Electronic Supplementary Information

Assembly of four modules onto a tetraazide platform by consecutive 1,2,3-triazole formations

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Contents

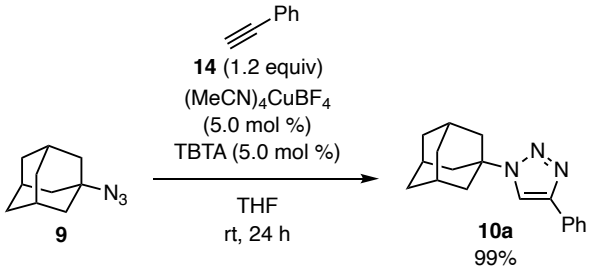
General Remarks

All reactions were performed in dry glassware under atmosphere of argon otherwise noted. Analytical thin-layer chromatography (TLC) was performed on precoated (0.25 mm) silica-gel plates (Merck Chemicals, Silica Gel 60 F_{254}, Cat. No. 1.05715). Column chromatography was conducted using silica-gel (Kanto Chemical Co., Inc., Silica Gel 60N, spherical neutral, particle size 40–50 μm, Cat. No. 37563-85 or particle size 63–210 μm, Cat. No. 37565-85). Preparative thin-layer chromatography (PTLC) was performed on silica-gel (Wako Pure Chemical Industries Ltd., Wakogel B5-F, Cat. No. 230-00043). Melting points (Mp) were measured on a YANACO MP-J3 instrument or an OptiMelt MPA100 (Stanford Research Systems), and are uncorrected. ^{1}H and ^{13}C NMR spectra were obtained with a Bruker AVANCE 500 spectrometer at 500 or 126 MHz, respectively. ^{19}F NMR spectra were obtained with a Bruker AVANCE 400 spectrometer at 376 MHz. Chemical shifts (δ) are given in parts per million (ppm) downfield from $(CH_3)_4Si$ (δ 0.00 for ^{1}H NMR in $CDCl_3$) or the solvent peak (δ 77.0 for ^{13}C NMR in $CDCl_3$) as an internal reference or α,α,α-trifluorotoluene (δ −63.0 ppm for ^{19}F NMR in $CDCl_3$) as an external standard with coupling constants (*J*) in hertz (Hz). The abbreviations s, d, t, q, sept, m, and br signify singlet, doublet, triplet, quartet, septet, multiplet, and broad, respectively. IR spectra were measured by diffuse reflectance method on a Shimadzu IRPrestige-21 spectrometer attached with DRS-8000A with the absorption band given in cm^{-1}. High-resolution mass spectra (HRMS) were measured on a Bruker micrOTOF mass spectrometer under positive electrospray ionization (ESI^{+}) conditions. High-performance liquid chromatography (HPLC) was performed on a Shimadzu Prominence HPLC system (CBM-20A lite, LC-20AD × 2, DGU-20A3R, SUS316L, and CTO-20A) equipped with a Shimadzu SPD-20A UV/Vis detector. The absorbance spectra (UV/Vis) and fluorescence spectra (FL) were measured with a JASCO UV-650 spectrophotometer and a JASCO FP-8500 spectrofluorophotometer, respectively, at 25 °C using a quartz cuvette (10 mm light path).

Unless otherwise noted, materials obtained from commercial suppliers were used without further purification. 5,6-Didehydro-11,12-dihydrodibenzo[*a*,*e*]cyclooctene (**7**),[S1] (1α,8α,9α)-bicyclo[6.1.0]non-4-yn-9-ylmethyl *N*-(2-(2-(2-propyn-1-yloxy)ethoxy)ethyl)carbamate (**17**),[S2] β-ketoamide **22**,[S3] alkyne **23**,[S3] cycloalkyne **24**,[S3] 3-azidoadamantane-1-carboxylic acid (**S2**),[S4] 4-(azidomethyl)phenylboronic acid (**S5**),[S5] 1-azido-2,6-diisopropyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzene (**S8**),[S3] 3-azido-5-(azidomethyl)phenylboronic acid (**S14**),[S6] and tris[(1-benzyl-1*H*-1,2,3-triazol-4-yl)methyl]amine (TBTA)[S7] were prepared according to the reported methods.

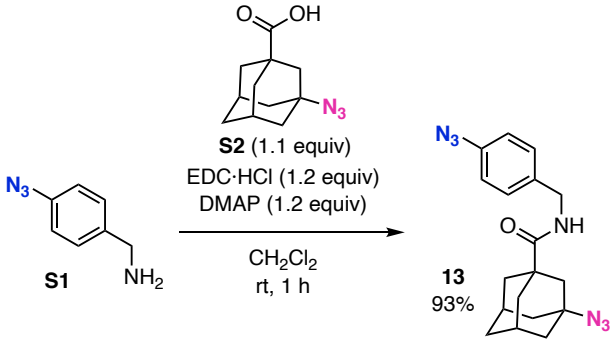
Chemical Experiments

A typical procedure for the CuAAC reaction



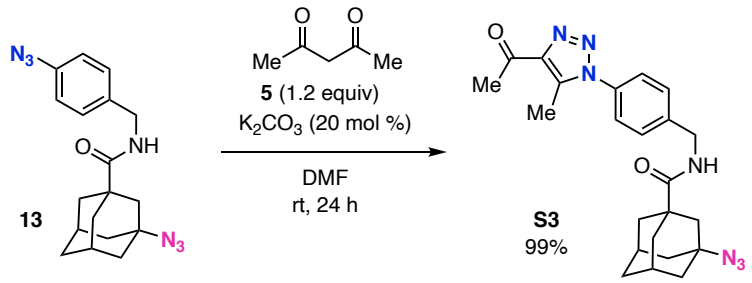
To a mixture of 1-azidoadamantane (**9**) (88.7 mg, 0.500 mmol), $(MeCN)_4CuBF_4$ (7.87 mg, 25.0 μmol), and TBTA (13.3 mg, 25.1 μmol) dissolved in THF (3.0 mL) was added phenylacetylene (**14**) (61.4 mg, 0.601 mmol) at room temperature. After stirring for 24 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP sphere cartridge 10 g, *n*-hexane/EtOAc = 89/11 to 68/32) to give 1-(adamantan-1-yl)-4-phenyl-1*H*-1,2,3-triazole (**10a**) (139 mg, 0.498 mmol, 99%) as a colorless solid.

*Synthesis of 3-azido-N-(4-azidobenzyl)- 1-adamantanamide (**13**)*



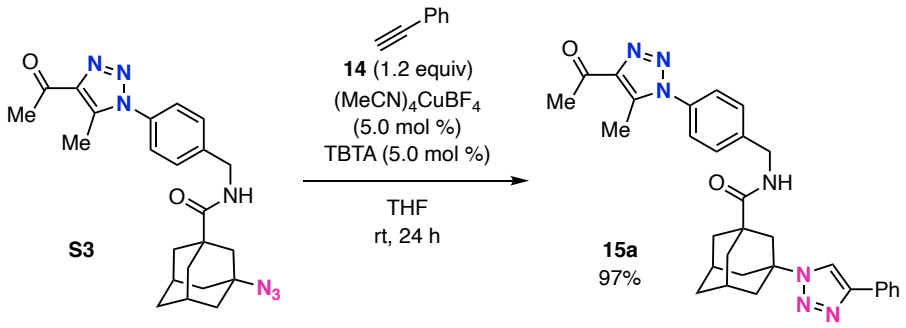
To a mixture of 4-azidobenzylamine (**S1**) (415 mg, 2.80 mmol) and 3-azido-1-adamantanecarboxylic acid (**S2**) (682 mg, 3.08 mmol) dissolved in CH_2Cl_2 (30 mL) was added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (644 mg, 3.36 mmol) and 4-(dimethylamino)pyridine (410 mg, 3.36 mmol) at room temperature. After stirring for 1 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by flash column chromatography (Biotage® ZIP-sphere cartridge 45 g, *n*-hexane/EtOAc = 1/1) to give 3-azido-*N*-(4-azidobenzyl)-1-adamantanamide (**13**) (910 mg, 2.59 mmol, 93%) as a colorless solid.

A procedure for the triazole formation using 1,3-dicarbonyl compounds



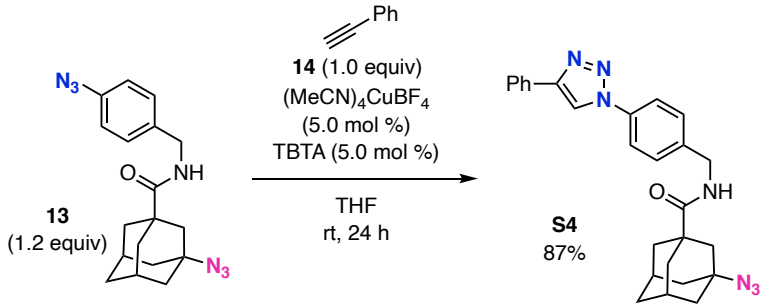
To a mixture of 3-azido-*N*-(4-azidobenzyl)-1-adamantanamide (**13**) (35.2 mg, 0.100 mmol), acetylacetone (**5**) (12.1 mg, 0.121 mmol) dissolved in DMF (2.0 mL) was added K_2CO_3 (2.8 mg, 20 µmol) at room temperature. After stirring for 24 h at the same temperature, to the mixture was added water. The mixture was extracted with Et_2O. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (*n*-hexane/EtOAc = 1/1) to give *N*-(4-(4-acetyl-5-methyl-1,2,3-triazol-1-yl)benzyl)-3-azido-1-adamantanamide (**S3**) (43.0 mg, 99.2 µmol, 99%) as a colorless oil.

*Synthesis of N-(4-(4-acetyl-5-methyl-1,2,3-triazol-1-yl)benzyl)-3-(4-phenyl-1,2,3-triazol-1-yl)-1-adamantanamide (**15a**)*



To a mixture of *N*-(4-(4-acetyl-5-methyl-1,2,3-triazol-1-yl)benzyl)-3-azido-1-adamantanamide (**S3**) (21.4 mg, 49.4 µmol), $(MeCN)_4CuBF_4$ (0.78 mg, 2.5 µmol), and TBTA (1.30 mg, 2.45 µmol) dissolved in THF (1.0 mL) was added phenylacetylene (**14**) (6.05 mg, 59.2 µmol) at room temperature. After stirring for 24 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 19/1) to give *N*-(4-(4-acetyl-5-methyl-1,2,3-triazol-1-yl)benzyl)-3-(4-phenyl-1,2,3-triazol-1-yl)-1-adamantanamide (**15a**) (25.7 mg, 48.0 µmmol, 97%) as a colorless solid.

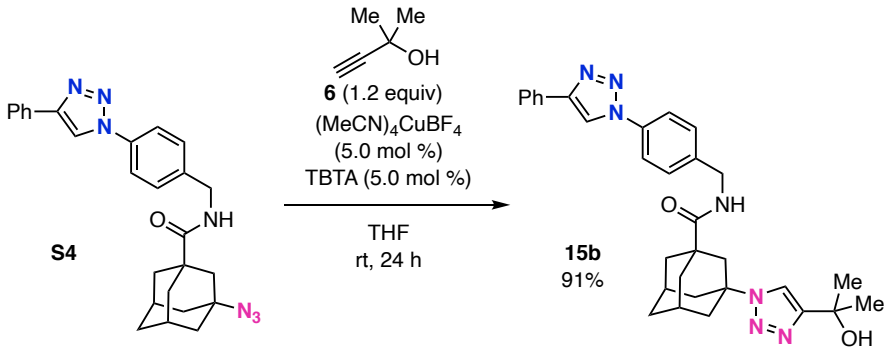
*Synthesis of 3-azido-N-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1-adamantanamide (**S4**)*



To a mixture of 3-azido-*N*-(4-azidobenzyl)-1-adamantanamide (**13**) (42.2 mg, 0.120 mmol), $(MeCN)_4CuBF_4$ (1.57 mg, 4.99 µmol), and TBTA (2.65 mg, 4.99 µmol) dissolved in THF (2.0 mL) was added phenylacetylene (**14**) (10.2 mg, 99.9 µmol) at room temperature. After stirring for 24 h at

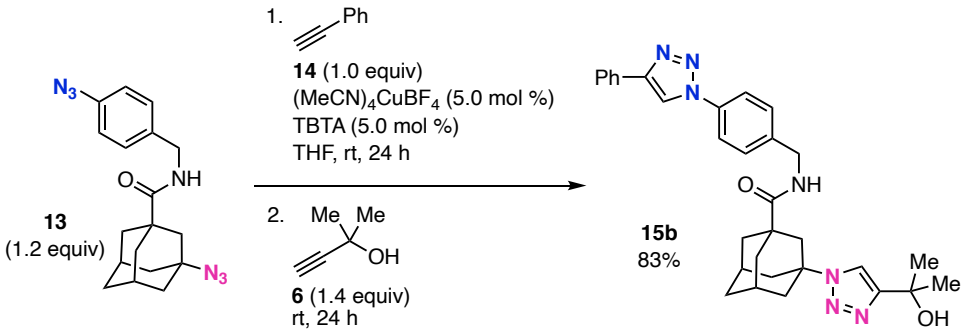
the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (*n*-hexane/EtOAc = 1/2) to give 3-azido-*N*-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1-adamantanamide (**S4**) (39.6 mg, 87.3 μmol, 87%) as a colorless solid.

*Synthesis of 3-(4-(2-hydroxyprop-2-yl)-N-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1,2,3-triazol-1-yl)-1-adamantanamide (**15b**)*



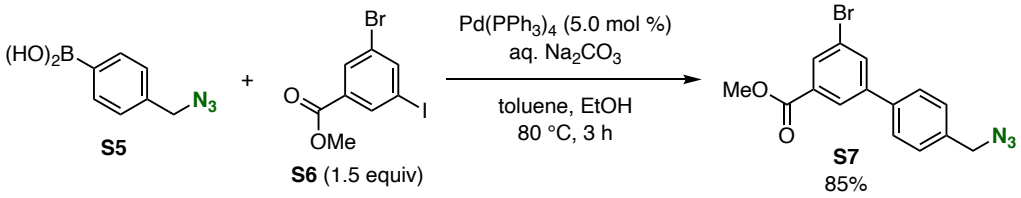
To a mixture of 3-azido-*N*-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1-adamantanamide (**S4**) (25.9 mg, 57.1 μmol), $(MeCN)_4CuBF_4$ (0.90 mg, 2.9 μmol), and TBTA (1.51 mg, 2.85 μmol) dissolved in THF (1.2 mL) was added 2-methyl-3-butyn-2-ol (**6**) (5.76 mg, 68.5 μmol) at room temperature. After stirring for 24 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 10/1) to give *N*-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-3-(4-(2-hydroxyprop-2-yl)-1,2,3-triazol-1-yl)-1-adamantanamide (**15b**) (27.9 mg, 51.9 μmol, 91%) as a pale yellow oil.

*One-pot synthesis of 3-(4-(2-hydroxyprop-2-yl)-N-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1,2,3-triazol-1-yl)-1-adamantanamide (**15b**)*



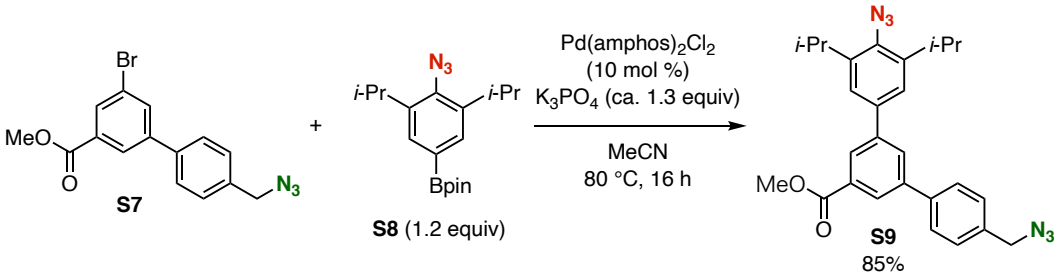
To a mixture of 3-azido-*N*-(4-azidobenzyl)-1-adamantanamide (**13**) (42.2 mg, 0.120 mmol), $(MeCN)_4CuBF_4$ (1.57 mg, 4.99 μmol), and TBTA (2.65 mg, 4.99 μmol) dissolved in THF (2.0 mL) was added phenylacetylene (**14**) (10.2 mg, 9.99 μmol) at room temperature. After stirring for 24 h at the same temperature, to the mixture was added 2-methyl-3-butyn-2-ol (**6**) (12.0 mg, 0.143 mmol). After stirring for 24 h, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 10/1) to give 3-(4-(2-hydroxyprop-2-yl)-*N*-(4-(4-phenyl-1,2,3-triazol-1-yl)benzyl)-1,2,3-triazol-1-yl)-1-adamantanamide (**15b**) (44.8 mg, 83.3 μmol, 83%) as a pale yellow oil.

*Synthesis of methyl 3-(4-(azidomethyl)phenyl)-5-bromobenzoate (**S7**)*



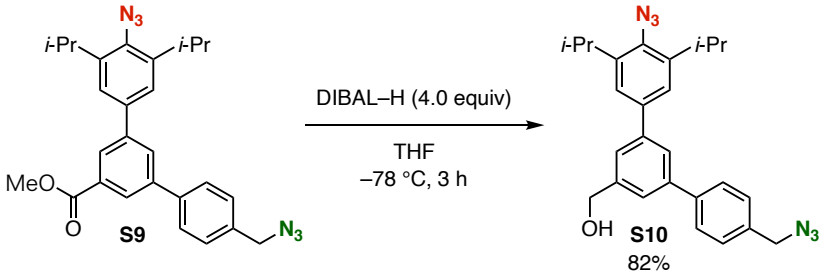
To a solution of 4-(azidomethyl)phenylboronic acid (**S5**) (354 mg, 2.00 mmol), methyl 3-bromo-5-iodobenzoate (**S6**) (1.02 g, 2.99 mmol), and $Pd(PPh_3)_4$ (116 mg, 0.100 mmol) dissolved in toluene (8.0 mL) and EtOH (1.3 mL) was added aqueous Na_2CO_3 (2.0 M, 8.0 mL) at room temperature. After stirring for 3 h at 80 °C, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP sphere cartridge 45 g, *n*-hexane/EtOAc = 100/0 to 94/6) to give methyl 3-(4-(azidomethyl)phenyl)-5-bromobenzoate (**S7**) (585 mg, 1.69 mmol, 85%) as a colorless solid.

*Synthesis of methyl 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzoate (**S9**)*



To a mixture of methyl 3-(4-(azidomethyl)phenyl)-5-bromobenzoate (**S7**) (82.6 mg, 0.239 mmol), 1-azido-2,6-diisopropyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzene (**S8**) (94.4 mg, 0.287 mmol), $Pd(amphos)_2Cl_2$ (16.9 mg, 0.0239 mmol), and tripotassium phosphate *n* hydrate (56.3 mg, ca. 0.3 mmol) was added MeCN (10 mL) and H_2O (1.0 mL) at room temperature. After stirring for 1.5 h at 80 °C, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP sphere cartridge 5 g, *n*-hexane/EtOAc = 100/0 to 95/5) to give methyl 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzoate (**S9**) (94.8 mg, 0.202 mmol, 85%) as a pale yellow oil.

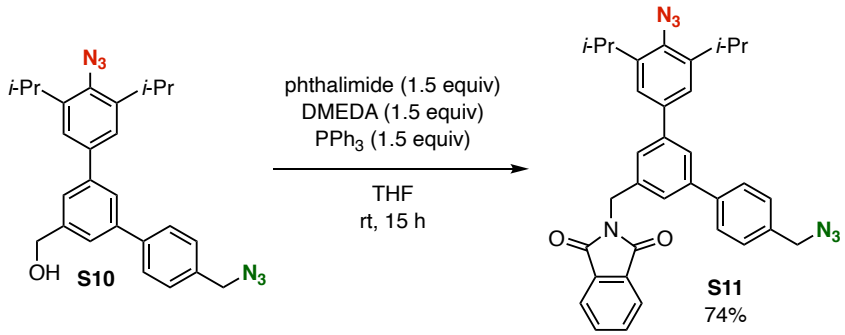
*Synthesis of 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl alcohol (**S10**)*



To a solution of methyl 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzoate (**S9**) (114 mg, 0.243 mmol) dissolved in THF (1.5 mL) was slowly added diisobutylaluminium hydride (1.02 M in *n*-hexane, 950 µL, 0.972 mmol) at –78 °C. After stirring for 3 h at the same temperature, to the mixture was slowly added water, and then aqueous HCl (2 M). The mixture was extracted with EtOAc, and the combined organic extract was washed with brine, dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by

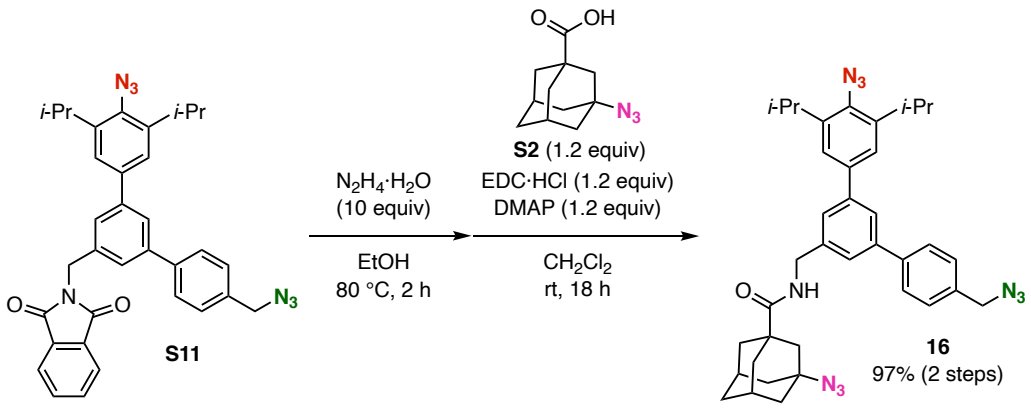
column chromatography (Biotage® ZIP sphere cartridge 5 g, *n*-hexane/EtOAc = 100/0 to 75/25) to give 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl alcohol (**S10**) (88.1 mg, 0.200 mmol, 82%) as a pale orange oil.

*Synthesis of N-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)phthalimide (**S11**)*



To a solution of 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl alcohol (**S10**) (86.3 mg, 0.196 mmol), phthalimide (45.0 mg, 0.306 mmol), and bis(2-methoxyethyl) azodicarboxylate (DMEAD) (71.7 mg, 0.306 mmol) dissolved in THF (2.0 mL) was added PPh_3 (80.3 mg, 0.306 mmol) at room temperature. After stirring for 15 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP sphere cartridge 5 g, *n*-hexane/EtOAc = 100/0 to 86/14) to give *N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)phthalimide (**S11**) (83.3 mg, 0.146 mmol, 74%) as a pale orange oil.

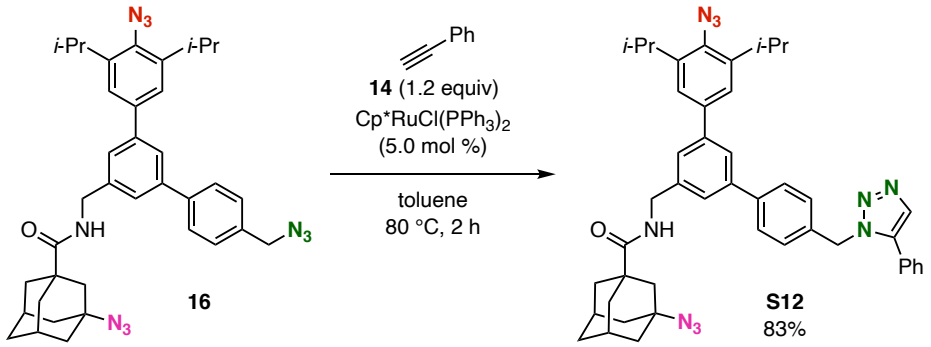
*Synthesis of 3-azido-N-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)-1-adamantanamide (**16**)*



To a solution of *N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)phthalimide (**S11**) (45.1 mg, 73.2 μmol) dissolved in EtOH (1.6 mL) was added hydrazine monohydrate (41.2 mg, 0.823 mmol) at room temperature. After stirring for 2 h at 80 °C, the mixture was concentrated under reduced pressure. After water was added to the residue, the mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. To the resulting mixture, 3-azido-1-adamantanecarboxylic acid (**S2**) (19.4 mg, 87.8 μmol), 1-ethyl-3-(3-(dimethylamino)propyl)carbodiimide hydrochloride (16.8 mg, 87.8 μmol), and 4-(dimethylamino)pyridine (10.7 mg, 87.8 μmol) was added CH_2Cl_2 (1.5 mL) at room temperature. After stirring for 18 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by flash column chromatography (Biotage® ZIP-sphere cartridge 5 g, *n*-hexane/EtOAc = 100/0 to 75/25) to give 3-azido-*N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)-1-adamantanamide (**16**) (45.5 mg, 70.8 μmol, 97%, in 2 steps) as a pale

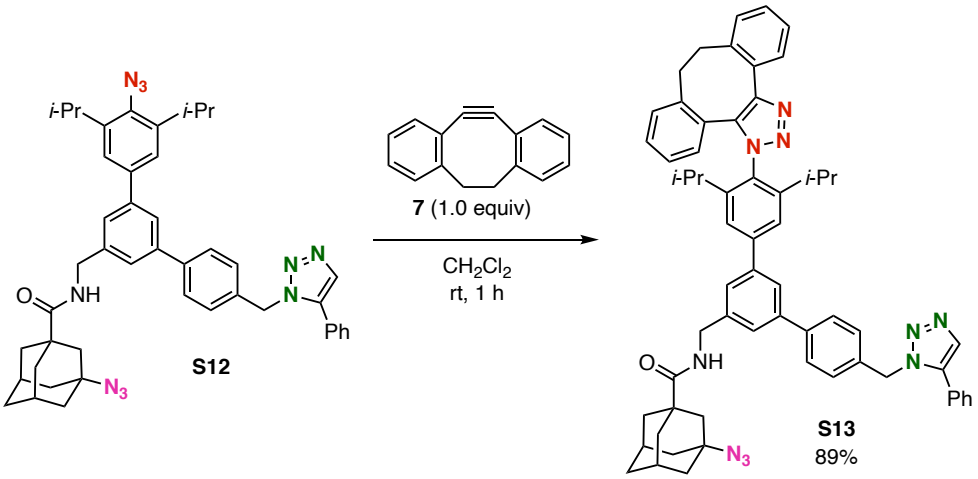
brown solid.

Synthesis of mono(triazole) ***S12***



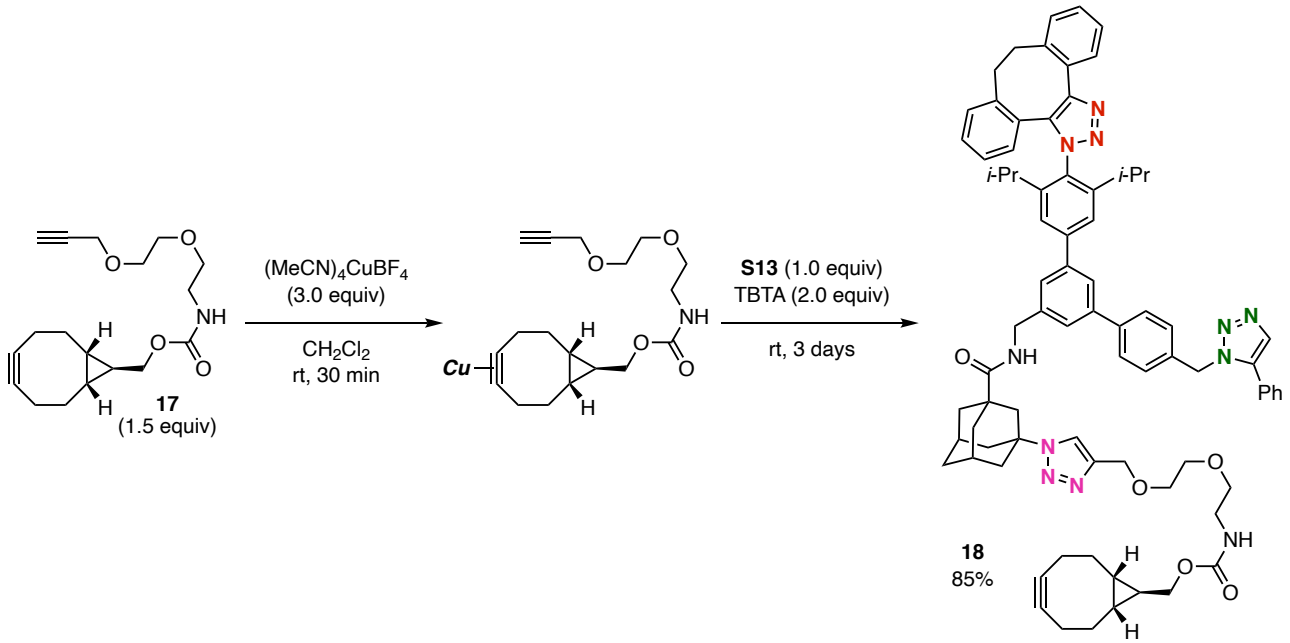
To a solution of platform **16** (32.1 mg, 50.0 μmol) dissolved in toluene (1.0 mL) was added phenylacetylene (**14**) (7.7 mg, 75 μmol) and (pentamethylcyclopentadienyl)bis(triphenylphosphine)ruthenium(II) chloride (1.99 mg, 2.50 μmol) at room temperature. After stirring for 2 h at 80 ºC, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 30/1) to give mono(triazole) **S12** (30.8 mg, 41.3 μmol, 83%) as a brown solid.

Synthesis of bis(triazole) ***S13***



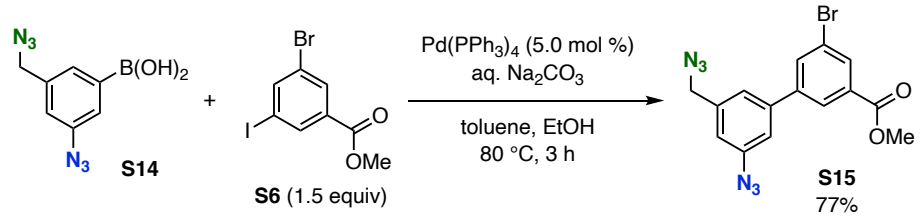
To a solution of mono(triazole) **S12** (20.3 mg, 27.3 μmol) dissolved in CH_2Cl_2 (0.50 mL) was added 5,6-didehydro-11,12-dihydrodibenzo[*a*,*e*]cyclooctene (**7**) (5.06 mg, 24.8 μmol) at the room temperature. After stirring for 1 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (*n*-hexane/EtOAc = 1/2) to give bis(triazole) **S13** (20.9 mg, 22.0 μmol, 89%) as a colorless solid.

Synthesis of tris(triazole) ***18***



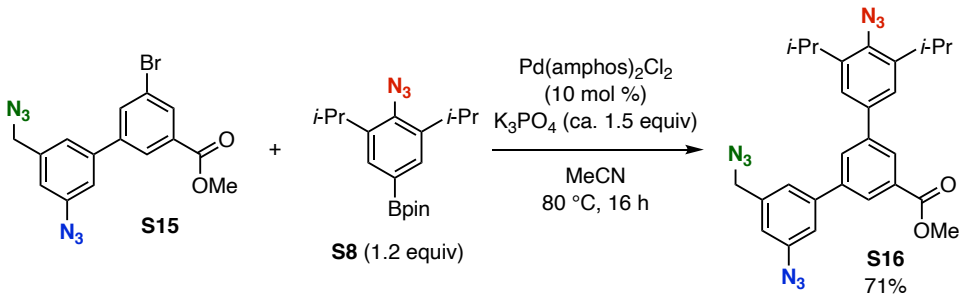
To a solution of (1α,8α,9α)-bicyclo[6.1.0]non-4-yn-9-ylmethyl *N*-(2-(2-(propargyloxy)ethoxy)ethyl)carbamate (**17**) (3.38 mg, 10.6 μmol) dissolved in CH_2Cl_2 (0.50 mL) was added tetrakis(acetonitrile)copper(I) tetrafluoroborate (6.61 mg, 21.0 μmol) at room temperature. After stirring for 30 min at the same temperature, to the mixture was added bis(triazole) **S13** (6.40 mg, 6.74 μmol) dissolved in CH_2Cl_2 (0.50 mL) and TBTA (7.46 mg, 14.1 μmol). After stirring for 3 days, to the mixture was added aqueous EDTA·2Na (0.1 M, 8.4 mL). After stirring for 24 h, the mixture was extracted with CH_2Cl_2 and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 20/1) and then preparative TLC (CH_2Cl_2/MeOH = 20/1) to give tris(triazole) **18** (7.29 mg, 5.75 μmol, 85%) as a colorless solid.

*Synthesis of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-bromobenzoate (****S15****)*



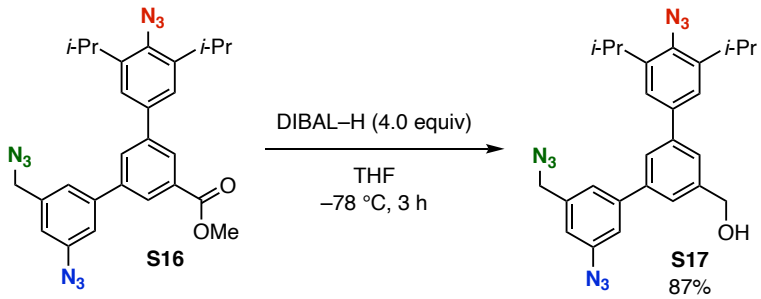
To a solution of methyl 3-bromo-5-iodobenzoate (**S6**) (1.40 g, 4.10 mmol) dissolved in toluene (12 mL) and EtOH (2.0 mL) was added $Pd(PPh_3)_4$ (159 mg, 0.138 mmol), aqueous Na_2CO_3 (1.6 M, 15.0 mL), and 3-azido-5-(azidomethyl)phenylboronic acid (**S14**) (597 mg, 2.74 mmol) at room temperature. After stirring for 3 h at 80 °C, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 120 g, *n*-hexane/CH_2Cl_2 = 58/42) to give methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-bromobenzoate (**S15**) (813 mg, 2.10 mmol, 77%) as a brown solid.

*Synthesis of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzoate (**S16**)*



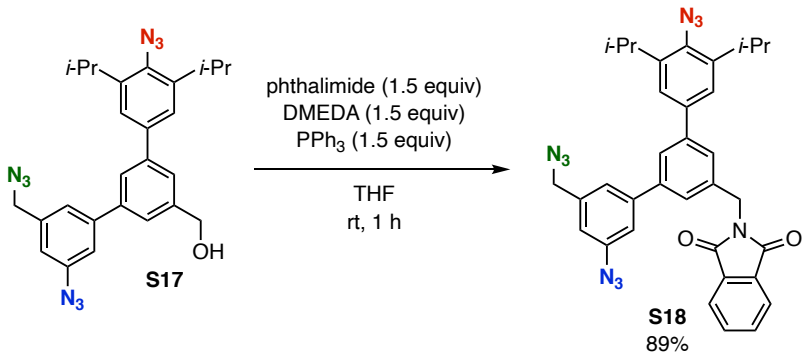
To a mixture of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-bromobenzoate (**S15**) (1.61 g, 4.16 mmol), 1-azido-2,6-diisopropyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzene (**S8**) (1.65 g, 5.01 mmol), $Pd(amphos)_2Cl_2$ (296 mg, 0.417 mmol), and tripotassium phosphate *n* hydrate (1.23 g, ca. 6 mmol) was added MeCN (16 mL) and H_2O (1.6 mL) at room temperature. After stirring for 16 h at 80 °C, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 30 g, *n*-hexane/CH_2Cl_2 = 59/41 to 0/100) to give methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzoate (**S16**) (1.50 g, 2.95 mmol, 71%) as a brown oil.

*Synthesis of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl alcohol (**S17**)*



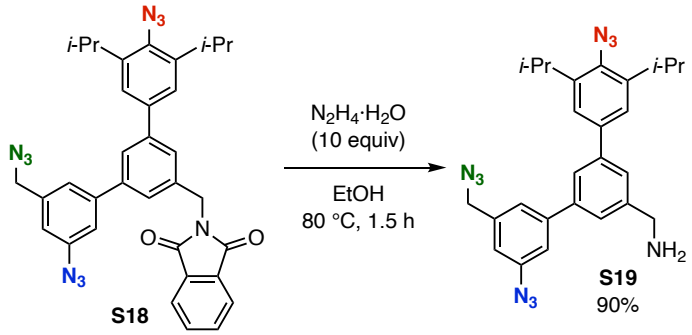
To a solution of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzoate (**S16**) (12.7 mg, 24.9 µmol) dissolved in THF (0.15 mL) was slowly added diisobutylaluminium hydride (1.02 M in *n*-hexane, 100 µL, 102 µmol) at –78 °C. After stirring for 3 h at the same temperature, to the mixture was slowly added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 5 g, *n*-hexane/EtOAc = 77/23) to give 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl alcohol (**S17**) (10.4 mg, 21.6 µmol, 87 %) as a brown oil.

*Synthesis of N-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)phthalimide (**S18**)*



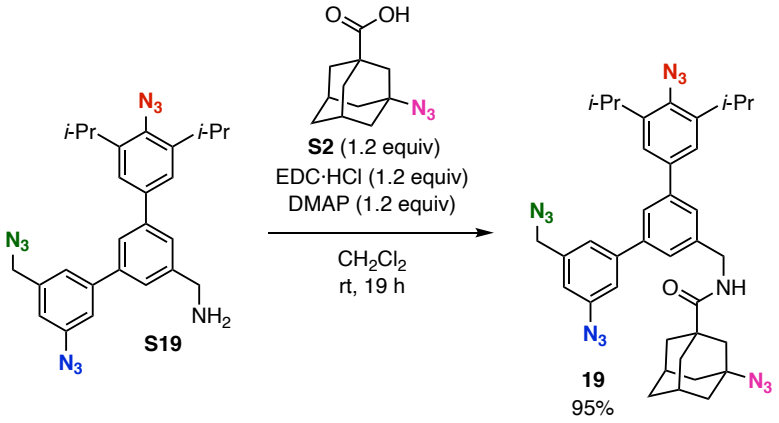
To a solution of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl alcohol (**S17**) (278 mg, 0.576 mmol), phthalimide (128 mg, 0.867 mmol), and dis(2-methoxyethyl) azodicarboxylate (DMEAD) (206 mg, 0.877 mmol) dissolved in THF (6.0 mL) was added PPh_3 (222 mg, 0.846 mmol) at room temperature. After stirring for 1 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 45 g, *n*-hexane/EtOAc = 87/13 to 66/34) to give *N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)phthalimide (**S18**) (313 mg, 0.513 mmol, 89%) as a pale brown solid.

*Synthesis of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzylamine (**S19**)*



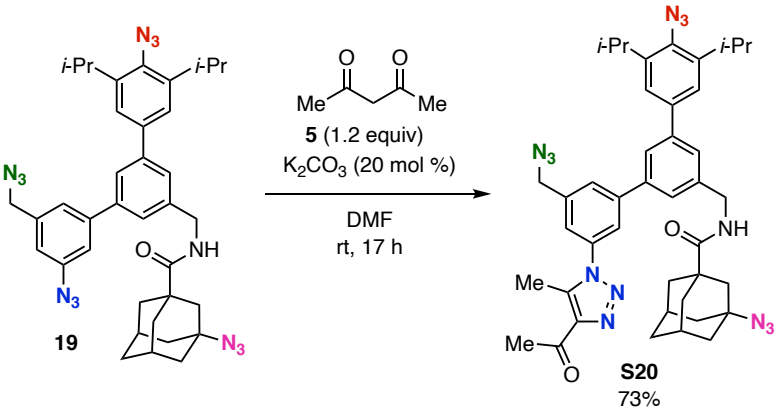
To a solution of *N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)phthalimide (**S18**) (1.00 g, 1.64 mmol) dissolved in EtOH (38 mL) was added hydrazine monohydrate (821 mg, 821 mmol) at room temperature. After stirring for 1.5 h at 80 °C, the mixture was concentrated under reduced pressure. After water was added to the residue, the mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (Biotage® ZIP-sphere cartridge 45 g, CH_2Cl_2/MeOH = 95/5 to 87/13) to give 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzylamine (**S19**) (708 mg, 1.47 mmol, 90%) as a brown oil.

*Synthesis of 3-azido-N-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)-1-adamantanamide (**19**)*



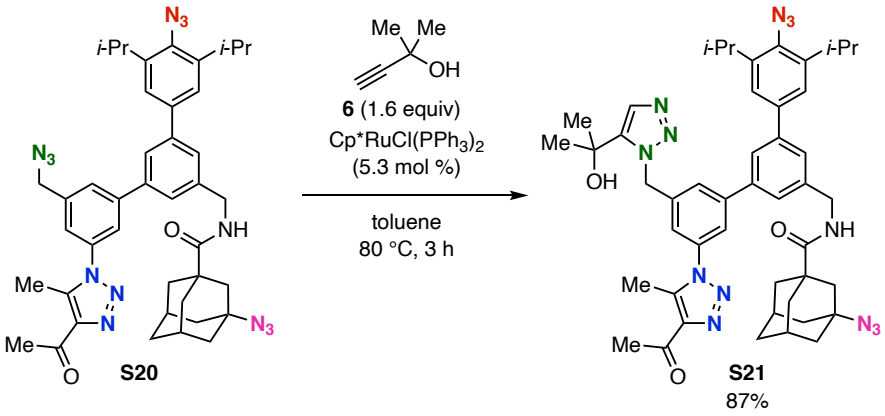
To a mixture of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl amine (**S19**) (631 mg, 1.31 mmol), 3-azido-1-adamantanecarboxylic acid (**S2**) (350 mg, 1.58 mmol), 1-ethyl-3-(3-(dimethylamino)propyl)carbodiimide hydrochloride (304 mg, 1.58 mmol), and 4-(dimethylamino)pyridine (192 mg, 1.57 mmol) was added CH_2Cl_2 (13 mL) at room temperature. After stirring for 19 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by flash column chromatography (Biotage® ZIP-sphere cartridge 45 g, *n*-hexane/EtOAc = 75/25 to 54/46) to give 3-azido-*N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)-1-adamantinamide (**19**) (855 mg, 1.25 mmol, 95%) as a pale yellow solid.

*Synthesis of mono(triazole) **S20***



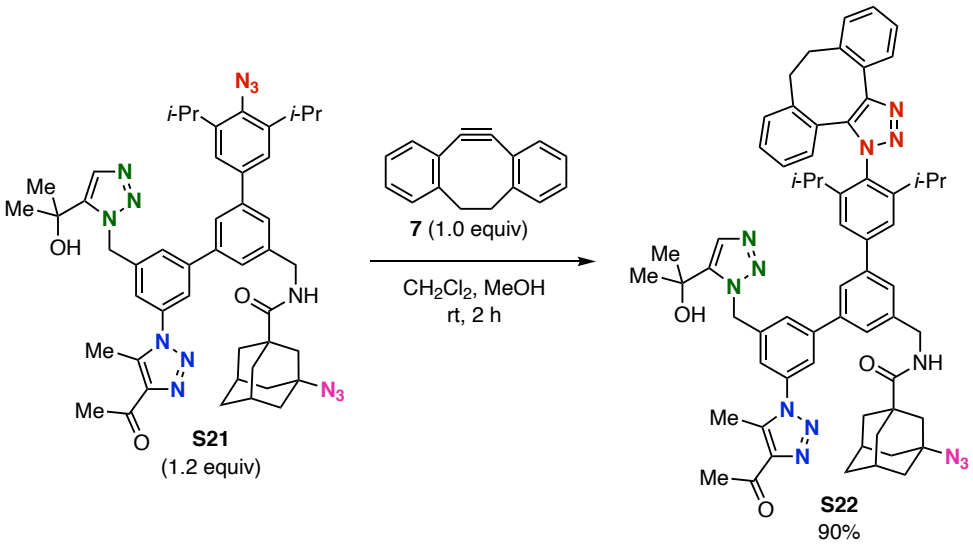
To a mixture of platform **19** (68.4 mg, 0.100 mmol), and acetylacetone (**5**) (11.9 mg, 0.119 mmol) dissolved in DMF (1.0 mL) was added K_2CO_3 (2.8 mg, 20 µmol) at room temperature. After stirring for 17 h at the same temperature, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 10 g, *n*-hexane/EtOAc = 67/33 to 46/54) to give mono(triazole) **S20** (56.2 mg, 73.4 µmol, 73%) as an orange solid.

Synthesis of bis(triazole) ***S21***



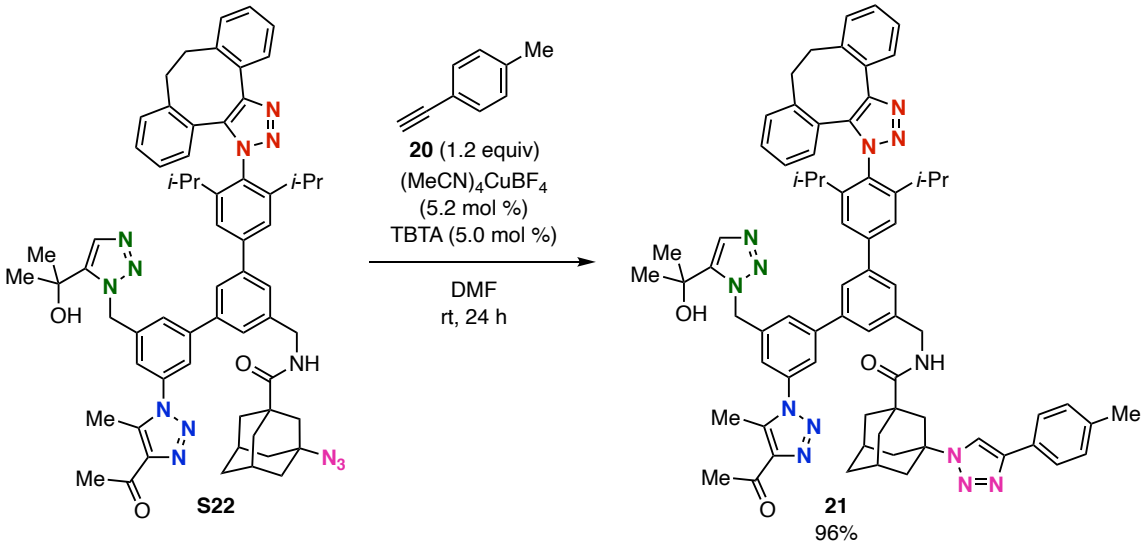
To a solution of mono(triazole) **S20** (51.2 mg, 66.8 μmol) dissolved in toluene (1.0 mL) was added 2-methyl-3-butyn-2-ol (**6**) (9.1 mg, 0.11 mmol) and (pentamethylcyclopentadienyl)bis(triphenylphosphine)ruthenium(II) chloride (2.8 mg, 3.5 μmol) at room temperature. After stirring for 3 h at 80 ºC, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 10 g, CH_2Cl_2/EtOAc = 55/45 to 0/100) to give bis(triazole) **S21** (49.3 mg, 58.0 μmol, 87%) as a brown solid.

Synthesis of tris(triazole) ***S22***



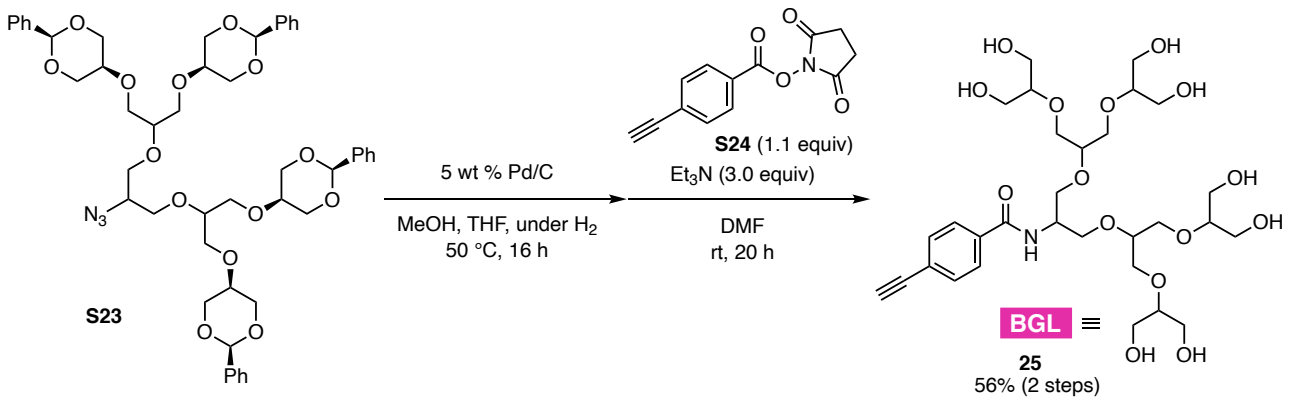
To a mixture of bis(triazole) **S21** (41.7 mg, 49.1 μmol. 1.19 equiv), and 5,6-didehydro-11,12-dihydrodibenzo[*a*,*e*]cyclooctene (**7**) (8.4 mg, 41 μmol) was added CH_2Cl_2 (0.50 mL), and MeOH (0.50 mL) at room temperature. After stirring for 2 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by preparative TLC (CH_2Cl_2/MeOH = 29/1), preparative TLC (CH_2Cl_2/MeOH = 19/1), and then preparative TLC (CH_2Cl_2/acetone = 6/4) to give tris(triazole) **S22** (39.2 mg, 37.2 μmol, 90%) as a colorless solid.

Synthesis of tetrakis(triazole) ***21***



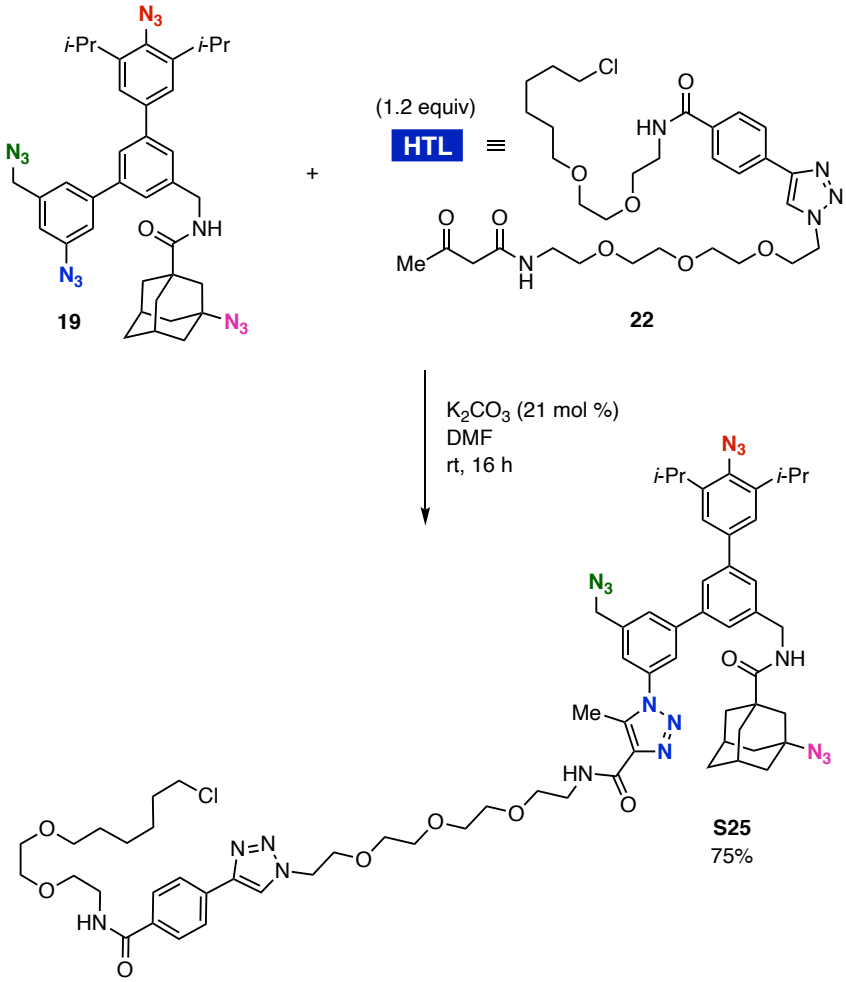
To a mixture of tris(triazole) **S22** (14.7 mg, 13.9 μmol) and 4-ethynyltoluene (**20**) (2.0 mg, 17 μmol) dissolved in DMF (60 μL) was added tetrakis(acetonitrile)copper(I) tetrafluoroborate (0.23 mg, 0.73 μmol) and TBTA (0.37 mg, 0.70 μmol) dissolved in DMF (140 μL) at the room temperature. After stirring for 24 h at the same temperature, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 10 g, *n*-hexane/EtOAc = 8/92 to 0/100) to give tetrakis(triazole) **21** (15.7 mg, 13.4 μmol, 96%) as a colorless solid.

*Synthesis of N-(5,11-bis(((1,3-dihydroxypropan-2-yl)oxy)methyl)-1,15-dihydroxy-2,14-bis(hydroxymethyl)-3,6,10,13-tetraoxapentadecan-8-yl)-4-ethynylbenzamide (**25**)*



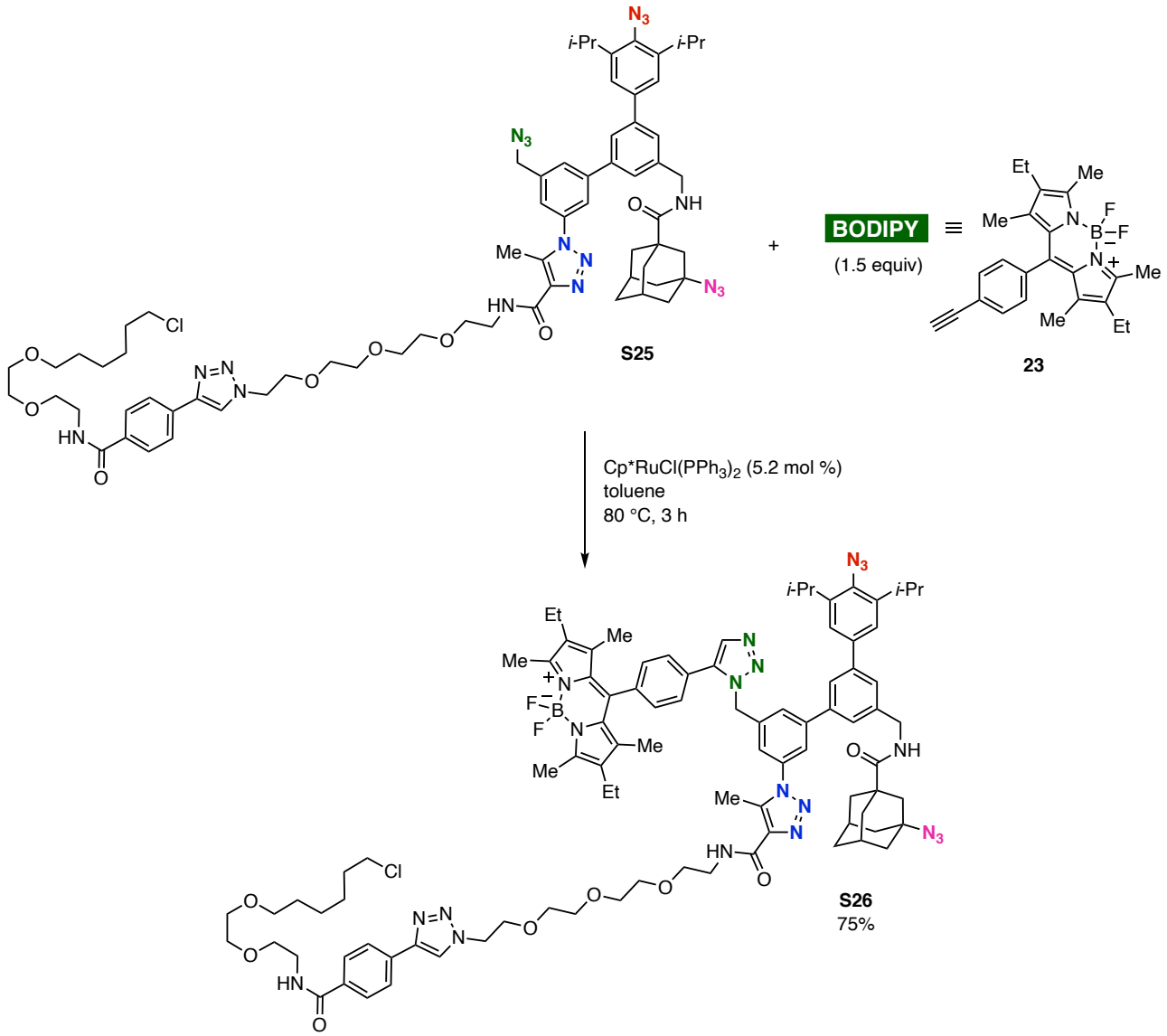
To a mixture of azide **S23** (67.0 mg, 73.3 μmol) and 5 wt % Pd/C (wetted with ca. 50 % water) (239 mg) was added methanol (6.0 mL) and THF (3.0 mL) at room temperature. After stirring for 16 h at 50 °C under a hydrogen atmosphere, the mixture was filtered with celite, and the filtrate was concentrated under reduced pressure. To the residue was added *N*-succinimidyl 4-ethynylbenzoate (**S24**) (20.0 mg, 82.2 μmol), triethylamine (22.3 mg, 220 μmol), and DMF (3.0 mL) at room temperature. After stirring for 20 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (CHROMATOREX Q-PACK ODS30 SIZE10, water/MeCN = 9/1) to give *N*-(5,11-bis(((1,3-dihydroxypropan-2-yl)oxy)methyl)-1,15-dihydroxy-2,14-bis(hydroxymethyl)-3,6,10,13-tetraoxapentadecan-8-yl)-4-ethynylbenzamide (**25**) (27.1 mg, 40.8 μmol, 56% in 2 steps) as colorless oil.

Synthesis of platform–HTL conjugate ***S25***



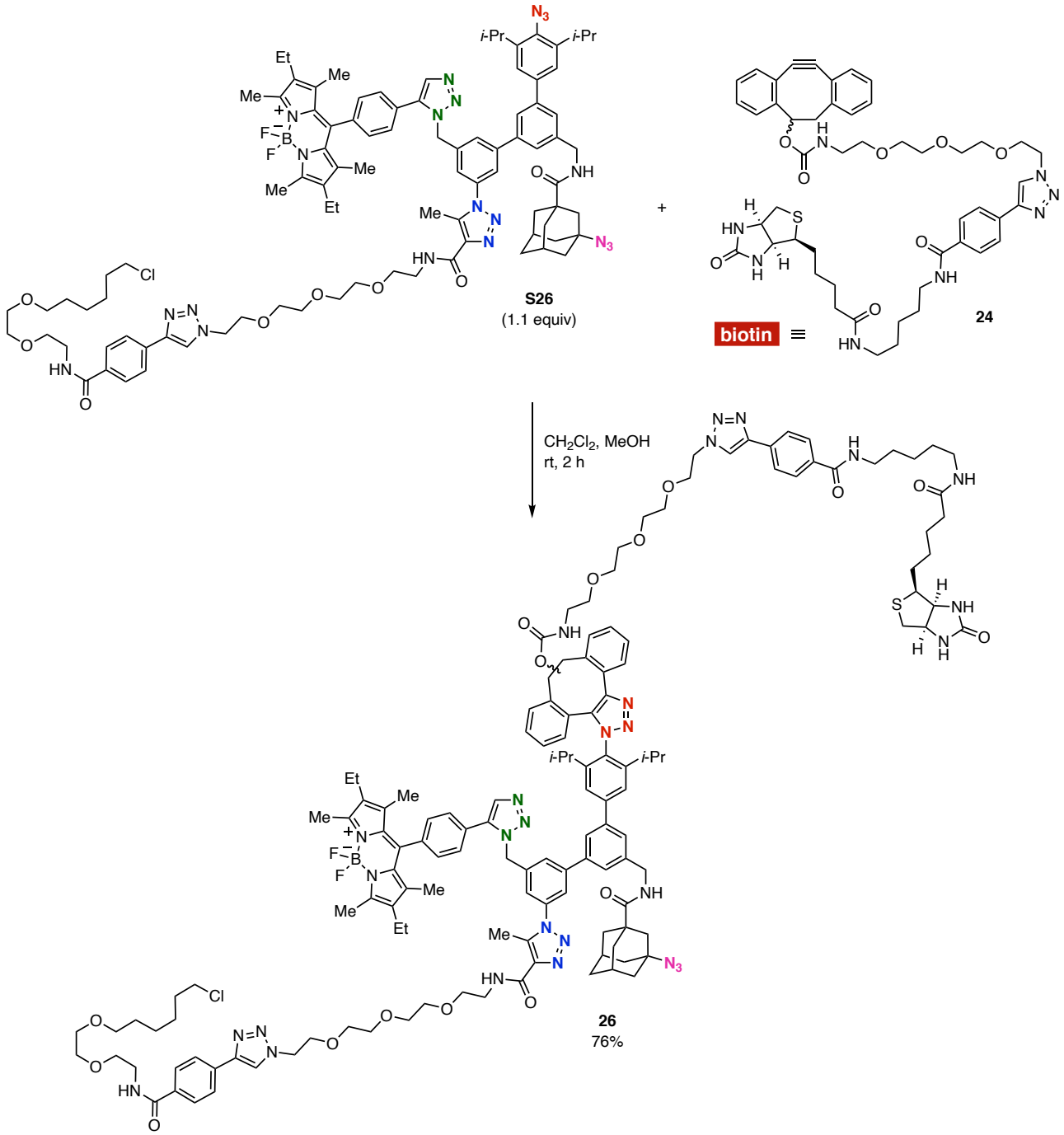
To a mixture of platform **19** (103 mg, 0.150 mmol) and β-ketoamide **22** (118 mg, 0.181 mmol) dissolved in DMF (1.0 mL) was added K_2CO_3 (4.3 mg, 31 μmol) at room temperature. After stirring for 16 h at the same temperature, to the mixture was added water. The mixture was extracted with EtOAc. The combined organic extract was washed with brine and dried with Na_2SO_4. After filtration, the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 10 g, EtOAc/MeOH = 100/0 to 94/6) to give platform–HTL conjugate **S25** (148 mg, 0.112 mmol, 75%) as a pale brown solid.

Synthesis of platform–HTL–BODIPY conjugate ***S26***



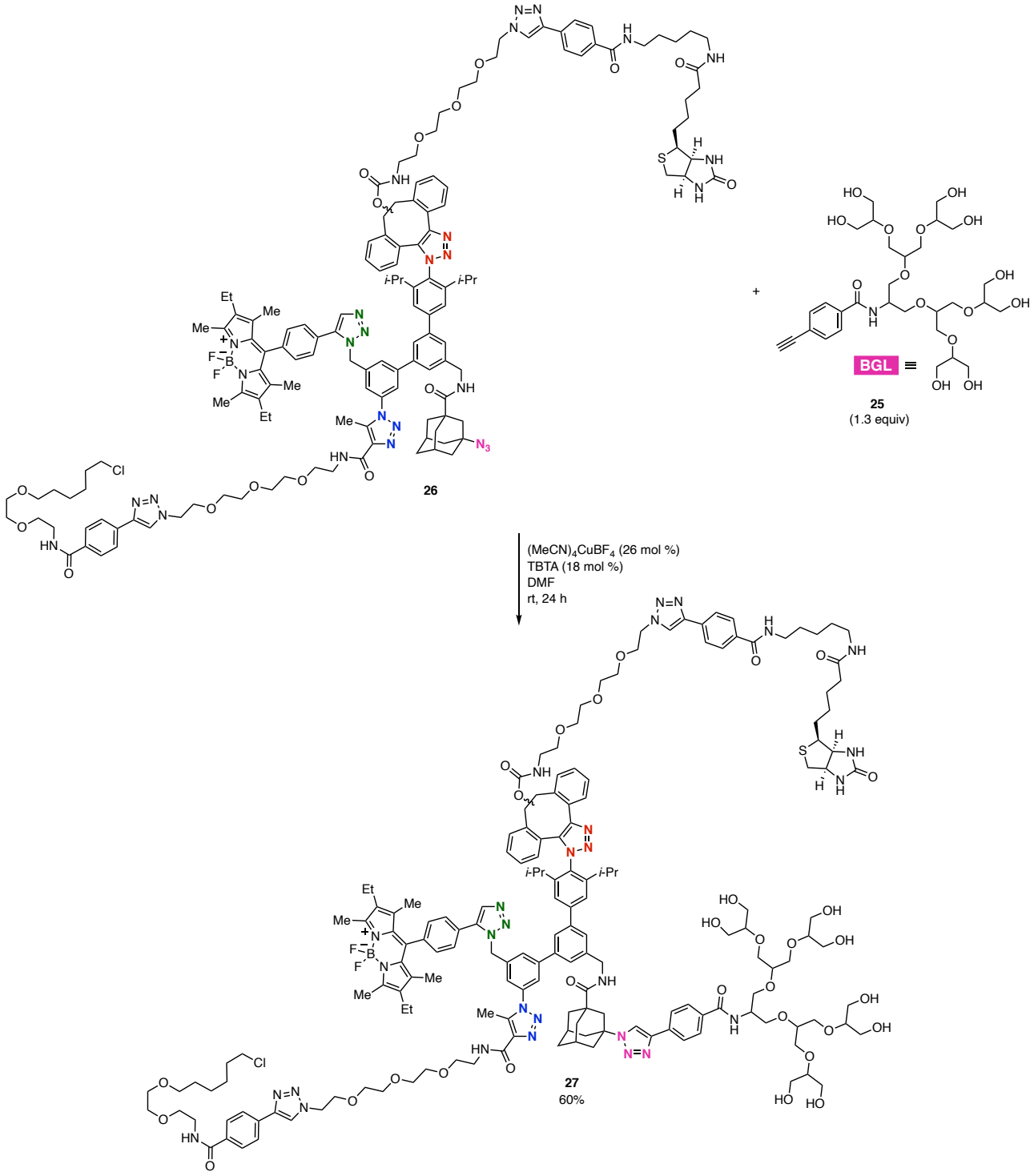
To a mixture of platform–HTL conjugate **S25** (51.1 mg, 38.7 μmol), alkyne **23** (23.5 mg, 58.1 μmol), and (pentamethylcyclopentadienyl)bis(triphenylphosphine)ruthenium(II) chloride (1.6 mg, 2.0 μmol) was added toluene (0.50 mL) at room temperature. After stirring for 1.5 h at 80 °C, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (Biotage® ZIP-sphere cartridge 10 g, EtOAc/MeOH = 100/0 to 90/10) to give platform–HTL–BODIPY conjugate **S26** (49.8 mg, 28.9 μmol, 75%) as a red solid.

Synthesis of platform–HTL–BODIPY–biotin conjugate ***26***



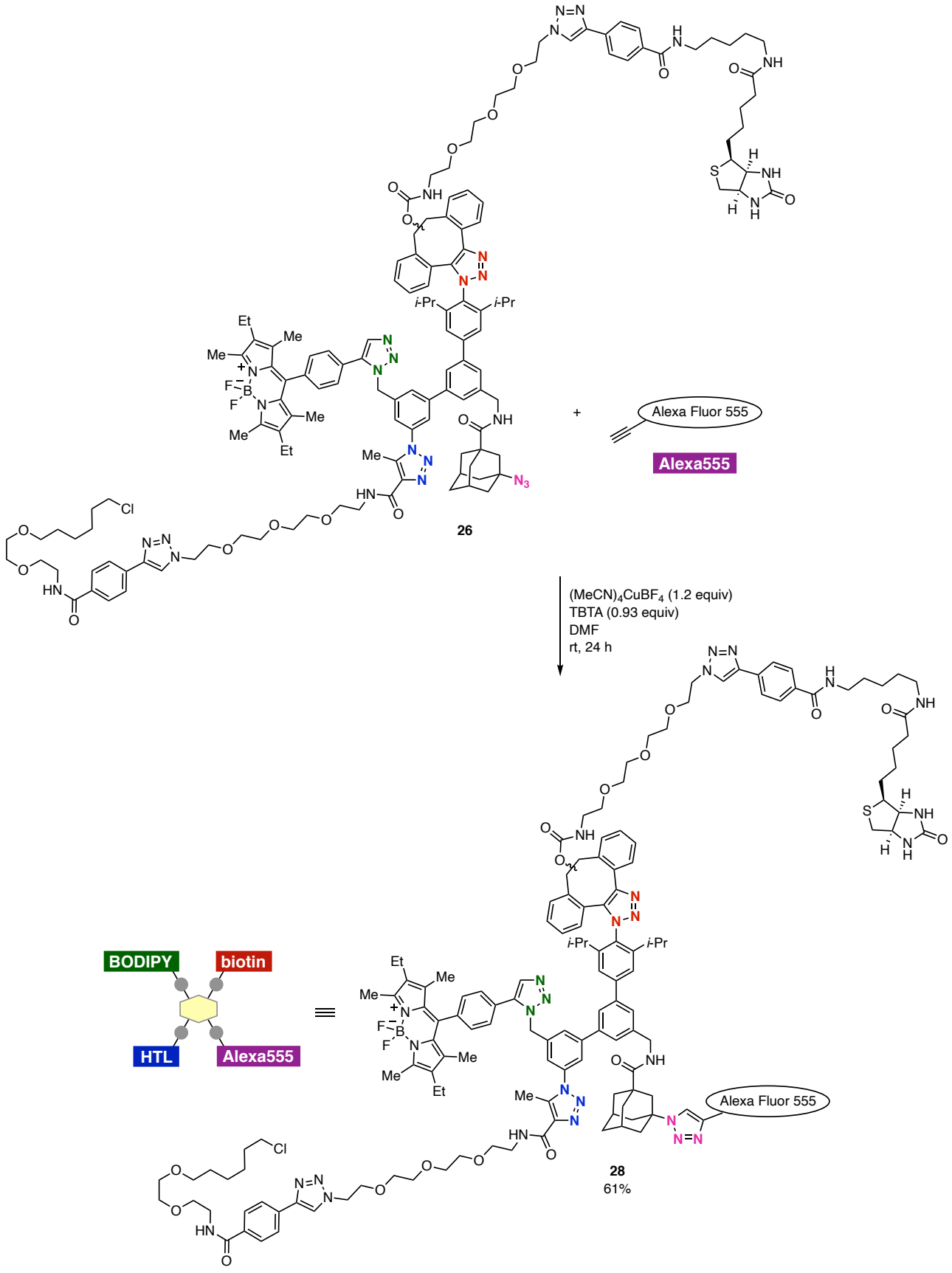
To a solution of platform–HTL–BODIPY conjugate **S26** (10.9 mg, 6.32 μmol) dissolved in CH_2Cl_2 (0.15 mL) and MeOH (0.15 mL) was added cycloalkyne **24** (5.16 mg, 5.60 μmol) dissolved in CH_2Cl_2 (0.10 mL) and MeOH (0.10 mL) at room temperature. After stirring for 2 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (silica-gel 700 mg, CH_2Cl_2/acetone = 50/50, then CH_2Cl_2/MeOH = 90/10) to give platform–HTL–BODIPY–biotin conjugate **26** (11.3 mg, 4.27 μmol, 76%) as a red solid.

*Synthesis of platform–HTL–BODIPY–biotin–BGL conjugate **27***



To a mixture of platform–HTL–BODIPY–biotin conjugate **26** (6.80 mg, 2.57 µmol), tetrakis(acetonitrile)copper(I) tetrafluoroborate (0.21 mg, 0.67 µmol), and TBTA (0.24 mg, 0.45 µmol) was added alkyne **25** (2.17 mg, 3.27 µmol) and DMF (0.10 mL) at room temperature. After stirring for 18 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (silica-gel 700 mg, CH_2Cl_2/MeOH = 100/0 to 0/100) to give platform–HTL–BODIPY–biotin–BGL conjugate **27** (5.1 mg, 1.5 µmol, 60%) as a red solid.

Synthesis of platform–HTL–BODIPY–biotin–Alexa Fluor 555 conjugate ***28***



To a mixture of platform–HTL–BODIPY–biotin conjugate **26** (1.65 mg, 0.624 μmol), tetrakis(acetonitrile)copper(I) tetrafluoroborate (0.23 mg, 0.73 μmol), and TBTA (0.31 mg, 0.58

μmol) was added Alexa Fluor™ 555 alkyne triethylammonium salt (MW = ~750, 0.5 mg, ca. 0.7 μmol) dissolved in DMF (0.10 mL) at room temperature. After stirring for 18 h at the same temperature, the mixture was concentrated under reduced pressure. The residue was purified by column chromatography (silica-gel 500 mg, CH_2Cl_2 to CH_2Cl_2/MeOH = 4/1) and then column chromatography (CHROMATOREX ODS-DM1020T 100-200 mesh 500 mg, H_2O/MeOH = 1/2 to MeOH) to give platform–HTL–BODIPY–biotin–Alexa555 conjugate **28** (MW = ~3400, 1.3 mg, 0.38 μmol, 61%) as a red solid.

Biological Experiments

Production of recombinant GST-HaloTag protein in E. coli

Escherichia coli strain Rosetta (DE3) pLysS cells (Merck Chemicals Ltd., Nottingham, England) were transformed with pGEX6P-1-HaloTag vector,[S8] and cultured in LB media containing 50 mg L^{-1} Carbenicillin (Nacalai Tesque, Kyoto, Japan) and 34 mg L^{-1} chloramphenicol (Nacalai Tesque). After induction for 16 h at 30 °C, the cells were collected by centrifugation at 4,500 g for 20 min, and frozen in liquid N_2. After thawing, the cells were suspended in cell lysis buffer containing 20 mM HEPES-KOH (pH 8.0), 200 mM NaCl, 2 mM tris(2-carboxyethyl)phosphine hydrochloride (Nacalai Tesque), 10% glycerol (Nacalai Tesque), and 1% Triton X-100, and then lysozyme (TCEP; Nacalai Tesque) was added to the cell lysate, which were incubated on ice for 30 min. $MgCl_2$ (final concentration at 10 mM) and DNase I (final concentration of approximately 20 μg mL^{-1}) were added into the cell lysate, and incubation was continued for 1 h at 4 °C. Cell debris and larger particles were removed by centrifugation at 8,000 g for 20 min at 4 °C, and the supernatant was then filtered through a 0.45-μm filter. The filtrated supernatants were frozen in liquid N_2, and stored at –80 ºC until use for the following labeling experiments.

Chemical modification of GST-HaloTag

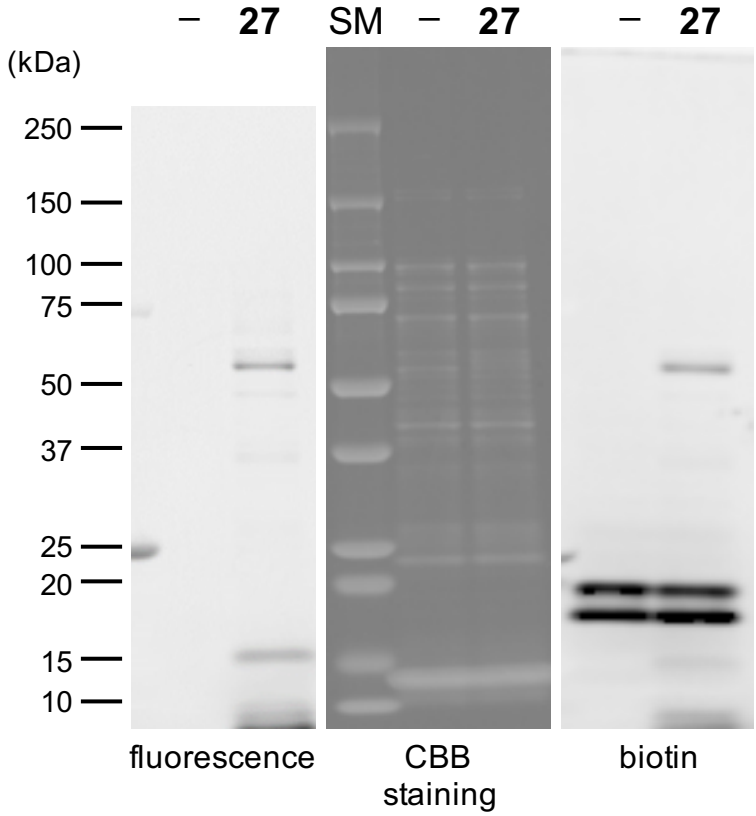
Into five hundred microlitter of the filtrated supernatants in a 1.5 mL-tube, five microlitter of the indicated compounds (10 mM stock in DMSO) were added, and immediately mix by vortex for 10 sec to be the final concentration of 100 μM. The solvent DMSO was used as a negative control. The mixtures were rotated gently in a dark room at room temperature for 16 h. Twenty-five microlitter of this reacted mixtures was diluted with equal volume of 2× SDS sample loading buffer (0.12 M Tris-HCl, pH 6.8, containing 3.4% SDS, 10% glycerol, and 20 mM DTT; Nacalai Tesque), heated at 98 °C for 10 min.

SDS-polyacrylamide gel electrophoresis (SDS-PAGE)

SDS-PAGE analysis was carried out under reducing conditions using a 5–20% polyacrylamide gel (ATTO, Tokyo, Japan). The gels were directly visualized by laser-scanning in a fluorescence imaging analyzer Typhoon 9410 (GE Healthcare). The gels were also stained with Coomassie brilliant blue (CBB) rapid stain kit (Nacalai Tesque).

The separated proteins in the gels were electrically transferred onto PVDF membranes in Mini Trans-Blot Cell (Bio-Rad Laboratories, Inc.). The membranes were immersed in Blocking One solution (Nacalai Tesque), and then incubated with horseradish peroxidase-conjugated streptavidin (HRP-streptavidin) (Kirkegaard & Perry Laboratories, Inc., Meryland, USA) diluted in 1% Blocking One /Tris-based saline containing 0.1% Tween 20 (TBST) at 4 ºC for 16 h. The membranes were extensively washed with TBST, and then reacted with ImmunoStar Zeta (FUJIFILM Wako Pure Chemical Corporation, Osaka, Japan). Luminescence signals were imaged on Amersham Imager 600 (GE Healthcare).

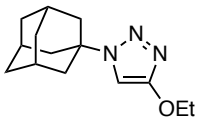
Chemical modification of the HaloTag protein by 27



Characterization Data of New Compounds

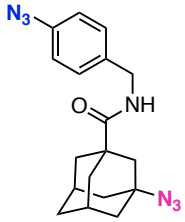
1-(1-Adamantyl)-4-phenyl-1*H*-1,2,3-triazole (**10a**),[S9] 1-(1-adamantyl)-4-(1-hydroxy-1-methylethyl)-1*H*-1,2,3-triazole (**10b**),[S10] and 1-(1-adamantyl)-4-(ethyoxycarbonyl)-1*H*-1,2,3-triazole (**10c**)[S11] were identical in spectra data with those reported in the literature.

1-(1-Adamantyl)-4-ethoxy-1*H*-1,2,3-triazole (**10d**)



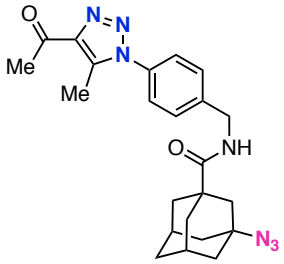
Colorless solid; Mp 136–138 °C; TLC R_f 0.37 (*n*-hexane/EtOAc = 4/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.40 (t, 3H, *J* = 7.0 Hz), 1.75–1.81 (m, 6H), 2.20–2.25 (m, 9H), 4.27 (q, 2H, *J* = 7.0 Hz), 7.04 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 14.9 (1C), 29.4 (3C), 35.9 (3C), 42.7 (3C), 59.6 (1C), 66.0 (1C), 102.5 (1C), 160.3 (1C); IR (KBr, cm^{-1}) 1182, 1215, 1369, 1452, 1560, 2914, 3127; HRMS (ESI^+) *m/z* 270.1576 ($[M+Na]^+$, $C_{14}H_{21}N_3NaO^+$ requires 270.1577).

3-Azido-*N*-(4-azidobenzyl)-1-adamantanamide (**13**)



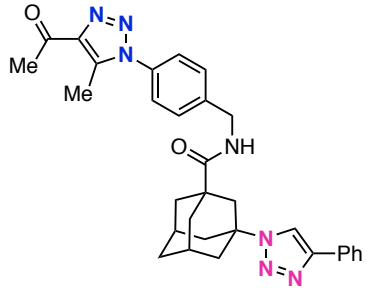
Colorless solid; Mp 83–85 °C; TLC R_f 0.51 (*n*-hexane/EtOAc = 1/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.63–1.67 (m, 2H), 176–1.82 (m, 8H), 1.88–1.92 (m, 2H), 2.29–2.33 (m, 2H), 4.40 (d, 2H, *J* = 6.0 Hz), 5.88 (br, 1H), 6.98–7.01 (m, 2H), 7.23–7.27 (m, 2H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 29.5 (2C), 34.8 (1C), 38.0 (2C), 40.5 (2C), 42.9 (1C), 43.1 (1C+1C, two signals overlapped), 58.9 (1C), 119.3 (2C), 129.1 (2C), 135.1 (1C), 139.3 (1C), 175.8 (1C); IR (KBr, cm^{-1}) 1287, 1506, 1638, 2089, 2922, 3333; HRMS (ESI^+) *m/z* 374.1700 ($[M+Na]^+$, $C_{18}H_{21}N_7NaO^+$ requires 374.1700).

N-(4-(4-Acetyl-5-methyl-1*H*-1,2,3-triazole-1-yl)benzyl)-3-azido-1-adamantanamide (**S3**)



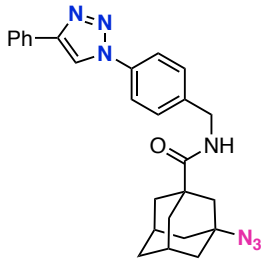
Colorless oil; TLC R_f 0.23 (*n*-hexane/EtOAc = 1/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.65–1.69 (m, 2H), 1.78–1.86 (m, 8H), 1.92–1.96 (m, 2H), 2.32–2.36 (m, 2H), 2.59 (s, 3H), 2.76 (s, 3H), 4.55 (d, 2H, *J* = 5.5 Hz), 6.03 (br, 1H), 7.41–7.44 (m, 2H), 7.45–7.48 (m, 2H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.2 (1C), 27.9 (1C), 29.5 (2C), 34.8 (1C), 38.0 (2C), 40.5 (2C), 42.8 (1C), 43.2 (1C+1C, two signals overlapped), 58.9 (1C), 125.5 (2C), 128.7 (2C), 134.5 (1C), 137.4 (1C), 140.8 (1C), 143.7 (1C), 176.1 (1C), 194.4 (1C); IR (KBr, cm^{-1}) 1244, 1517, 1643, 1681, 2089, 2920, 3342; HRMS (ESI^+) *m/z* 434.2284 ($[M+H]^+$, $C_{23}H_{28}N_7O_2^+$ requires 434.2299).

N-(4-(4-Acetyl-5-methyl-1*H*-1,2,3-triazole-1-yl)benzyl)-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)-1-adamantanamide (**15a**)



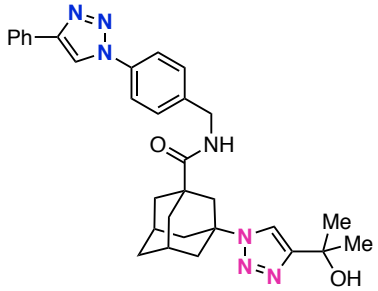
Colorless solid; Mp 179–181 °C; TLC R_f 0.66 (CH_2Cl_2/MeOH = 10/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.77–1.84 (m, 2H), 1.98–2.02 (m, 4H), 2.27–2.31 (m, 4H), 2.43–2.47 (m, 4H), 2.58 (s, 3H), 2.75 (s, 3H), 4.55 (d, 2H, *J* = 6.0 Hz), 6.36 (t, 1H, *J* = 6.0 Hz), 7.31–7.34 (m, 1H), 7.38–7.46 (m, 6H), 7.78–7.81 (m, 2H), 7.84 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.1 (1C), 27.9 (1C), 29.3 (2C), 34.9 (1C), 38.0 (2C), 42.0 (2C), 42.8 (1C), 42.9 (1C), 44.3 (1C), 59.8 (1C), 116.2 (1C), 125.5 (2C), 125.6 (2C), 128.1 (1C), 128.7 (2C), 128.8 (2C), 130.7 (1C), 134.4 (1C), 137.4 (1C), 140.8 (1C), 143.7 (1C), 147.0 (1C), 175.9 (1C), 194.4 (1C); IR (KBr, cm^{-1}) 1287, 1422, 1548, 1651, 1674, 2933, 3116, 3252; HRMS (ESI^+) *m/z* 558.2590 ($[M+Na]^+$, $C_{31}H_{33}N_7NaO_2^+$ requires 558.2588).

3-Azido-*N*-(4-(4-phenyl-1*H*-1,2,3-triazole-1-yl)benzyl)-1-adamantanamide (**S4**)



Colorless solid; Mp 211–214 °C; TLC R_f 0.51 (*n*-hexane/EtOAc = 1/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.64–1.68 (m, 2H), 1.77–1.86 (m, 8H), 1.92–1.96 (m, 2H), 2.30–2.34 (m, 2H), 4.52 (d, 2H, *J* = 5.5 Hz), 5.99 (br s, 1H), 7.36–7.40 (m, 1H), 7.41–7.49 (m, 4H), 7.72–7.73 (m, 2H), 7.88–7.91 (m, 2H), 8.18 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 29.5 (2C), 34.8 (1C), 38.0 (2C), 40.5 (2C), 42.8 (1C), 43.2 (1C+1C, two signals overlapped), 58.9 (1C), 117.6 (1C), 120.7 (2C), 125.8 (2C), 128.5 (1C), 128.8 (2C), 128.9 (2C), 130.1 (1C), 136.2 (1C), 139.4 (1C), 148.3 (1C), 176.1 (1C); IR (KBr, cm^{-1}) 1240, 1450, 1523, 1626, 2085, 2916, 3306; HRMS (ESI^+) *m/z* 476.2165 ($[M+Na]^+$, $C_{26}H_{27}N_7NaO^+$ requires 476.2169).

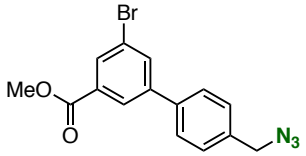
3-(4-(1-Hydroxy-1-methylethyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(4-(4-phenyl-1*H*-1,2,3-triazole-1-yl)benzyl)-1-adamantanamide (**15b**)



Colorless solid; Mp 133–136 °C; TLC R_f 0.51 (CH_2Cl_2/MeOH = 10/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.62 (s, 6H), 1.76–1.80 (m, 2H), 1.96–2.00 (m, 4H), 2.20–2.24 (m, 4H), 2.35–2.39 (m, 2H), 2.40–2.44 (m, 2H), 4.50 (d, 2H, *J* = 5.0 Hz), 6.36 (br, 1H), 7.36–7.40 (m, 3H), 7.44–7.47 (m, 2H), 7.54 (s, 1H), 7.69–7.73 (m, 2H), 7.88–7.91 (m, 2H), 8.19 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 29.2 (2C), 30.4 (2C), 34.8 (1C), 37.9 (2C), 41.9 (2C), 42.8 (1C), 42.9 (1C), 44.3 (1C), 60.0 (1C), 68.5 (1C),

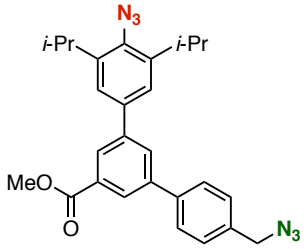
115.7 (1C), 117.7 (1C), 120.7 (2C), 125.8 (2C), 128.5 (1C), 128.8 (2C), 128.9 (2C), 130.1 (1C), 136.1 (1C), 139.5 (1C), 148.4 (1C), 154.8 (1C), 176.0 (1C); IR (KBr, cm^{-1}) 1228, 1521, 1628, 2922, 3142, 3335; HRMS (ESI^+) *m/z* 560.2729 ($[M+Na]^+$, $C_{31}H_{35}N_7NaO_2^+$ requires 560.2744).

Methyl 3-(4-(azidomethyl)phenyl)-5-bromobenzoate (**S7**)



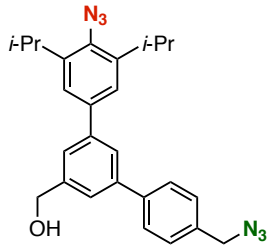
Colorless solid; Mp 71–72 °C; TLC R_f 0.37 (*n*-hexane/EtOAc = 9/1); ^1H NMR ($CDCl_3$, 500 MHz) δ 3.96 (s, 3H), 4.41 (s, 2H), 7.41–7.44 (m, 2H), 7.60–7.63 (m, 2H), 7.91 (dd, 1H, *J* = 1.8, 1.8 Hz), 8.16 (dd, 1H, *J* = 1.8, 1.8 Hz), 8.19 (dd, 1H, *J* = 1.8, 1.8 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 52.5 (1C), 54.4 (1C), 122.9 (1C), 126.7 (1C), 127.6 (2C), 128.9 (2C), 131.3 (1C), 132.4 (1C), 134.2 (1C), 135.6 (1C), 138.7 (1C), 142.7 (1C), 165.7 (1C); IR (KBr, cm^{-1}) 1250, 1305, 1443, 1560, 1720, 2102, 2951; HRMS (ESI^+) *m/z* 368.0007 ($[M+Na]^+$, $C_{15}H_{12}{}^{79}BrN_3NaO_2^+$ requires 368.0005).

Methyl 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzoate (**S9**)



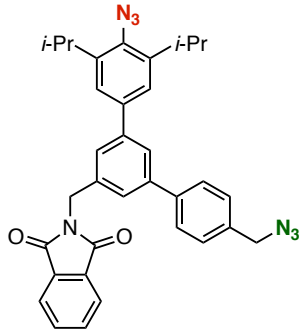
Pale yellow oil; TLC R_f 0.33 (*n*-hexane/EtOAc = 9/1); ^1H NMR ($CDCl_3$, 500 MHz) δ 1.34 (d, 12H, *J* = 6.9 Hz), 3.41–3.47 (m, 2H), 3.99 (s, 3H), 4.42 (s, 2H), 7.37 (s, 2H), 7.43–7.47 (m, 2H), 7.68–7.71 (m, 2H), 7.91 (dd, 1H, *J* = 1.5, 1.5 Hz), 8.20 (dd, 1H, *J* = 1.5, 1.5 Hz), 8.24 (dd, 1H, *J* = 1.5, 1.5 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 29.0 (2C), 52.4 (1C), 54.5 (1C), 123.0 (2C), 127.1 (1C), 127.3 (1C), 127.8 (2C), 128.8 (2C), 130.3 (1C), 131.3 (1C), 135.1 (1C), 135.2 (1C), 138.7 (1C), 140.2 (1C), 141.5 (1C), 142.3 (1C), 143.8 (2C), 166.9 (1C); IR (KBr, cm^{-1}) 1242, 1328, 1436, 1597, 1724, 2100, 2962; HRMS (ESI^+) *m/z* 491.2161 ($[M+Na]^+$, $C_{27}H_{28}N_6NaO_2^+$ requires 491.2166).

3-(4-Azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl alcohol (**S10**)



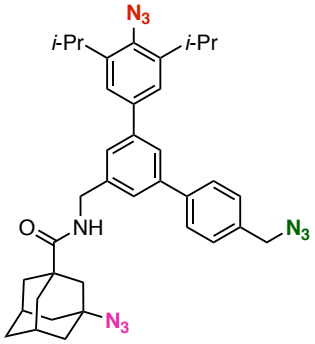
Pale orange oil; TLC R_f 0.19 (*n*-hexane/EtOAc = 4/1); ^1H NMR ($CDCl_3$, 500 MHz) δ 1.33 (d, 12H, *J* = 6.9 Hz), 1.80 (t, 1H, *J* = 5.7 Hz), 3.39–3.46 (m, 2H), 4.41 (s, 2H), 4.85 (d, 2H, *J* = 5.7 Hz), 7.37 (s, 2H), 7.41–7.45 (m, 2H), 7.54 (s, 1H), 7.58 (s, 1H), 7.64–7.68 (m, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 29.0 (2C), 54.5 (1C), 65.3 (1C), 123.0 (2C), 124.8 (1C), 125.0 (1C), 125.4 (1C), 127.8 (2C), 128.8 (2C), 134.7 (1C), 134.9 (1C), 139.4 (1C), 141.0 (1C), 141.5 (1C), 142.0 (1C), 142.3 (1C), 143.6 (2C); IR (KBr, cm^{-1}) 1259, 1327, 1438, 1597, 2100, 2962, 3327; HRMS (ESI^+) *m/z* 463.2211 ($[M+Na]^+$, $C_{26}H_{28}N_6NaO^+$ requires 463.2217).

N-(3-(4-Azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)phthalimide (**S11**)



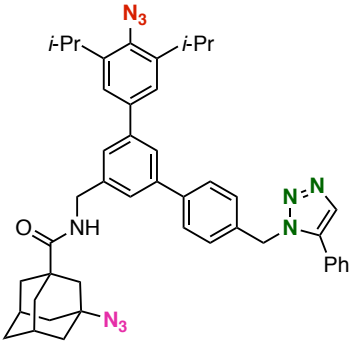
Pale orange oil; TLC R_f 0.40 (*n*-hexane/EtOAc = 4/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.32 (d, 12H, *J* = 6.8 Hz), 3.37–3.44 (m, 2H), 4.39 (s, 2H), 4.98 (s, 2H), 7.32 (s, 2H), 7.39–7.42 (m, 2H), 7.59–7.65 (m, 5H), 7.69–7.73 (m, 2H), 7.84–7.88 (m, 2H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.5 (4C), 29.0 (2C), 41.6 (1C), 54.5 (1C), 123.1 (2C), 123.4 (2C), 125.7 (1C), 126.4 (1C), 126.8 (1C), 127.8 (2C), 128.7 (2C), 132.1 (2C), 134.1 (2C), 134.7 (1C), 134.9 (1C), 137.5 (1C), 139.3 (1C), 140.8 (1C), 141.7 (1C), 142.5 (1C), 143.5 (2C), 168.1 (2C); IR (KBr, cm^{-1}) 1260, 1340, 1597, 1716, 1770, 2102, 2965; HRMS (ESI$^+$) *m/z* 592.2425 ([M+Na]$^+$, $C_{34}H_{31}N_7NaO_2^+$ requires 592.2431).

3-Azido-*N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)-1-adamantanamide (**16**)



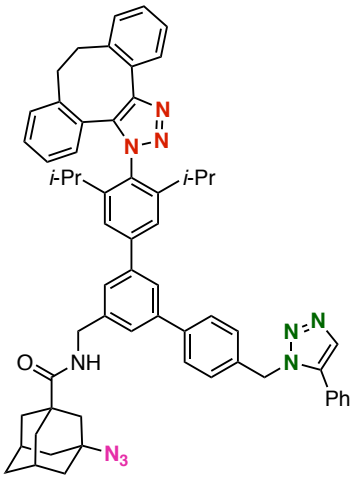
Pale brown solid; Mp 150 °C (decomp.); TLC R_f 0.37 (*n*-hexane/EtOAc = 7/3); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.33 (d, 12H, *J* = 6.9 Hz), 1.64–1.68 (m, 2H), 1.77–1.83 (m, 4H), 1.84–1.88 (m, 4H), 1.93–1.97 (m, 2H), 2.30–2.34 (m, 2H), 3.39–3.47 (m, 2H), 4.41 (s, 2H), 4.59 (d, 2H, *J* = 5.6 Hz), 5.97 (t, 1H, *J* = 5.6 Hz), 7.34 (s, 2H), 7.37–7.41 (m, 1H), 7.42–7.46 (m, 3H), 7.62–7.66 (m, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 28.9 (2C), 29.5 (2C), 34.8 (1C), 38.1 (2C), 40.5 (2C), 43.15 (1C), 43.19 (1C), 43.4 (1C), 54.5 (1C), 58.9 (1C), 123.0 (2C), 125.3 (1C), 125.4 (1C), 125.5 (1C), 127.7 (2C), 128.9 (2C), 134.8 (1C), 135.0 (1C), 139.2 (1C), 139.5 (1C), 140.8 (1C), 141.8 (1C), 142.5 (1C), 143.6 (2C), 175.9 (1C); IR (KBr, cm^{-1}) 1257, 1327, 1438, 1535, 1637, 2090, 2926, 3327; HRMS (ESI$^+$) *m/z* 665.3446 ([M+Na]$^+$, $C_{37}H_{42}N_{10}NaO^+$ requires 665.3435).

3-Azido-*N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**S12**)



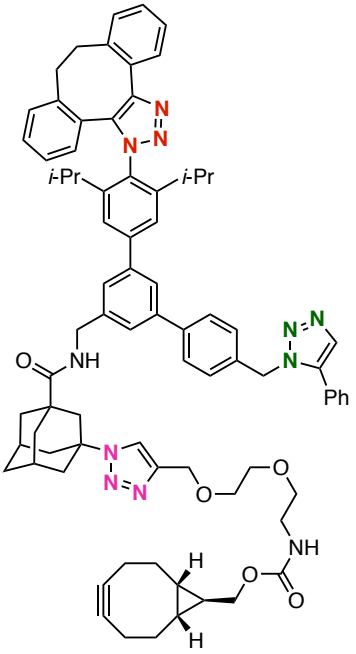
Brown solid; Mp 96 °C (decomp.); TLC R_f 0.47 (CH_2Cl_2/MeOH = 30/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.32 (d, 12H, J = 6.5 Hz), 1.62–1.67 (m, 2H), 1.75–1.84 (m, 4H), 1.84–1.89 (m, 4H), 1.92–1.97 (m, 2H), 2.29–2.34 (m, 2H), 3.38–3.45 (m, 2H), 4.57 (d, 2H, J = 5.6 Hz), 5.60 (s, 2H), 5.98–6.02 (br, 1H), 7.18–7.22 (m, 2H), 7.29–7.33 (m, 4H), 7.38 (s, 1H), 7.40 (s, 1H), 7.43–7.47 (m, 3H), 7.52–7.56 (m, 2H), 7.59 (s, 1H), 7.77 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 28.9 (2C), 29.5 (2C), 34.8 (1C), 38.1 (2C), 40.5 (2C), 43.1 (1C), 43.2 (1C), 43.4 (1C), 51.5 (1C), 58.9 (1C), 122.9 (2C), 125.2 (1C), 125.4 (1C), 125.5 (1C), 126.9 (1C), 127.7 (2C), 127.8 (2C), 128.9 (2C), 129.0 (2C), 129.6 (1C), 133.3 (1C), 134.9 (1C), 135.0 (1C), 138.2 (1C), 139.2 (1C), 139.5 (1C), 140.7 (1C), 141.6 (1C), 142.5 (1C), 143.6 (2C), 175.9 (1C); IR (KBr, cm^{-1}) 1246, 1439, 1517, 1643, 2089, 2926, 3323; HRMS (ESI$^+$) *m/z* 767.3903 ([M+Na]$^+$, $C_{45}H_{48}N_{10}NaO^+$ requires 767.3905).

3-Azido-*N*-(3-(4-(8,9-dihydro-1*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**S13**)



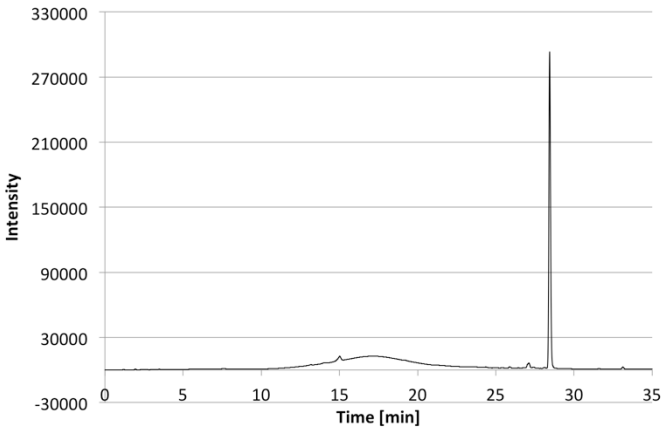
Colorless solid; Mp 132–134 °C; TLC R_f 0.27 (CH_2Cl_2/MeOH = 30/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ1.08–1.42 (br, 12H), 1.62–1.67 (m, 2H), 1.75–1.89 (m, 8H), 1.92–1.97 (m, 2H), 2.28–2.34 (m, 2H), 2.40–2.52 (br, 2H), 3.08–3.28 (br, 2H), 3.32–3.48 (br, 2H), 4.58 (d, 2H, J = 5.7 Hz), 5.60 (s, 2H), 6.08 (br t, 1H, J = 5.7 Hz), 6.75 (d, 1H, J = 7.6 Hz), 6.96 (dd, 1H, J = 7.6 Hz), 7.15–7.29 (m, 7H), 7.29–7.35 (m, 2H), 7.35–7.50 (m, 7H), 7.52–7.59 (m, 2H), 7.62 (s, 1H), 7.66–7.72 (m, 1H), 7.77 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 22.6 (2C), 25.4 (2C), 28.9 (2C), 29.5 (2C), 32.7 (1C), 34.8 (1C), 36.8 (1C), 38.1 (2C), 40.5 (2C), 43.1 (1C), 43.2 (1C), 43.3 (1C), 51.5 (1C), 58.9 (1C), 122.9 (2C), 125.3 (1C), 125.7 (1C), 125.8 (1C), 125.9 (1C), 126.0 (1C), 126.1 (1C), 126.9 (1C), 127.7 (2C), 127.8 (2C), 128.1 (2C), 128.8 (1C), 128.9 (2C), 129.1 (2C), 129.55 (1C), 129.58 (1C), 129.6 (2C), 129.9 (1C), 130.9 (1C), 131.6 (1C), 132.6 (1C), 135.0 (1C), 135.1 (1C), 137.5 (2C), 139.7 (1C), 140.6 (1C), 141.5 (1C), 141.7 (1C), 142.0 (1C), 142.9 (2C), 146.2 (1C), 176.0 (1C); IR (KBr, cm^{-1}) 1244, 1454, 1504, 1643, 2087, 2926, 3335; HRMS (ESI$^+$) *m/z* 971.4868 ([M+Na]$^+$, $C_{61}H_{60}N_{10}NaO^+$ requires 971.4844).

3-(4-(((((((1*R**,8*S**,9*R**)-Bicyclo[6.1.0]non-4-yn-9-yl)methyl)oxycarbonylamino)ethoxy)ethoxy)methyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(3-(4-(8,9-dihydro-1*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**18**)

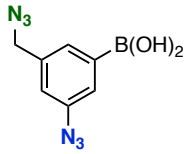


Colorless solid; Mp 105–106 °C; TLC R_f 0.67 (CH_2Cl_2/MeOH = 10/1); HPLC analysis: R*t* = 28.4 min [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; IR (KBr, cm^{-1}) 1278, 1452, 1517, 1720, 2922, 3340; HRMS (ESI^+) *m/z* 1290.6617 ($[M+Na]^+$, $C_{79}H_{85}N_{11}NaO_5^+$ requires 1266.6627).

HPLC chart:

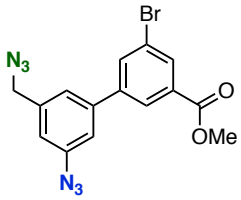


(3-Azido-5-(azidomethyl)phenyl)boronic acid (**S8**)



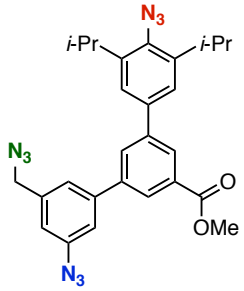
Pale yellow solid; Mp 114−116 °C; TLC R_f 0.45 (*n*-hexane/EtOAc = 1/1); ^{1}H NMR ($CDCl_3$, 500 MHz, observed as a mixture of the titled compound and its boroxine) δ 4.37 (s, 2H for boroxine), 4.48 (s, 2H), 7.07 (s,1H for boroxine), 7.23 (dd, 1H, J = 2.0, 2.0 Hz), 7.37 (s, 1H for boroxine), 7.43 (s, 1H for boroxine), 7.77 (d, 1H, J = 2.0 Hz), 7.87 (br s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz, observed as a mixture of the titled compound and its boroxine) δ 54.2, 121.2, 122.9, 123.7, 125.6, 129.5, 131.4, 132.0, 137.5, 140.6, 140.8; IR (KBr, cm^{-1}) 1293, 1355, 1428, 2105, 3287; HRMS (ESI$^+$) *m/z* 241.0616 ([M+Na]$^+$, $C_7H_7BN_6NaO_2^+$ requires 241.0616).

Methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-bromobenzoate (**S15**)



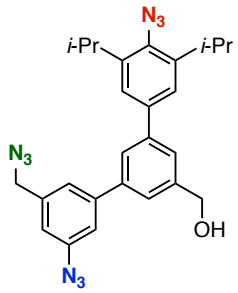
Brown solid; Mp 93−94 °C (decomp.); TLC R_f 0.35 (*n*-hexane/CH_2Cl_2 = 2/3); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 3.97 (s, 3H), 4.44 (s, 2H), 7.03 (dd, 1H, J = 1.8, 1.8 Hz), 7.17 (dd, 1H, J = 1.8, 1.8 Hz), 7.28 (dd, 1H, J = 1.6, 1.6 Hz), 7.88 (dd, 1H, J = 1.8, 1.8 Hz), 8.15 (dd, 1H, J = 1.6, 1.6 Hz), 8.19 (dd, 1H, J = 1.6, 1.6 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 52.6 (1C), 54.2 (1C), 117.5 (1C), 118.1 (1C), 123.0 (1C), 123.3 (1C), 126.9 (1C), 131.9 (1C), 132.5 (1C), 134.3 (1C), 138.3 (1C), 141.1 (1C), 141.6 (1C), 141.8 (1C), 165.5 (1C); IR (KBr, cm^{-1}) 768, 855, 1245, 1284, 1327, 1345, 1431, 1569, 1595, 1726, 2110; HRMS (ESI$^+$) *m/z* 409.0017 ([M+Na]$^+$, $C_{15}H_{11}{}^{79}BrN_6NaO_2^+$ requires 409.0019).

Methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzoate (**S16**)



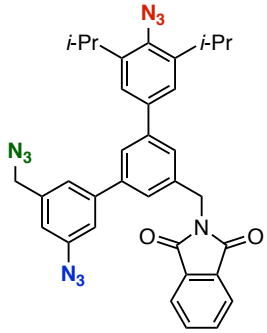
Pale brown solid; Mp 100−102 °C (decomp.); TLC R_f 0.49 (*n*-hexane/CH_2Cl_2 = 3/7); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.34 (d, 12H, J = 6.8 Hz), 3.43 (sept, 2H, J = 6.8 Hz), 4.00 (s, 3H), 4.45 (s, 2H), 7.04 (dd, 1H, J = 1.6, 1.6 Hz), 7.25 (dd, 1H, J = 1.8, 1.8 Hz), 7.36 (s, 3H), 7.86 (dd, 1H, J = 1.8, 1.8 Hz), 8.20 (dd, 1H, J = 1.6, 1.6 Hz), 8.22 (dd, 1H, J = 1.6, 1.6 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.5 (4C), 29.0 (2C), 52.4 (1C), 54.3 (1C), 117.8 (2C), 123.1 (2C), 123.5 (1C), 127.1 (1C), 127.9 (1C), 130.3 (1C), 131.4 (1C), 135.3 (1C), 138.2 (1C), 138.5 (1C), 140.7 (1C), 141.4 (1C), 142.5 (1C), 142.7 (1C), 143.8 (2C), 166.7 (1C); IR (KBr, cm^{-1}) 1243, 1261, 1288, 1308, 1332, 1438, 2110, 2966; HRMS (ESI$^+$) *m/z* 532.2180 ([M+Na]$^+$, $C_{27}H_{27}N_9NaO_2^+$ requires 532.2180).

3-(3-Azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl alcohol (**S17**)



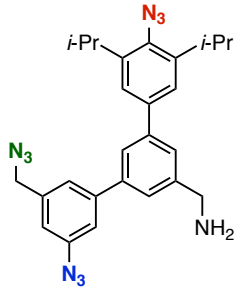
Brown oil; TLC R_f 0.36 (*n*-hexane/EtOAc = 7/3); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.34 (d, 12H, J = 6.8 Hz), 1.84 (t, 1H, J = 5.6 Hz), 3.43 (sept, 2H, J = 6.8 Hz), 4.43 (s, 2H), 4.86 (d, 2H, J = 4.9 Hz), 7.00 (dd, 1H, J = 1.6, 1.6 Hz), 7.24 (dd, 1H, J = 1.8, 1.8 Hz), 7.34−7.35 (m, 3H), 7.55−7.56 (m, 2H), 7.61 (dd, 1H, J = 1.6, 1.6 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 29.0 (2C), 54.3 (1C), 65.2 (1C), 117.5 (1C), 117.7 (1C), 123.0 (2C), 123.6 (1C), 124.7 (1C), 125.4 (1C), 125.5 (1C), 135.0 (1C), 138.0 (1C), 139.2 (1C), 140.7 (1C), 141.3 (1C), 142.1 (1C), 142.5 (1C), 143.5 (1C), 143.7 (2C); IR (KBr, cm^{-1}) 853, 1254, 1285, 1309, 1337, 1364, 1392, 1422, 1440, 1462, 1592, 2108, 2872, 2932, 2966, 3319; HRMS (ESI$^+$) *m/z* 504.2221 ([M+Na]$^+$, $C_{26}H_{27}N_9NaO^+$ requires 504.2231).

N-(3-(3-Azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)phthalimide (**S18**)



Pale brown sold; Mp 56−58 °C (decomp.); TLC R_f 0.33 (*n*-hexane/EtOAc = 4/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ1.32 (d, 12H, J = 6.8 Hz), 3.41 (sept, 2H, J = 6.8 Hz), 4.42 (s, 2H), 4.98 (s, 2H), 7.00 (dd, 1H, J = 1.8, 1.8 Hz), 7.19 (dd, 1H, J = 1.8, 1.8 Hz), 7.29 (br s, 1H), 7.30 (s, 2H), 7.57 (dd, 1H, J = 1.6, 1.6 Hz), 7.59 (dd, 1H, J = 1.6, 1.6 Hz), 7.62 (dd, 1H, J = 1.6, 1.6 Hz), 7.70−7.73 (m, 2H), 7.84−7.88 (m, 2H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.5 (4C), 29.0 (2C), 41.6 (1C), 54.3 (1C), 117.4 (1C), 117.9 (1C), 123.1 (2C), 123.4 (2C), 123.6 (1C), 125.7 (1C), 126.5 (1C), 127.4 (1C), 132.1 (2C), 134.1 (2C), 135.0 (1C), 137.6 (1C), 138.0 (1C), 139.1 (1C), 140.9 (1C), 141.2 (1C), 142.7 (1C), 143.3 (1C), 143.6 (2C), 168.0 (2C); IR (KBr, cm^{-1}) 713, 733, 1255, 1285, 1311, 1323, 1342, 1364, 1393, 1428, 1440, 1467, 1592, 1716, 1770, 2109, 2966; HRMS (ESI$^+$) *m/z* 633.2447 ([M+Na]$^+$, $C_{34}H_{30}N_{10}NaO_2^+$ requires 633.2445).

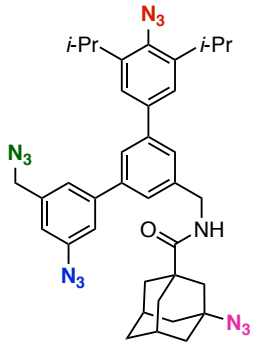
3-(3-Azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzylamine (**S19**)



Brown oil; TLC R_f 0.39 (CH_2Cl_2/MeOH = 9/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.34 (d, 12H, J = 6.8 Hz), 1.66−1.81 (br, 2H), 3.43 (sept, 2H, J = 6.8 Hz), 4.04 (s, 2H), 4.43 (s, 2H), 7.00 (dd, 1H, J = 1.6, 1.6 Hz), 7.24 (dd, 1H, J = 1.8, 1.8 Hz), 7.34−7.36 (m, 3H), 7.50−7.51 (m, 2H), 7.56 (dd, 1H, J = 1.6,

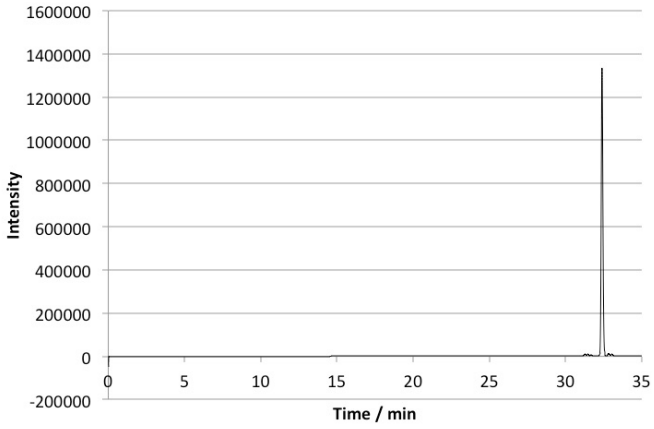
1.6 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.6 (4C), 29.0 (2C), 46.5 (1C), 54.3 (1C), 117.4 (1C), 117.8 (1C), 123.1 (2C), 123.6 (1C), 124.7 (1C), 125.1 (1C), 125.9 (1C), 135.0 (1C), 137.9 (1C), 139.4 (1C), 140.7 (1C), 141.2 (1C), 142.5 (1C), 143.6 (2C), 143.7 (1C), 144.4 (1C); IR (KBr, cm^{-1}) 851, 1254, 1284, 1309, 1333, 1364, 1387, 1421, 1440, 1462, 1591, 2109, 2872, 2929, 2965; HRMS (ESI^+) *m/z* 481.2571 ($[M+H]^+$, $C_{26}H_{29}N_{10}^+$ requires 481.2571).

3-Azido-*N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**19**)

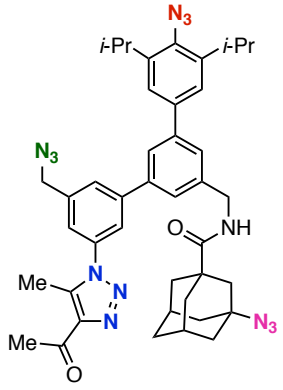


Pale yellow solid; Mp 113–115 ºC (decomp.); TLC R_f 0.32 (*n*-hexane/EtOAc = 7/3); HPLC analysis: R*t* = 32.4 min [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; ^{1}H NMR ($CDCl_3$, 500 MHz) δ1.33 (d, 12H, *J* = 6.8 Hz), 1.63−1.68 (m, 2H), 1.77−1.89 (m, 8H), 1.93−1.97 (m, 2H), 2.31−2.32 (m, 2H) 3.43 (sept, 2H, *J* = 6.8 Hz), 4.43 (s, 2H), 4.59 (d, 2H, *J* = 5.5 Hz), 6.00 (t, 1H, *J* = 5.5 Hz), 7.00 (dd, 1H, *J* = 1.6, 1.6 Hz), 7.20 (dd, 1H, *J* = 1.8, 1.8 Hz), 7.31−7.32 (m, 3H), 7.40−7.41 (m, 2H), 7.59 (dd, 1H, *J* = 1.6, 1.6 Hz); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 23.5 (4C), 28.9 (2C), 29.5 (2C), 34.8 (1C), 38.1 (2C), 40.5 (2C), 43.1 (1C), 43.2 (1C), 43.3 (1C), 54.3 (1C), 58.9 (1C), 117.6 (1C), 117.7 (1C), 123.0 (2C), 123.5 (1C), 125.3 (1C), 125.4 (1C), 126.1 (1C), 135.1 (1C), 138.1 (1C), 139.1 (1C), 139.7 (1C), 140.9 (1C), 141.3 (1C), 142.7 (2C), 143.3 (1C), 143.7 (1C), 175.9 (1C); IR (KBr, cm^{-1}) 850, 1252, 1284, 1306, 1338, 1364, 1422, 1441, 1462, 1527, 1593, 1639, 2091, 2109, 2857, 2911, 2928, 2965, 3331; HRMS (ESI^+) *m/z* 706.3450 ($[M+Na]^+$, $C_{37}H_{41}N_{13}NaO^+$ requires 706.3449).

HPLC chart:

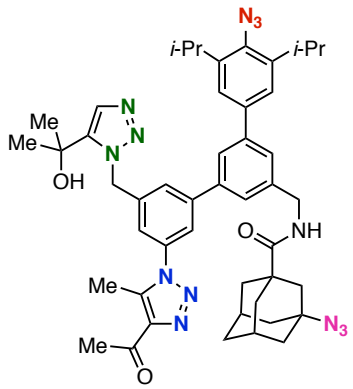


N-(3-(3-(4-Acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S20**)



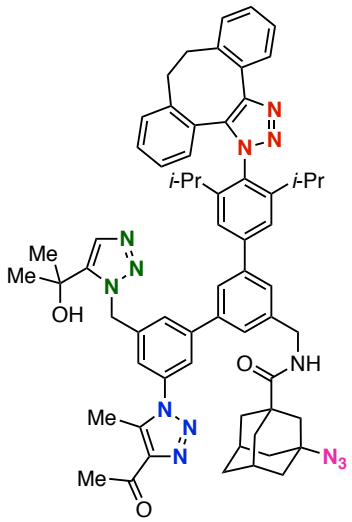
Orange solid; Mp 74–76 ºC (decomp.); TLC R_f 0.39 (*n*-hexane/EtOAc = 1/1); ^{1}H NMR ($CDCl_3$, 500 MHz) δ1.33 (d, 12H, *J* = 6.8 Hz), 1.63−1.69 (m, 2H), 1.77−1.90 (m, 8H), 1.91−1.97 (br, 2H), 2.29−2.35 (m, 2H), 2.66 (s, 3H), 2.77 (s, 3H), 3.37−3.47 (m, 2H), 4.57 (s, 2H), 4.60 (d, 2H, *J* = 5.8 Hz), 6.03 (t, 1H, *J* = 5.8 Hz), 7.31 (s, 2H), 7.43 (br s, 1H), 7.44−7.48 (m, 2H), 7.62 (dd, 1H, *J* = 1.5, 1.5 Hz), 7.65 (dd, 1H, *J* = 1.5, 1.5 Hz), 7.73 (br s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.3 (1C), 23.6 (4C), 27.9 (1C), 28.9 (2C), 29.5 (2C), 34.8 (1C), 38.1 (2C), 40.5 (2C), 43.17 (1C), 43.21 (1C), 43.24 (1C), 54.0 (1C), 58.9 (1C), 123.0 (2C), 123.5 (1C), 123.9 (1C), 125.3 (1C), 125.5 (1C), 126.5 (1C), 128.2 (1C), 135.2 (1C), 136.3 (1C), 137.5 (1C), 138.3 (1C), 138.9 (1C), 140.0 (2C), 142.9 (1C), 143.5 (1C), 143.7 (2C), 143.8 (1C), 176.0 (1C), 194.3 (1C); IR (KBr, cm^{-1}) 706, 737, 853, 870, 953, 976, 1016, 1074, 1246, 1265, 1281, 1337, 1362, 1385, 1429, 1445, 1483, 1524, 1555, 1595, 1647, 1684, 2091, 2857, 2911, 2928, 2963; HRMS (ESI$^+$) *m/z* 788.3870 ([M+Na]$^+$, $C_{42}H_{47}N_{13}NaO_2^+$ requires 788.3868).

3-Azido-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S21**)



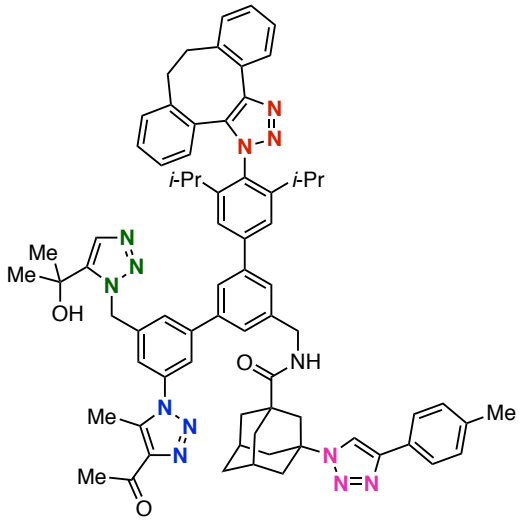
Brown solid; Mp 84–86 ºC (decomp.); TLC R_f 0.35 (*n*-hexane/EtOAc = 1/4); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.32 (d, 12H, *J* = 6.9 Hz), 1.61−1.67 (m, 8H), 1.75−1.85 (m, 8H), 1.91−1.95 (m, 2H), 2.28−2.34 (m, 2H), 2.56 (s, 3H), 2.71 (s, 3H), 3.21 (br s, 1H), 3.37−3.47 (m, 2H), 4.53 (d, 2H, *J* = 5.8 Hz), 5.96 (s, 2H), 6.21 (t, 1H, *J* = 5.8 Hz), 7.30 (s, 2H), 7.31 (br s, 1H), 7.41 (br s, 2H), 7.43 (s, 1H), 7.57 (br s, 1H), 7.59 (dd, 1H, *J* = 1.6, 1.6 Hz), 7.76 (br s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.2 (1C), 23.5 (4C), 27.9 (1C), 28.9 (2C), 29.5 (2C), 30.9 (2C), 34.8 (1C), 38.0 (2C), 40.5 (2C), 43.1 (1C), 43.19 (1C), 43.23 (1C), 52.1 (1C), 58.9 (1C), 67.9 (1C), 122.9 (2C), 123.4 (1C), 123.5 (1C), 125.1 (1C), 125.7 (1C), 126.4 (1C), 128.4 (1C), 130.8 (1C), 135.2 (1C), 136.0 (1C), 137.5 (1C), 138.9 (1C), 139.0 (1C), 139.9 (1C), 140.0 (1C), 142.8 (1C), 143.1 (1C), 143.2 (1C), 143.6 (1C), 143,7 (2C), 176.2 (1C), 194.2 (1C); IR (KBr, cm^{-1}) 696, 706, 741, 854, 872, 955, 984, 1125, 1175, 1244, 1265, 1285, 1364, 1429, 1445, 1483, 1528, 1555, 1595, 1639, 1684, 2089, 2116, 2859, 2911, 2932, 2965, 3354; HRMS (ESI$^+$) *m/z* 872.4415 ([M+Na]$^+$, $C_{47}H_{55}N_{13}NaO_3^+$ requires 872.4443).

3-Azido-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-(8,9-dihydro-1-*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S22**)



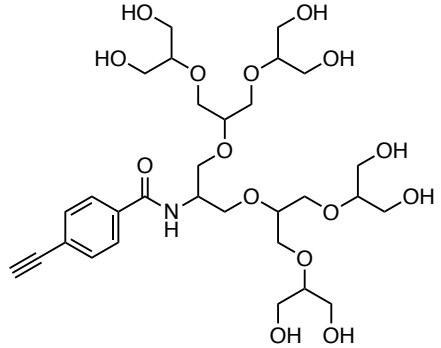
Colorless solid; Mp 151 ºC (decomp.); TLC R_f 0.32 (*n*-hexane/EtOAc = 1/4); ^{1}H NMR ($CDCl_3$ 500 MHz) δ 1.10−1.40 (br, 12H), 1.61−1.67 (m, 8H), 1.76−1.86 (m, 8H), 1.92−1.96 (m, 2H), 2.28−2.34 (m, 2H), 2.41−2.49 (br, 2H), 2.57 (s, 3H), 2.72 (s, 3H), 3.09−3.24 (br, 2H), 3.25 (br s, 1H), 3.31−3.46 (br, 2H), 4.55 (d, 2H, J = 5.5 Hz), 5.96 (s, 2H), 6.31 (t, 1H, J = 5.5 Hz), 6.76 (d, 1H, J = 7.5 Hz), 6.98 (dd, 1H, J = 7.5, 7.5 Hz), 7.20−7.28 (m, 4H), 7.30−7.34 (m, 2H), 7.35−7.40 (br, 2H), 7.44 (s, 1H), 7.46 (br s, 2H), 7.59−7.62 (m, 2H), 7.66−7.70 (m, 1H), 7.77 (br s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.2 (1C), 22.6 (2C), 25.4 (2C), 27.9 (1C), 28.9 (1C), 29.2 (1C), 29.5 (2C), 30.9 (2C), 32.7 (1C), 34.8 (1C), 36.8 (1C), 38.0 (2C), 40.5 (2C), 43.0 (1C), 43.1 (1C), 43.2 (1C), 52.1 (1C), 58.9 (1C), 67.9 (1C), 122.9 (2C), 123.5 (2C), 125.2 (1C), 125.8 (1C), 126.0 (1C), 126.1 (2C), 126.5 (1C), 128.1 (1C), 128.5 (1C), 128.8 (2C), 129.5 (1C), 129.6 (1C), 129.9 (1C), 130.8 (1C), 130.9 (1C), 131.7 (1C), 132.5 (1C), 135.1 (1C), 136.0 (1C), 137.4 (1C), 137.5 (1C), 139.0 (1C), 140.0 (1C), 140.2 (1C), 141.4 (1C), 142.2 (1C), 142.6 (1C), 143.0 (1C), 143.2 (1C), 143.7 (2C), 146.2 (1C), 176.3 (1C), 194.2 (1C); IR (KBr, cm^{-1}) 1240, 1365, 1450, 1595, 1681, 2089, 2928, 3347; HRMS (ESI$^+$) *m/z* 1076.5381 ([M+Na]$^+$, $C_{63}H_{67}N_{13}NaO_3^+$ requires 1076.5382).

3-(4-(4-Metylphenyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-(8,9-dihydro-1-*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**21**)



Colorless solid; Mp 173 ºC (decomp.); TLC R_f 0.17 (*n*-hexane/EtOAc = 1/9); ^{1}H NMR ($CDCl_3$ 500 MHz) δ 1.10−1.40 (br, 12H), 1.62 (s, 6H), 1.72−1.78 (m, 2H), 1.90−2.00 (m, 4H), 2.12−2.24 (m, 4H), 2.27−2.33 (m, 2H), 2.34 (s, 3H), 2.35−2.40 (br, 2H), 2.41−2.49 (br, 2H), 2.50 (s, 3H), 2.72 (s, 3H), 3.09−3.23 (br, 2H), 3.32−3.46 (br, 2H), 4.10−4.30 (br, 1H), 4.51 (d, 2H, *J* = 5.3 Hz), 5.94 (s, 2H), 6.74 (d, 1H, *J* = 7.6 Hz), 6.77−6.87 (br, 1H), 6.96 (dd, 1H, *J* = 7.6, 7.6 Hz), 7.15−7.33 (m, 8H), 7.34−7.41 (br, 2H), 7.44 (s, 2H), 7.52−7.62 (m, 5H), 7.66−7.71 (m, 1H), 7.74 (s, 1H), 7.75 (br s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 10.2 (1C), 21.2 (1C), 22.6 (2C), 25.4 (2C), 27.8 (1C), 28.9 (2C), 29.2 (2C), 30.8 (2C), 32.7 (1C), 34.8 (1C), 36.8 (1C), 37.9 (2C), 41.9 (2C), 42.9 (1C), 43.1 (1C), 44.0 (1C), 52.1 (1C), 59.8 (1C), 67.7 (1C), 115.9 (1C), 122.9 (2C), 123.4 (2C), 125.1 (1C), 125.4 (2C), 125.8 (1C), 126.0 (1C), 126.10 (1C), 126.14 (1C), 126.8 (1C), 127.5 (1C), 128.1 (1C), 128.5 (1C), 128.8 (2C), 129.5 (2C), 129.6 (2C), 129.9 (1C), 130.9 (2C), 131.7 (1C), 132.5 (1C), 135.1 (1C), 135.9 (1C), 137.5 (2C), 138.0 (1C), 138.9 (1C), 140.0 (1C), 140.4 (1C), 141.4 (1C), 142.2 (1C), 142.7 (1C), 142.9 (1C), 143.6 (2C), 143.7 (1C), 146.2 (1C), 146.7 (1C), 176.2 (1C), 194.1 (1C); IR (KBr, cm^{-1}) 1278, 1365, 1454, 1595, 1681, 2926, 3341; HRMS (ESI^+) *m/z* 1192.6005 ($[M+Na]^+$, $C_{72}H_{75}N_{13}NaO_3^+$ requires 1192.6008).

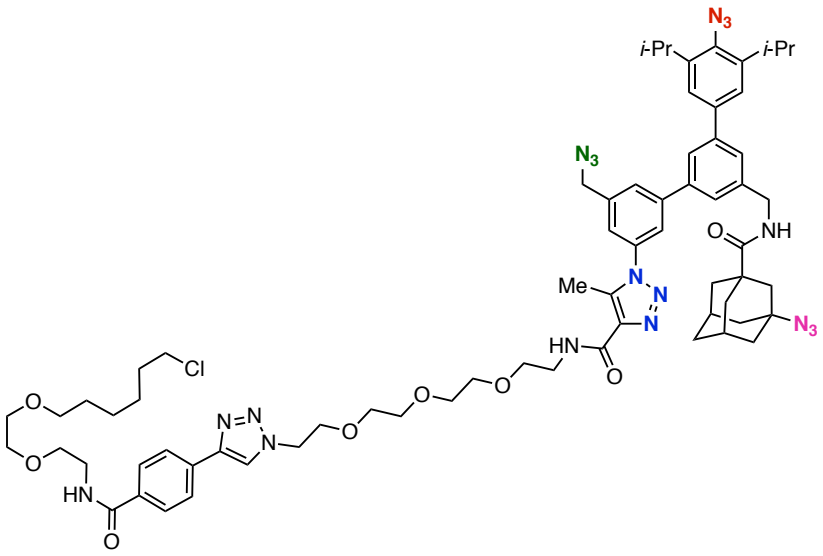
N-(5,11-Bis(((1,3-dihydroxypropan-2-yl)oxy)methyl)-1,15-dihydroxy-2,14-bis(hydroxymethyl)-3,6,10,13-tetraoxapentadecan-8-yl)-4-ethynylbenzamide (**25**)



Colorless oil; TLC (reverse phase) R_f 0.29 (H_2O/MeCN = 4/1); ^{1}H NMR (CD_3OD, 500 MHz) δ 3.40−3.45 (m, 4H), 3.54−3.59 (m, 8H), 3.61−3.66 (m, 8H), 3.67 (s, 1H), 3.70−3.77 (m, 10H), 3.82−3.88 (m, 4H), 4.36−4.41 (m, 1H), 7.55−7.56 (m, 2H), 7.84−7.85 (m, 2H); ^{13}C NMR (CD_3OD, 126 MHz) δ 51.9 (1C), 62.45−62.50 (m, 8C), 70.0 (2C), 70.8−70.9 (m, 4C), 80.4 (2C), 81.1 (1C), 83.1−83.2 (m, 4C), 83.6 (1C), 127.0 (1C), 128.7 (2C), 133.0 (2C), 135.8 (1C), 169.5 (1C); IR (KBr, cm^{-1}) 1033, 1053, 1109, 1318, 1347, 1402, 1465, 1549, 1646, 2844, 2883, 2940, 3357; HRMS (ESI^+)

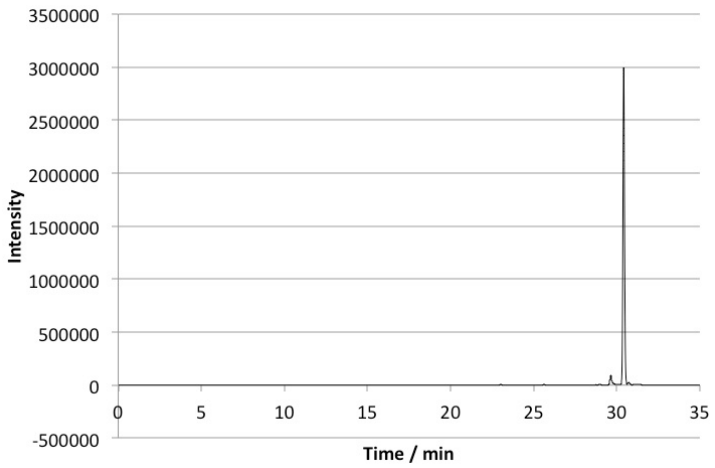
m/z 686.2990 ([M+Na]$^+$, $C_{30}H_{49}NNaO_{15}^+$ requires 686.2994).

Platform–HTL conjugate **S25**

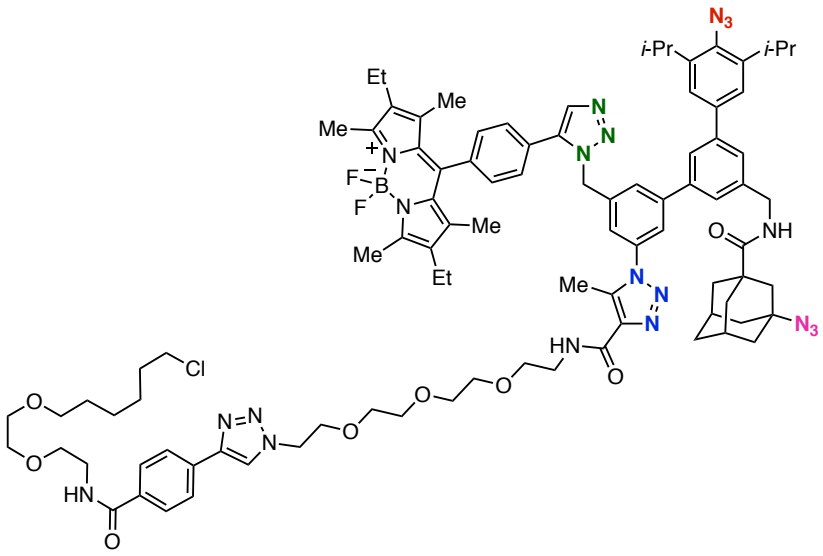


Pale brown solid; Mp 60–62 ºC (decomp.); TLC R_f 0.45 (EtOAc/MeOH = 9/1); HPLC analysis: R*t* = 30.4 min [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; ^{1}H NMR ($CDCl_3$, 500 MHz) δ 1.30−1.43 (m, 16H), 1.54−1.43 (m, 2H), 1.69 (br s, 2H), 1.69−1.89 (m, 10H), 1.94 (s, 2H), 2.29 (m, 2H), 2.64 (s, 3H), 3.38−3.49 (m, 6H), 3.58−3.60 (m, 2H), 3.65−3.71 (m, 18H), 3.95 (t, 2H, *J* = 5.0 Hz), 4.56 (s, 2H), 4.59−4.62 (m, 4H), 6.39 (t, 1H, *J* = 5.6 Hz), 6.85−6.86 (m, 1H), 7.32 (s, 2H), 7.39 (m, 1H), 7.46 (s, 2H), 7.62−7.64 (m, 3H), 7.71 (s, 1H), 7.78−7.80 (m, 2H), 7.83−7.85 (m, 2H), 8.11 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 9.7, 23.5, 25.3, 26.6, 28.9, 29.4, 29.5, 32.4, 34.8, 38.0, 38.7, 39.7, 40.5, 43.1, 43.2, 45.0, 50.3, 53.9, 58.9, 69.4, 69.6, 69.7, 70.0, 70.2, 70.4, 70.49, 70.50, 70.6, 71.2, 121.7, 122.9, 123.3, 123.7, 125.1, 125.4, 126.5, 127.5, 128.1, 133.70, 133.71, 135.1, 136.4, 136.7, 138.2, 138.6, 138.9, 139.9, 140.2, 142.7, 143.4, 143.7, 146.5; IR (KBr, cm^{-1}) 860, 1109, 1255, 1284, 1325, 1339, 1348, 1447, 1456, 1490, 1522, 1586, 1652, 2862, 2912, 2933, 3341; HRMS (ESI$^+$) *m/z* 1341.6499 ([M+Na]$^+$, $C_{68}H_{87}{}^{35}ClN_{18}NaO_8^+$ requires 1341.6535).

HPLC chart:

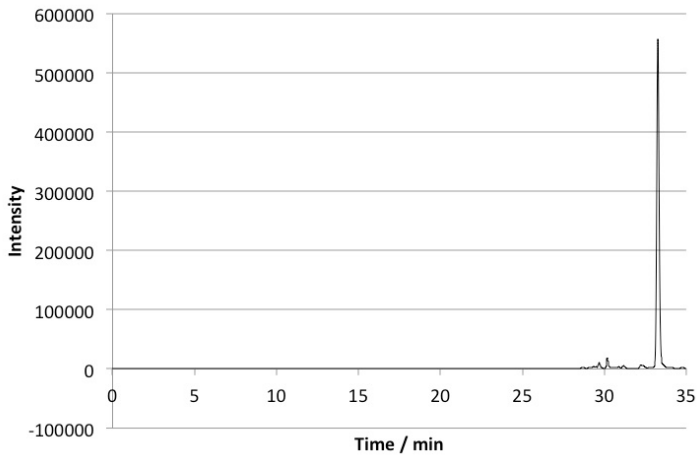


Platform–HTL–BODIPY conjugate **S26**

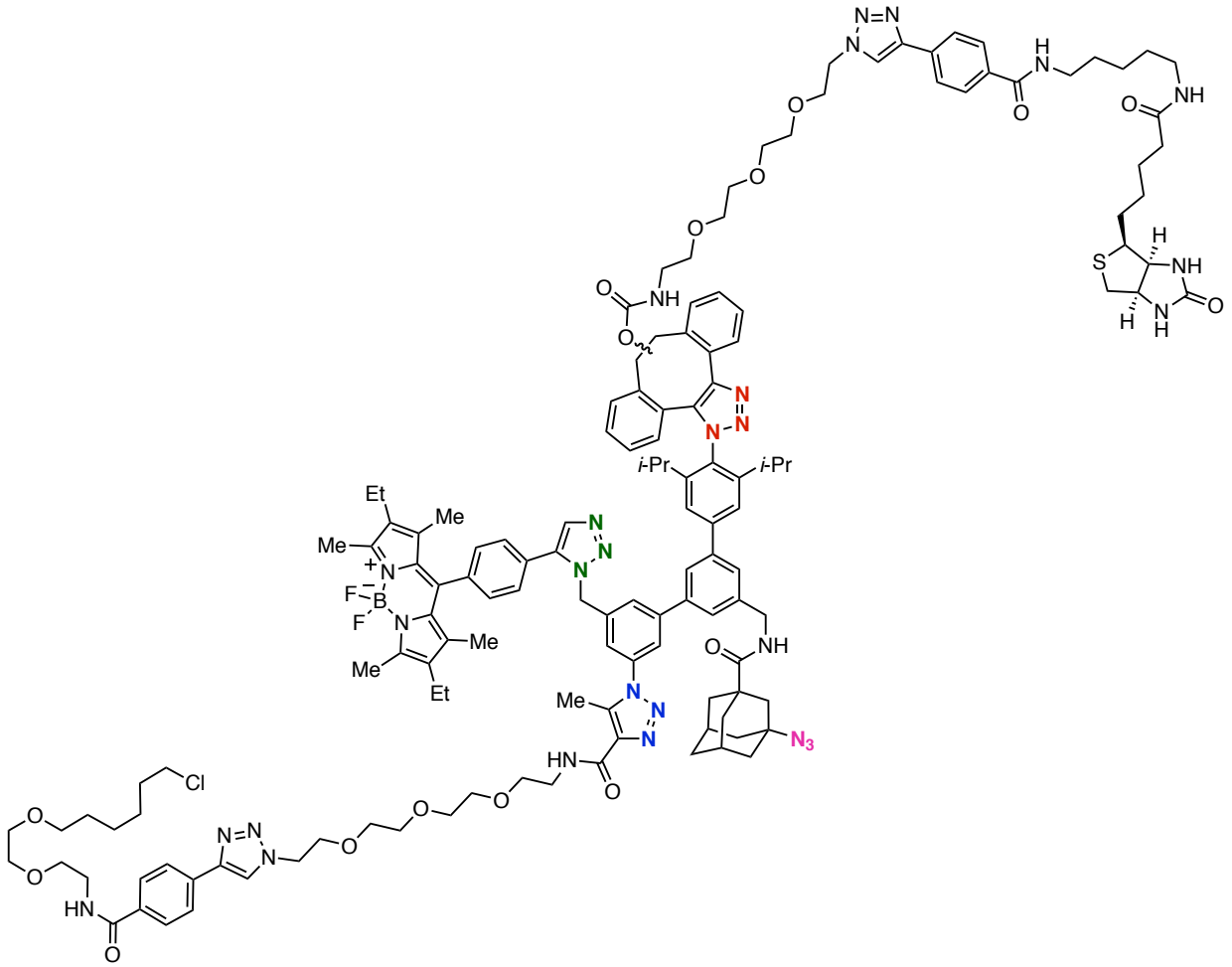


Red solid; Mp 95–97 ºC (decomp.); TLC R_f 0.51 (EtOAc/MeOH = 9/1); HPLC analysis: R*t* = 33.3 min [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; ^{1}H NMR ($CDCl_3$, 500 MHz) δ 0.91 (t, 6H, *J* = 7.6 Hz), 1.16 (s, 6H), 1.28−1.43 (m, 16H), 1.53−1.61 (m, 2H), 1.63 (br s, 2H), 1.69−1.88 (m, 10H), 1.92 (br s, 2H), 2.19−2.25 (m, 4H), 2.27−2.31 (m, 2H), 2.51 (s, 6H), 2.56 (s, 3H), 3.38−3.49 (m, 6H), 3.58−3.60 (m, 2H), 3.61−3.71 (m, 18H), 3.92 (t, 2H, *J* = 5.0 Hz), 4.56−4.60 (m, 4H), 5.81 (s, 2H), 6.33 (t, 1H, *J* = 5.8 Hz), 6.85 (t, 1H, *J* = 5.0 Hz), 7.12 (br s, 1H), 7.28 (s, 2H), 7.38−7.42 (m, 3H), 7.45 (br s, 1H), 7.48−7.52 (m, 2H), 7.53−7.56 (m, 2H), 7.58−7.62 (m, 2H), 7.76−7.80 (m, 2H), 7.81−7.85 (m, 2H), 7.89 (s, 1H), 8.09 (s, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 9.7, 11.8, 12.5, 14.6, 17.0, 23.5, 25.4, 26.6, 28.9, 29.4, 29.5, 32.5, 34.8, 38.0, 38.7, 39.7, 40.5, 43.1, 43.2, 45.0, 50.4, 51.3, 58.9, 69.4, 69.7, 69.8, 70.0, 70.2, 70.43, 70.49, 70.5, 70.6, 71.3, 121.8, 122.3, 122.9, 123.9, 125.1, 125.4, 125.5, 126.7, 127.01, 127.04, 127.5, 129.2, 129.6, 130.4, 133.1, 133.70, 133.71, 133.8, 135.2, 136.6, 136.7, 137.5, 137.6, 137.7, 137.9, 138.1, 138.7, 138.8, 139.6, 140.3, 142.8, 143.6, 143.7, 146.5, 154.4, 161.0, 167.0, 176.1; IR (KBr, cm^{-1}) 1192, 1321, 1539, 1651, 2089, 2116, 2928; HRMS (ESI^+) *m*/*z* 1745.8769 ($[M+Na]^+$, $C_{93}H_{114}{}^{11}B^{35}ClF_2N_{20}NaO_8^+$ requires 1745.8770).

HPLC chart:

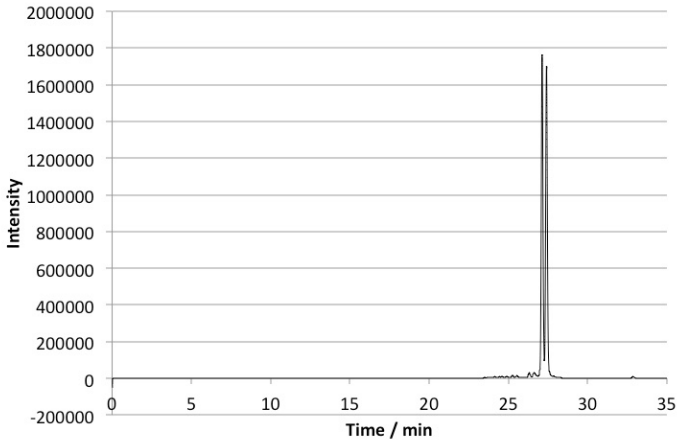


Platform–HTL–BODIPY–biotin conjugate **26**

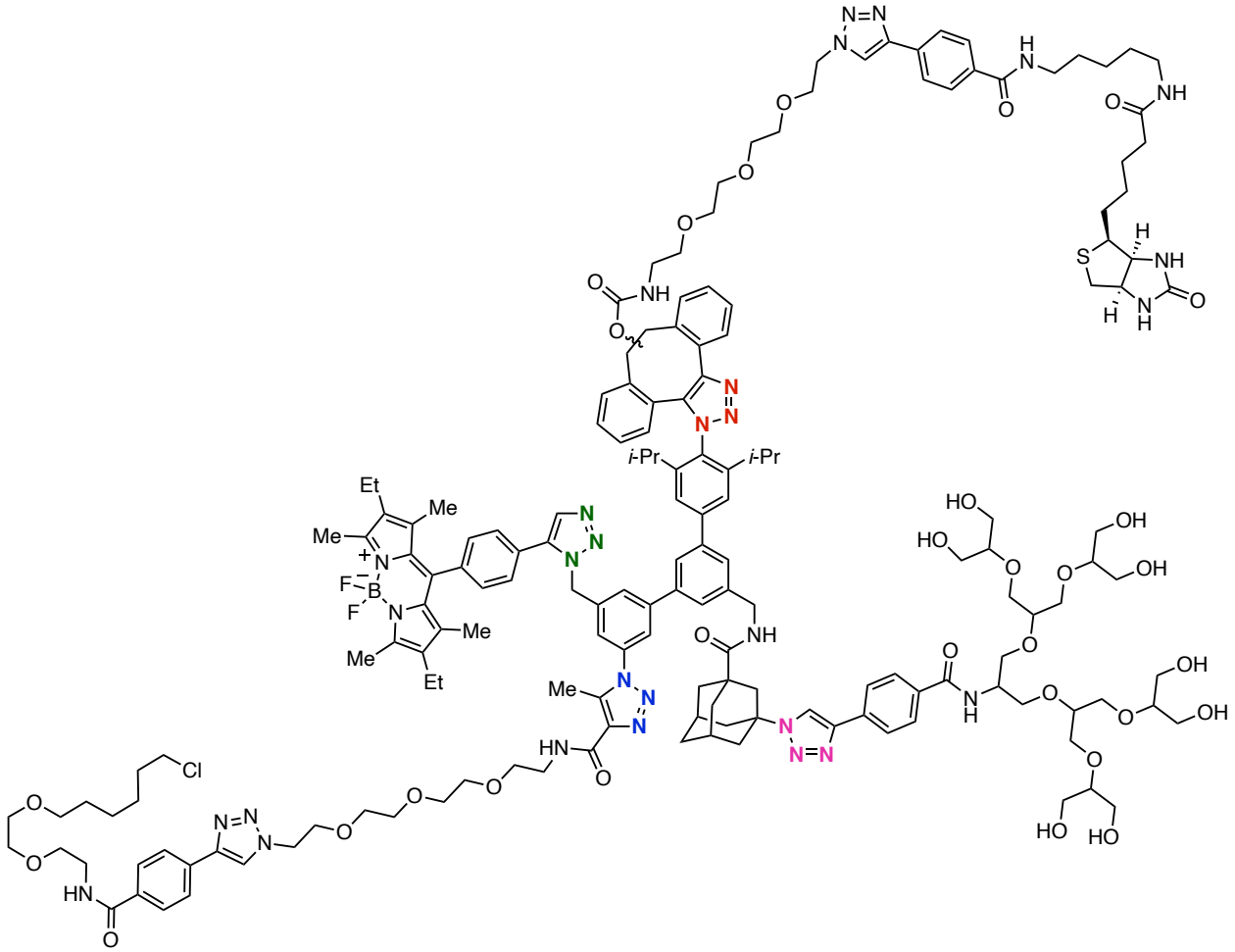


Red solid; TLC R_f 0.20 (CH_2Cl_2/MeOH = 9/1); HPLC analysis: R*t* = 27.1 min (51%) and 27.4 (49%) [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; IR (KBr, cm^{-1}) 1192, 1454, 1539, 1645, 2089, 2932; HRMS (ESI$^+$) m/z 2666.3073 ([M+Na]$^+$, $C_{142}H_{174}{}^{11}B^{35}ClF_2N_{28}NaO_{16}S^+$ requires 2666.3025).

HPLC chart:

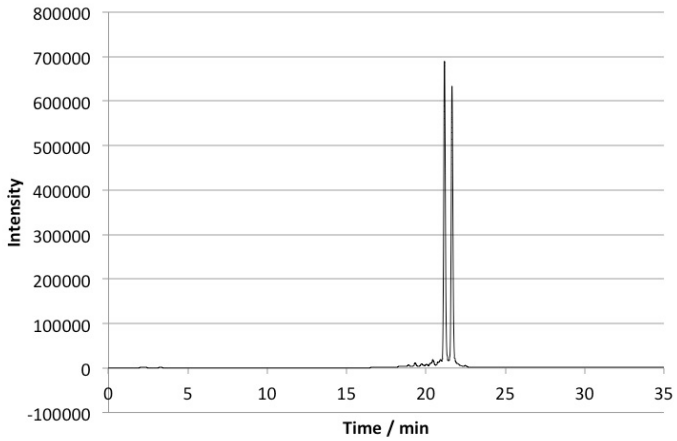


Platform–HTL–BODIPY–biotin–BGL conjugate **27**

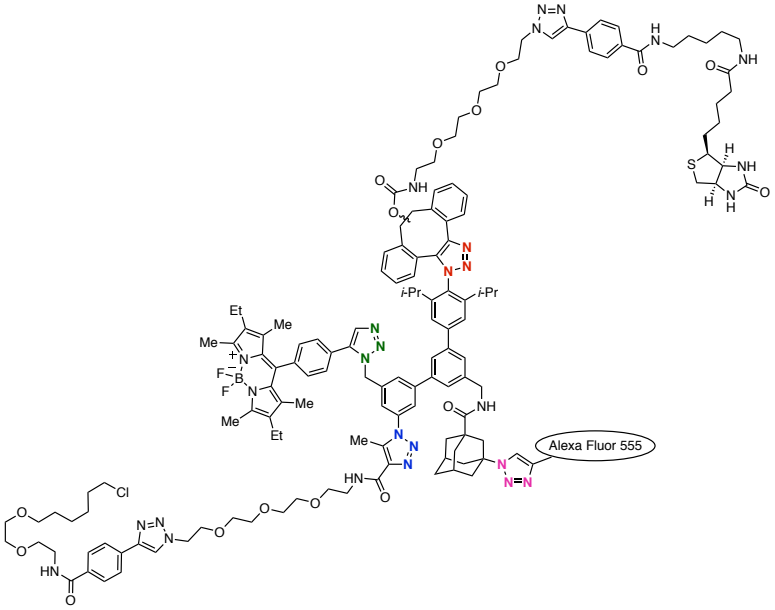


Red solid; TLC R_f 0.27 (tailing) (CH_2Cl_2/MeOH = 8/2); HPLC analysis: R*t* = 21.2 min (51%) and 21.6 min (49%) [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: CH_3CN:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−25 min), 99:1 (25−35 min); flow rate: 1.00 mL/min; detection: UV at 254 nm]; IR (KBr, cm^{-1}) 1193, 1454, 1537, 1645, 2928, 3337; HRMS (ESI$^+$) m/z 3329.6127 ([M+Na]$^+$, $C_{172}H_{223}{}^{11}B^{35}ClF_2N_{29}NaO_{31}S^+$ requires 3329.6127).

HPLC chart:

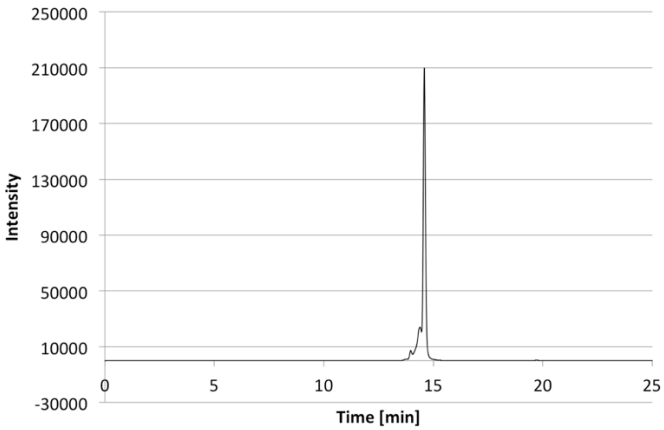


Platform–HTL–BODIPY–biotin–Alexa555 conjugate **28**



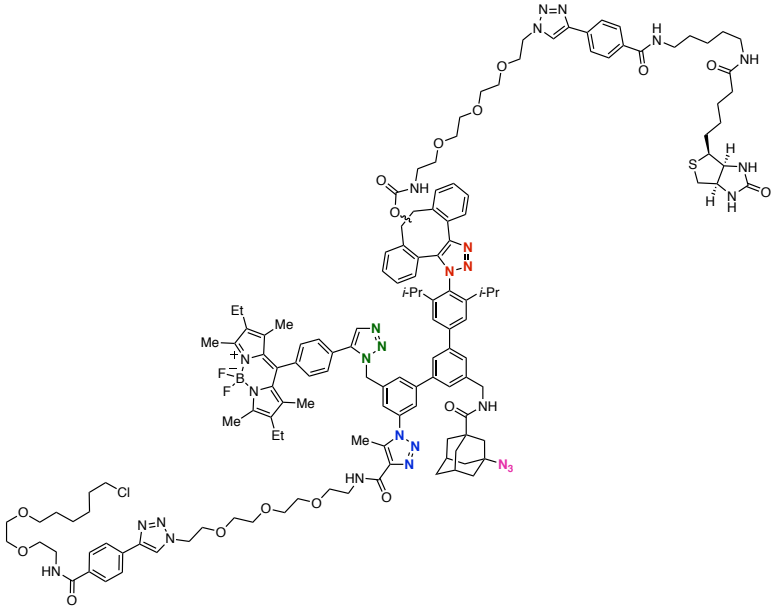
Red solid; TLC R_f 0.45 (CH_2Cl_2/MeOH = 7/3); HPLC analysis: Rt = 14.6 min [column: Shiseido CAPCELL PAK MG II (4.6 mm i.d. × 250 mm); mobile phase: MeOH:H_2O = 40:60 (0−5 min), linear gradient from 40:60 to 99:1 (5−10 min), 99:1 (10−25 min); flow rate: 1.00 mL/min; detection: UV at 550 nm]

HPLC chart:



Absorption and Fluorescent Properties and Spectra

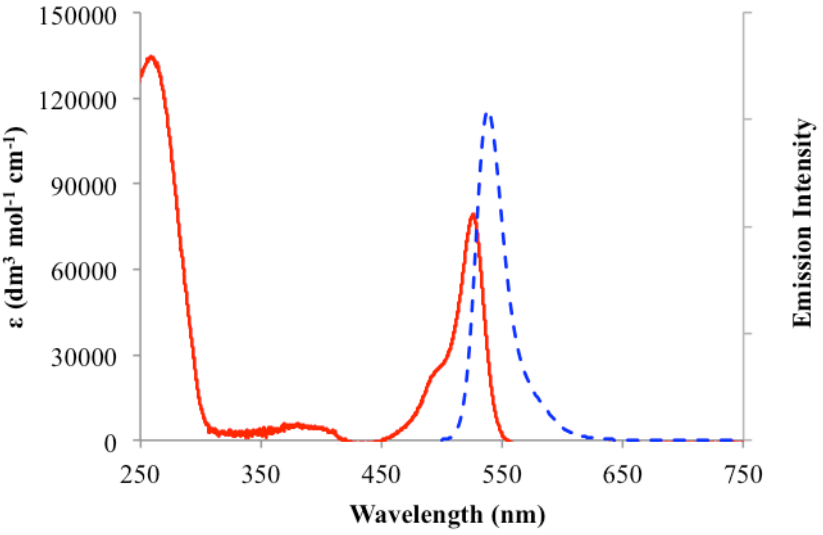
Platform–HTL–BODIPY–biotin conjugate **26**



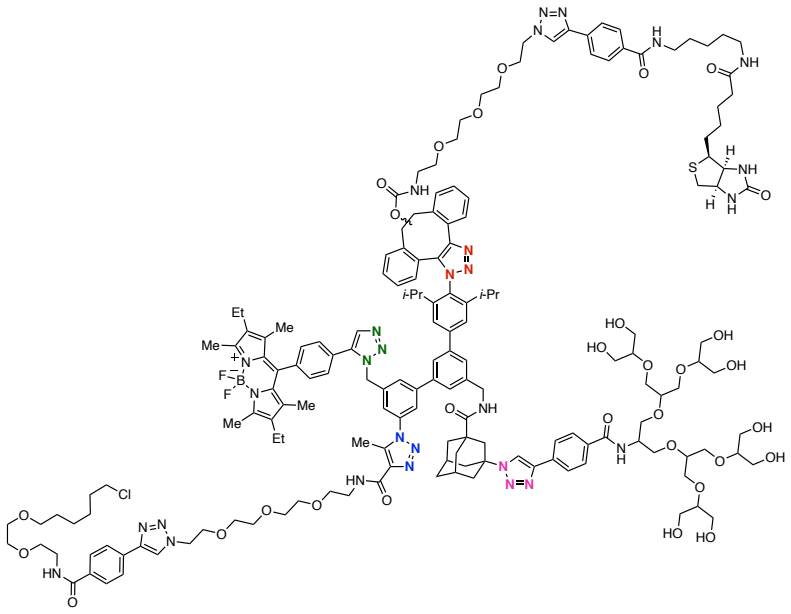
In MeOH

UV/Vis (4 μM): λ_{max} (ε) = 526 (79341) nm

FL (4 μM): λ_{max} = 538 nm (excited at 350 nm)



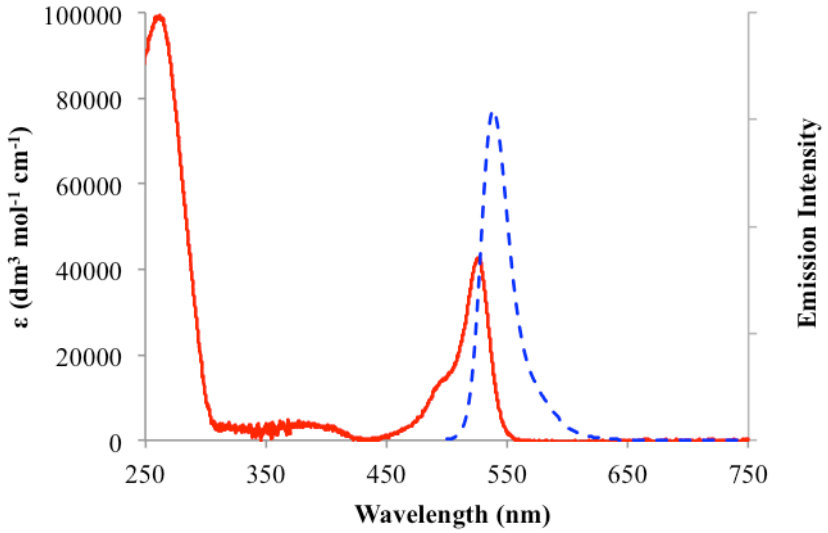
Platform–HTL–BODIPY–biotin–BGL conjugate **27**



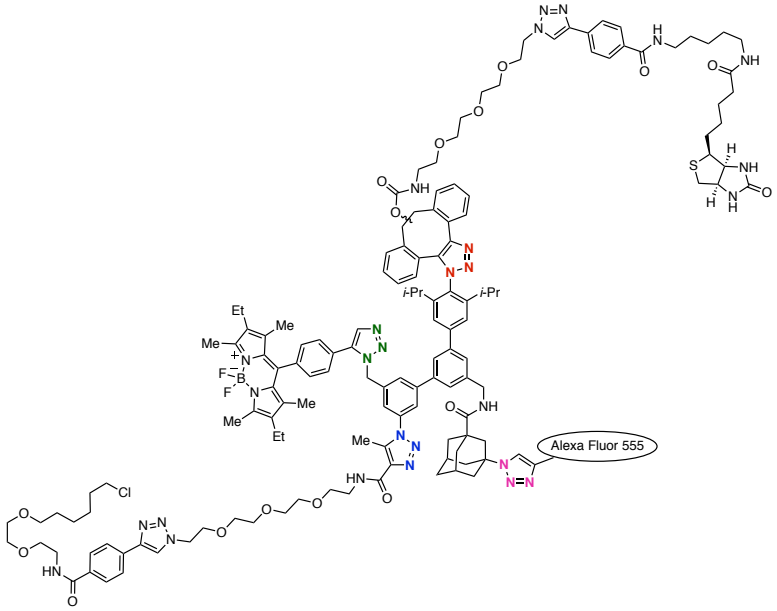
In MeOH

UV/Vis (4 μM): λ_{max} (ε) = 526 (42808) nm

FL (0.4 μM): λ_{max} = 539 nm (excited at 350 nm)



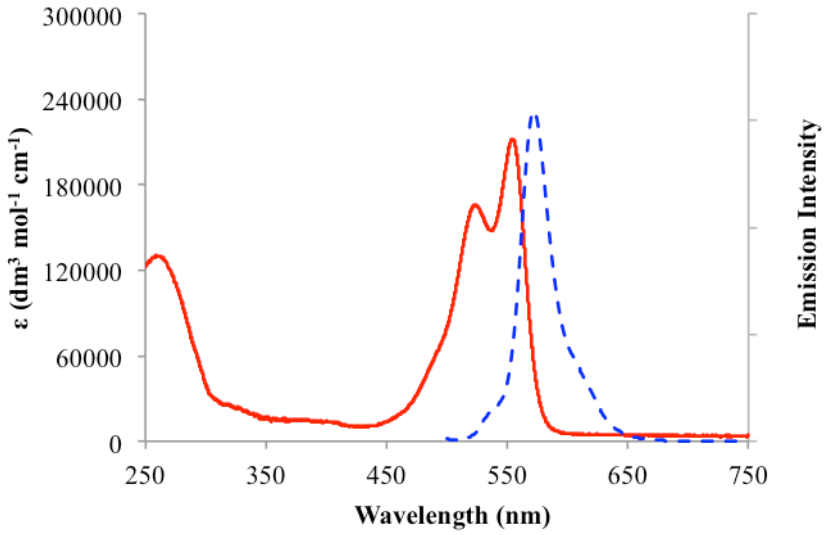
Platform–HTL–BODIPY–biotin–Alexa555 conjugate **28**



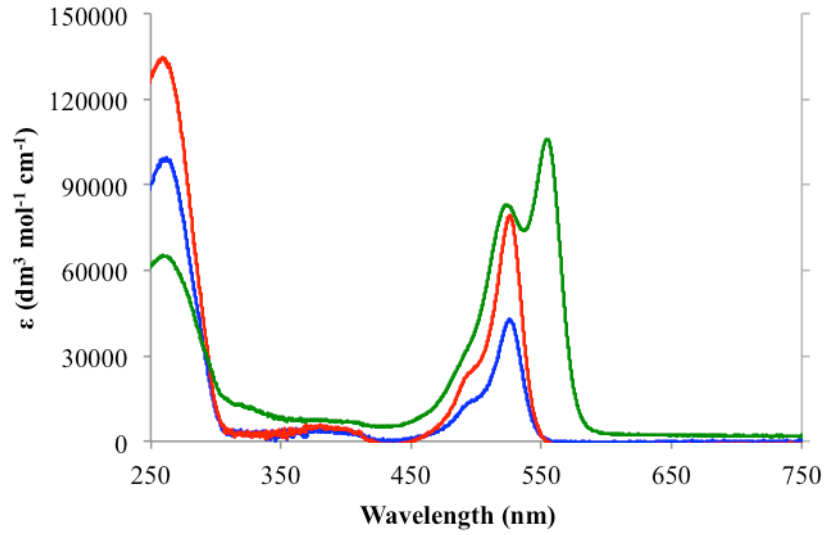
In MeOH

UV/Vis (4 μM): λ_{max} (ε) = 523 (165620), 555 (212082) nm

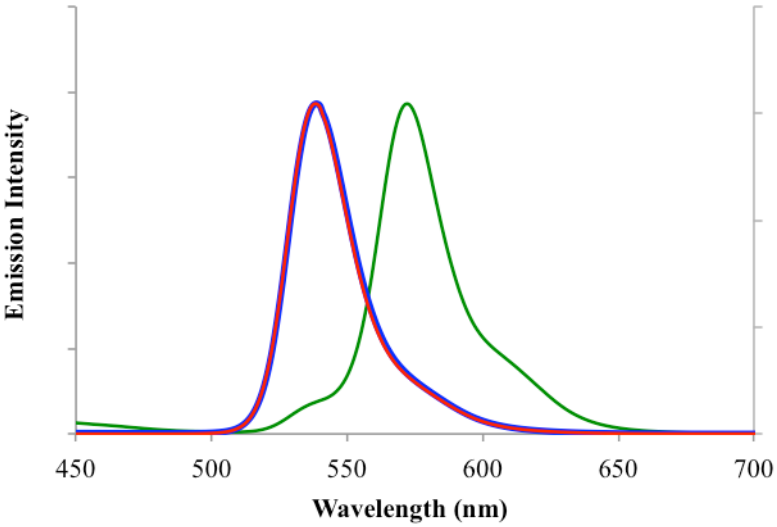
FL (4 μM): λ_{max} = 572 nm (excited at 350 nm)



Merged absorption spectra of **26**–**28** (1 μM in MeOH) (**26**: red, **27**: blue, **28**: green)



Merged fluorescence spectra of **26**–**28** (1 μM in MeOH) (**26**: red, **27**: blue, **28**: green)



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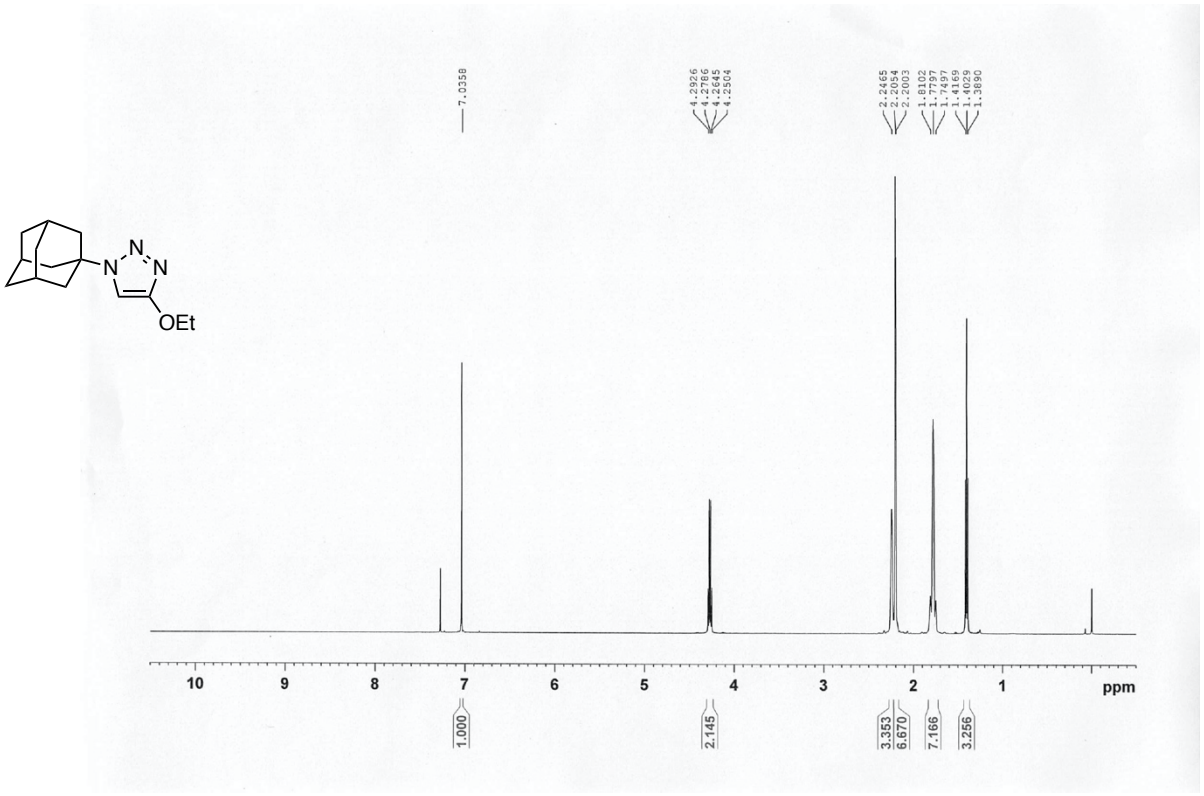
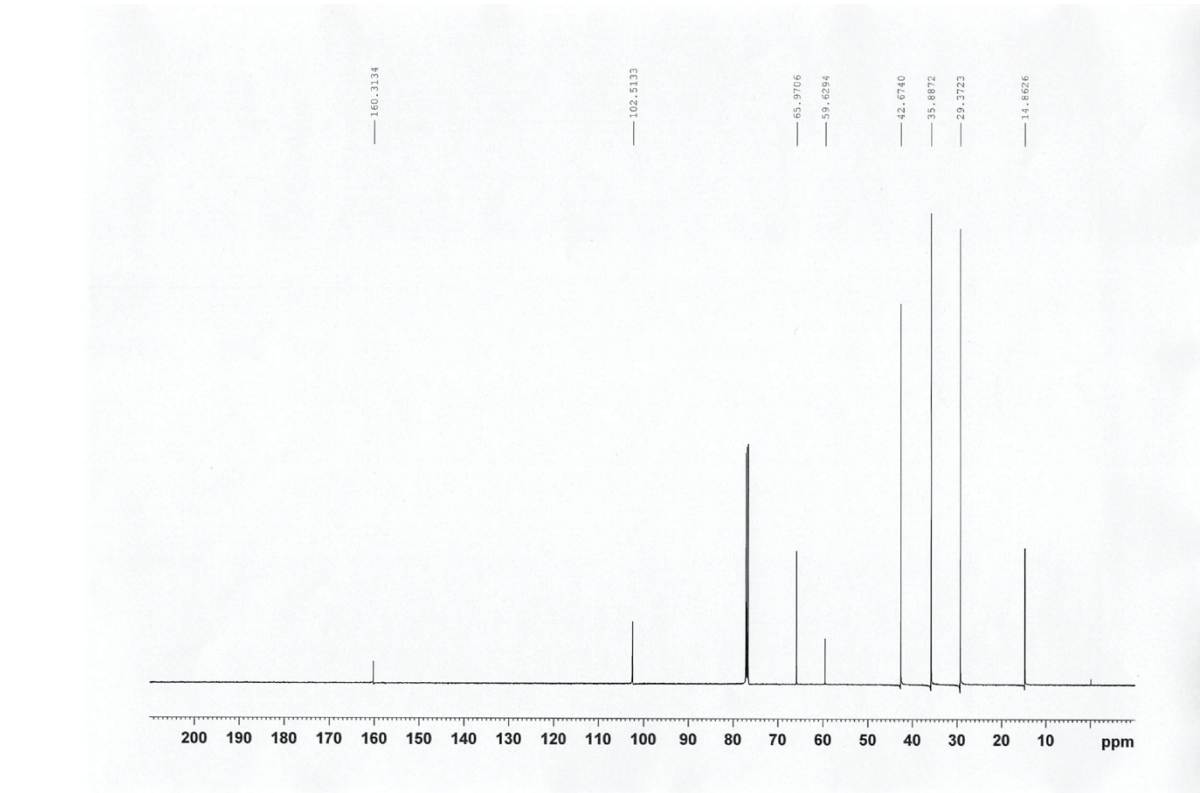
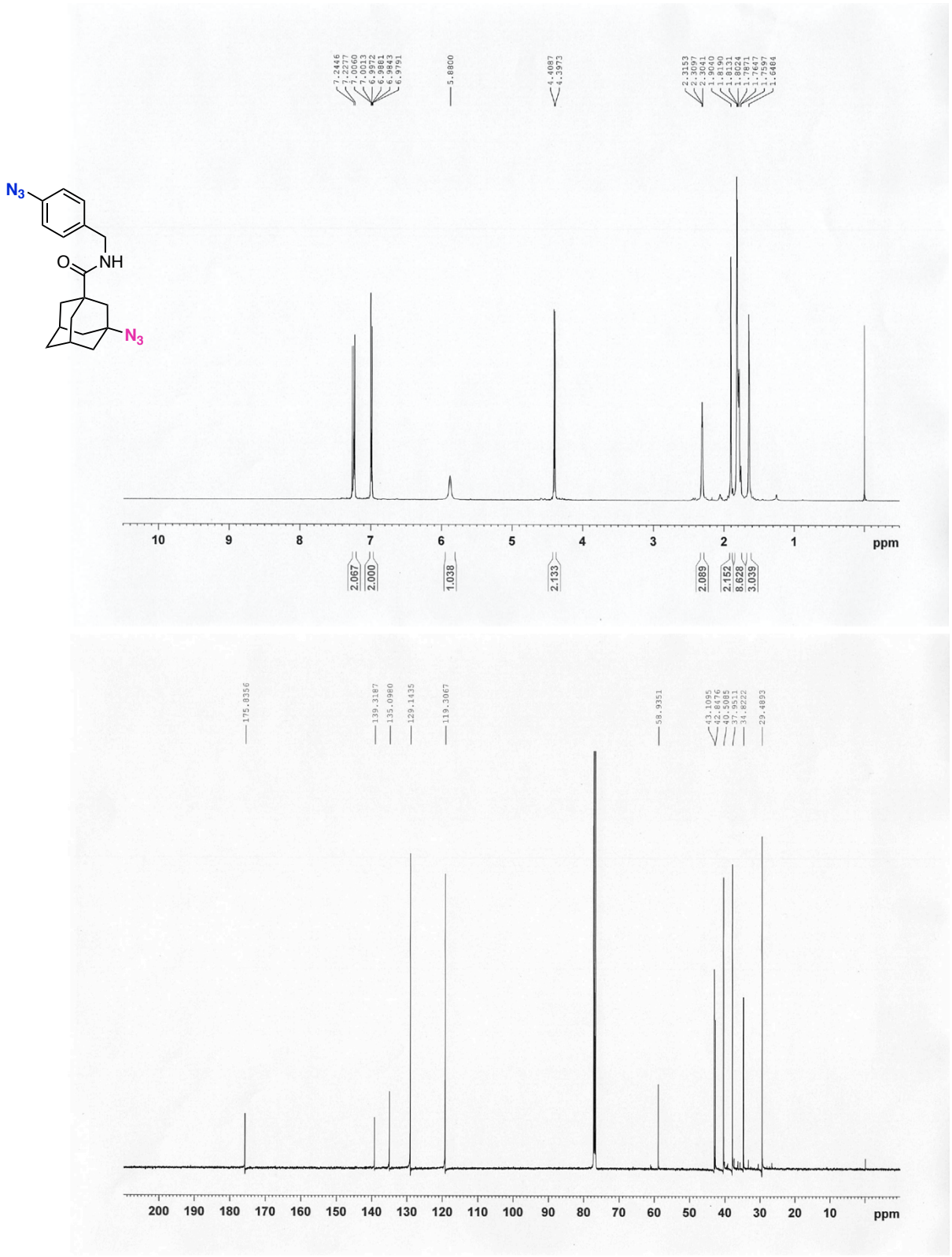
NMR Spectra of New Compounds

^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 1-(1-adamantyl)-4-ethoxy-1*H*-1,2,3-triazole (**10d**) ($CDCl_3$)

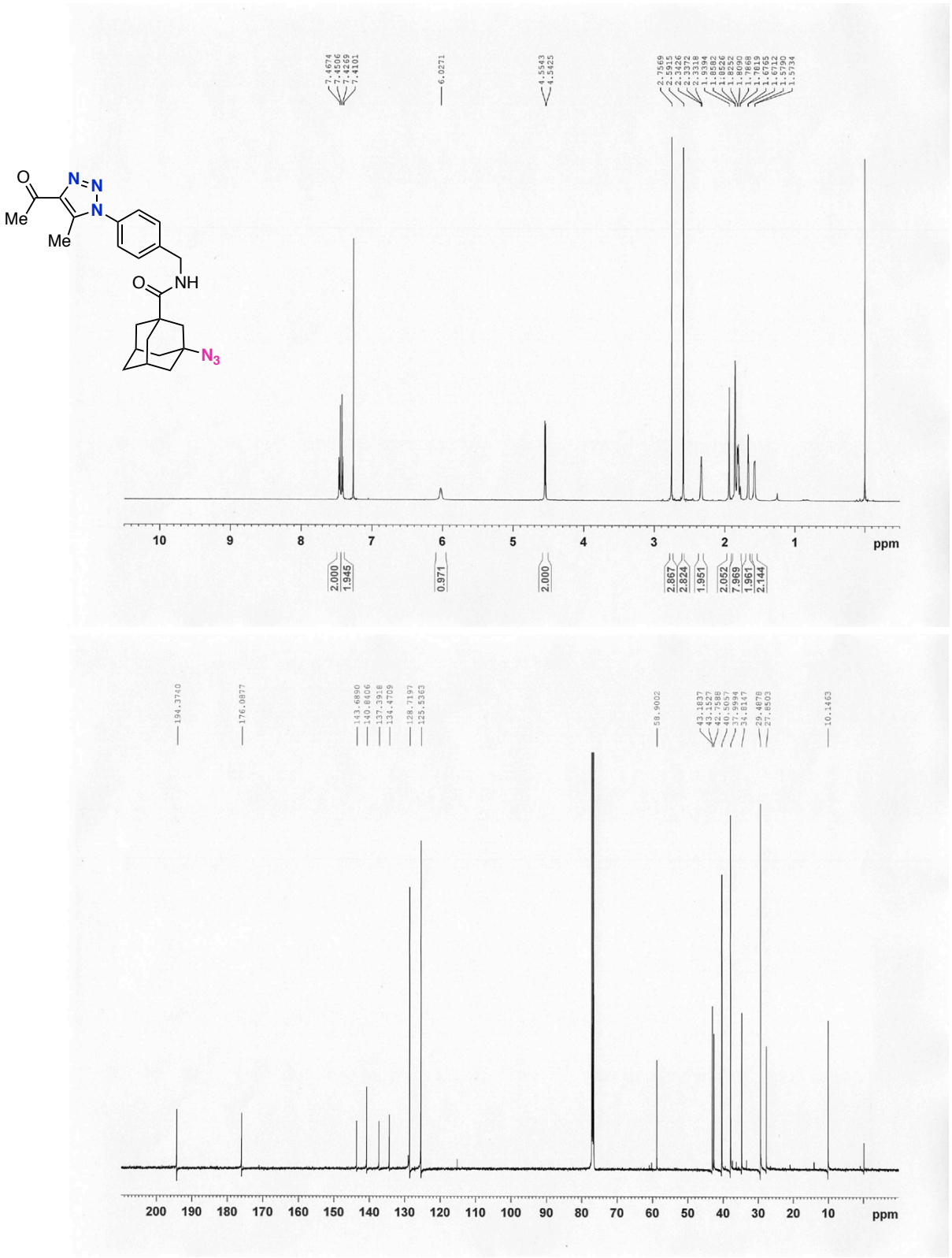




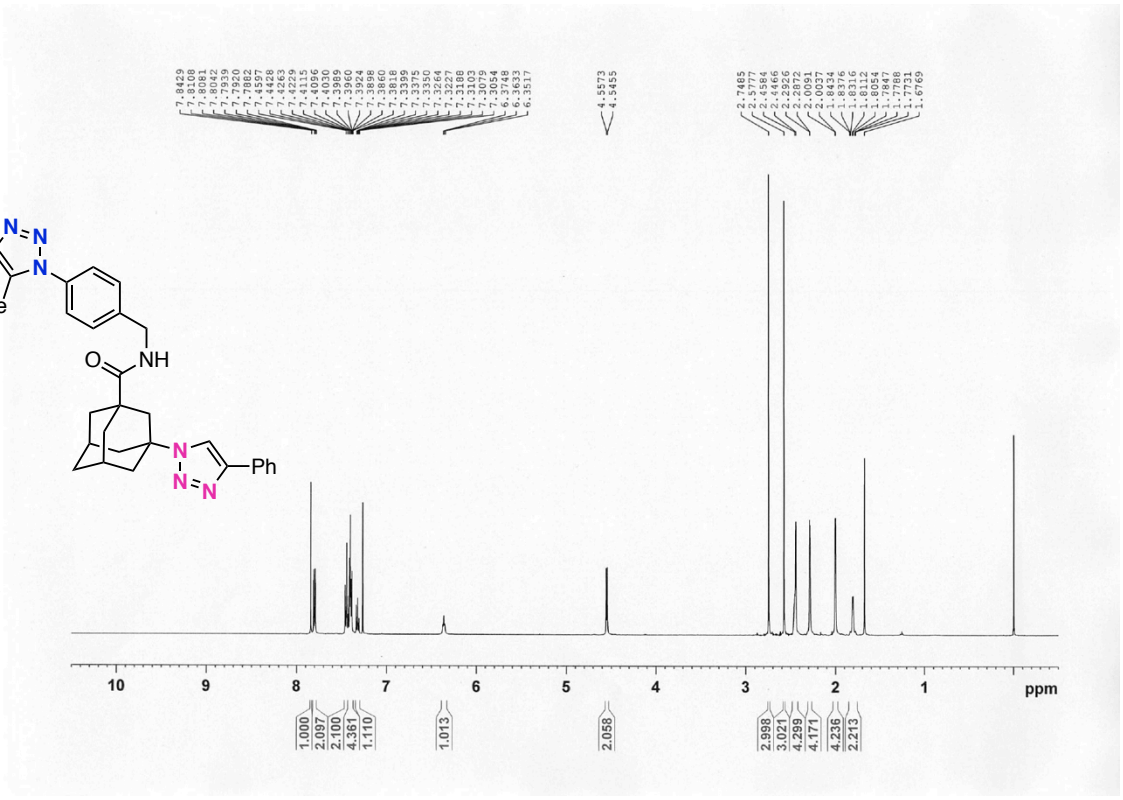
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(4-azidobenzyl)adamantanamide (**13**) ($CDCl_3$)

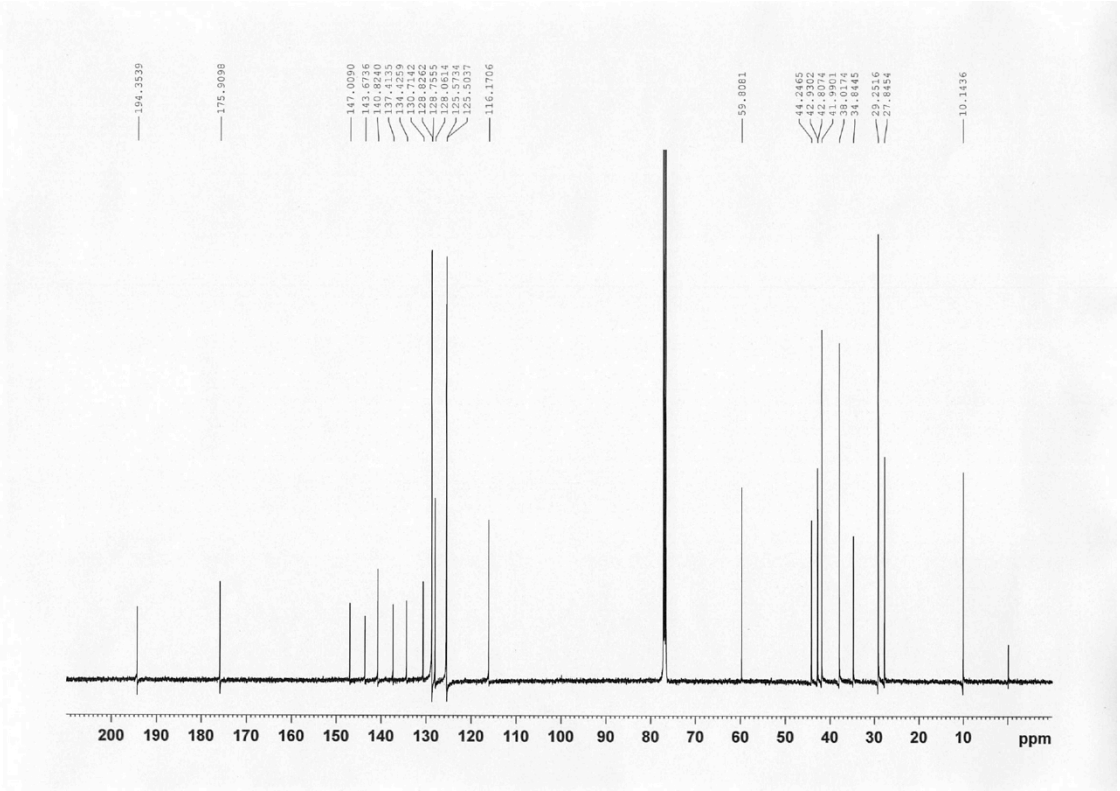


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(4-(4-acetyl-5-methyl-1*H*-1,2,3-triazole-1-yl)benzyl)-3-azido-1-adamantanamide (**S3**) ($CDCl_3$)

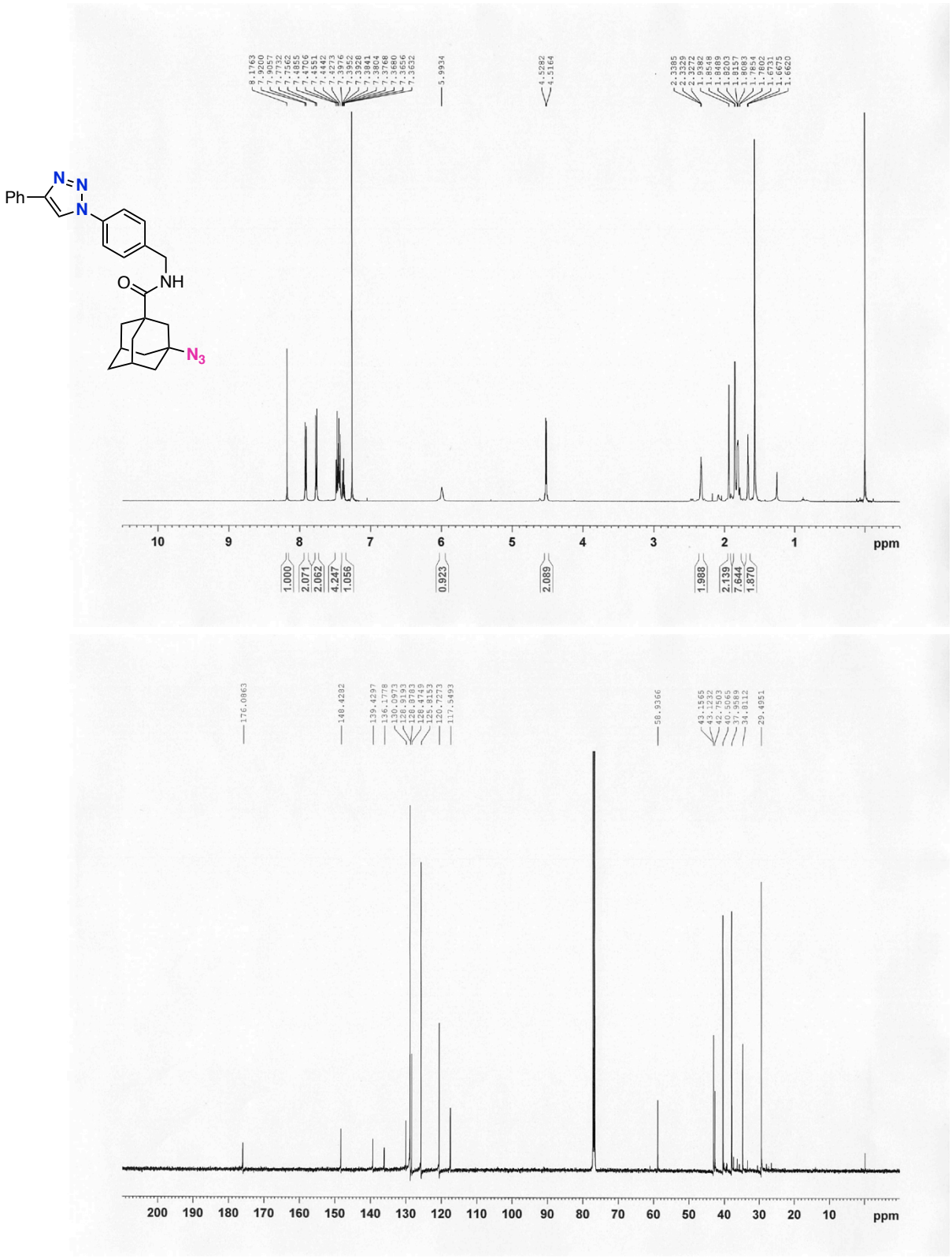


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(4-(4-acetyl-5-methyl-1*H*-1,2,3-triazole-1-yl)benzyl)-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)-1-adamantanamide (**15a**) ($CDCl_3$)

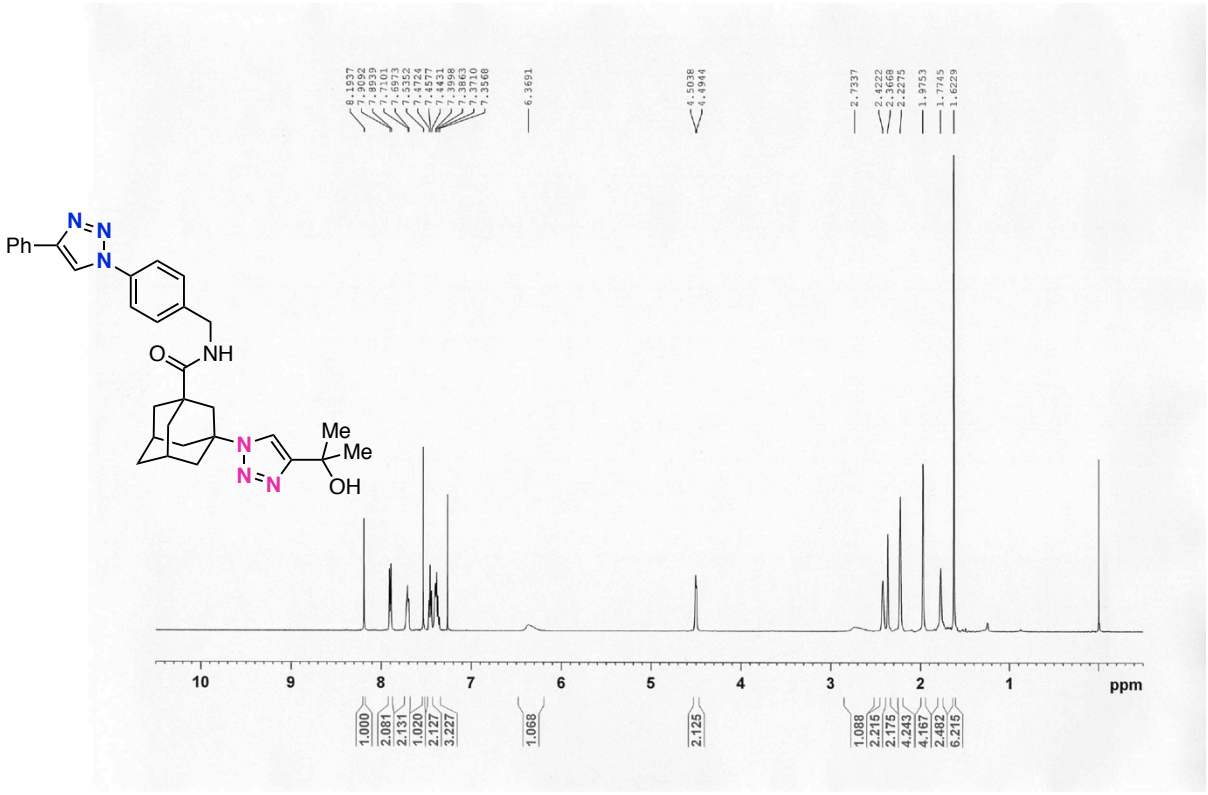


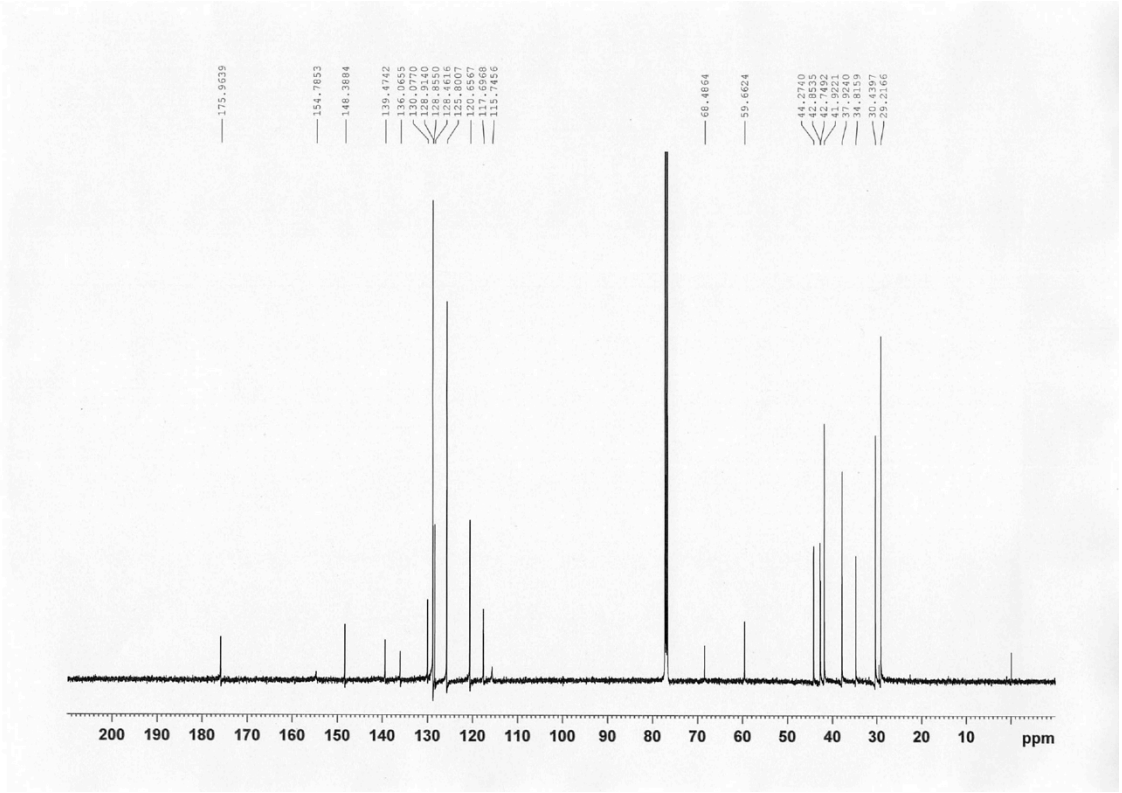


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(4-(4-phenyl-1*H*-1,2,3-triazole-1-yl)benzyl)-1-adamantanamide (**S4**) ($CDCl_3$)

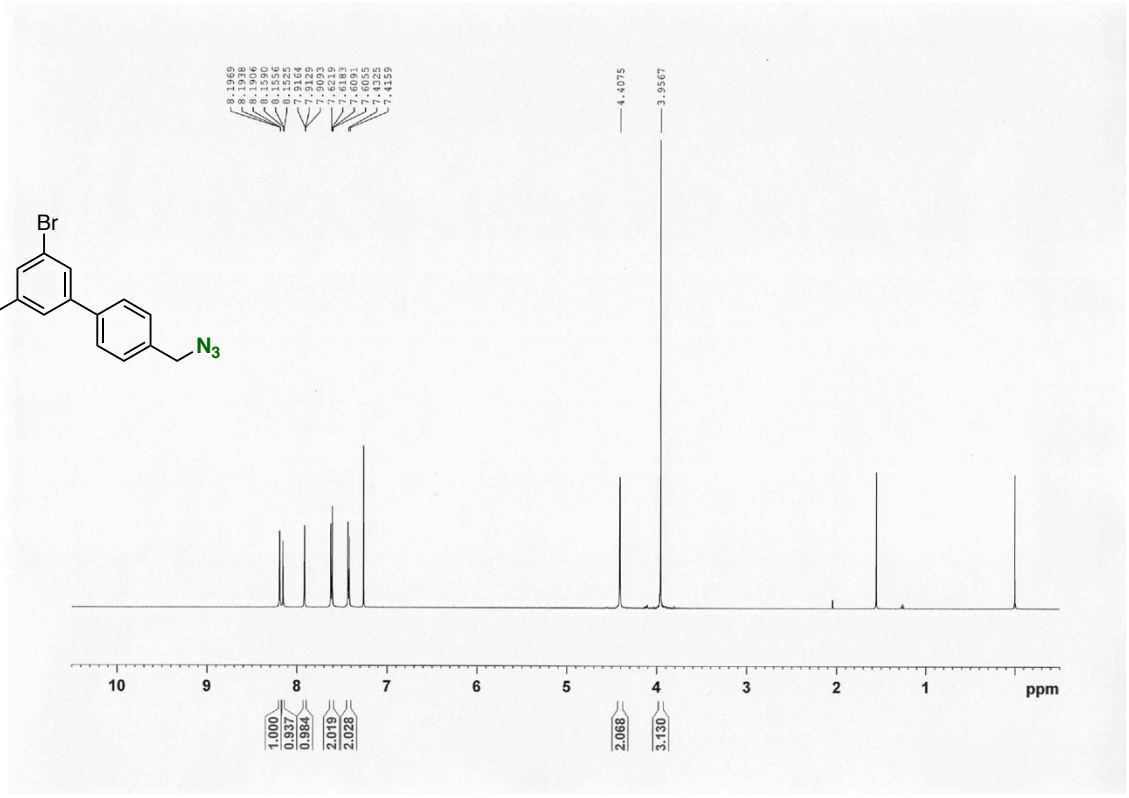


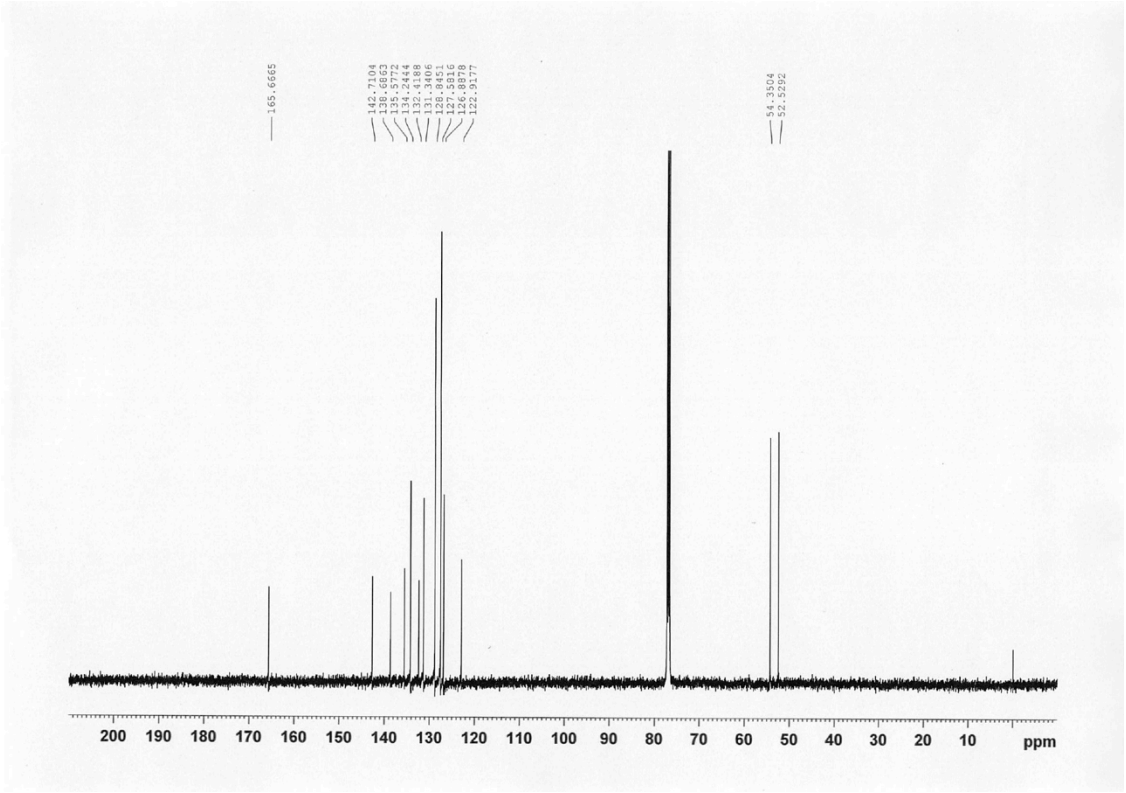
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-(4-(1-hydroxy-1-methylethyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(4-(4-phenyl-1*H*-1,2,3-triazole-1-yl)benzyl)-1-adamantanamide (**15b**) ($CDCl_3$)



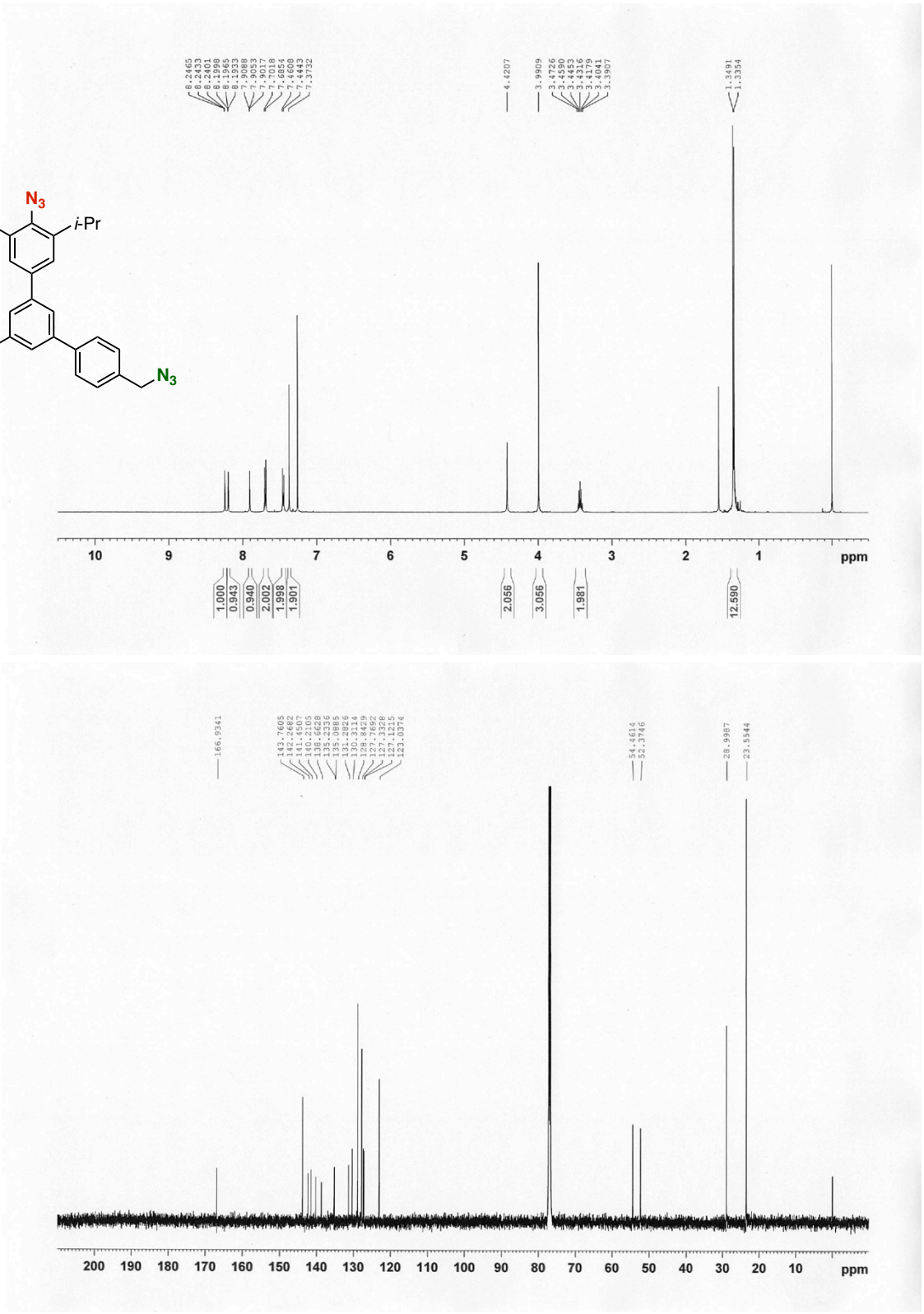


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of methyl 3-(4-(azidomethyl)phenyl)-5-bromobenzoate (**S7**) ($CDCl_3$)

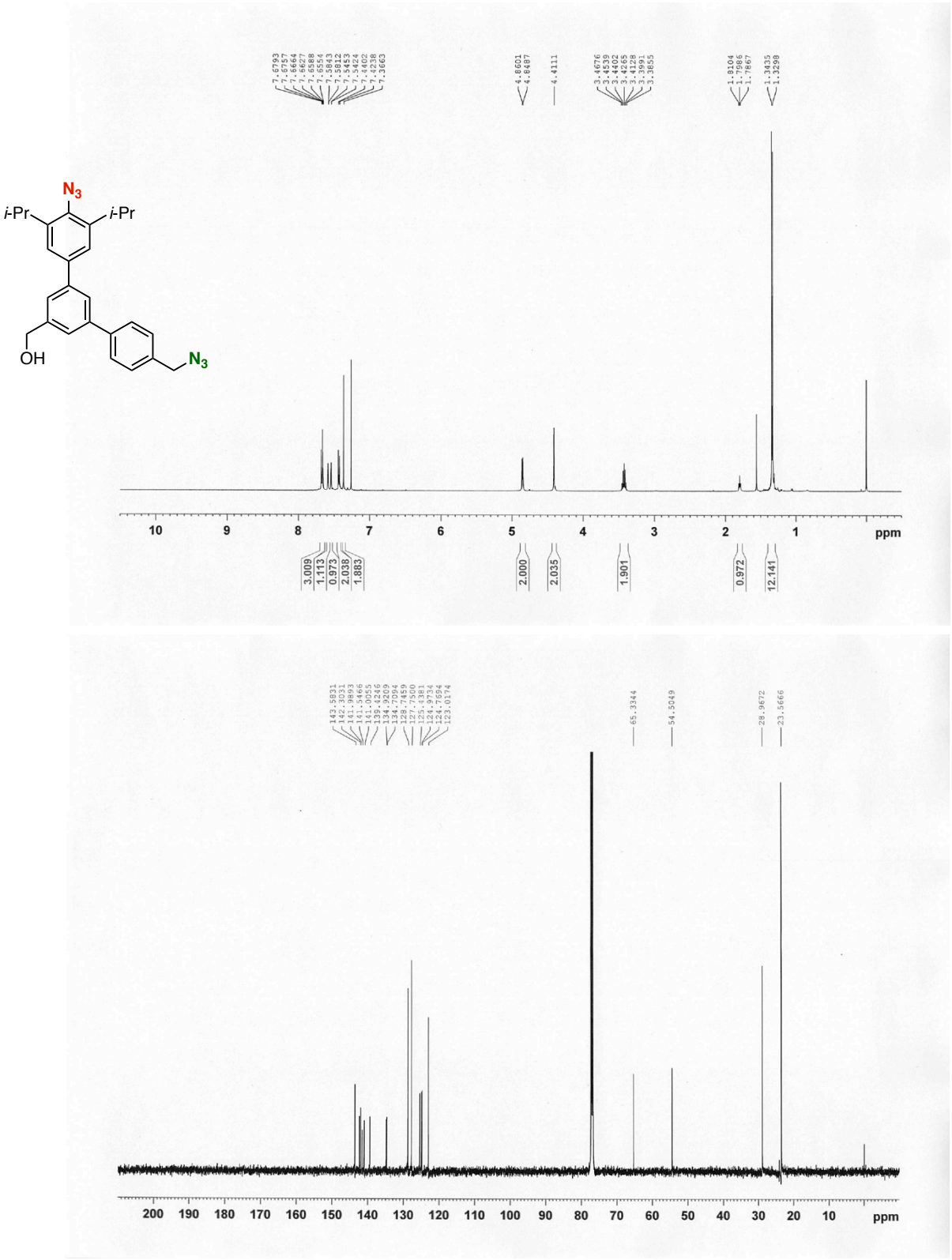




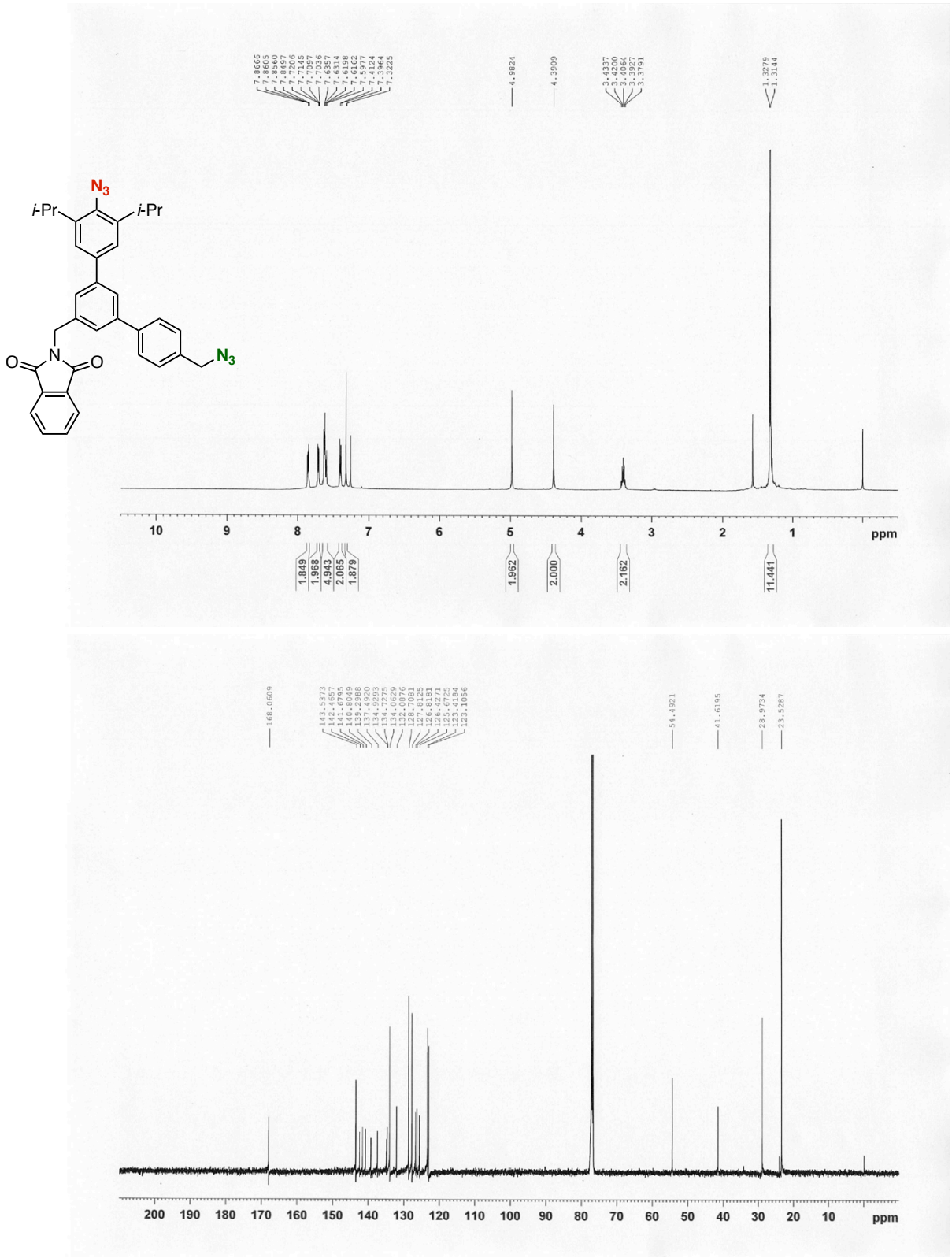
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of methyl 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzoate (**S9**) ($CDCl_3$)



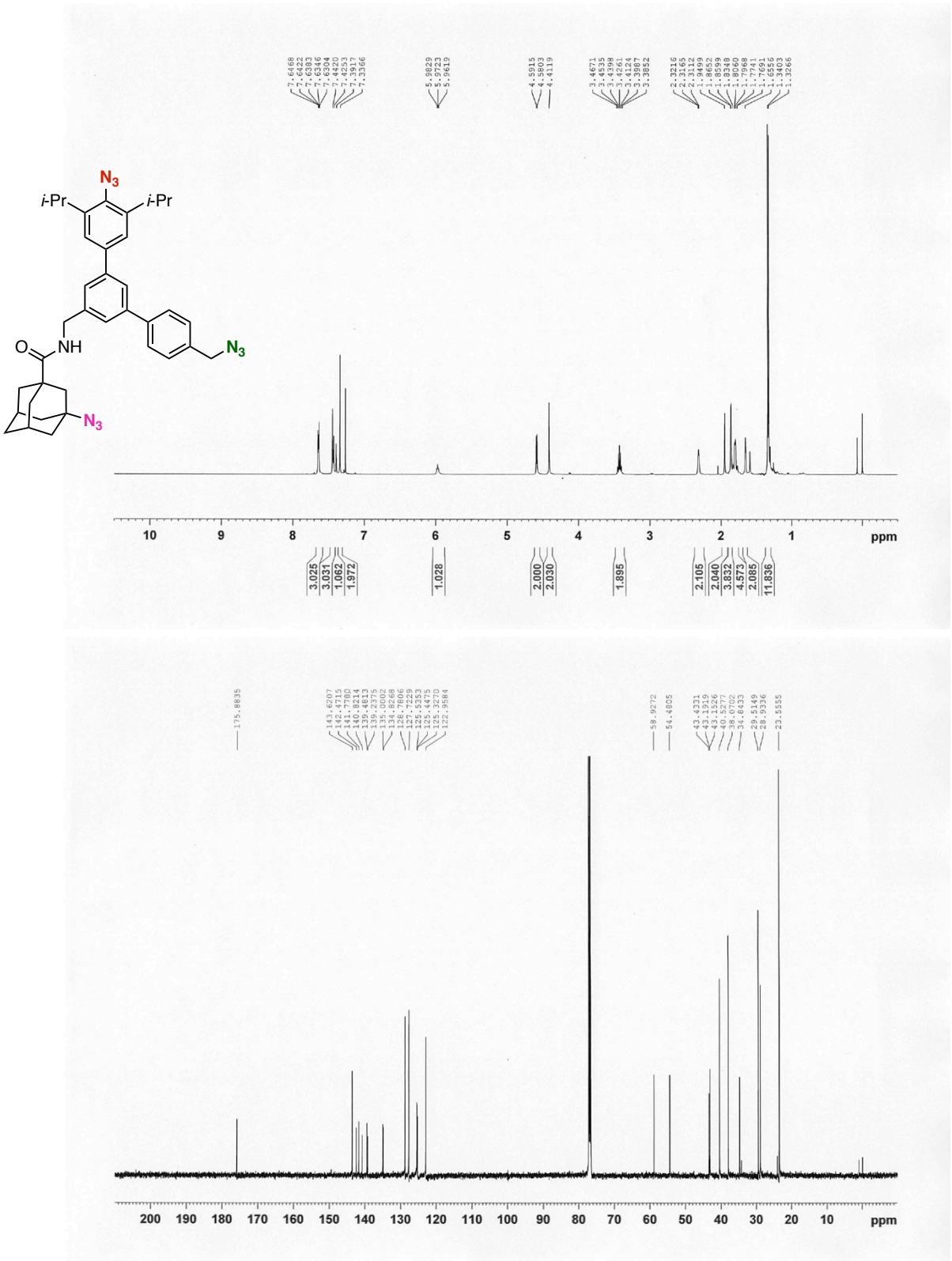
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl alcohol (**S10**) ($CDCl_3$)



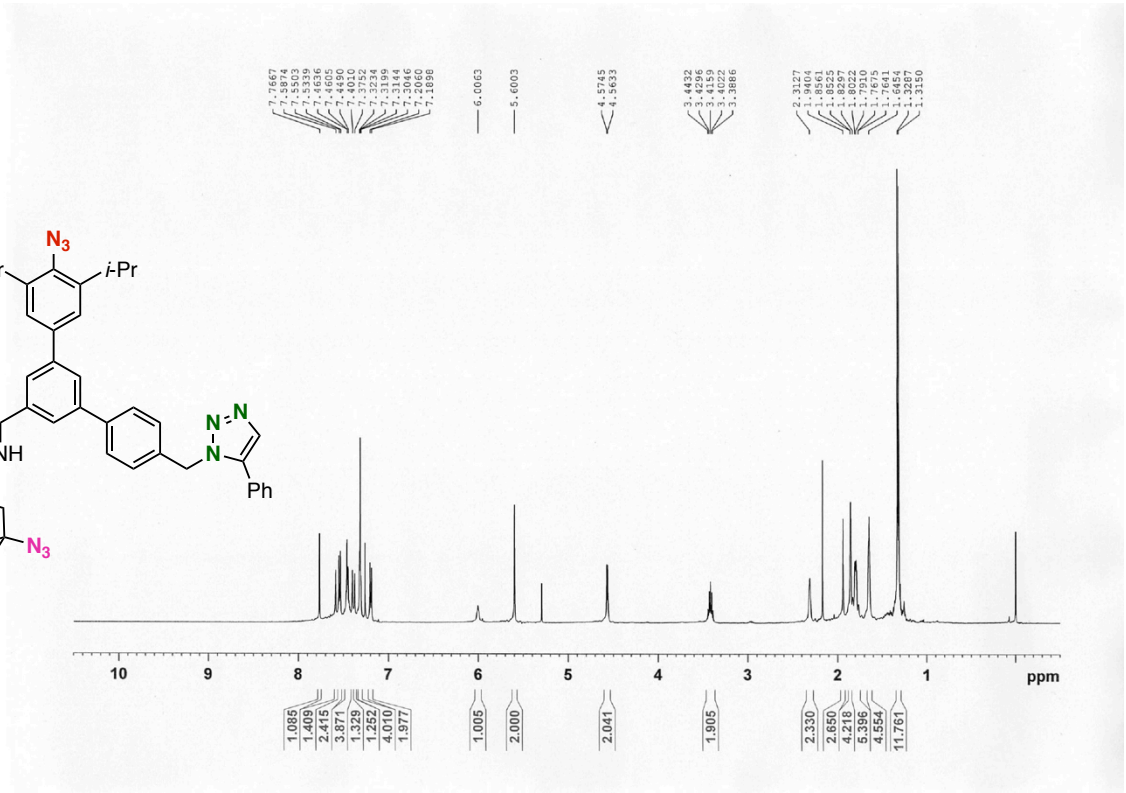
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)phthalimide (**S11**) ($CDCl_3$)

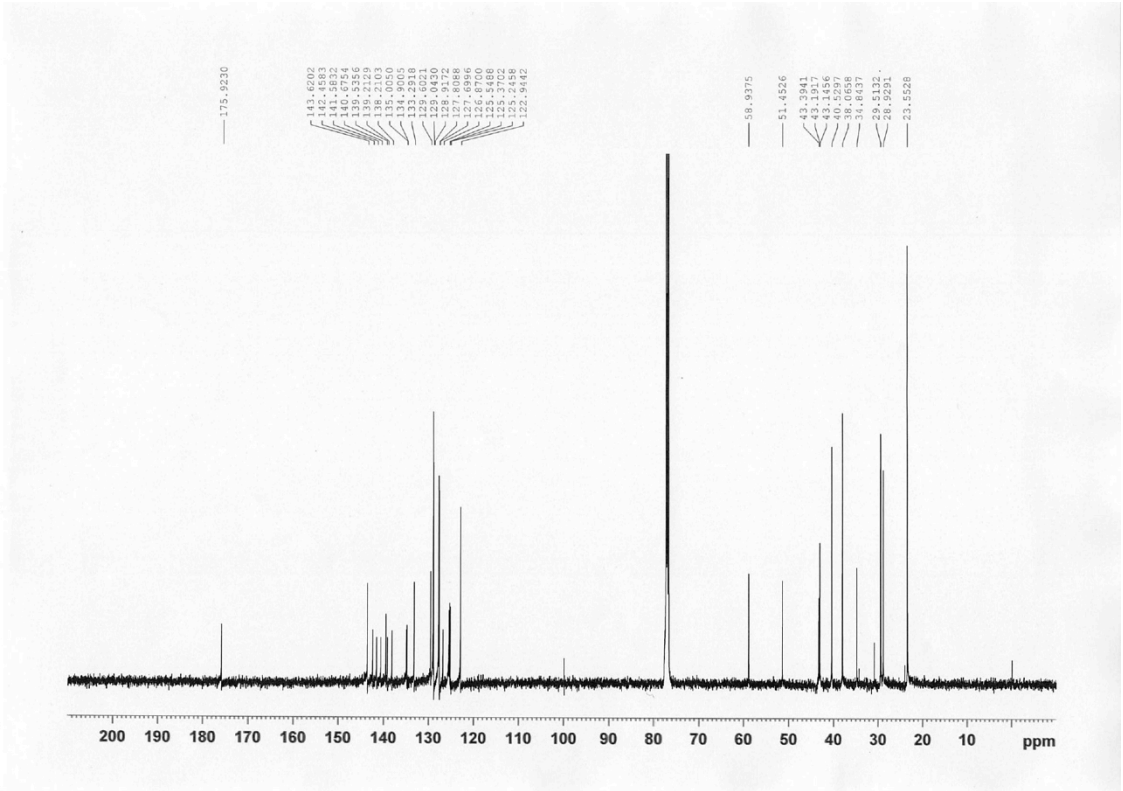


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-(azidomethyl)phenyl)benzyl)-1-adamantanamide (**16**) ($CDCl_3$)

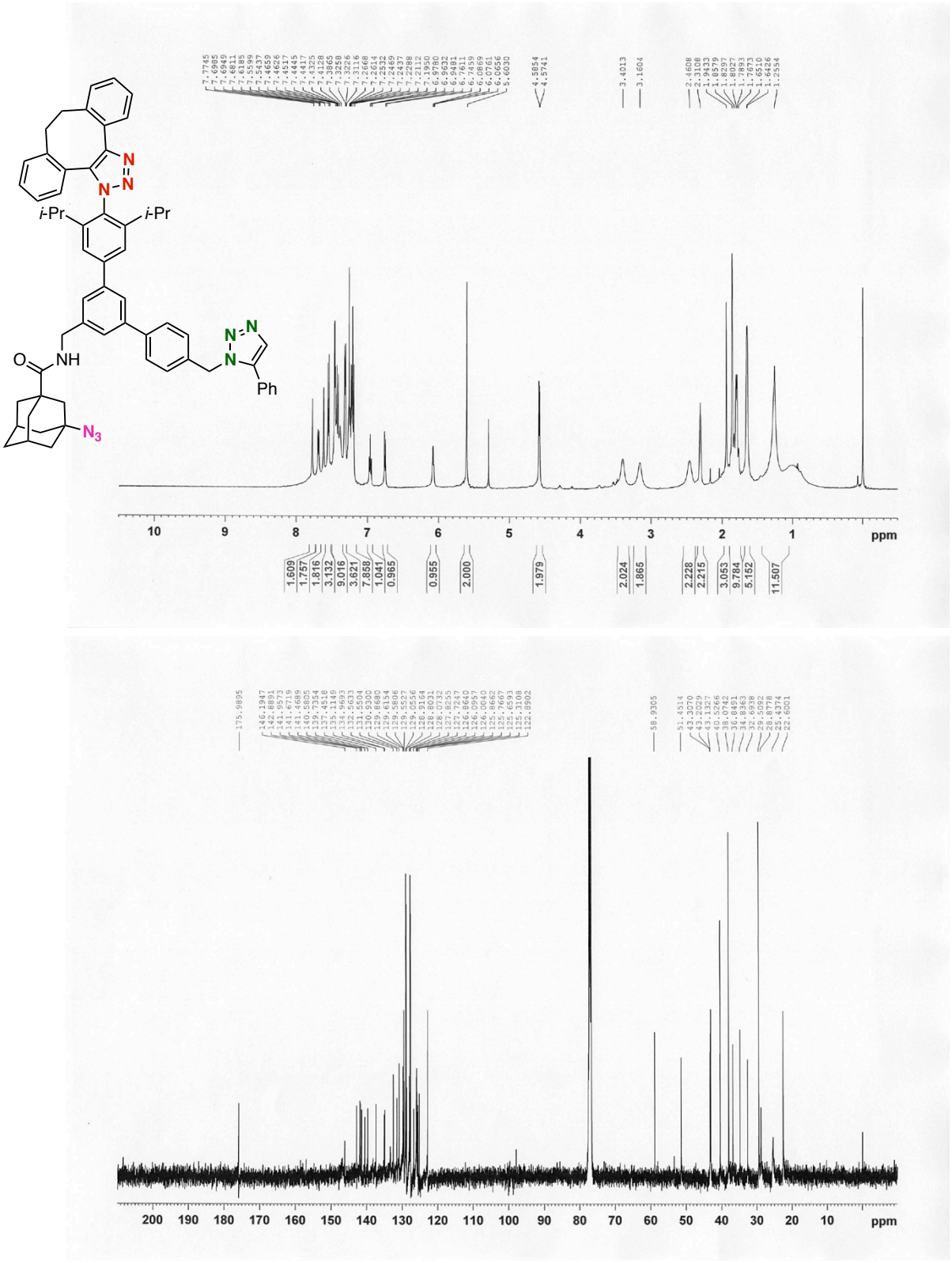


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(4-azido-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**S12**) ($CDCl_3$)

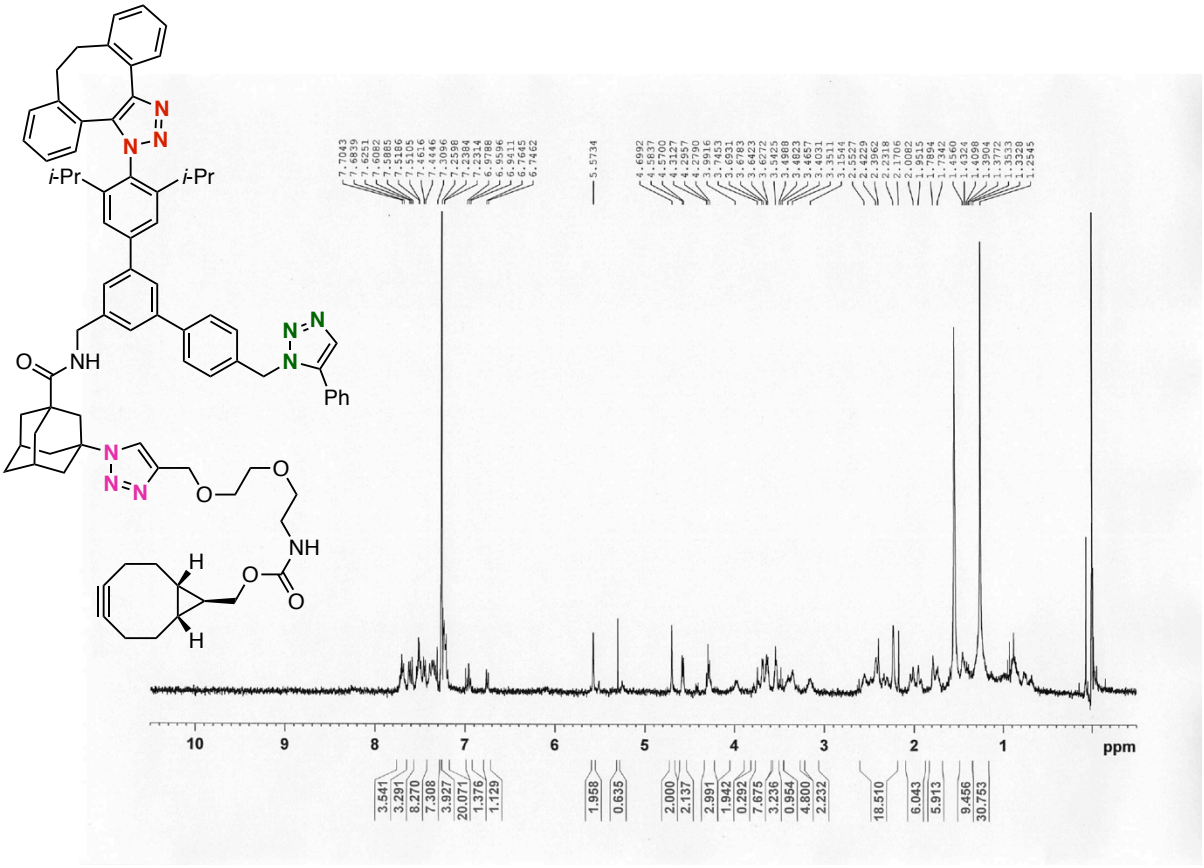




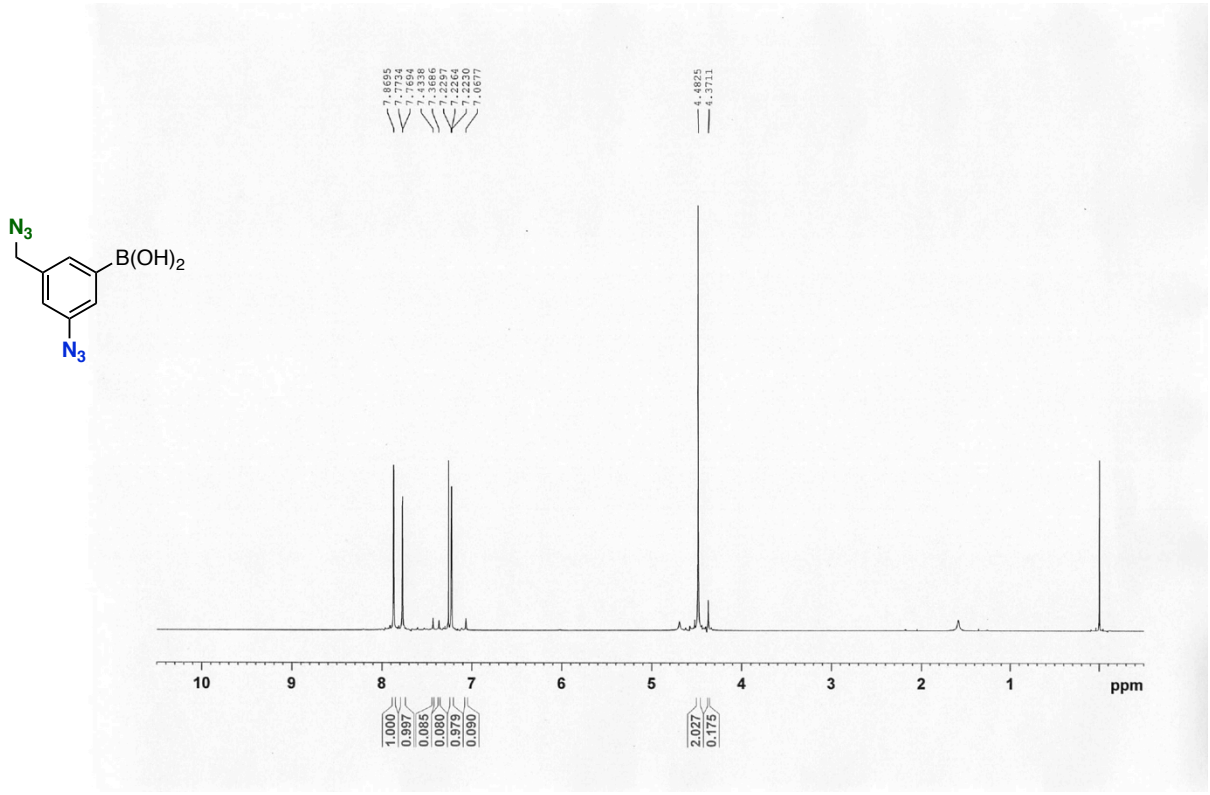
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(4-(8,9-dihydro-1*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**S13**) ($CDCl_3$)

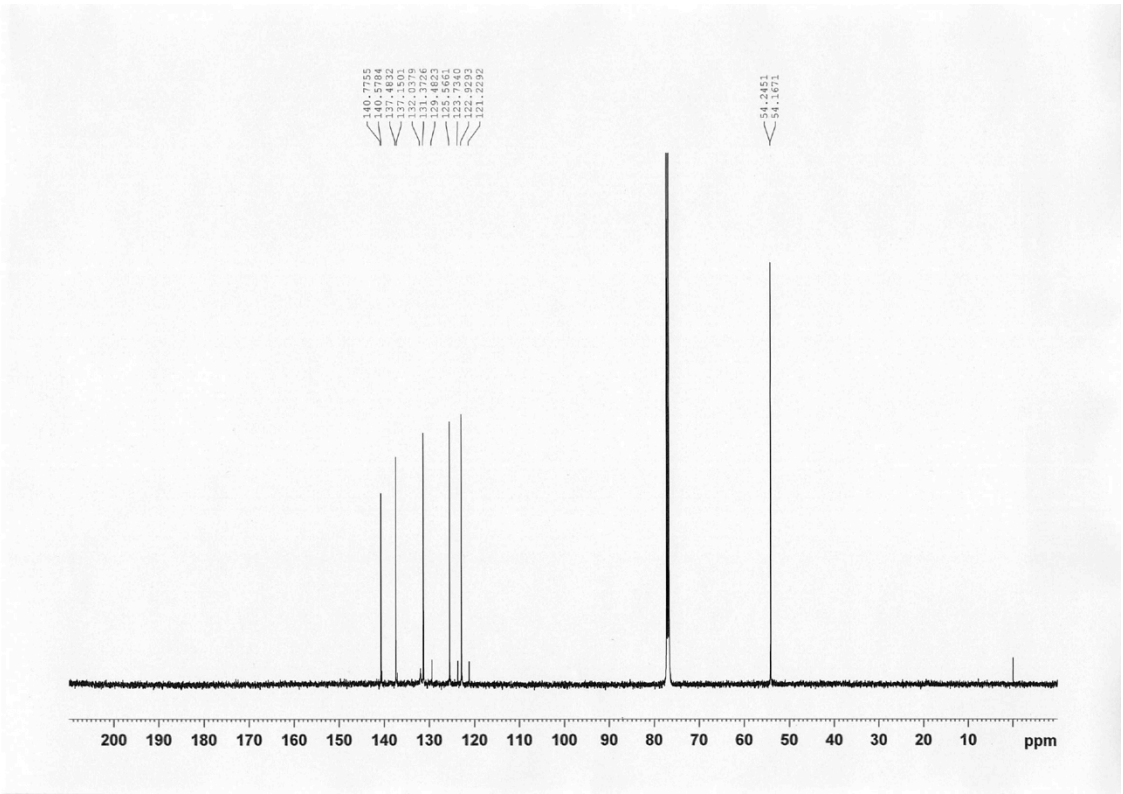


^{1}H NMR (500 MHz) spectrum of 3-(4-(((((((1*R**,8*S**,9*R**)-bicyclo[6.1.0]non-4-yn-9-yl)methyl)oxycarbonylamino)ethoxy)ethoxy)methyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(3-(4-(8,9-dihydro-1*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)-5-(4-((5-phenyl-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)benzyl)-1-adamantanamide (**18**) ($CDCl_3$)

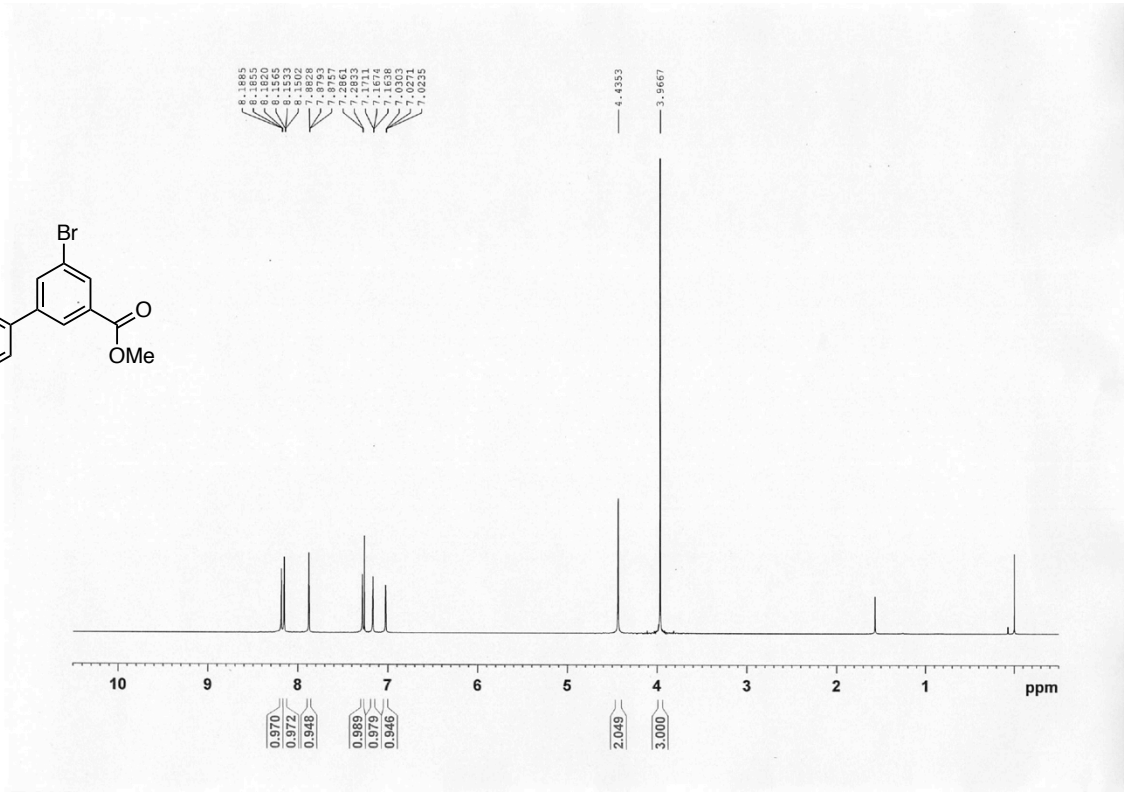


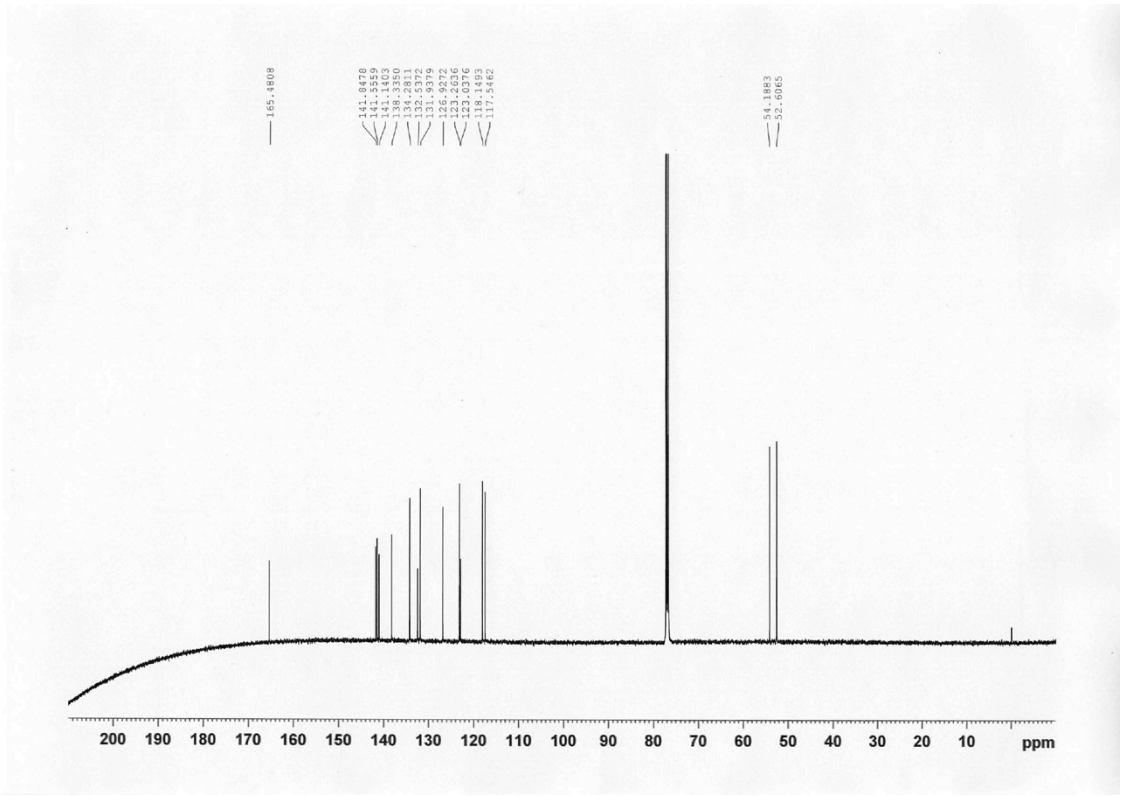
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of (3-azido-5-(azidomethyl)phenyl)boronic acid (**S8**) ($CDCl_3$)



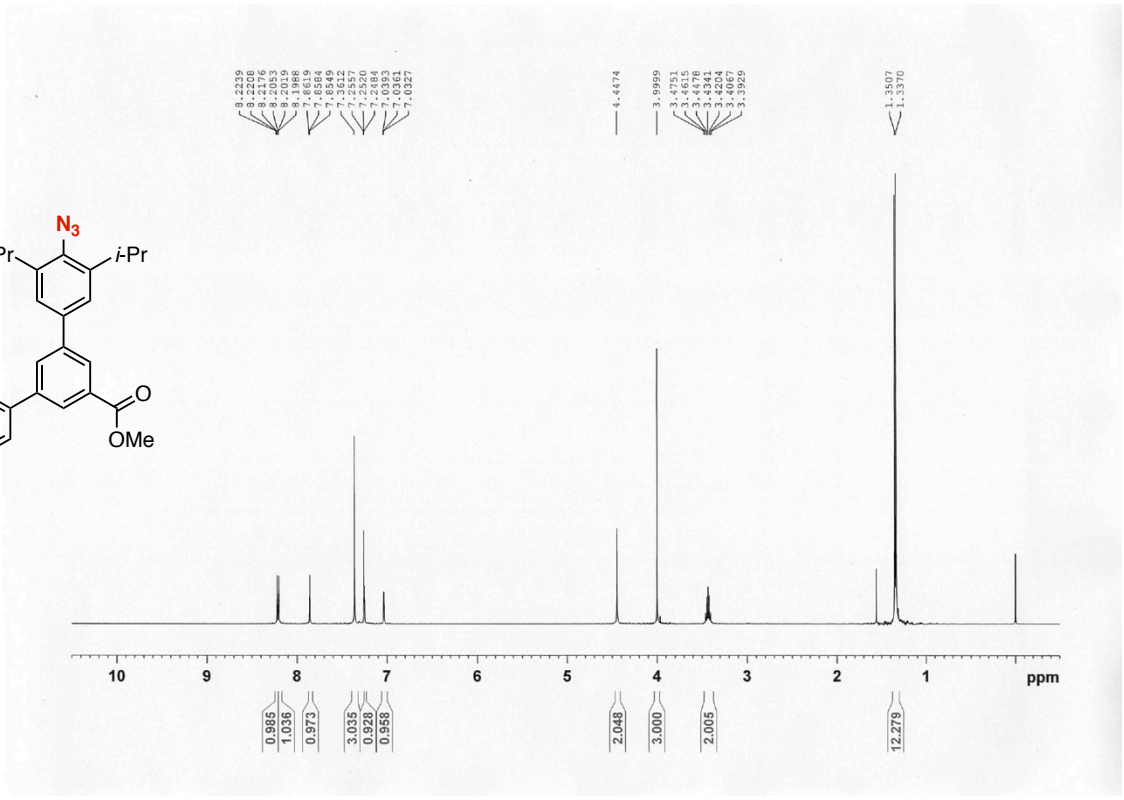


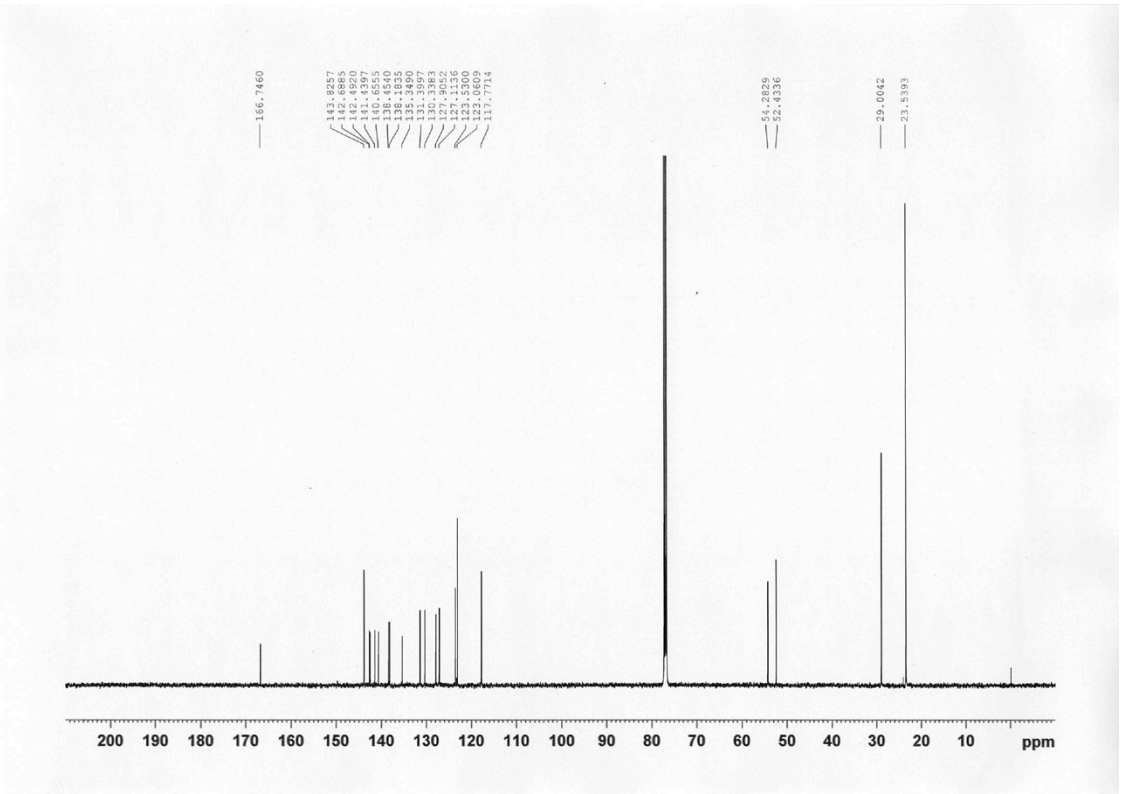
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-bromobenzoate (**S15**) ($CDCl_3$)



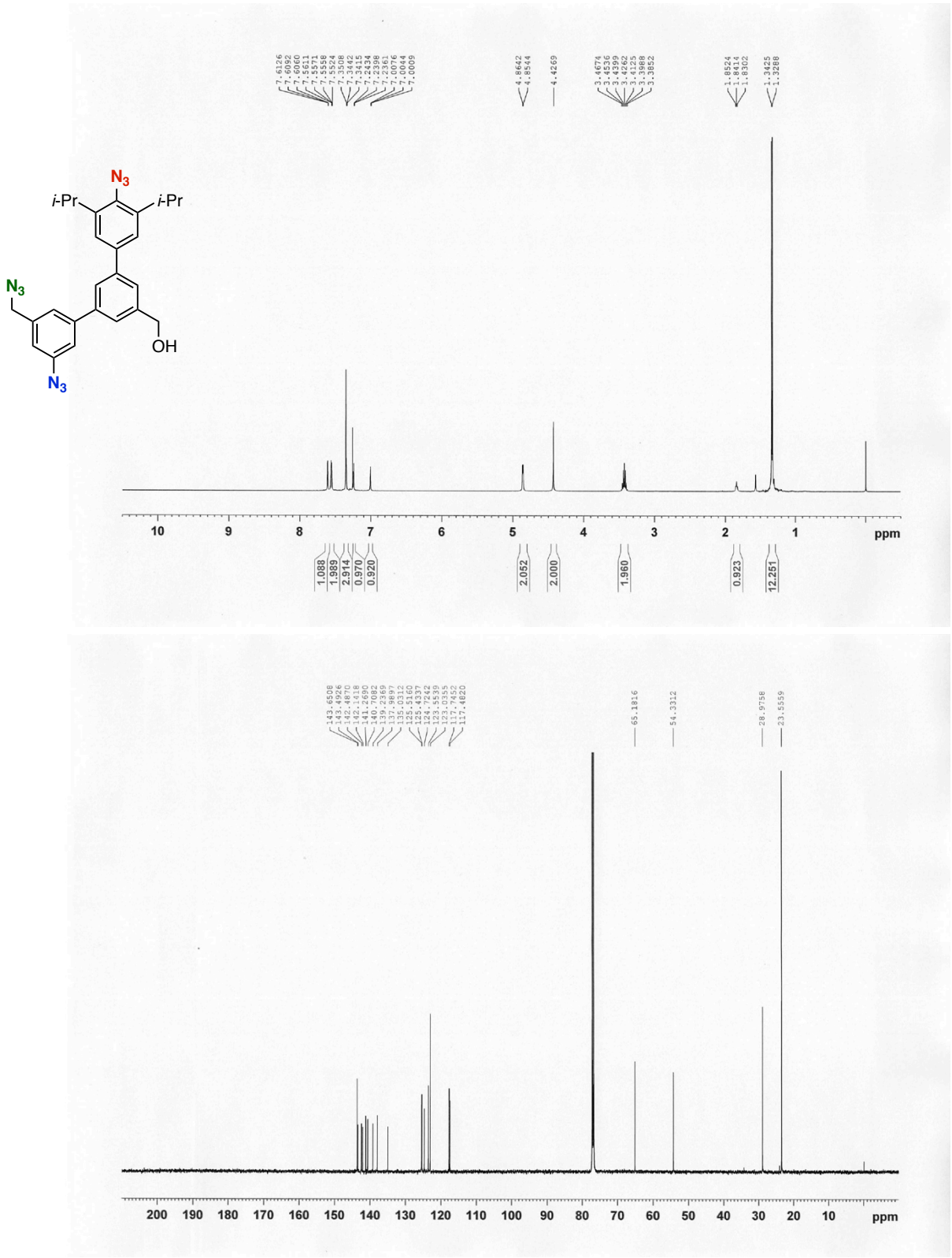


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of methyl 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzoate (**S16**) ($CDCl_3$)

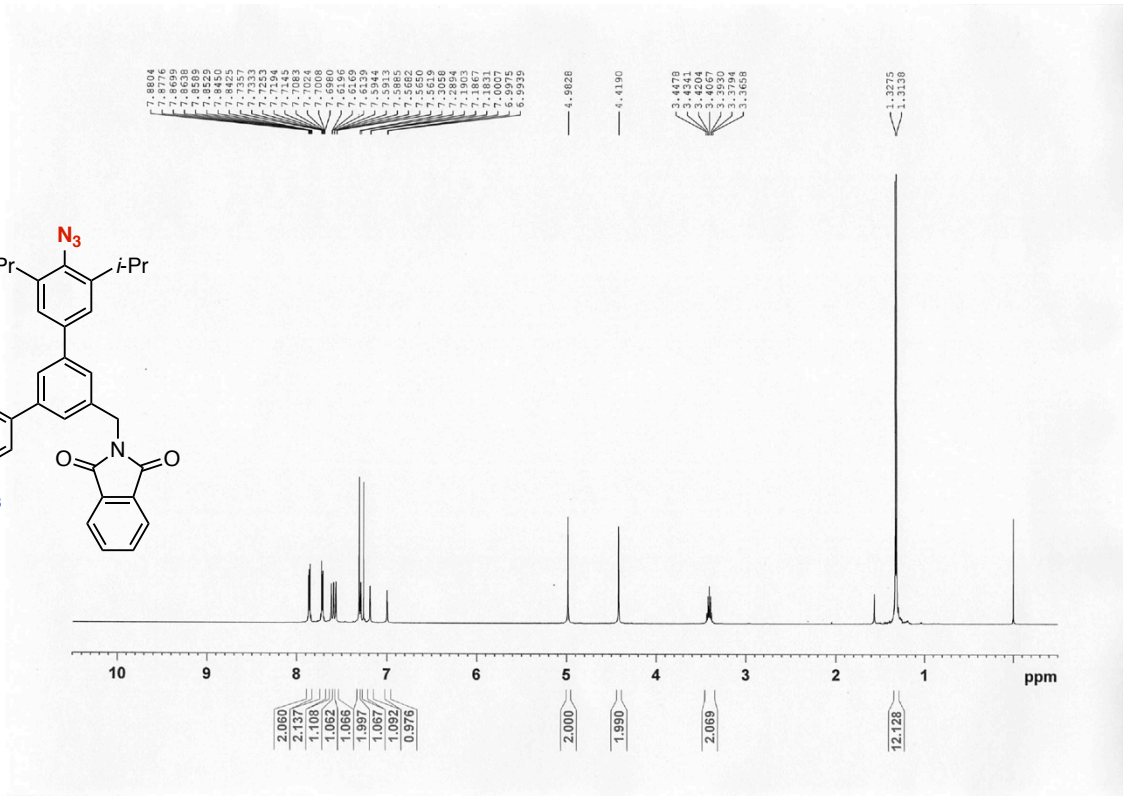


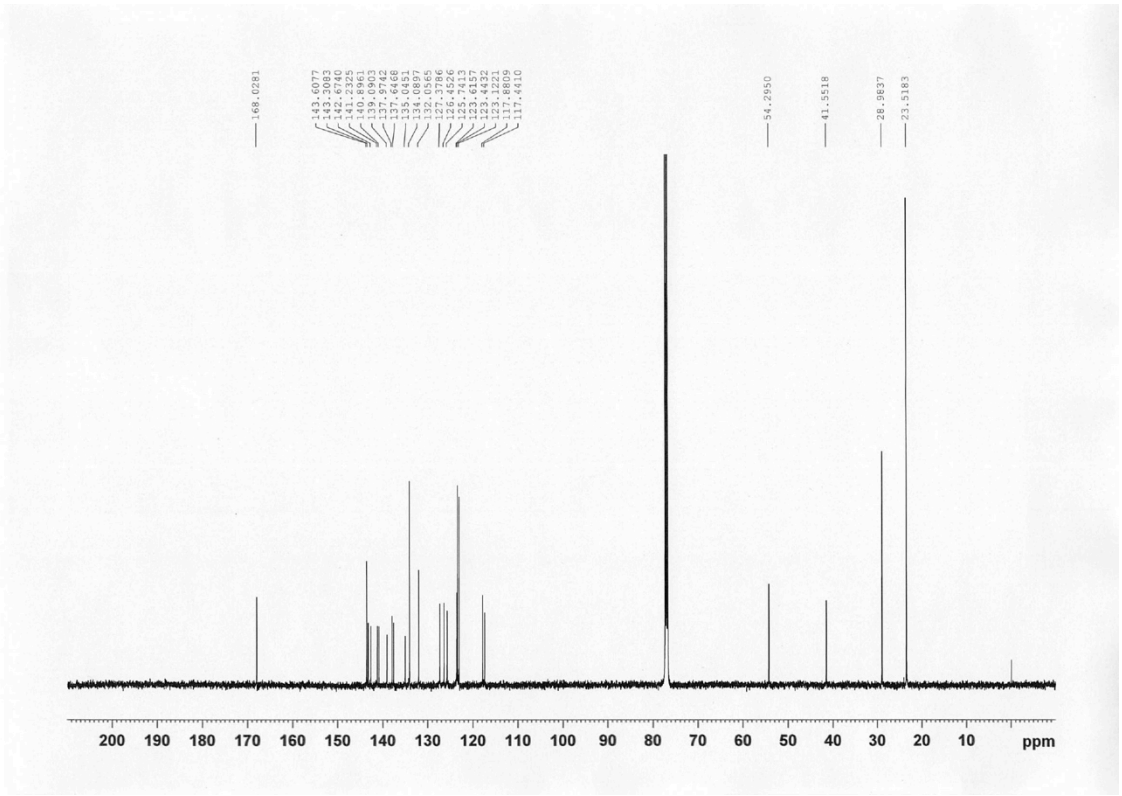


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl alcohol (**S17**) ($CDCl_3$)

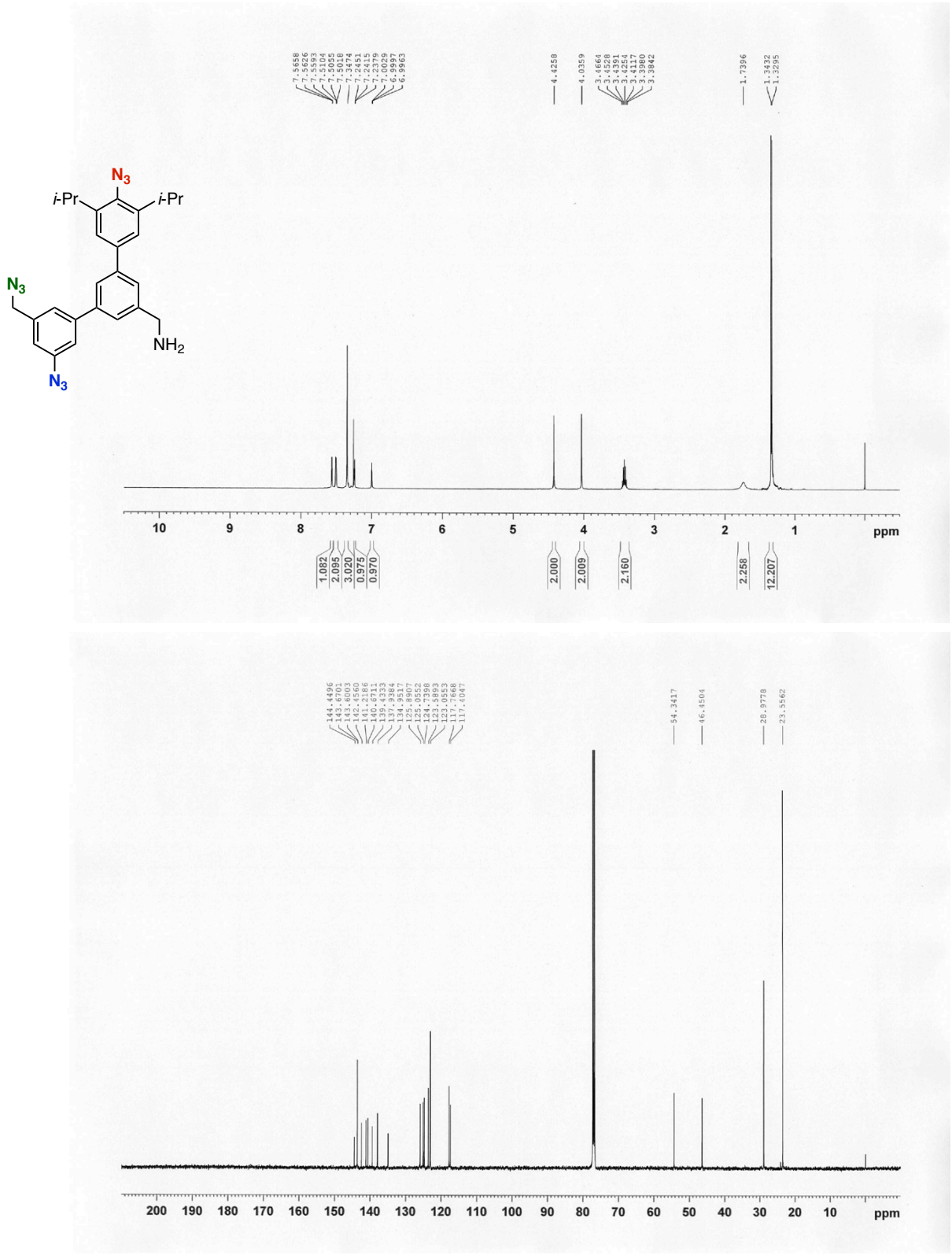


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)phthalimide (**S18**) ($CDCl_3$)

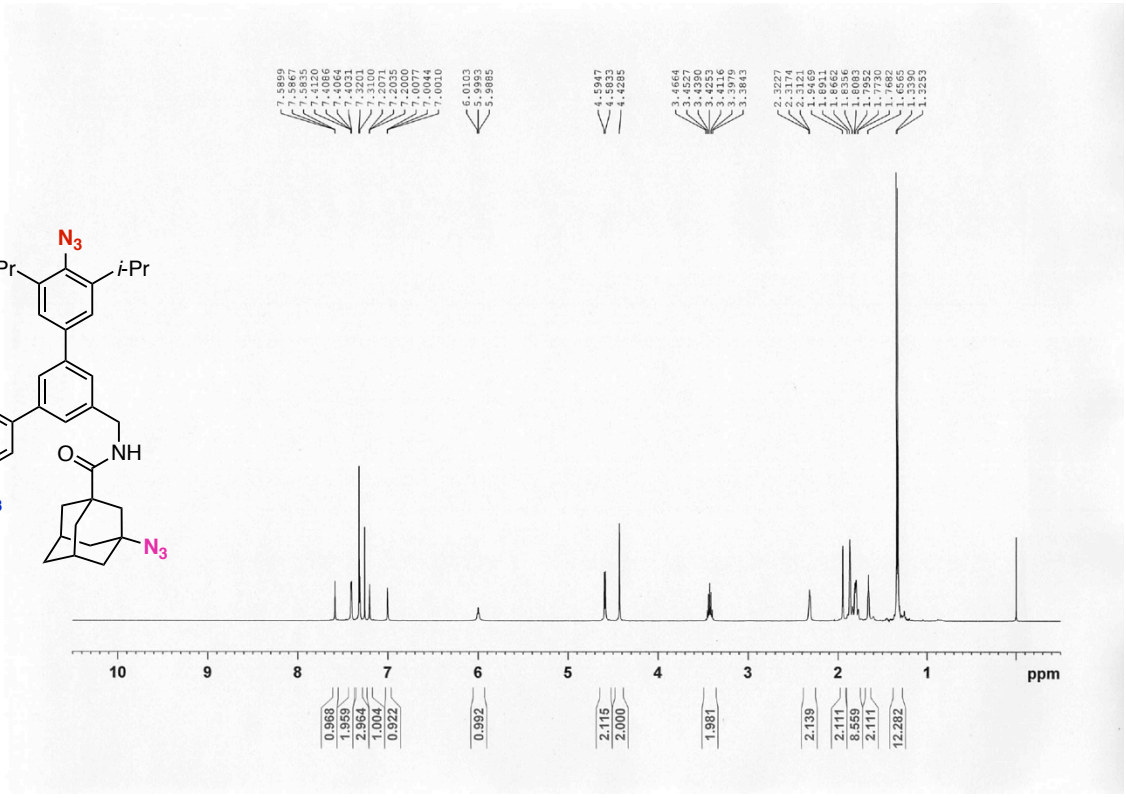


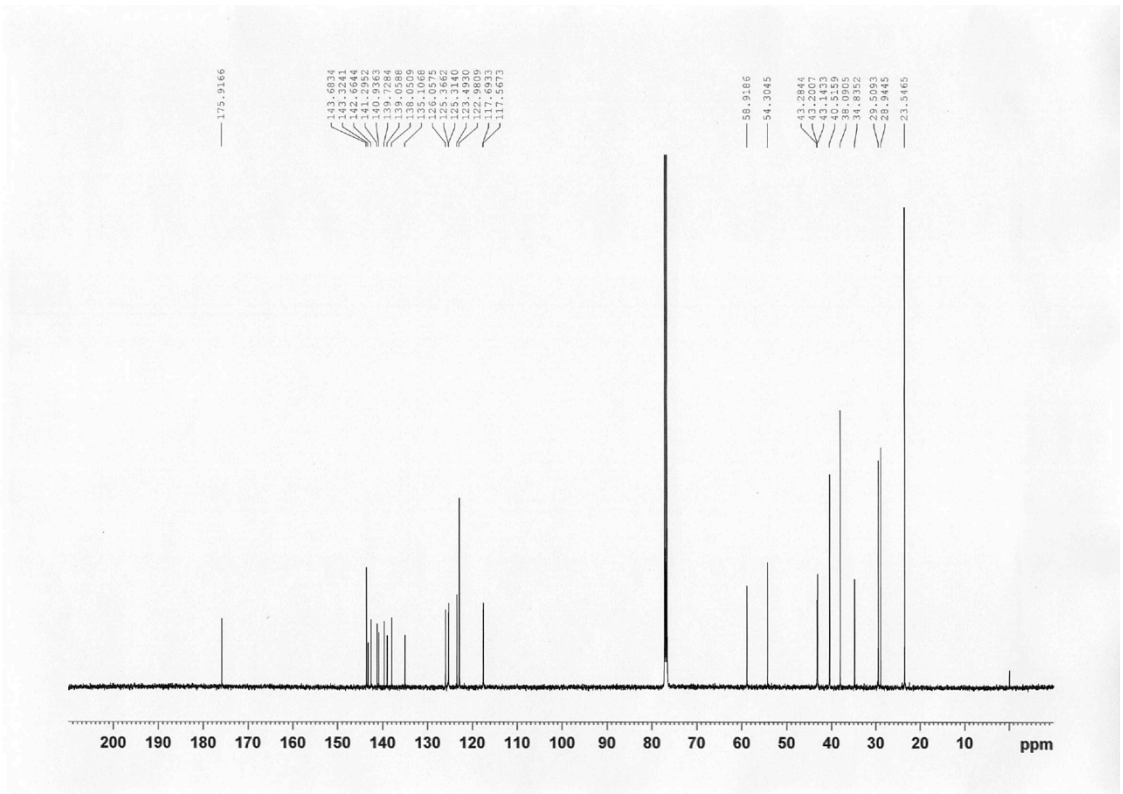


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzylamine (**S19**) ($CDCl_3$)

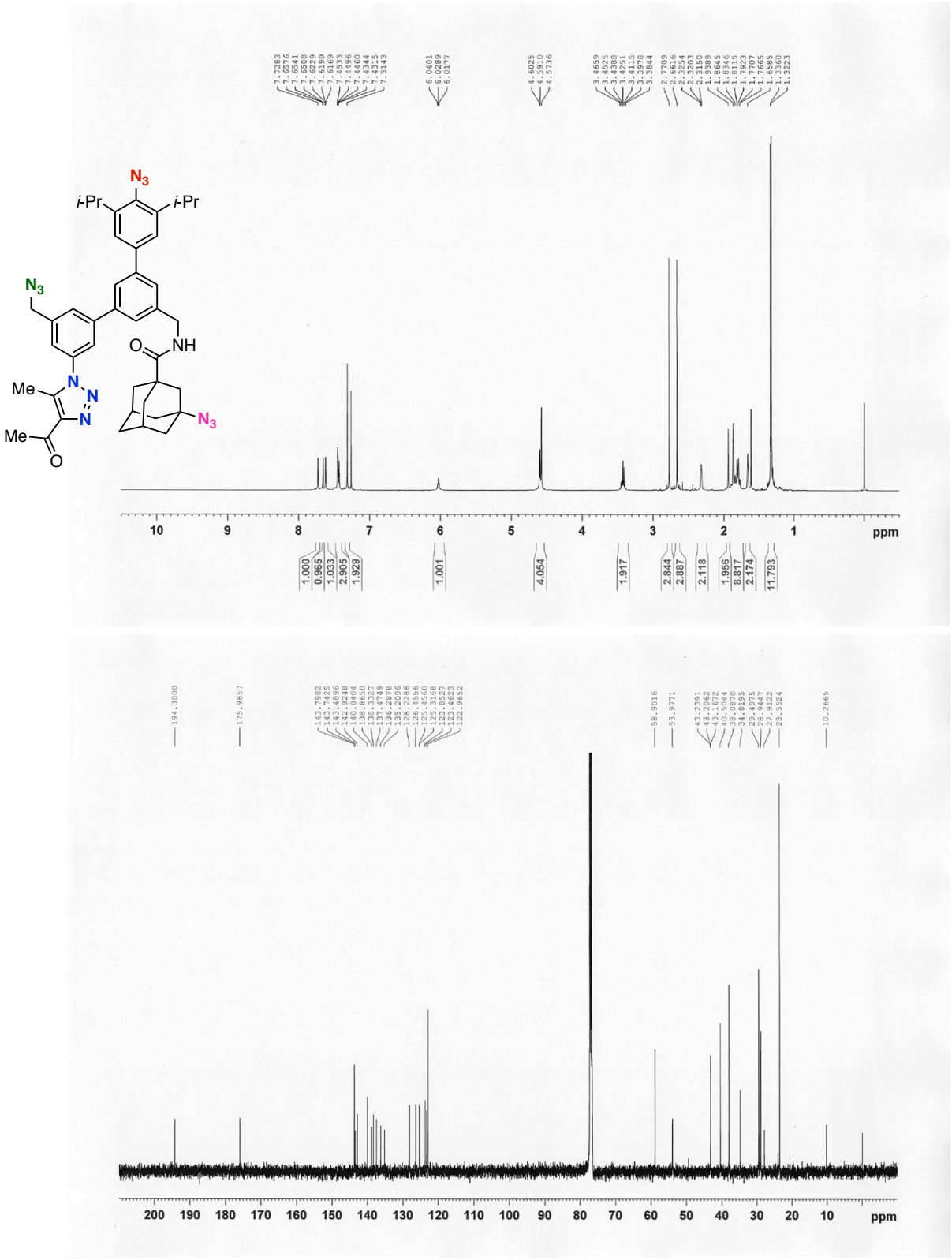


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**19**) ($CDCl_3$)

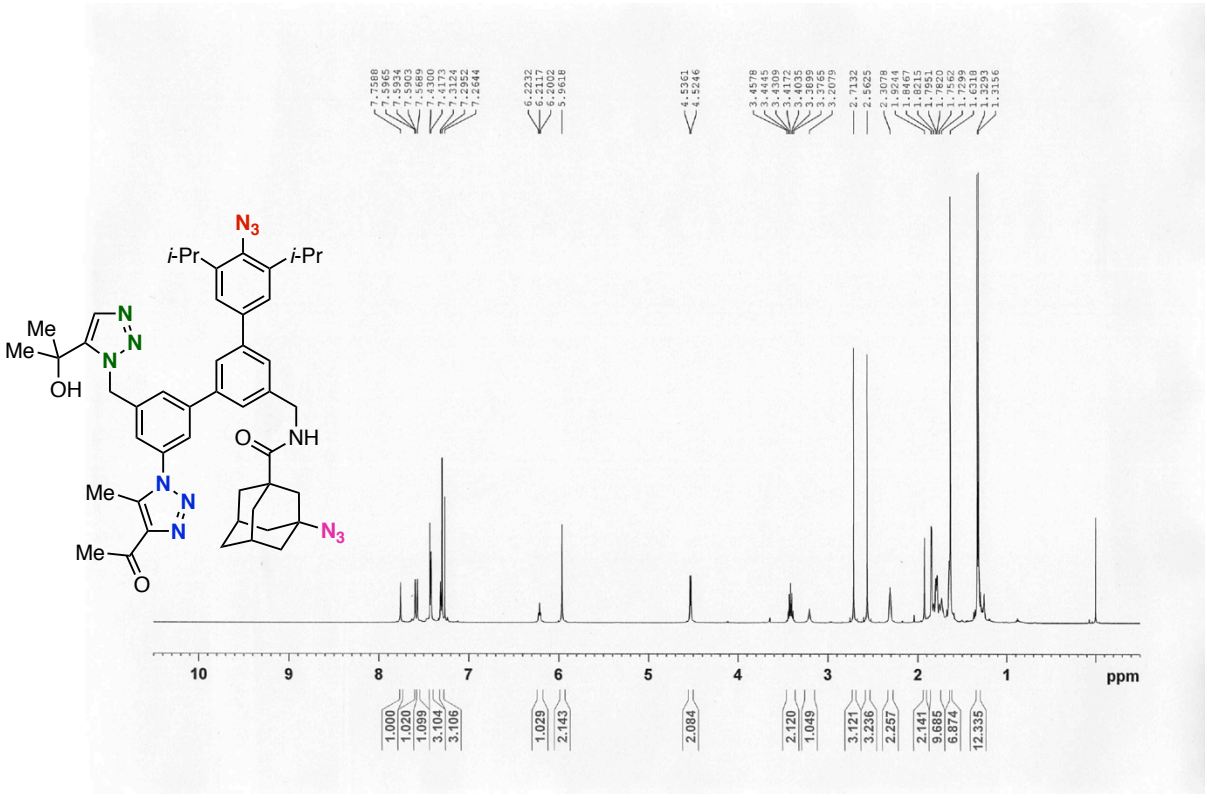


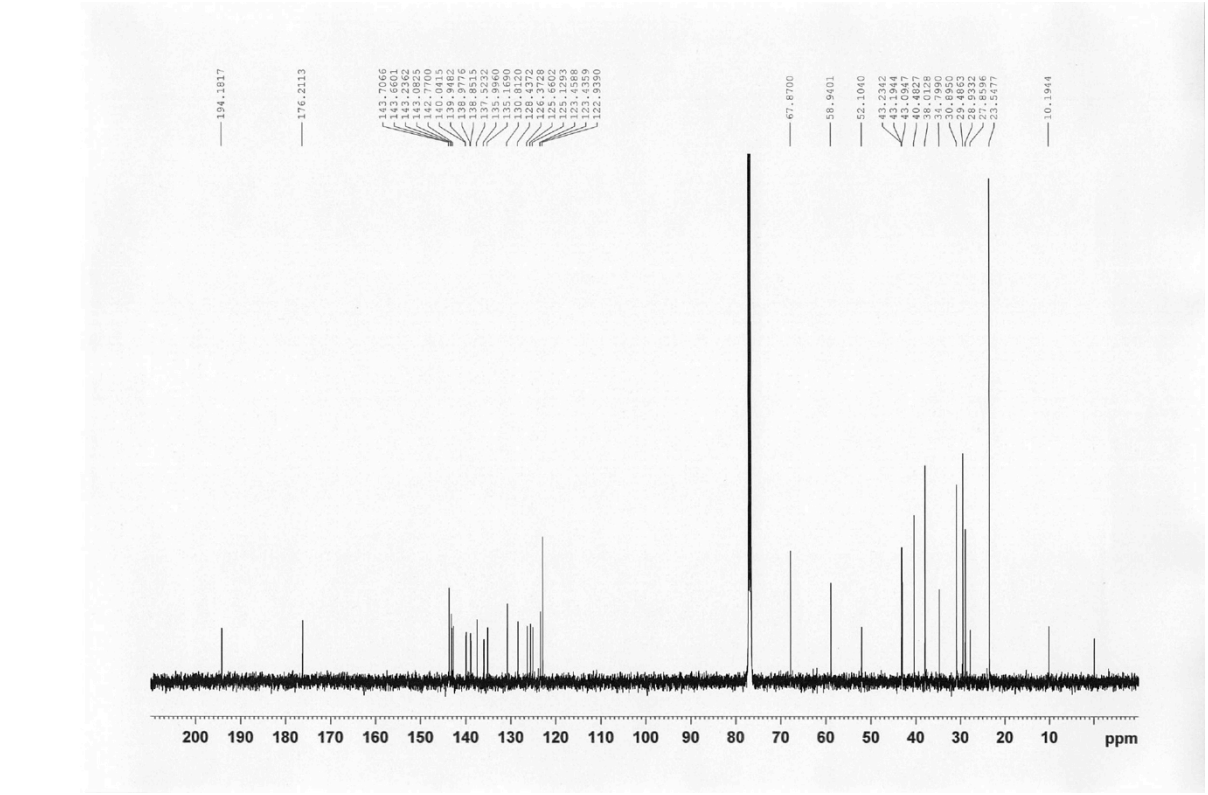


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-3-azido-5-(azidomethyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S20**) ($CDCl_3$)

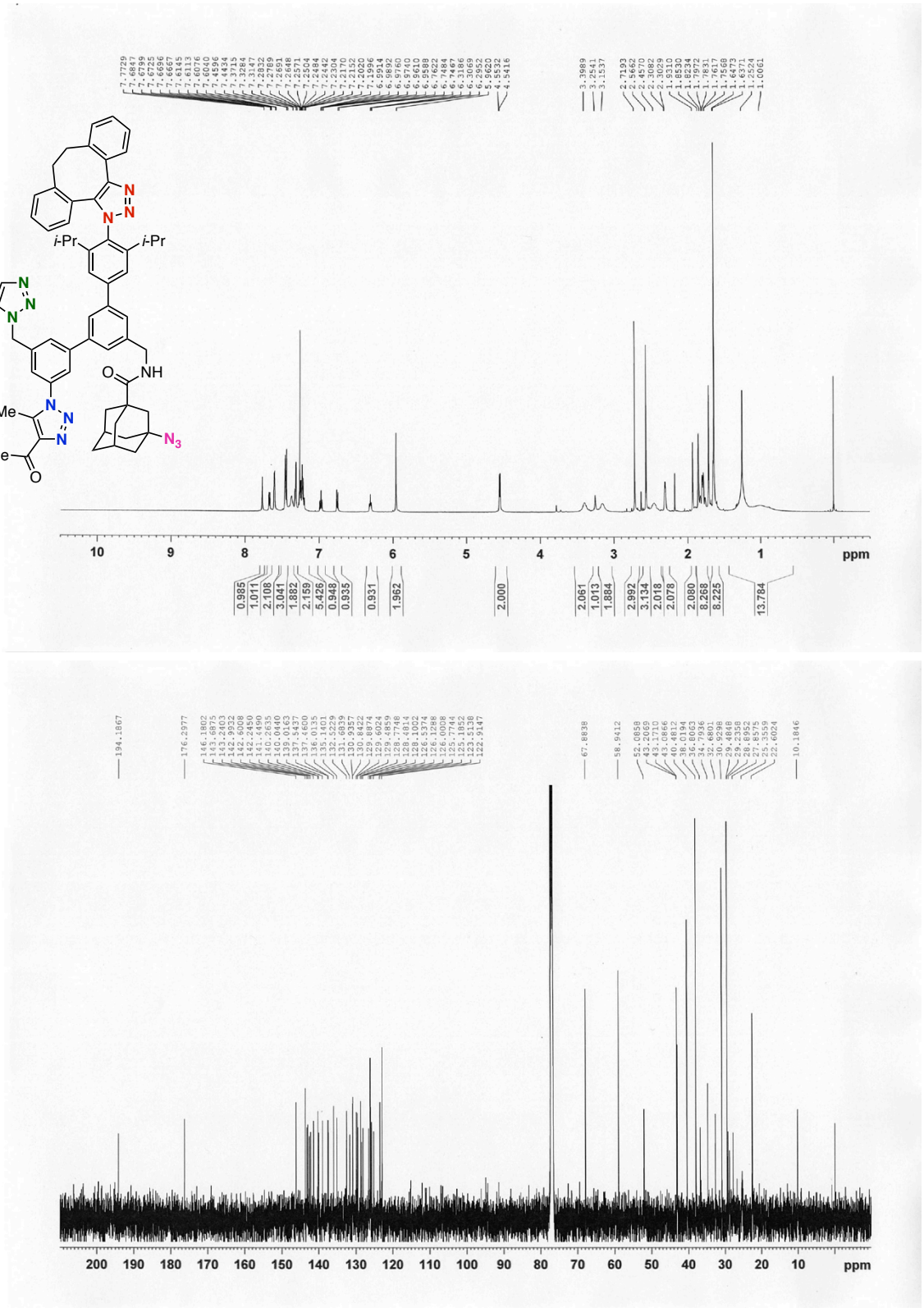


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-azido-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S21**) ($CDCl_3$)

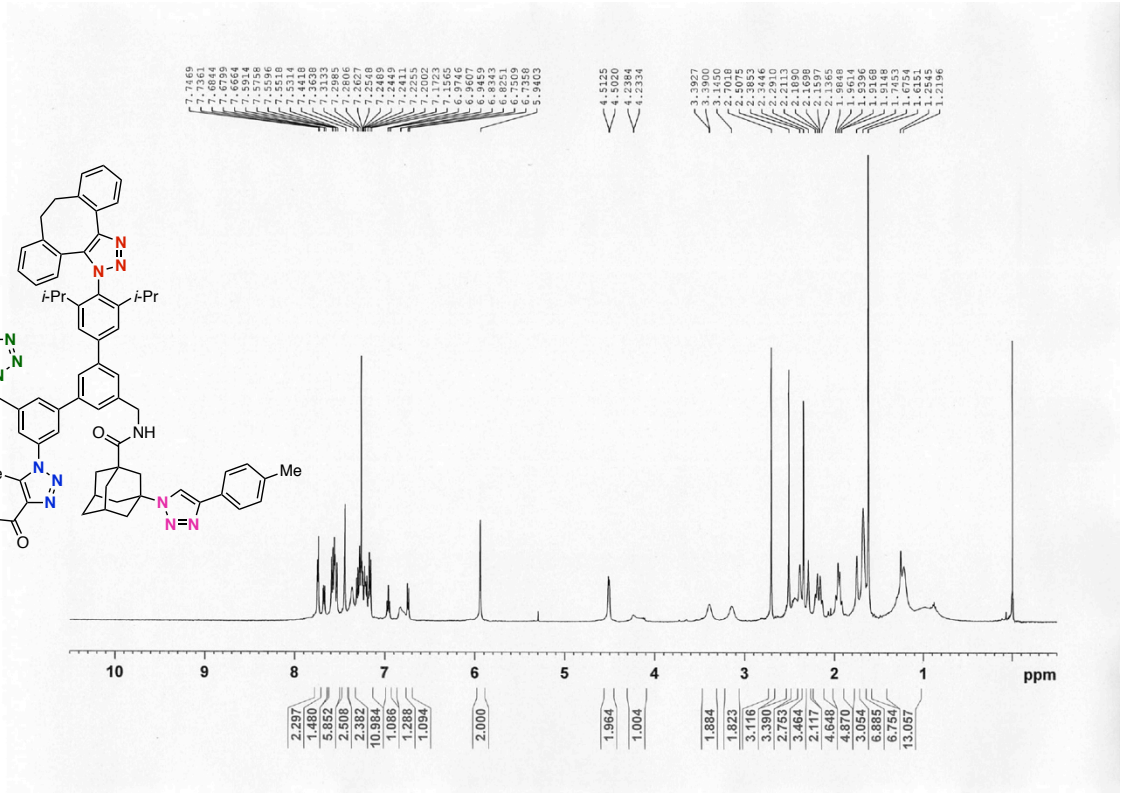


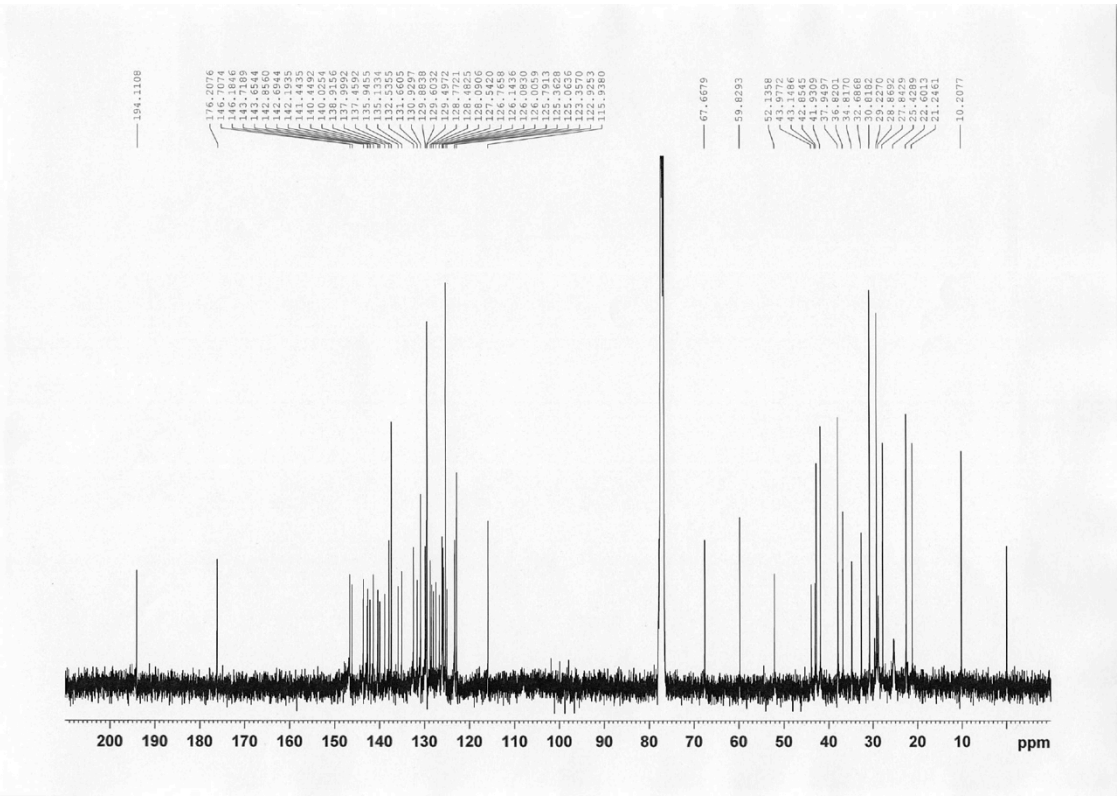


^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-azido-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-(8,9-dihydro-1-*H*-dibenzo[3,4:7,8]cycloocta[1,2-d][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**S22**) ($CDCl_3$)

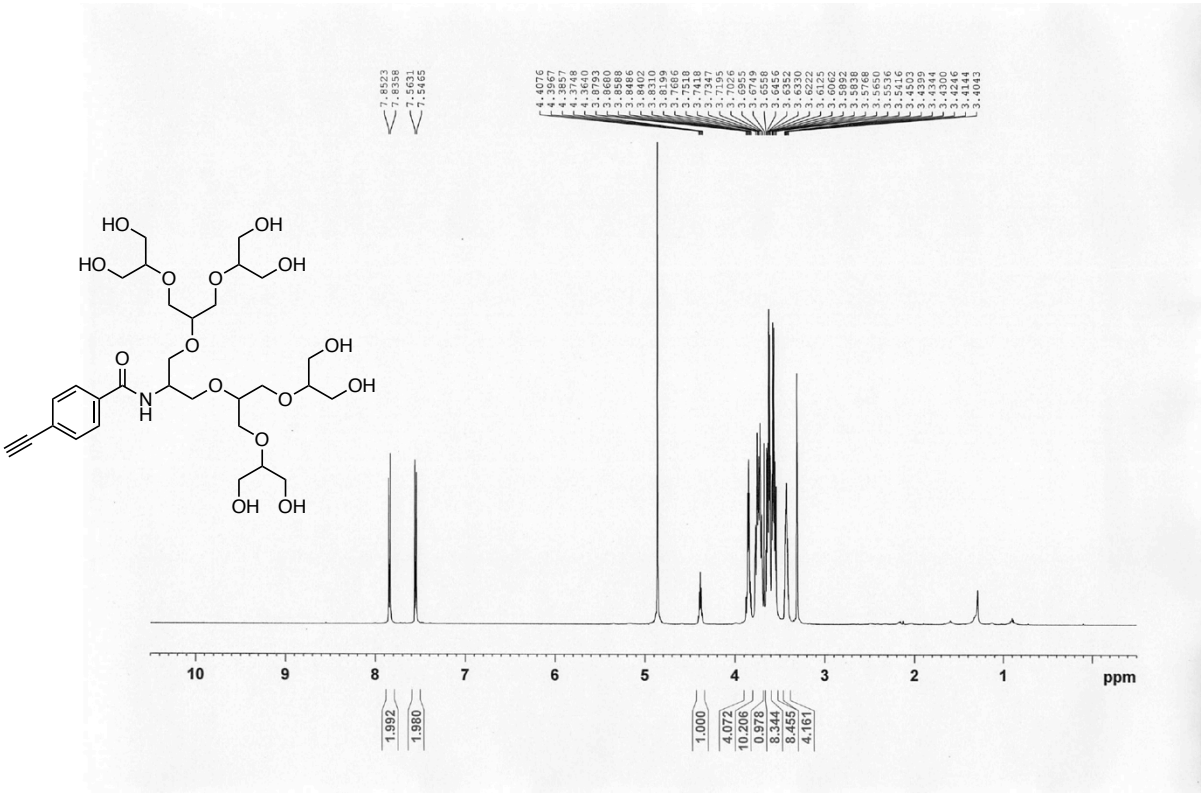


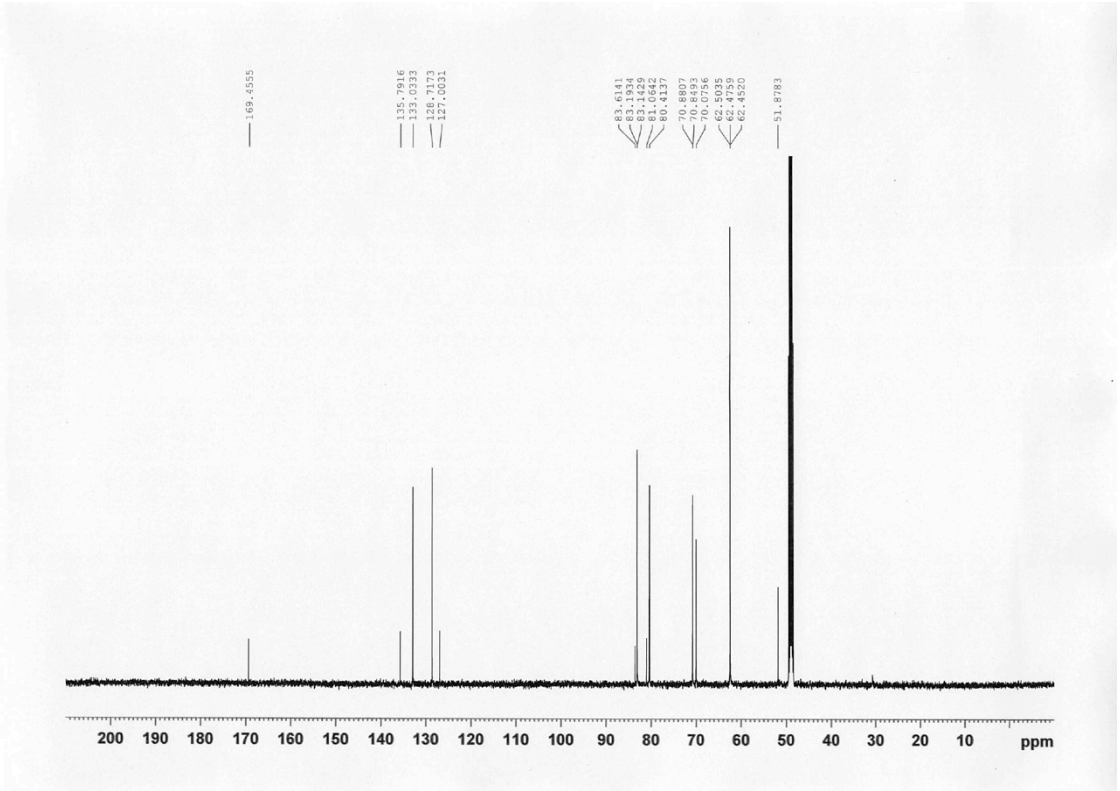
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of 3-(4-(4-metylphenyl)-1*H*-1,2,3-triazol-1-yl)-*N*-(3-(3-(4-acetyl-5-methyl-1*H*-1,2,3-triazol-1-yl)-5-((5-(2-hydroxypropan-2-yl)-1*H*-1,2,3-triazol-1-yl)methyl)phenyl)-5-(4-(8,9-dihydro-1-*H*-dibenzo[3,4:7,8]cycloocta[1,2-*d*][1,2,3]triazol-1-yl)-3,5-diisopropylphenyl)benzyl)adamantane-1-carboxamide (**21**) ($CDCl_3$)



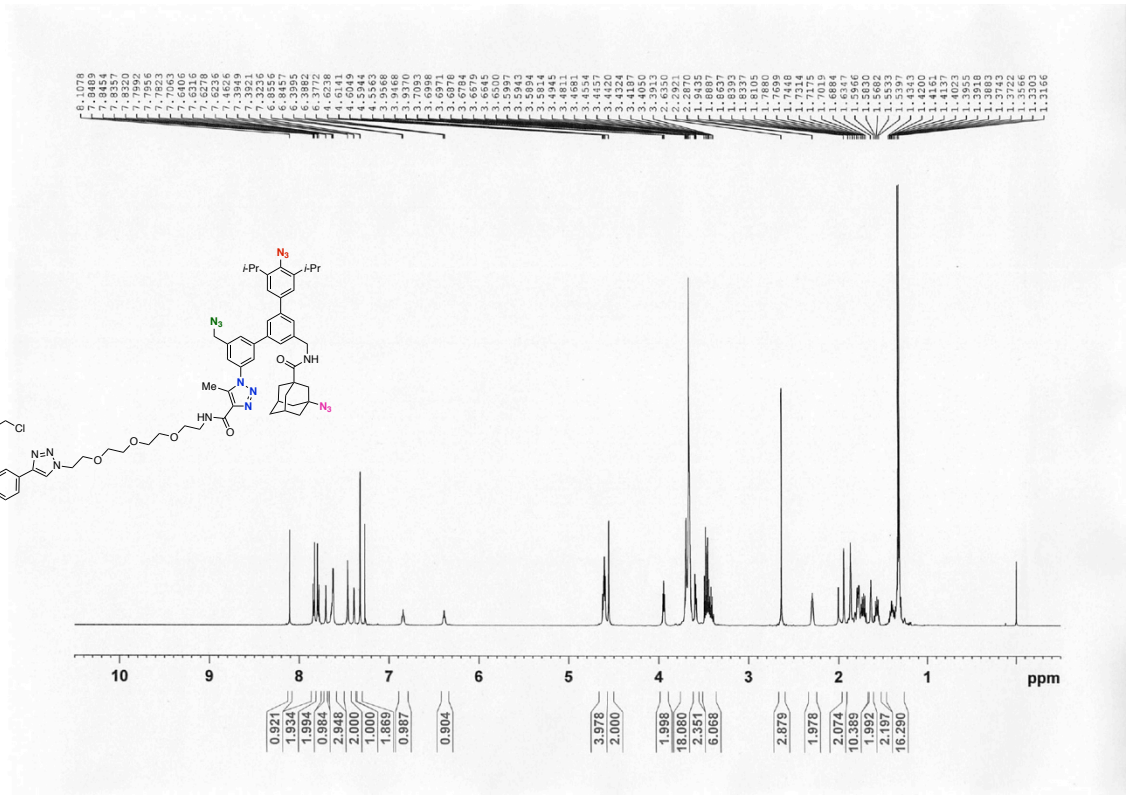


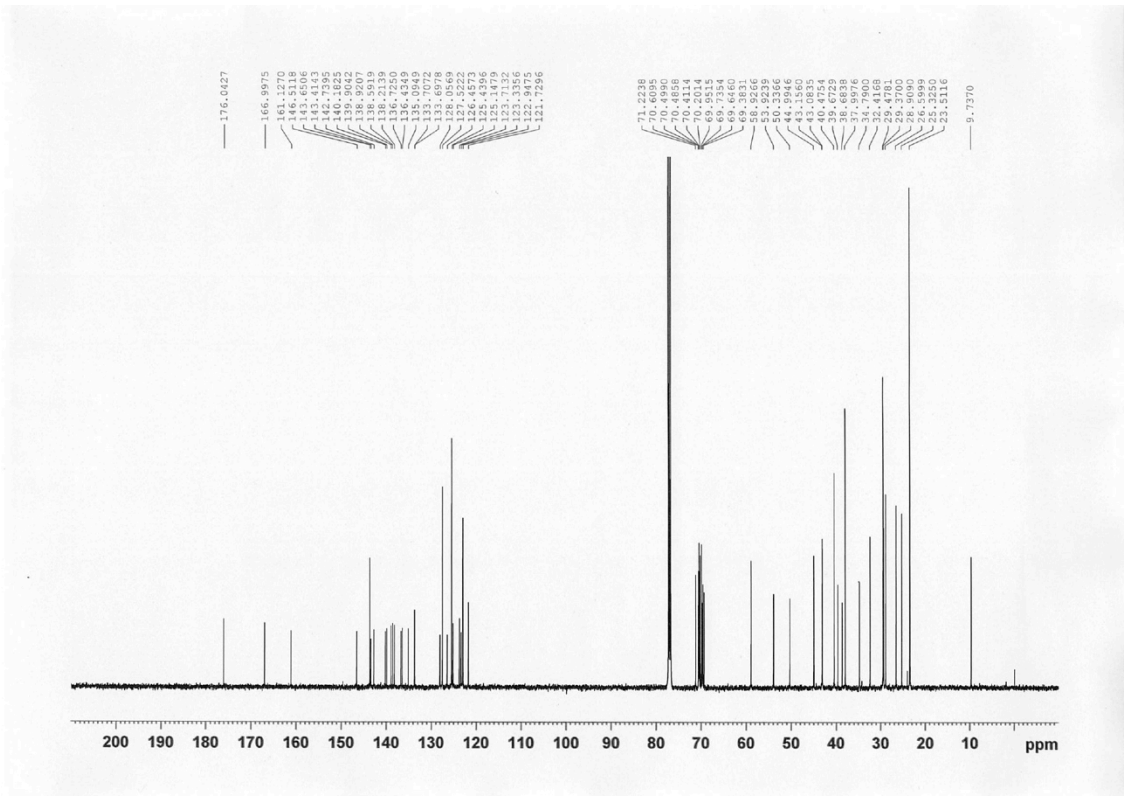
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of *N*-(5,11-bis(((1,3-dihydroxypropan-2-yl)oxy)methyl)-1,15-dihydroxy-2,14-bis(hydroxymethyl)-3,6,10,13-tetraoxapentadecan-8-yl)-4-ethynylbenzamide (**25**) (CD_3OD)



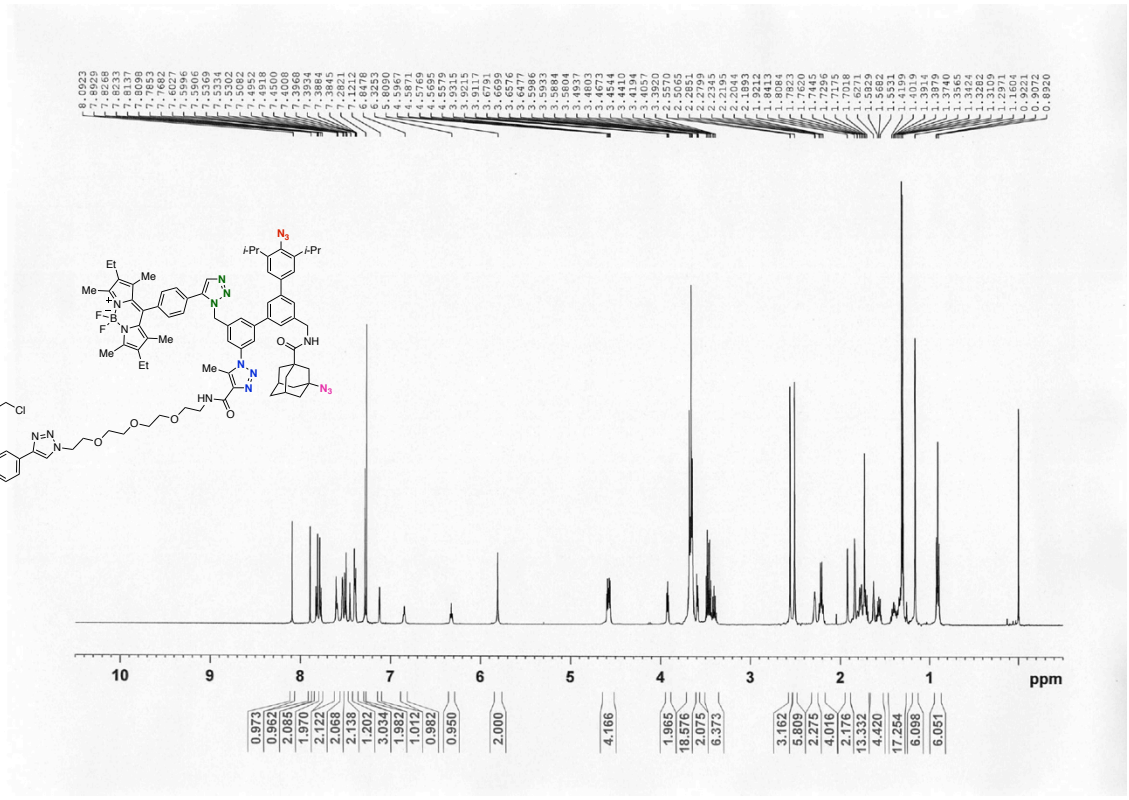


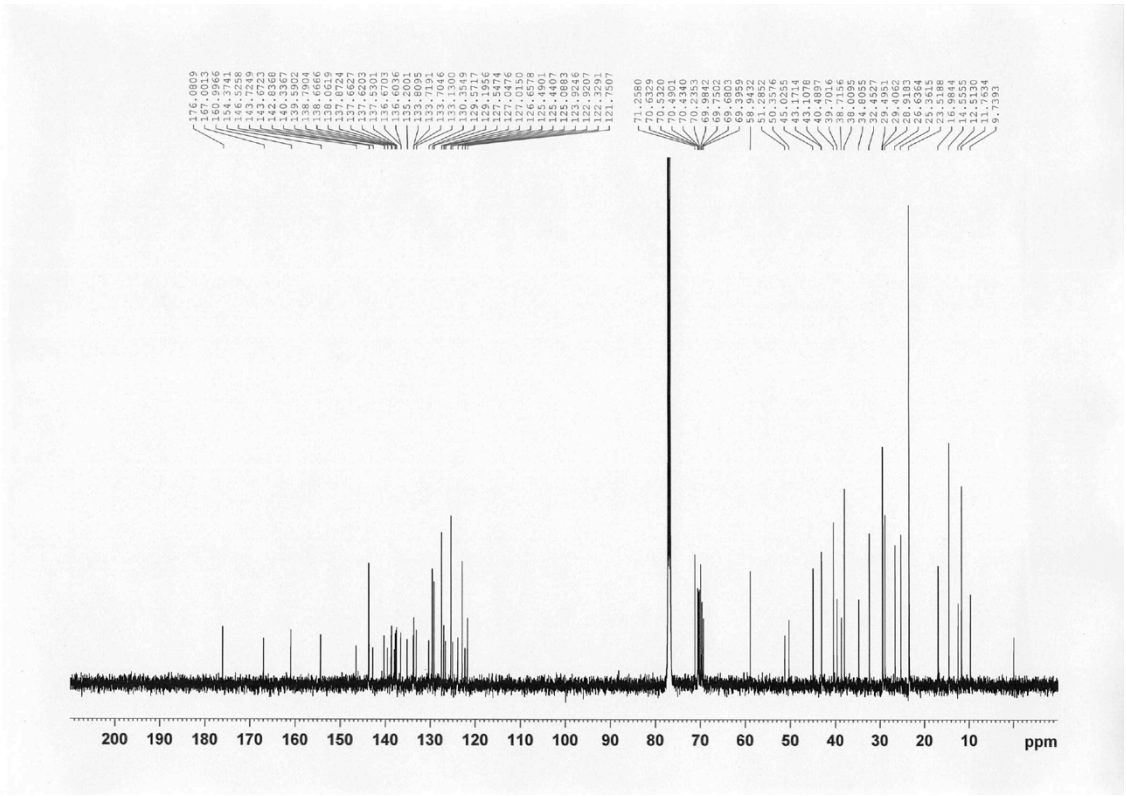
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of platform–HTL conjugate **S25** ($CDCl_3$)



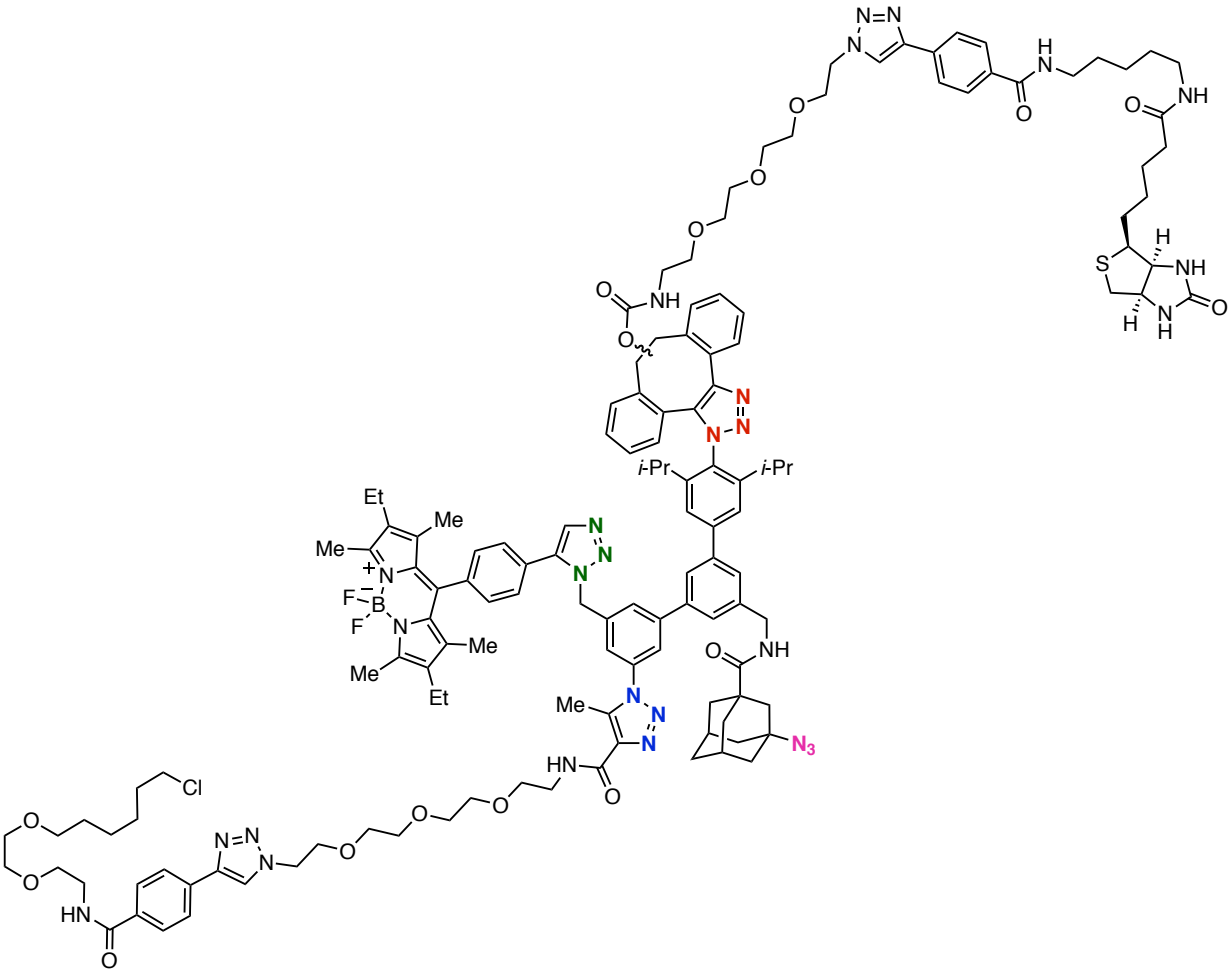


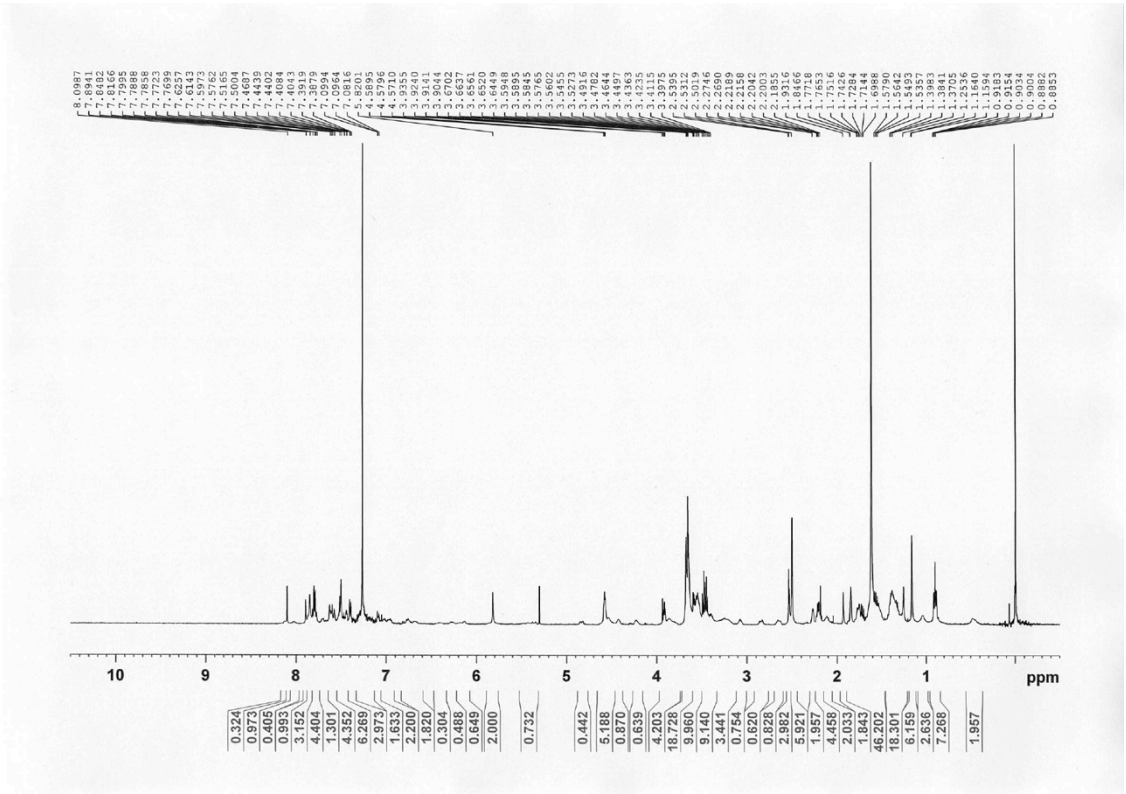
^{1}H NMR (500 MHz) and ^{13}C NMR (126 MHz) spectra of platform–HTL–BODIPY conjugate **S26** ($CDCl_3$)





^{1}H NMR (500 MHz) spectrum of platform–HTL–BODIPY–biotin conjugate **26** ($CDCl_3$)





^{1}H NMR (500 MHz) spectrum of platform–HTL–BODIPY–biotin–BGL conjugate **27** ($CDCl_3$)