1-phenylnon-1-yn-3-yl)-dihydroquinoline (**4h**)

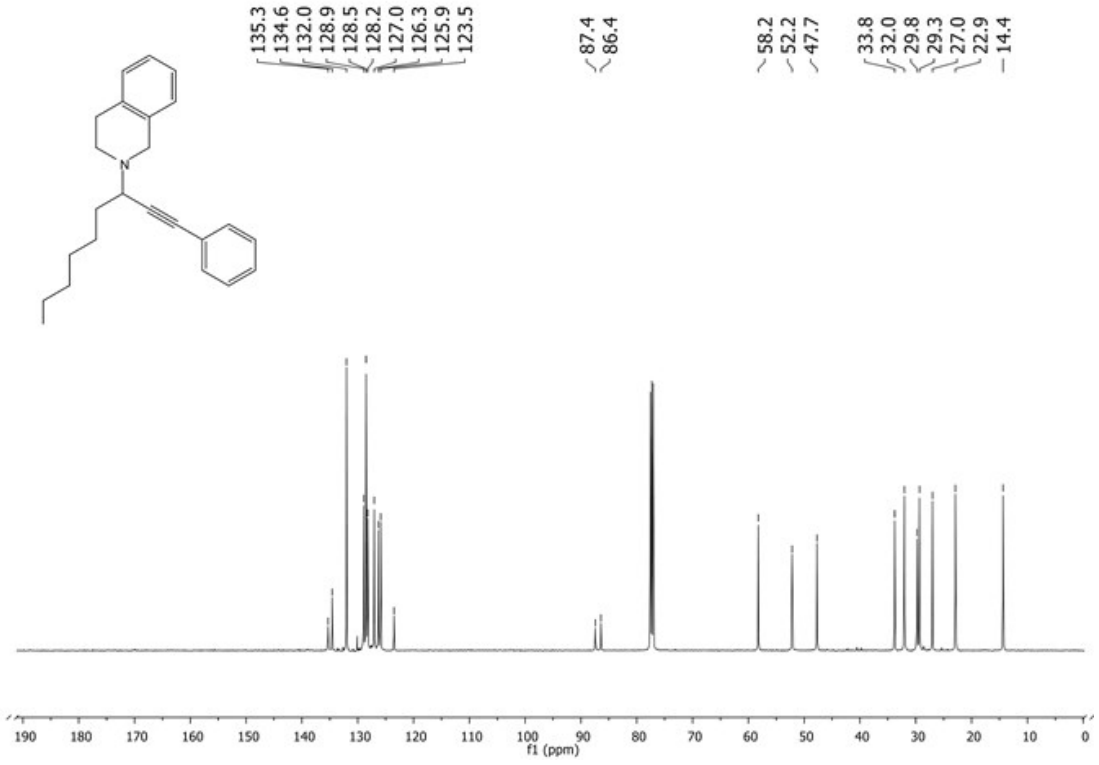

Fig. S16. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1-(1-phenylnon-1-yn-3-yl)-dihydroquinoline (**4h**)

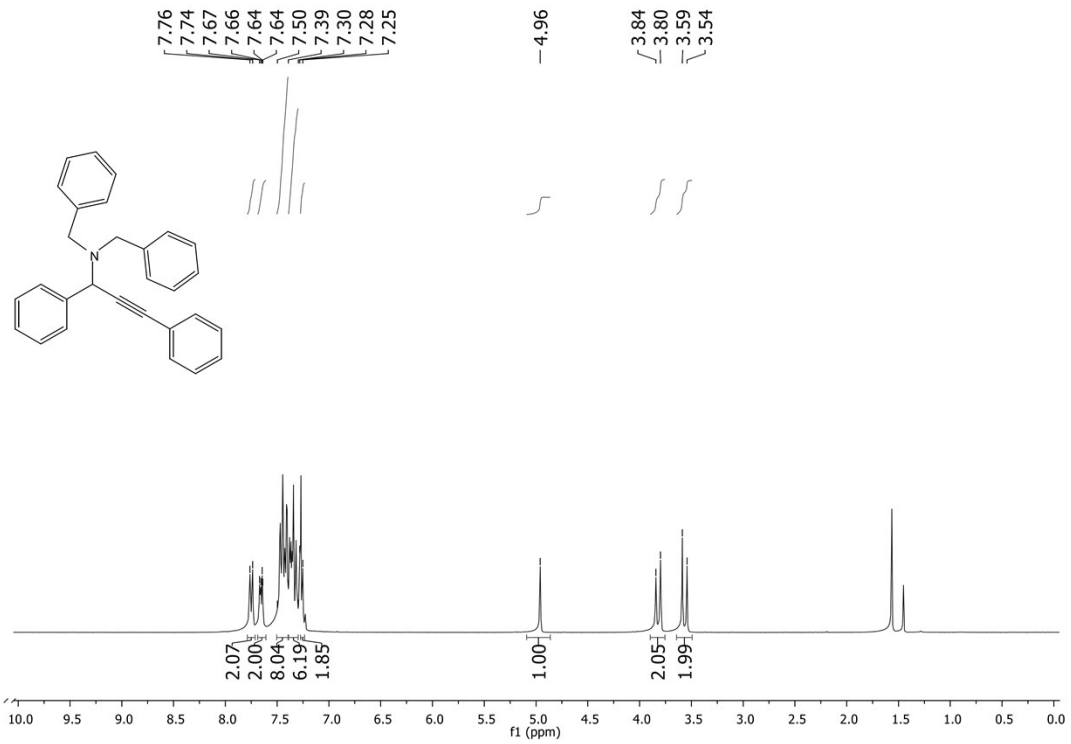

Fig. S17. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N,N-Dibenzyl-1,3-diphenylprop-2-yn-1-amine (**4i**)

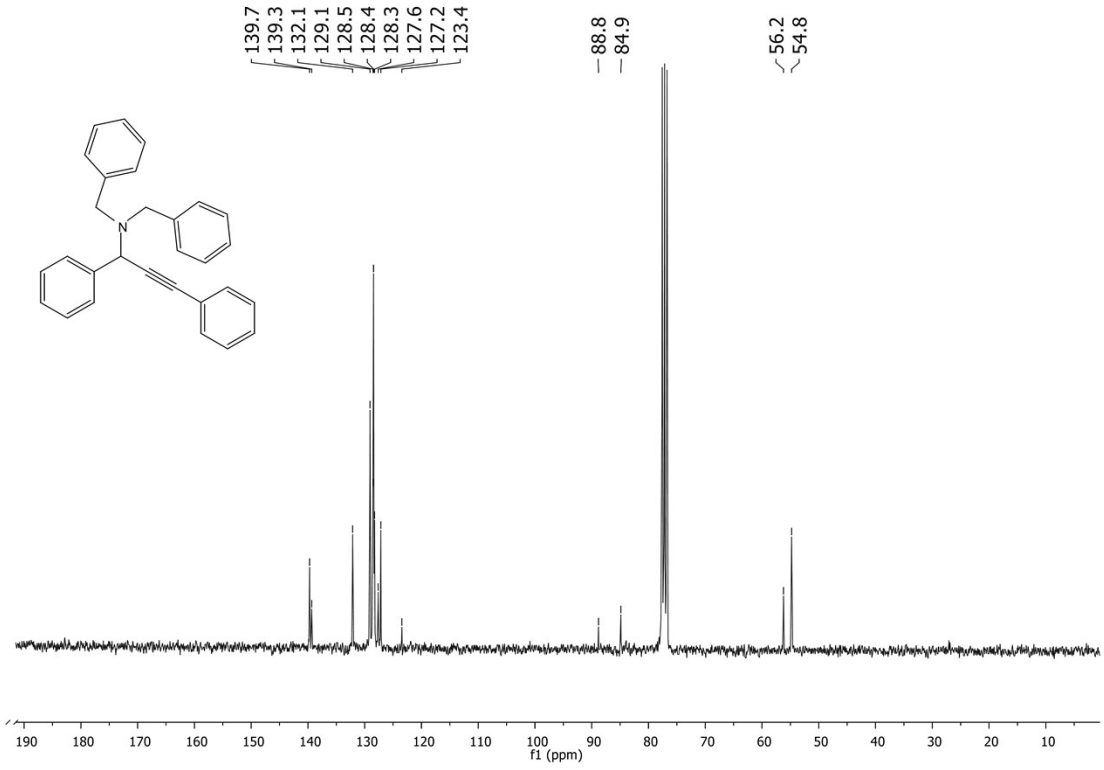

Fig. S18. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N,N-Dibenzyl-1,3-diphenylprop-2-yn-1-amine (**4i**)

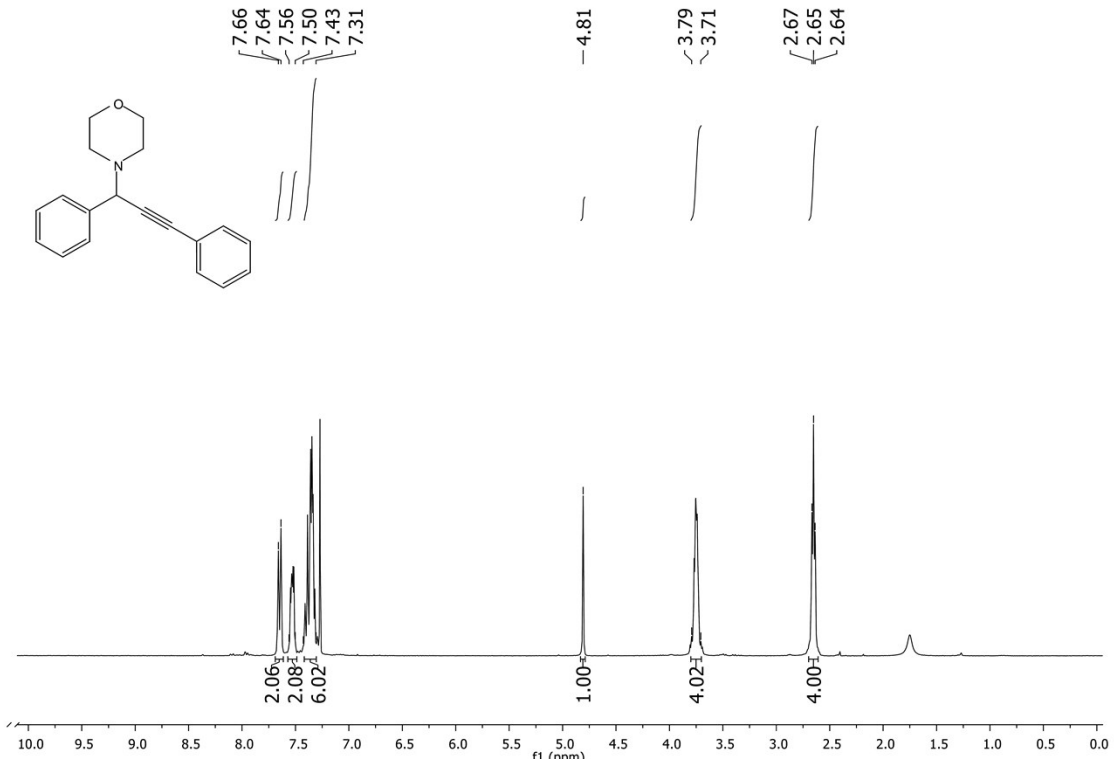

Fig. S19. ^{1}H NMR (300 MHz, $CDCl_3$) spectrum of N-(1,3-Diphenylprop-2-yn-1-yl) morpholine (**4j**)

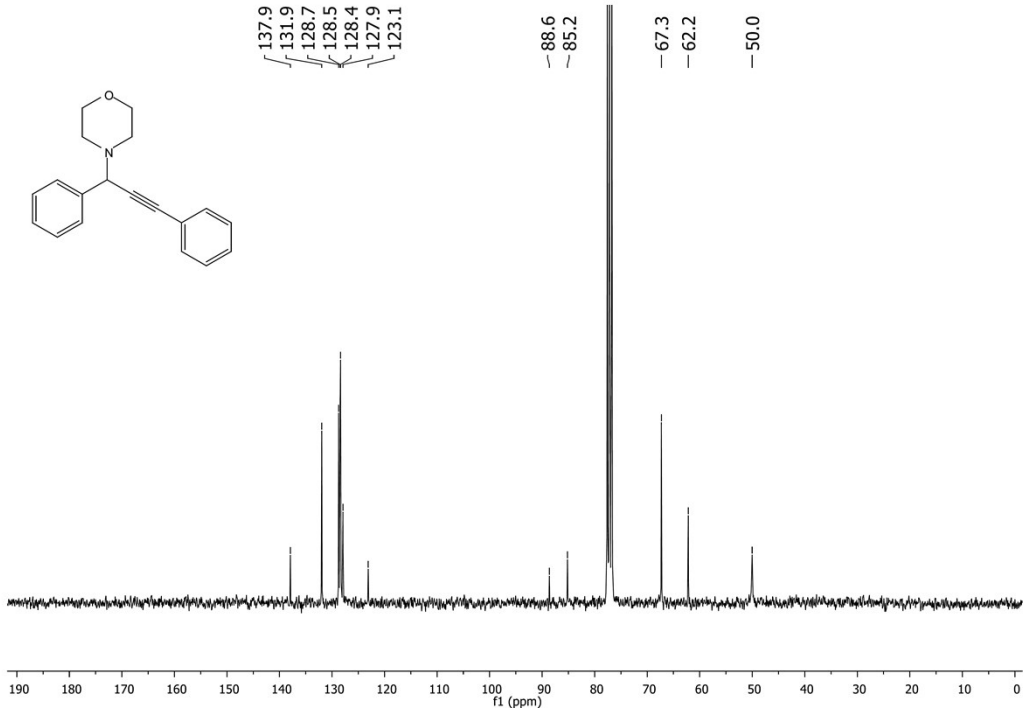

Fig. S20. ^{13}C NMR (75 MHz, $CDCl_3$) spectrum of N-(1,3-Diphenylprop-2-yn-1-yl) morpholine (**4j**)

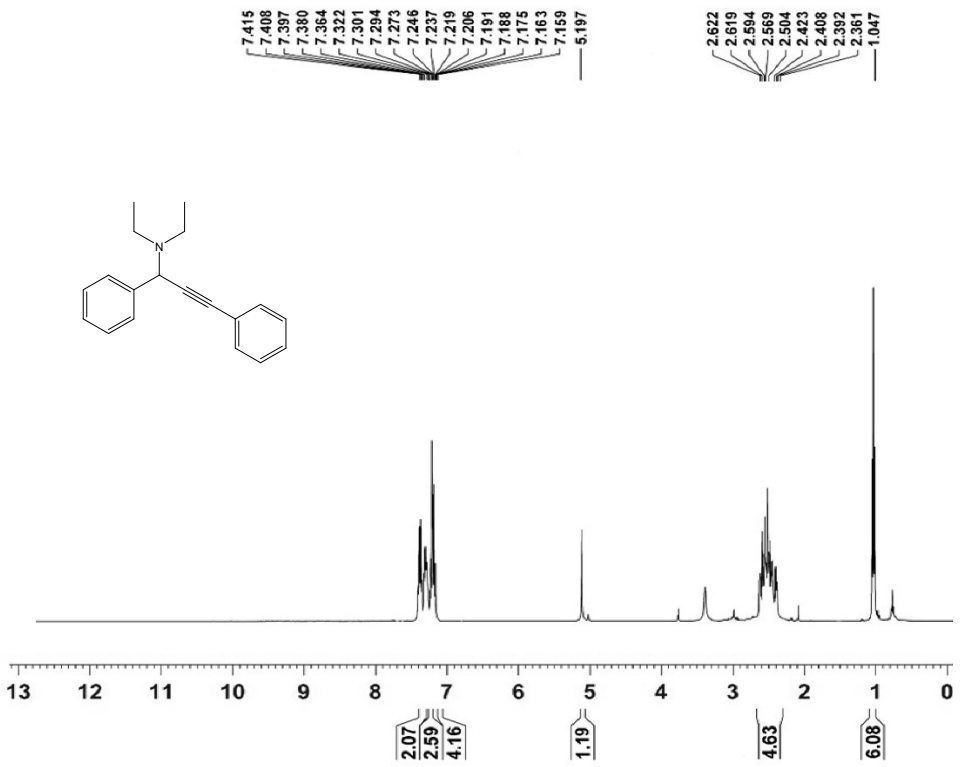

Fig. S21. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of N,N-Diethyl-1,3-diphenylprop-2-yn-1-amine (**4k**)

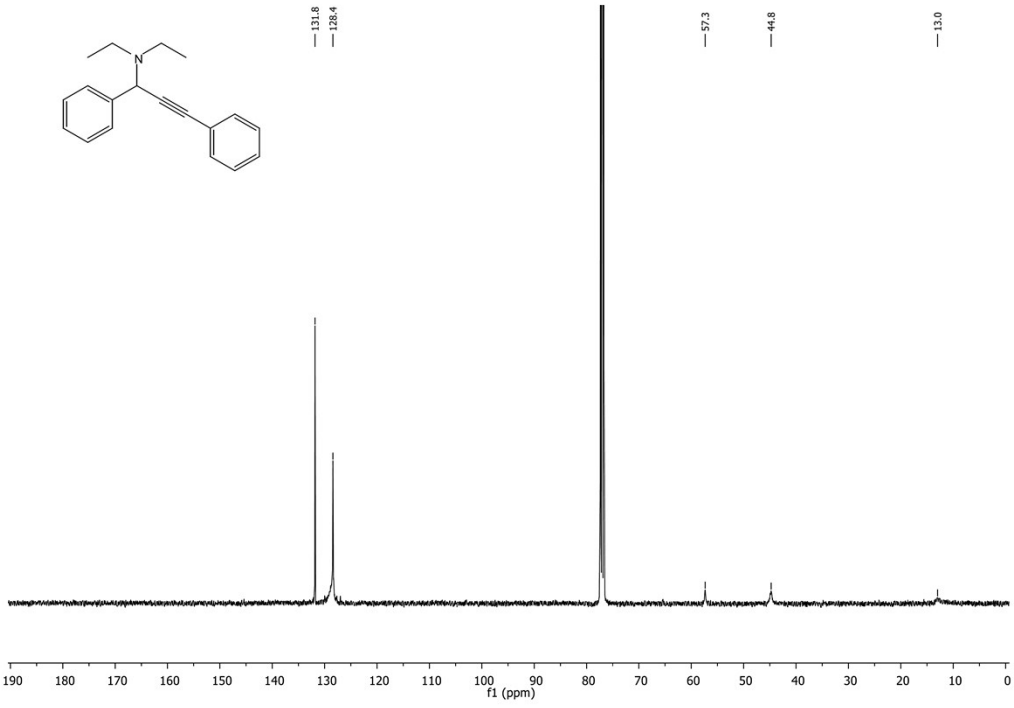

Fig. S22. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of N,N-Diethyl-1,3-diphenylprop-2-yn-1-amine (**4k**)

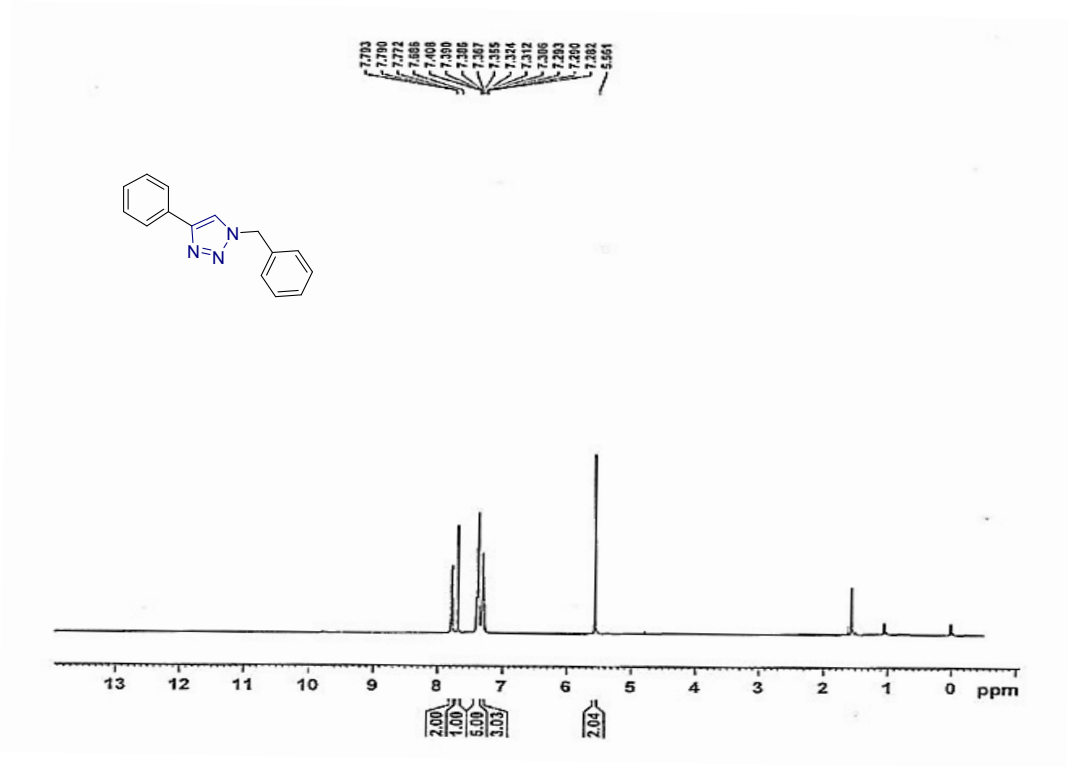

Fig. S23. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 1-benzyl-4-phenyl-1H-1,2,3-triazole (**7a**)

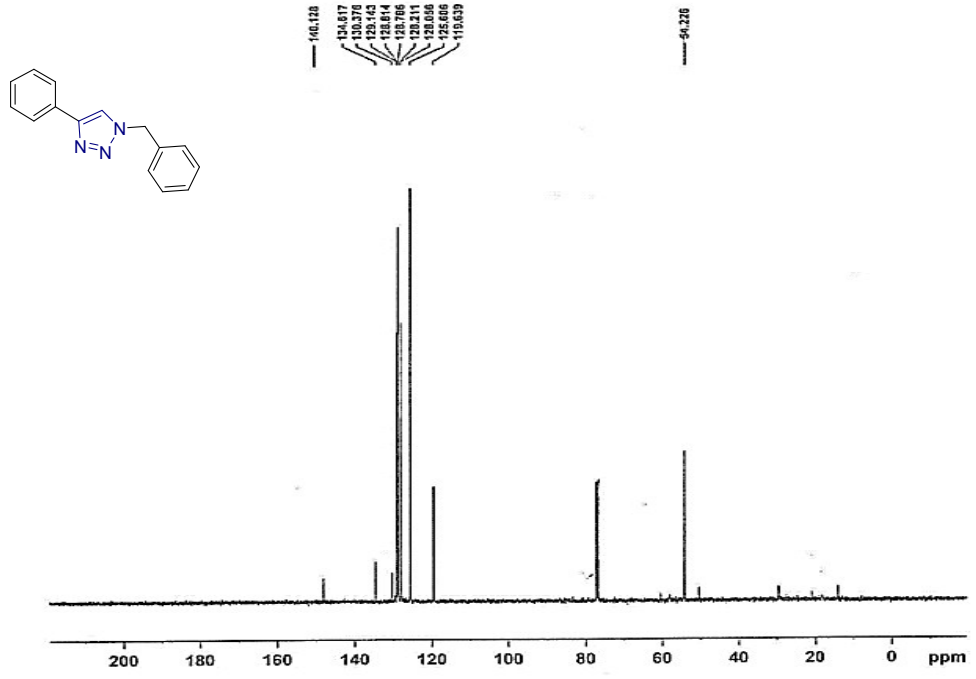

Fig. S24. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 1-benzyl-4-phenyl-1H-1,2,3-triazole (**7a**)

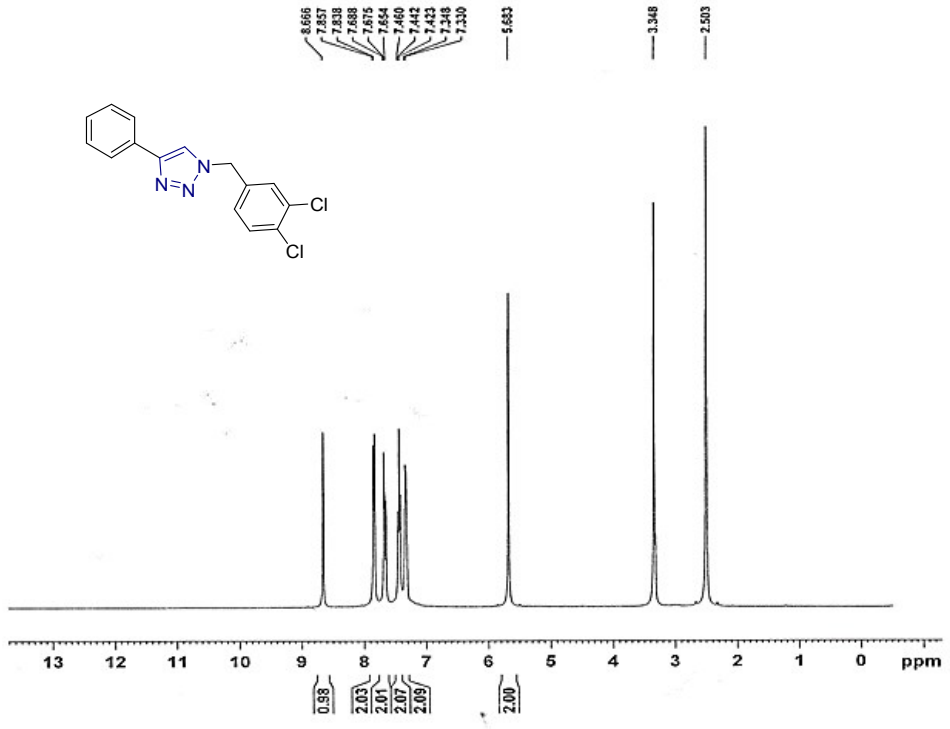

Fig. S25. ^{1}H NMR (400 MHz, DMSO) spectrum of 1-(3,4-dichlorobenzyl)-4-phenyl-1H-1,2,3-triazole (**7b**)

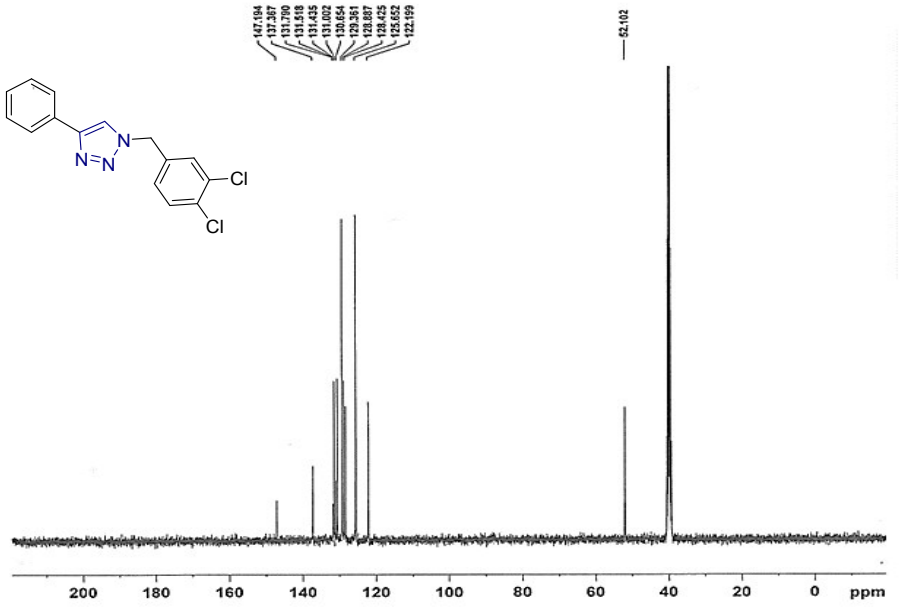

Fig. S26. ^{13}C NMR (101 MHz, DMSO) spectrum of 1-(3,4-dichlorobenzyl)-4-phenyl-1H-1,2,3-triazole (**7b**).

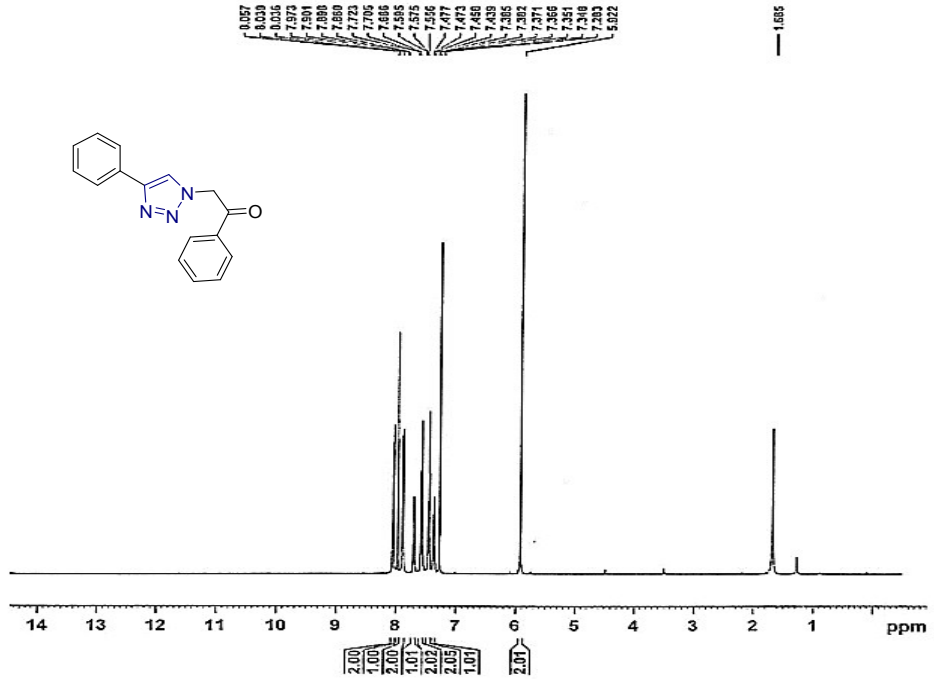

Fig. S27. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethan-1-one (**7c**)

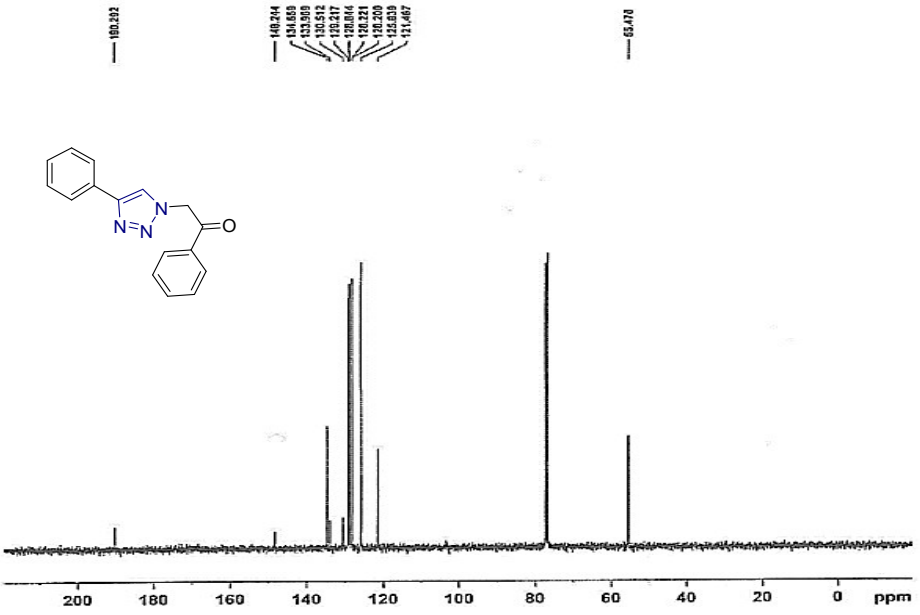

Fig. S28. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethan-1-one (**7c**)

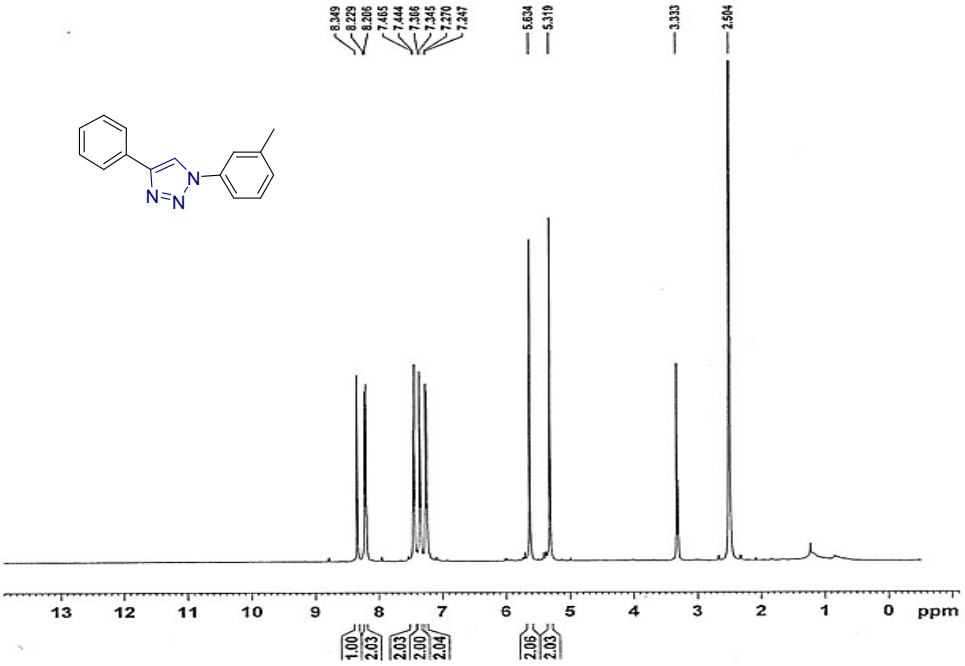

Fig. S29. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 4-phenyl-1-(m-tolyl)-1H-1,2,3-triazole (**7d**)

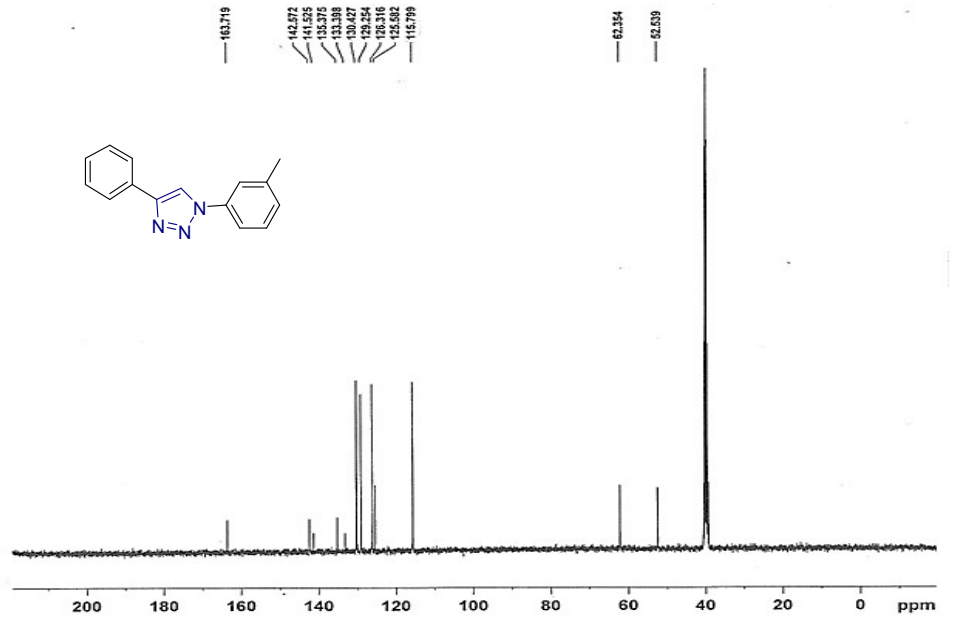

Fig. S30. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 4-phenyl-1-(m-tolyl)-1H-1,2,3-triazole (**7d**)

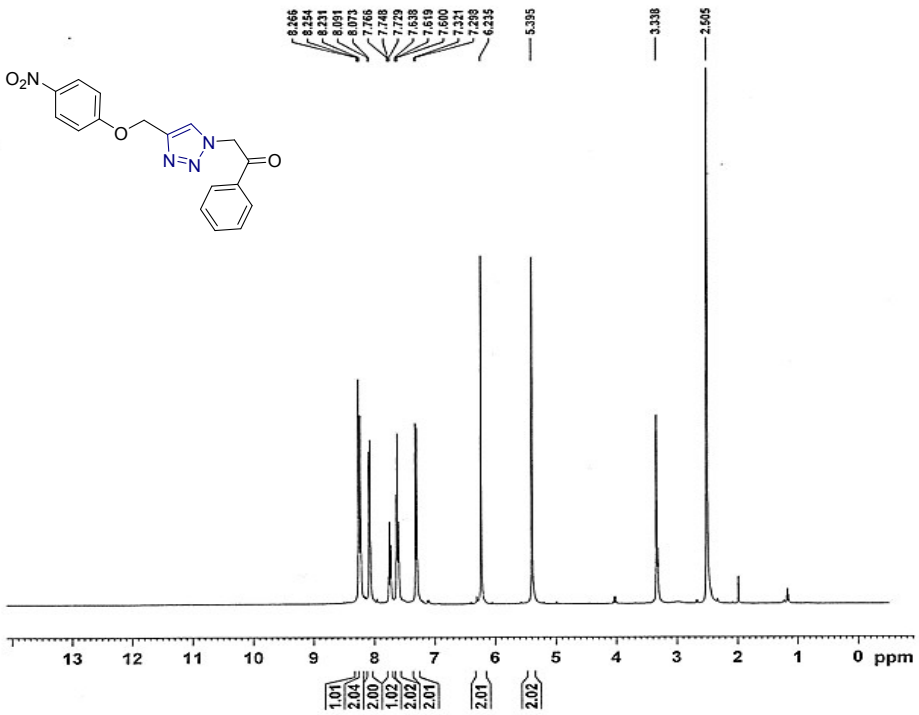

Fig. S31. [1]H NMR (400 MHz, DMSO) spectrum of 2-(4-((4-nitrophenoxy)methyl)-1H-1,2,3-triazol-1-yl)-1-phenylethan-1-one (**7e**)

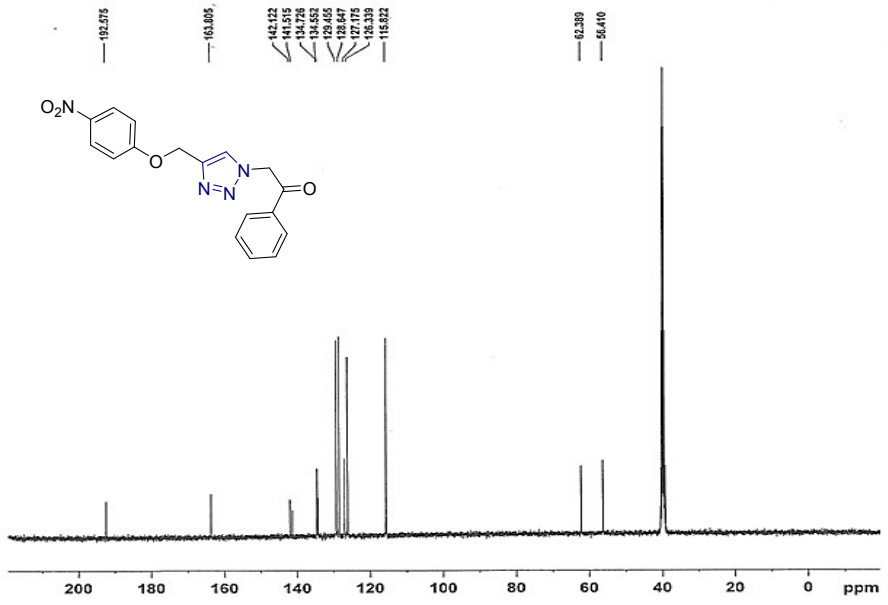

Fig. S32. [13]C NMR (101MHz, DMSO) spectrum of 2-(4-((4-nitrophenoxy)methyl)-1H-1,2,3-triazol-1-yl)-1-phenylethan-1-one (**7e**)

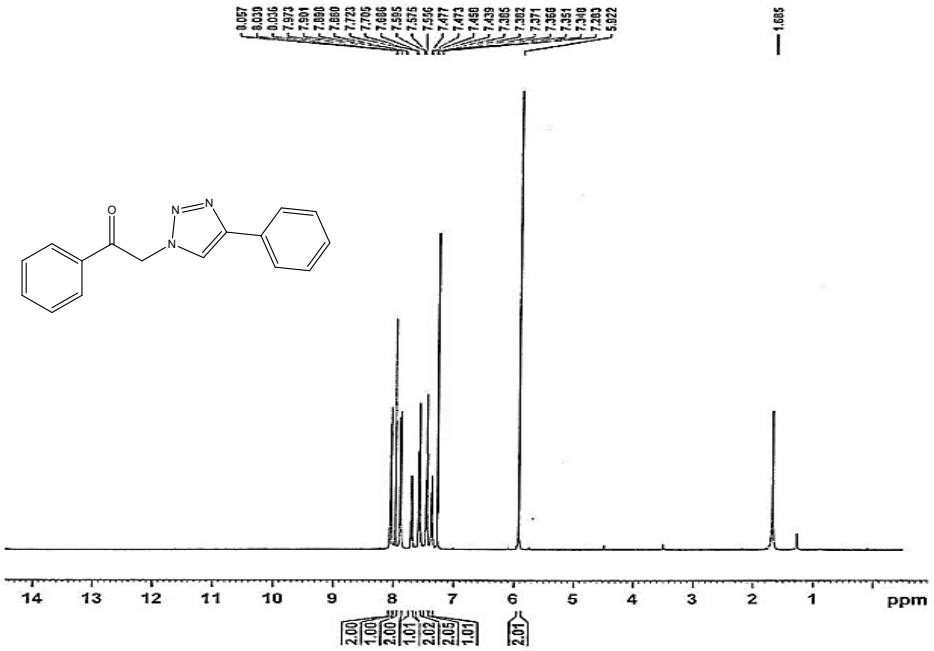

Fig. S33. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of .1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethenone (**7f**)

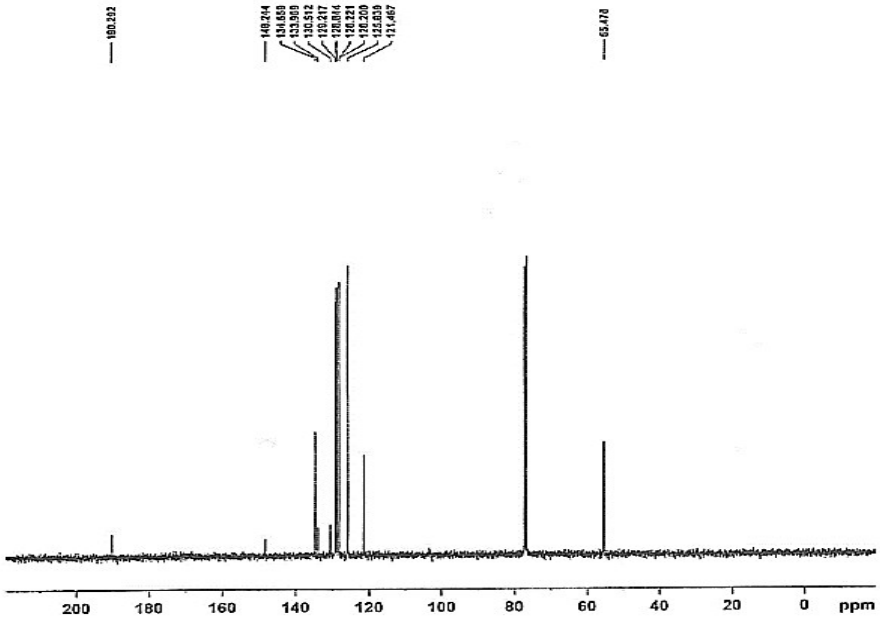

Fig. S34. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 1-phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethenone (**7f**)

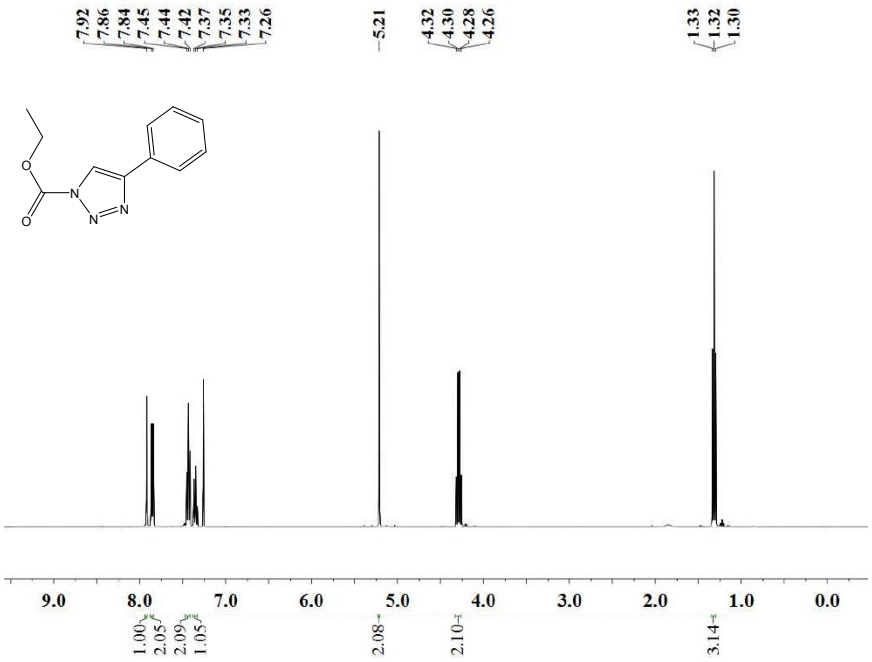

Fig. S35. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of ethyl 2-(4-phenyl-1H-1,2,3-triazol-1-yl) acetate (**7g**)

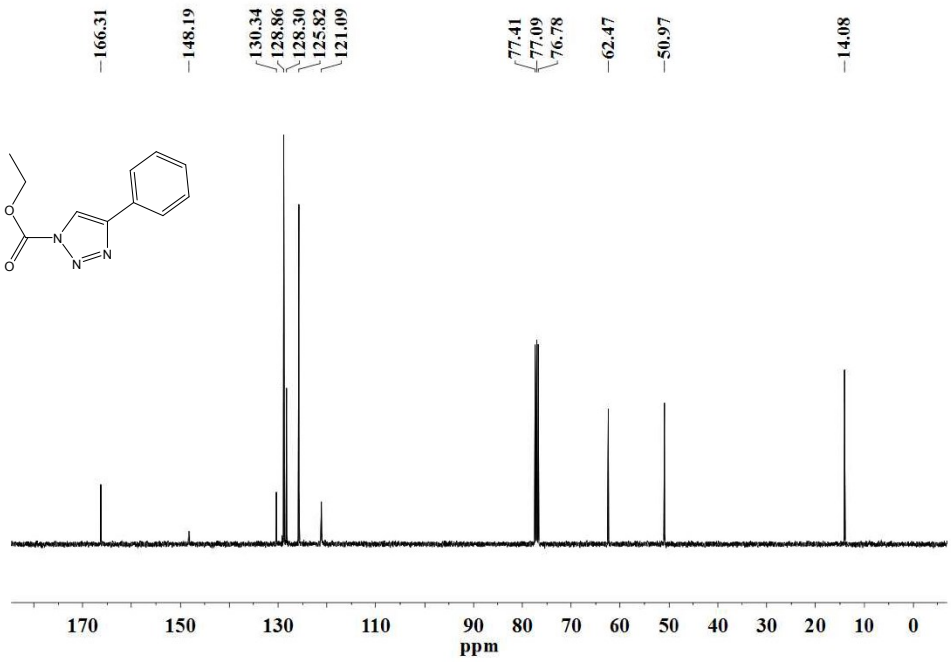

Fig. S36. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of ethyl 2-(4-phenyl-1H-1,2,3-triazol-1-yl) acetate (**7g**)

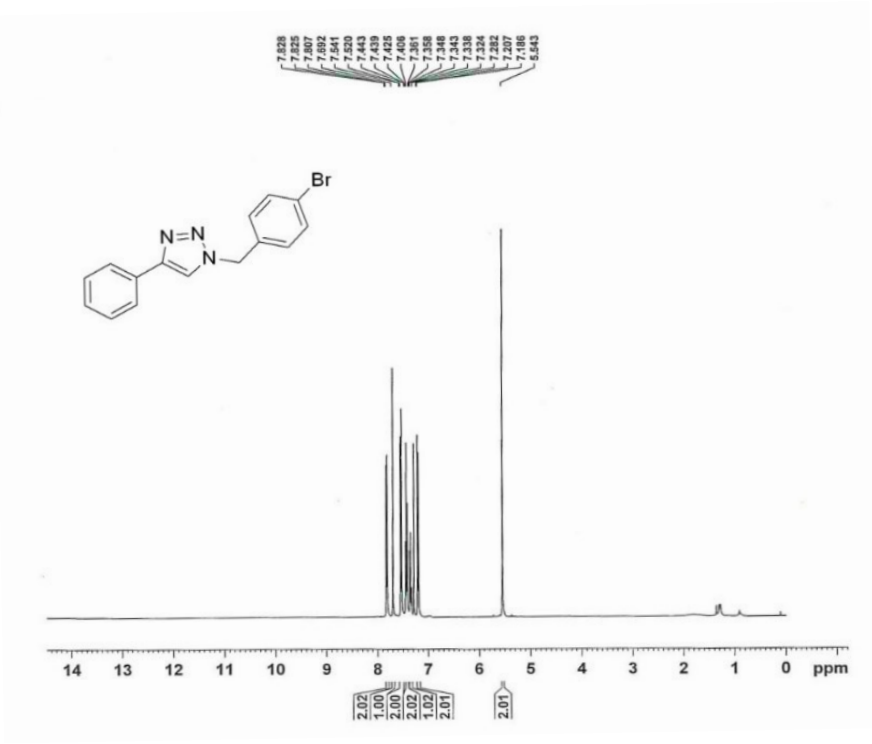

Fig. S37. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 1-(4-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (**7h**)

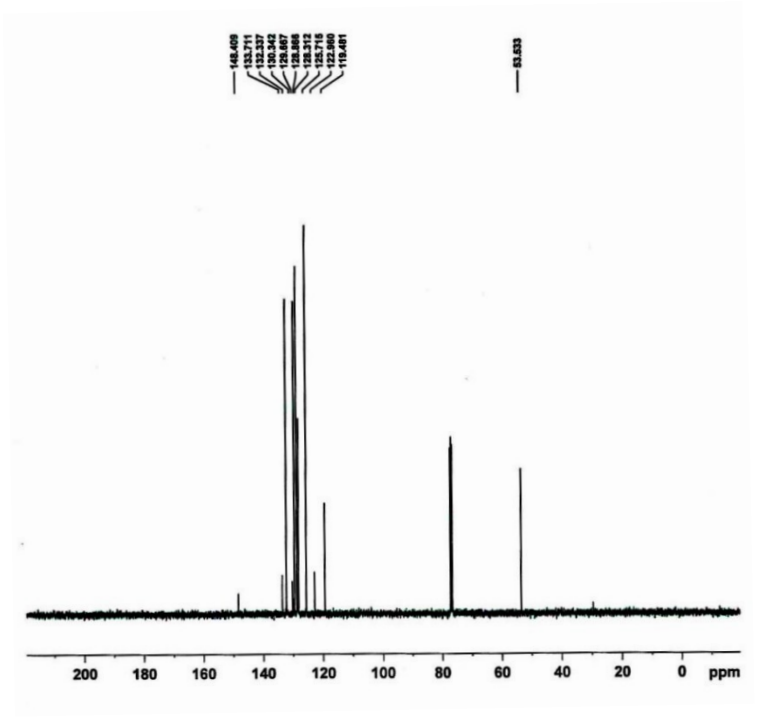

Fig. S38. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 1-(4-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (**7h**)

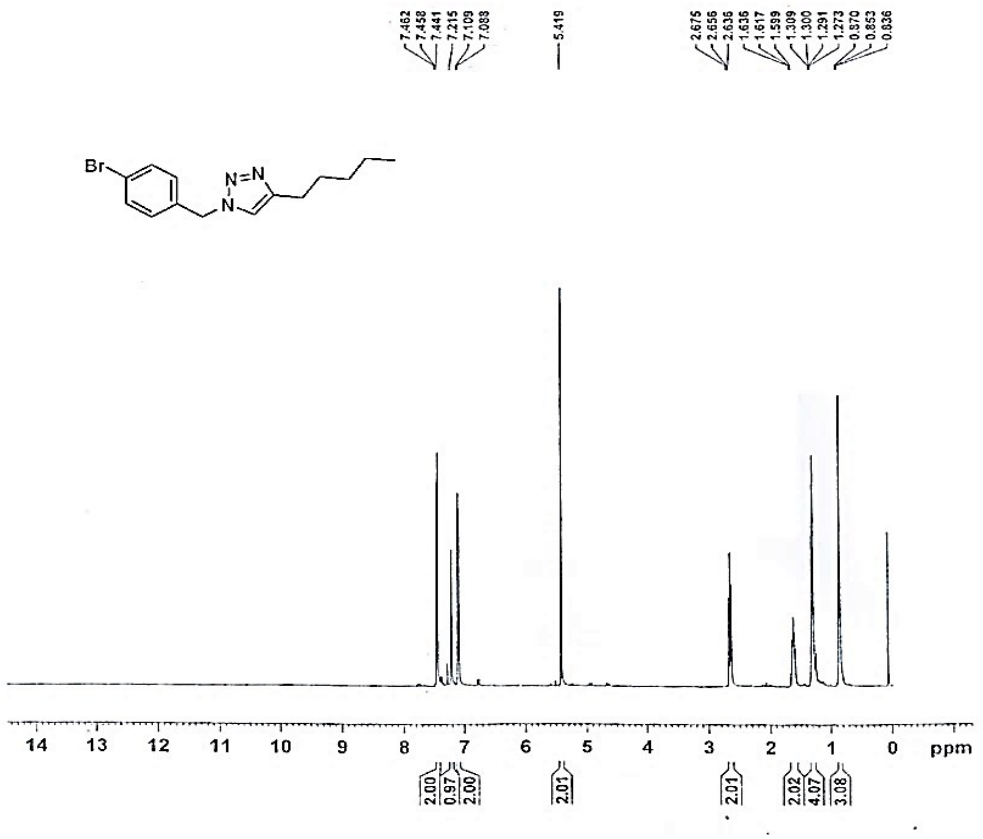

Fig. S39. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 1-(4-bromobenzyl)-4-pentyl-1H-1,2,3-triazole (**7i**)

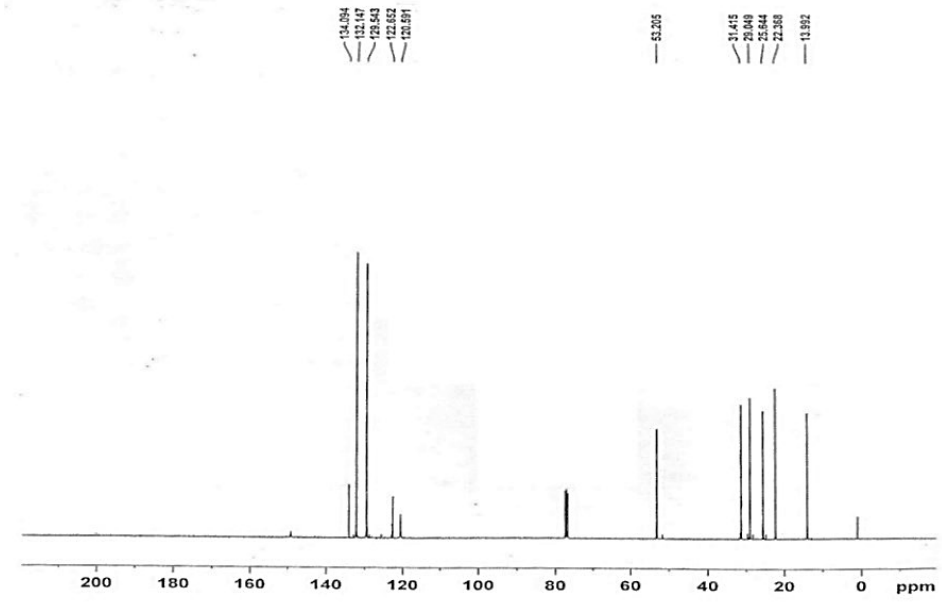

Fig. S40. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 1-(4-bromobenzyl)-4-pentyl-1H-1,2,3-triazole (**7i**)

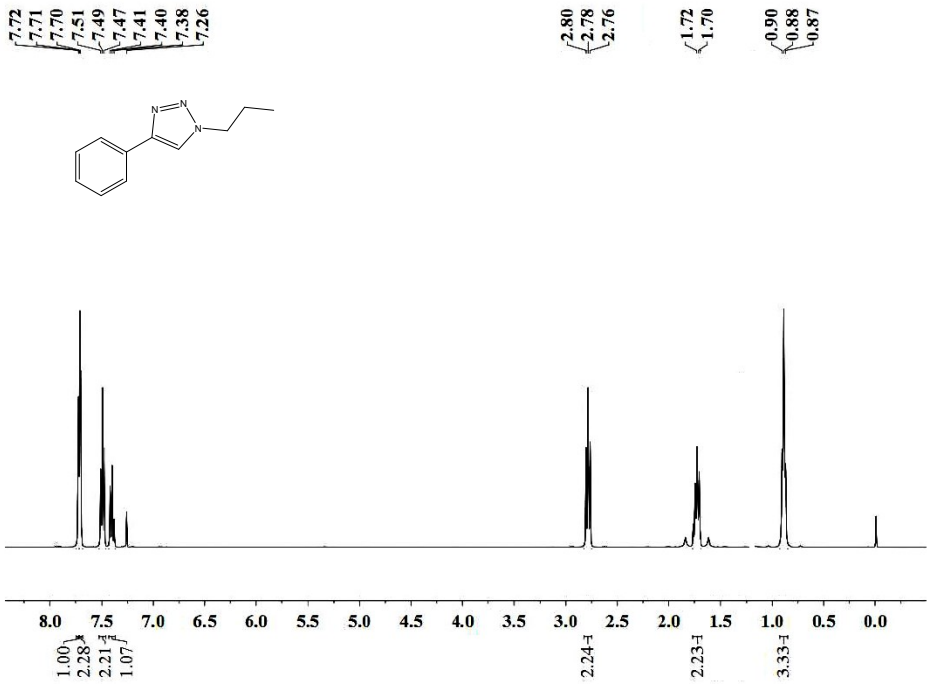

Fig. S41. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 4-phenyl-1-propyl-1H-1,2,3-triazole (**7j**)

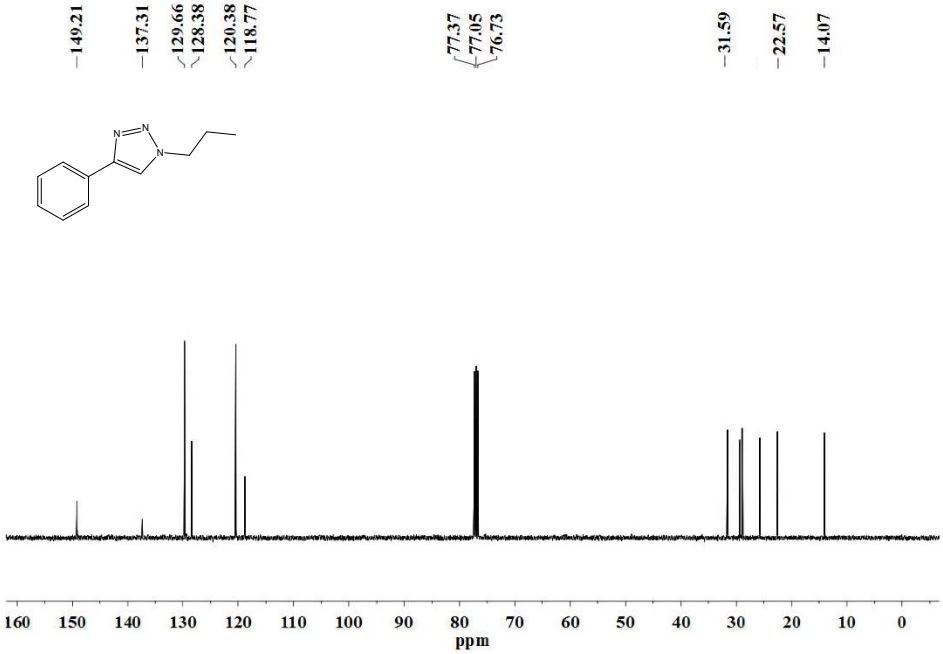

Fig. S42. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 4-phenyl-1-propyl-1H-1,2,3-triazole (**7j**)

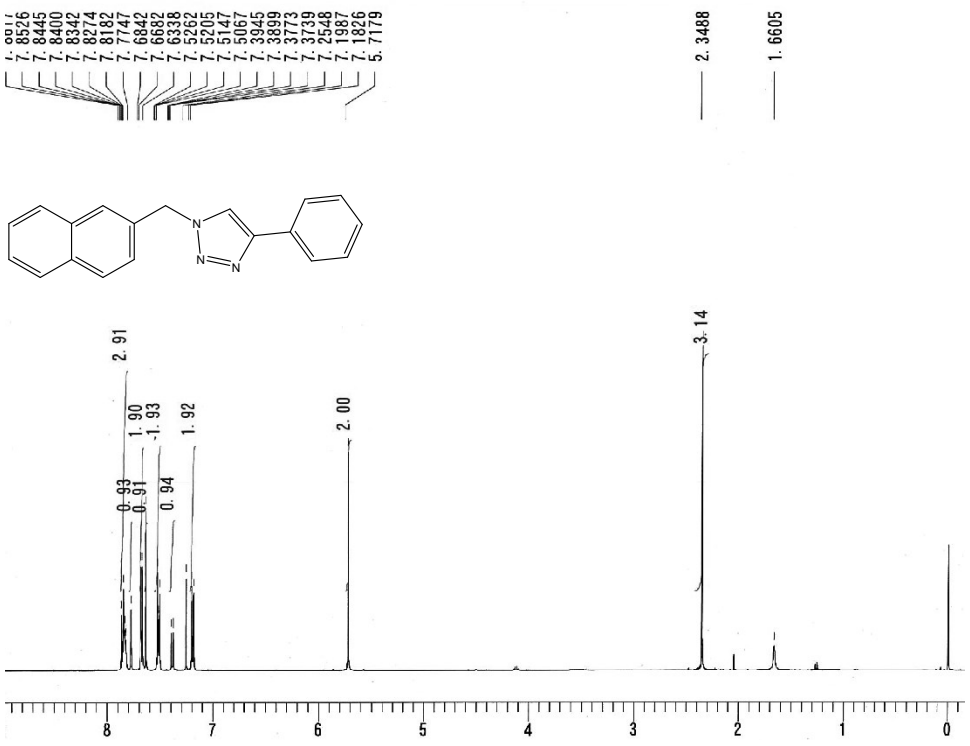

Fig. S43. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1-Naphthale-4-p-tolyl-1H-1,2,3-triazole (**7k**)

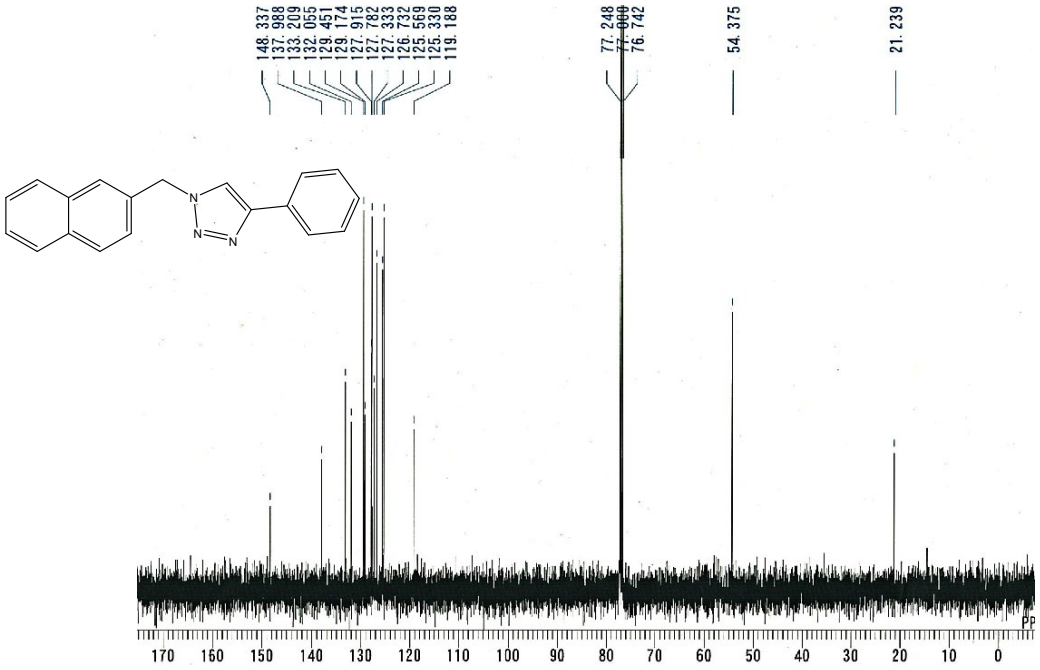

Fig. S44. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1-Naphthale-4-p-tolyl-1H-1,2,3-triazole (**7k**)

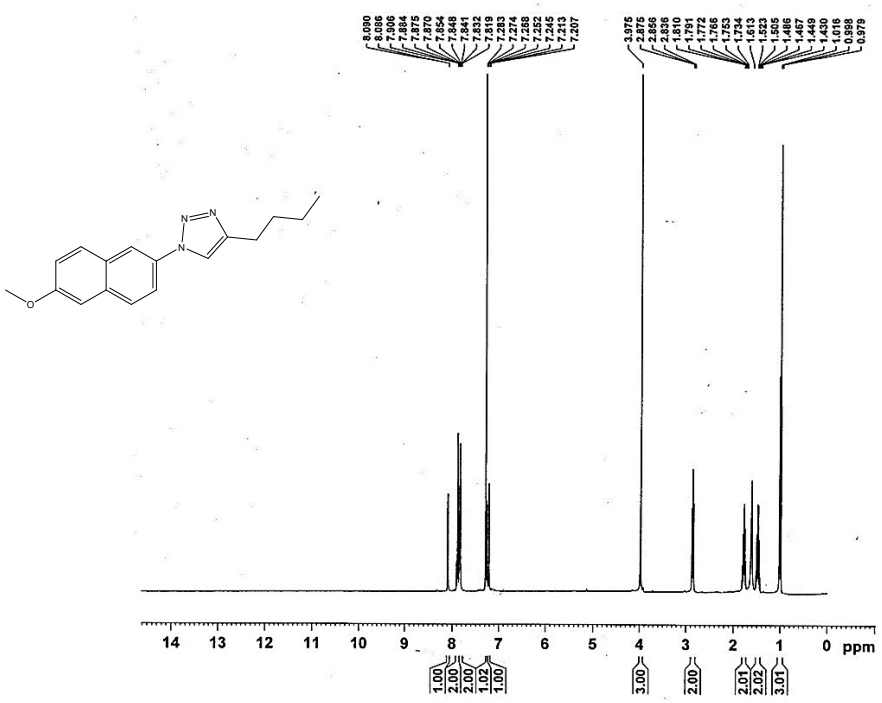

Fig. S45. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 4-butyl-1-(6-methoxynaphthalen-2-yl)-1H-1,2,3-triazole (**7l**)

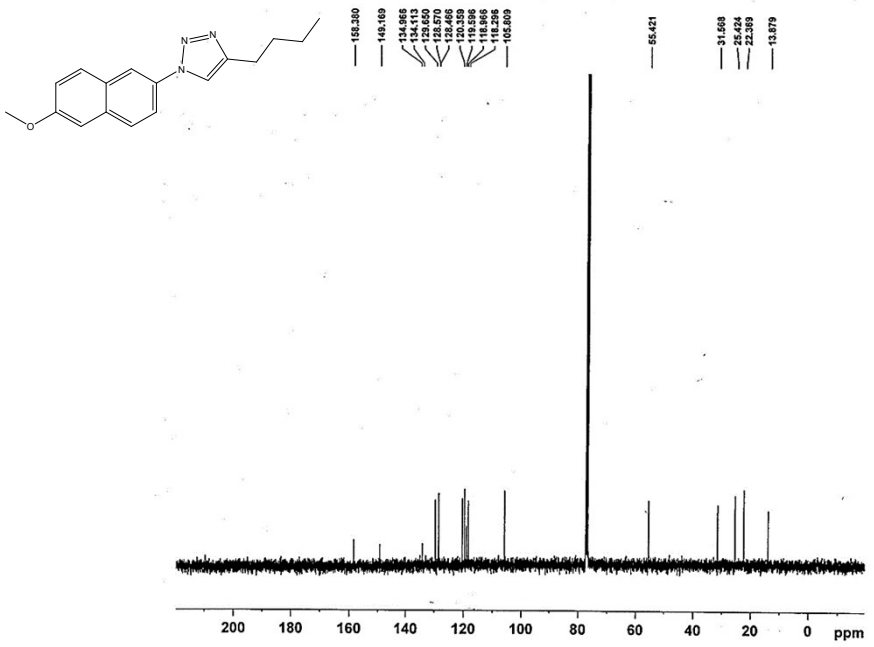

Fig. S46. ^{13}C NMR (101 MHz, $CDCl_3$) spectrum of 4-butyl-1-(6-methoxynaphthalen-2-yl)-1H-1,2,3-triazole (**7l**)