

Supporting Information

Org. Commun. 16:3 (2023) 125-133

Synthesis and biological evaluation of [1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a] indoles: One-pot reaction under microwave irradiation

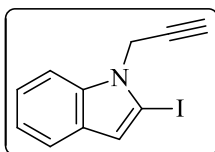
Abhilasha Dubba and Koppula Shiva Kumar*

*Department of Chemistry, GITAM deemed to be University, Hyderabad campus, Rudraram,
Sangareddy, Hyderabad, 502329, Telangana, India*

Table of Contents	Page
Experimental Section and Spectral Data	2-8
Figure S1: ¹ H-NMR (400 MHz, DMSO-d ₆) Spectrum of 4b	9
Figure S2: ¹³ C-NMR (100 MHz, DMSO-d ₆) Spectrum of 4b	9
Figure S3: ¹ H-NMR (400 MHz, DMSO-d ₆) Spectrum of 4h	10
Figure S4: ¹³ C-NMR (100 MHz, DMSO-d ₆) Spectrum of 4h	10
Figure S5: ¹ H-NMR (400 MHz, DMSO-d ₆) Spectrum of 4j	11
Figure S6: ¹³ C-NMR (100 MHz, DMSO-d ₆) Spectrum of 4j	11
Figure S7: ¹ H-NMR (400 MHz, DMSO-d ₆) Spectrum of 4m	12
Figure S8: ¹³ C-NMR (100 MHz, DMSO-d ₆) Spectrum of 4m	12
Figure S9: ESI-MS Spectrum of 4b	13
Figure S10: ESI-MS Spectrum of 4h	13
Figure S11: ESI-MS Spectrum of 4j	14
Figure S12: ESI-MS Spectrum of 4m	14

SI : Experimental Section and Spectral Data

Synthesis of 2-iodo-1-(prop-2-yn-1-yl)-1H-indole (**2**)

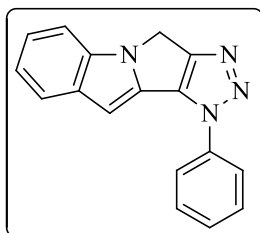


For 6 hours, a combination of 2-iodo-1H-indole (**1**) (5g, 0.02 mol), K₂CO₃ (0.06 mol), and propargyl bromide (0.026 mol) in DMF (60 mL) was agitated at 60 °C. After the reaction was completed, the mixture was diluted with water (50 mL) and extracted with ethyl acetate (2 50 mL). The mixed organic layer was washed with brine (2x50 mL), dried with anhydrous Na₂SO₄, and then concentrated under vacuum to yield compound (**2**) (72%). ¹H NMR (400MHz, DMSO-d₆; in ppm): □7.70 (d, *J* = 8.0 Hz, 1H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.35 - 7.30 (m, 1H), 7.20 (s, 1H), 7.10 - 7.05 (m, 1H), 3.75 (d, *J* = 4.0 Hz, 2H, NCH₂), 2.21 (t, *J* = 4.0 Hz, 1H, alkyne-H); ESI-MS(*m/z*): 200 [M+H]⁺.

2.3.3. Synthesis of 1-(aryl)-1,4-dihydro[1,2,3]triazolo-[4',5':3,4]pyrrolo-[1,2-a]indole (**4a-4p**):

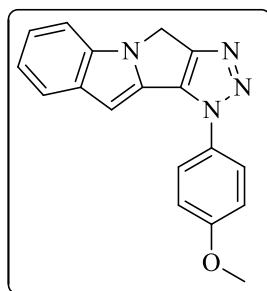
CuI (10 mol%) was added to a solution of 2-iodo-1-(prop-2-yn-1-yl)-1H-indole (**2**) (1.0 mmol), aryl azide (1.2 mmol), and ^tBuOK (3.0 mmol) in a microwave reactor vessel (10 mL). The mixture was heated at 100 °C for 30-40 minutes. TLC was used to track the course of the reaction. The reaction mixture was carefully emptied into ice-cold water (10 mL) and the product was extracted with ethyl acetate (2x15 mL) after the container was allowed to cool at room temperature. The organic layers were washed in brine and dried over anhydrous Na₂SO₄. Following filtration, the solvent was evaporated under vacuum, and the crude product produced was refined using column chromatography (hexane/ethyl acetate gradient) to yield the pure needed product.

1-phenyl-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole(**4a**)



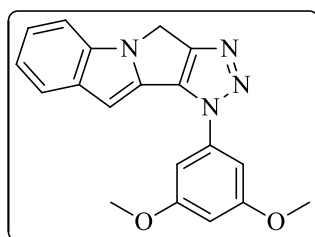
Color: White crystalline solid (74% yield); M.P: 122-124 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.71 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.60 - 7.56 (m, 2H, Ar-H), 7.52 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.43 - 7.39 (m, 3H, Ar-H), 7.33 - 7.28 (m, 1H, Ar-H), 7.21 (s, 1H, Ar-H), 7.10 - 7.05 (m, 1H, Ar-H), 5.23 (s, 2H, CH₂); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.24, 139.54, 136.50, 135.33, 129.67(2C), 128.40, 127.34, 124.80, 124.23(2C), 123.49, 122.32, 121.35, 110.76, 107.79, 42.23; ESI-MS(*m/z*): 273 [M+H]. Anal.Cal for C₁₇H₁₂N₄; C, 74.98; H, 4.44; N, 20.58; found C, 74.94; H, 4.46; N, 20.60.

1-(4-methoxyphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4b)



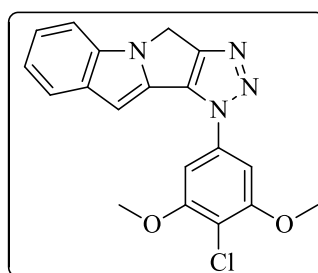
Color: White crystalline solid (71% yield); M.P: 130-132 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.78 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.70 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.54 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.35 - 7.31 (m, 1H, Ar-H), 7.19 (s, 1H, Ar-H), 7.10 - 7.06 (m, 1H, Ar-H), 6.99 (d, *J* = 8.0 Hz, 2H, Ar-H), 5.25 (s, 2H, CH₂), 3.84 (s, 3H, -OCH₃); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.66, 159.79, 139.60, 135.09, 131.39, 127.85, 126.37(2C), 124.33, 123.42, 122.52, 121.21, 114.88(2C), 110.45, 108.39, 56.21, 42.36; ESI-MS(*m/z*): 303 [M+H]. Anal.Cal for C₁₈H₁₄N₄O; C, 71.51; H, 4.67; N, 18.53; found C, 71.54; H, 4.65; N, 18.51.

1-(3,5-dimethoxyphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4c)



Color: Pale yellow solid (68% yield), M.P: 156-158 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.72 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.60 (s, 2H, Ar-H), 7.52 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.30 - 7.26 (m, 1H, Ar-H), 7.22 (s, 1H, Ar-H), 7.11 - 7.06 (m, 1H, Ar-H), 7.02 (s, 1H, Ar-H), 5.23 (s, 2H, CH₂), 3.83 (s, 6H, 2-OCH₃); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.45, 159.24(2C), 139.67, 138.37, 135.35, 127.51, 124.26, 123.35, 122.70, 121.51, 110.72, 107.21, 104.92(2C), 102.96, 56.18(2C), 42.28; ESI-MS(*m/z*): 333 [M+H]. Anal.Cal for C₁₉H₁₆N₄O₂; C, 68.66; H, 4.85; N, 16.86; found C, 68.69; H, 4.83; N, 16.84.

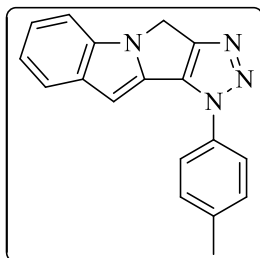
1-(4-chloro-3,5-dimethoxyphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4d)



Color: Yellow crystalline solid (78 % yield), M.P: 164-166 °C, ¹H-NMR (400 MHz, DMSO-

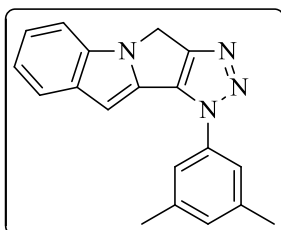
δ ; δ in ppm): 7.73 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.51 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.36 - 7.32 (m, 1H, Ar-H), 7.21 (s, 1H, Ar-H), 7.15 (s, 2H, Ar-H), 7.09 - 7.05 (m, 1H, Ar-H), 5.24 (s, 2H, CH_2), 3.85 (s, 6H, 2-OCH₃); ¹³C-NMR (100 MHz, DMSO- d_6) 161.53, 156.57(2C), 139.30, 138.09, 135.25, 127.30, 124.19, 123.29, 122.56, 121.08, 118.42, 110.54, 107.72, 104.70(2C), 56.66(2C), 42.27; ESI-MS(m/z): 367 [M+H]. Anal.Cal for C₁₉H₁₅ClN₄O₂; C, 62.21; H, 4.12; N, 15.27; found C, 62.23; H, 4.14; N, 15.23.

1-(p-tolyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4e)



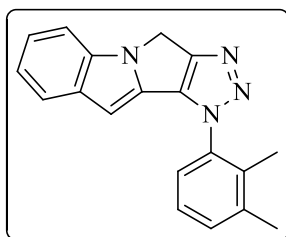
Color: White solid (70 % yield); M.P: 127-129 °C, ¹H-NMR (400 MHz, DMSO- d_6 ; δ in ppm): 7.72 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.66 (d, $J = 8.0$ Hz, 2H, Ar-H), 7.51 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.42 (d, $J = 8.0$ Hz, 2H, Ar-H), 7.35 - 7.30 (m, 1H, Ar-H), 7.22 (s, 1H, Ar-H), 7.10 - 7.06 (m, 1H, Ar-H), 5.25 (s, 2H, CH_2), 2.31 (s, 3H, -CH₃); ¹³C-NMR (100 MHz, DMSO- d_6) δ 161.61, 139.38, 138.49, 136.87, 135.18, 130.05 (2C), 127.63, 125.77(2C), 124.08, 123.03, 122.08, 121.09, 110.61, 107.48, 42.37, 21.36; ESI-MS(m/z): 287 [M+H]. Anal.Cal for C₁₈H₁₄N₄; C, 75.50; H, 4.93; N, 19.57; found C, 75.55; H, 4.90; N, 19.55.

1-(3,5-dimethylphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4f)



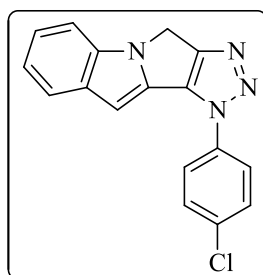
Color: Pale red solid (69 % yield); M.P: 130-132 °C, ¹H-NMR (400 MHz, DMSO- d_6 ; δ in ppm): 7.71 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.52 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.45 (s, 1H, Ar-H), 7.35 - 7.30 (m, 1H, Ar-H), 7.22 (s, 1H, Ar-H), 7.15 (s, 1H, Ar-H), 7.08 - 7.04 (m, 1H, Ar-H), 5.23 (s, 2H, CH_2), 2.37 (s, 6H, 2-CH₃); ¹³C-NMR (100 MHz, DMSO- d_6) δ 161.47, 140.24(2C), 139.11, 137.01, 135.14, 128.47, 127.24, 125.37(2C), 124.24, 123.02, 122.07, 121.05, 110.32, 107.65, 42.47, 21.65(2C); ESI-MS(δ): 301 [M+H]. Anal.Cal for C₁₉H₁₆N₄; C, 75.98; H, 5.37; N, 18.65; found C, 75.94; H, 5.39; N, 18.67.

1-(2,3-dimethylphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4g)



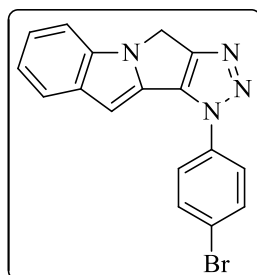
Color: Pale red solid (66 % yield); M.P: 124-126 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.73 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.51 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.44 - 7.40 (m, 2H, Ar-H), 7.35 - 7.27 (m, 3H, Ar-H), 7.22 (s, 1H, Ar-H), 7.09 - 7.05 (m, 1H, Ar-H), 5.23 (s, 2H, CH₂), 2.19 (s, 3H, -CH₃), 1.93 (s, 3H, -CH₃); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.57, 139.38, 138.46, 137.50, 135.43, 131.24, 128.61, 127.46, 125.82, 125.33, 124.80, 123.69, 121.62, 120.56, 110.20, 107.39, 42.41, 19.63, 15.78; ESI-MS(*m/z*): 301 [M+H]. Anal.Cal for C₁₉H₁₆N₄; C, 75.98; H, 5.37; N, 18.65; found C, 75.95; H, 5.39; N, 18.66.

1-(4-chlorophenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4h)



Color: Pale Yellow solid (76 % yield); M.P: 135-137 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.80 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.71 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.53 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.41 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.34 - 7.30 (m, 1H, Ar-H), 7.19 (s, 1H, Ar-H), 7.09 - 7.05 (m, 1H, Ar-H), 5.24 (s, 2H, CH₂); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.57, 139.38, 136.41, 135.29, 134.27, 128.62(2C), 127.32, 125.29(2C), 124.41, 123.64, 122.08, 121.36, 110.91, 107.55, 42.47; ESI-MS(*m/z*): 307 [M+H]. Anal.Cal for C₁₇H₁₁ClN₄; C, 66.56; H, 3.61; N, 18.26; found C, 66.53; H, 3.63; N, 18.28.

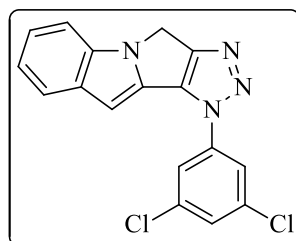
1-(4-bromophenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4i)



Color: White solid (67 % yield); M.P: 143-145 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.73 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.66 - 7.60 (m, 4H, Ar-H), 7.51 (d, *J* = 8.0 Hz, 1H, Ar-

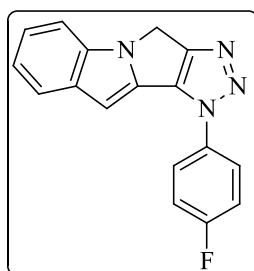
H), 7.34 - 7.29 (m, 1H, Ar-H), 7.21 (s, 1H, Ar-H), 7.10-7.04 (m, 1H, Ar-H), 5.24 (s, 2H, CH₂); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.30, 139.51, 135.53, 133.88, 131.23(2C), 127.36, 124.80, 124.11(2C), 123.07, 122.42, 121.22, 120.74, 110.64, 107.56, 42.33; ESI-MS(*m/z*): 351 [M+H] & 353[M+3H]. Anal.Cal for C₁₇H₁₁BrN₄; C, 58.14; H, 3.16; N, 15.95; found C, 58.17; H, 3.14; N, 15.93.

1-(3,5-dichlorophenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4j)



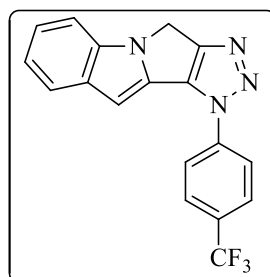
Color: Pale Yellow solid (77 % yield); M.P: 151-153 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.82 (s, 2H, Ar-H), 7.72 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.55 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.42 (s, 1H, Ar-H), 7.33 - 7.27 (m, 1H, Ar-H), 7.23 (s, 1H, Ar-H), 7.11-7.06 (m, 1H, Ar-H), 5.26 (s, 2H, CH₂); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.73, 139.38, 135.44, 134.48, 131.43(2C), 127.42, 124.81, 124.12(2C), 123.33, 122.52, 121.31, 120.22, 110.98, 107.12, 42.22; ESI-MS(*m/z*): 341 [M+H]. Anal.Cal for C₁₇H₁₀Cl₂N₄; C, 59.84; H, 2.95; N, 16.42; found C, 59.81; H, 2.94; N, 16.45.

1-(4-fluorophenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4k)



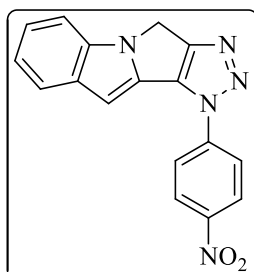
Color: Pale red solid (73 % yield); M.P: 127-129 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 8.10 (d, *J* = 8.0 Hz, 2H), 7.90 (d, *J* = 8.0 Hz, 2H), 7.75 (d, *J* = 8.0 Hz, 1H), 7.53 (d, *J* = 8.0 Hz, 1H), 7.37 - 7.33 (m, 1H), 7.21 (s, 1H), 7.11 - 7.06 (m, 1H), 5.27 (s, 2H, CH₂); ESI-MS(*m/z*): 291 [M+H]. Anal.Cal for C₁₇H₁₁FN₄; C, 70.34; H, 3.82; N, 19.30; found C, 70.37; H, 3.80; N, 19.32.

1-(4-(trifluoromethyl)phenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4l)



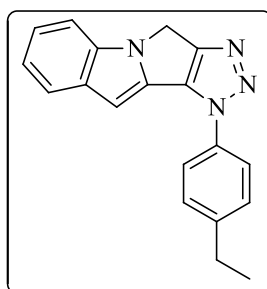
Color: Pale red solid (67 % yield), $^1\text{H-NMR}$ (400 MHz, DMSO-d_6 ; δ in ppm): 8.16 (d, $J = 8.0$ Hz, 2H, Ar-H), 8.05 (d, $J = 8.0$ Hz, 2H, Ar-H), 7.75 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.52 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.38 - 7.33 (m, 1H, Ar-H), 7.22 (s, 1H, Ar-H), 7.11 - 7.05 (m, 1H, Ar-H), 5.26 (s, 2H, CH_2); ESI-MS(m/z): 341 [$\text{M}+\text{H}$]. Anal.Cal for $\text{C}_{18}\text{H}_{11}\text{F}_3\text{N}_4$; C, 63.53; H, 3.26; N, 16.46; found C, 63.56; H, 3.28; N, 16.42.

1-(4-nitrophenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4m)



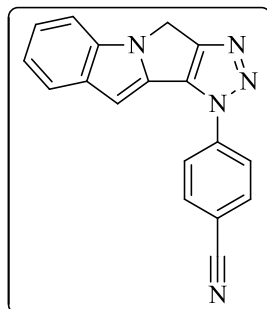
Color: Yellow solid (80 % yield); M.P: 150-152 °C, $^1\text{H-NMR}$ (400 MHz, DMSO-d_6 ; δ in ppm): 8.41 (d, $J = 8.0$ Hz, 2H), 8.21 (d, $J = 8.0$ Hz, 2H), 7.73 (d, $J = 8.0$ Hz, 1H), 7.54 (d, $J = 8.0$ Hz, 1H), 7.36 - 7.31 (m, 1H), 7.21 (s, 1H), 7.10 - 7.06 (m, 1H), 5.27 (s, 2H, CH_2); $^{13}\text{C-NMR}$ (100 MHz, DMSO-d_6) δ 161.77, 147.65, 140.19, 139.14, 135.03, 127.55, 126.17(2C), 124.07, 123.45(2C), 122.95, 122.08, 121.08, 110.72, 107.12, 42.37; ESI-MS(m/z): 318 [$\text{M}+\text{H}$]. Anal.Cal for $\text{C}_{17}\text{H}_{11}\text{N}_5\text{O}_2$; C, 64.35; H, 3.49; N, 22.07; found C, 64.38; H, 3.47; N, 22.05.

1-(4-ethylphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (4n)



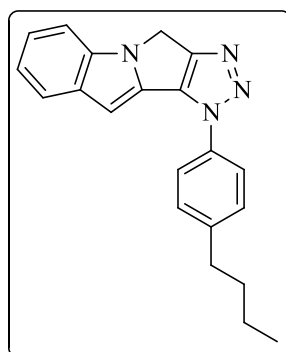
Color: White red solid (72 % yield); M.P: 134-136 °C, $^1\text{H-NMR}$ (400 MHz, DMSO-d_6 ; δ in ppm): 7.70 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.60 (d, $J = 8.0$ Hz, 2H, Ar-H), 7.50 (d, $J = 8.0$ Hz, 1H, Ar-H), 7.38 - 7.34 (m, 1H, Ar-H), 7.28 (d, $J = 8.0$ Hz, 2H, Ar-H), 7.18 (s, 1H, Ar-H), 7.09-7.05 (m, 1H, Ar-H), 5.23 (s, 2H, CH_2), 2.28 (q, $J = 4.0$ Hz, 2H, $-\text{CH}_2$), 1.68 (t, $J = 4.0$ Hz, 2H, $-\text{CH}_3$); $^{13}\text{C-NMR}$ (100 MHz, DMSO-d_6) δ 161.73, 141.27, 139.41, 138.10, 135.21, 129.61(2C), 127.83, 127.23(2C), 124.81, 123.66, 122.53, 121.24, 110.53, 107.28, 42.33, 23.20, 13.78; ESI-MS(m/z): 301 [$\text{M}+\text{H}$]. Anal.Cal for $\text{C}_{19}\text{H}_{16}\text{N}_4$; C, 75.98; H, 5.37; N, 18.65; found C, 75.94; H, 5.39; N, 18.67.

4-([1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indol-1(4H)-yl)benzonitrile (**4o**)



Color: White solid (72 % yield); M.P: 141-143 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.80 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.72 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.50 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.41 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.36 - 7.31 (m, 1H, Ar-H), 7.21 (s, 1H, Ar-H), 7.11 - 7.06 (m, 1H, Ar-H), 5.24 (s, 2H, CH₂); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.48, 139.42, 138.12, 135.38, 127.63, 127.11(2C), 126.10(2C), 124.19, 123.32, 122.42, 121.43, 119.53, 117.54, 110.41, 107.25, 42.22; ESI-MS(*m/z*): 298 [M+H]. Anal.Cal for C₁₈H₁₁N₅; C, 72.72; H, 3.73; N, 23.56; found C, 72.76; H, 3.71; N, 23.54.

1-(4-butylphenyl)-1,4-dihydro-[1,2,3]triazolo[4',5':3,4]pyrrolo[1,2-a]indole (**4p**)



Color: Pale Yellow solid (66 % yield), M.P: 146-148 °C, ¹H-NMR (400 MHz, DMSO-d₆; δ in ppm): 7.72 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.64 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.50 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.35 - 7.30 (m, 1H, Ar-H), 7.24 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.18 (s, 1H, Ar-H), 7.10 - 7.05 (m, 1H, Ar-H), 5.25 (s, 2H, CH₂), 2.68 (t, *J* = 4.0 Hz, 2H, -CH₂), 1.68 - 1.58 (m, 2H, -CH₂), 1.38 - 1.29 (m, 2H, -CH₂), 0.94 (t, *J* = 4.0 Hz, 3H, -CH₃); ¹³C-NMR (100 MHz, DMSO-d₆) δ 161.37, 139.33, 138.14(2C), 135.78, 130.01, 129.14(2C), 128.07, 127.03, 124.22, 123.02, 122.38, 121.44, 110.58, 107.53, 42.47, 34.21, 32.89, 21.65, 13.70; ESI-MS(*m/z*): 329 [M+H]. Anal.Cal for C₂₁H₂₀N₄; C, 76.80; H, 6.14; N, 17.06; found C, 76.84; H, 6.16; N, 17.00.

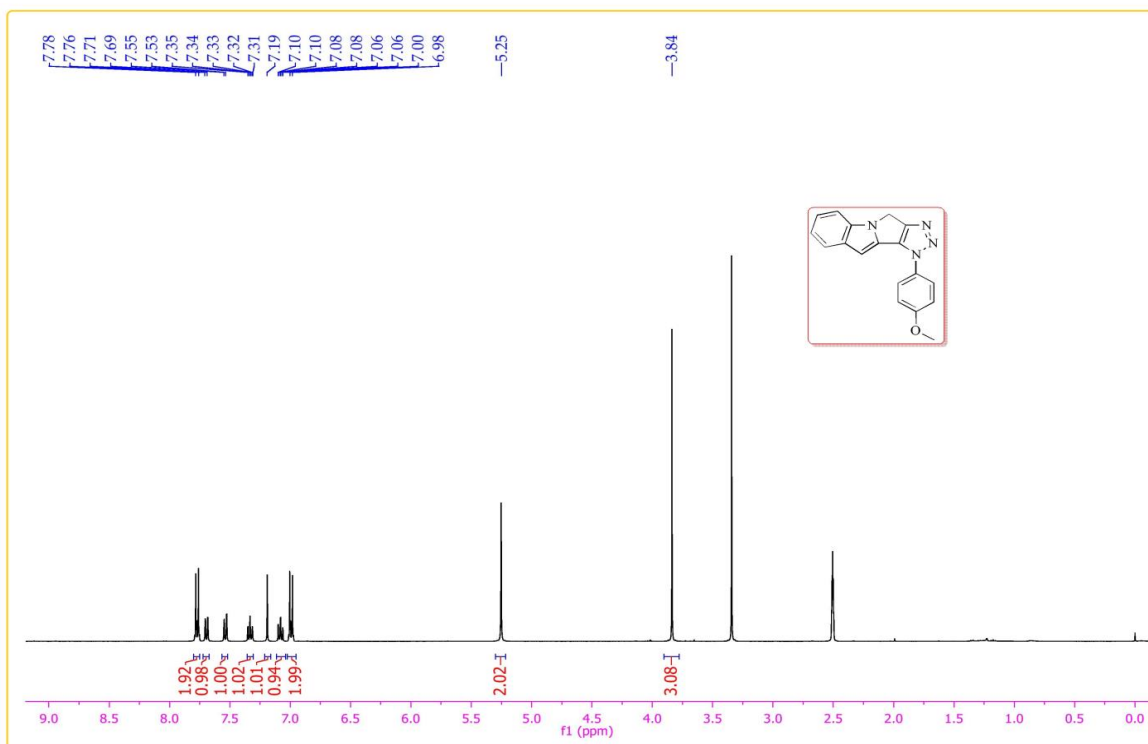


Figure S1: $^1\text{H-NMR}$ Spectrum of **4b**

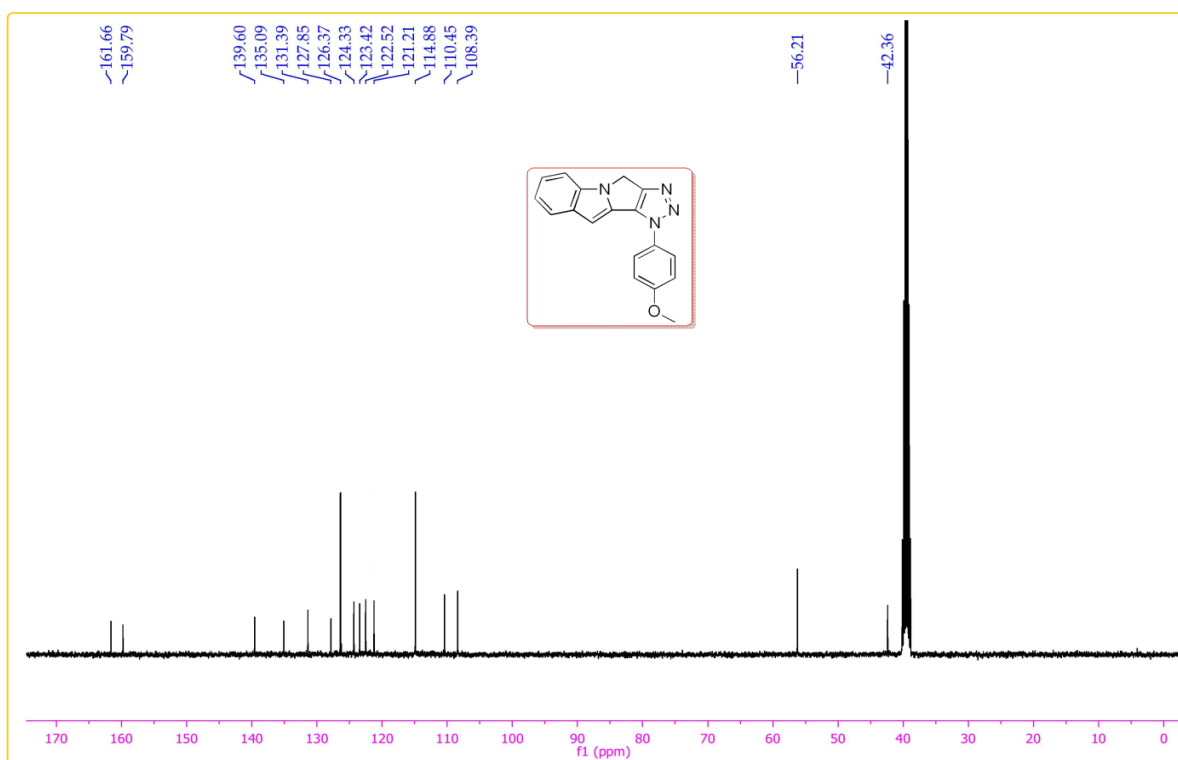


Figure S2: $^{13}\text{C-NMR}$ Spectrum of **4b**

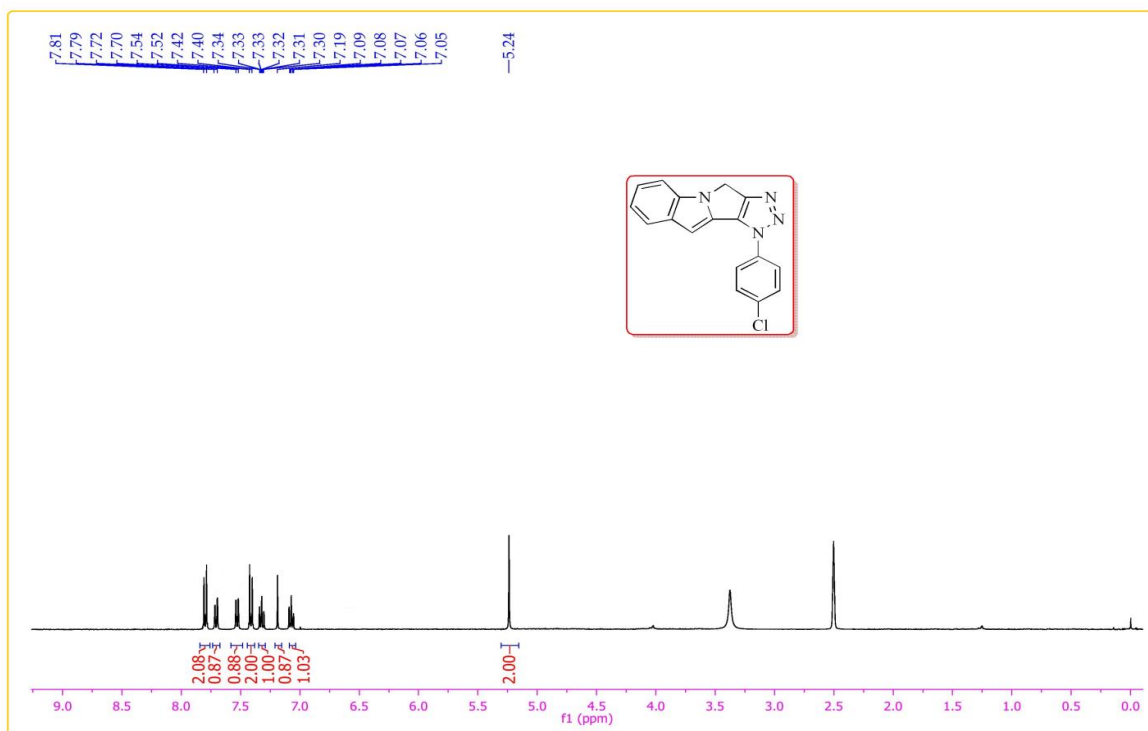


Figure S3: ¹H-NMR Spectrum of 4h

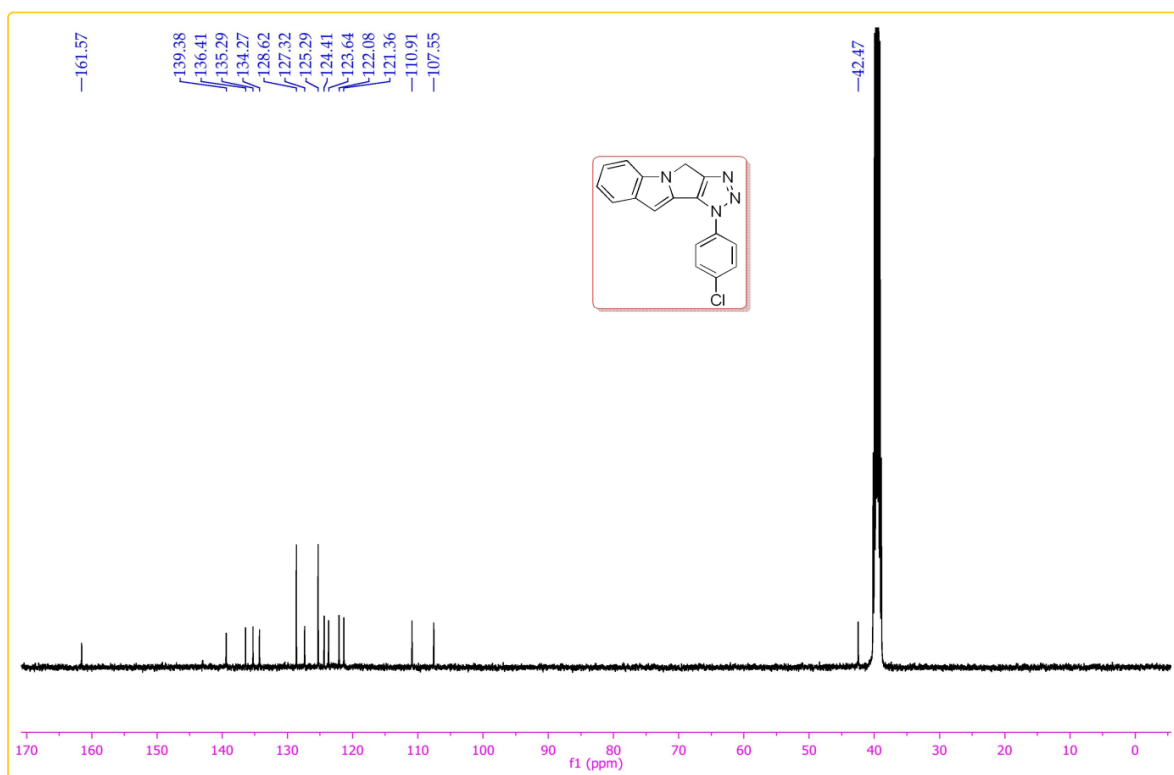


Figure S4: ¹³C-NMR Spectrum of 4h

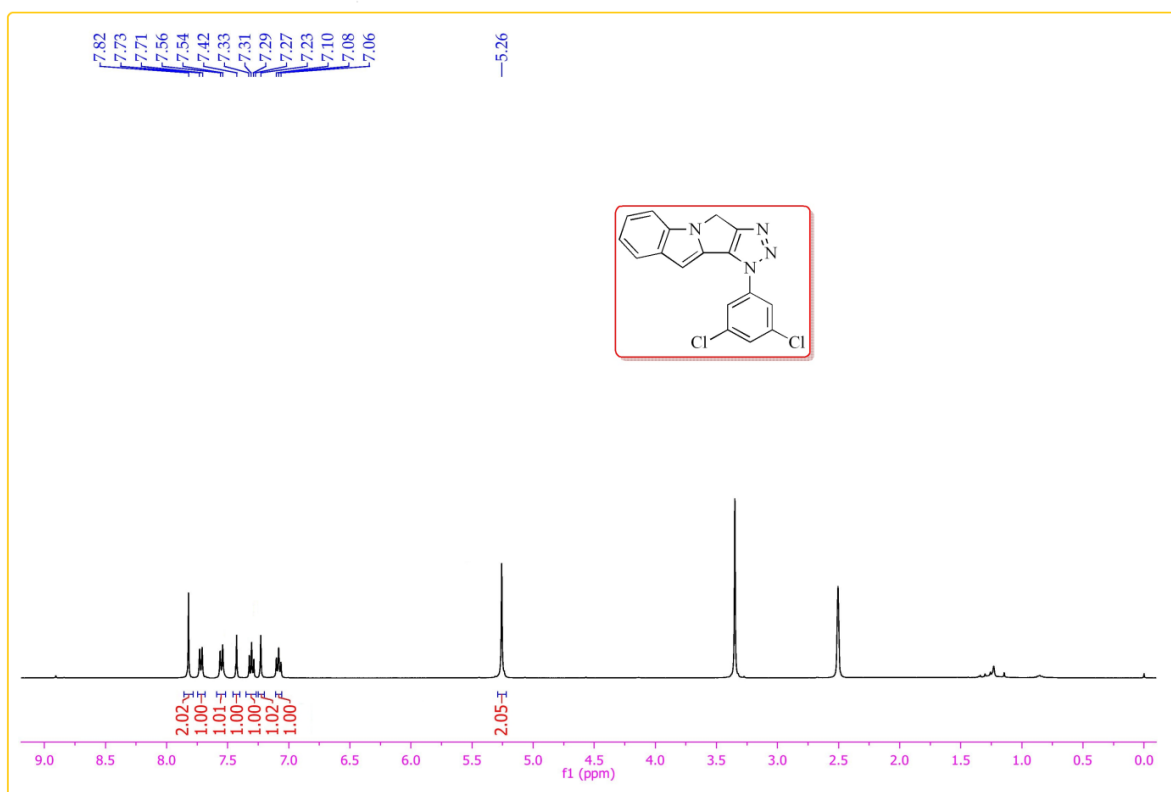


Figure S5: ¹H-NMR Spectrum of 4j.

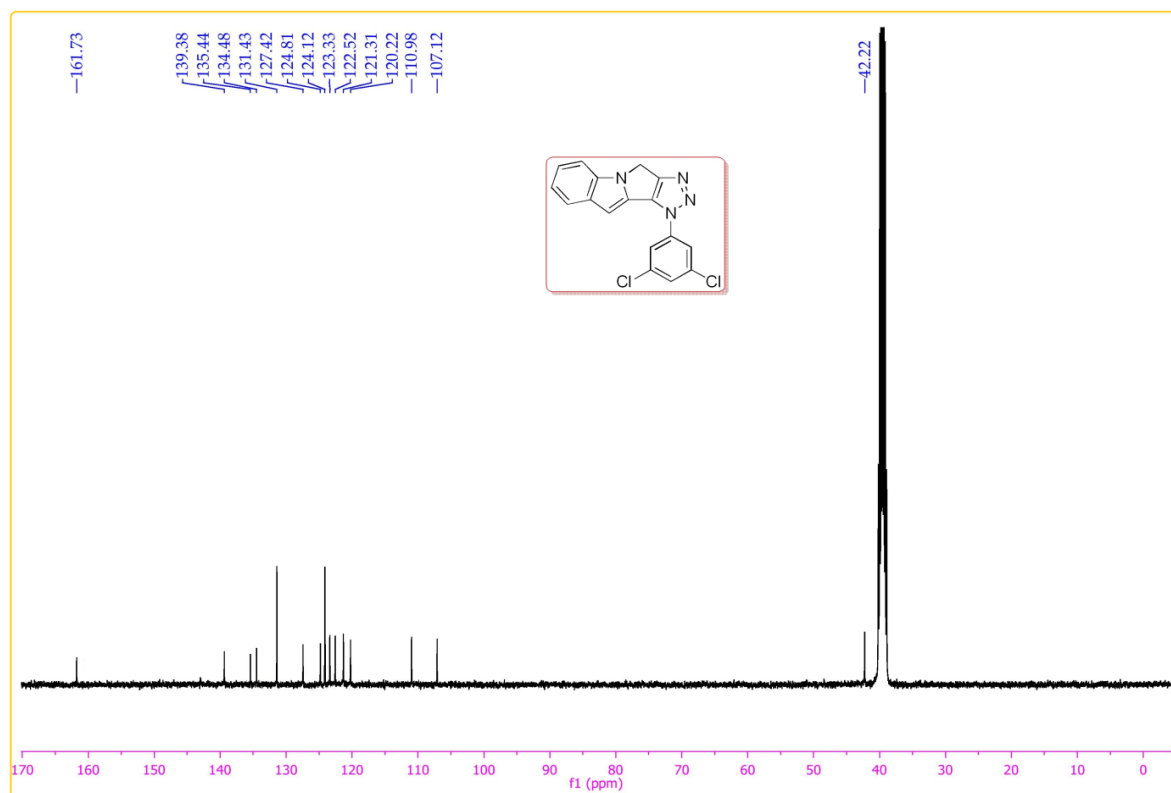


Figure S6: ¹³C-NMR Spectrum of 4j.

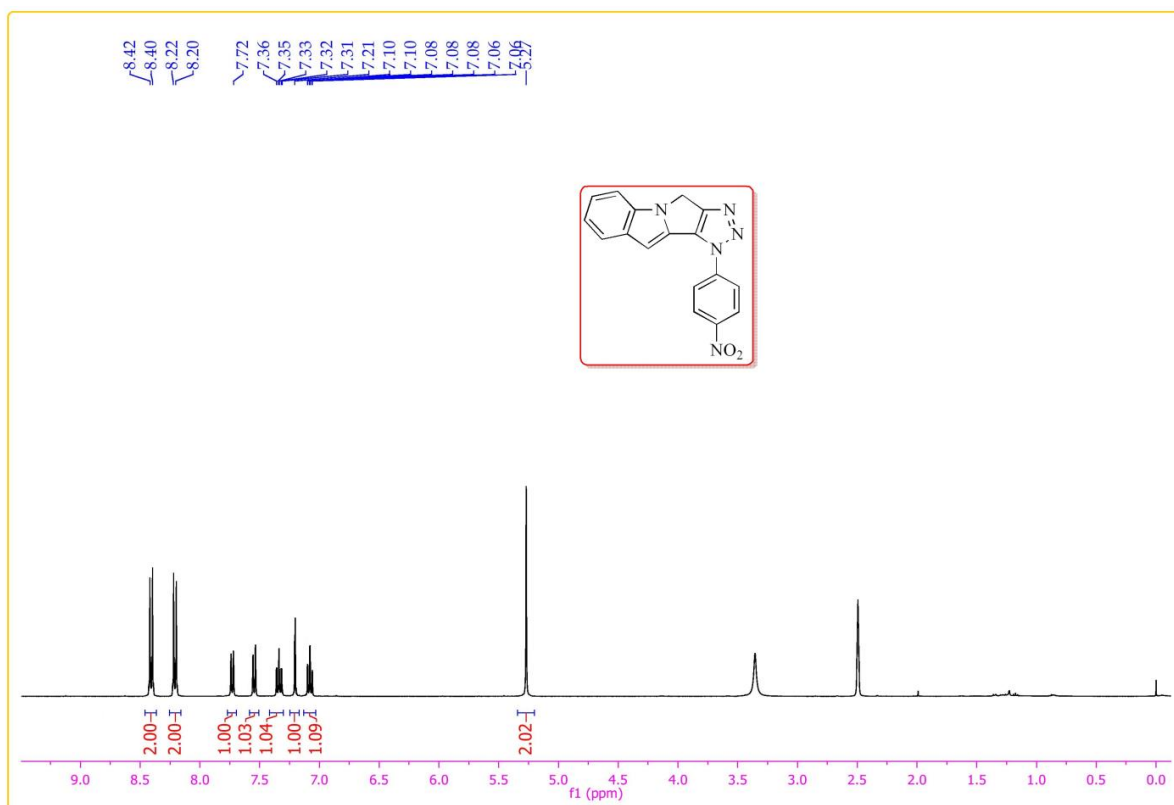


Figure S7: ¹H-NMR Spectrum of 4m

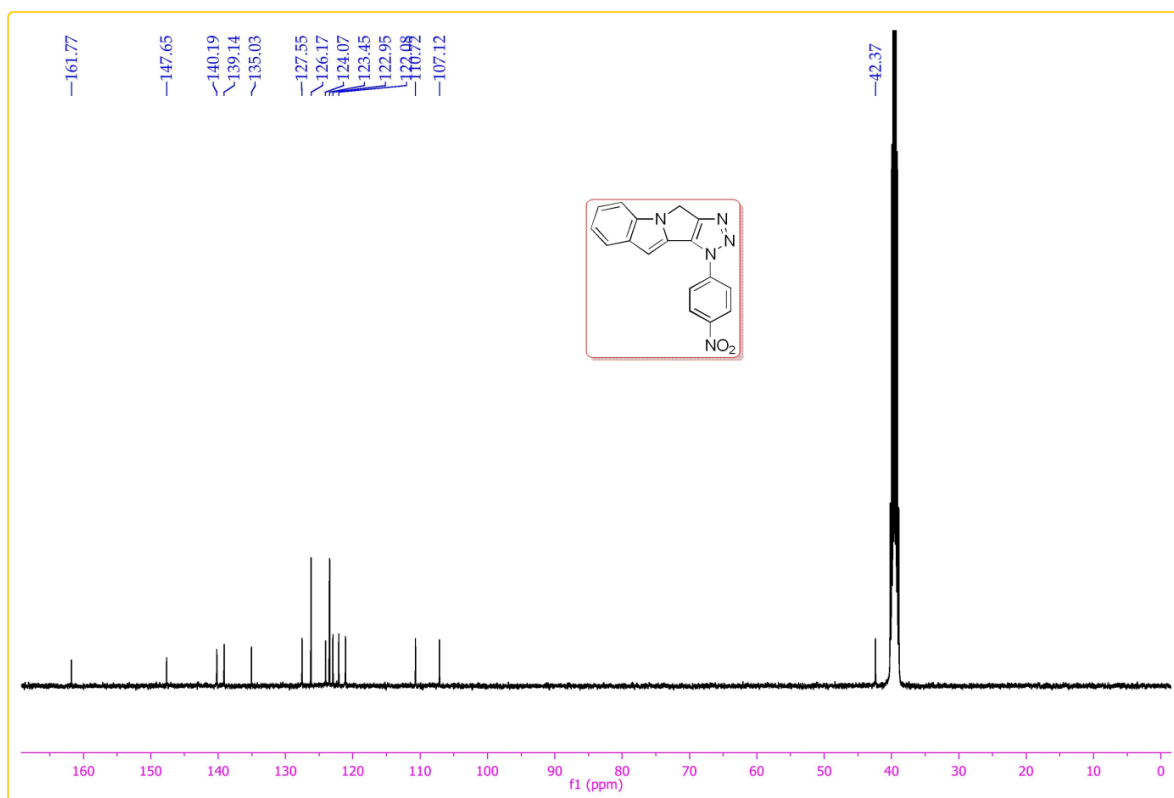


Figure S8: ¹³C-NMR Spectrum of 4m

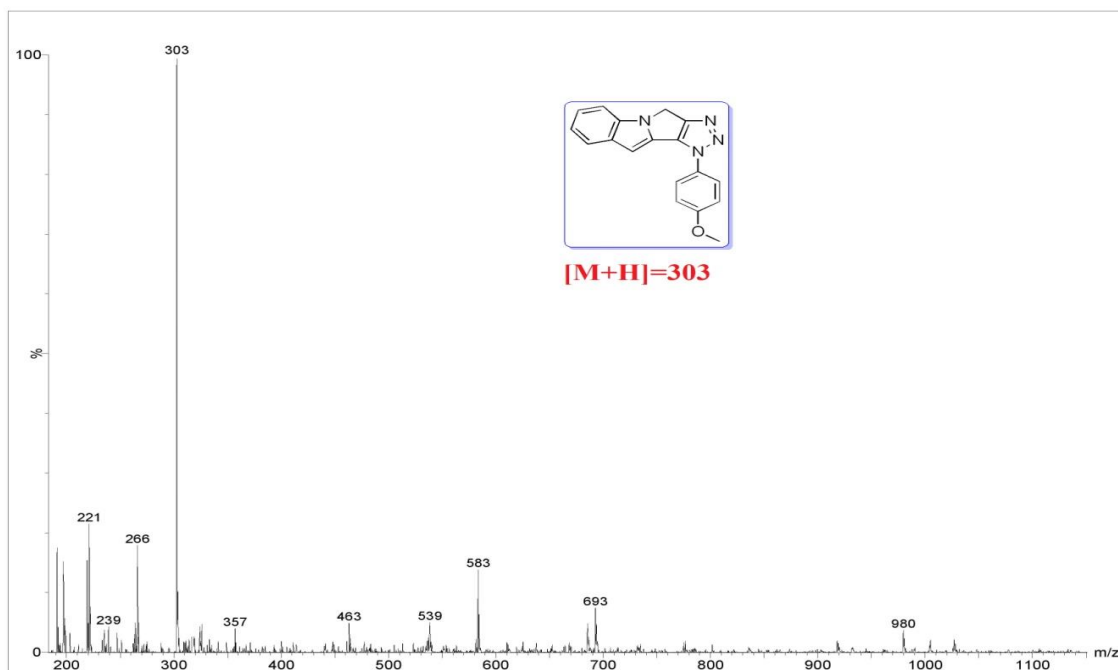


Figure S9: ESI-MS Spectrum of 4b

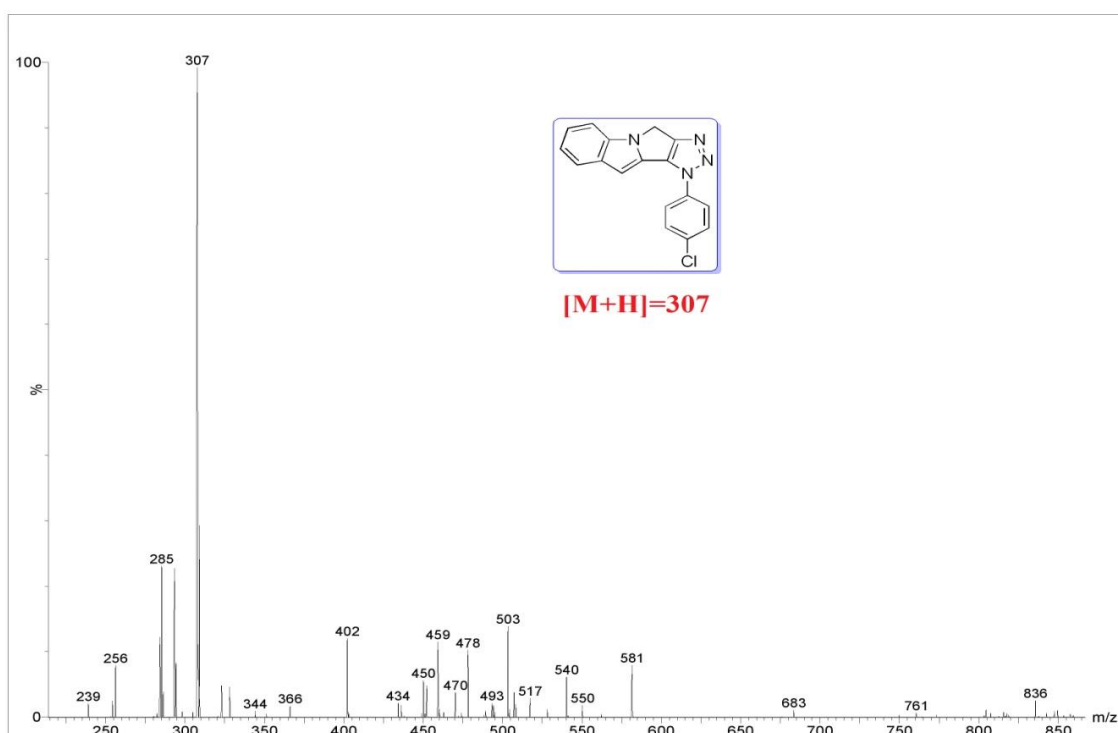


Figure S10: ESI-MS Spectrum of 4h

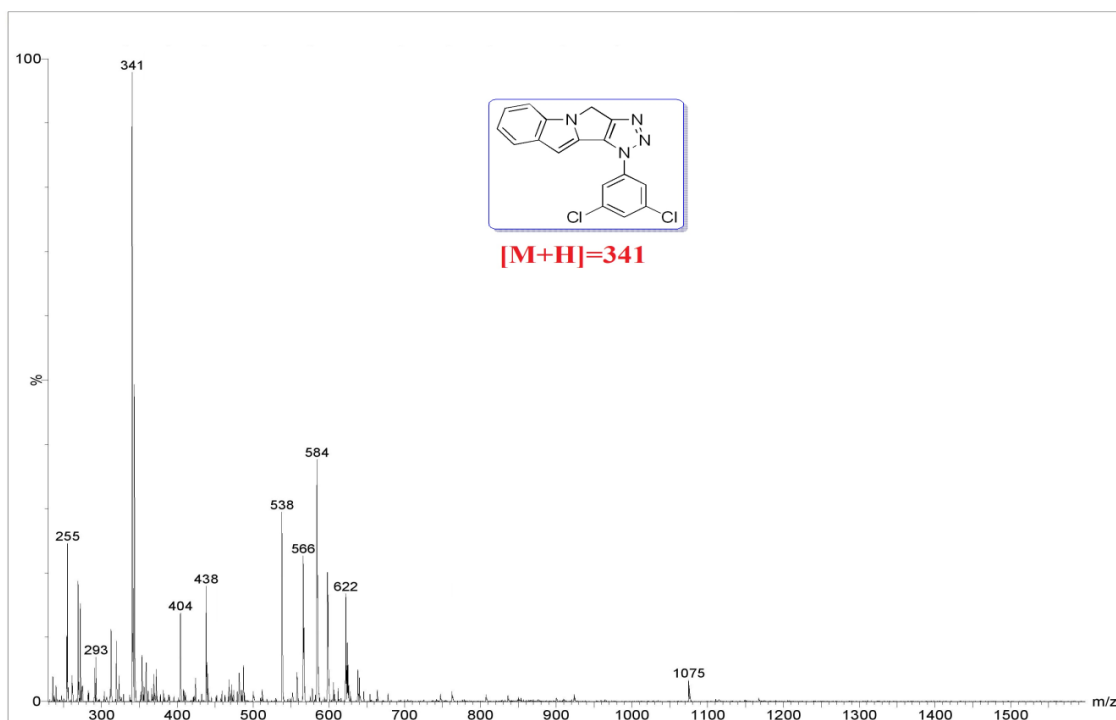


Figure S11: ESI-MS Spectrum of **4j**

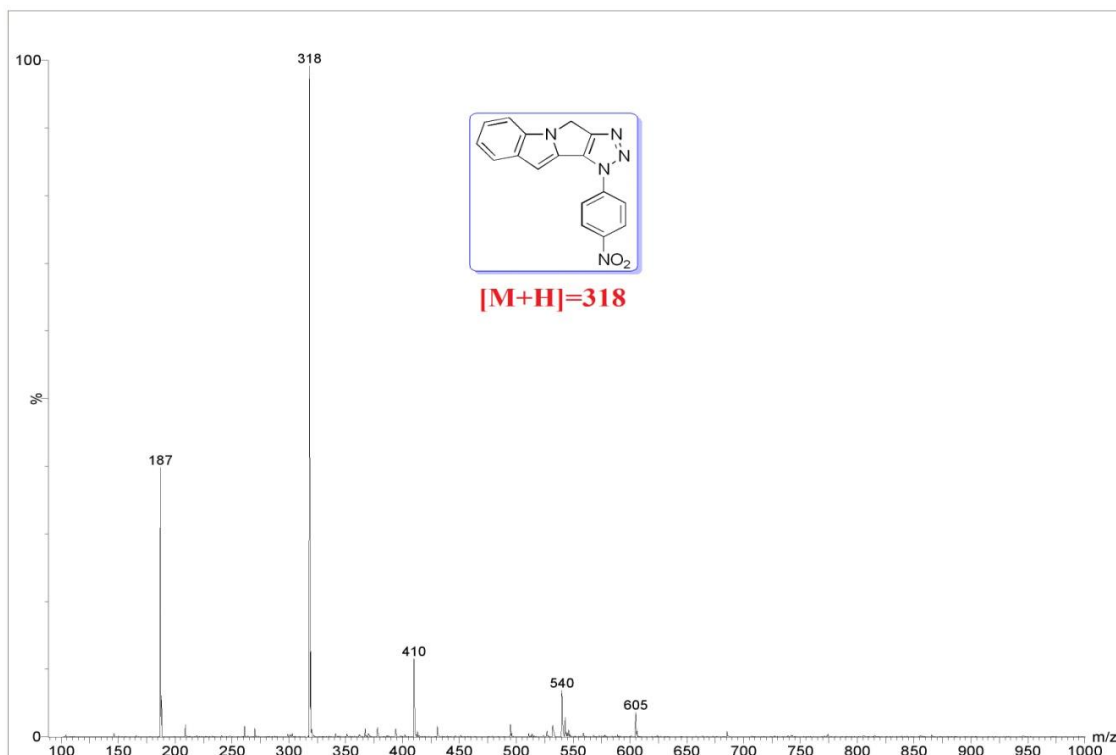


Figure S12: ESI-MS Spectrum of **4m**