Supplementary Material

Novel tetrahydropyrimidinyl-substituted benzimidazoles and benzothiazoles: Synthesis, antibacterial activity, DNA interactions and ADME profiling

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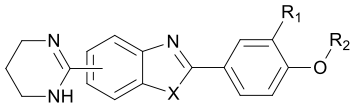
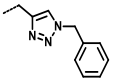
1. Cytotoxic activity

Table S1. Cytotoxic activity of selected compounds against HepG2 cell lines



Compd	X	R_1	R_2	IC_{50} (μM) HepG2
12a	NH	H		>100
12c	NH	OCH_3		>100
15a	NH	H		>100
15b	NH	F		>100
15c	NH	OCH_3		>100
16a	NH	H		>100
16c	NH	OCH_3		>100
17a	NH	H		>100
18a	NH	H		>100
21b	S	F		>100

[a]50% inhibitory concentration or compound concentration required to inhibit tumour cell proliferation by 50%.

2. Spectroscopic characterization of **15a-c**, **16a**, **16c**, **17a**, **21a** and **21b**

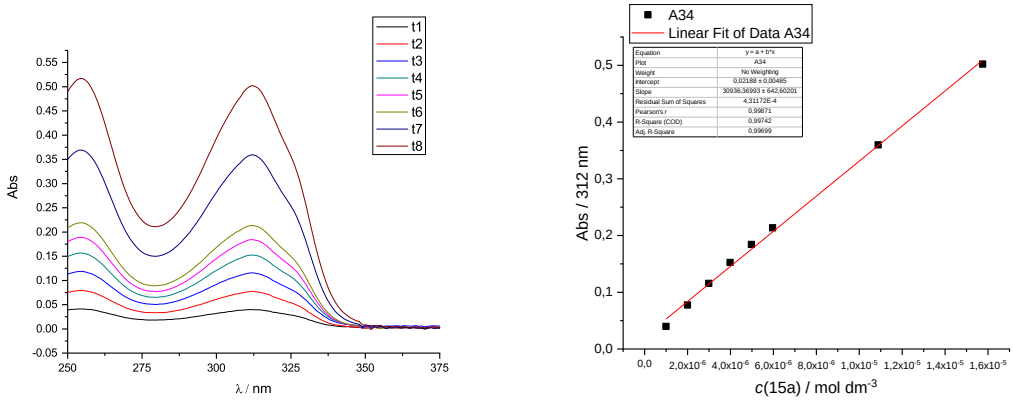


Figure S1. UV/Vis spectra changes of **15a** at different concentrations (concentration range from $1 \times 10^{-6} – 1.6\times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

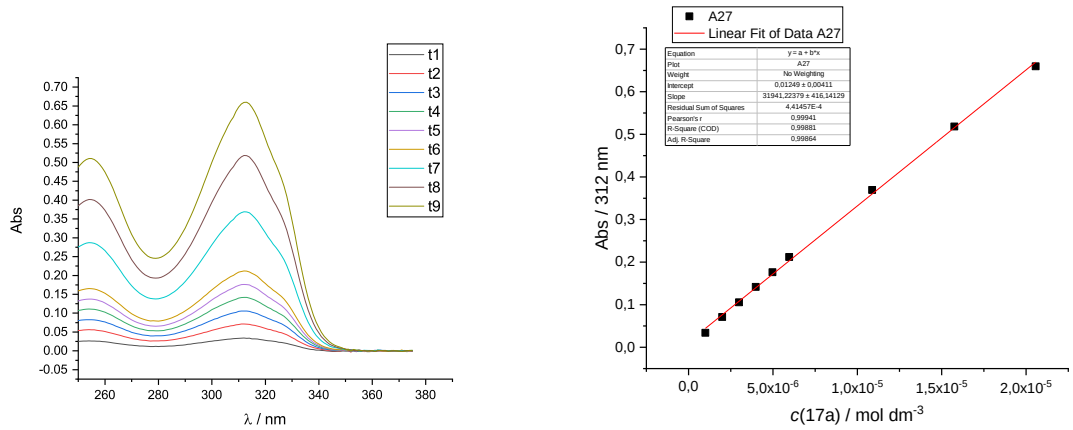


Figure S2. UV/Vis spectra changes of **17a** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

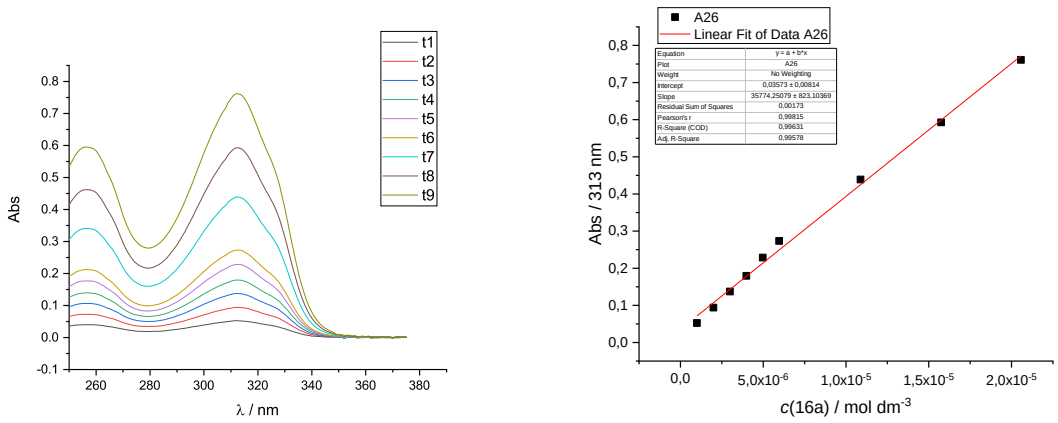


Figure S3. UV/Vis spectra changes of **16a** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

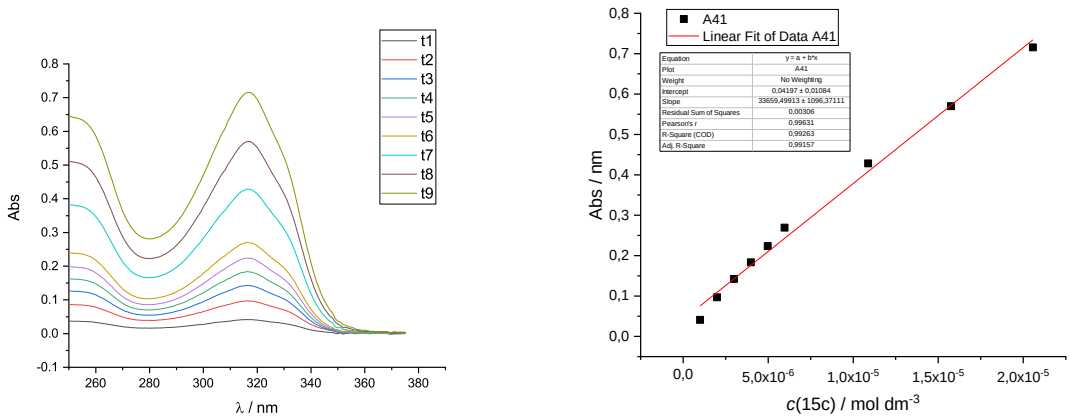


Figure S4. UV/Vis spectra changes of **15c** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

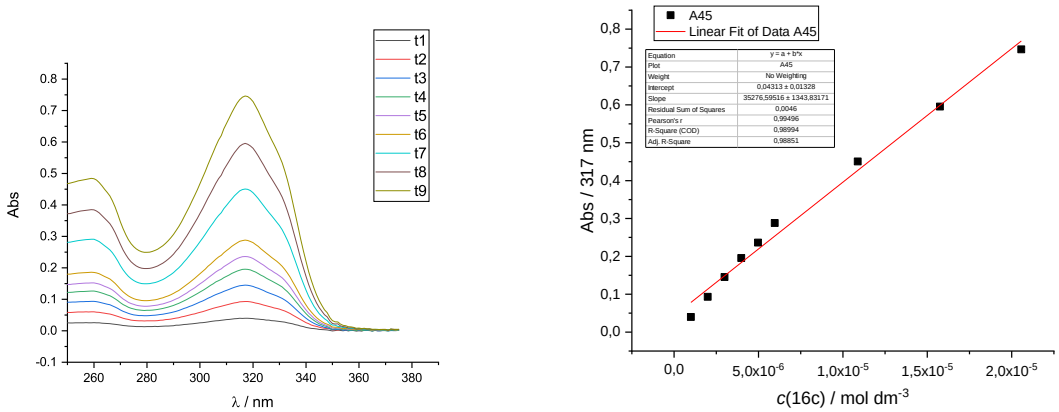


Figure S5. UV/Vis spectra changes of **16c** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

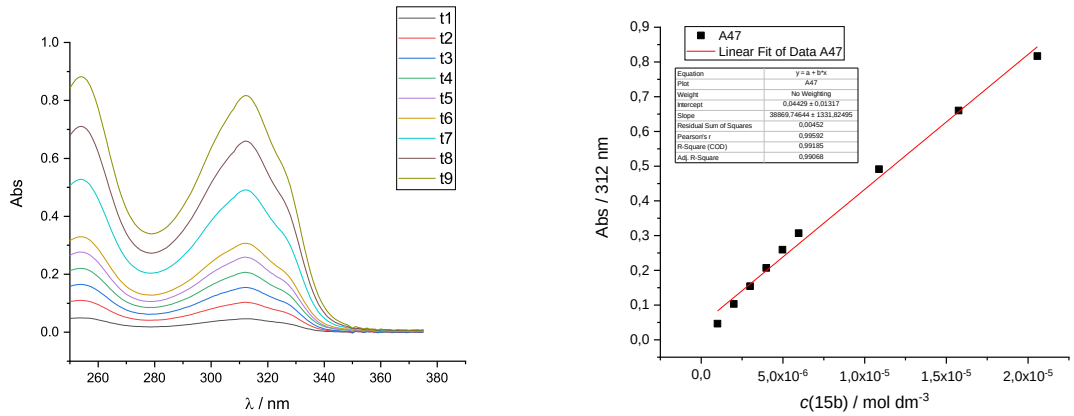


Figure S6. UV/Vis spectra changes of **15b** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

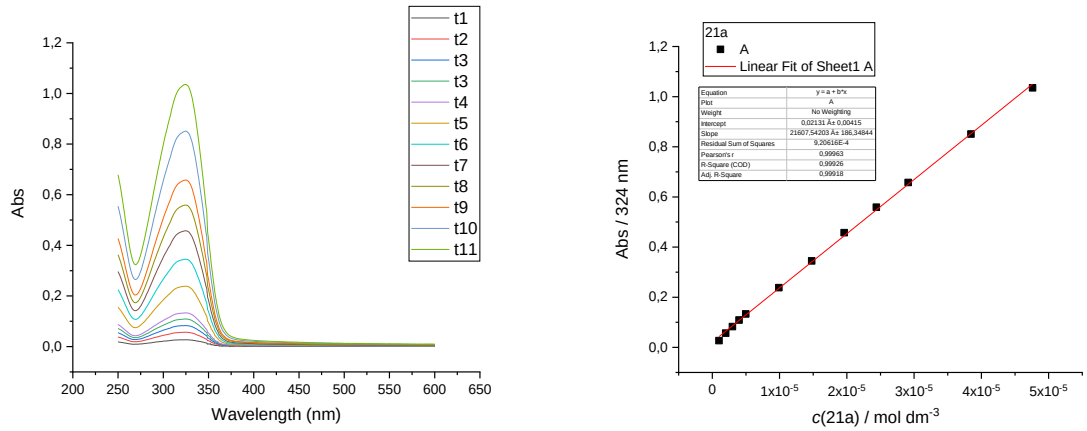


Figure S7. UV/Vis spectra changes of **21a** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

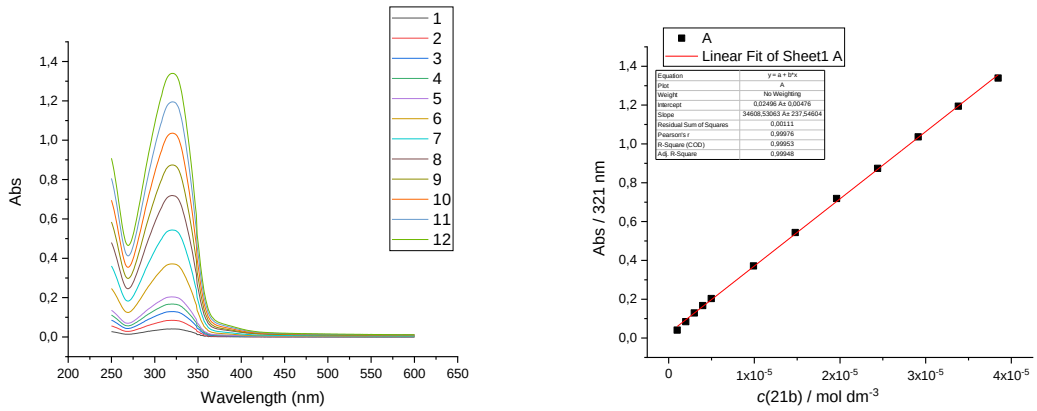


Figure S8. UV/Vis spectra changes of **21b** at different concentrations (concentration range from $1 \times 10^{-6} – 2 \times 10^{-5}$ mol dm^{-3}) at pH=7, sodium cacodylate buffer, *I*=0.05 M.

Table S2. Electronic absorption data **15a-c, 16a, 16c, 17a, 21a** and **21b**

	pH = 7,0[a]	
	λ_{max} / nm	$\varepsilon \times 10^3$ / mmol^{-1} cm^2
15a	312	30.94
15b	312	38.87
15c	317	33.66
16a	313	35.77
16c	317	35.27
17a	312	31.94
21a	324	21.61
21b	321	34.61

[a] Sodium cacodylate buffer, *I* = 0.05 mol dm^{-3}, pH = 7.0.

3. Interactions of 15a-c, 16a, 16c, 17a, 21a and 21b with ds-polynucleotides in neutral medium (pH=7.0)

3.1. Fluorimetric titrations

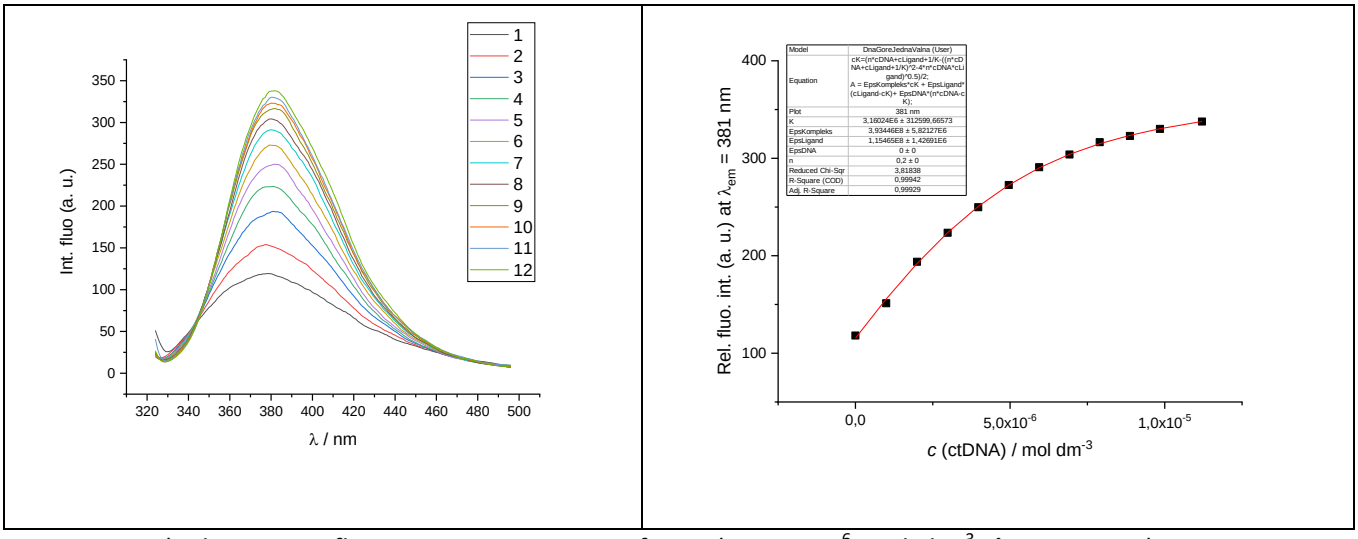


Figure S9. a) Changes in fluorescence spectrum of **15a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.1 × 10^{-5} mol dm^{-3}); b) Dependence of **15a** absorbance at λ = 381 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

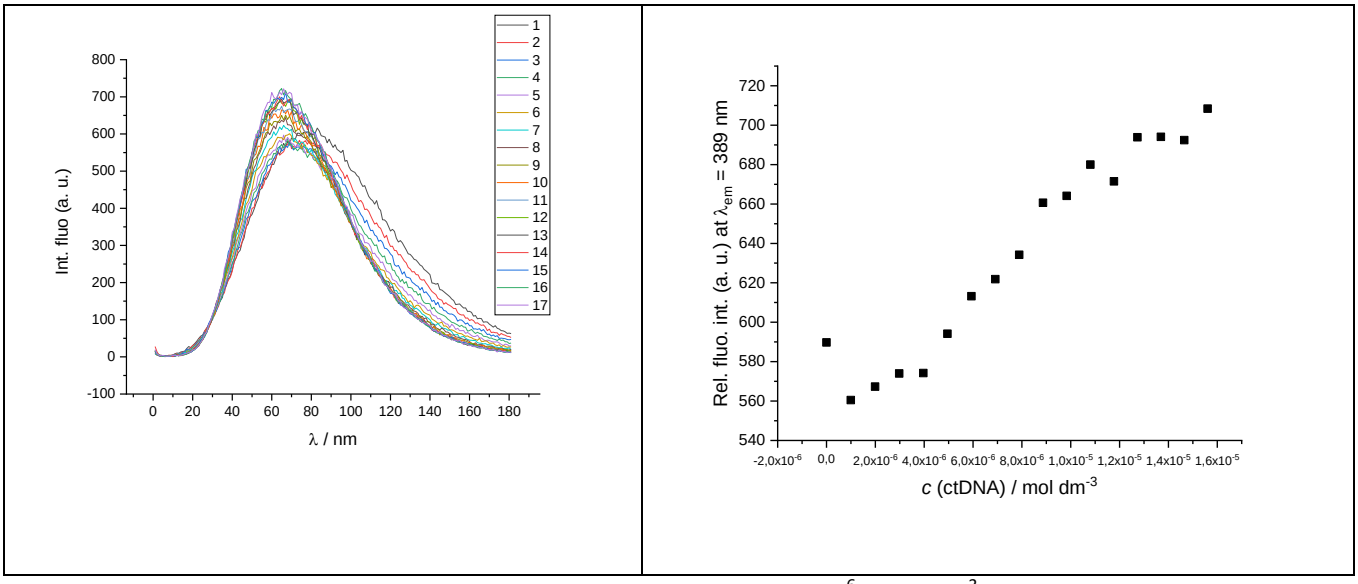


Figure S10. a) Changes in fluorescence spectrum of **17a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.6 × 10^{-5} mol dm^{-3}); b) Dependence of **17a** absorbance at λ = 389 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

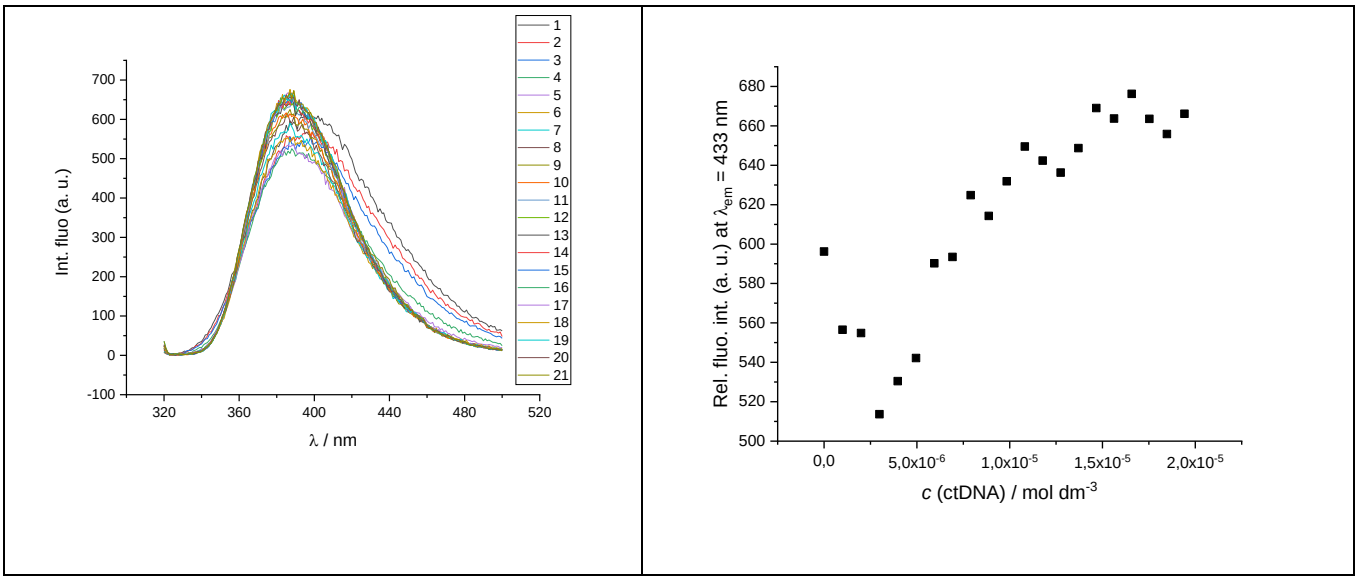


Figure S11. a) Changes in fluorescence spectrum of **16a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=313 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.9 × 10^{-5} mol dm^{-3}); b) Dependence of **16a** absorbance at λ = 433 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

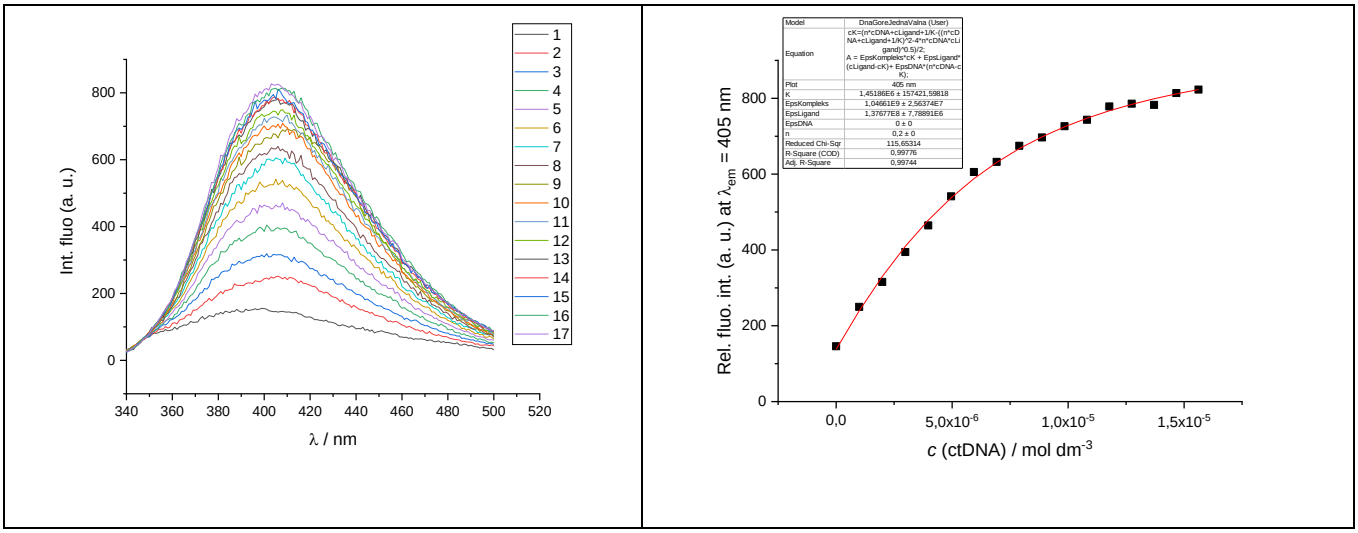


Figure S12. a) Changes in fluorescence spectrum of **15c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.6 × 10^{-5} mol dm^{-3}); b) Dependence of **15c** absorbance at λ = 405 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

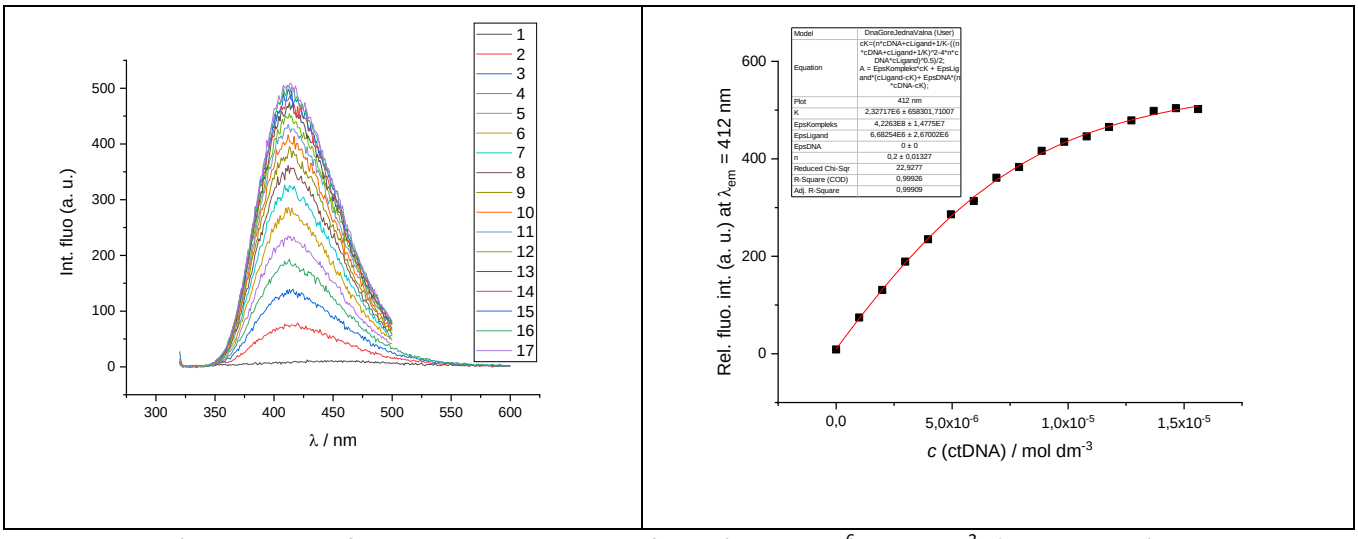


Figure S13. a) Changes in fluorescence spectrum of **16c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.6 × 10^{-5} mol dm^{-3}); b) Dependence of **16c** absorbance at λ = 412 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

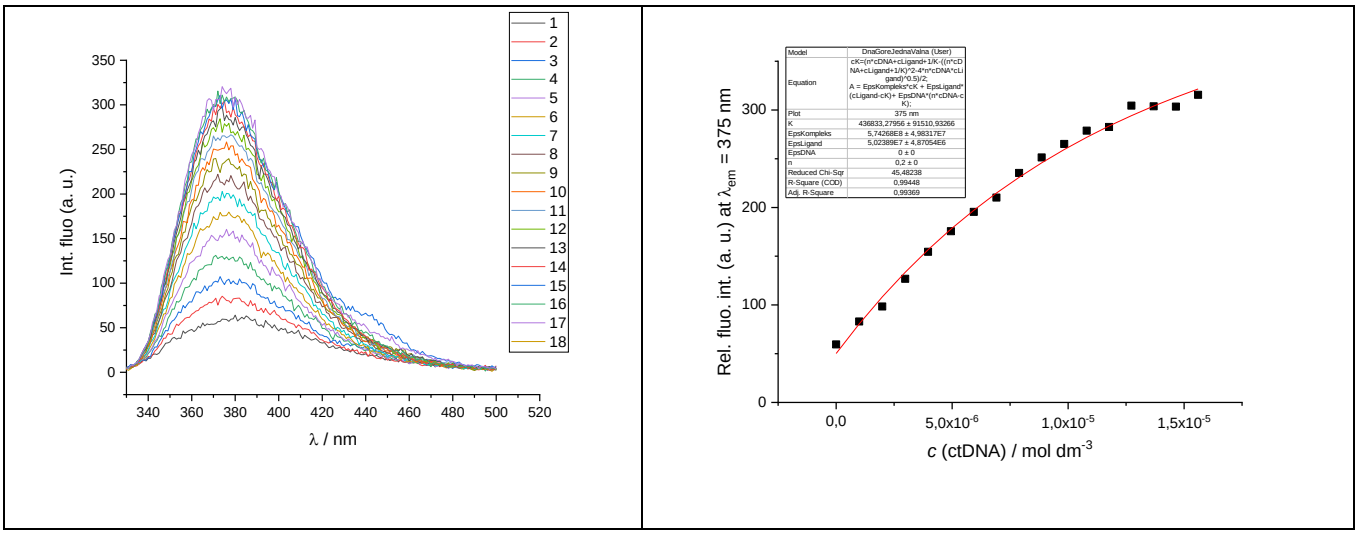


Figure S14. a) Changes in fluorescence spectrum of **15b** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with ctDNA (c= 1.0 × 10^{-6} – 1.6 × 10^{-5} mol dm^{-3}); b) Dependence of **15b** absorbance at λ = 375nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

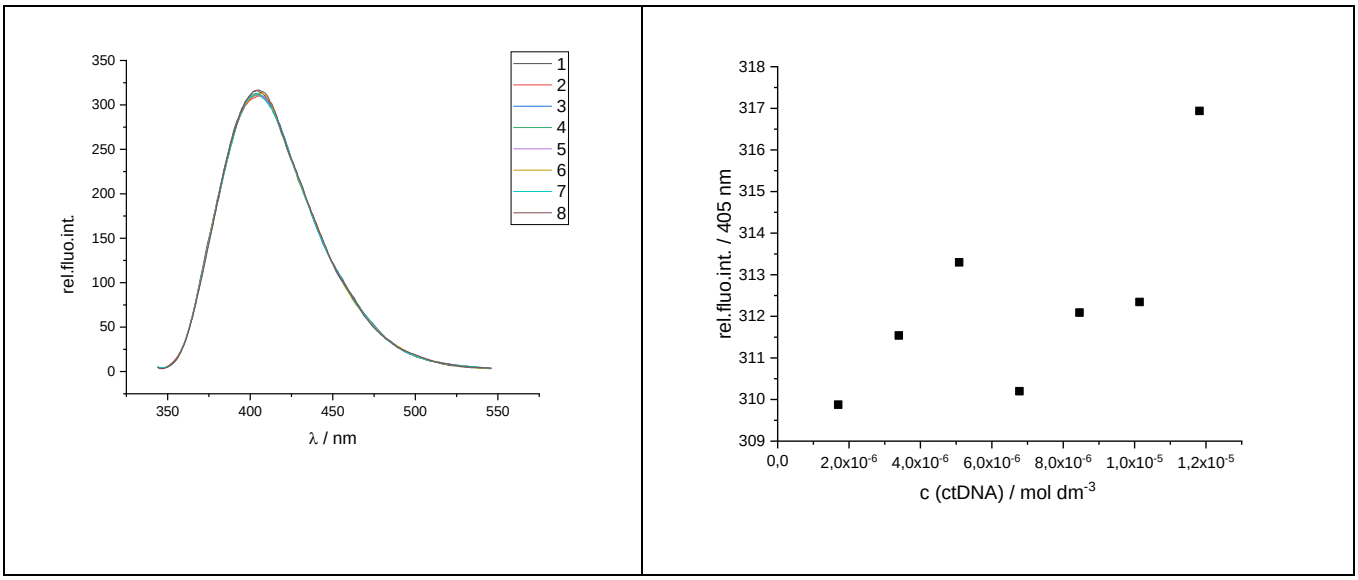


Figure S15. a) Changes in fluorescence spectrum of **21a** (c= 2 × 10^{-6} mol dm^{-3}, λ_{exc}=324 nm) upon titration with ctDNA (c= 1.7 × 10^{-6} – 1.2 × 10^{-5} mol dm^{-3}); b) Dependence of **21a** absorbance at λ = 405 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

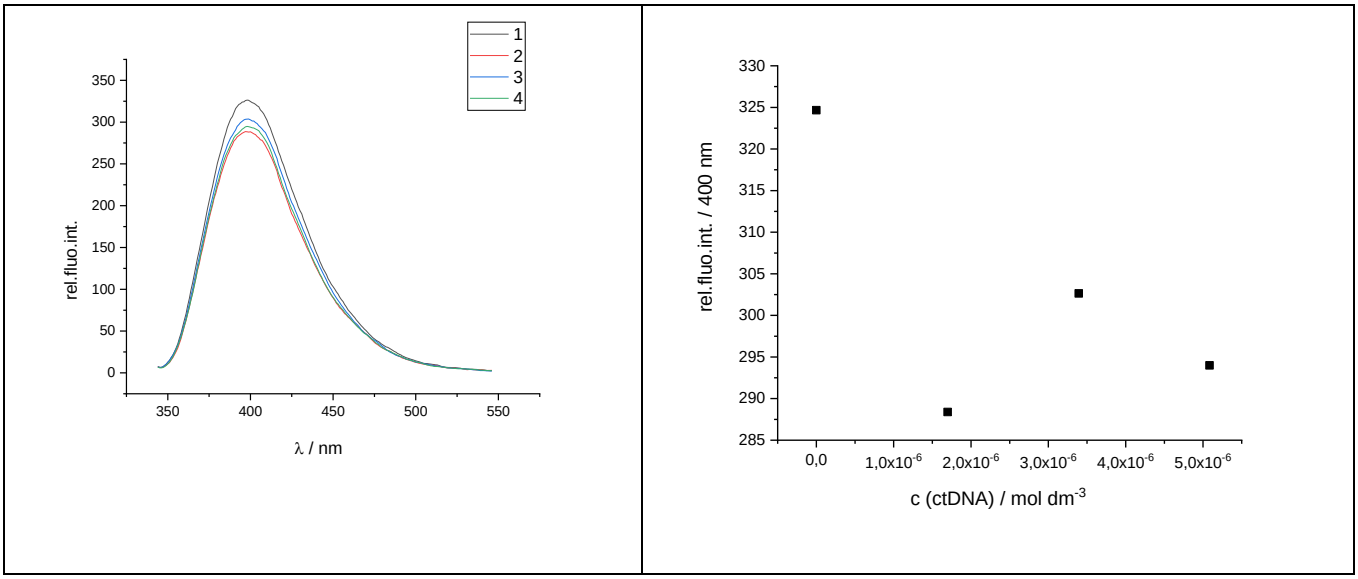


Figure S16. a) Changes in fluorescence spectrum of **21b** (c= 2 × 10^{-6} mol dm^{-3}, λ_{exc}=321 nm) upon titration with ctDNA (c= 1.7 × 10^{-6} – 1.2 × 10^{-5} mol dm^{-3}); b) Dependence of **21b** absorbance at λ = 400 nm on c(ctDNA), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

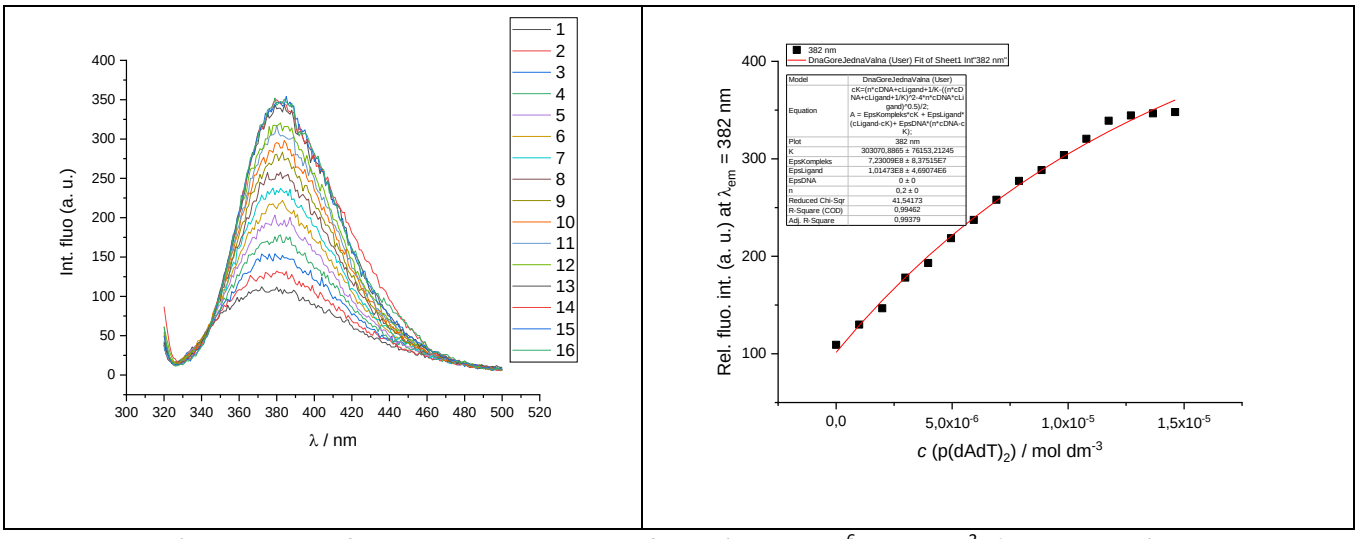


Figure S17. a) Changes in fluorescence spectrum of **15a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 1.5 × 10^{-5} mol dm^{-3}); b) Dependence of **15a** absorbance at λ = 382 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

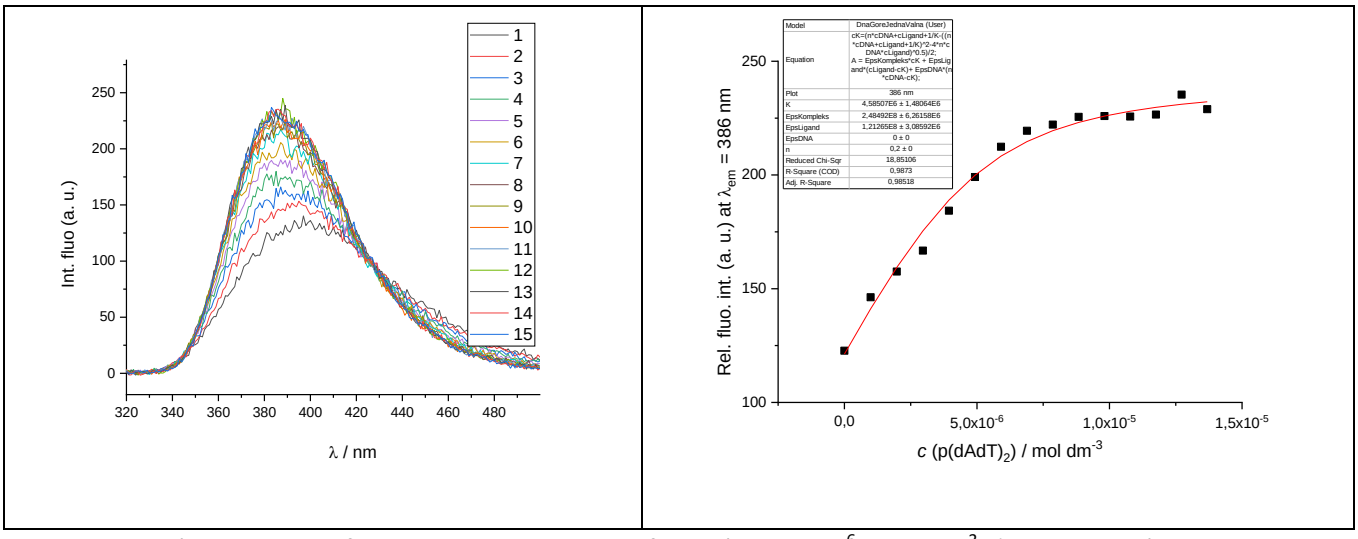


Figure S18. a) Changes in fluorescence spectrum of **17a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 1.4 × 10^{-5} mol dm^{-3}); b) Dependence of **17a** absorbance at λ = 386 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

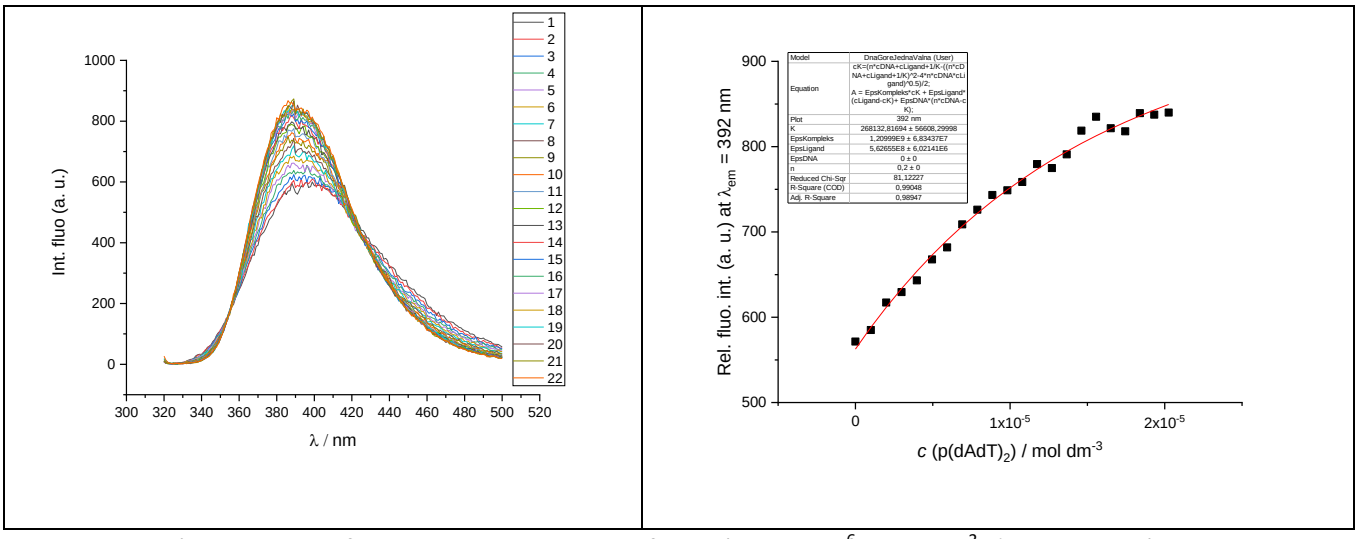


Figure S19. a) Changes in fluorescence spectrum of **16a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=313 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 2.0 × 10^{-5} mol dm^{-3}); b) Dependence of **16a** absorbance at λ = 392 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

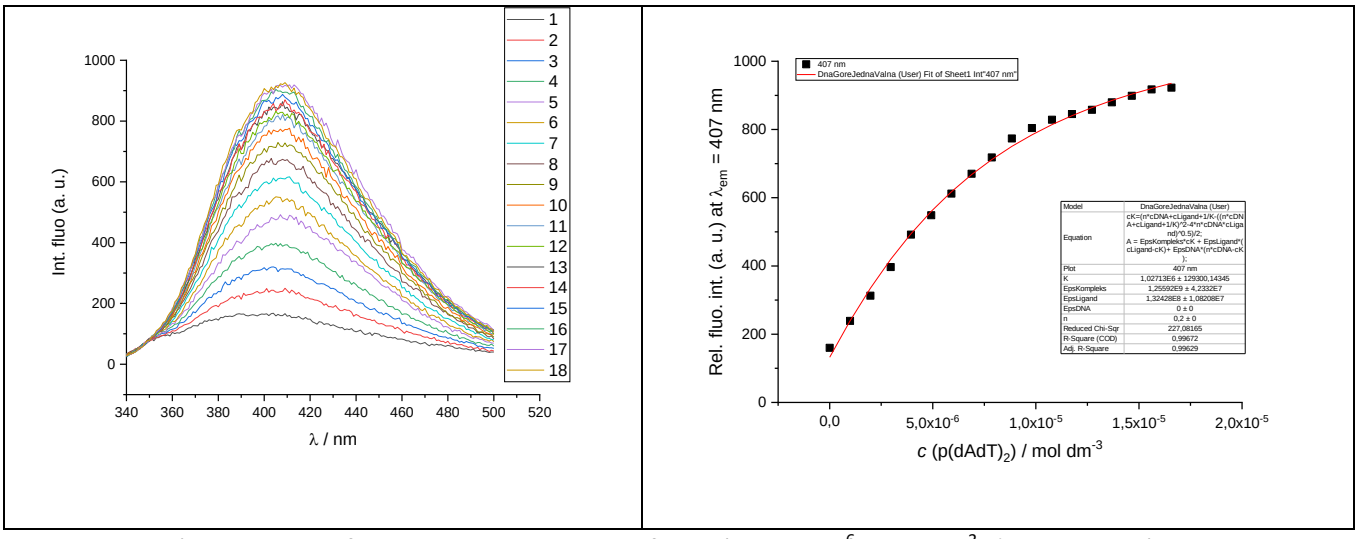


Figure S20. a) Changes in fluorescence spectrum of **15c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **15c** absorbance at λ = 407 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

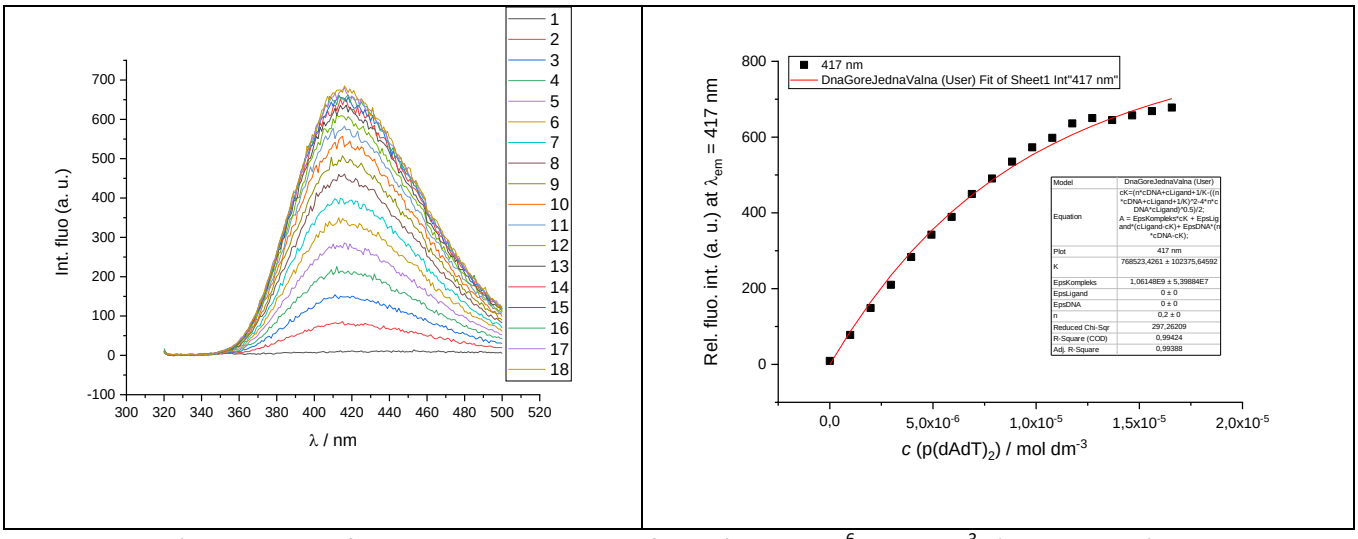


Figure S21. a) Changes in fluorescence spectrum of **16c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **16c** absorbance at λ = 417 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

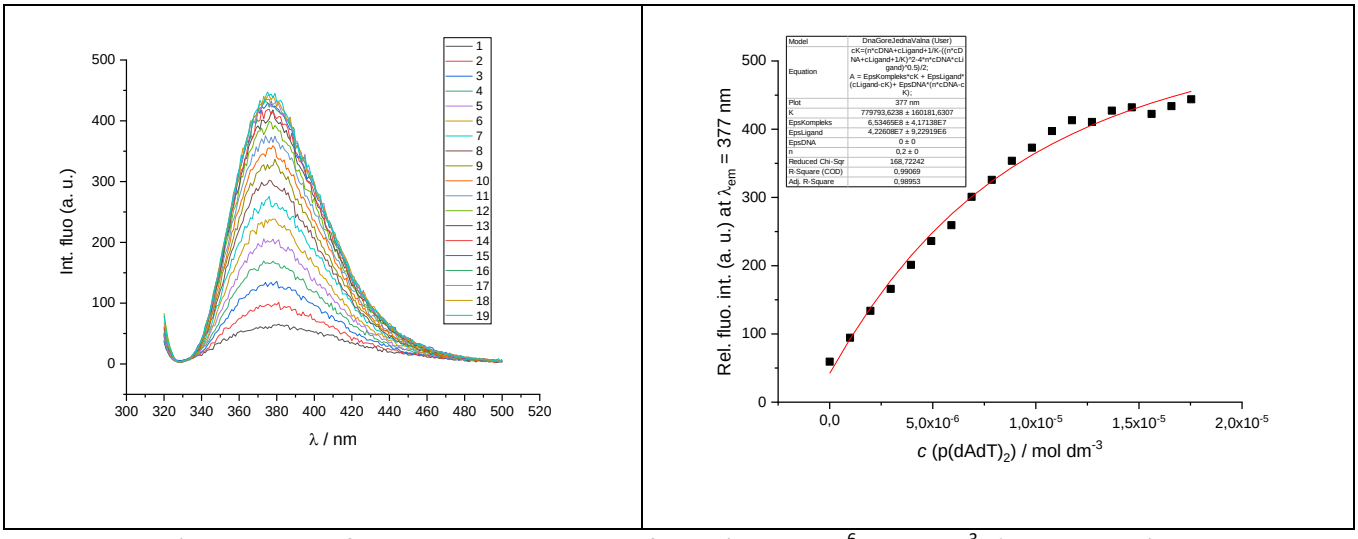


Figure S22. a) Changes in fluorescence spectrum of **15b** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with $p(dAdT)_2$ (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **15b** absorbance at λ = 377 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

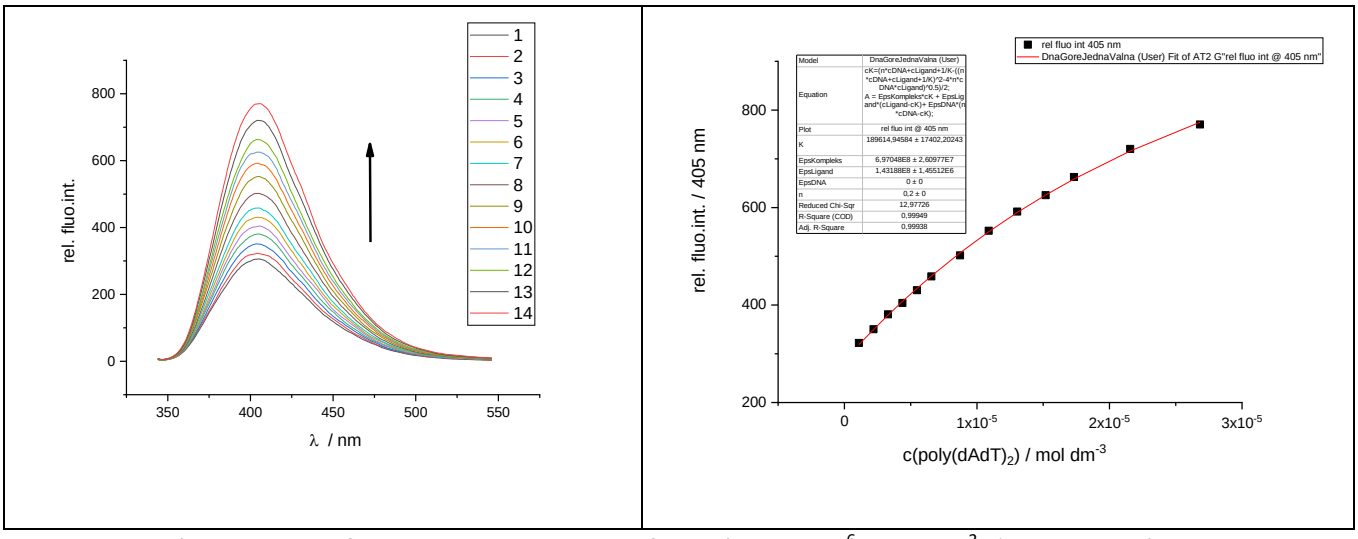


Figure S23. a) Changes in fluorescence spectrum of **21a** (c= 2× 10^{-6} mol dm^{-3}, λ_{exc}=324 nm) upon titration with $p(dAdT)_2$ (c= 2.5 × 10^{-6} – 8.5 × 10^{-5} mol dm^{-3}); b) Dependence of **21a** absorbance at λ = 405nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

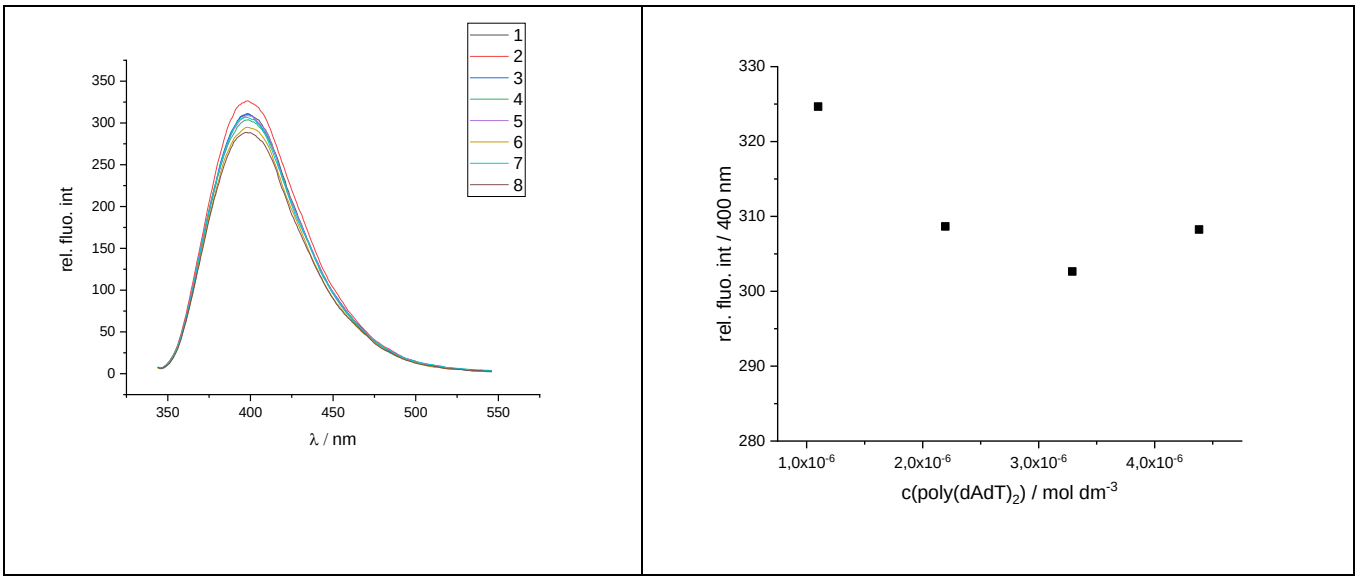


Figure S24. a) Changes in fluorescence spectrum of **21b** (c= 2 × 10^{-6} mol dm^{-3}, λ_{exc}=321 nm) upon titration with $p(dAdT)_2$ (c= 2.1 × 10^{-6} – 4.4 × 10^{-6} mol dm^{-3}); b) Dependence of **21b** absorbance at λ = 400 nm on $c(p(dAdT)_2)$, at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

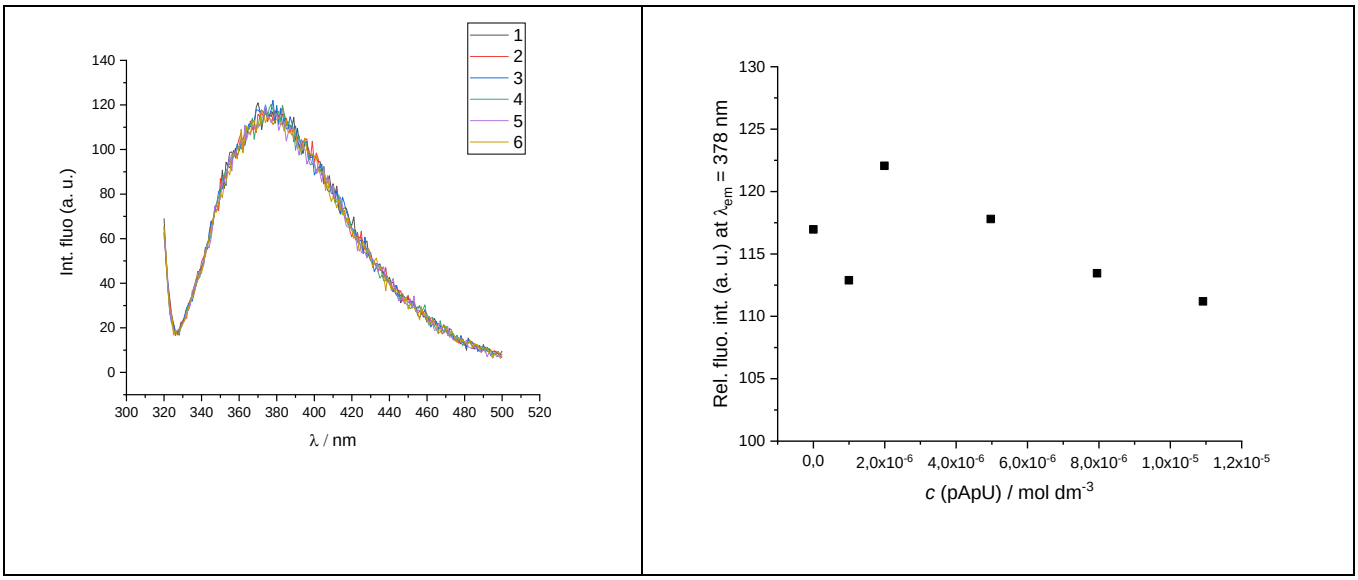


Figure S25. a) Changes in fluorescence spectrum of **15a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.0 × 10^{-5} mol dm^{-3}); b) Dependence of **15a** absorbance at λ = 378 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

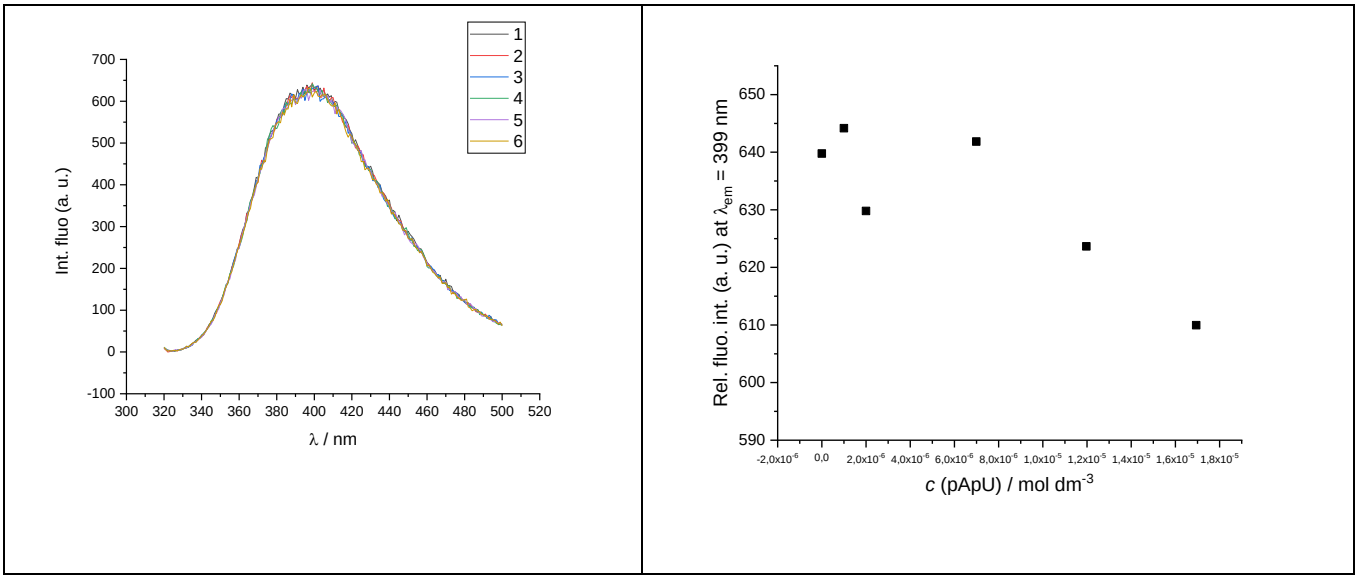


Figure S26. a) Changes in fluorescence spectrum of **17a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **17a** absorbance at λ = 399 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

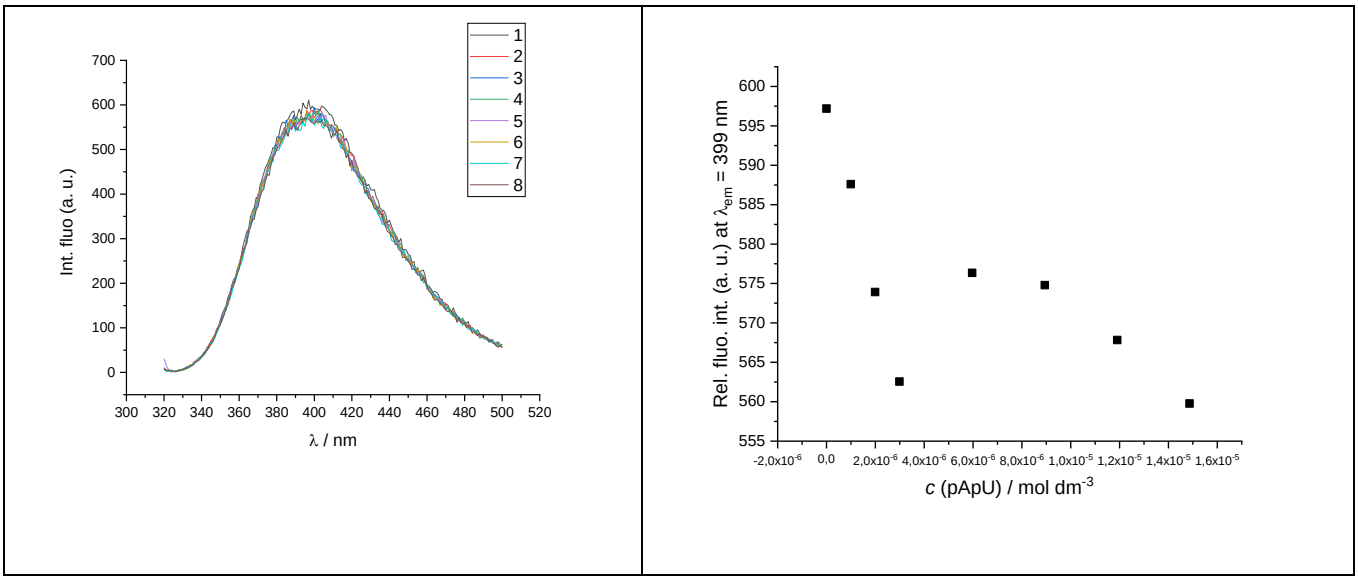


Figure S27. a) Changes in fluorescence spectrum of **16a** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=313 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.5 × 10^{-5} mol dm^{-3}); b) Dependence of **16a** absorbance at λ = 399 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

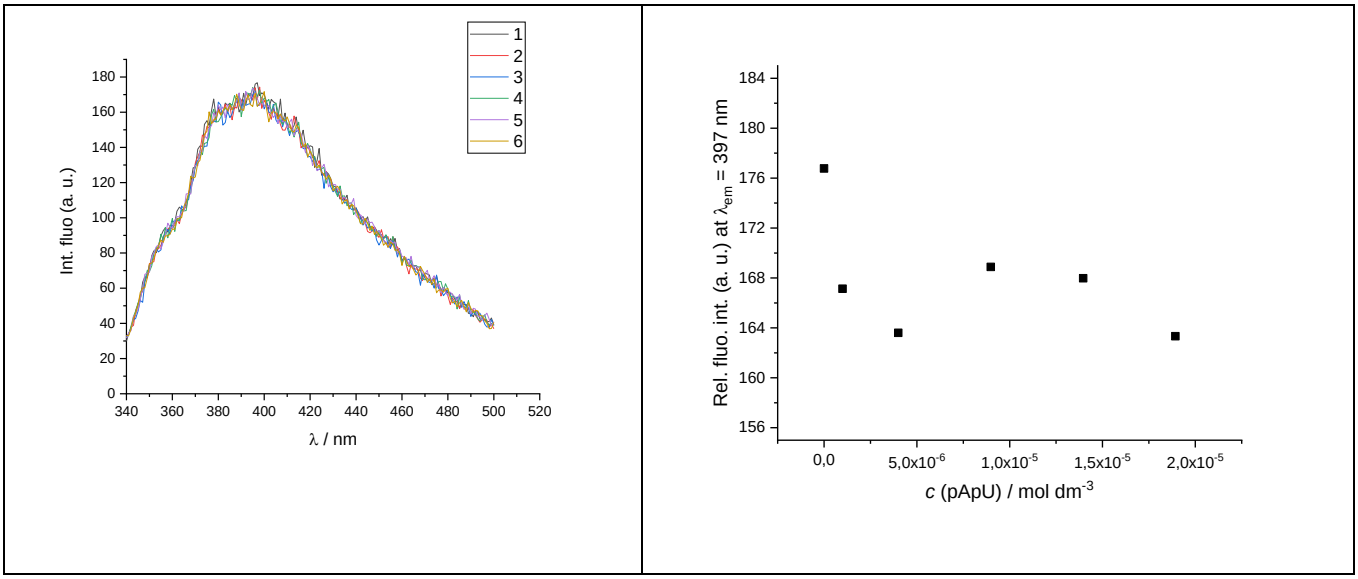


Figure S28. a) Changes in fluorescence spectrum of **15c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.9 × 10^{-5} mol dm^{-3}); b) Dependence of **15c** absorbance at λ = 397 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

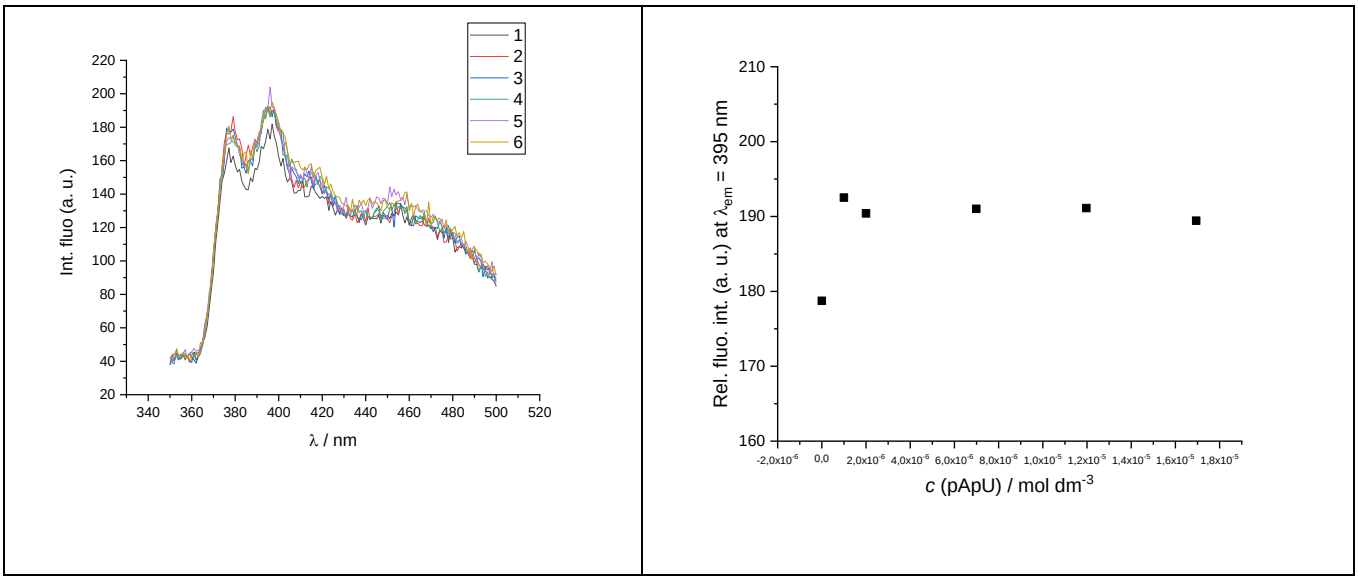


Figure S29. a) Changes in fluorescence spectrum of **16c** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=317 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **16c** absorbance at λ = 395 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

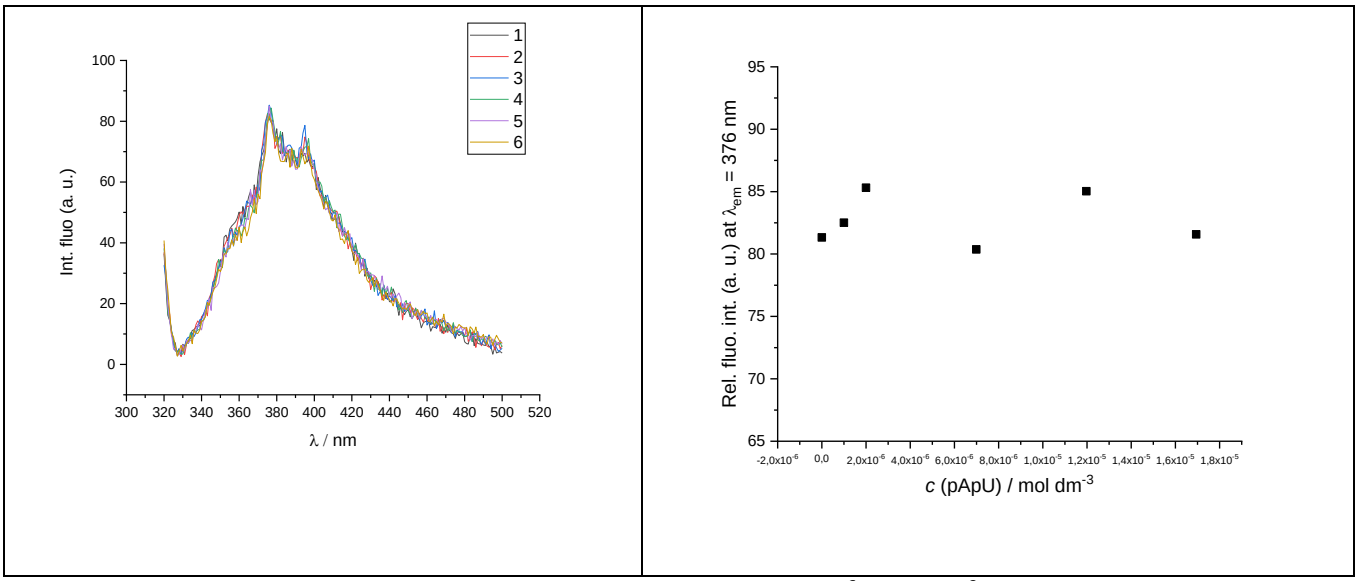


Figure S30. a) Changes in fluorescence spectrum of **15b** (c= 1× 10^{-6} mol dm^{-3}, λ_{exc}=312 nm) upon titration with poly A-poly U (c= 1.0 × 10^{-6} – 1.7 × 10^{-5} mol dm^{-3}); b) Dependence of **15b** absorbance at λ = 376 nm on c(poly A-poly U), at pH=7, sodium cacodylate buffer, I = 0.05 mol dm^{-3}.

3.2. Thermal melting experiments

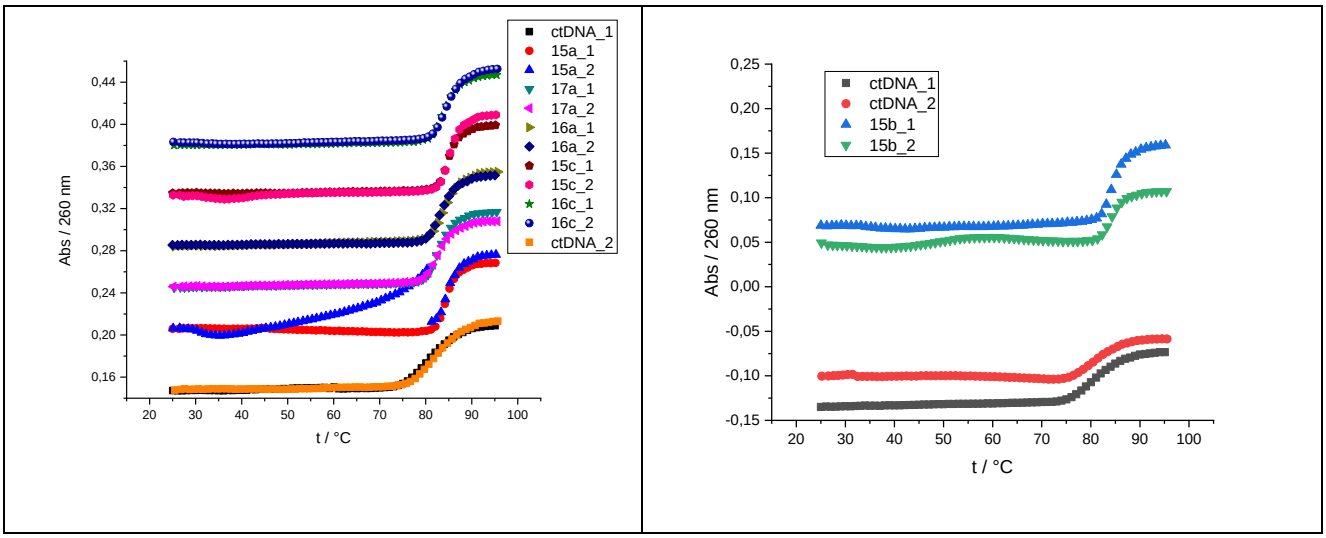


Figure S31. Melting curve of ctDNA upon addition of ratio, ***r*** ([compound/ [polynucleotide])=0.3 of **15a-c, 16a, 16c, 17a, 21a** and **21b** at pH = 7.0 (buffer sodium cacodylate, *I* = 0.05 mol dm^{-3}).

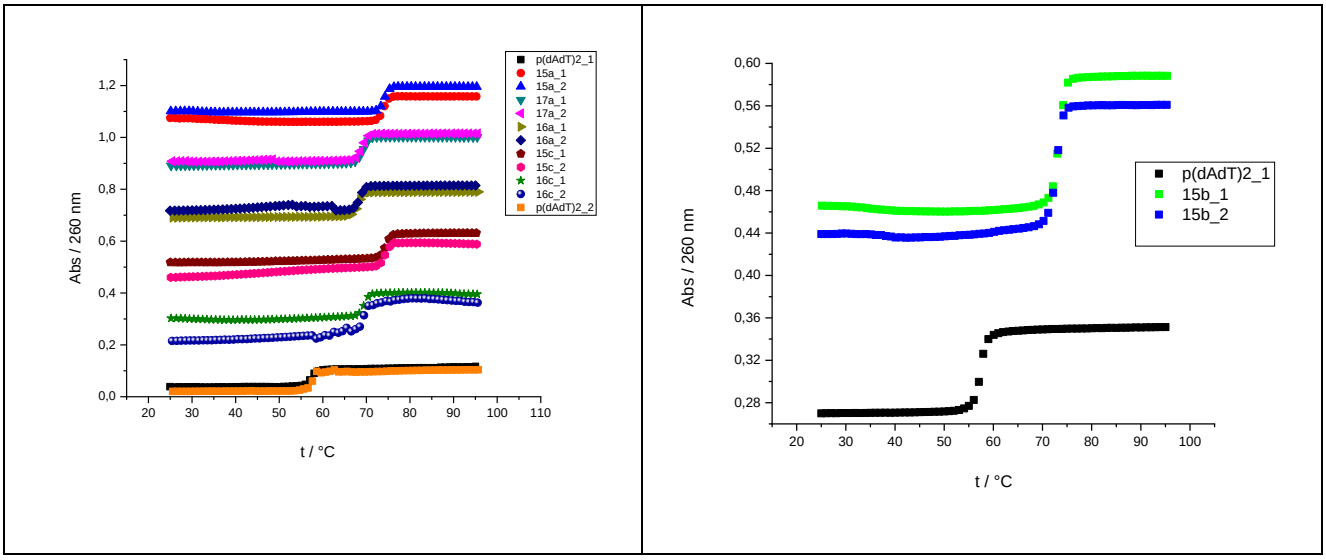


Figure S32. Melting curve of p(dAdT)$_2$ upon addition of ratio, ***r*** ([compound/ [polynucleotide])=0.3 of **15a-c, 16a, 16c** and **17a** at pH = 7.0 (buffer sodium cacodylate, *I* = 0.05 mol dm^{-3}).

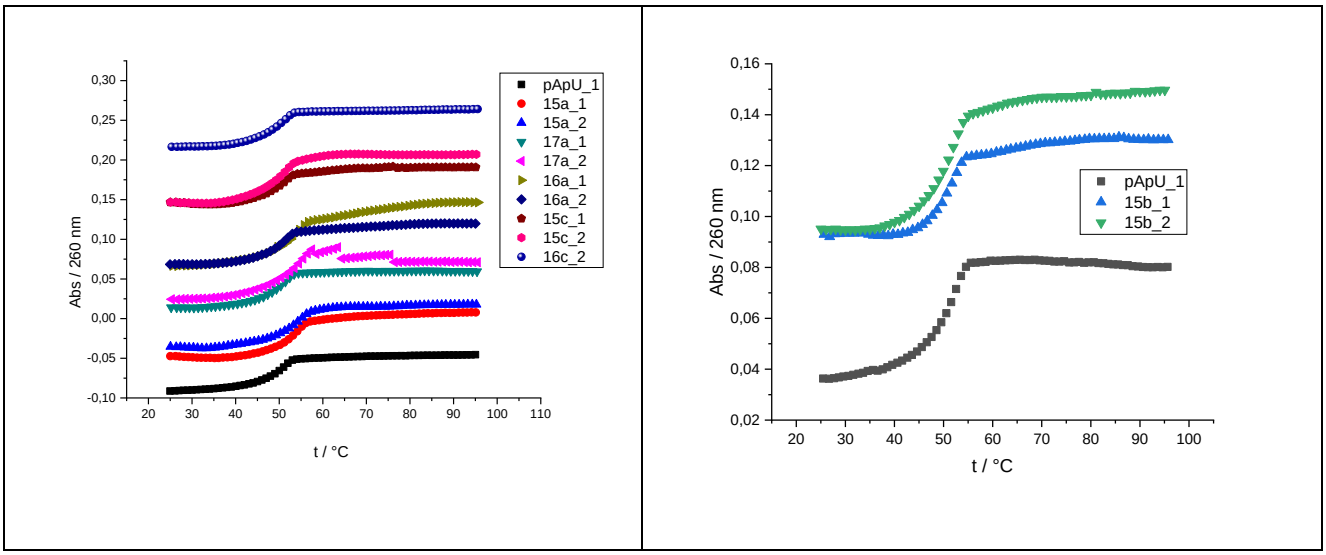


Figure S33. Melting curve of poly A – poly U upon addition of ratio, ***r*** ([compound/ [polynucleotide])=0.3 of **15a-c, 16a, 16c** and **17a** at pH = 7.0 (buffer sodium cacodylate, *I* = 0.05 mol dm^{-3}).

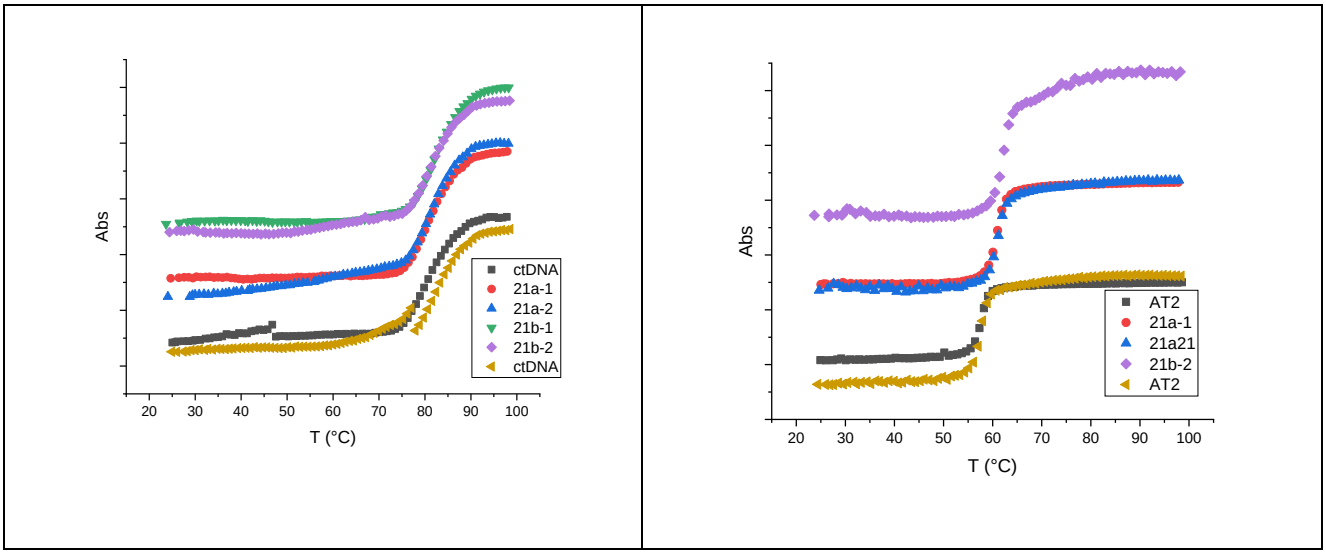
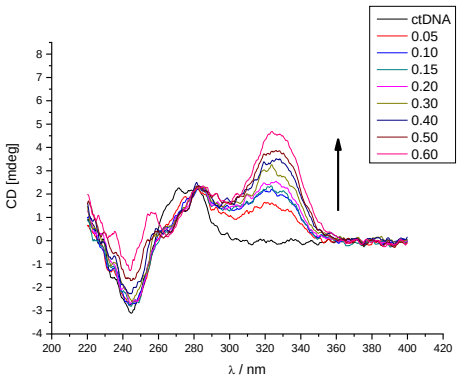
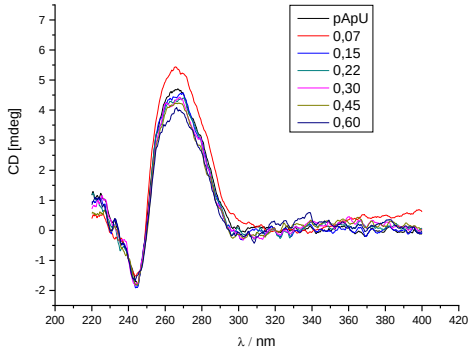
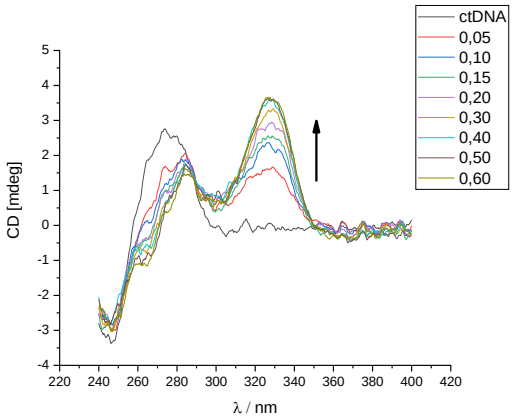
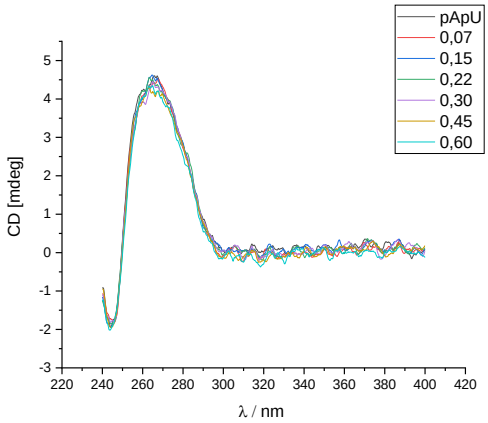
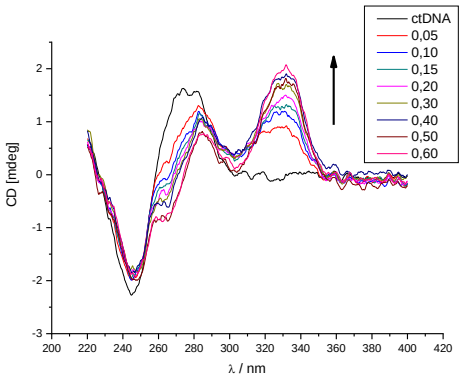
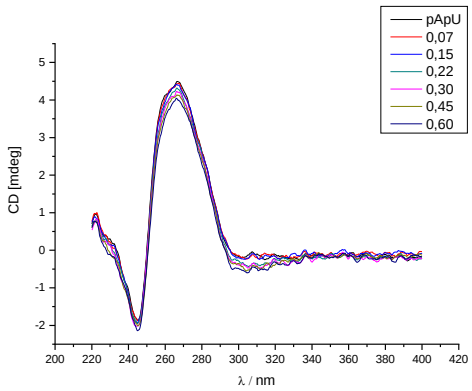
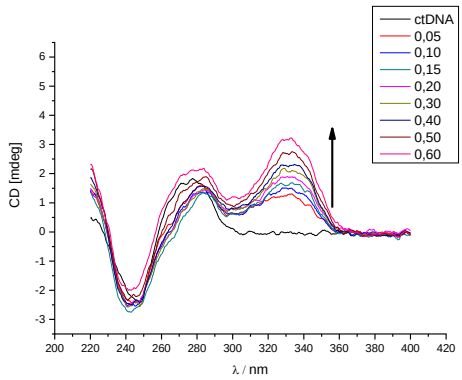
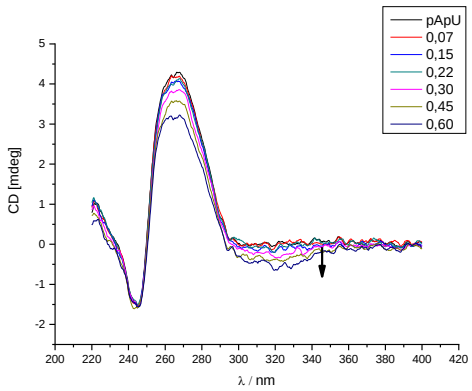
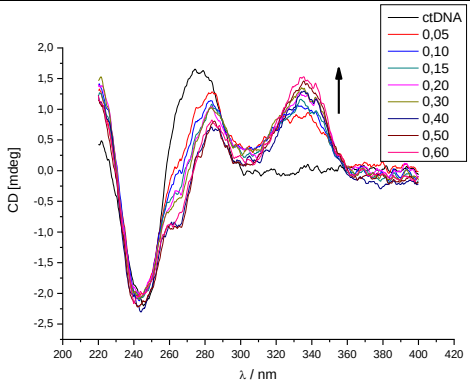
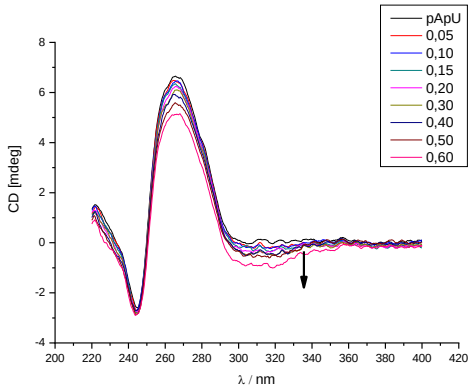
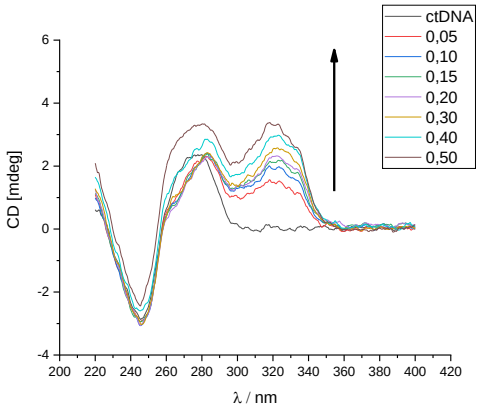
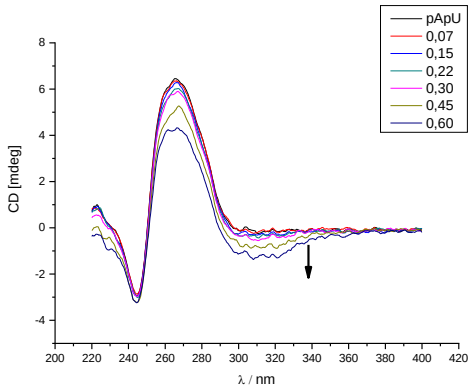


Figure S34. Melting curve of ctDNA and poly(dAdT)$_2$ upon addition of ratio, ***r*** ([compound/ [polynucleotide])=0.3 of **21a** and **21b** at pH = 7.0 (buffer sodium cacodylate, *I* = 0.05 mol dm^{-3}).

3.3. Circular dichroism (CD) titrations

	ctDNA	Poly A – poly U
15a		
17a		
16a		

15c	 ctDNA 0,05 0,10 0,15 0,20 0,30 0,40 0,50 0,60 CD [mdeg] λ / nm	 pApU 0,07 0,15 0,22 0,30 0,45 0,60 CD [mdeg] λ / nm
16c	 ctDNA 0,05 0,10 0,15 0,20 0,30 0,40 0,50 0,60 CD [mdeg] λ / nm	 pApU 0,05 0,10 0,15 0,20 0,30 0,40 0,50 0,60 CD [mdeg] λ / nm
15b	 ctDNA 0,05 0,10 0,15 0,20 0,30 0,40 0,50 CD [mdeg] λ / nm	 pApU 0,07 0,15 0,22 0,30 0,45 0,60 CD [mdeg] λ / nm

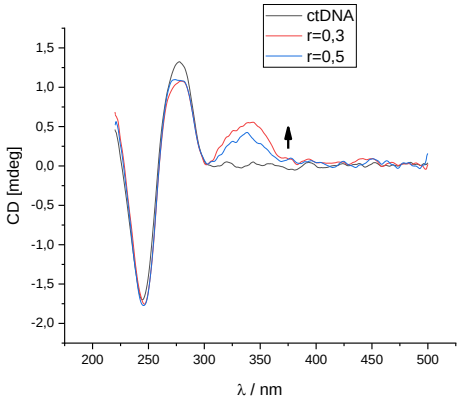
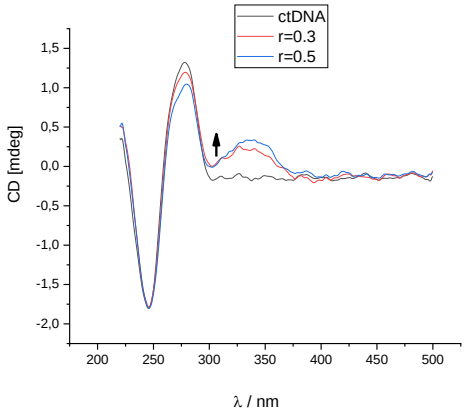
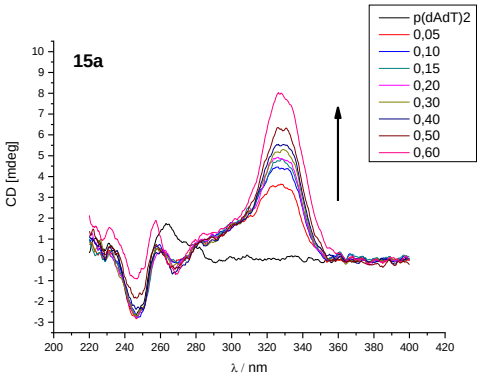
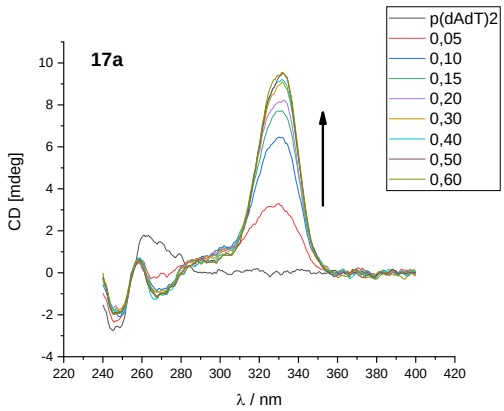
21b		
21a		

Figure S35. CD titration of ctDNA (c = 3.0 × 10^{-5} mol dm^{-3}) and poly A-poly U (c = 3.0 × 10^{-5} mol dm^{-3}) with **15a-c, 16a, 16c, 17a, 21a** and **21b** at molar ratios ***r*** = [compound] / [polynucleotide] (pH = 7.0, buffer sodium cacodylate, I = 0.05 mol dm^{-3}).





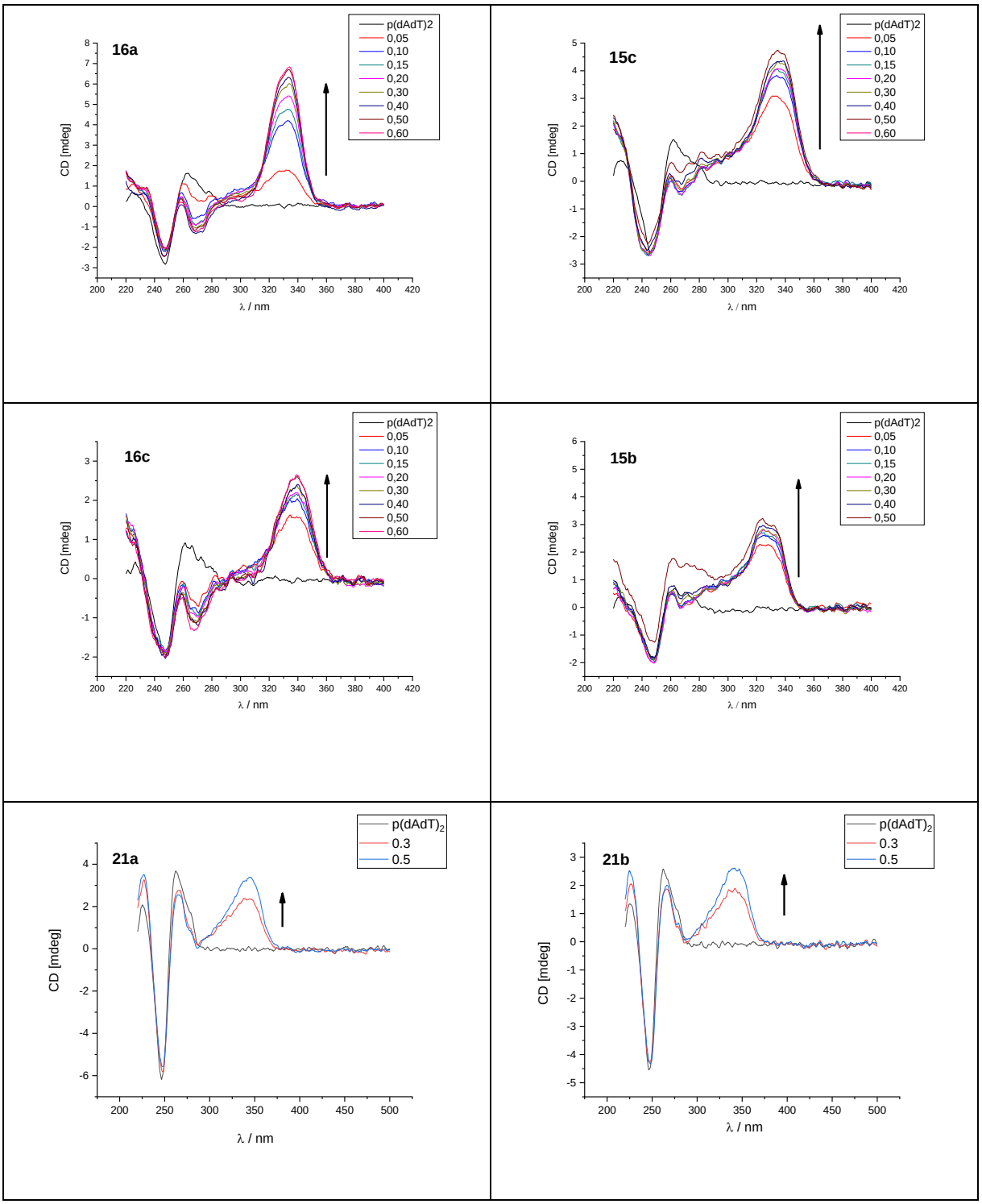
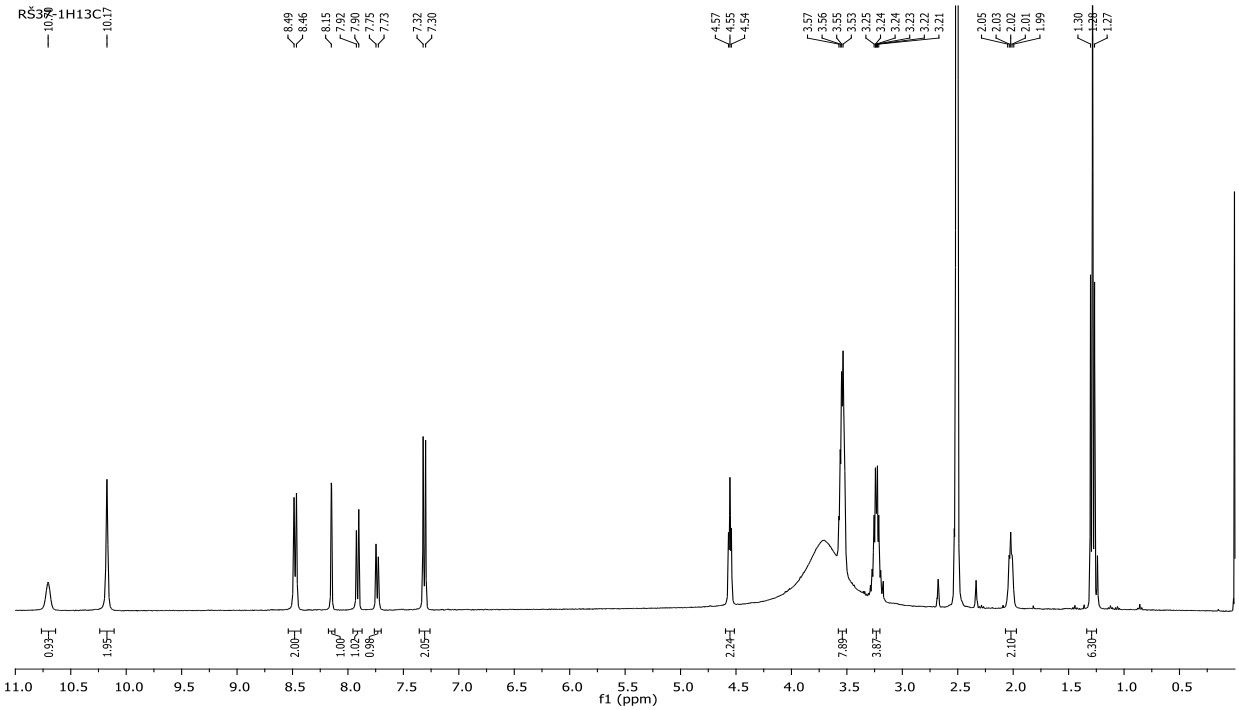
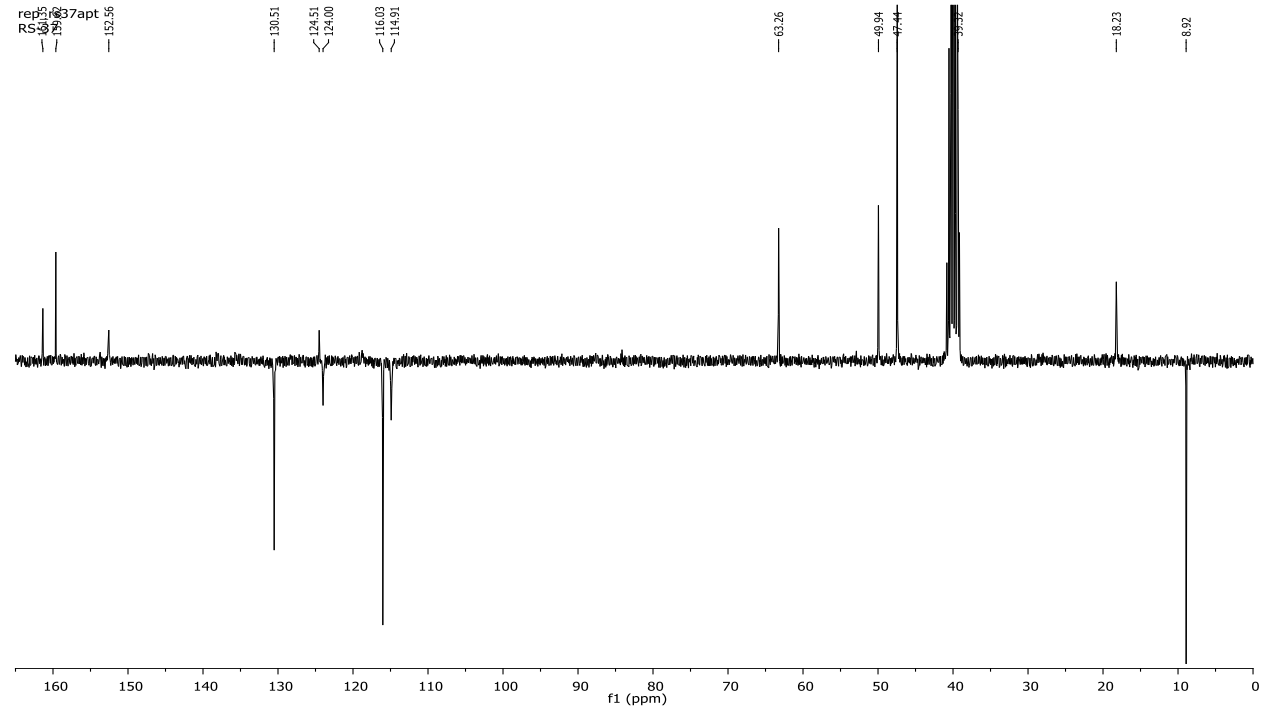


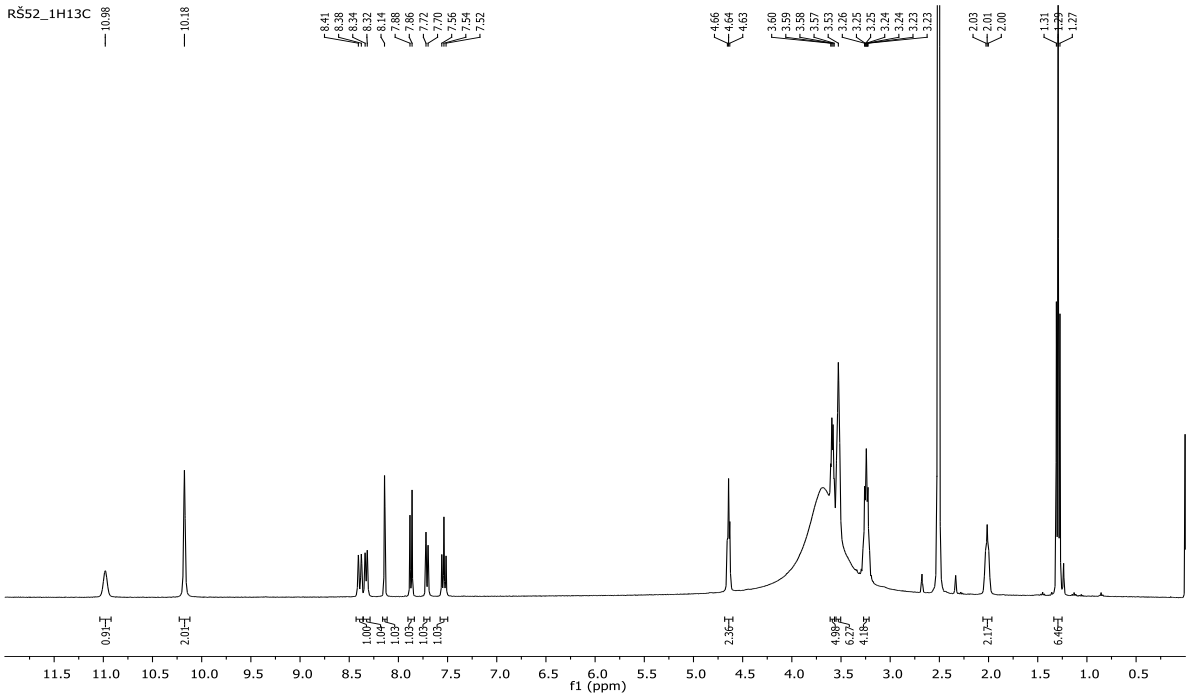
Figure S36. CD titration of poly(dAdT)$_2$ (c = 3.0 × 10^{-5} mol dm^{-3}) with **15a-c, 16a, 16c, 17a, 21a** and **21b** at molar ratios ***r*** = [compound] / [polynucleotide] (pH = 7.0, buffer sodium cacodylate, I = 0.05 mol dm^{-3}).



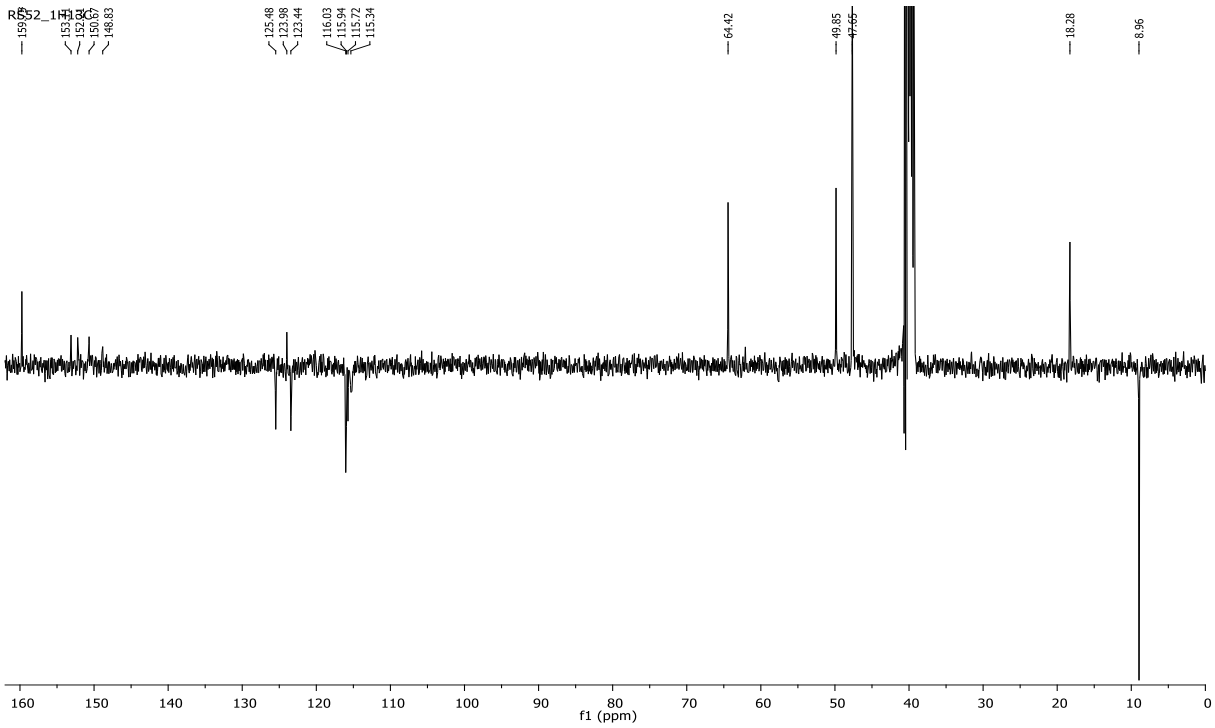
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12a**)



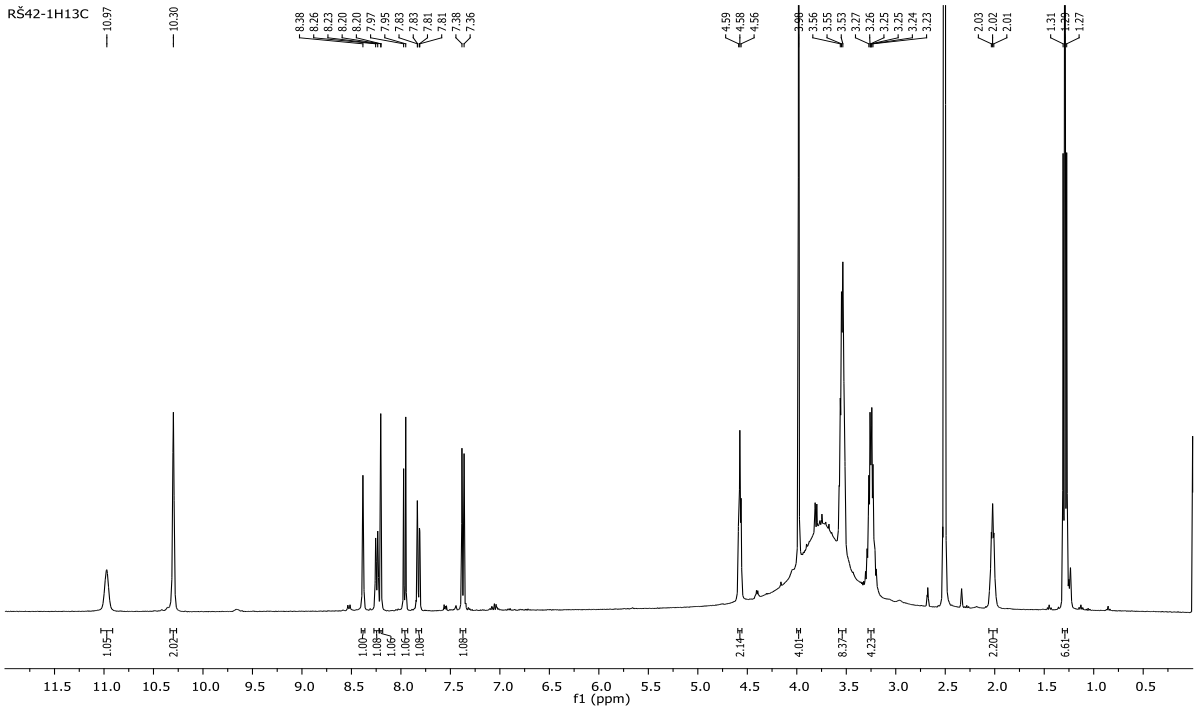
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12a**)



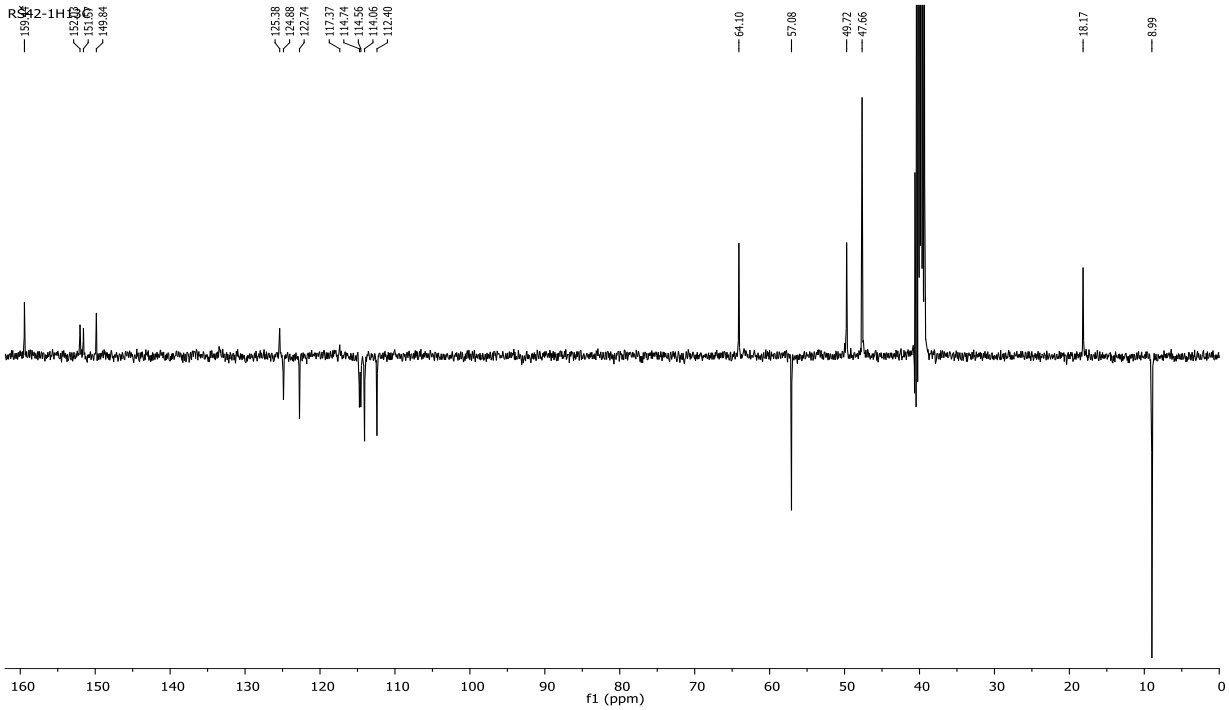
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12b**)



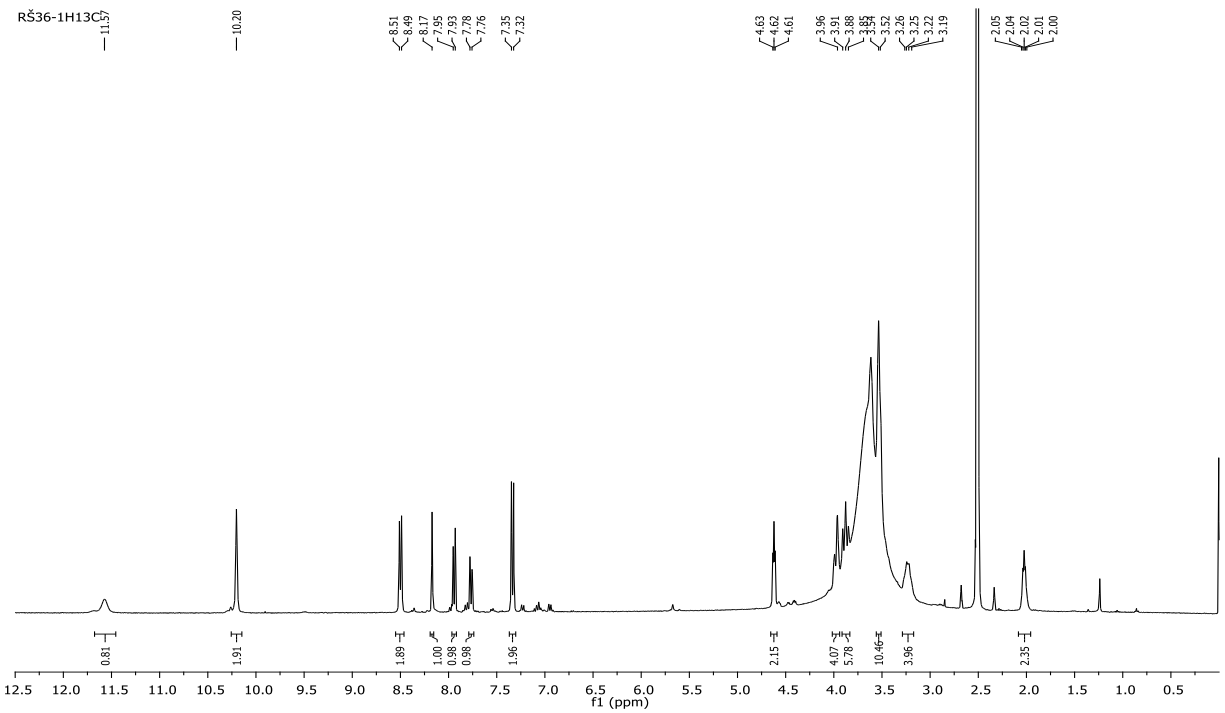
^{13}C NMR (101 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12b**)



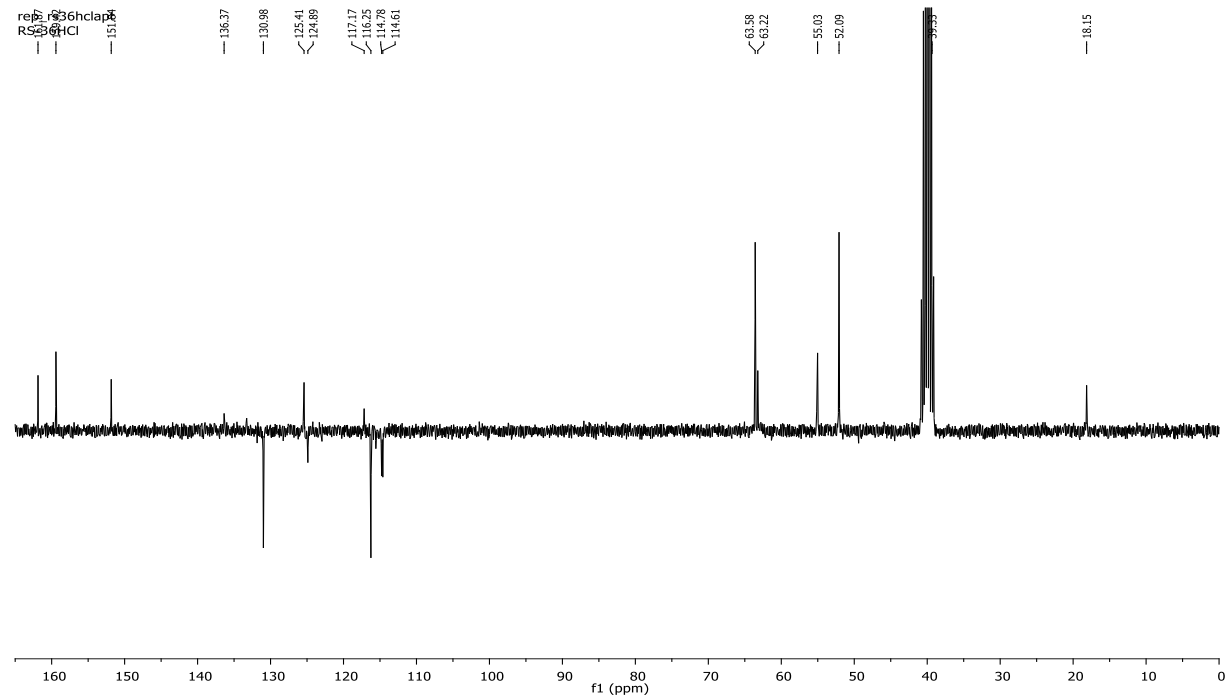
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12c**)



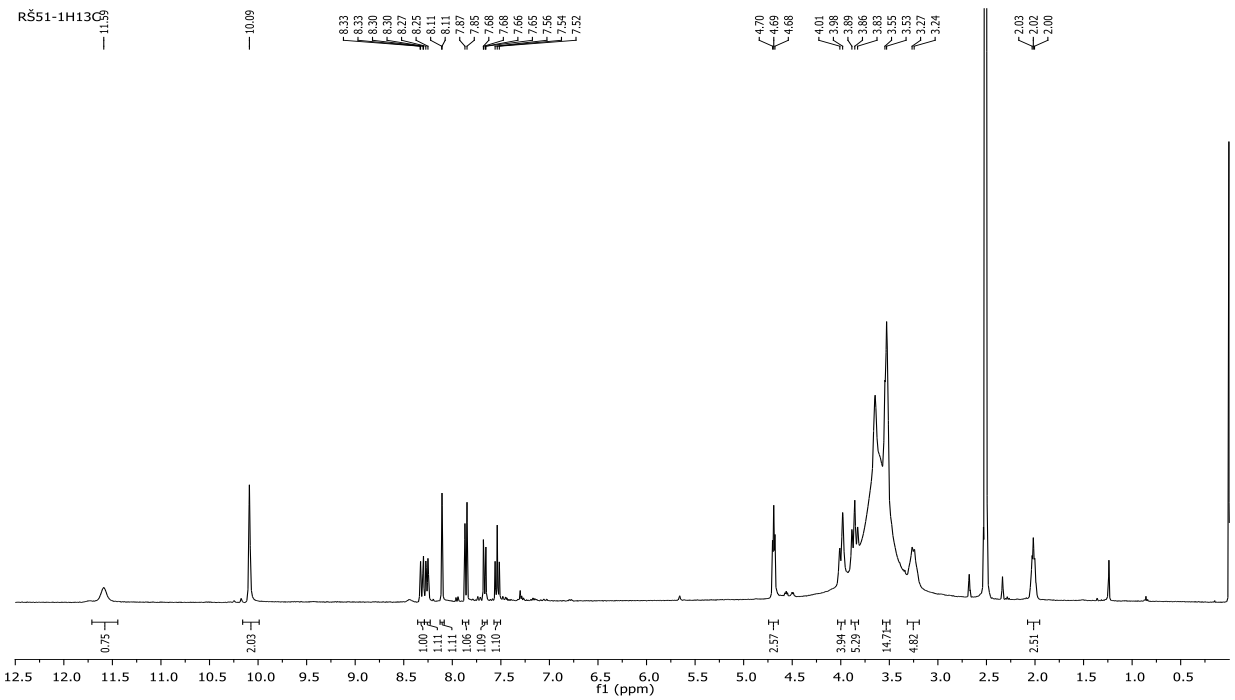
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-(2-(Diethylamino)ethoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**12c**)



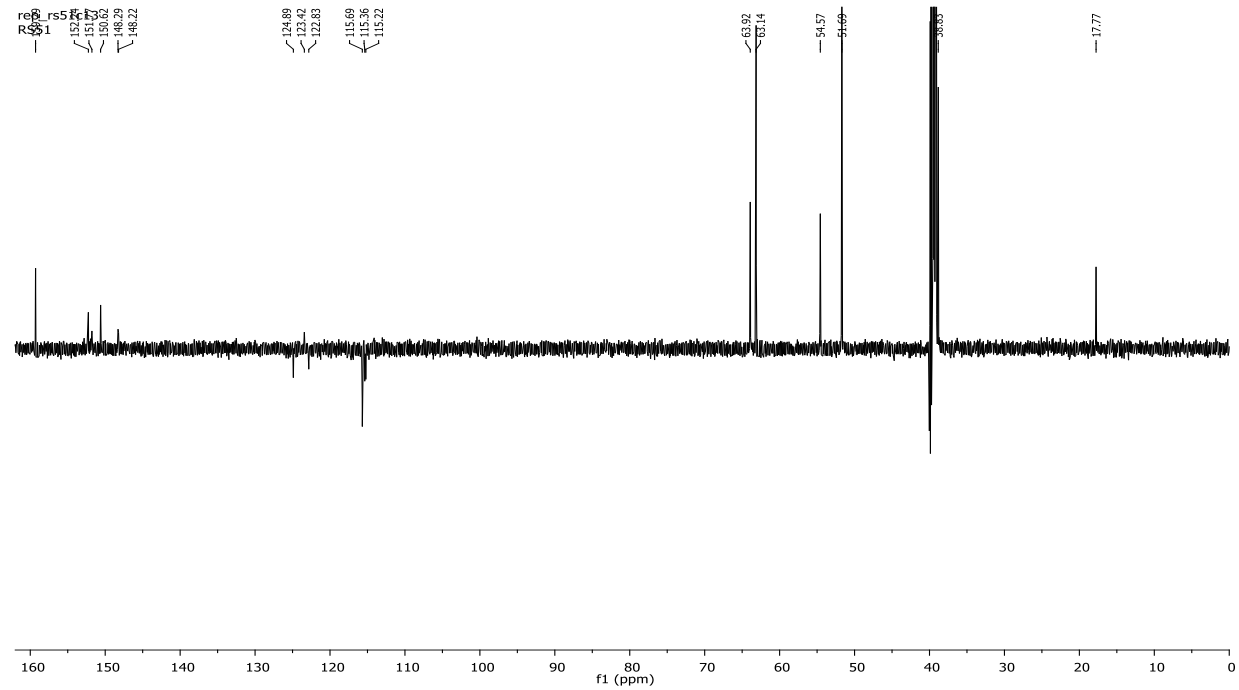
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(2-Morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13a**)



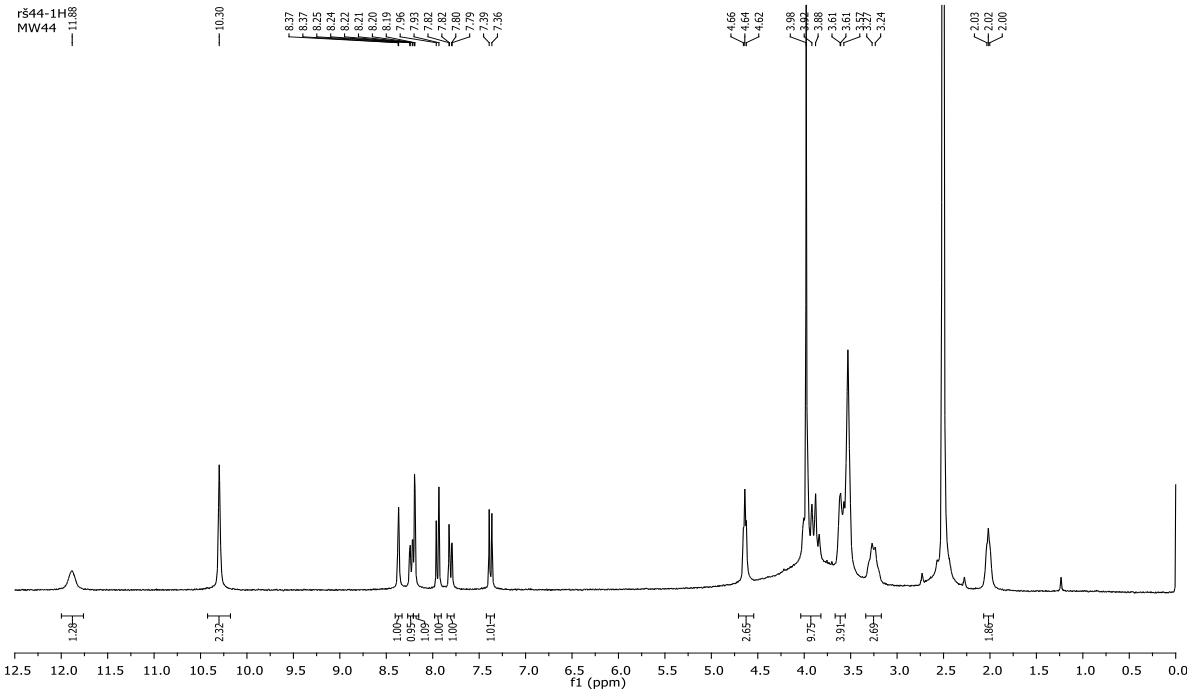
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-(2-Morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13a**)



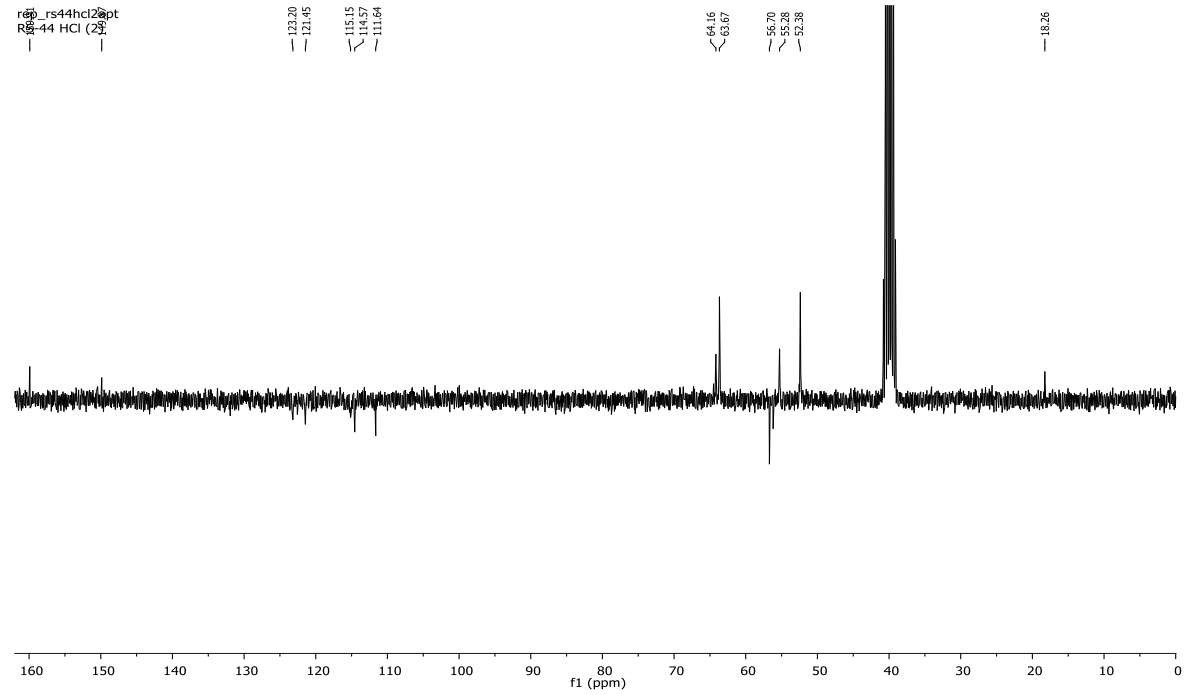
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13b**)



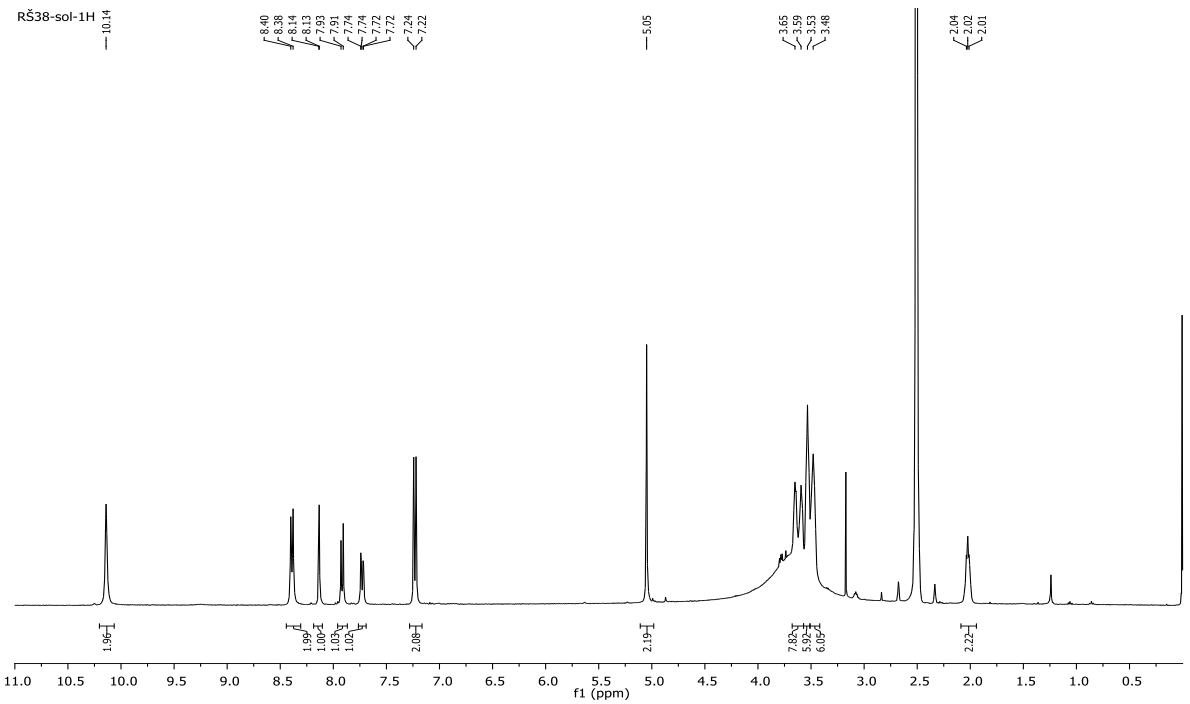
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13b**)



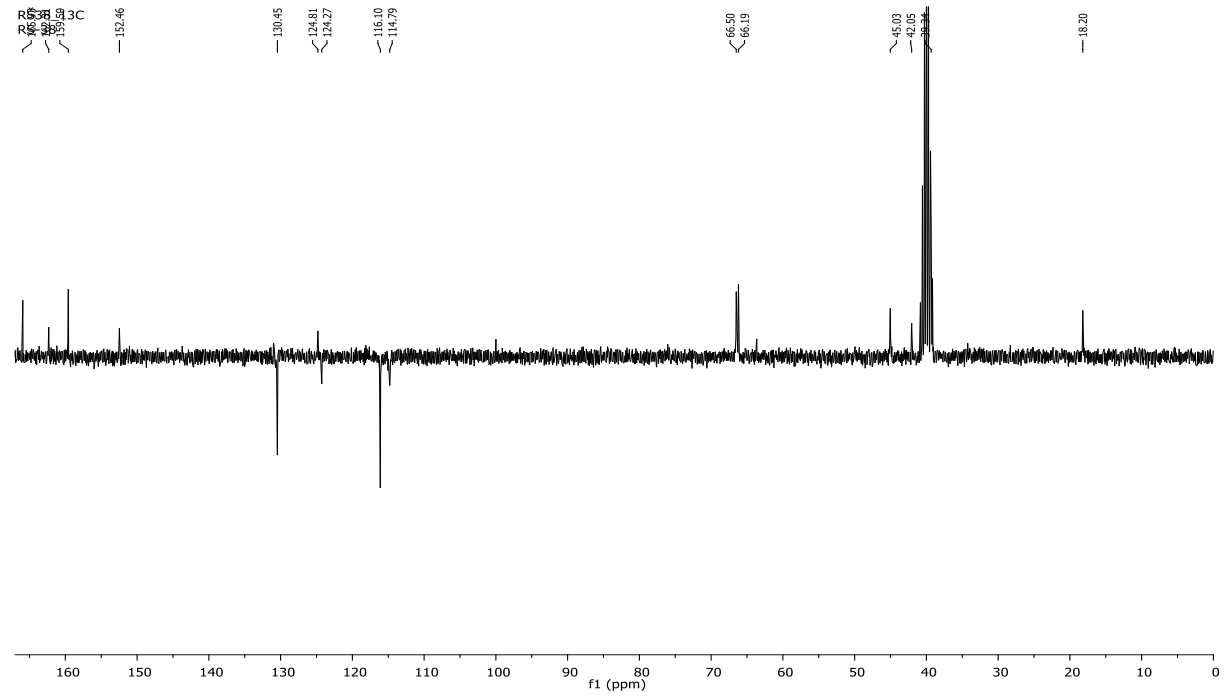
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(2-morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13c**)



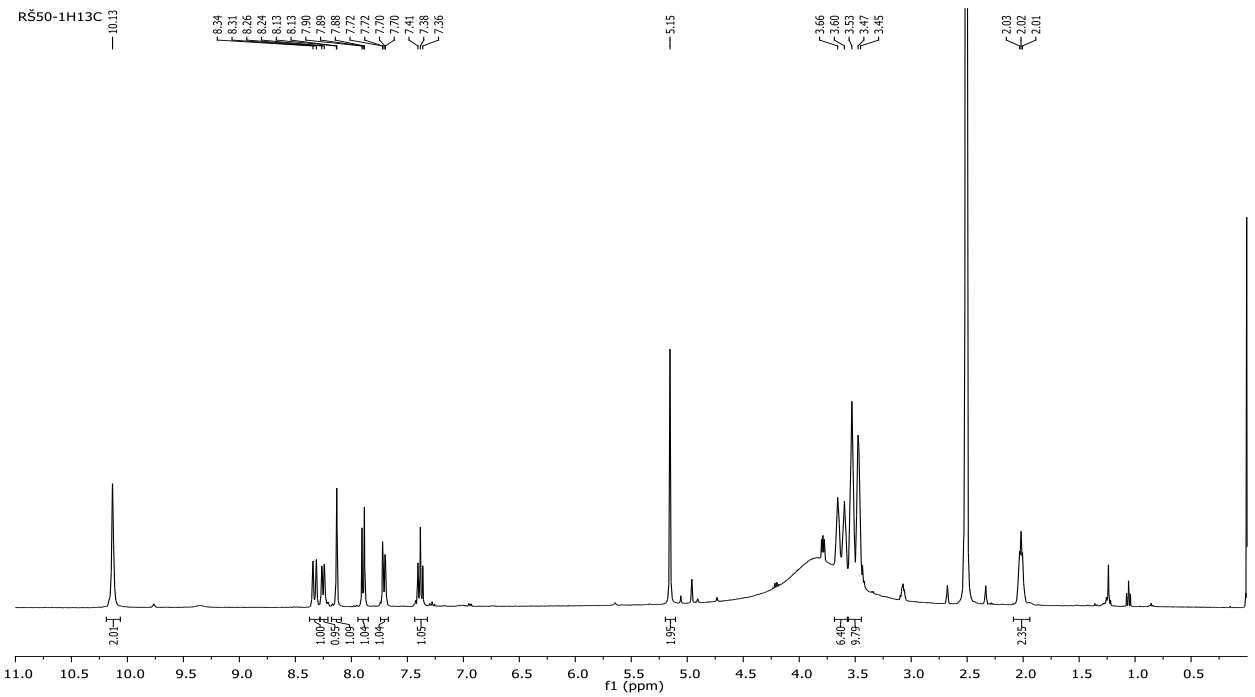
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(2-morpholinoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**13c**)



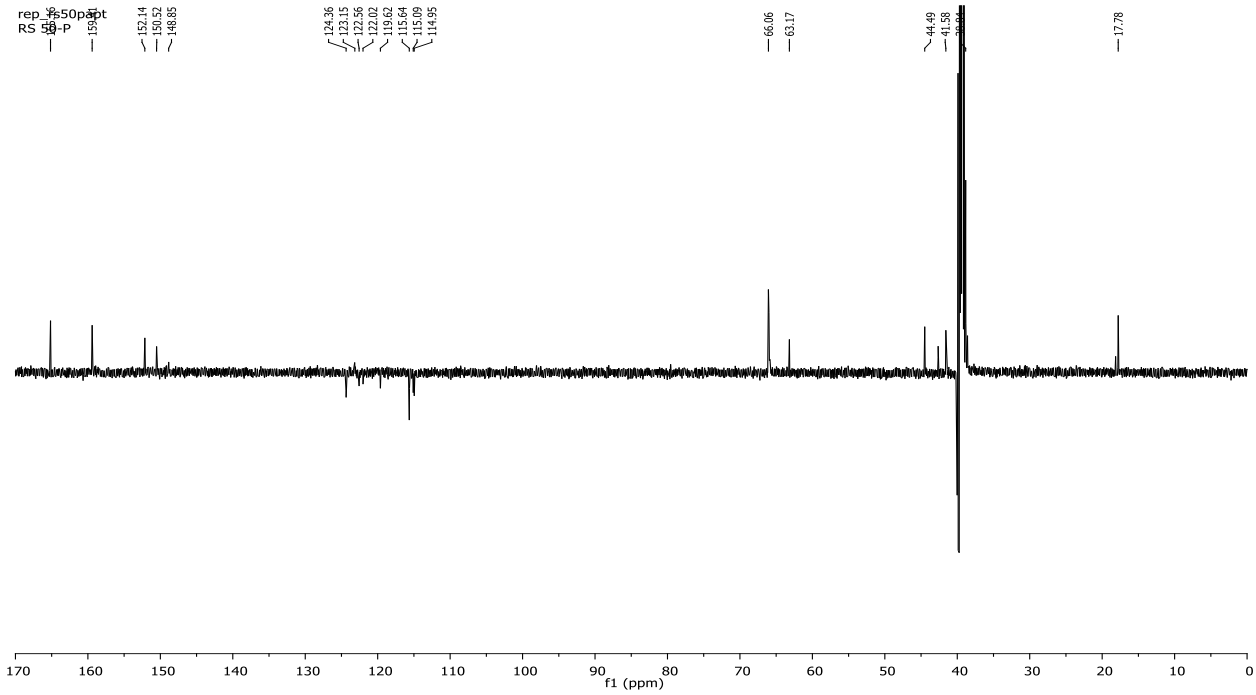
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(2-Morpholino-2-oxoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*- benzimidazole hydrochloride (**14a**)



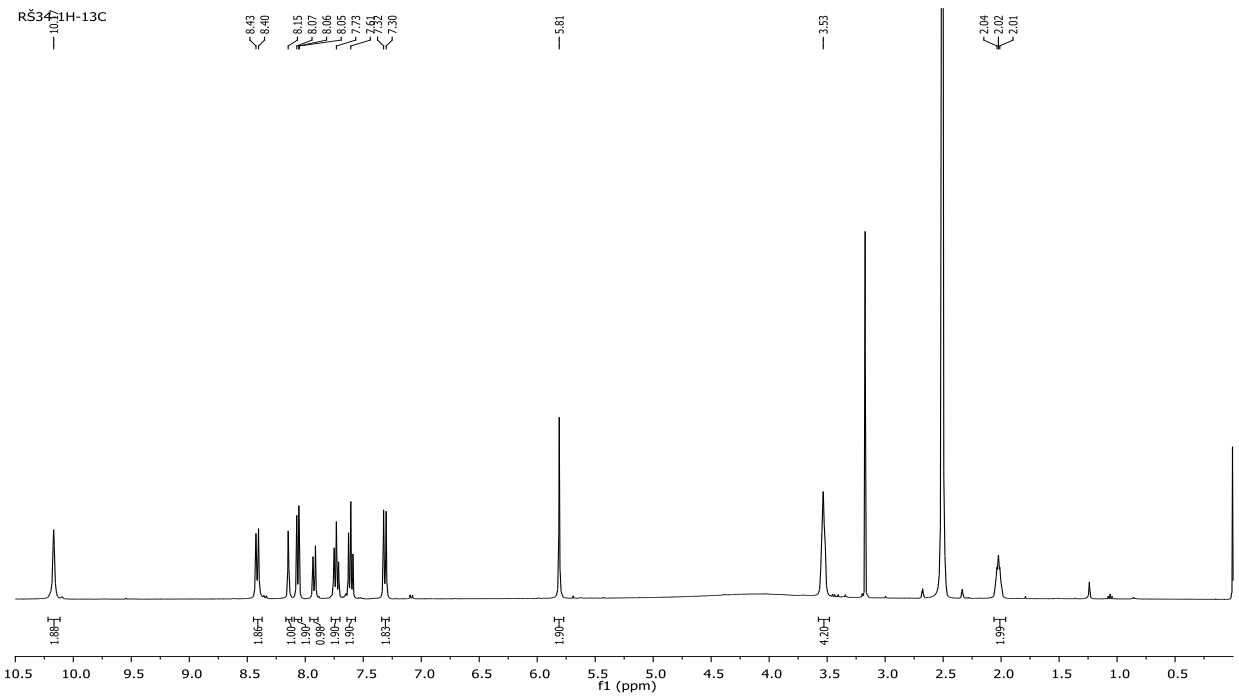
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-(2-Morpholino-2-oxoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*- benzimidazole hydrochloride (**14a**)



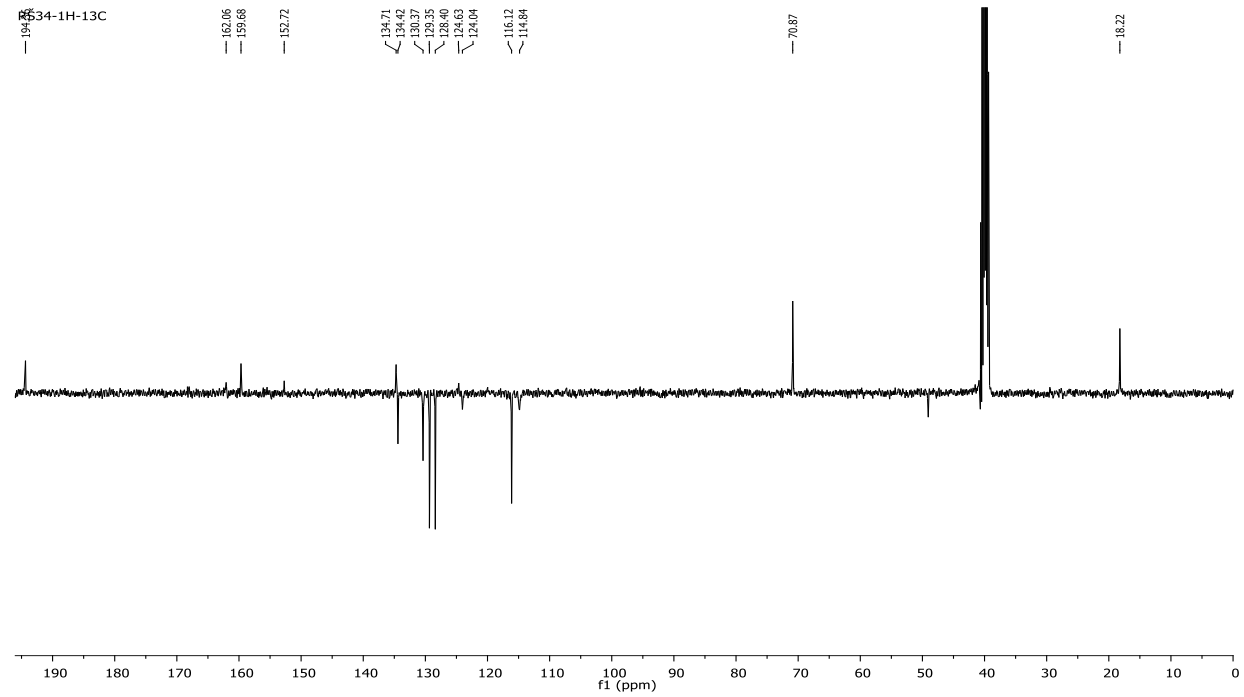
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-morpholino-2-oxoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H- benzimidazole hydrochloride (**14b**)



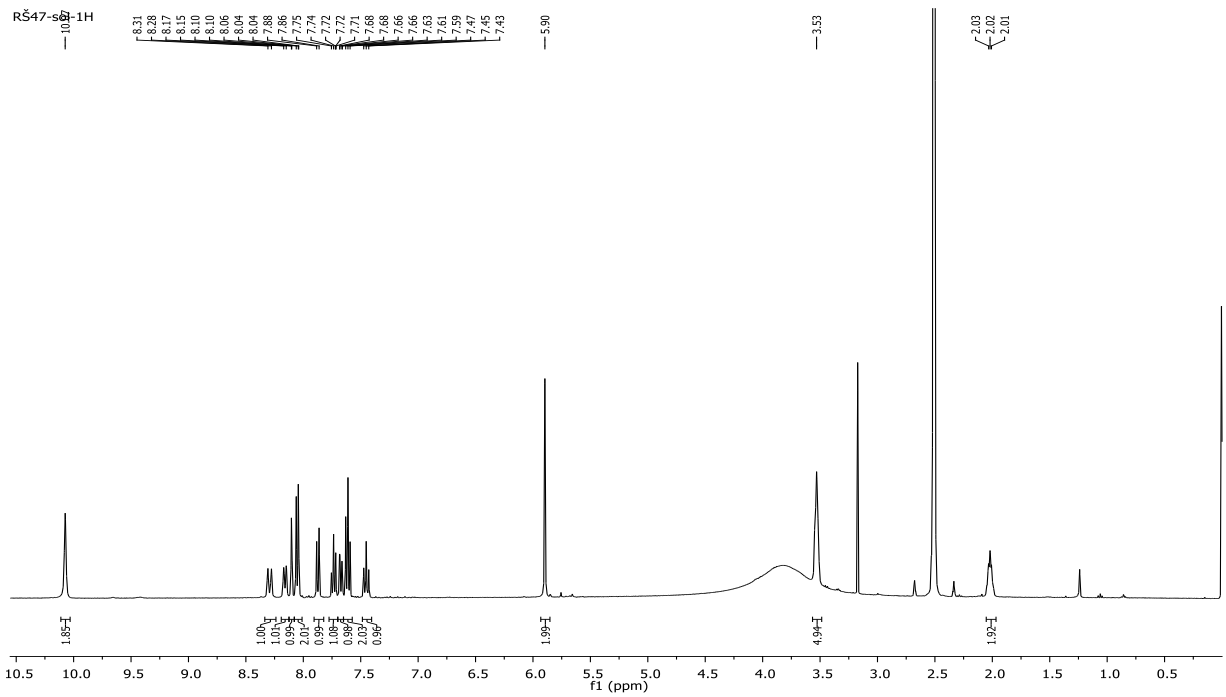
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-morpholino-2-oxoethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H- benzimidazole hydrochloride (**14b**)



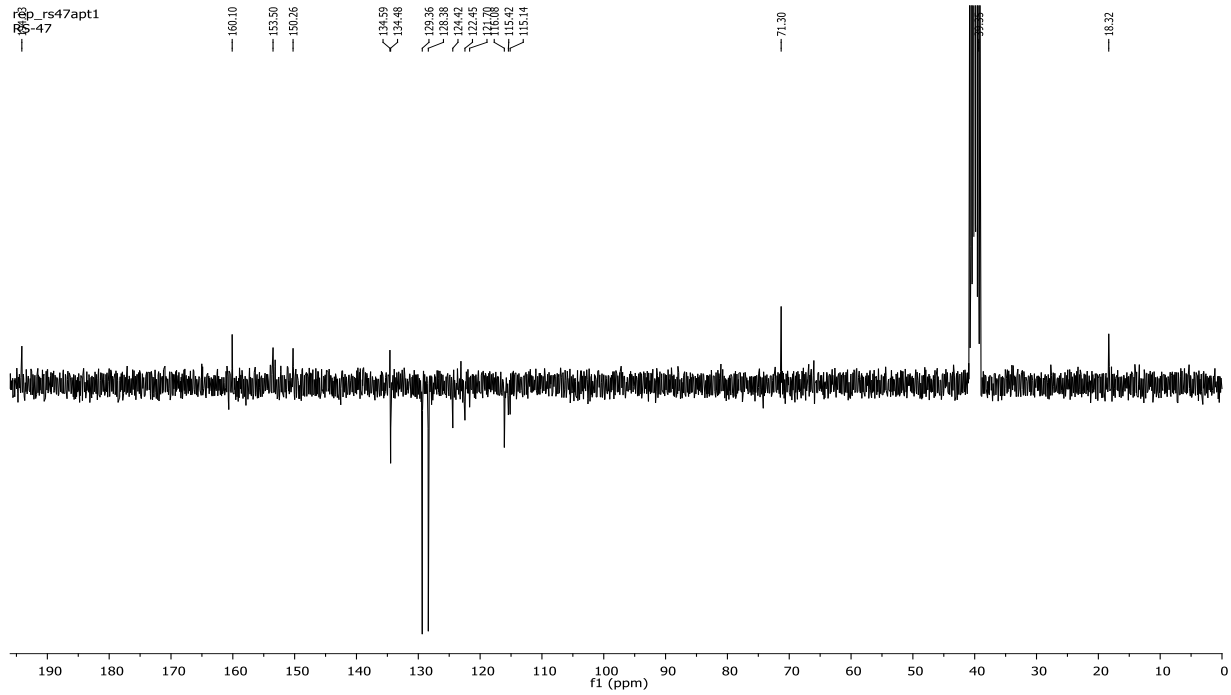
^{1}H NMR (400 MHz, DMSO) *δ* spectrum of 2-(4-(2-Oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*-benzimidazole hydrochloride (**15a**)



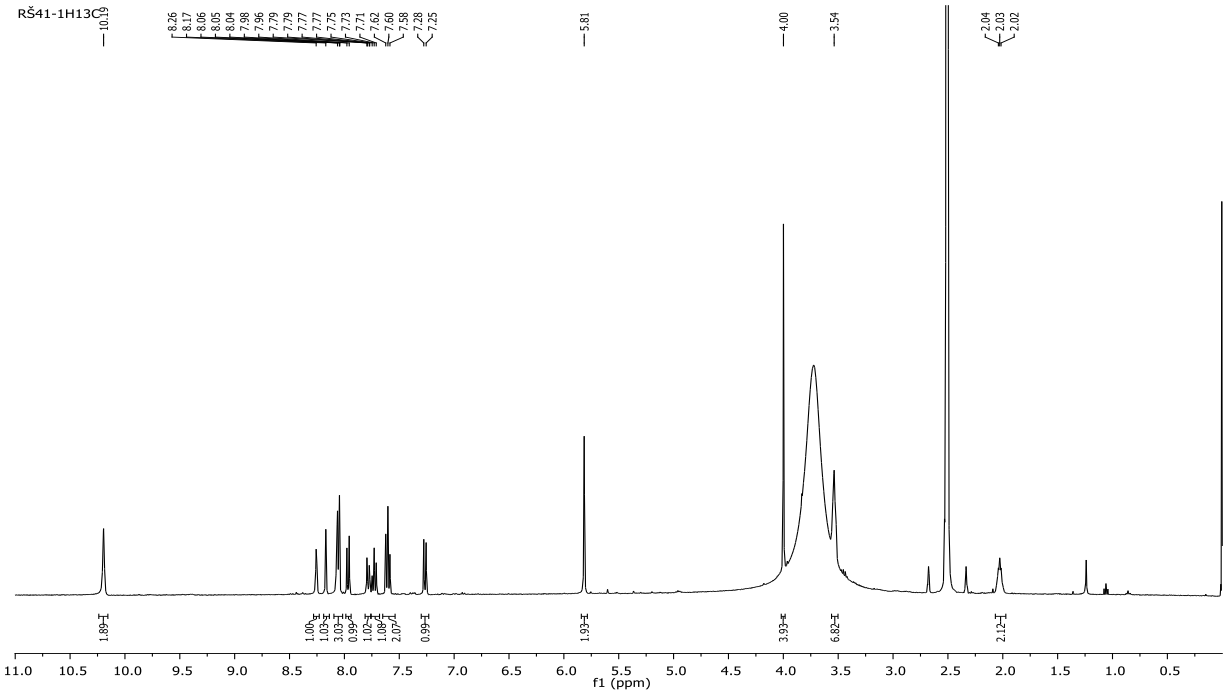
^{13}C NMR (101 MHz, DMSO) *δ* spectrum of 2-(4-(2-Oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*-benzimidazole hydrochloride (**15a**)



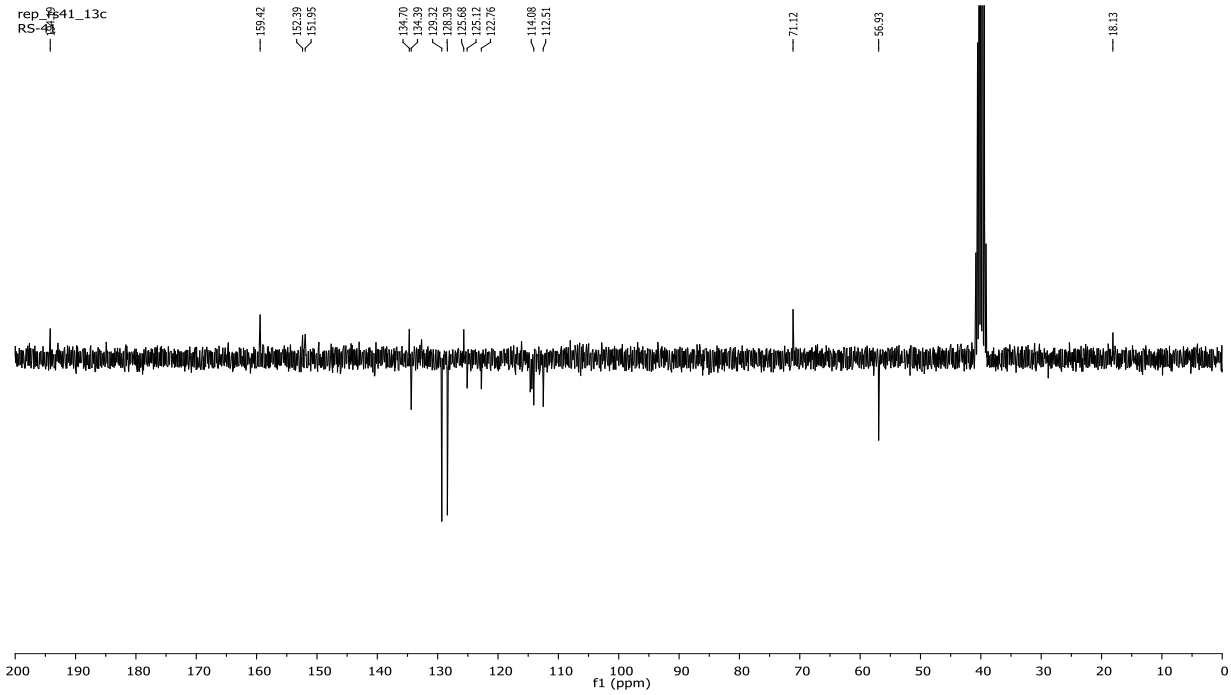
^{1}H NMR (400 MHz, DMSO) *δ* spectrum of 2-(3-Fluoro-4-(2-oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*- benzimidazole hydrochloride (**15b**)



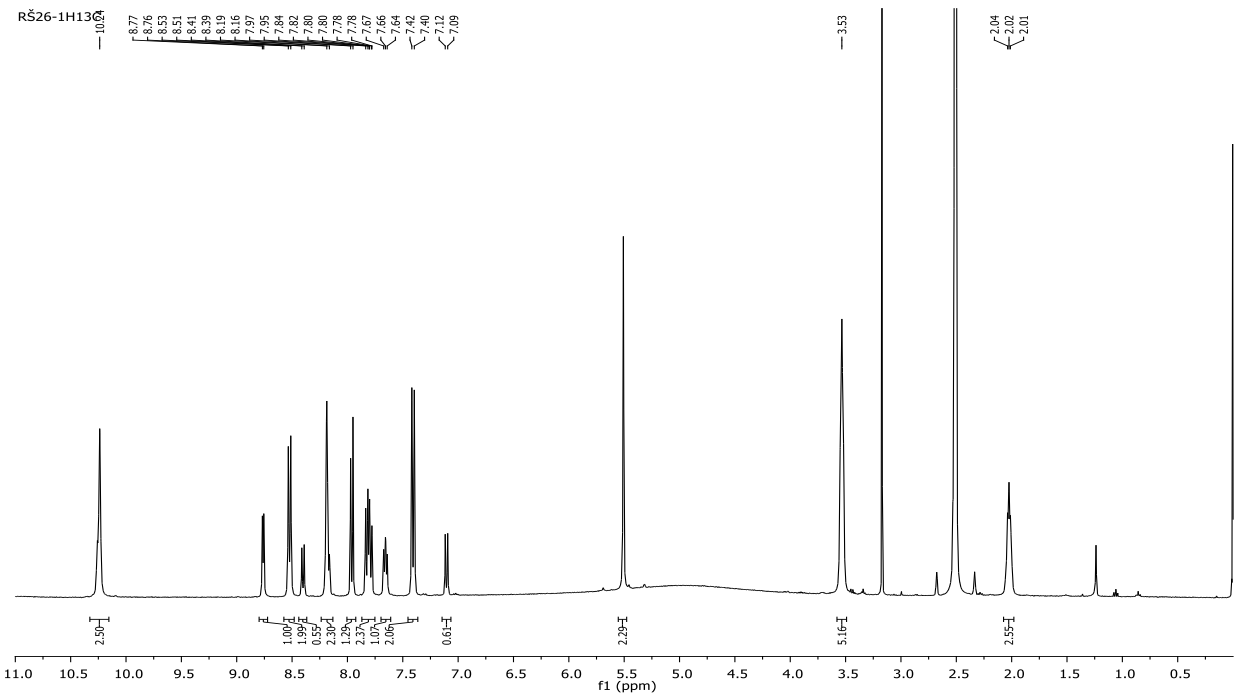
^{13}C NMR (75 MHz, DMSO) *δ* spectrum of 2-(3-Fluoro-4-(2-oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*- benzimidazole hydrochloride (**15b**)



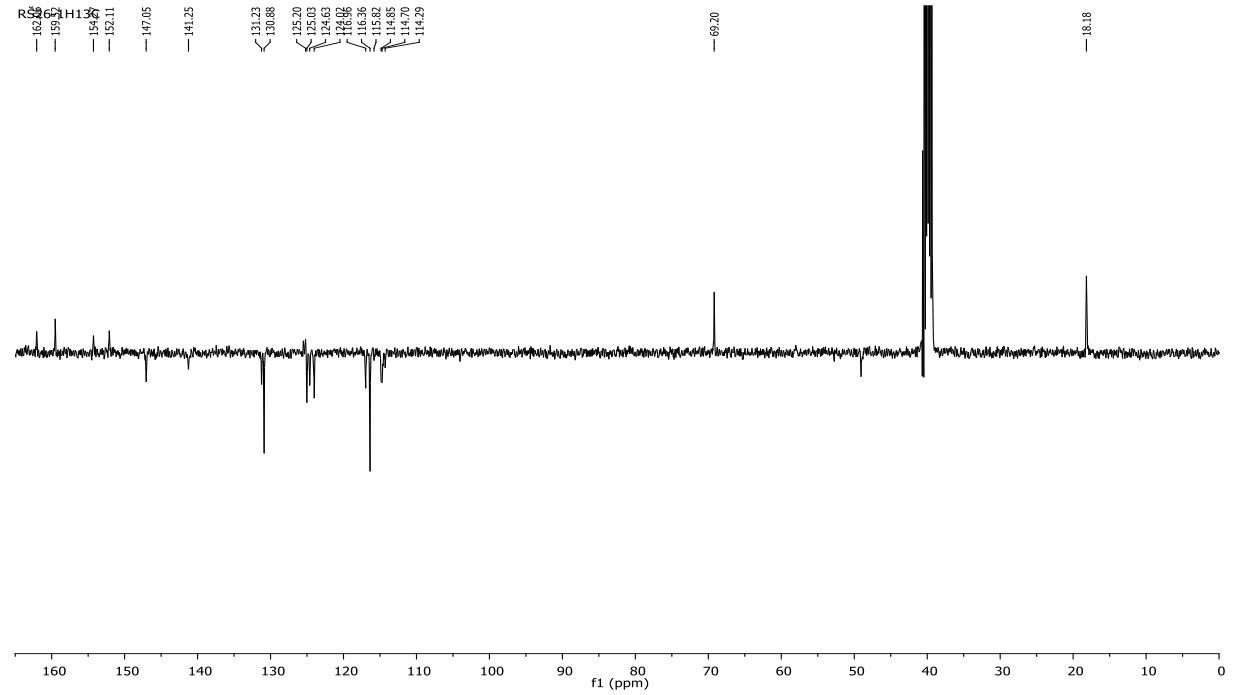
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(2-oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H- benzimidazole hydrochloride (**15c**)



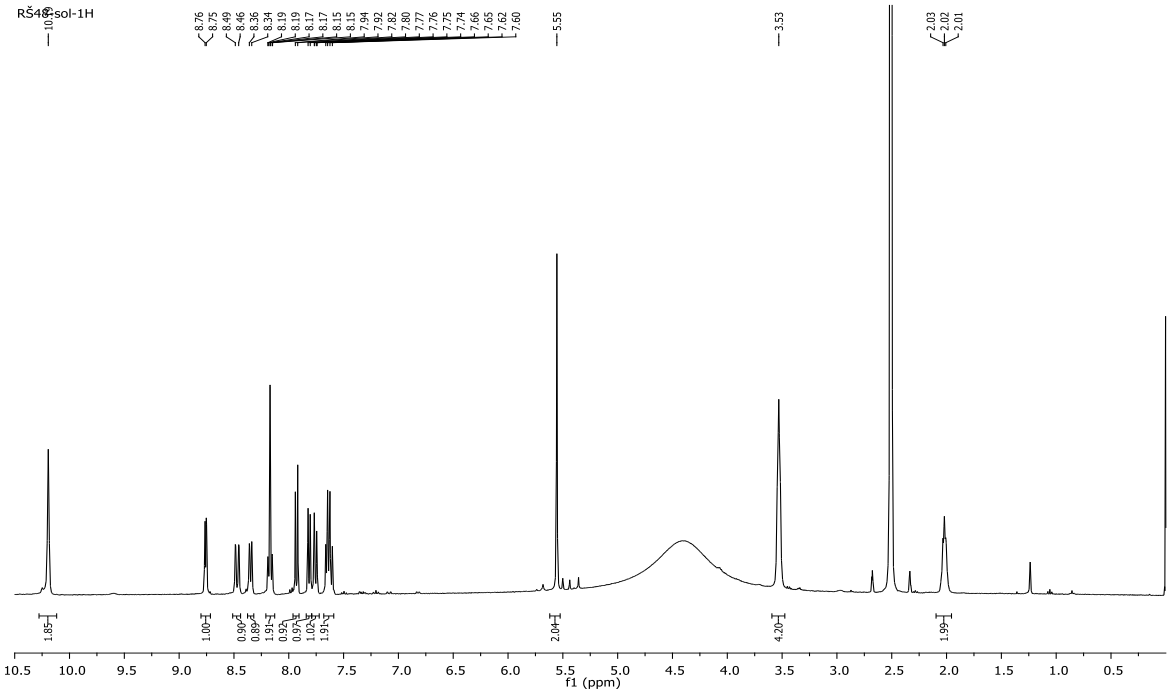
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(2-oxo-2-phenylethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H- benzimidazole hydrochloride (**15c**)



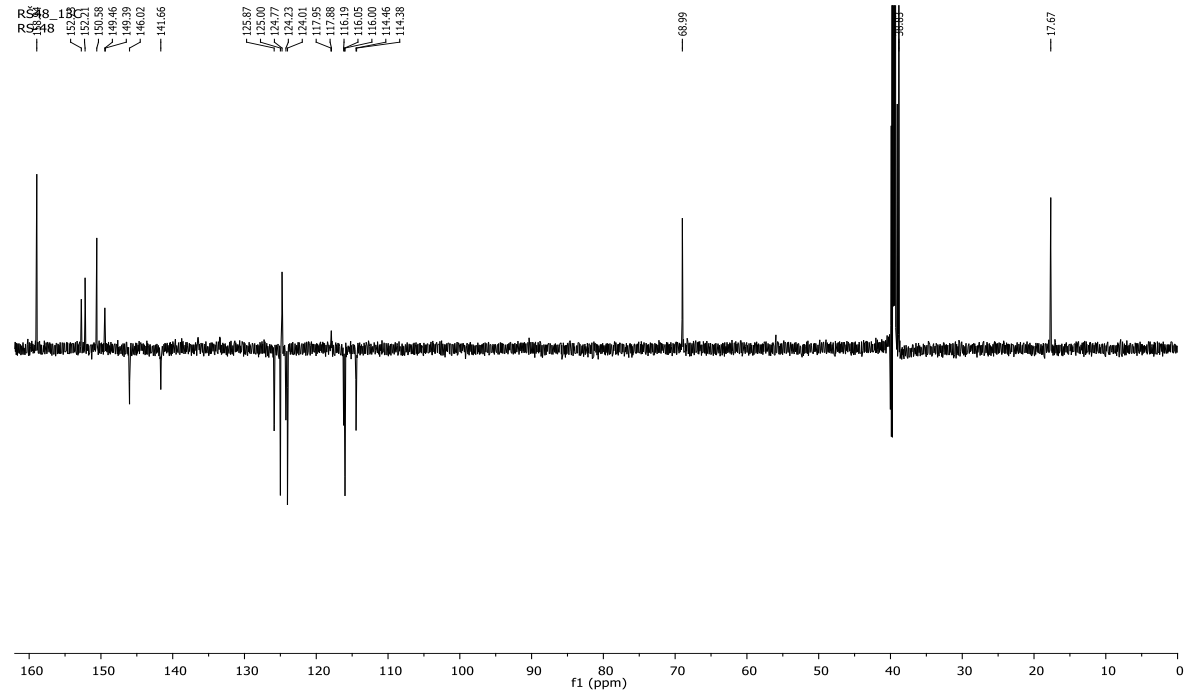
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-(Pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*-benzimidazole hydrochloride (**16a**)



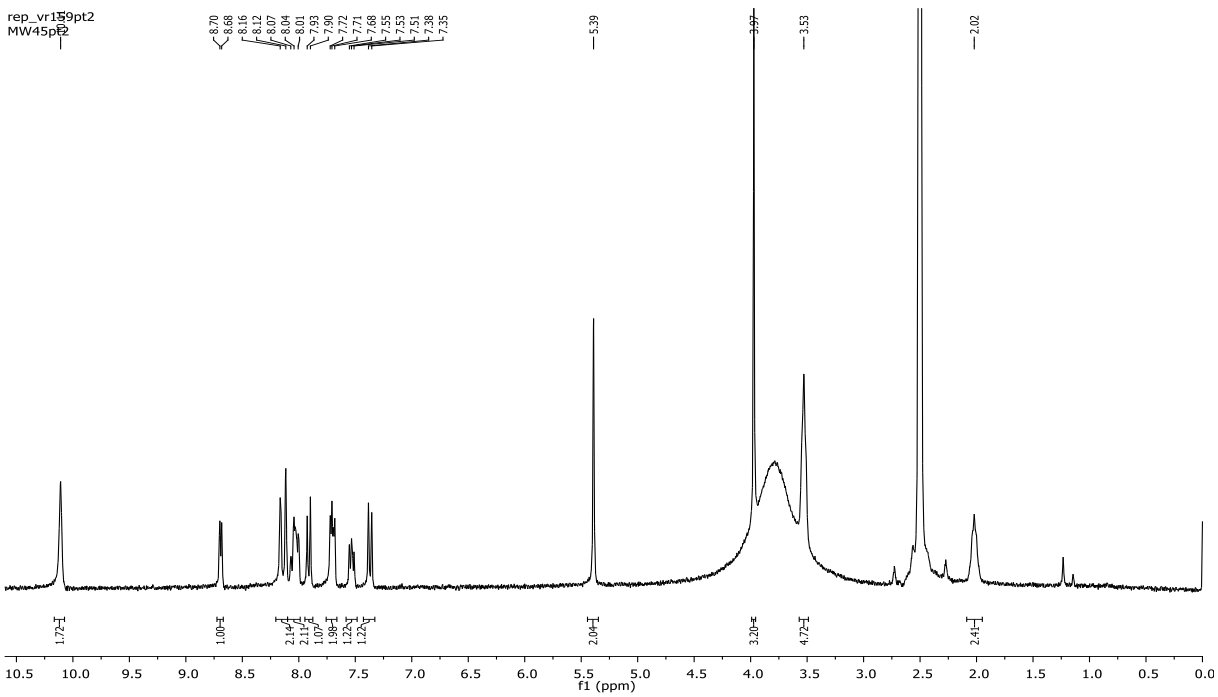
^{13}C NMR (101 MHz, DMSO) δ spectrum of 2-(4-(Pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1*H*-benzimidazole hydrochloride (**16a**)



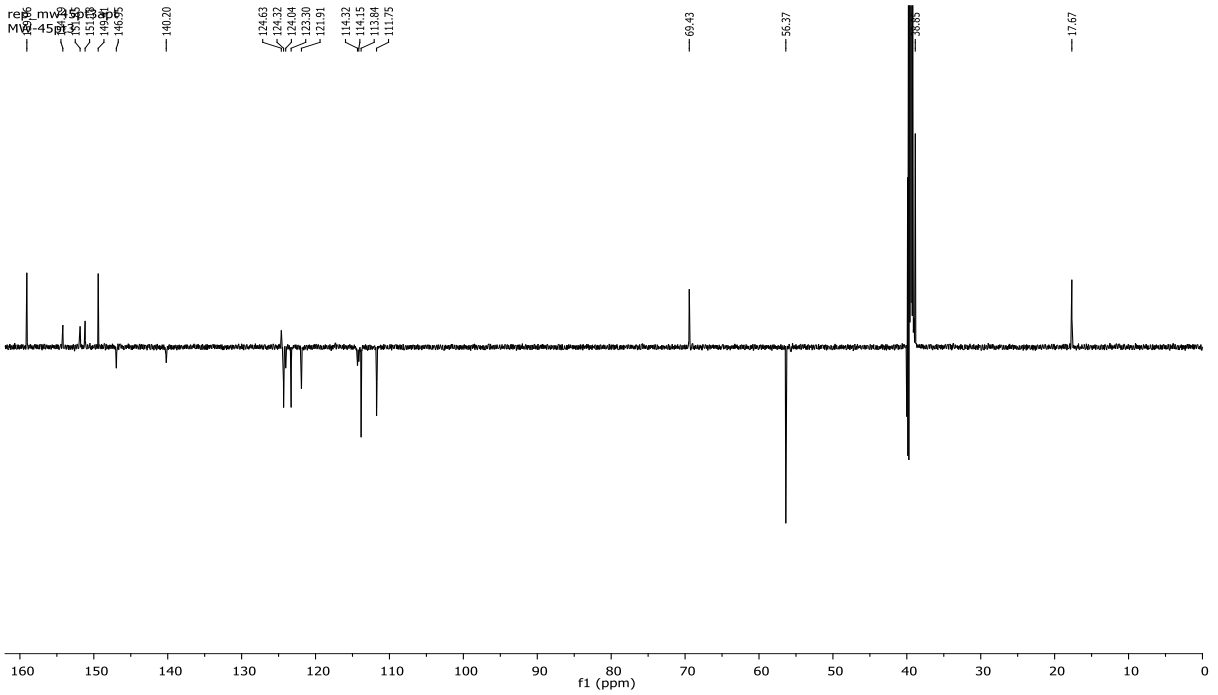
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**16b**)



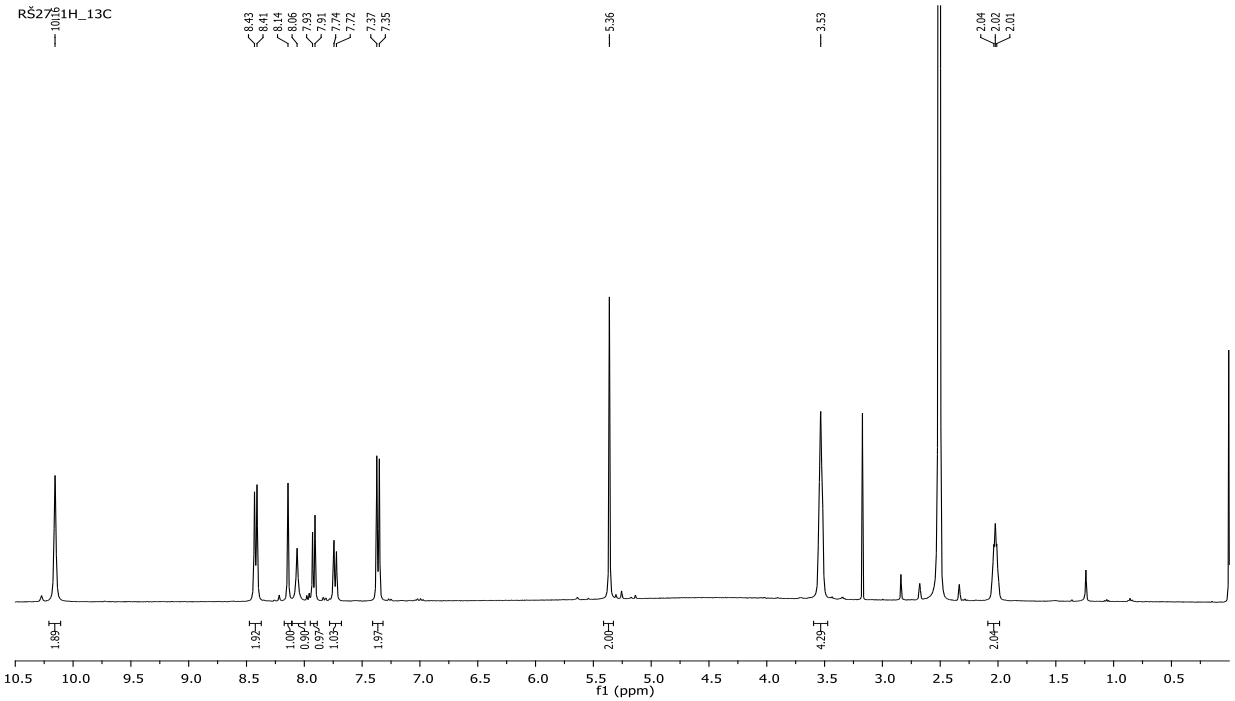
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**16b**)



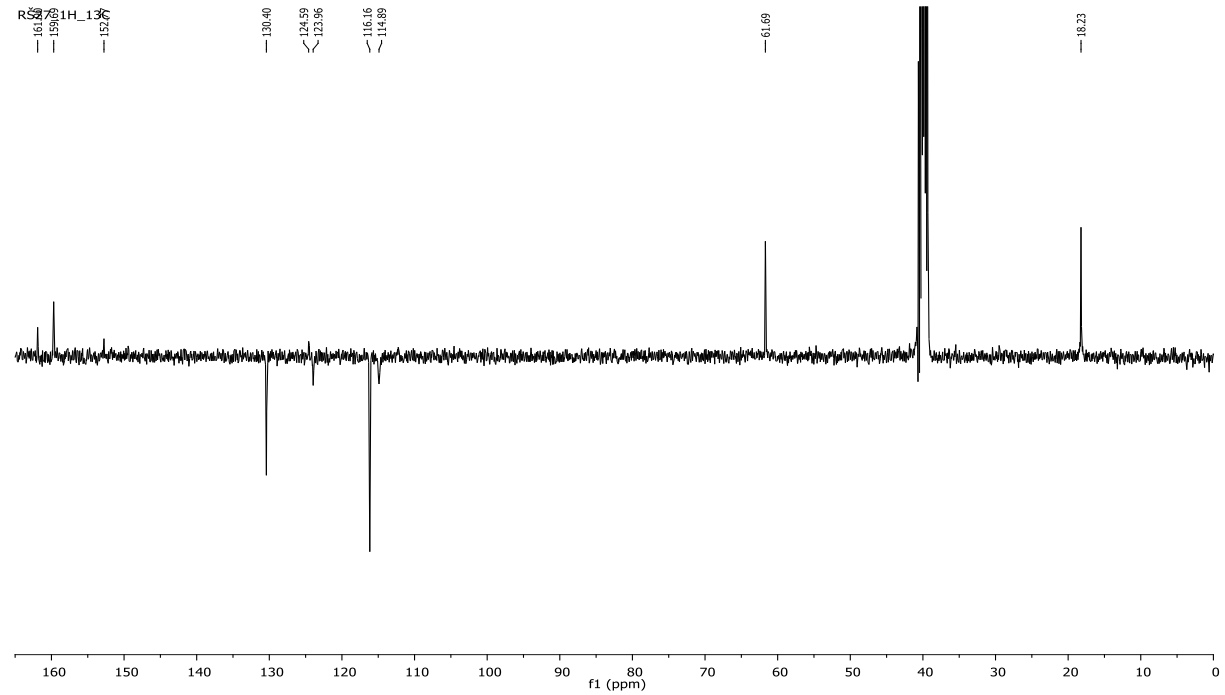
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**16c**)



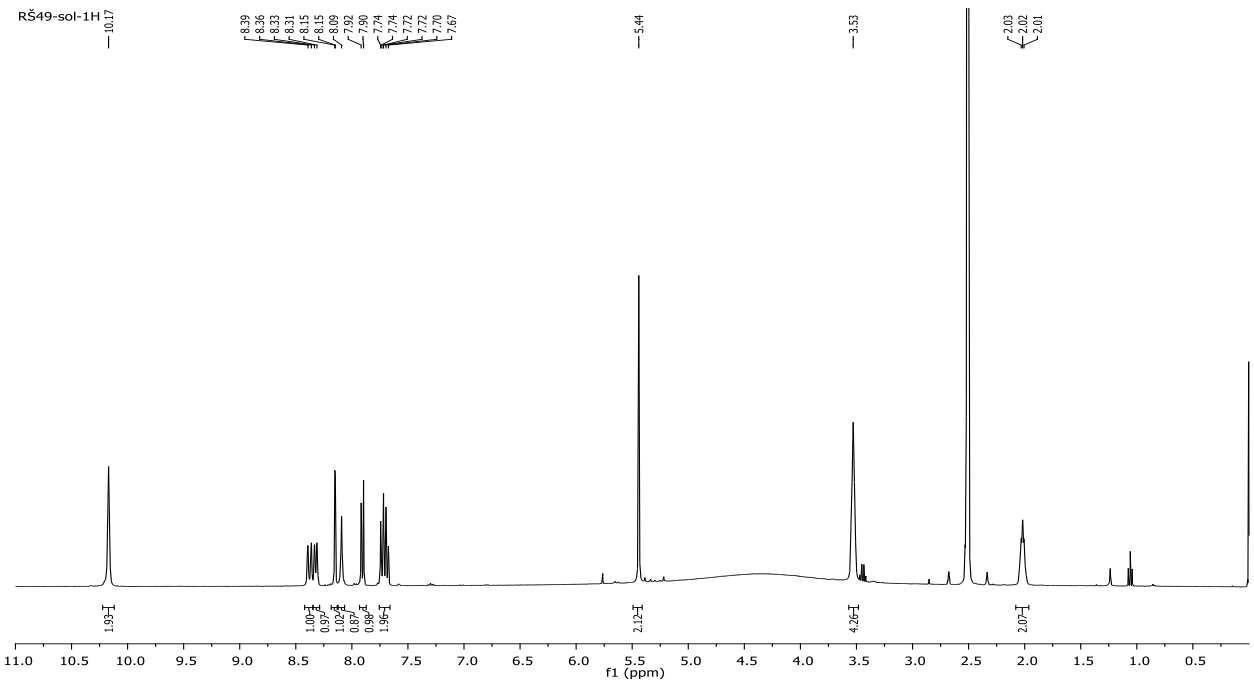
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(pyridin-2-ylmethoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**16c**)



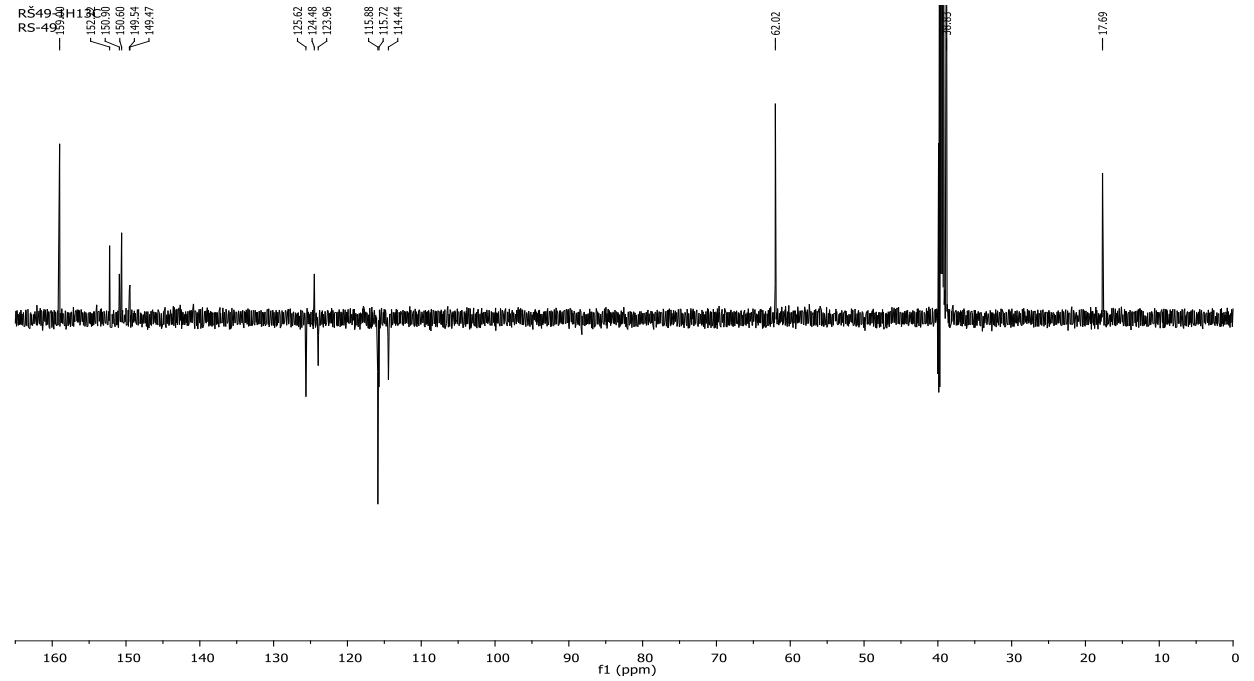
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17a**)



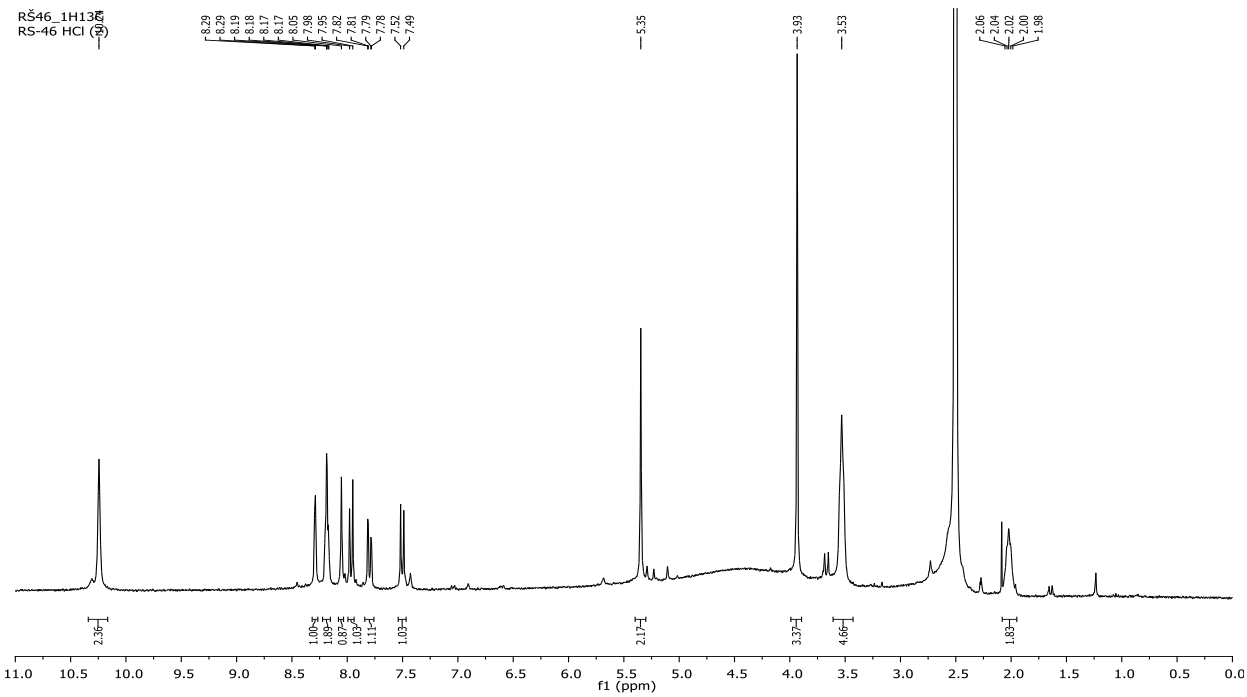
^{13}C NMR (101 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17a**)



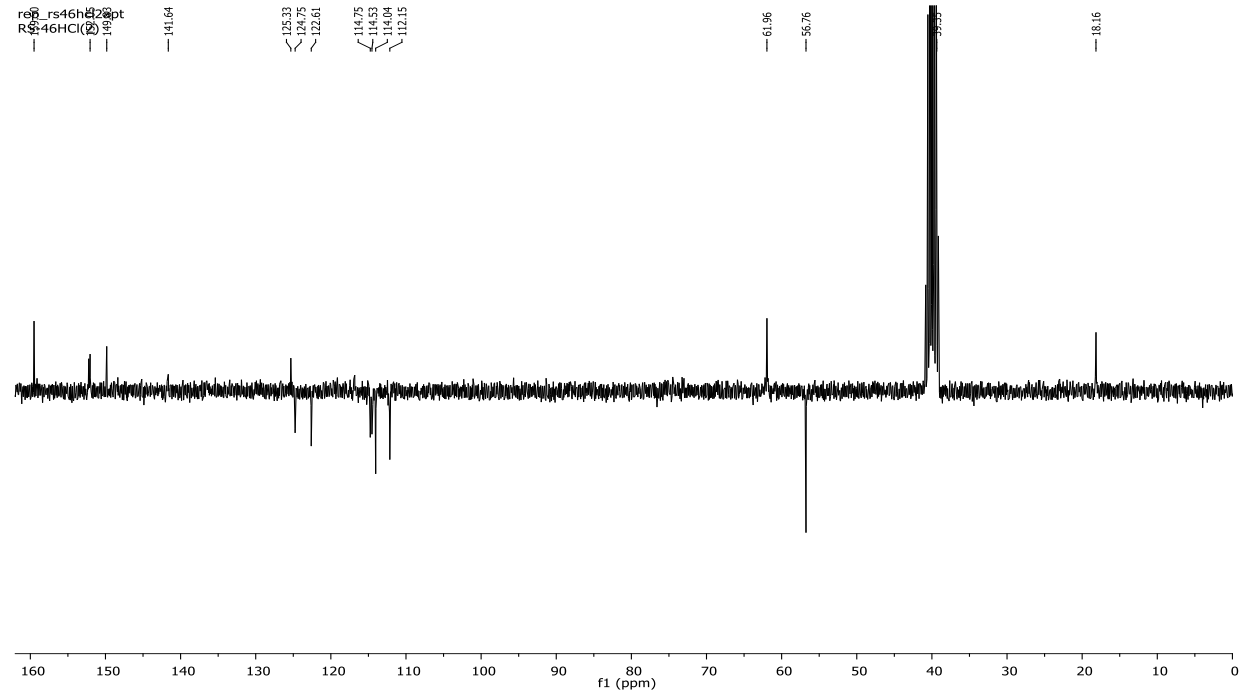
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17b**)



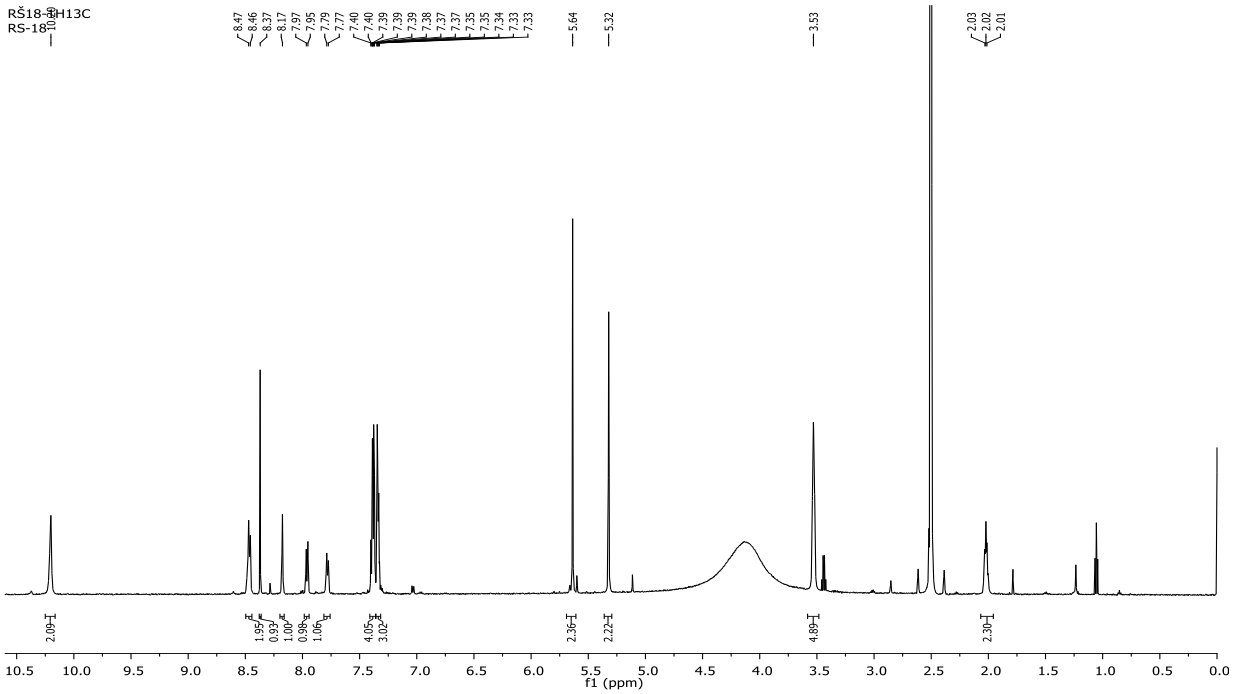
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17b**)



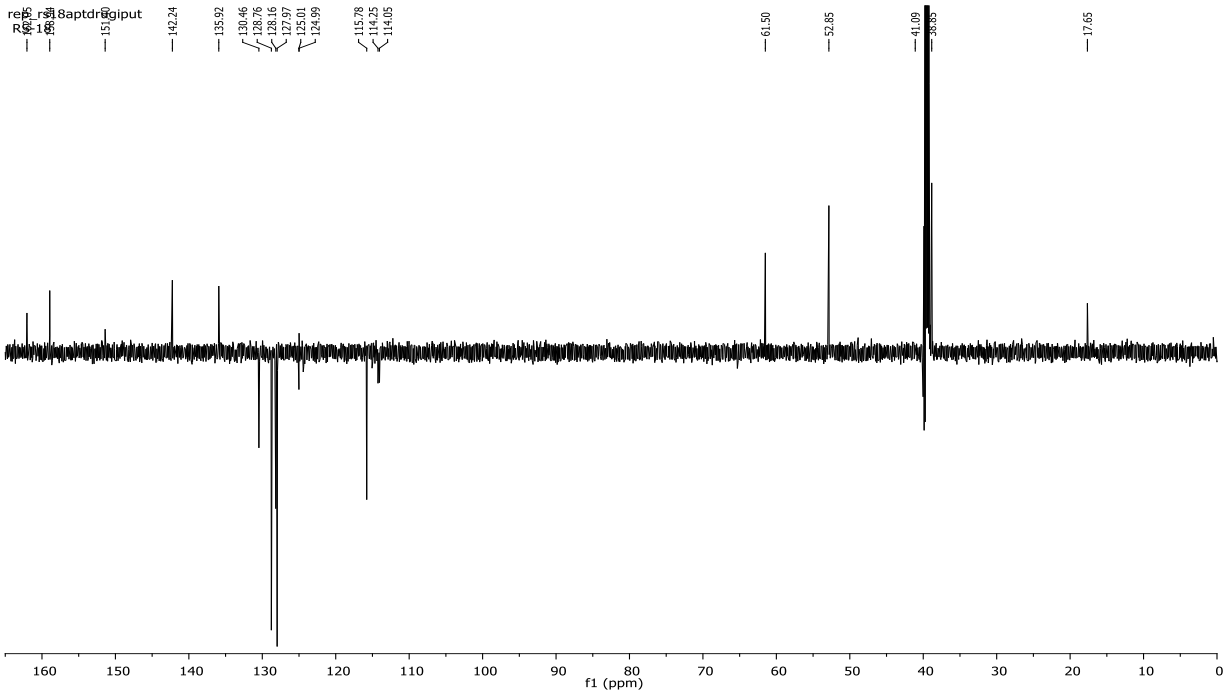
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17c**)



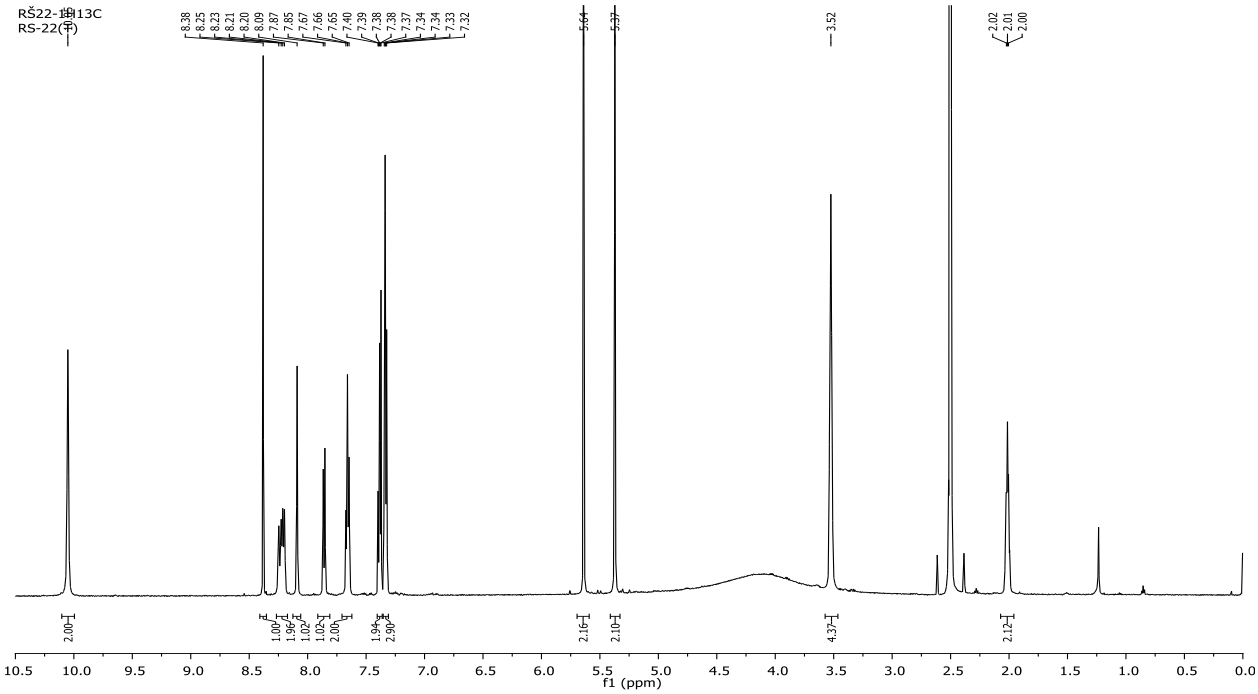
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**17c**)



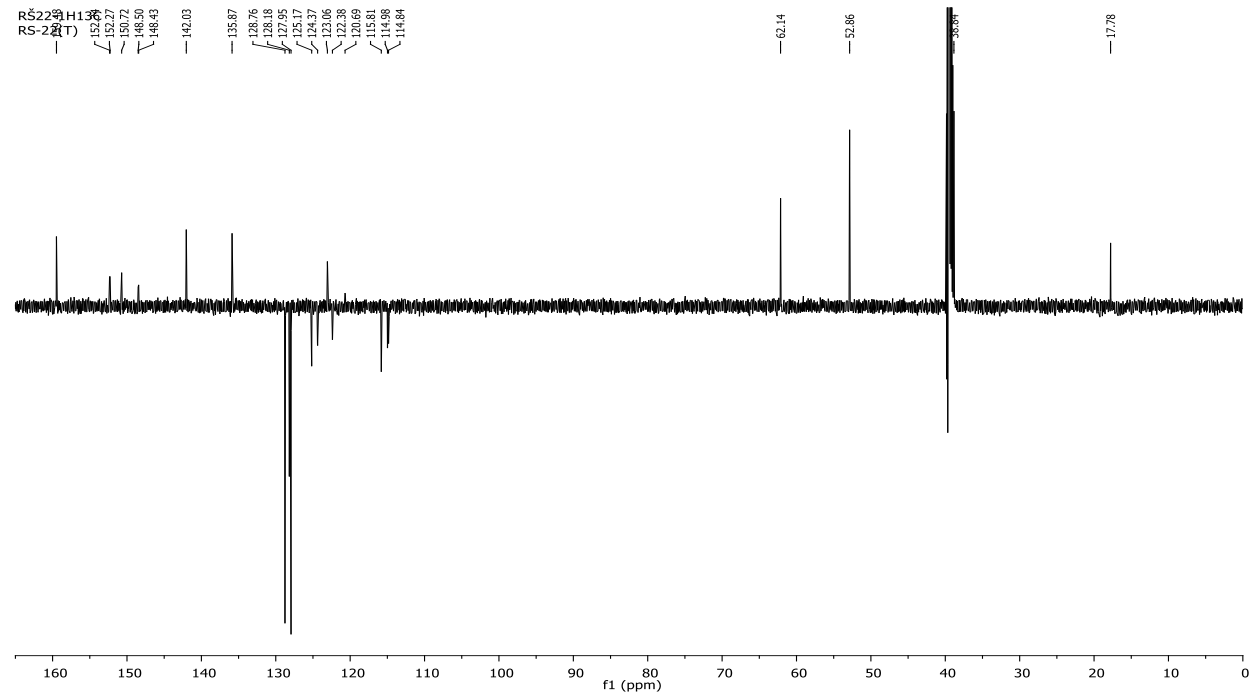
^{1}H NMR (600 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18a**)



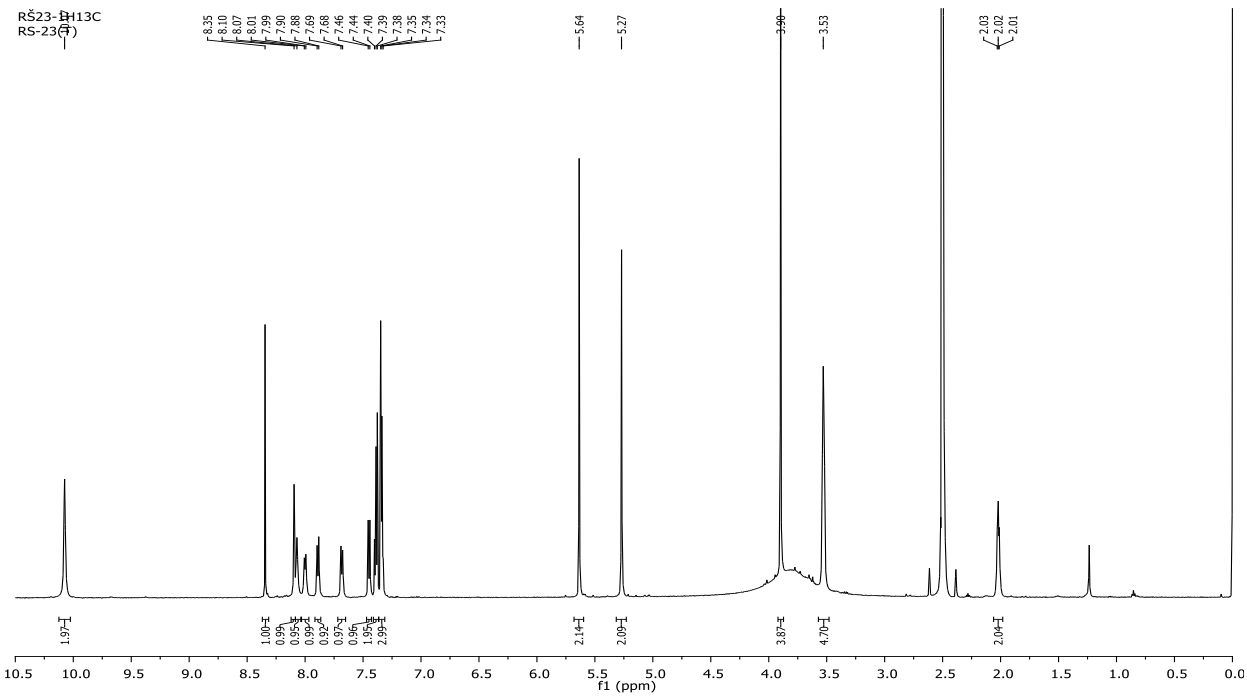
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18a**)



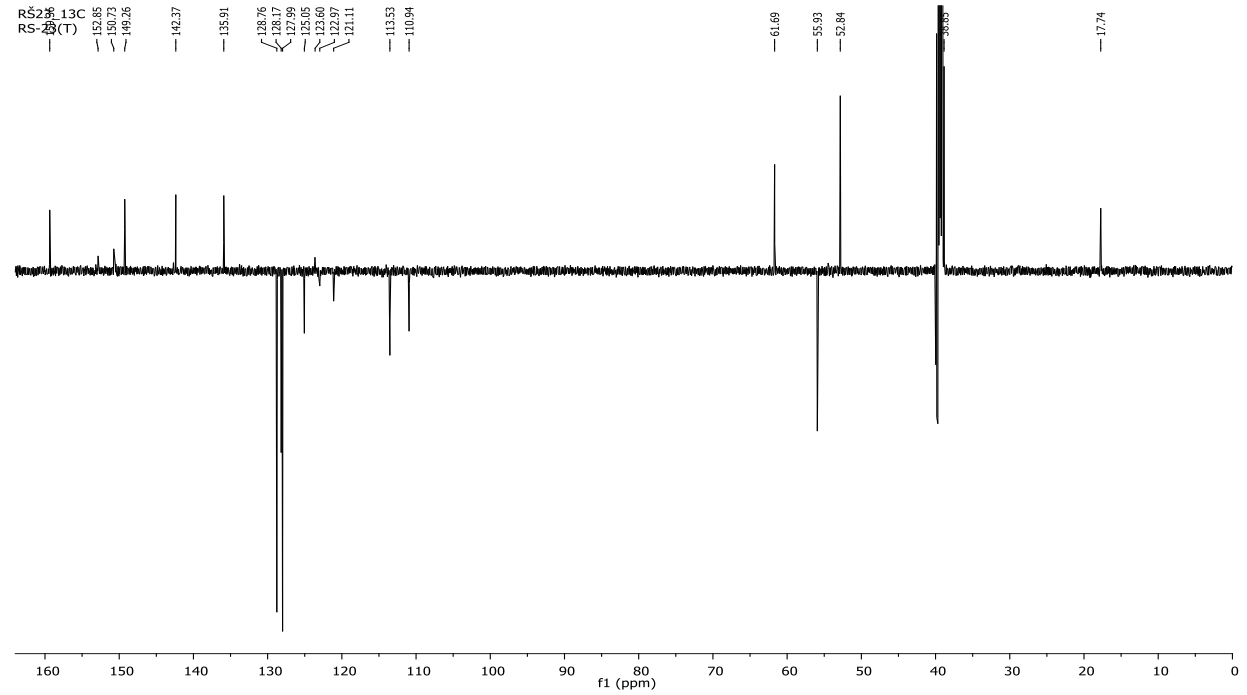
^{1}H NMR (600 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18b**)



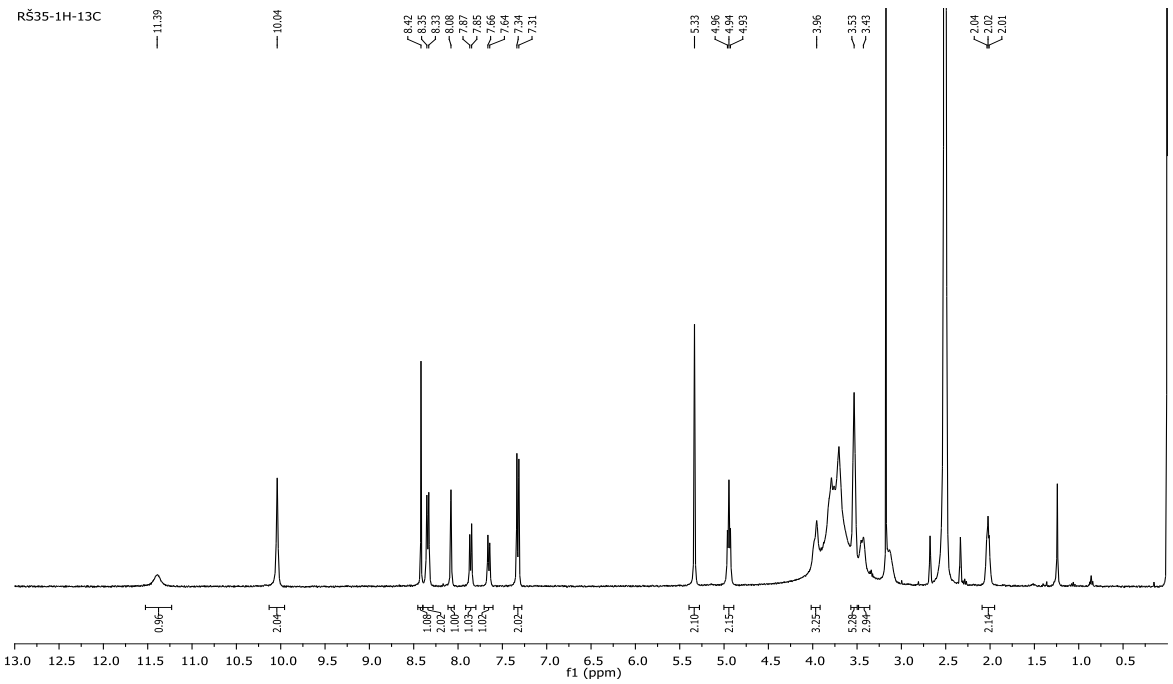
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)-3-fluorophenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18b**)



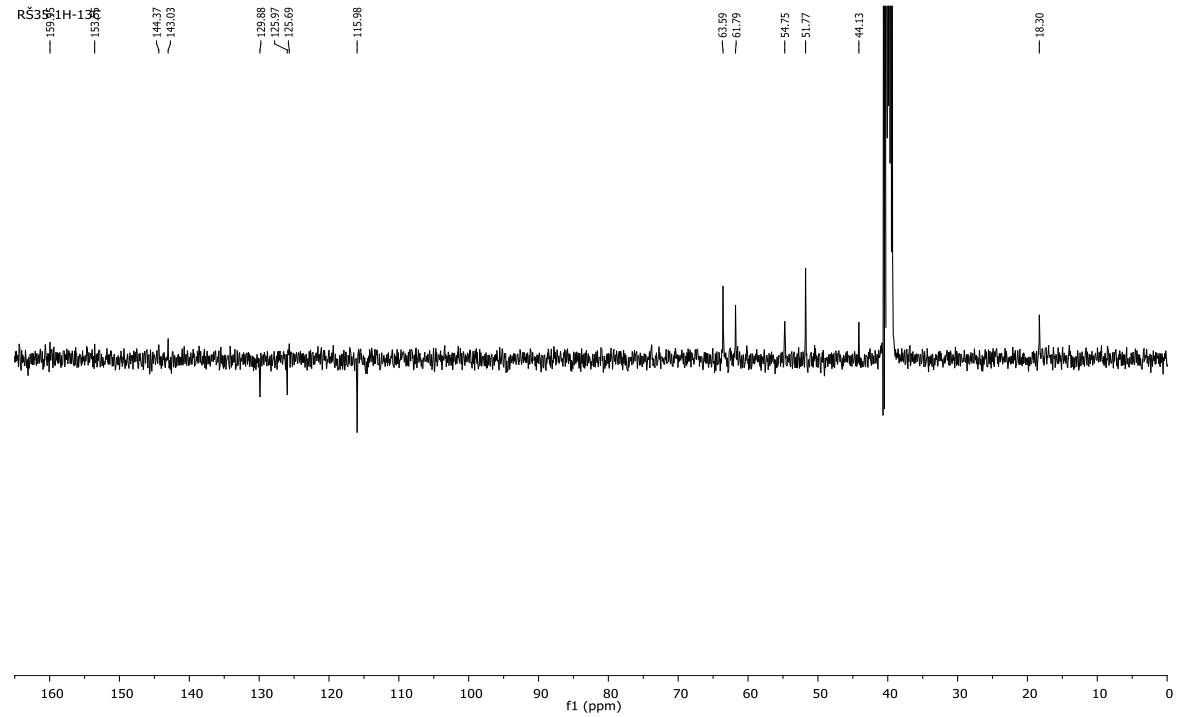
^{1}H NMR (600 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18c**)



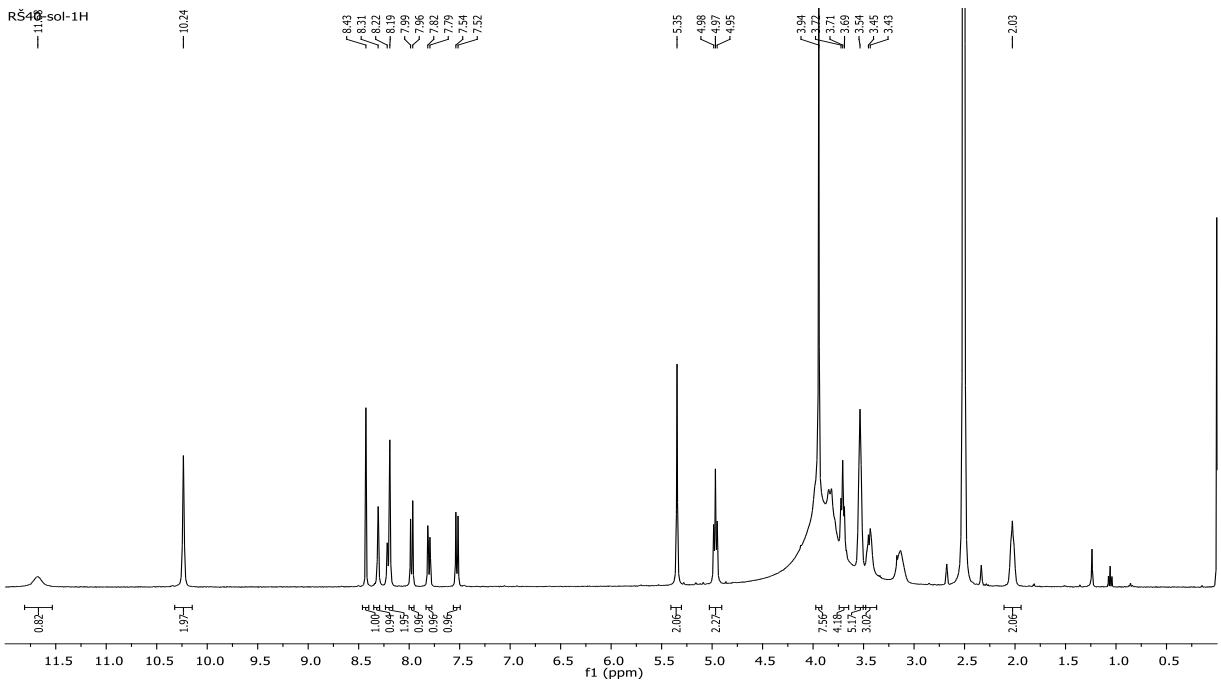
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole hydrochloride (**18c**)



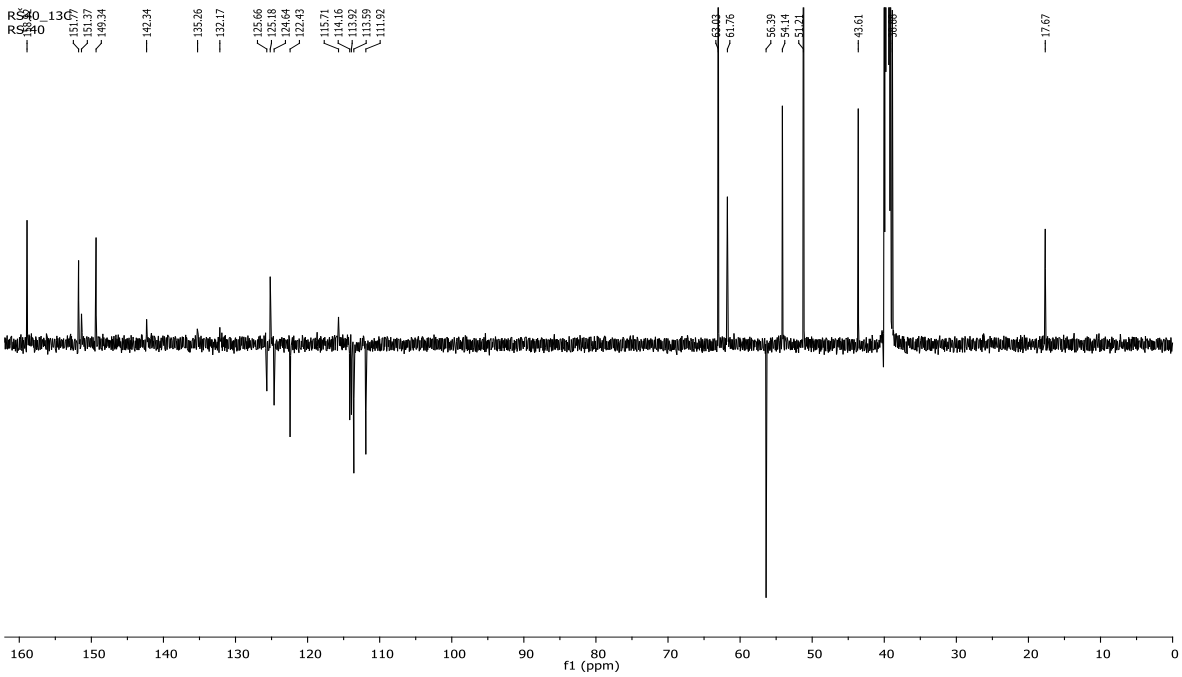
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(4-((1-(2-Morpholinoethyl)-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**19a**)



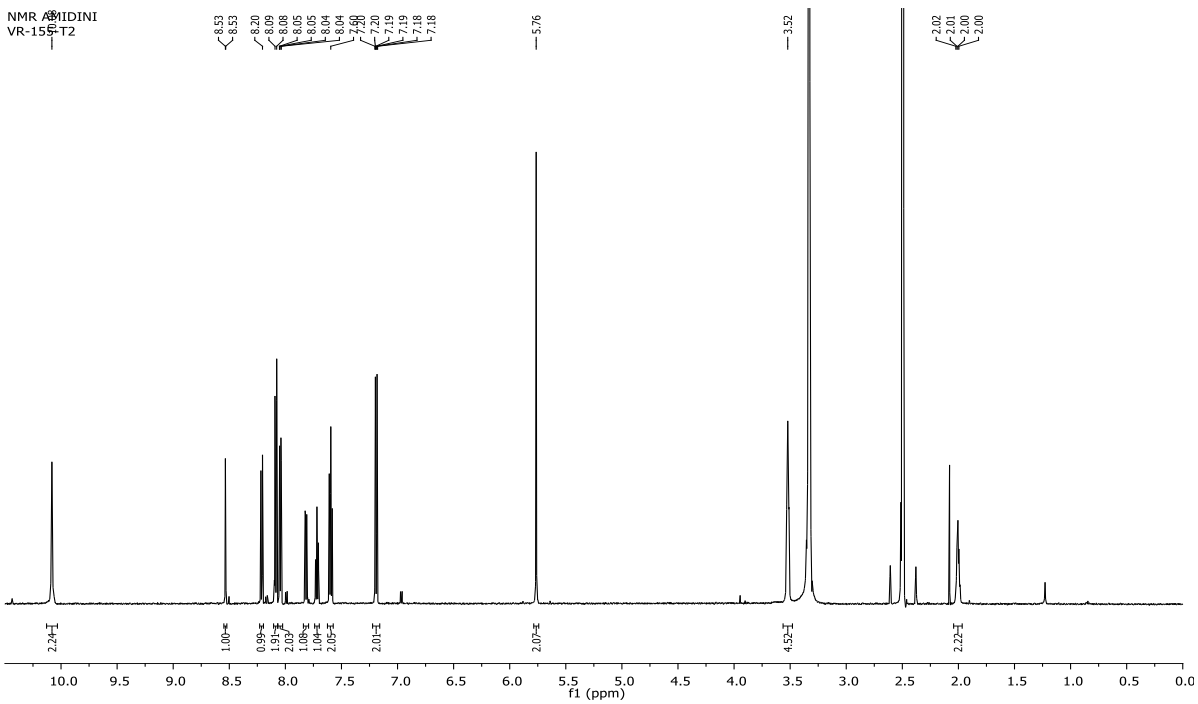
^{13}C NMR (101 MHz, DMSO) δ spectrum of 2-(4-((1-(2-Morpholinoethyl)-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**19a**)



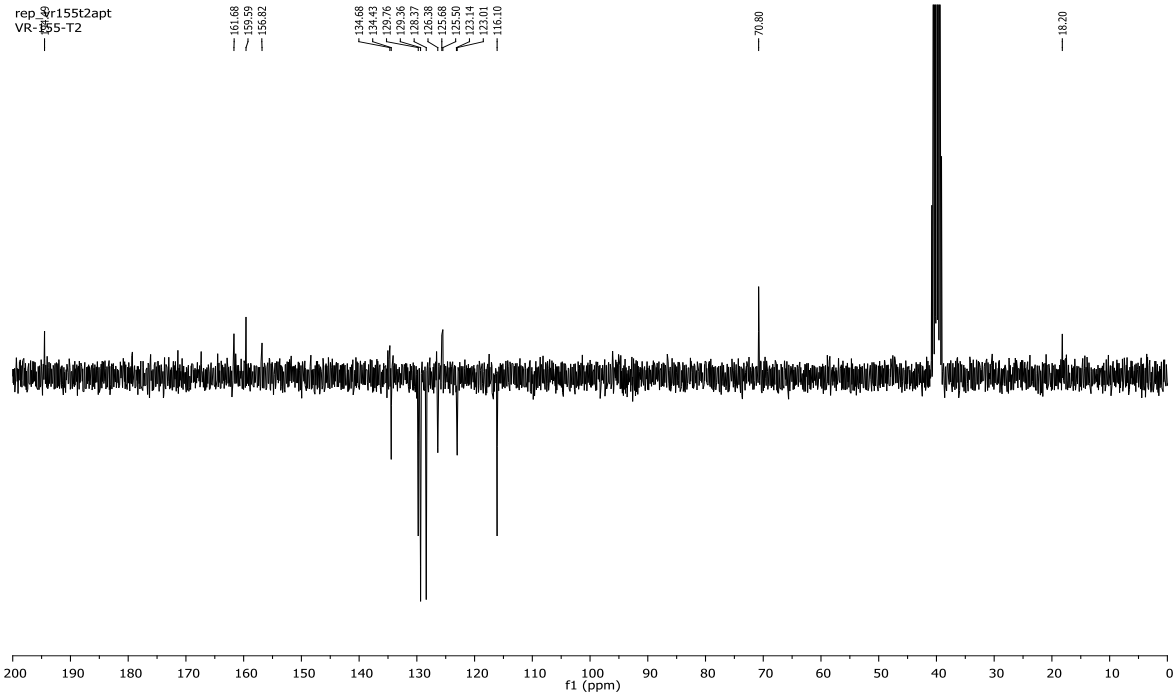
^{1}H NMR (400 MHz, DMSO) δ spectrum of 2-(4-((1-(2-Morpholinoethyl)-1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**19c**)



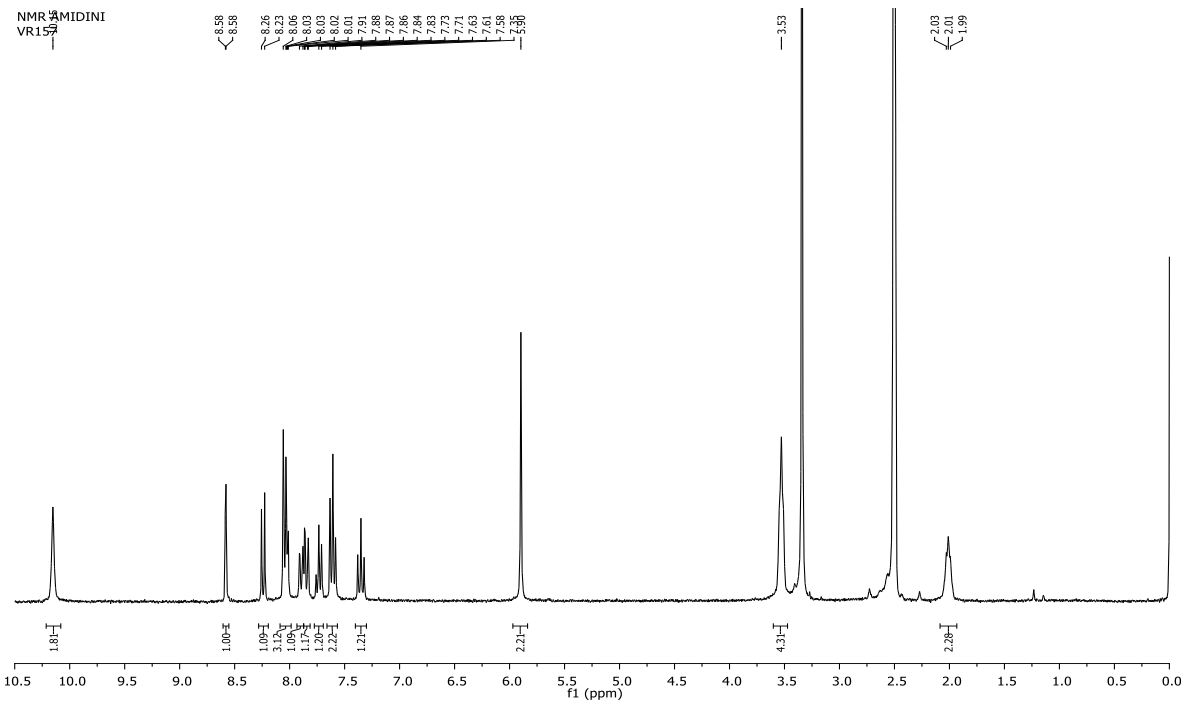
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(4-((1-(2-Morpholinoethyl)-1H-1,2,3-triazol-4-yl)methoxy)-3-methoxyphenyl)-5(6)-(3,4,5,6-tetrahydropyrimidin-2-yl)-1H-benzimidazole dihydrochloride (**19c**)



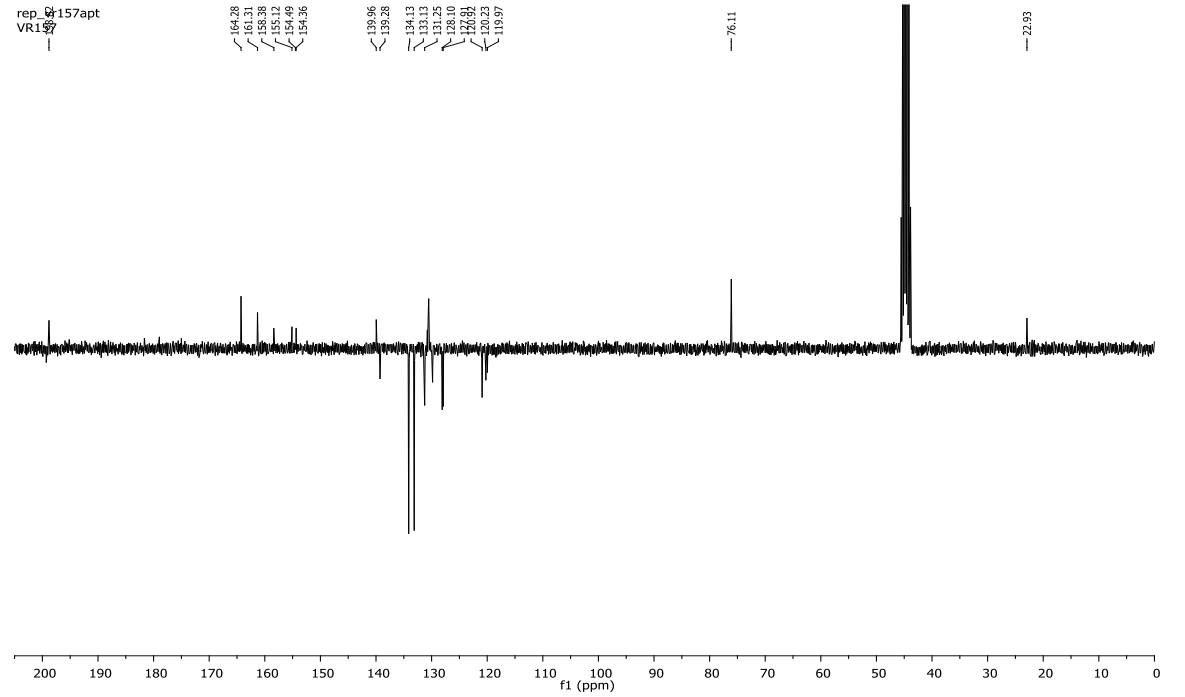
^{1}H NMR (600 MHz, DMSO) δ spectrum of 2-(4-(2-Oxo-2-phenylethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**21a**)



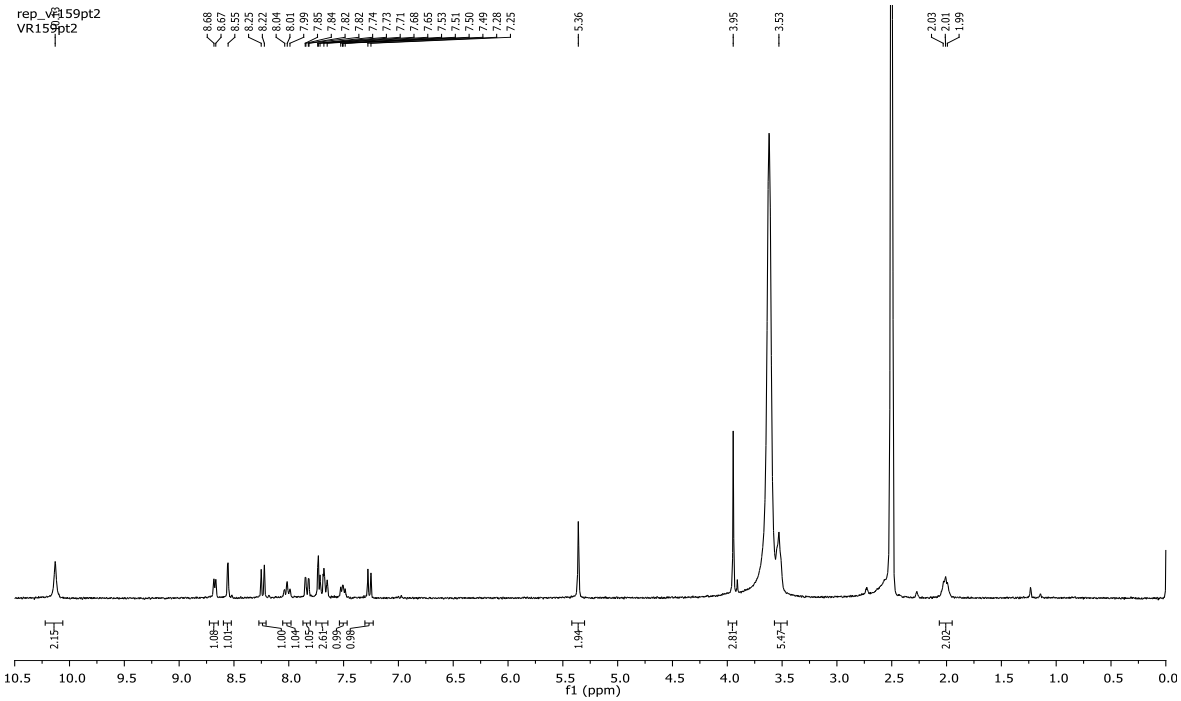
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-(2-Oxo-2-phenylethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**21a**)



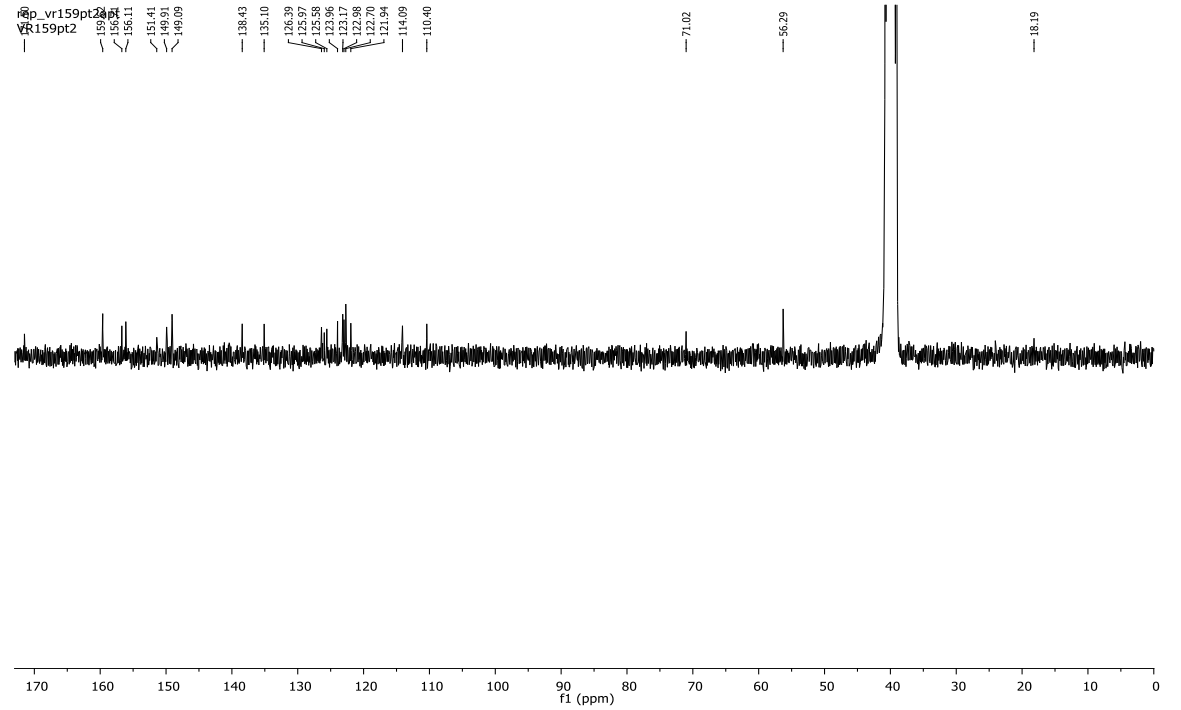
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-oxo-2-phenylethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**21b**)



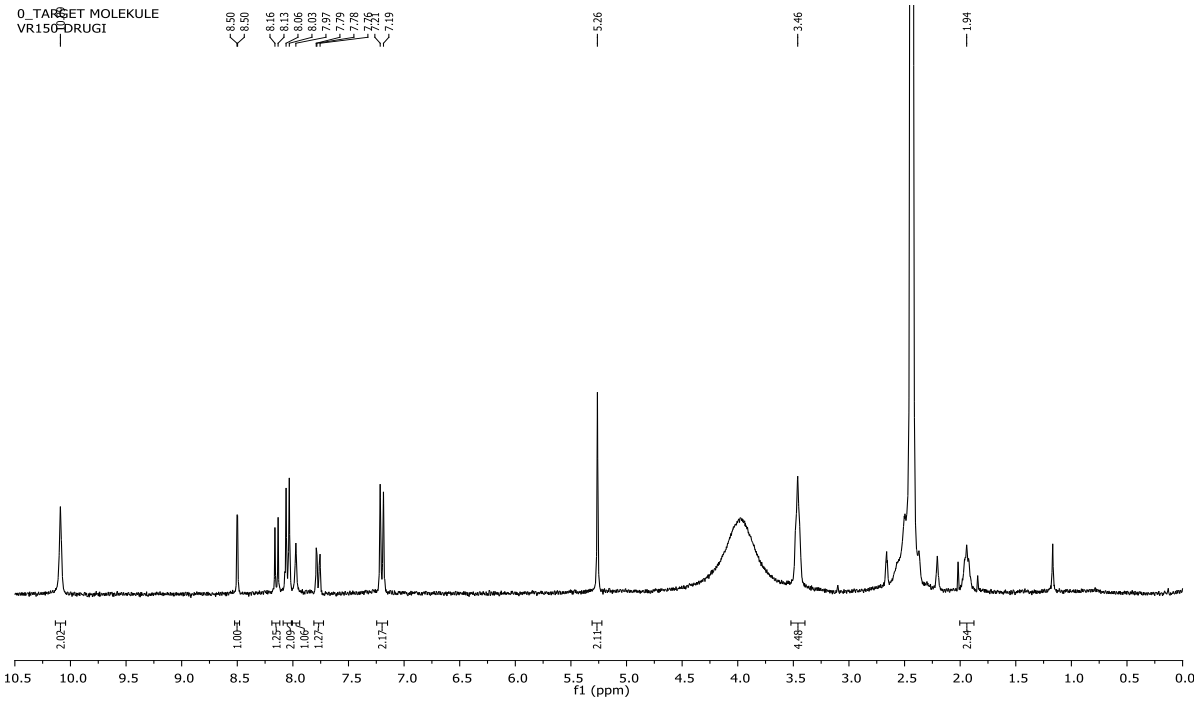
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-(2-oxo-2-phenylethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**21b**)



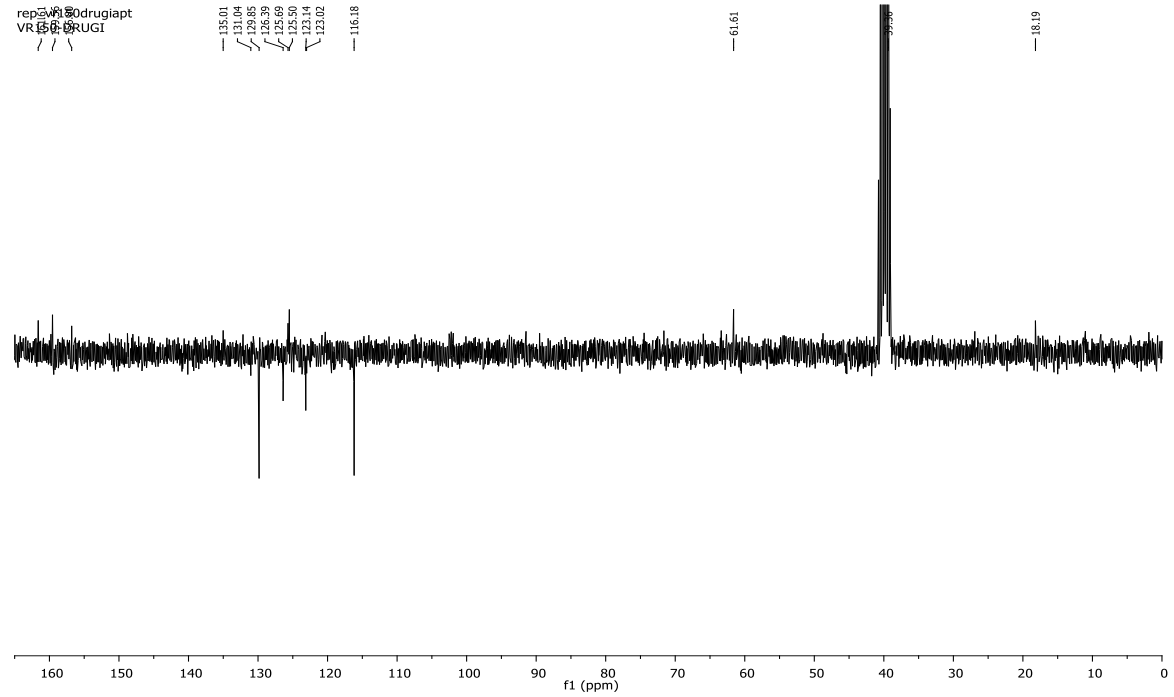
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(pyridin-2-ylmethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**22c**)



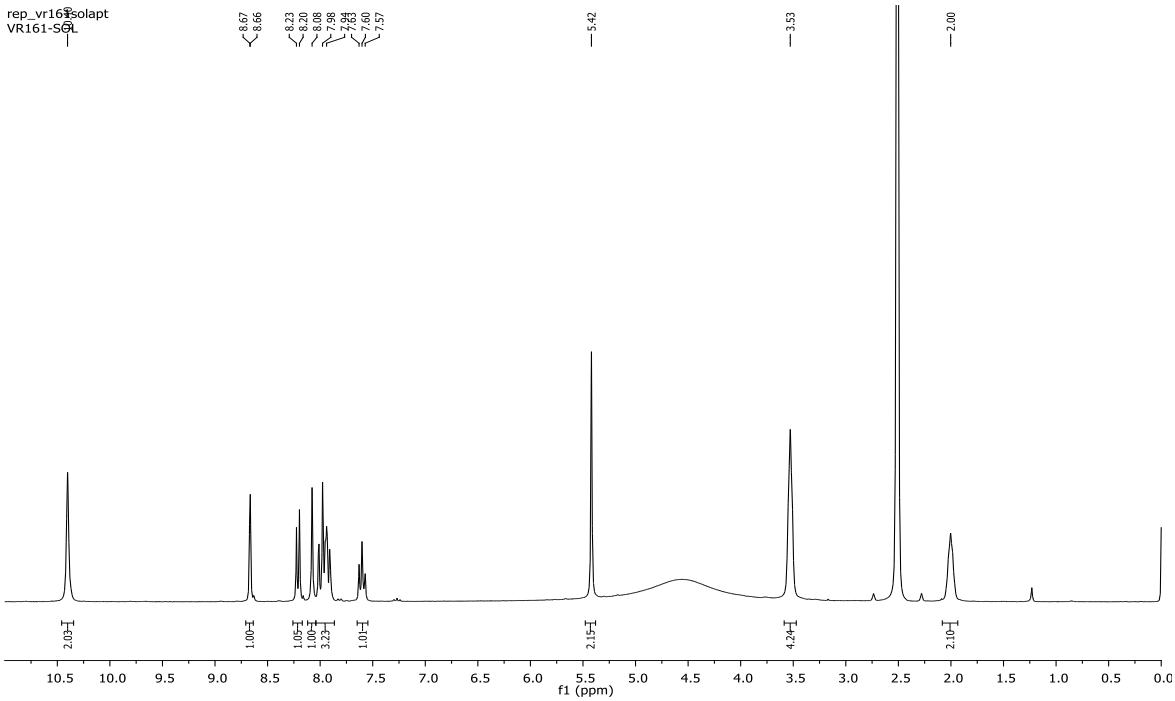
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-(pyridin-2-ylmethoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**22c**)



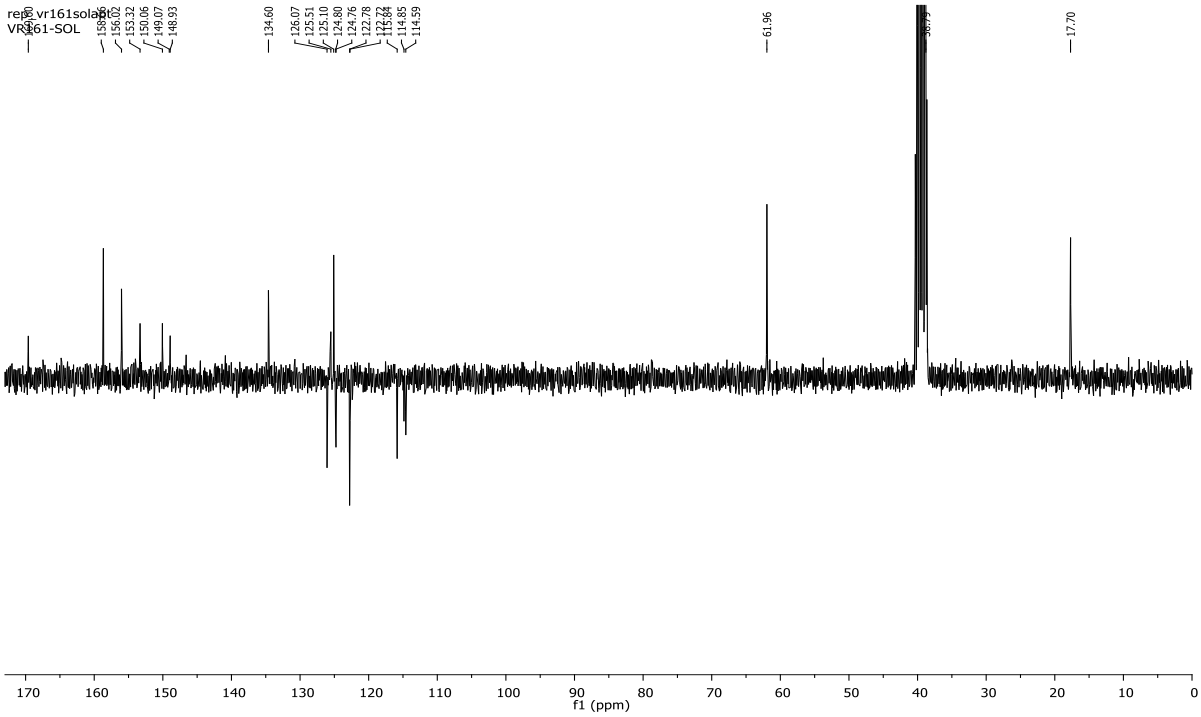
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23a**)



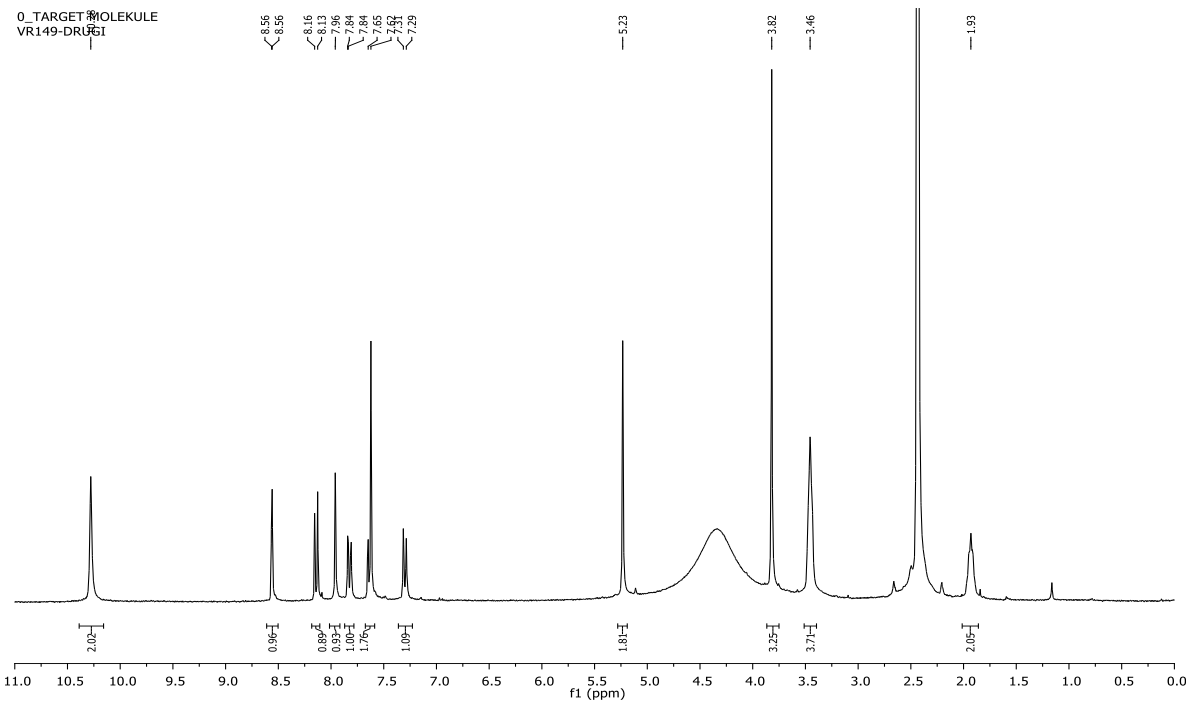
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23a**)



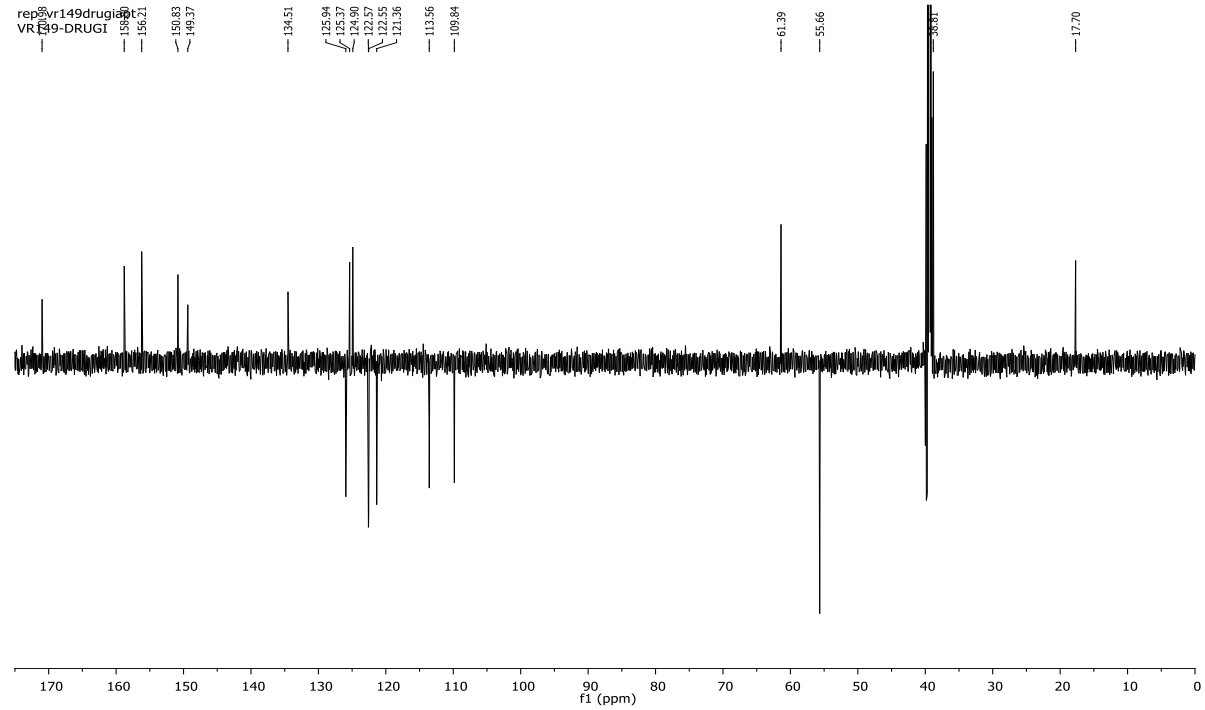
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23b**)



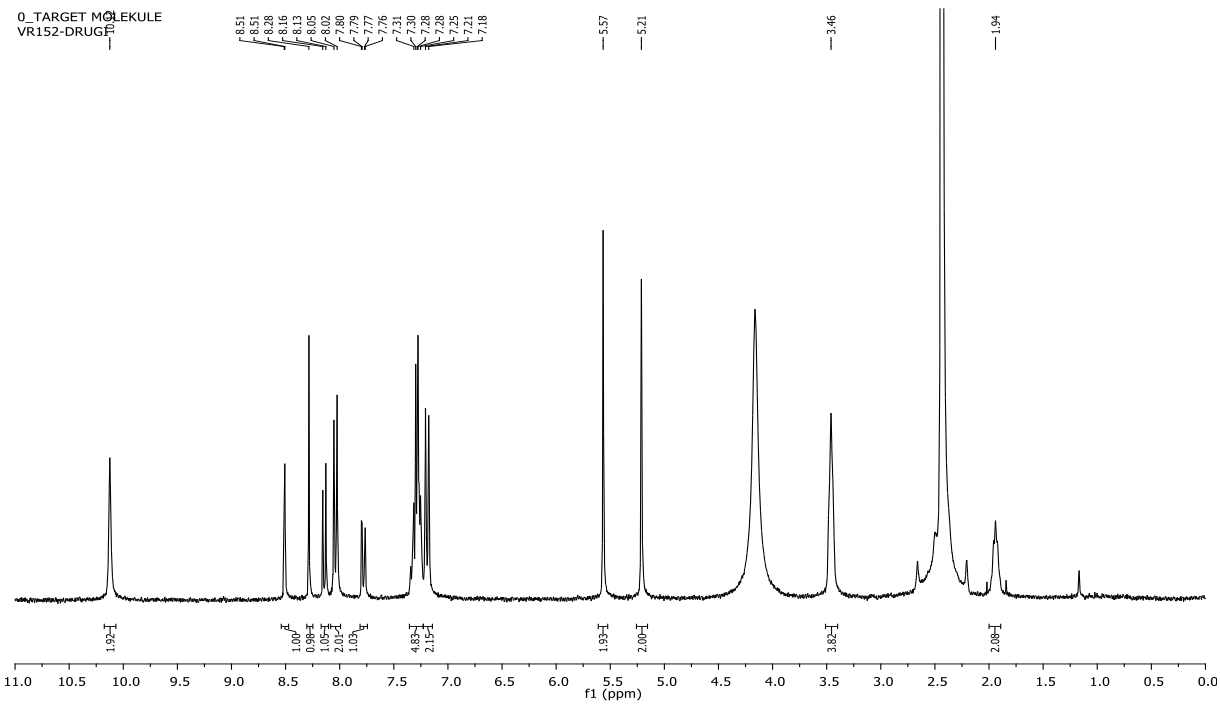
^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-Fluoro-4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23b**)



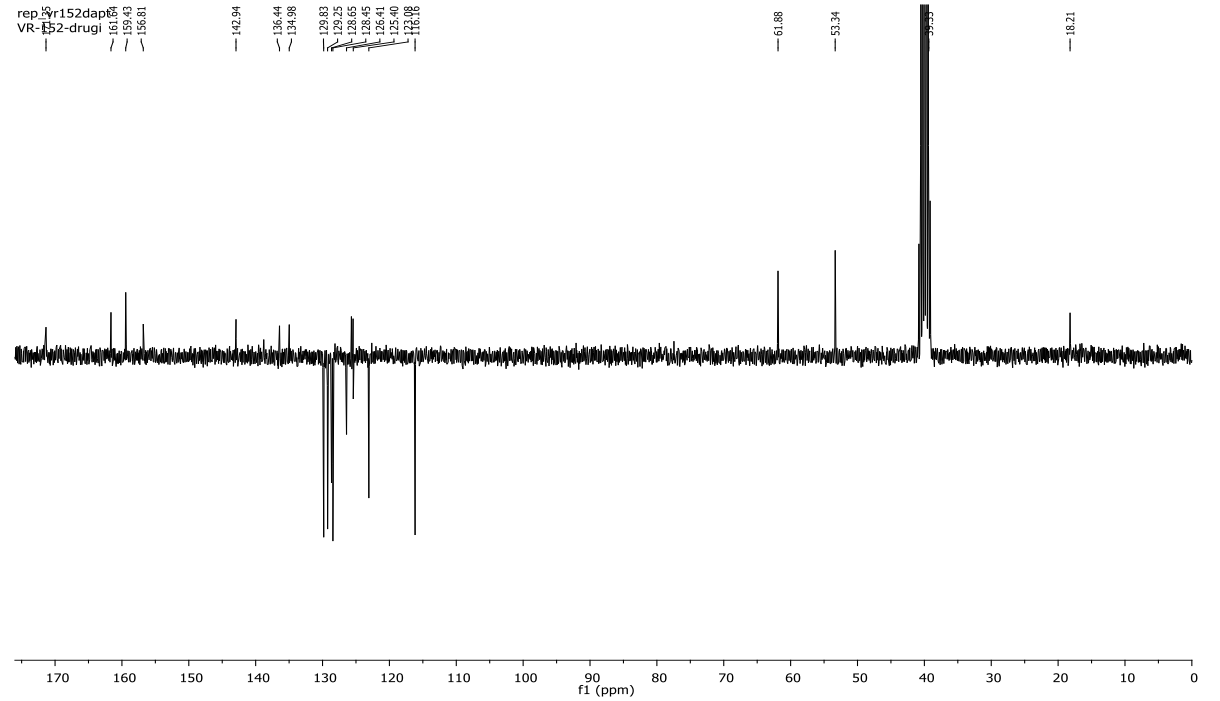
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23c**)



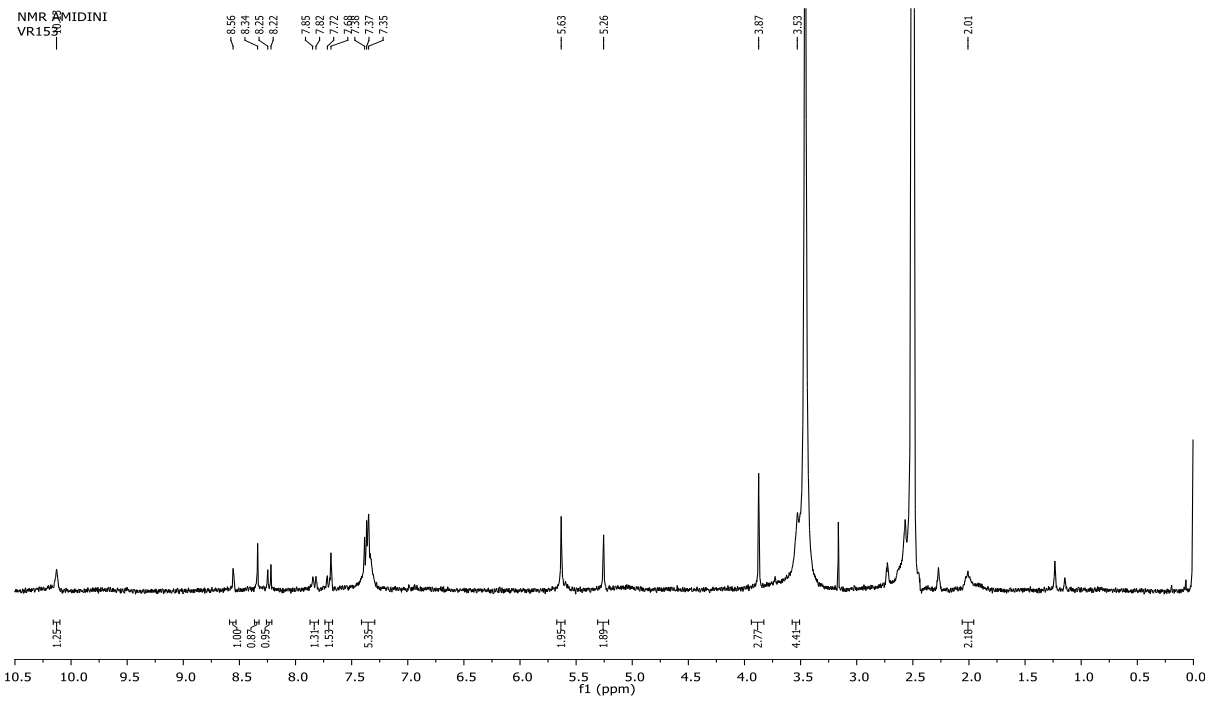
^{13}C NMR (151 MHz, DMSO) δ spectrum of 2-(3-Methoxy-4-((1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**23c**)



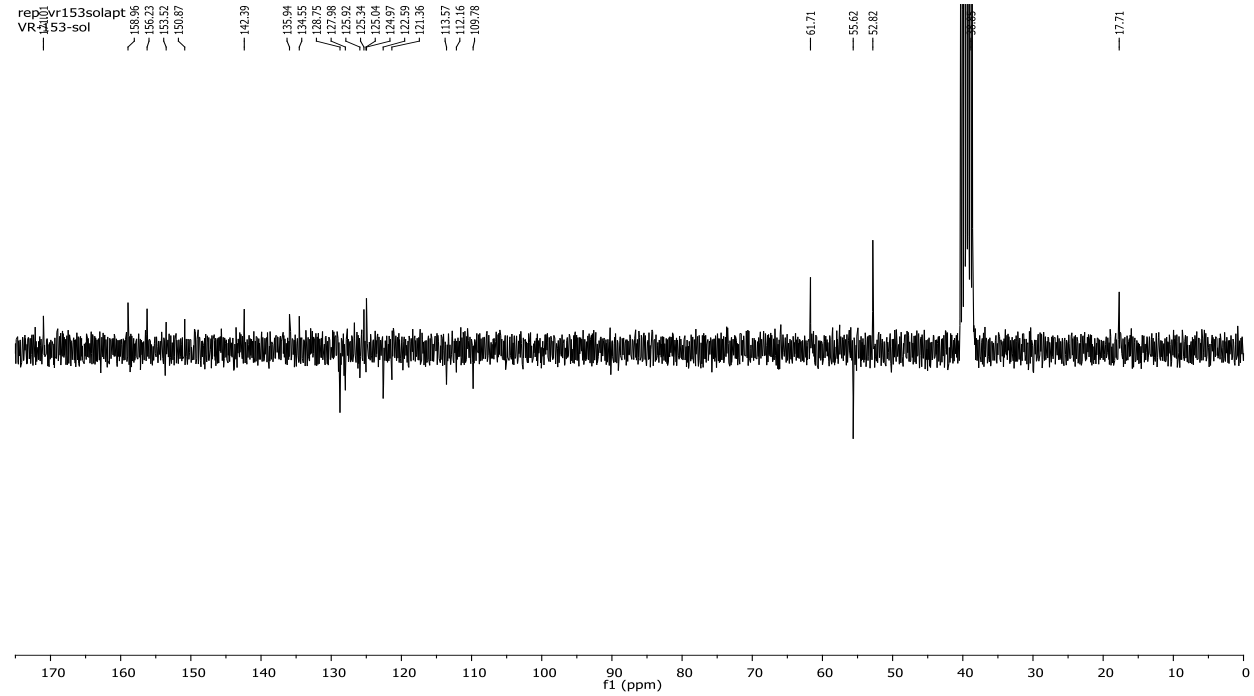
^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**24a**)



^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(4-((1-Benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**24a**)



^{1}H NMR (300 MHz, DMSO) δ spectrum of 2-(3-methoxy-4-((1-benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**24c**)



^{13}C NMR (75 MHz, DMSO) δ spectrum of 2-(3-methoxy-4-((1-benzyl-1H-1,2,3-triazol-4-yl)methoxy)phenyl)-6-(1,4,5,6-tetrahydropyrimidin-2-yl)benzothiazole hydrochloride (**24c**)