Supporting Information for

Multicomponent Azide-Alkyne Cycloaddition Catalyzed by Impregnated Bimetallic Nickel and Copper on Magnetite

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General Information

XPS analyses were carried out on a VG-Microtech Multilab. XRD analyses were obtained on a BRUKER D-8 ADVANCE diffractometer with Göebel mirror, with a high temperature chamber (up to 900°C), with a X-ray generator KRISTALLOFLEX K 760-80F (3KW, 20-60KV and 5-80mA). TEM images were obtained on a JEOL, model JEM-2010 equipped with an X-ray detector OXFORD INCA Energy TEM 100 for microanalysis (EDS). XRF analyses were obtained on a PHILIPS MAGIX PRO (PW2400) X-ray spectrometer equipped with a rhodium X-ray tube and a beryllium window. BET isotherms were carried out on a AUTOSORB-6 (Quantachrome), using N2. Melting points were obtained with a Reichert Thermovar apparatus. NMR spectra were recorded on a Bruker AC-300 (300 MHz for $^1$H and 75 MHz for $^{13}$C) using CDCl$_3$ as a solvent and TMS as internal standard for $^1$H and $^{13}$C; chemical shifts are given in δ (parts per million) and coupling constants ($J$ in Hertz. FT-IR spectra were obtained on a JASCO 4100LE (Pike Miracle ATR) spectrophotometer. Mass spectra (EI) were obtained at 70 eV on a Himazdu QP-5000 spectrometer, giving fragment ions in m/z with relative intensities (%) in parentheses. Thin layer chromatography (TLC) was carried out on Schleicher & Schuell F1400/LS 254 plates coated with a 0.2 mm layer of silica gel; detection by UV$_{254}$ light, staining with phosphomolybdic acid [25 g phosphomolybdic acid, 10 g Ce(SO$_4$)$_2$ 4 H$_2$O, 60 mL of concentrated H$_2$SO$_4$ and 940 mL H$_2$O]. Column chromatography was performed using silica gel 60 of 40-63 mesh. All reagents were commercially available (Acros, Aldrich, Fluorochem) and were used as received. The ICP-MS analyses were carried out on a Thermo Elemental VGPQ-ExCell spectrometer. The Elemental Analysis was performed on a Elemental Microanalyzer Thermo Finningan Flash 1112 Series.

Particle Size Distribution for the Two-Component Reaction

![CuO-Fe$_3$O$_4$ Catalyst](image)
**General procedure for the preparation of NiO/Cu-Fe$_3$O$_4$ catalyst**

To a stirred solution of CuCl$_2$ (1 mmol, 130 mg) and NiCl$_2$·H$_2$O (1 mmol, 130 mg) in deionized water (120 mL) was added commercially available Fe$_3$O$_4$ (4 g, 17 mmol, powder < 5 µm, BET area: 9.86 m$^2$/g). After 10 minutes at room temperature, the mixture was slowly basified with NaOH (1M) until pH around 13. The mixture was stirred during one day at room temperature in air. After that, the catalyst was filtered and washed several times with deionized water (3 × 10 mL). The solid was dried at 100°C during 24h in a standard glassware oven, obtaining thereafter the expected catalyst.

**Auger Spectroscopy**

**Before reaction**

![Auger Spectroscopy Graph](image-url)
XPS Data

Before reaction

![XPS Data Graph]

![XPS Data Graph](below)
After reaction
TEM Images

Before reaction

After reaction
General procedures for the preparation of the products

To a stirred solution of sodium azide (6, 2 mmol) and benzyl halide (5, 2 mmol) were added NiO/Cu-Fe₃O₄ (50 mg, 0.9 mol% of Ni, 0.9 mol% of Cu) and the corresponding alkyne (1 or 7, 1 mmol). The resulting mixture was stirred at 50°C until the end of reaction. The catalyst was removed by a magnet and the resulting mixture was quenched with deionised water and extracted with AcOEt (3 × 5 mL). The organic phases were dried over MgSO₄, followed by evaporation under reduced pressure to remove the solvent. The product was usually purified by chromatography on silica gel (hexane/ethyl acetate) to give the corresponding products 3 or 8. Physical and spectroscopic data, as well as references for known compounds, follow:
1-benzyl-4-phenyl-1H-1,2,3-triazole (3a): White solid; m.p. 104-108°C (hexane/AcOEt); IR (cm\(^{-1}\)):3021, 2920, 1450, 1223; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.57 (s, 2H), 7.3-7.45 (m, 8H), 7.66 (s, 1H), 7.75-7.8 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 54.2, 119.4, 125.2 (2C), 128.0 (2C), 128.1, 128.8 (3C), 129.1 (2C), 130.5, 134.7, 148.2; EI-MS \(m/z\): 235 (M\(^+\), 22%), 207 (14), 206 (71), 180 (13), 179 (11), 116 (100), 104 (21), 91 (84), 89 (29), 65 (20), 63 (11).

1-(4-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (3b): White solid; m.p. 150-152°C (hexane/AcOEt); IR (cm\(^{-1}\)):3082, 1489, 1221, 1073; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.5 (s, 2H), 7.17 (d, \(J_{H,H}=8.4\) Hz, 2H), 7.3-7.35 (m, 1H), 7.4-7.45 (m, 2H), 7.52 (d, \(J_{H,H}=8.4\) Hz, 2H), 7.7 (s, 1H), 7.8-7.85 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 53.5, 119.4, 122.9, 125.7 (2C), 128.3, 128.8 (2C), 130.3, 132.3 (2C), 133.6, 148.4; EI-MS \(m/z\): 315 (M\(^+\)+2, 9%), 313 (M\(^+\), 10%), 286 (16), 284 (17), 206 (20), 171 (24), 169 (25), 116 (100), 90 (19), 89 (28).

1-(3-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (3c): White solid; m.p. 85-87°C (hexane/AcOEt); IR (cm\(^{-1}\)):3084, 1460, 1216; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.54 (s, 2H), 7.2-7.25 (m, 2H), 7.3-7.35 (m, 2H), 7.4-7.45 (m, 2H), 7.45-7.5 (m, 2H), 7.71 (s, 1H), 7.8-7.85 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 53.4, 119.5, 123.1, 125.7 (2C), 126.5, 128.3, 128.8 (2C), 130.2, 130.7, 130.9, 131.9, 136.8, 148.3; EI-MS \(m/z\): 315 (M\(^+\)+2, 8%), 313 (M\(^+\), 8%), 286 (14), 284 (14), 206 (21), 171 (22), 169 (23), 116 (100), 90 (20), 89 (29).

1-(2-bromobenzyl)-4-phenyl-1H-1,2,3-triazole (3d): White solid; m.p. 101-103°C (hexane/AcOEt); IR (cm\(^{-1}\)):3051, 1459, 1430, 1220, 1043; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.7 (s, 2H), 7.15-7.25 (m, 2H), 7.3-7.35 (m, 2H), 7.4-7.45 (m, 2H), 7.62 (dd, \(J_{H,H}=7.3\) Hz, 2H), 7.82 (d, \(J_{H,H}=7.3\) Hz, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 53.8, 119.8, 123.4, 125.7 (2C), 128.2 (2C), 128.8 (2C), 130.1, 130.2, 130.4, 133.2, 134.2, 148.1; EI-MS \(m/z\): 315 (M\(^+\)+2, 12%), 313 (M\(^+\), 11%), 208 (12), 207 (59), 206 (93), 184 (11), 171 (31), 169 (32), 117 (11), 116 (100), 103 (13), 91 (21), 90 (24), 89 (34), 63 (10).

1-(2-methylbenzyl)-4-phenyl-1H-1,2,3-triazole (3e): White solid; m.p. 98-99°C (hexane/AcOEt); IR (cm\(^{-1}\)):3096, 1462, 1216; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 2.31 (s, 3H), 5.6 (s, 2H), 7.2-7.25 (m, 3H), 7.3-7.35 (m, 2H), 7.54 (s, 1H), 7.75-7.8 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 19.0, 52.5, 119.2, 125.6 (2C), 126.7, 128.1, 128.8 (2C), 129.2, 129.4, 130.5, 131.1, 132.5, 137.0, 148.0; EI-MS \(m/z\): 249 (M\(^+\), 22%), 220 (35), 207 (17), 206 (11), 118(31), 117 (39), 116 (100), 105 (63), 104 (10), 103 (15), 89 (23), 79 (14), 77 (21).
1-(3-methylbenzyl)-4-phenyl-1H-1,2,3-triazole (3f): White solid; m.p. 95-96°C (hexane/AcOEt); IR (cm\(^{-1}\)): 3089, 1464, 1222; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 2.34 (s, 3H), 5.52 (s, 2H), 7.1-7.2 (m, 3H), 7.25-7.45 (m, 4H), 7.66 (s, 1H), 7.8-7.85 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 21.3, 54.2, 119.5, 125.1, 125.6 (2C), 128.1, 128.7, 128.8 (2C), 129.0, 129.5, 130.5, 134.5, 139.0, 148.1; EI-MS m/z: 249 (M\(^+\), 29%), 221 (13), 220 (61), 206 (36), 179 (20), 118 (14), 117 (17), 116 (100), 105 (66), 103 (14), 89 (24), 79 (13), 77 (20).

1-(3,5-dimethoxybenzyl)-4-phenyl-1H-1,2,3-triazole (3g): White solid; m.p. 90-92°C (hexane/AcOEt); IR (cm\(^{-1}\)): 3086, 1610, 1197; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 3.76 (s, 6H), 5.49 (s, 2H), 6.44 (s, 3H), 7.3-7.35 (m, 1H), 7.35-7.4 (m, 2H), 7.68 (s, 1H), 7.75-7.8 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 54.2, 55.4 (2C), 100.4, 106.0 (2C), 119.5, 125.6(2C), 128.1, 128.8 (2C), 130.5, 136.7, 148.2, 161.2 (2C); EI-MS m/z: 296 (M\(^+\)+1, 13%), 295 (M\(^+\), 74%), 281 (14), 266 (41), 252 (10), 239 (32), 236 (19), 209 (21), 208 (15), 207 (61), 164 (36), 152 (13), 151 (100), 117 (12), 116 (100), 91 (19), 89 (21), 78 (11), 77 (18), 65 (11).

1-benzyl-4-(4-chlorophenyl)-1H-1,2,3-triazole (3h): White solid; m.p. 125-127°C (hexane/AcOEt); IR (cm\(^{-1}\)): 3060, 1481, 1222, 1069; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.57 (s, 2H), 7.3-7.4 (m, 7H), 7.65 (s, 1H), 7.72 (d, \(3J(H,H)=8.7\) Hz, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 54.3, 60.4, 119.5, 126.9 (2C), 128.1 (2C), 128.8, 129.0 (2C), 129.2 (2C), 133.9, 134.5, 147.1; EI-MS m/z: 271 (M\(^+\)+2, 9%), 269 (M\(^+\), 26%), 242 (23), 241 (15), 240 (70), 207 (14), 206 (27), 179 (29), 152 (36), 151 (10), 150 (100), 125 (10), 123 (25), 104 (20), 102 (11), 91 (93), 65 (22).

1-(4-bromobenzyl)-4-(4-chlorophenyl)-1H-1,2,3-triazole (3i): White solid; m.p. 146-150°C (hexane/AcOEt); IR (cm\(^{-1}\)): 1487, 1456, 1227, 1092, 1072; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.53 (s, 2H), 7.18 (d, \(3J(H,H)=8.4\) Hz, 2H), 7.36 (d, \(3J(H,H)=8.5\) Hz, 2H), 7.51 (d, \(3J(H,H)=8.4\) Hz, 2H), 7.66 (s, 1H), 7.72 (d, \(3J(H,H)=8.5\) Hz, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 53.5, 119.5, 123.0, 126.9 (2C), 128.8, 129.0 (2C), 129.6 (2C), 132.3 (2C), 133.5, 1339., 147.3; EI-MS m/z: 349 (M\(^+\)+2, 17%), 347 (M\(^+\), 13%), 320 (19), 318 (14), 240 (26), 207 (10), 171 (27), 169 (29), 152 (33), 151 (10), 150 (100), 123 (16), 90 (19), 89 (16); HRMS (ESI): m/z calcd for C\(_{15}\)H\(_{11}\)BrClN\(_3\): 346.9825; found: 346.9828.
1-benzyl-4-(2-chlorophenyl)-1H-1,2,3-triazole (3j): $^5$ White solid; m.p. 77-78°C (hexane/AcOEt); IR (cm$^{-1}$): 3083, 1461, 1227, 1056; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 5.61 (s, 2H), 7.2-7.45 (m, 8H), 8.12 (s, 1H), 8.22 (dd, $^3$J(H,H)=7.8 Hz, $^4$J(H,H)=1.8 Hz, 2H); $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 54.2, 123.1, 127.1, 127.9 (2C), 128.7, 129.0, 129.1 (2C), 129.2, 129.8, 130.1, 131.1, 134.6, 144.4; EI-MS m/z: 271 (M$^+$+2, 6%), 269 (M$^+$, 17%), 242 (12), 240 (36), 206 (40), 179 (30), 152 (28), 150 (87), 123 (14), 104 (26), 102 (10), 91 (100), 65 (19).

1-benzyl-4-(4-bromophenyl)-1H-1,2,3-triazole (3k): $^7$ White solid; m.p. 143-145°C (hexane/AcOEt); IR (cm$^{-1}$): 3070, 1477, 1449, 1222, 1051; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 5.56 (s, 2H), 7.3-7.4 (m, 5H), 7.5-7.55 (m, 2H), 7.65-7.7 (m, 3H); $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 54.3, 119.5, 122.0, 127.2 (2C), 128.1 (2C), 128.8, 129.1 (2C), 129.4, 131.9 (2C), 134.4, 147.1; EI-MS m/z: 315 (M$^+$+2, 23%), 313 (M$^+$, 24%), 287 (10), 286 (54), 285 (11), 284 (53), 207 (12), 206 (40), 204 (11), 196 (73), 194 (75), 179 (32), 178 (12), 169 (13), 167 (13), 115 (11), 104 (18), 102 (12), 91 (100), 88 (14), 65 (19).

4-(4-bromophenyl)-1-(3-methylbenzyl)-1H-1,2,3-triazole (3l): White solid; m.p. 127-128°C (hexane/AcOEt); IR (cm$^{-1}$): 3016, 1450, 1225, 1069; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 2.35 (s, 3H), 5.53 (s, 2H), 7.11 (d, $^3$J(H,H)=7.3 Hz, 2H), 7.18 (d, $^3$J(H,H)=7.3 Hz, 1H), 7.28 (d, $^3$J(H,H)=7.3 Hz, 1H), 7.52 (d, $^3$J(H,H)=8.6 Hz, 2H), 7.65 (s, 1H), 7.67 (d, $^3$J(H,H)=8.6 Hz, 2H); $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 21.3, 54.3, 119.5, 122.0, 125.2, 127.2 (2C), 128.8, 129.0, 129.5, 129.6, 131.9 (2C), 134.3, 139.1, 147.1; EI-MS m/z: 329 (M$^+$+2, 24%), 327 (M$^+$, 22%), 300 (34), 298 (36), 286 (27), 284 (26), 220 (21), 207 (22), 196 (70), 194 (76), 193 (27), 178 (12), 169 (12), 167 (12), 118 (18), 117 (11), 115 (15), 105 (100), 103 (20), 102 (14), 88 (15), 79; Elemental analysis calcd. for C$_{16}$H$_{13}$BrN$_3$: C = 58.55; H = 4.30; N = 12.80; found: C = 58.50; H = 4.29; N = 12.69.

1-benzyl-4-(4-methoxyphenyl)-1H-1,2,3-triazole (3m): $^5$ White solid; m.p. 135-136°C (hexane/AcOEt); IR (cm$^{-1}$): 1455, 1250; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 3.82 (s, 3H), 5.55 (s, 2H), 6.93 (d, $^3$J(H,H)=8.9 Hz, 2H), 7.25-7.4 (m, 5H), 7.58 (s, 1H), 7.72 (d, $^3$J(H,H)=8.9 Hz, 2H); $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 54.1, 55.3, 114.2 (2C), 118.6, 123.2, 127.0 (2C), 128.0 (2C), 128.7, 129.1 (2C), 134.7, 148.0, 159.5; EI-MS m/z: 266 (M$^+$+1, 6%), 265 (M$^+$, 35%), 237 (21), 236 (100), 222 (17), 210 (10), 209
1-benzyl-4-(m-tolyl)-1H-1,2,3-triazole (3n):\(^6\) White solid; m.p. 145-146°C (hexane/AcOEt); IR (cm\(^{-1}\)):\ 3031, 1454, 1220; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 2.38 (s, 3H), 5.58 (s, 2H), 7.12 (d, \(^3\)J(H,H)=7.6 Hz, 1H), 7.25-7.45 (m, 6H), 7.58 (d, \(^3\)J(H,H)=7.6 Hz, 1H), 7.65-7.7 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 21.4, 54.2, 119.4, 122.8, 126.3, 128.0 (2C), 128.7, 128.8, 129.9, 129.1 (2C), 130.3, 134.7, 138.5, 148.3; EI-MS \(m/z\): 249 (M\(^+\), 25%), 221 (13), 220 (58), 206 (10), 179 (12), 131 (11), 130 (100), 104 (13), 103 (14), 91 (70), 77 (14), 65 (14).

1-(3-bromobenzyl)-4-(m-tolyl)-1H-1,2,3-triazole (3o):\(^7\) White solid; m.p. 90-93°C (hexane/AcOEt); IR (cm\(^{-1}\)):\ 3036, 1429, 1223, 1084; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 2.35 (s, 3H), 5.48 (s, 2H), 7.1-7.3 (m, 4H), 7.4-7.45 (m, 2H), 7.57 (d, \(^3\)J(H,H)=7.8 Hz, 1H), 7.65 (s, 1H), 7.7 (s, 1H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 21.3, 53.2, 119.5, 122.6, 122.9, 126.2, 126.4, 128.6, 128.9, 130.1, 130.5, 130.7, 131.7, 136.8, 138.4, 148.3; EI-MS \(m/z\): 329 (M\(^+\),+2, 11%), 327 (M\(^+\), 12%), 300 (18), 298 (17), 220 (18), 207 (39), 171 (24), 169 (22), 131 (11), 130 (100), 103 (814), 90 (14), 89 (13).

1-(3-methylbenzyl)-4-(m-tolyl)-1H-1,2,3-triazole (3p): White solid; m.p. 127-128°C (hexane/AcOEt); IR (cm\(^{-1}\)):\ 3017, 1446, 1220; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 2.34 (s, 3H), 2.37 (s, 3H), 5.52 (s, 2H), 7.1-7.2 (m, 4H), 7.25-7.3 (m, 2H), 7.57 (d, \(^3\)J(H,H)=7.8 Hz, 1H), 7.6 (s, 1H), 7.66 (s, 1H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 21.3, 54.2, 119.4, 122.7, 125.1, 126.3, 128.6, 128.7, 128.8, 129.0, 129.5, 130.4, 134.6, 138.4, 139.0, 148.2; EI-MS \(m/z\): 264 (M\(^+\)+1, 7%), 263 (M\(^+\), 35%), 235 (14), 234 (62), 220 (41), 207 (18), 193 (18), 131 (10), 130 (100), 118 (15), 105 (62), 103 (22), 79 (10), 77 (25); HRMS (ESI): \(m/z\) calcd for C\(_{17}\)H\(_{17}\)N\(_3\) 263.1422; found: 263.1414.

1-benzyl-4,5-diphenyl-1H-1,2,3-triazole (8a):\(^8\) White solid; m.p. 109-110°C (hexane/AcOEt); IR (cm\(^{-1}\)):\ 3058, 1449, 1246; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 5.41 (s, 2H), 7.0-7.05 (m, 2H), 7.1-7.15 (m, 2H), 7.2-7.3 (m, 6H), 7.4-7.5 (m, 3H), 7.55-7.6 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 52.0, 126.7 (2C), 127.5 (2C), 127.7, 127.8, 128.1, 128.4 (2C), 128.7 (2C), 129.1 (2C), 129.6, 130.1 (2C), 130.9, 133.9, 135.3, 144.5; EI-MS \(m/z\): 311 (M\(^+\), 17%), 193 (16), 192 (100), 165 (23), 91 (75), 89 (16).
1-benzyl-4,5-bis(4-butylphenyl)-1\(H\)-1,2,3-triazole (8b): Pale yellow oil; IR (cm\(^{-1}\)): 3030, 1455, 1245; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta 0.89\) (t, \(^3J(H,H)=7.3\) Hz, 3H), \(0.97\) (t, \(^3J(H,H)=7.3\) Hz, 3H), 1.25-1.45 (m, 4H), 1.50-1.7 (m, 4H), 2.55 (t, \(^3J(H,H)=7.6\) Hz, 2H), 2.67 (t, \(^3J(H,H)=7.6\) Hz, 2H), 5.39 (s, 2H), 7.0-7.1 (m, 6H), 7.2-7.25 (m, 5H), 7.45-7.5 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta 13.9, 14.0, 22.3\) (2C), 33.3, 35.3, 35.5, 51.9, 125.1, 126.5 (2C), 127.0, 127.5 (2C), 128.0, 128.4 (2C), 128.6 (2C), 129.1 (2C), 129.9 (2C), 133.6, 135.5, 142.4, 144.4, 144.5; EI-MS \(m/z\): 423 (M\(^+\), 0%), 361 (16), 360 (69), 359 (24), 328 (13), 283 (18), 282 (20), 281 (72), 209 (13), 208 (18), 207 (100); Elemental analysis calcd. for C\(_{29}\)H\(_{33}\)N\(_3\): C = 82.23; H = 7.85; N = 9.92; found: C = 82.26; H = 7.75; N = 9.89.

1-(3-bromobenzyl)-4,5-diphenyl-1\(H\)-1,2,3-triazole (8c): White solid; m.p. 70-73°C (hexane/AcOEt); IR (cm\(^{-1}\)):3054, 1572, 1241; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta 5.37\) (s, 2H), 6.97 (d, \(^3J(H,H)=7.7\) Hz, 1H), 7.1-7.15 (m, 4H), 7.2-7.3 (m, 3H), 7.35-7.6 (m, 6H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta 51.4, 122.7, 126.2, 126.6\) (2C), 127.6 (2C), 127.8, 128.4 (2C), 129.3 (2C), 129.9, 130.0 (2C), 130.3, 130.7, 131.4, 133.8, 137.3, 144.6; EI-MS \(m/z\): 391 (M\(^+\)+2, 6%), 389 (M\(^+\), 6%), 193 (15), 192 (100), 165 (28), 89 (15); Elemental analysis calcd. for C\(_{21}\)H\(_{16}\)BrN\(_3\): C = 64.63; H = 4.13; N = 10.77; found: C = 64.65; H = 4.17; N = 10.69.

2-((4-phenyl-1\(H\)-1,2,3-triazol-1-yl)methyl)isoindoline-1,3-dione (x): White solid; m.p. 186-188°C (hexane/AcOEt); IR (cm\(^{-1}\)):1715; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta 6.26\) (s, 2H), 7.25-7.4 (m, 3H), 7.75-7.85 (m, 4H), 7.9-7.95 (m, 2H), 8.11 (s, 1H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta 49.7, 120.5, 124.1\) (2C), 125.8 (2C), 128.3, 128.8 (2C), 130.1, 131.4 (2C), 134.9 (2C), 148.4, 166.5 (2C); EI-MS \(m/z\): 304 (M\(^+\), 31%), 281 (11), 248 (10), 208 (10), 207 (40), 161 (11), 160 (100), 133 (15), 116 (31), 104 (16), 77 (15), 76 (14); Elemental analysis calcd. for C\(_{17}\)H\(_{12}\)N\(_4\)O\(_2\): C = 67.10; H = 3.97; N = 18.41; found: C = 67.11; H = 3.96; N = 18.42.

1-((2'-(azidomethyl)-[1,1'-biphenyl]-2-yl)-4-phenyl-1\(H\)-1,2,3-triazole (x): Colorless oil; IR (cm\(^{-1}\)):2092, 1242; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta 3.95-4.05\) (m, 2H), 5.25-5.35 (m, 2H), 7.15-7.2 (m, 1H), 7.2-7.3 (m, 3H), 7.35-7.5 (m, 8H), 7.7-7.8 (m, 2H); \(^13\)C NMR (75 MHz, CDCl\(_3\)): \(\delta 51.7, 52.3, 119.7, 125.5\) (2C), 128.0, 128.4 (2C), 128.5, 128.6, 128.7 (2C), 128.9, 129.6, 129.9, 130.1, 132.9, 133.5, 139.1 (2C), 147.5; EI-MS \(m/z\): 194 (M\(^+\)-172, 16%), 193 (100), 192 (28), 166 (14), 165 (56), 164 (10), 163 (5%), 162 (9%)
163 (10); Elemental analysis calcd. for C_{22}H_{18}N_{6}: C = 72.11; H = 4.95; N = 22.94; found: C = 72.12; H = 4.98; N = 22.98.

4-(4-methoxyphenyl)-1-((2’-(4-phenyl-1H-1,2,3-triazol-1-yl)methyl)-[1,1’-biphenyl]-2-yl)methyl)-1H-1,2,3-triazole (x): Pale yellow oil; IR (cm⁻¹): 1245; ¹H NMR (300 MHz, CDCl₃): δ 3.83 (s, 3H), 5.1-5.25 (m, 2H), 5.3-5.35 (m, 2H), 6.9-6.95 (m, 2H), 7.25-7.3 (m, 3H), 7.3-7.45 (m, 9H), 7.47 (s, 1H), 7.6-7.65 (m, 2H), 7.7-7.75 (m, 2H); ¹³C NMR (75 MHz, CDCl₃): δ 51.8, 55.3, 60.3, 114.2 (2C), 114.5, 119.5, 120.4, 123.0, 125.6 (2C), 126.9 (2C), 128.1, 128.6 (2C), 128.7 (2C), 128.8, 129.1, 129.9, 130.0, 130.1, 130.3, 133.3 (2C), 138.6 (2C), 147.4 (2C), 159.6; EI-MS m/z: 499 (M⁺+1, 5%), 498 (M⁺, 14%), 399 (11), 325 (15), 324 (13), 309 (11), 295 (16), 294 (15), 292 (10), 283 (14), 282 (62), 180 (27), 179 (100), 178 (61), 166 (10), 165 (36), 146 (16), 133 (12), 132 (11), 116 (19), 89 (10); Elemental analysis calcd. for C_{31}H_{26}N_{6}O: C = 74.68; H = 5.26; N = 16.86; found: C = 74.69; H = 5.28; N = 16.87.

References

$^{1}$H NMR (300 MHz, CDCl$_3$)
$^1$H NMR (75 MHz, CDCl$_3$)

$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$\text{NMR (75 MHz, CDCl}_3\text{)}$

$^{13}\text{C NMR (75 MHz, CDCl}_3\text{)}$

$3c$

![Chemical Structure](image)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)

3e
$^{1}$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)

3f
$^{1}H$ NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)

3g
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)

![Chemical Structure](image)

3h
$^1\text{H NMR (300 MHz, CDCl}_3\text{)}$
[^13]C NMR (75 MHz, CDCl$_3$)

3i
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^{1}H$ NMR (300 MHz, CDCl$_3$)
$\text{C NMR (75 MHz, CDCl}_3\text{)}$

$3k$

$^{13}\text{C NMR (75 MHz, CDCl}_3\text{)}$
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)

3m

$^1$H NMR (300 MHz, CDCl$_3$)
\[ \text{C NMR (75 MHz, CDCl}_3 \text{)} \]

3m

\[ ^{13}\text{C NMR (75 MHz, CDCl}_3 \text{)} \]
$^{1}H$ NMR (300 MHz, CDCl$_3$)
$\text{C NMR (75 MHz, CDCl}_3$)

$\text{13C NMR (75 MHz, CDCl}_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$\text{H NMR (300 MHz, CDCl}_3\text{)}$

$\text{3p}$

$^1\text{H NMR (300 MHz, CDCl}_3\text{)}$
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
^1H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^{1}$H NMR (300 MHz, CDCl$_3$)

8c

$\text{Br} - \text{N} - \text{N} - \text{N}$

[Chemical structure diagram]

S50
$^{13}$C NMR (75 MHz, CDCl$_3$)
\[^{1}\text{H NMR (300 MHz, CDCl}_3\text{)}\]
$^{13}$C NMR (75 MHz, CDCl$_3$)
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}\text{C NMR (75 MHz, CDCl}_3\text{)}$

![Chemical structure diagram]

$^{13}\text{C NMR (75 MHz, CDCl}_3\text{)}$
$^1$H NMR (300 MHz, CDCl$_3$)
$^{13}$C NMR (75 MHz, CDCl$_3$)