

Supplementary Material

Fluorous 1,2,3-Triazol-4-ylmethyl Amines and Amine Derivatives for Novel Surfactant Applications

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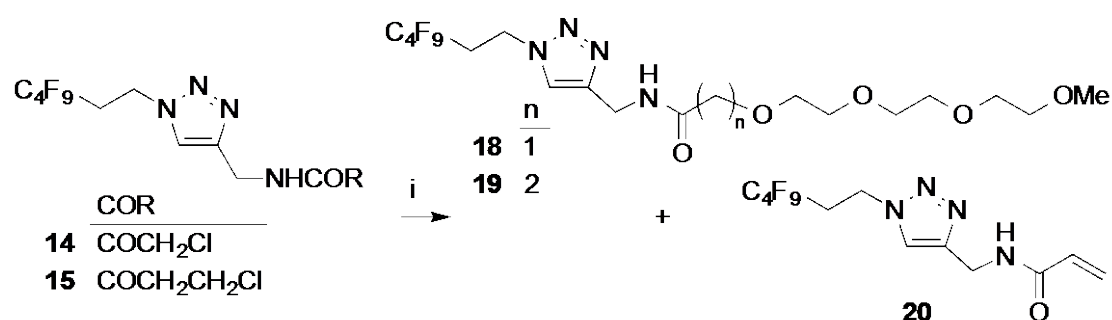
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Contents

Reaction of amides 14 and 15 with 2-(2-(2-methoxyethoxy)ethoxy)ethanol 17	3
Reaction of amine 10 with mesylate 21	4
Reaction of alcohol 31 with various oxidants	6
Reaction of aldehyde 34 with amine 36 in the presence of various reductants	7
¹ H NMR, ¹³ C NMR and mass spectra of reported compounds.....	8

Reaction of amides **14** and **15** with 2-(2-(2-methoxyethoxy)ethoxy)ethanol **17**



Reagents & conditions: i. MeO(CH₂CH₂O)₃H **17**, base, THF, ambient or reflux, 16 h

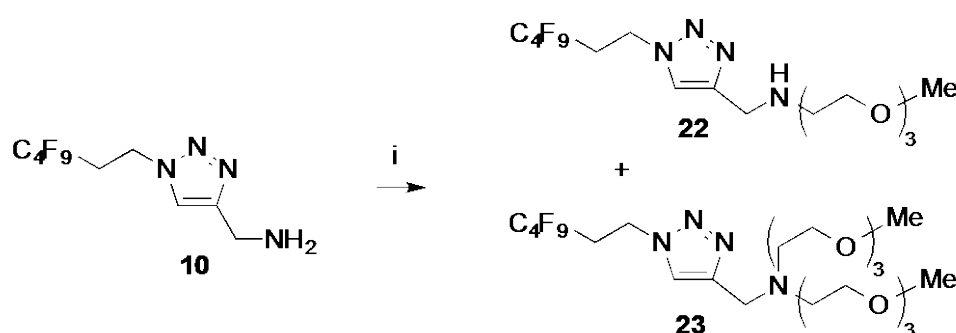
Chloroamide	Alcohol 17 / mol equiv	Base (mol equiv)	Reaction Temperature	Products (Isolated Yield)	
				Substitution	+ Elimination
14	1.1	KHMDS (1.5)	r.t.	18 (43%)	–
14	1.1	KHMDS (1.5)	reflux	18 (28%)	–
15	1.1	KHMDS (1.1)	r.t.	–	20 (48%)
15	1.0	KHMDS (2.0)	r.t.	–	20 (48%)
15	2.0	DMAP (1.0)	r.t.	19 (55%)	20 (3%)
15	2.0	DMAP (1.0)	reflux	19 (22%)	20 (3%)

Scheme 1

Dry 2-(2-(2-methoxyethoxy)ethoxy)ethanol **17** was dissolved in dry THF (10 mL), the solution stirred under nitrogen at 0°C for 15 min then base (6.07 mL of a 0.5 M solution in toluene of either KHMDS or DMAP) was added dropwise by syringe over 0.5 min, and the mixture was allowed to warm to r.t. After 40 mins, the reaction mixture was transferred by syringe over 0.5 min into a solution of amide in dry THF (10 mL) at 0°C under nitrogen. The reaction mixture was allowed to warm to r.t. and stirred at ambient temperature or at reflux for 16 h. The reaction mixture was quenched with sat. aq. NH₄Cl (20 mL) and the resulting mixture was extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with brine (2 x 50 mL), dried over MgSO₄ and the solvent was evaporated under reduced pressure. The residue was flash chromatographed on reverse-phase fluorosilica gel using a H₂O:MeOH – MeOH gradient.

Compounds **18** and **19** were obtained from fluoruous silica gel, but could not be made pure. The acrylate **20** was obtained after chromatography on fluoruous silica gel as a fine solid that was characterised by accurate mass measurement through HR-MS (ESI) (see the Experimental section in the main text).

Reaction of amine **10** with mesylate **21**



Reagents & conditions: i. 1 equiv MeO(CH₂CH₂O)₃SO₂Me **21**, base, conditions as below.

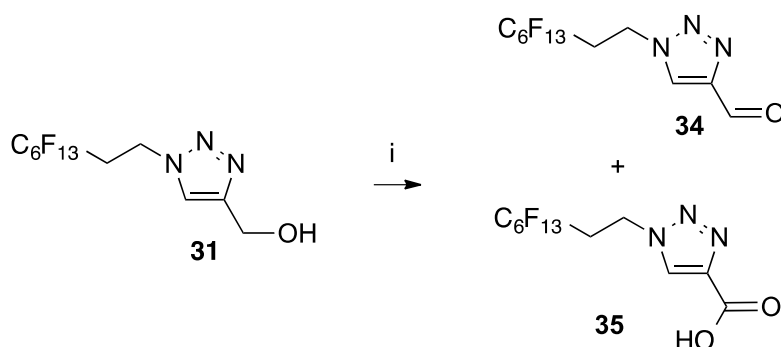
Solvent	Conditions	Base	Ratio 10 : 22 : 23
MeCN	r.t. (2 h), then reflux (16 h)	K ₂ CO ₃	1 : 2 : 1
Perfluorohexane	r.t. (16 h)	NEt ₃	1 : 2 : 1
DMF	40°C (16 h)	K ₂ CO ₃	1 : 2 : 1

Scheme 2

Base (K₂CO₃ (0.48 g) or NEt₃ (0.37 mL), 2.70 mmol) and amine **10** (1.20 g, 2.70 mmol) were stirred together in solvent (20 mL) at r.t. for 30 min, before the dropwise addition of a solution of the mesylate **21** (0.58 g, 2.70 mmol) in solvent (5 mL) over a period of 1 min. The reaction mixture was either (i) stirred at r.t. for 2 h, then heated at reflux for an additional 16 h, (ii) stirred at r.t. for 16 h or (iii) stirred at 40°C for 16 h before quenching the reaction with brine (25 mL). The product was extracted with EtOAc (3 x 20 mL), and the combined organic layers were dried over MgSO₄. The solvent was removed under reduced pressure to give a pale yellow powder, which was identified as a mixture of primary amine **10**, secondary

amine **22** and tertiary amine **23** using ^1H NMR spectroscopy. The outcome was independent of the conditions used.

Reaction of alcohol **31** with various oxidants



Reagents & conditions: i. as listed below.

Oxidant ^a	Solvent ^b	Conditions	Conversion ^c
PDC	CH ₂ Cl ₂	r.t. (16 h)	0
PDC	BTF	r.t. (16 h)	0
CrO ₃ /H ₂ SO ₄	CH ₃ COCH ₃	0°C (30 min)	20% 34 , 58% 35
DMP	DMSO	60°C (16 h)	55% 35
MnO ₂	MeCN	r.t. (16 h)	7% 34
MnO ₂	BTF	r.t. (48 h)	16% 34
MnO ₂	BTF	85°C (16 h)	19% 34
MnO ₂	BTF	103°C (16 h)	100% 34 ^d

^aPDC = pyridinium dichromate, DMP = Dess-Martin periodinane

^bBTF = benzene trifluoride

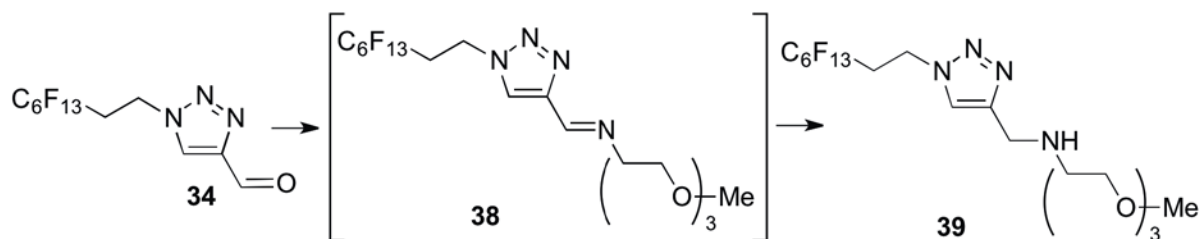
^cRemainder was unreacted **31**, which could be recovered quantitatively in first two cases.

^dIsolated yield = 89%

Scheme 3

To a mixture of alcohol **31** (8.39 g, 18.9 mmol) in the solvent specified (50 mL) was added the oxidant (*ca.* 5 eq.). The reaction mixture was treated as outlined above, filtered through Celite in the case of the MnO₂ reactions, and the solvent evaporated under reduced pressure. ¹H NMR spectroscopic analysis of the crude reaction mixtures was used to determine the extent of conversion, particularly noting signals at *d* 8.0 (**31**), 8.06 (**34**) and 8.18 (**35**). For the case where 100% conversion of the starting material was noted, recrystallization of the crude material from EtOAc/hexane (1:19) gave 1-(2-perfluorohexylethyl)-1H-1,2,3-triazole-4-carbaldehyde **34** as a white powder (7.39 g, 89%). See main text for full characterisation.

Reaction of aldehyde **34** with amine **36** in the presence of various reductants



Reagents & conditions: as described below



Reductant (mol equiv)	Reagents & conditions	Yield of 39 / %
NaBH(OAc) ₃ (1.4)	i) THF, 36 , reductant, reflux, 16 h	0 ^a
NaBH(OAc) ₃ (1.4)	i) THF, 36 , reductant, r.t., 48 h	0 ^a
NaBH(OAc) ₃ (1.4)	i) THF, 36 , r.t., 16 h, N ₂	0 ^b
	ii) reductant, 0°C, 15 min, N ₂	
	iii) reflux, 16 h, N ₂	
NaBH(OAc) ₃ (1.4)	i) THF, 36 , AcOH (3 equiv) reflux, 30 min, N ₂	0 ^b
	ii) reductant, 0°C, 15 min, N ₂	
	iii) reflux, 16 h, N ₂	
NaBH(OAc) ₃ (1.4)	i) THF, 36 , reflux, 1 h	0 ^b
	ii) reductant, 0°C, 15 min	
	iii) r.t., 16 h	
NaBH ₄ (2.0)	i) THF, 36 , reflux, 1 h	0 ^c
	ii) reductant, 0°C, 15 min	
	iii) r.t., 16 h	
NaBH ₄ (2.0)	i) EtOH, 36 , reflux, 1 h	100
	ii) reductant, 0°C, 15 min	
	iii) r.t., 16 h	
NaBH ₄ (0.5)	i) EtOH, 36 , reflux, 1 h	67
	ii) reductant, 0°C, 15 min	
	iii) r.t., 16 h	
NaBH ₄ (1.0)	i) EtOH, 36 , reflux, 1 h	100
	ii) reductant, 0°C, 15 min	
	iii) r.t., 16 h	

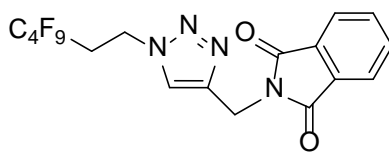
^aOnly reduction of aldehyde **34** to the corresponding alcohol **31** was noted.

^bInseparable mixture of the imine **38** and the desired amine **39**.

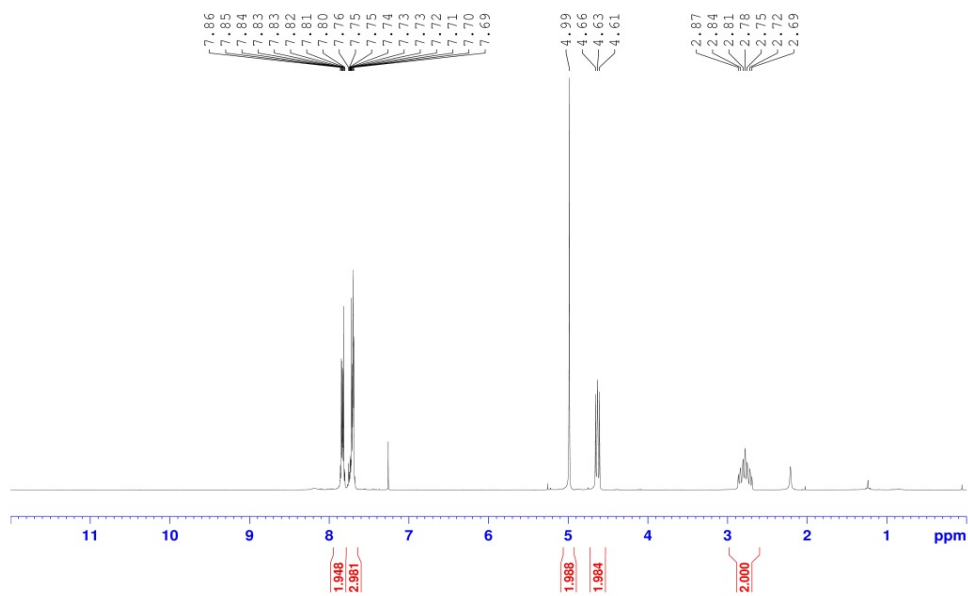
^cImine **38** was noted.

Scheme 4

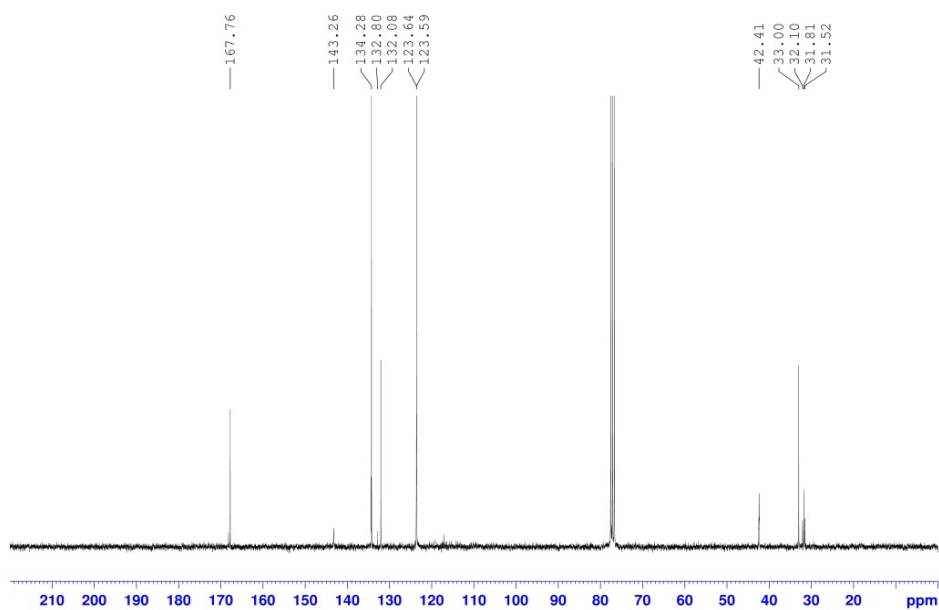
^1H NMR, ^{13}C NMR and mass spectra of reported compounds



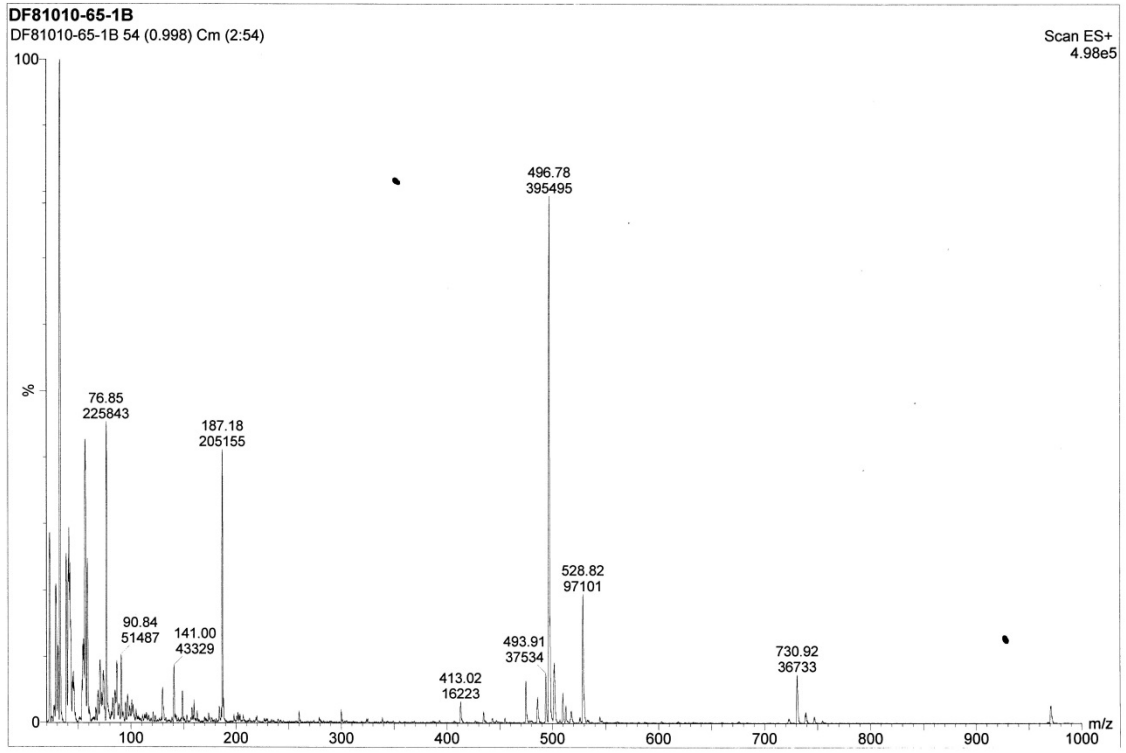
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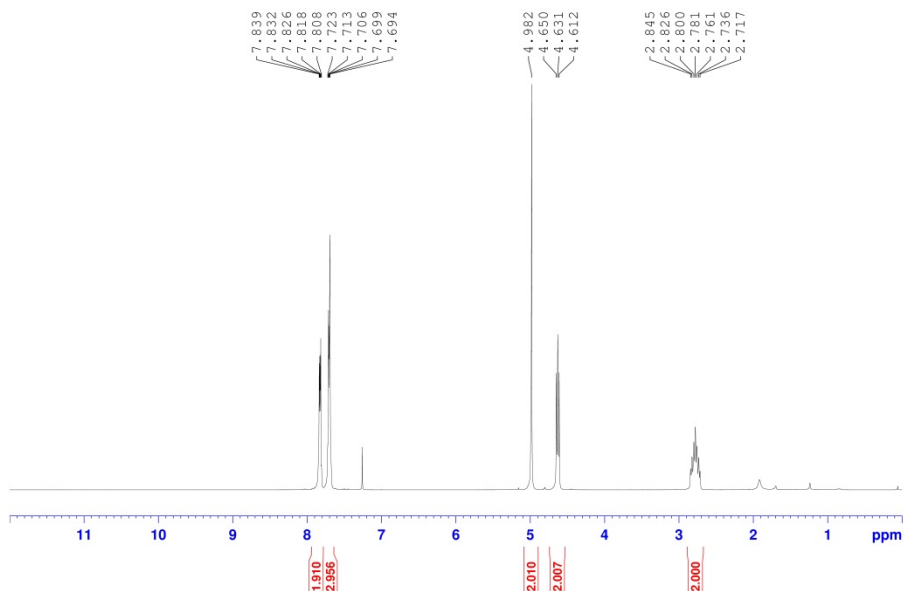
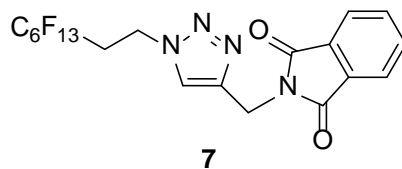
^1H NMR (400 MHz, CDCl_3)



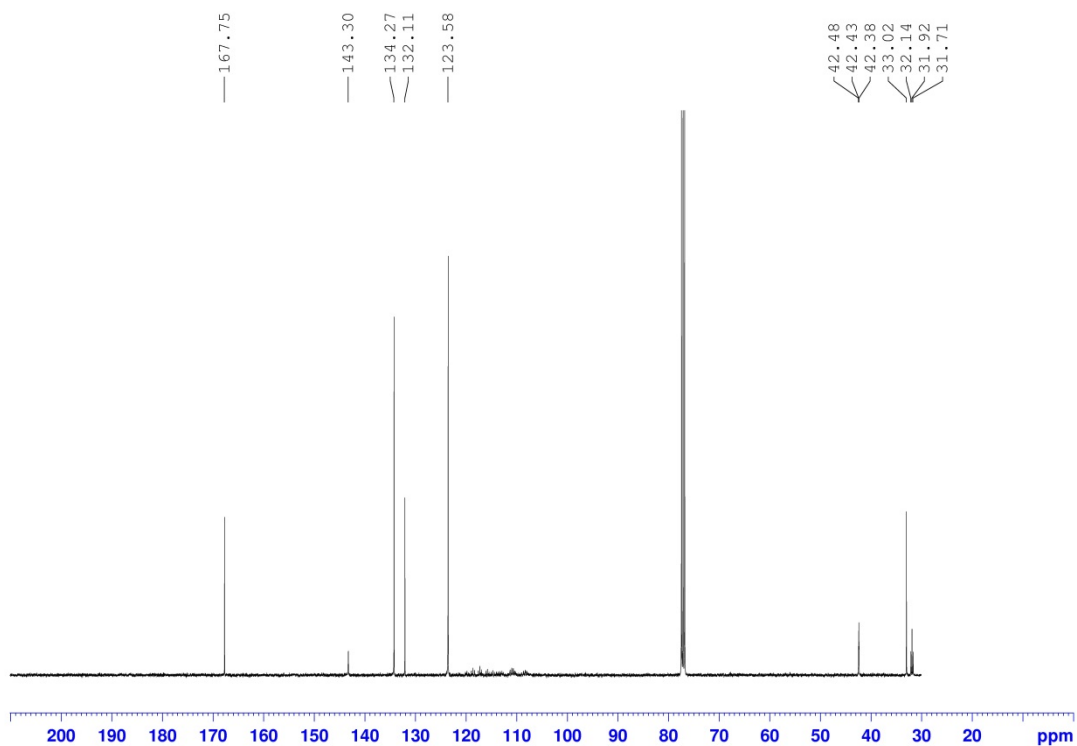
^{13}C NMR (100 MHz, CDCl_3)



Low resolution MS (MeOH)



¹H NMR (400 MHz, CDCl₃)

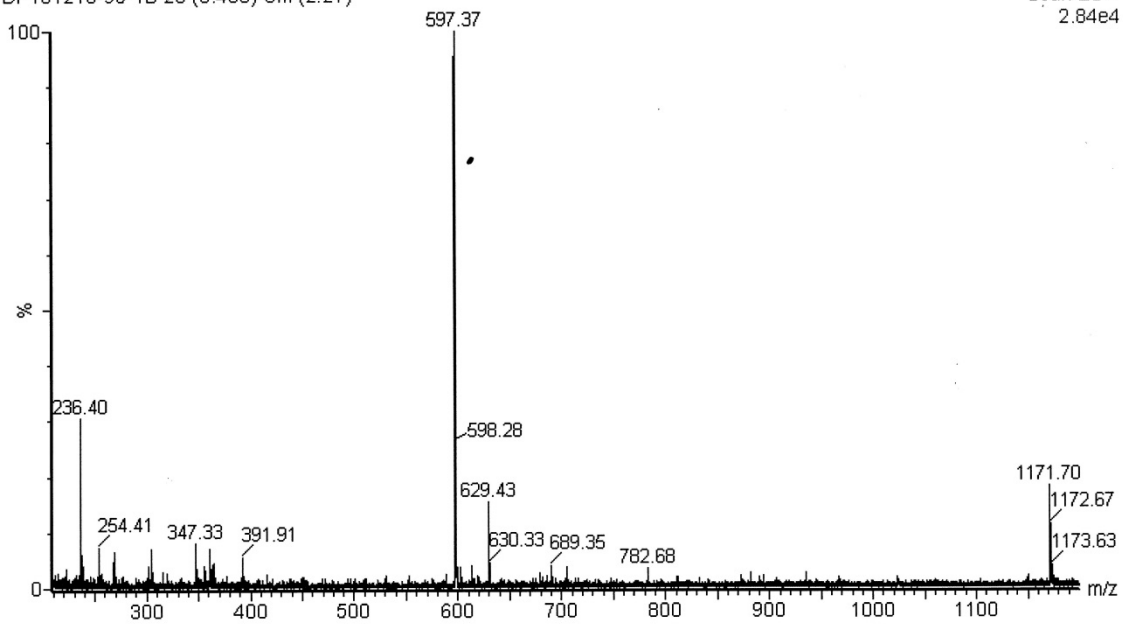


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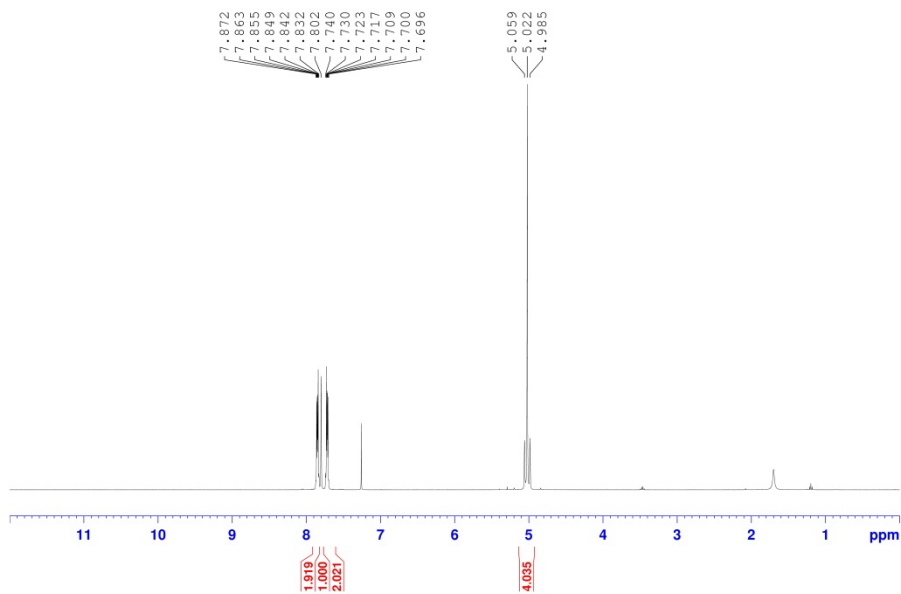
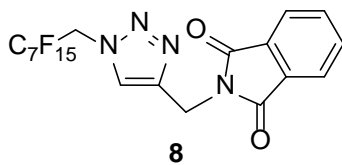
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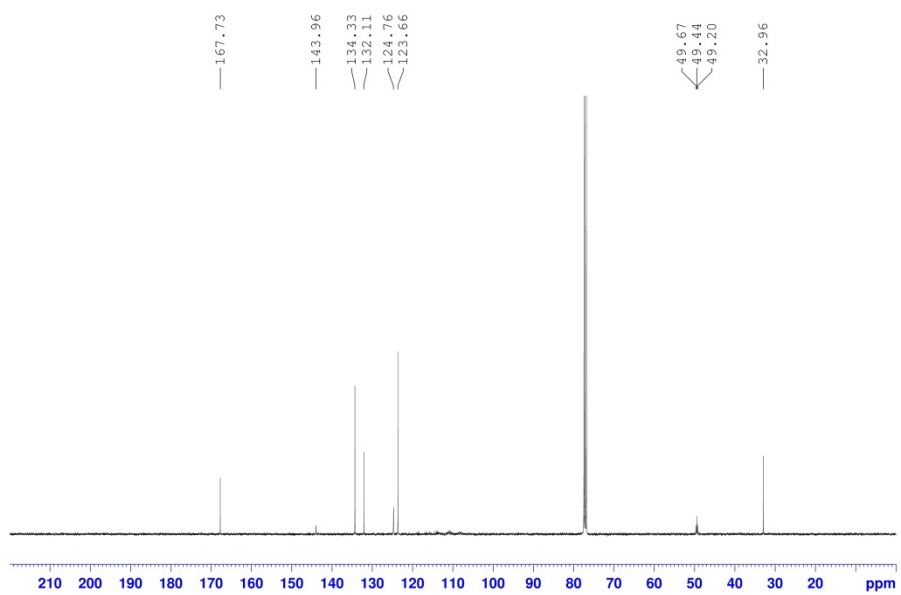
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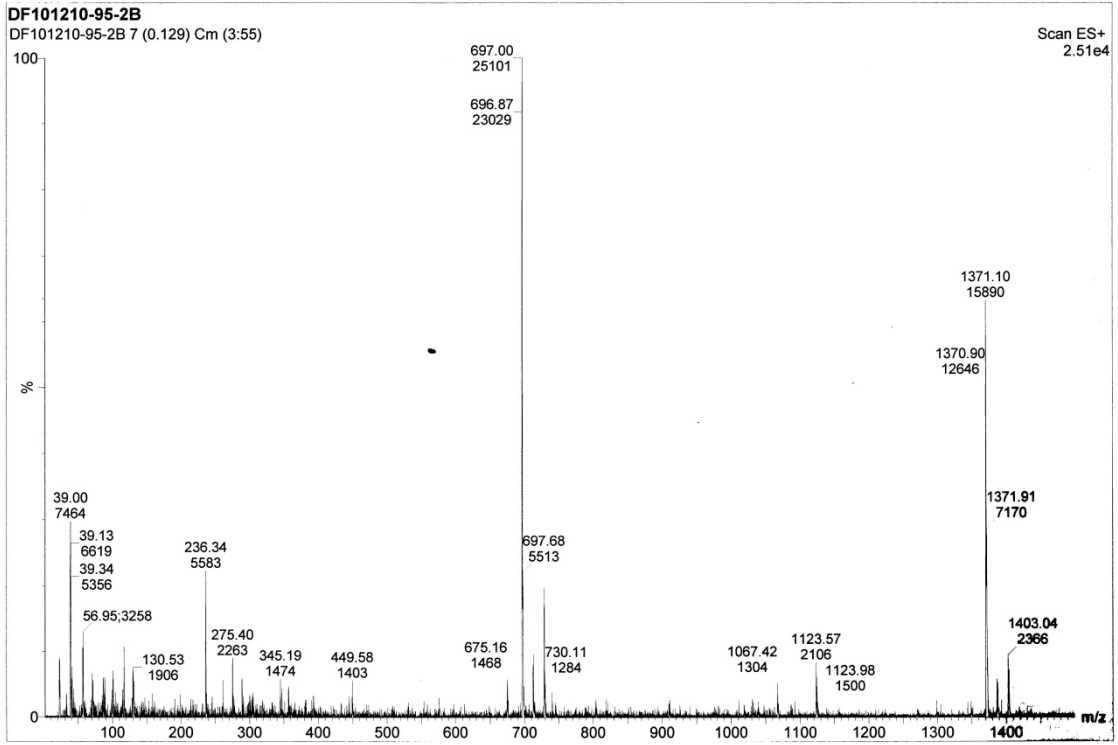
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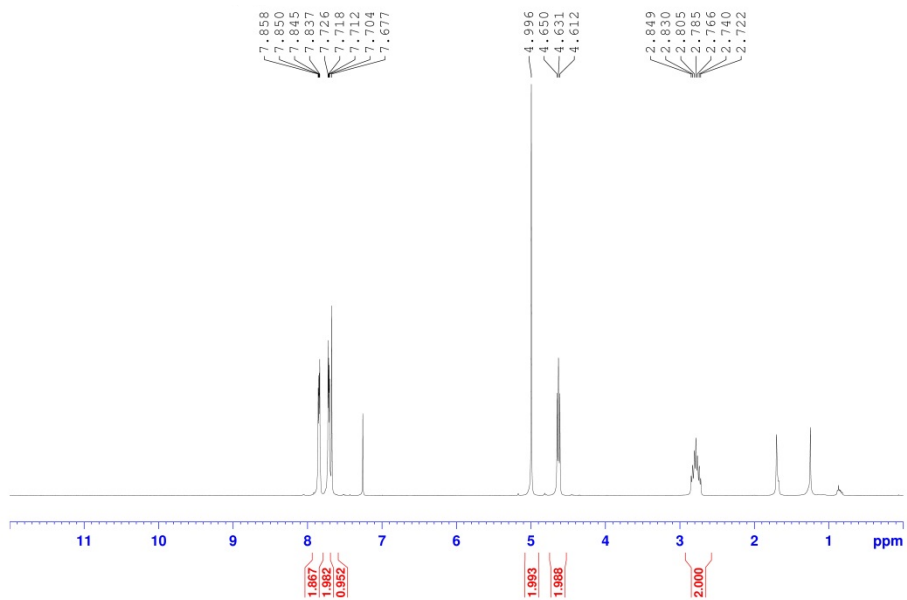
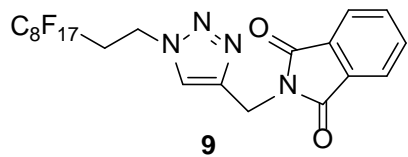
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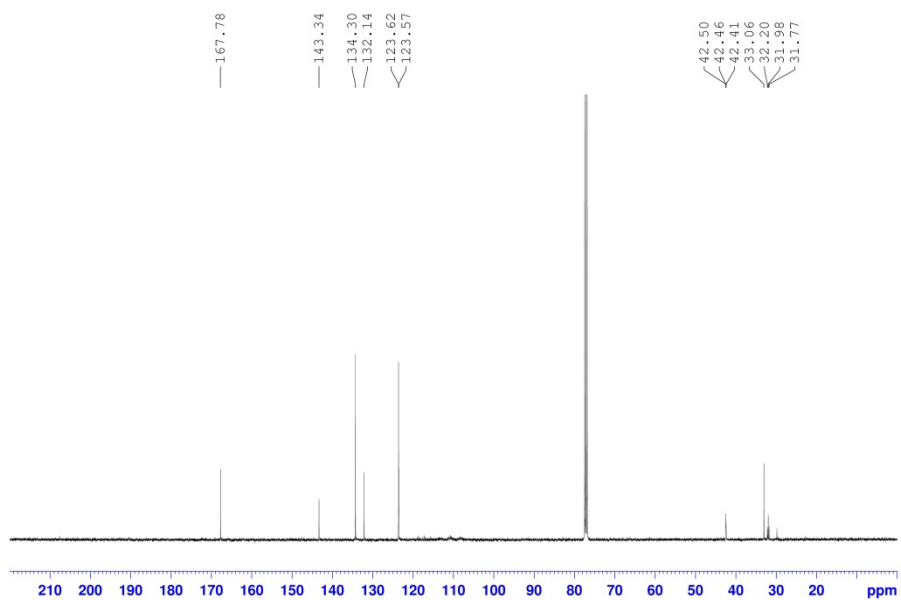
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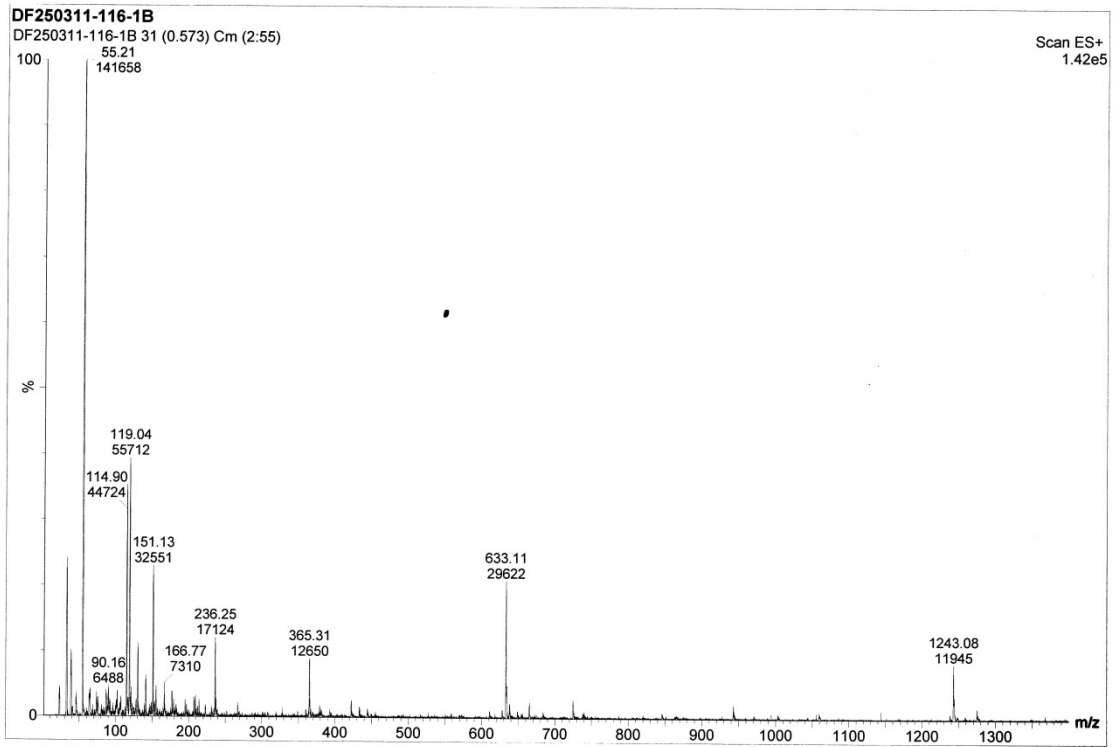
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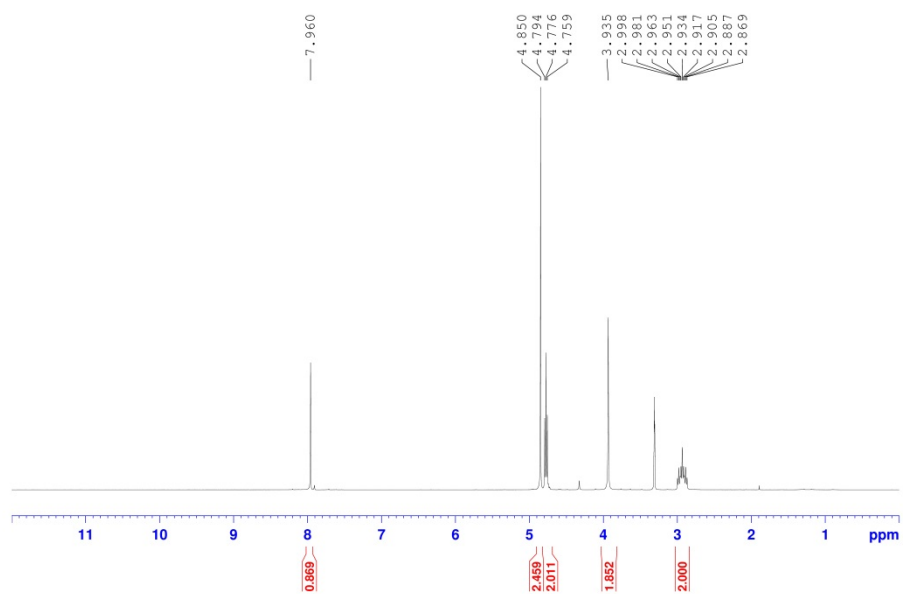
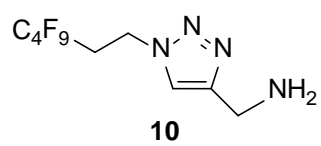
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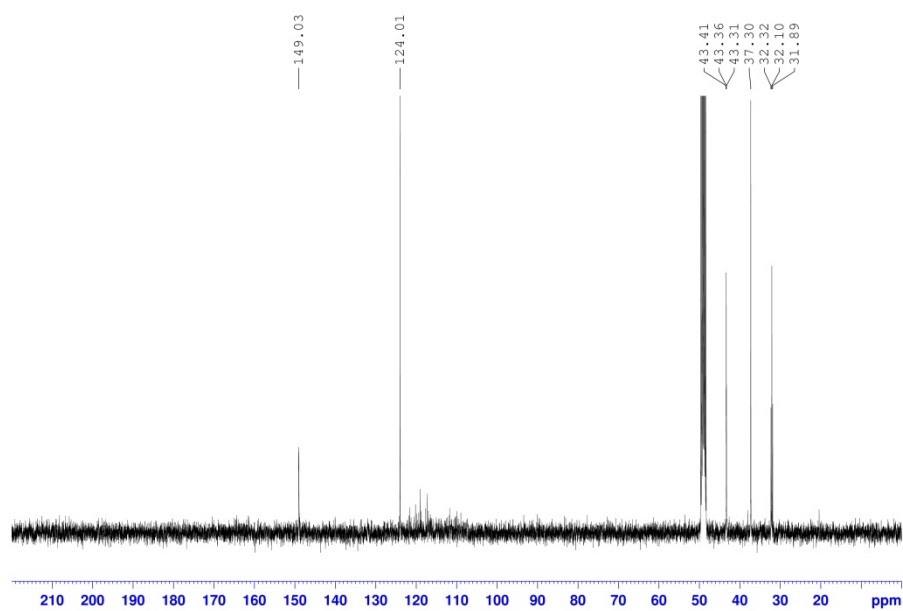
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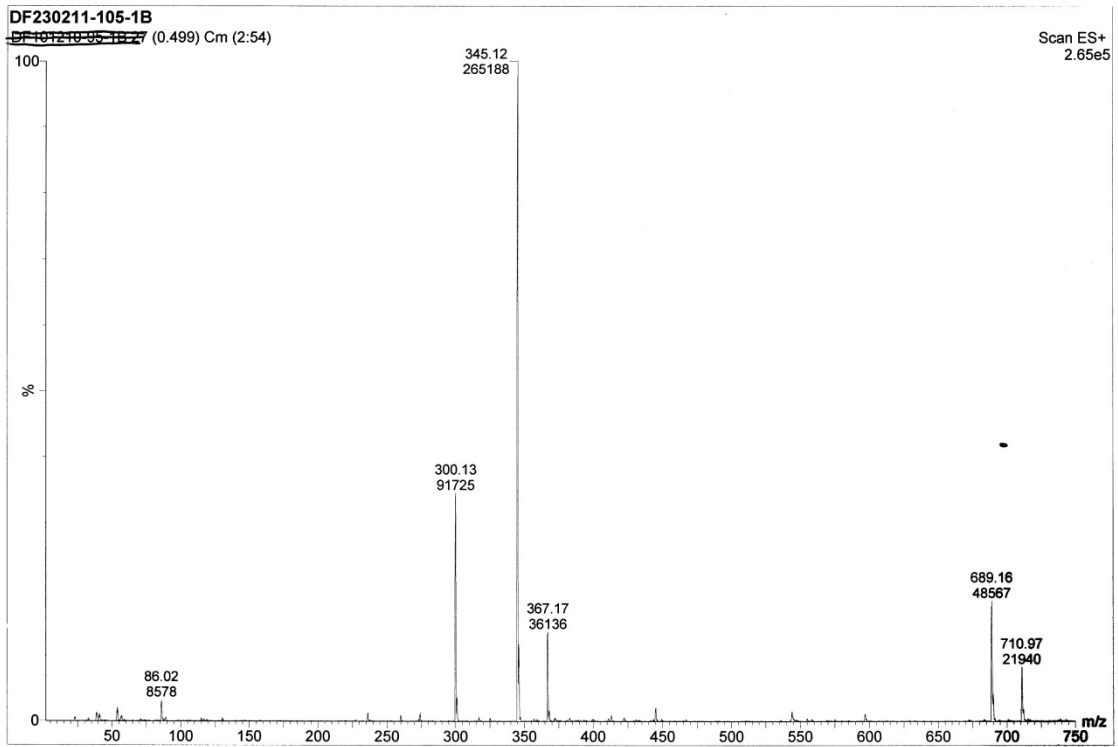
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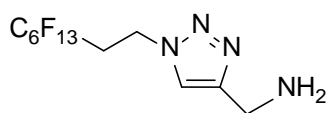
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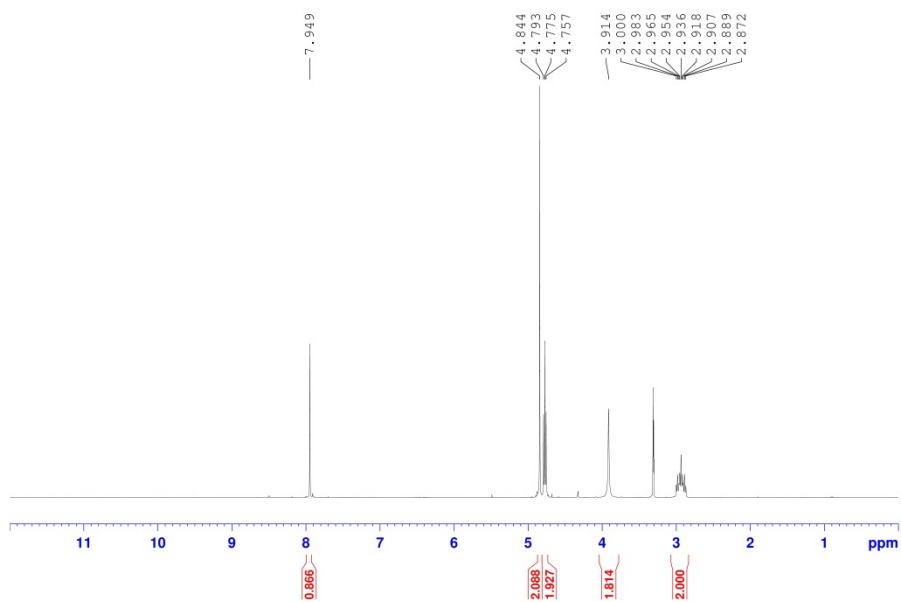
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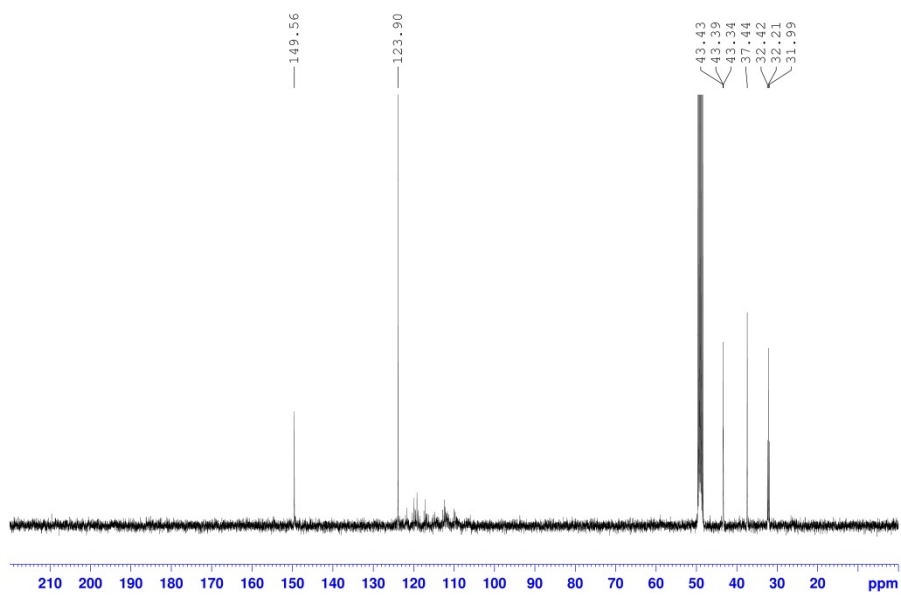
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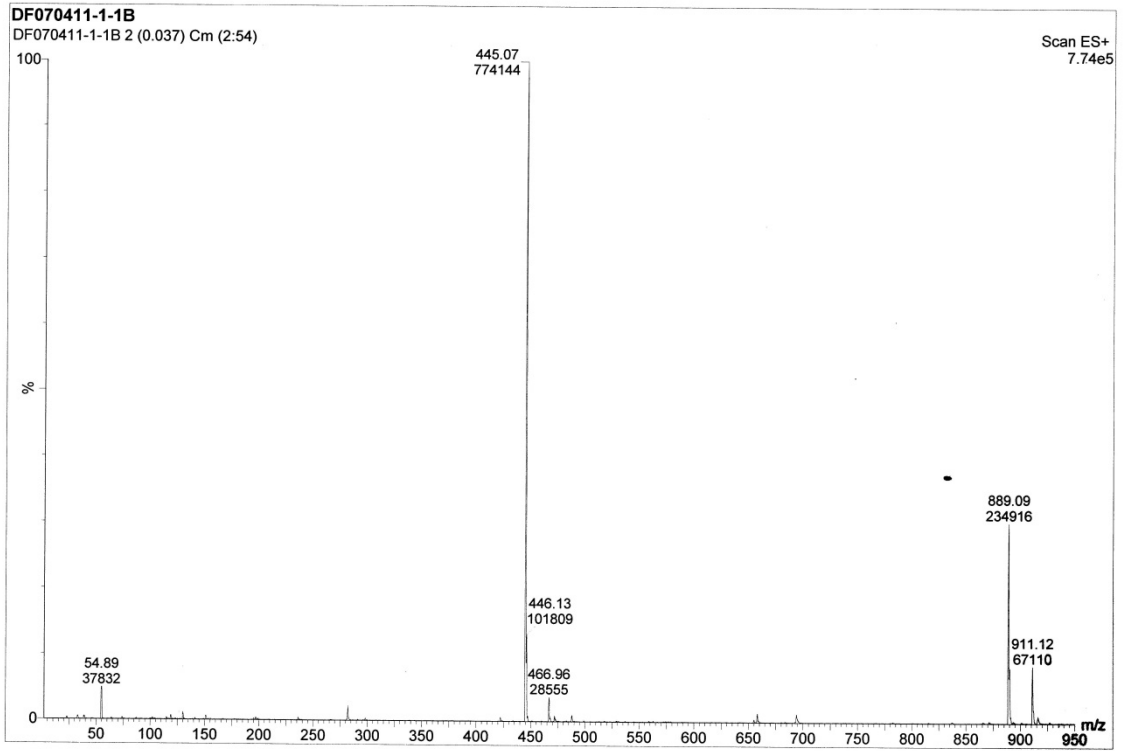
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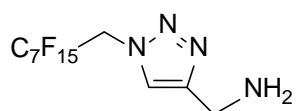
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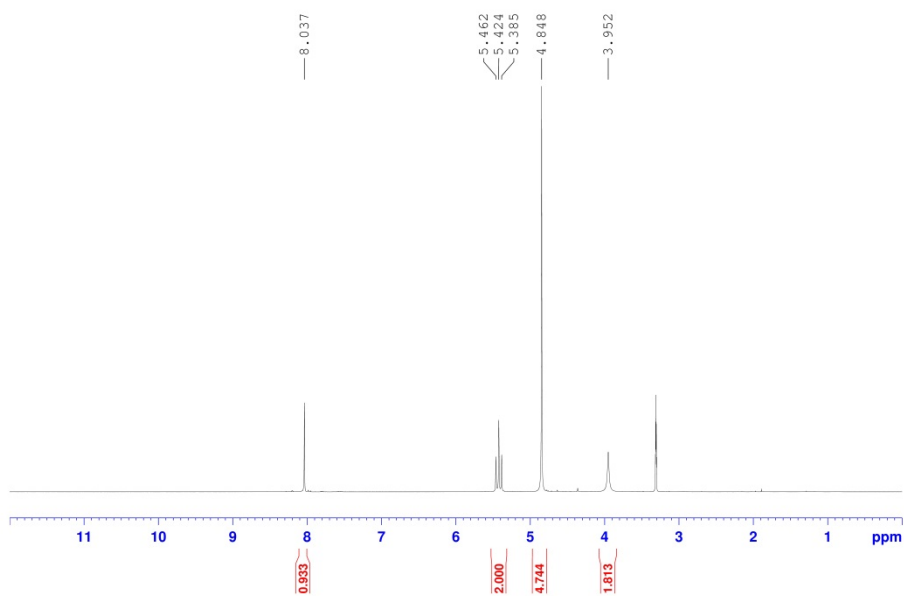
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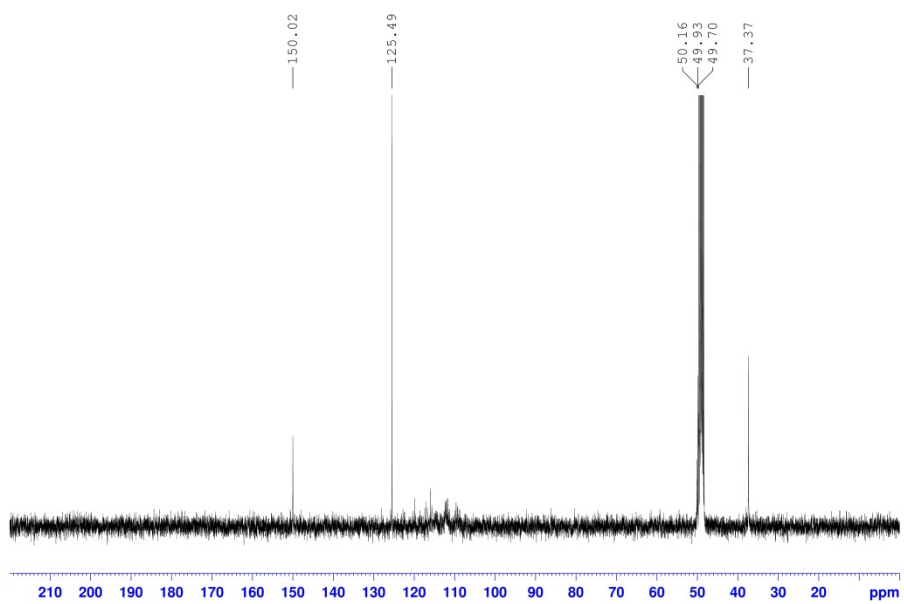
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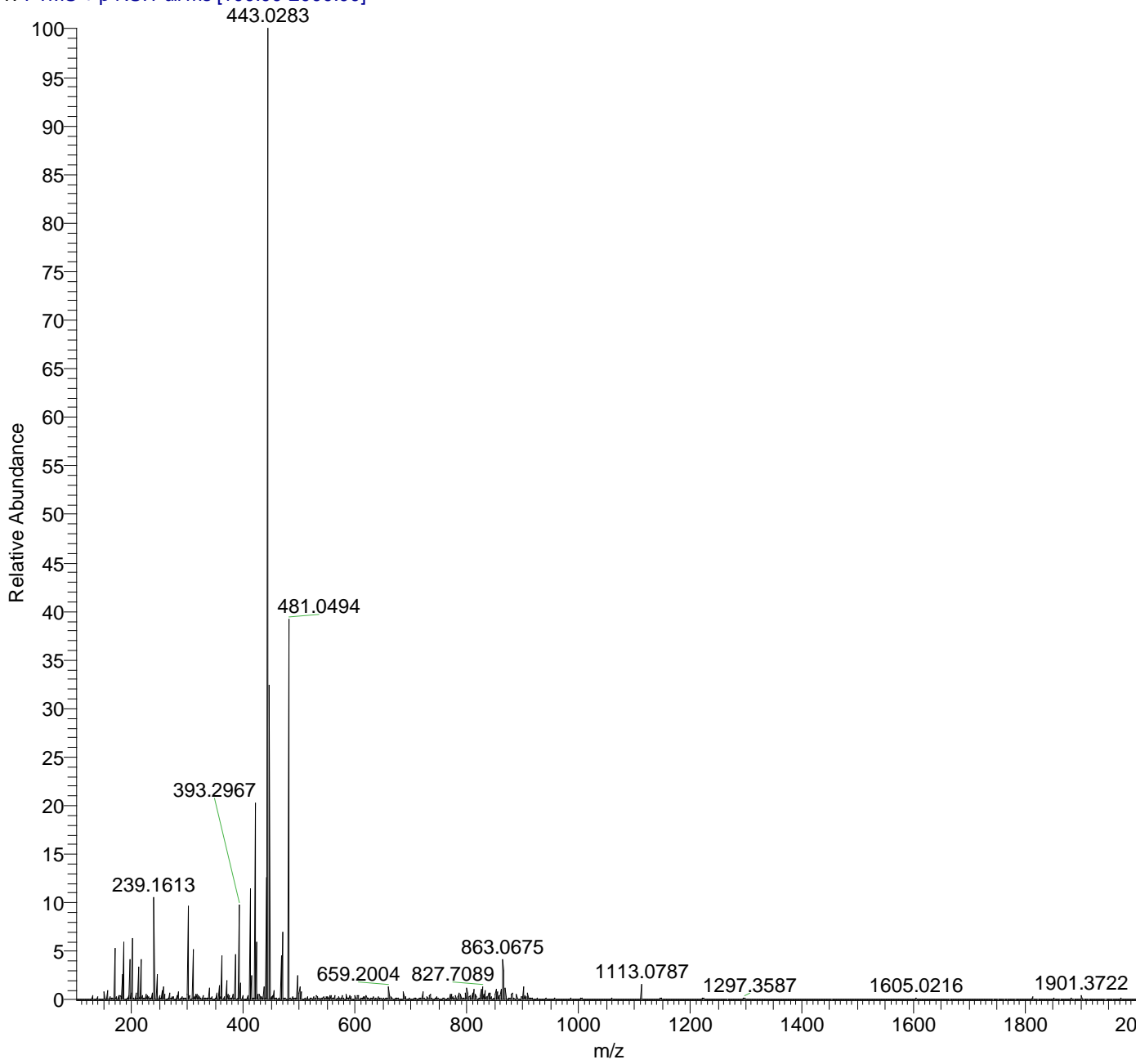


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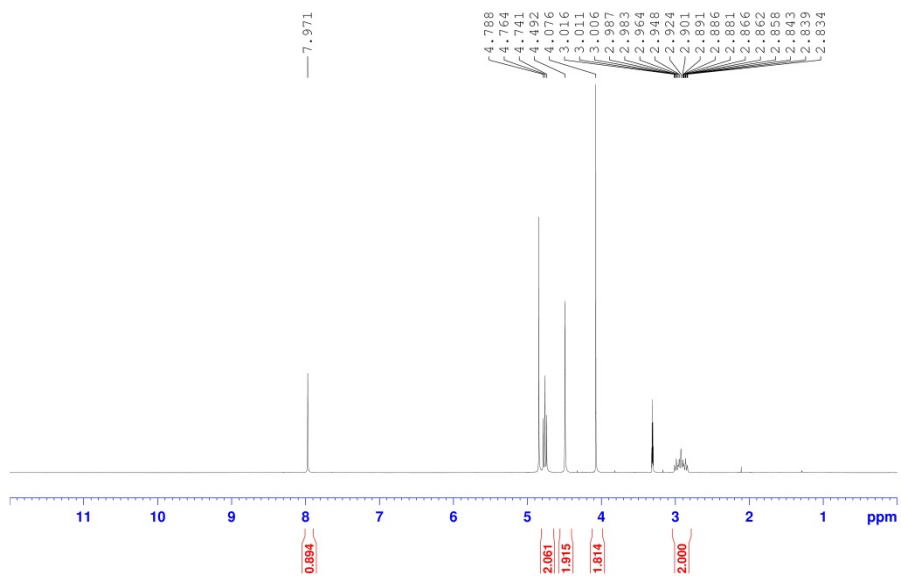
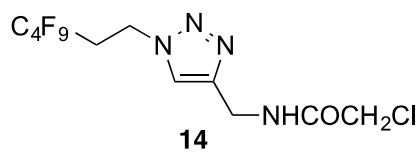


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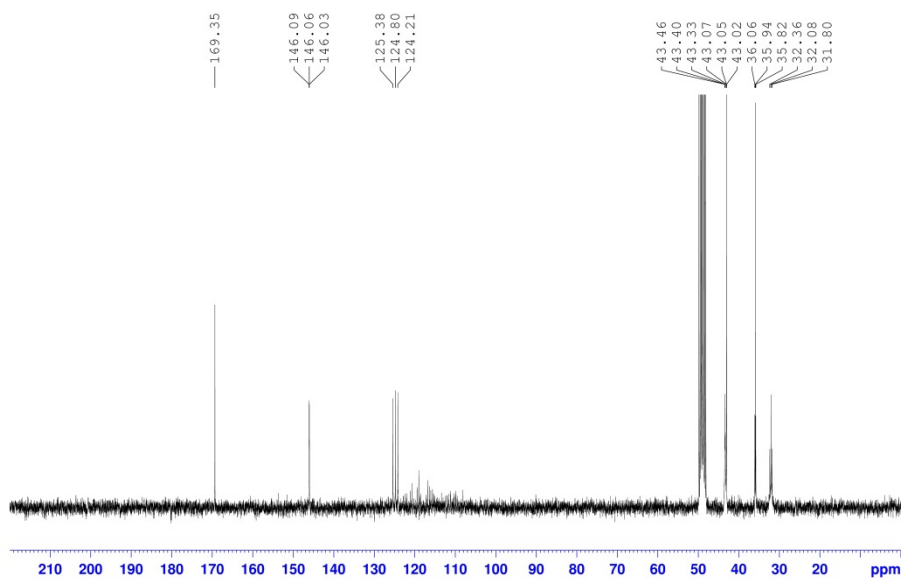
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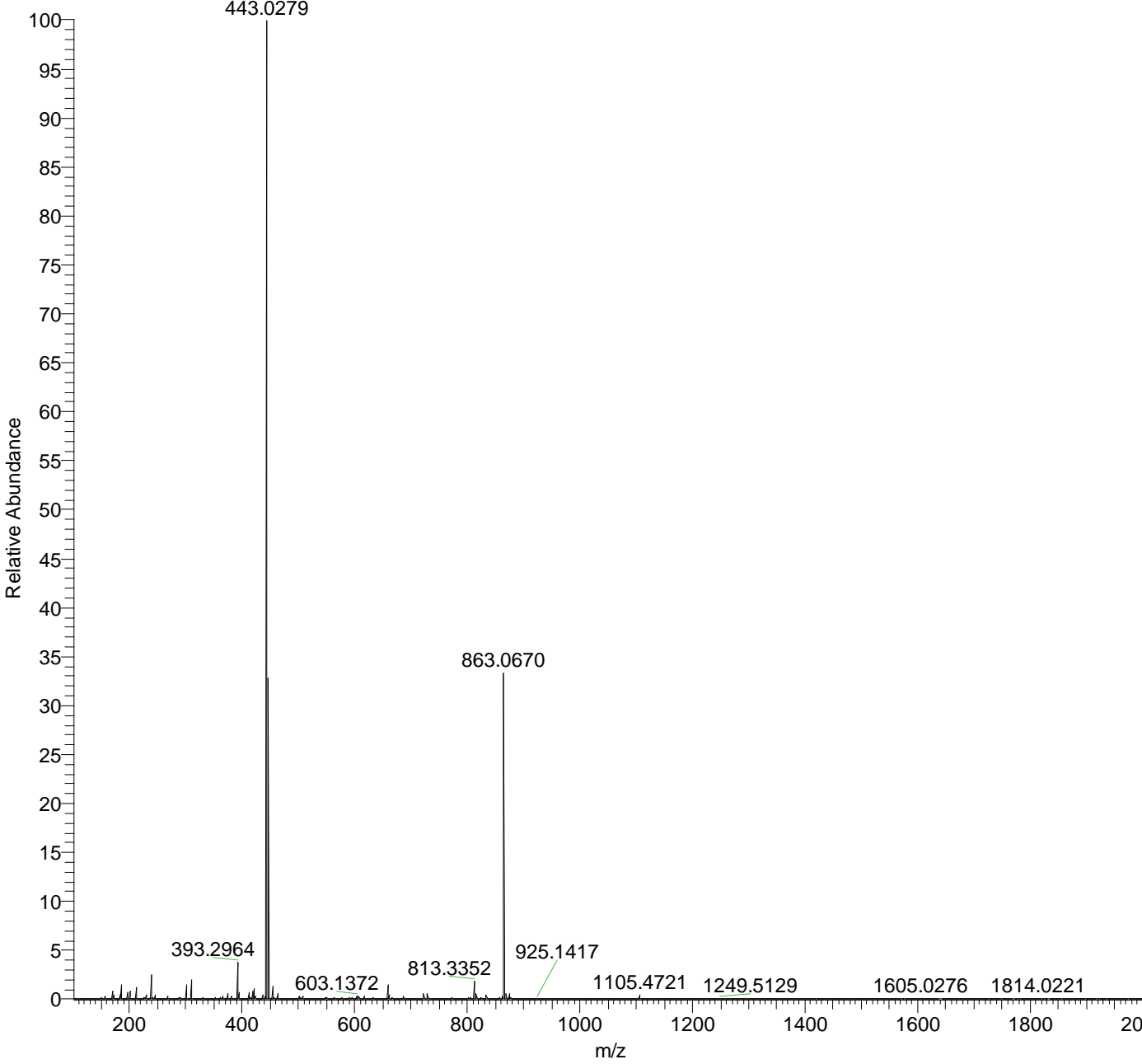
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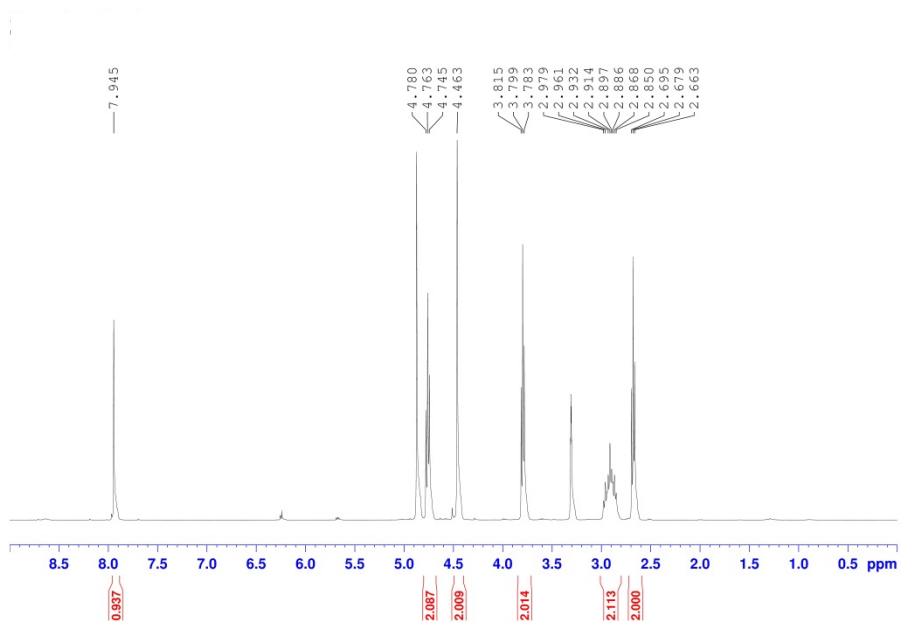
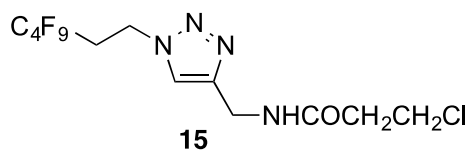
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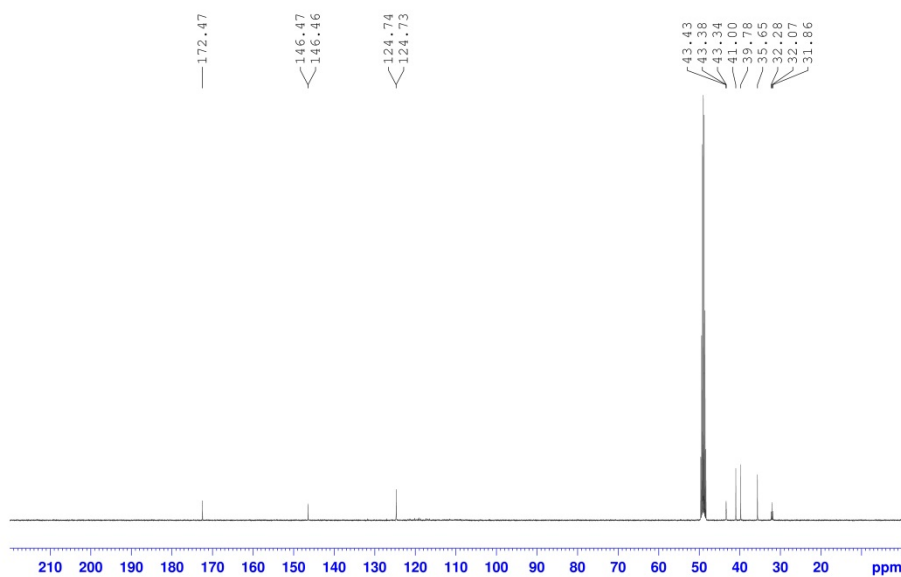
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High resolution MS (MeOH)

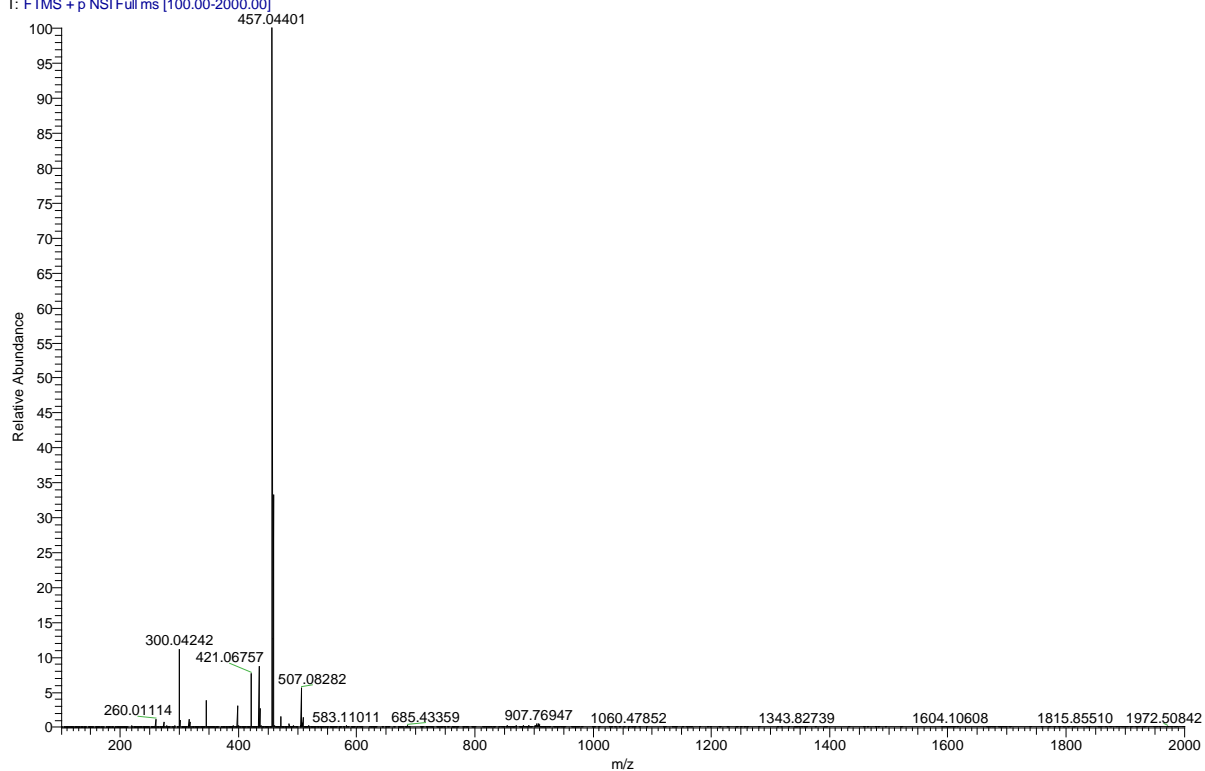


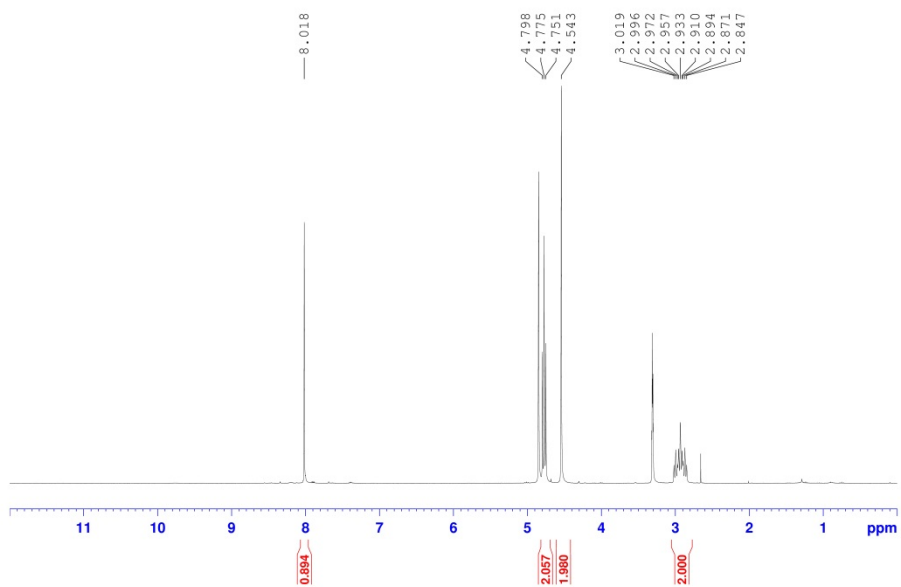
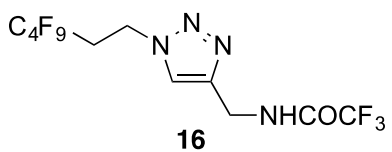
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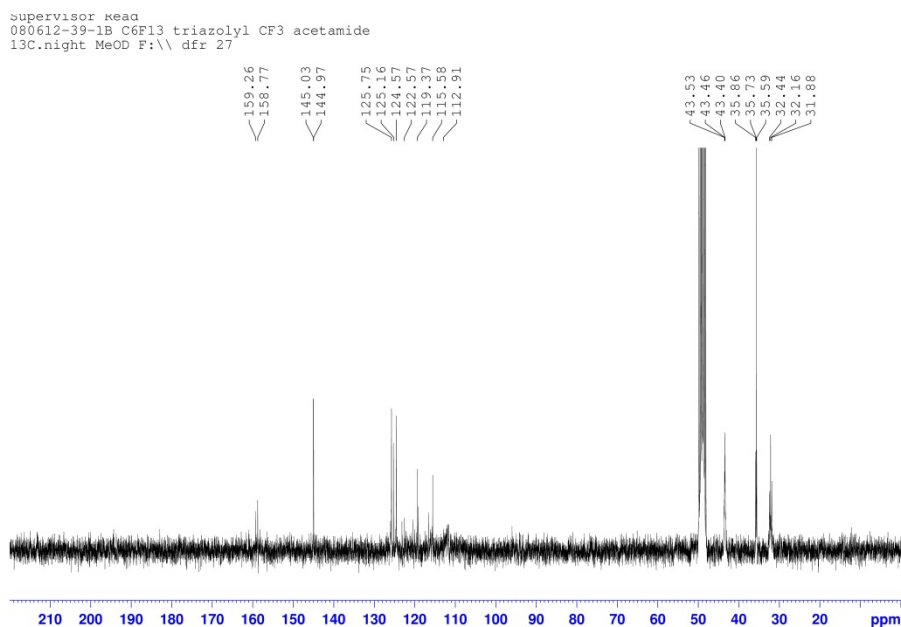
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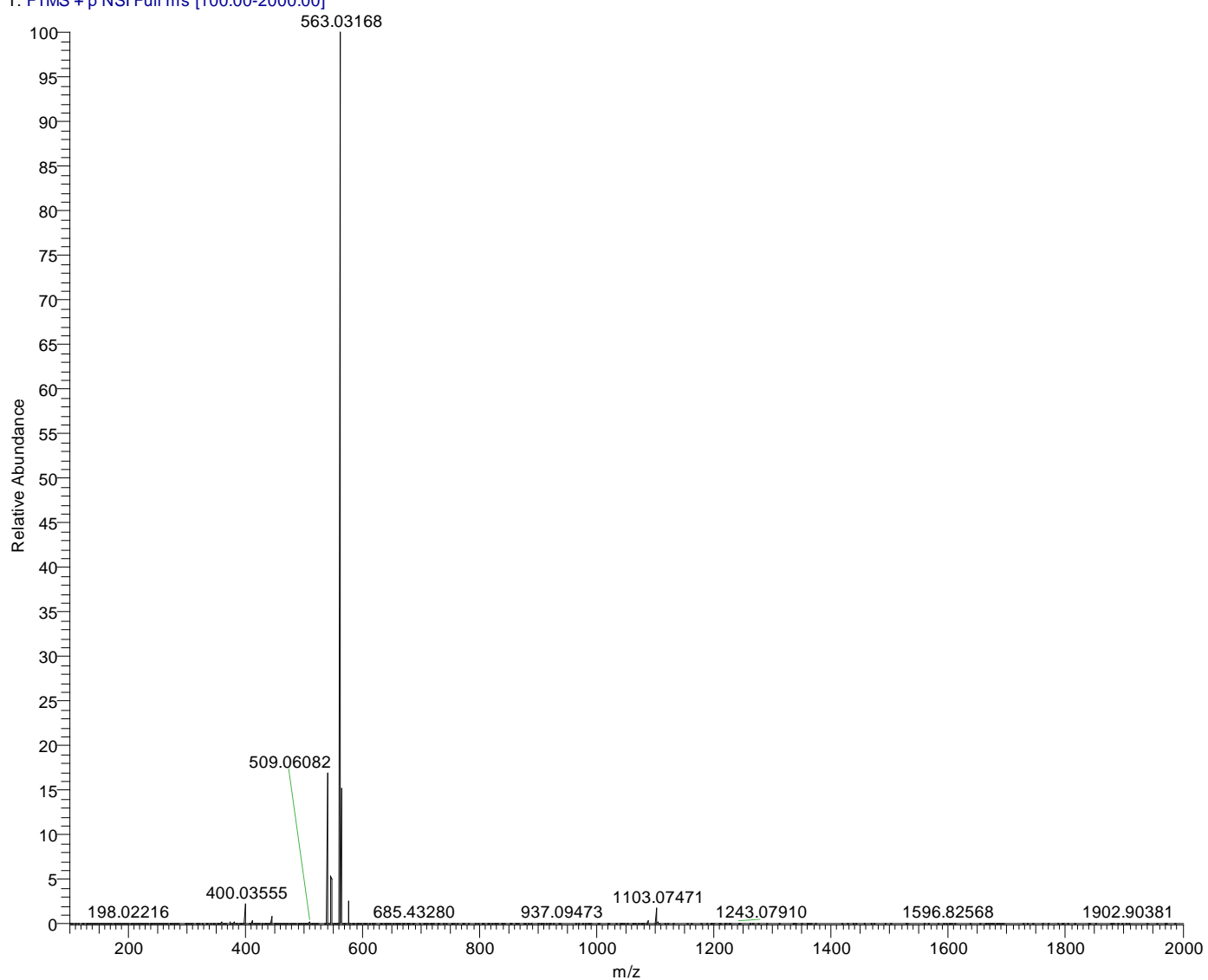


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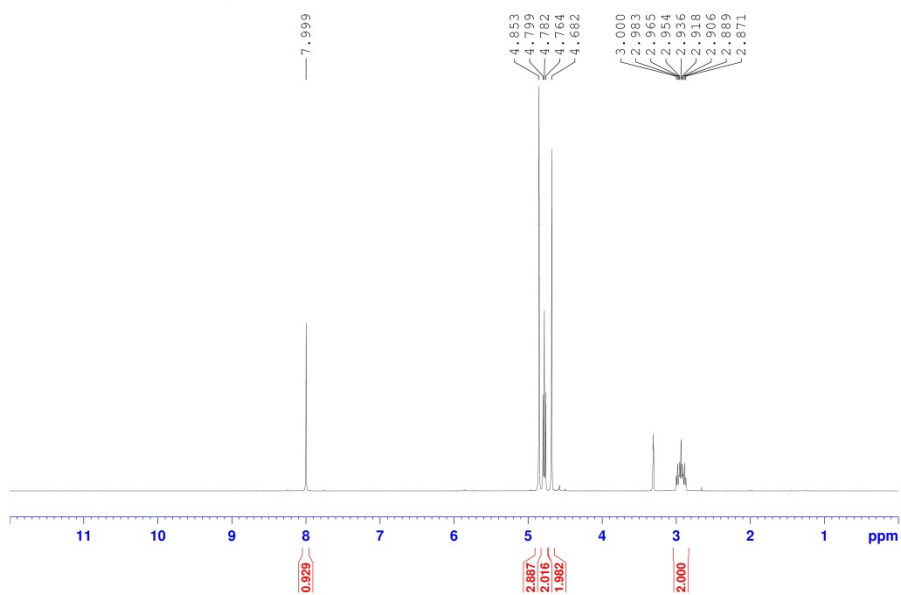
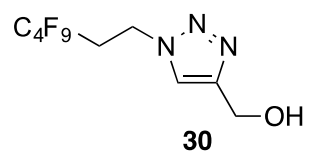


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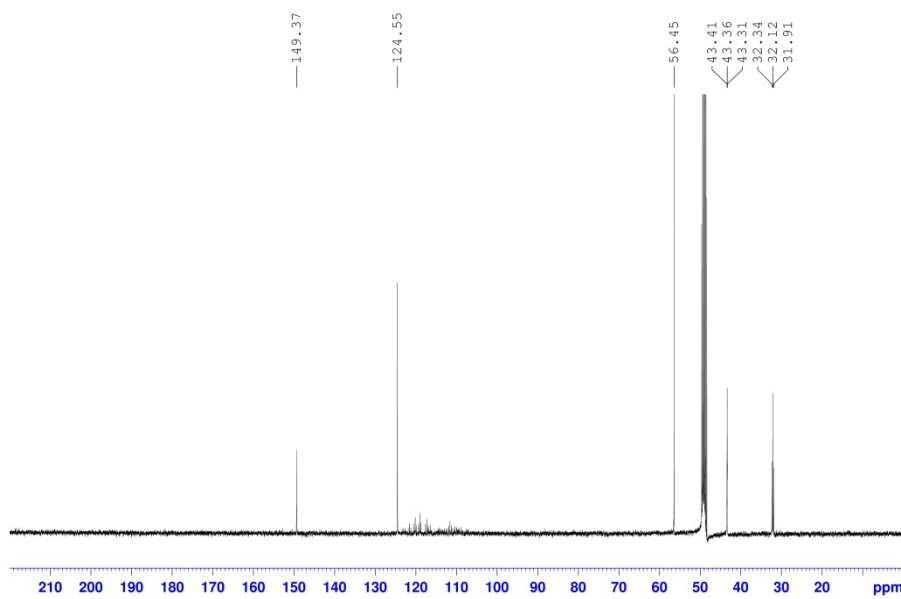
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High resolution MS (MeOH)

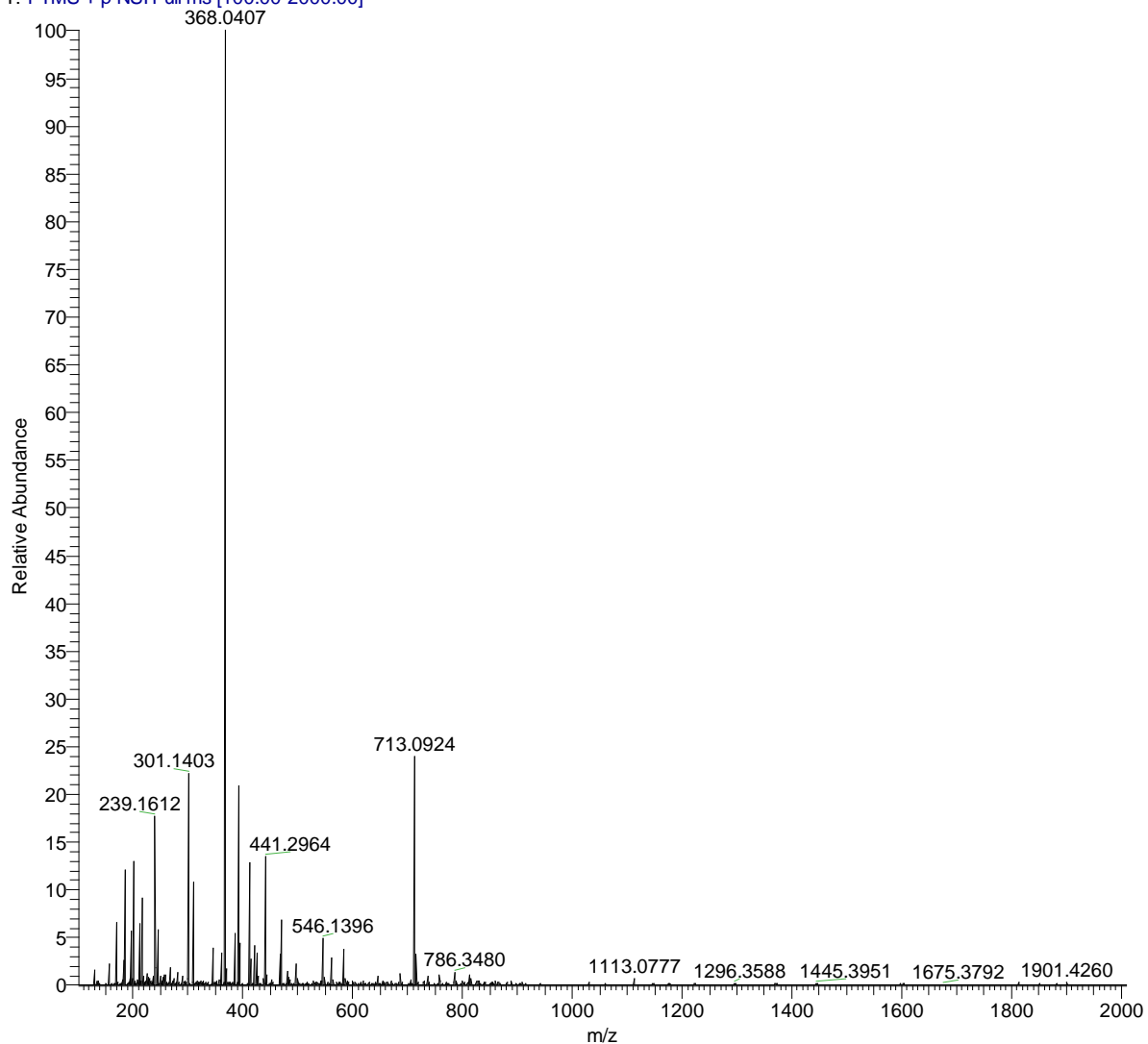


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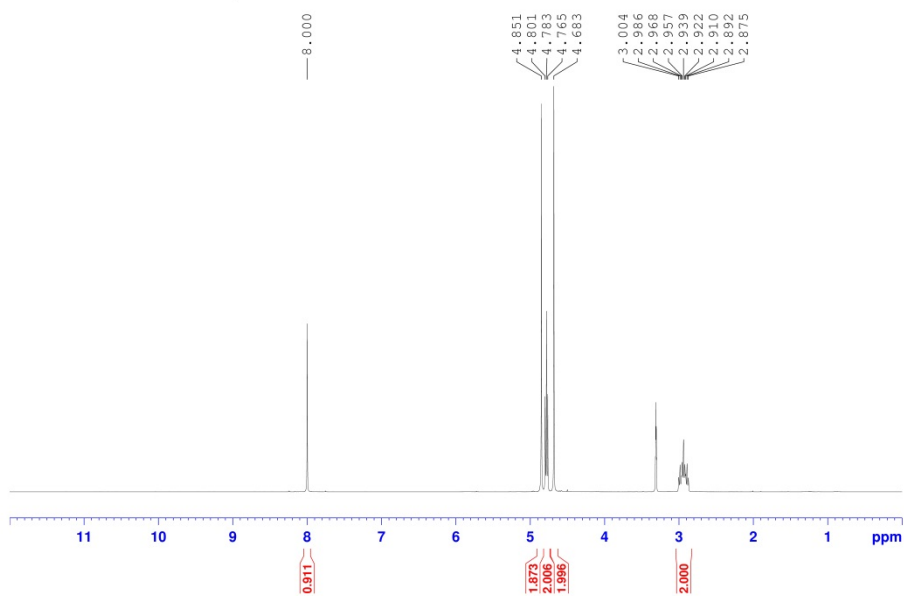
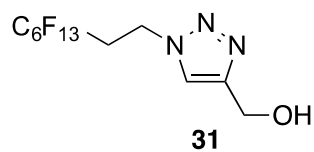


^{13}C NMR (100 MHz, CD_3OD)

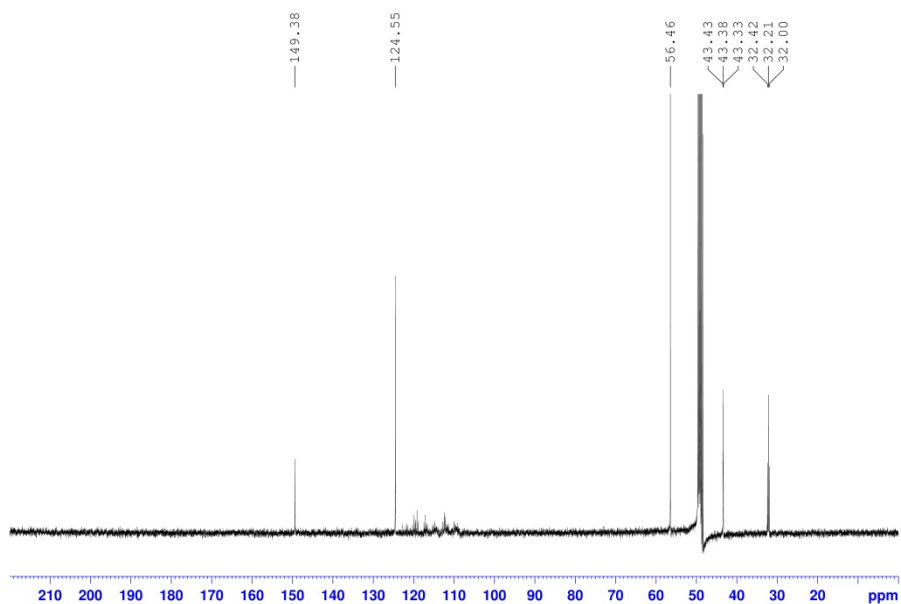
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High resolution MS (MeOH)

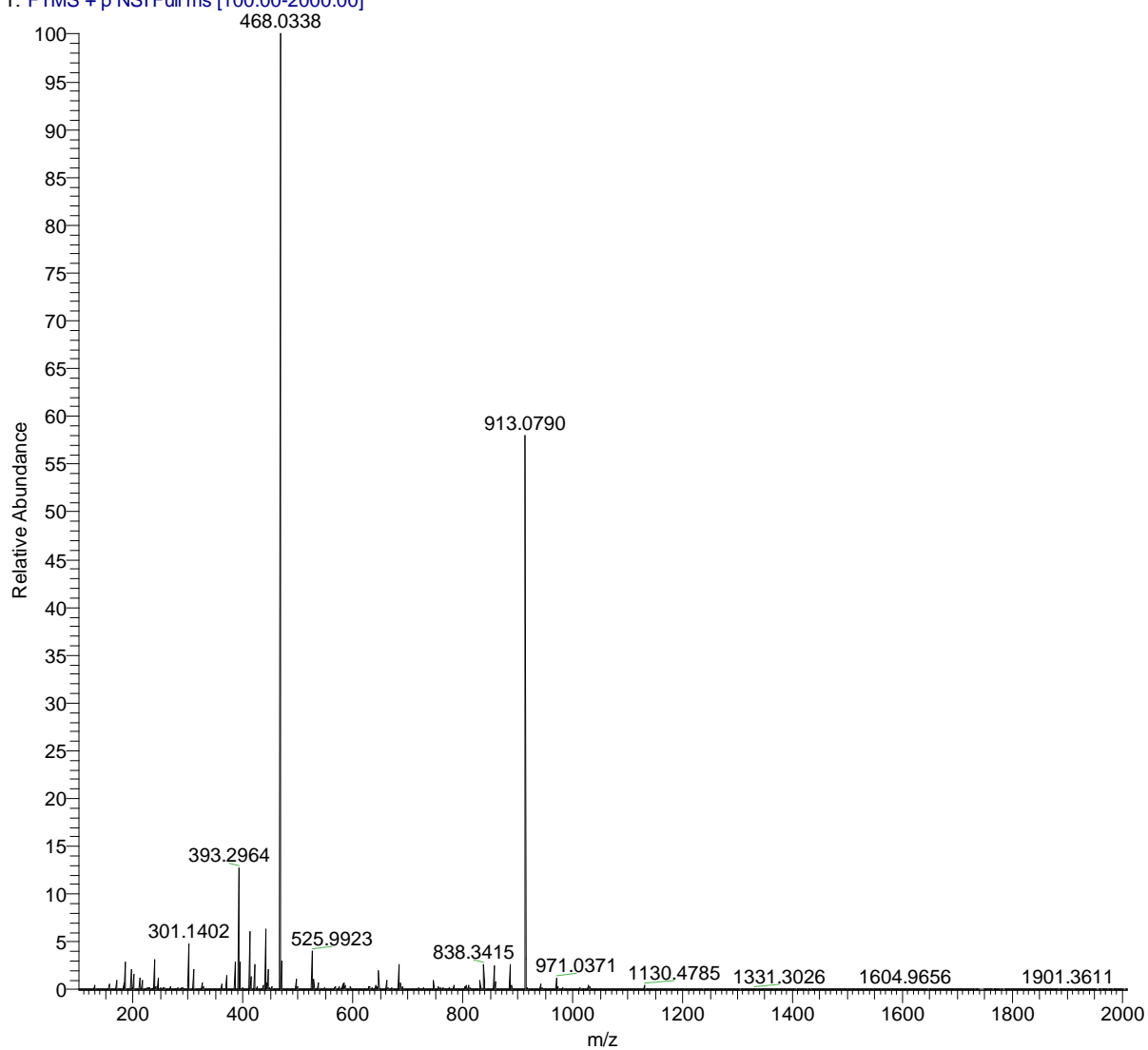


^1H NMR (400 MHz, CD_3OD)

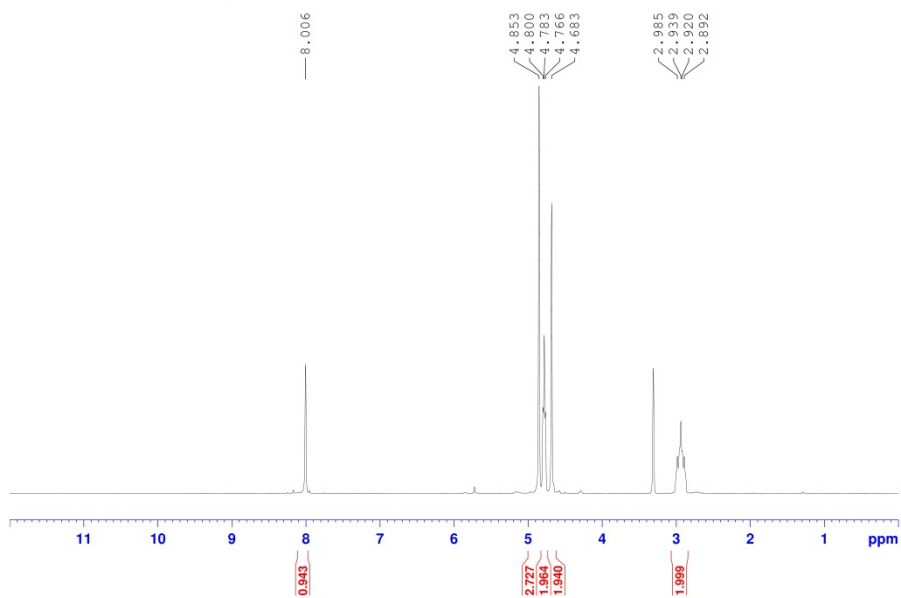
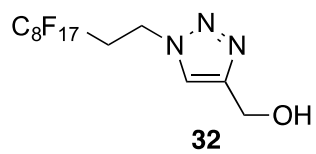


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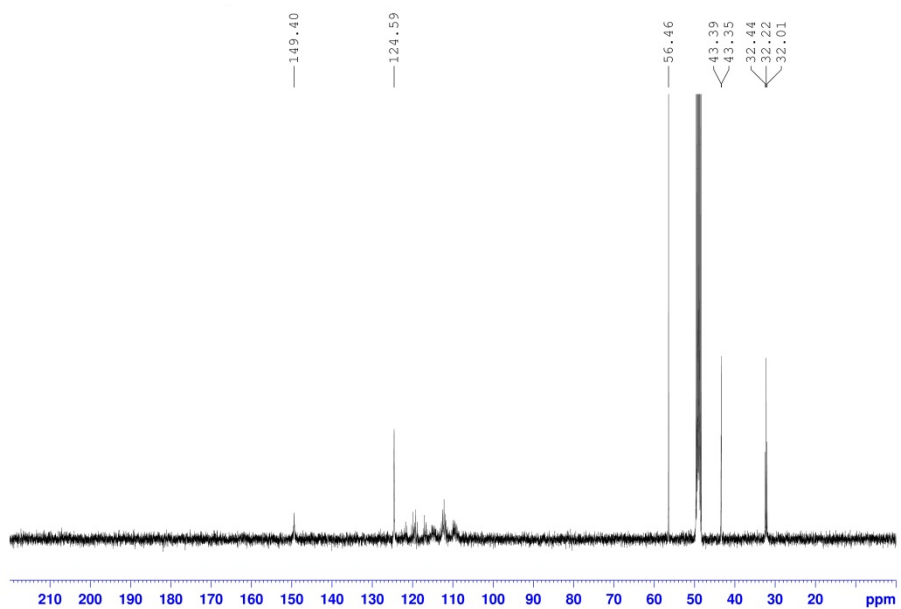
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High resolution MS (MeOH)

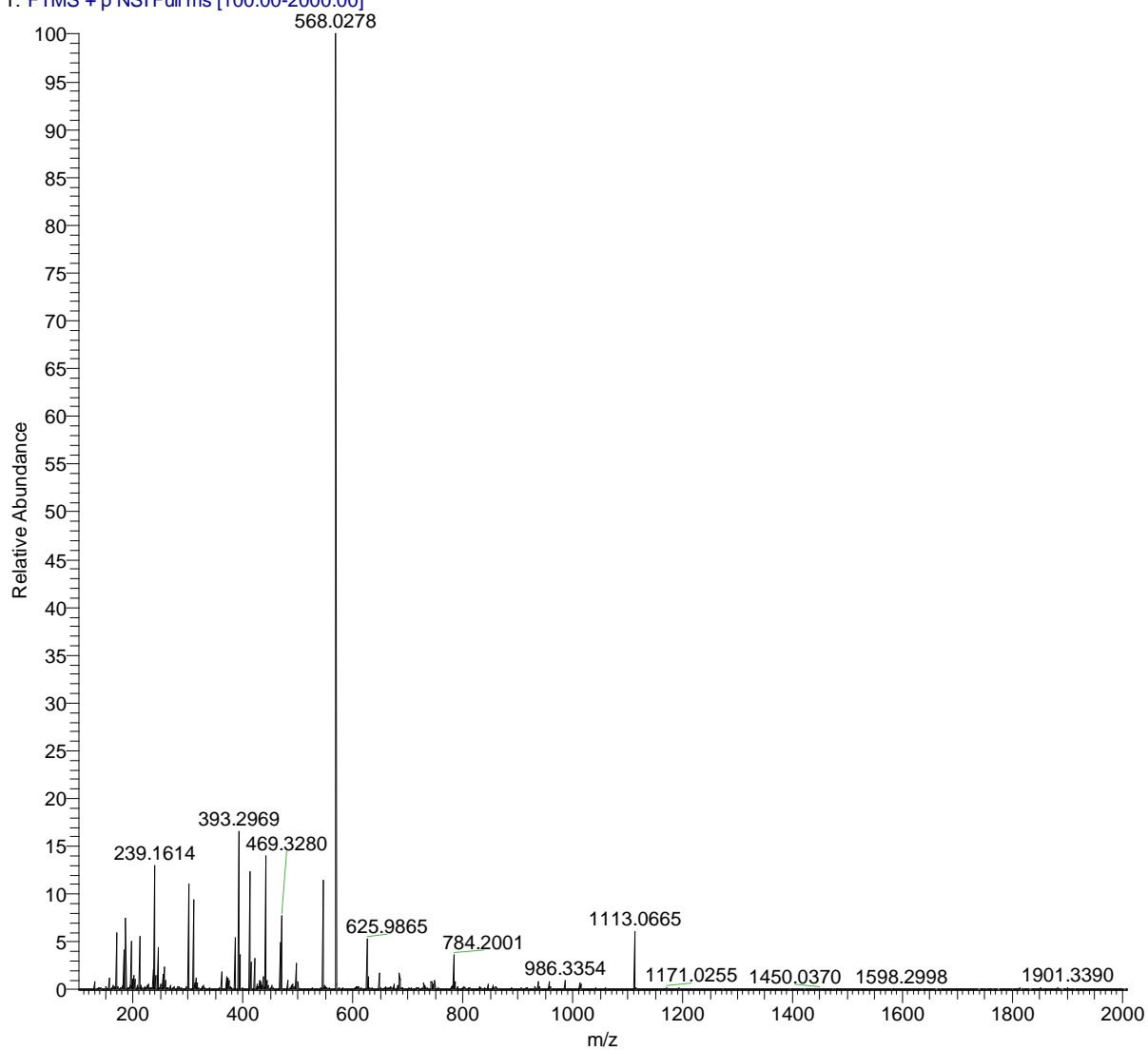


^1H NMR (400 MHz, CD_3OD)

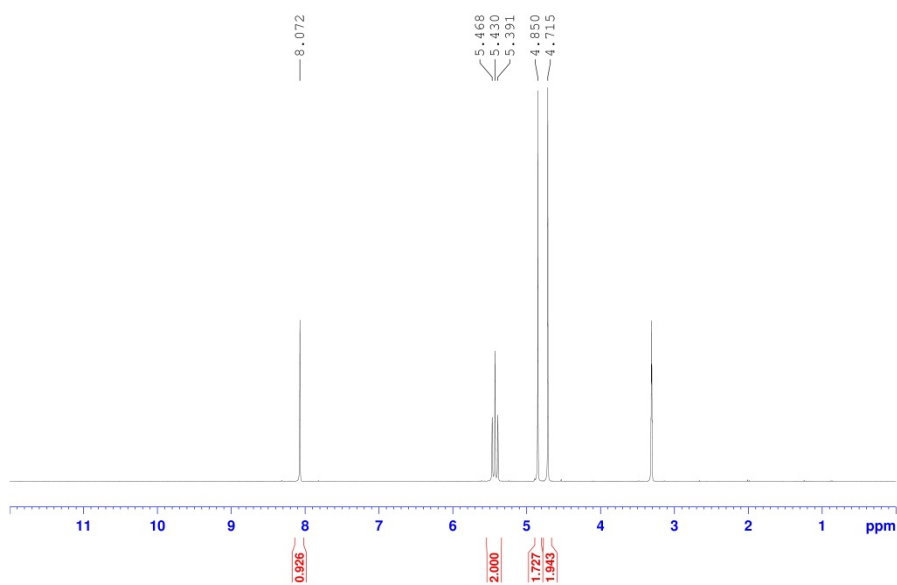
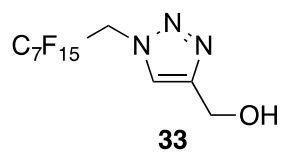


^{13}C NMR (100 MHz, CD_3OD)

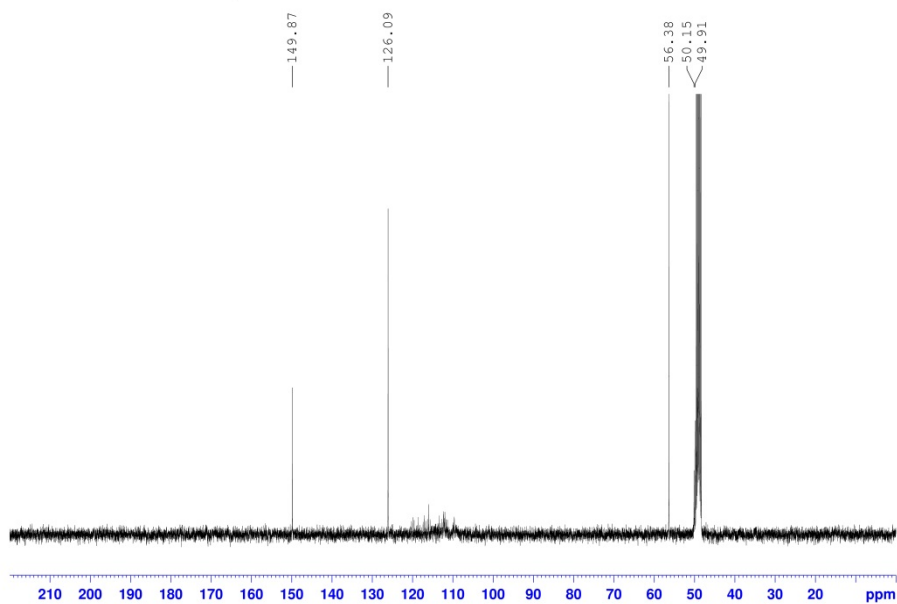
150411-4-1B #1-34 RT: 0.01-0.49 AV: 34 NL: 4.30E7
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

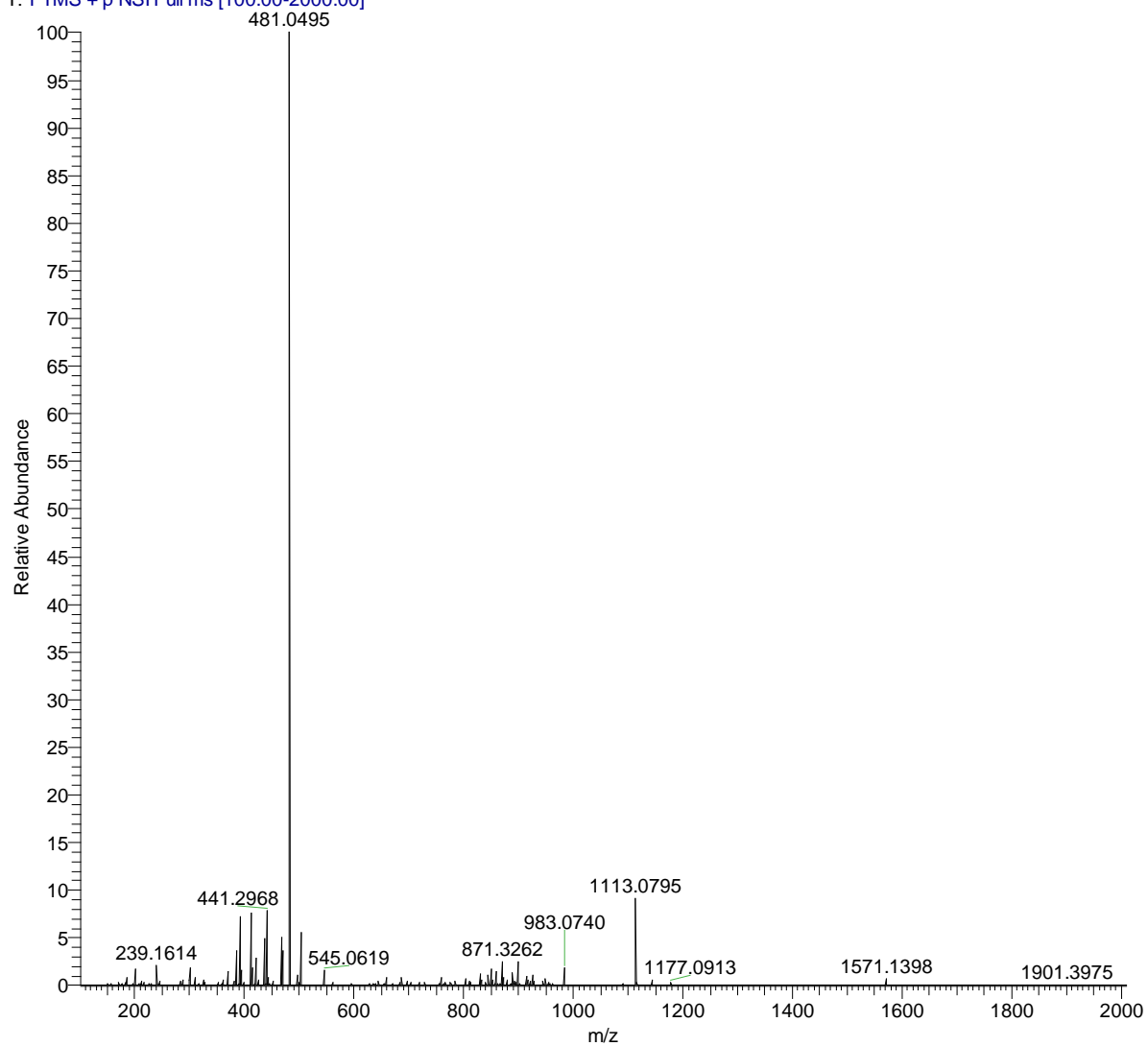


^1H NMR (400 MHz, CD_3OD)

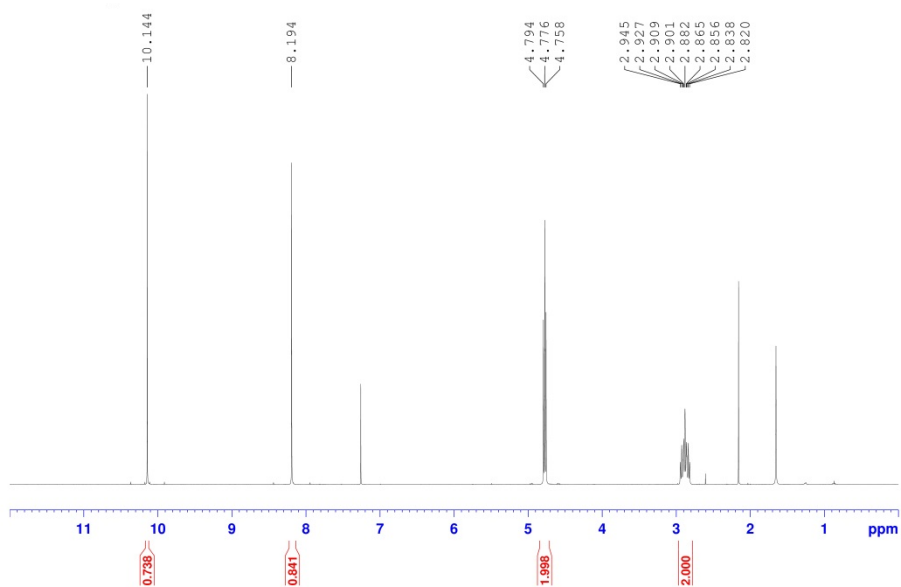
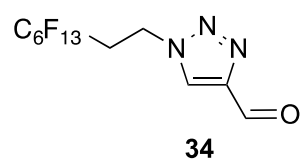


^{13}C NMR (100 MHz, CD_3OD)

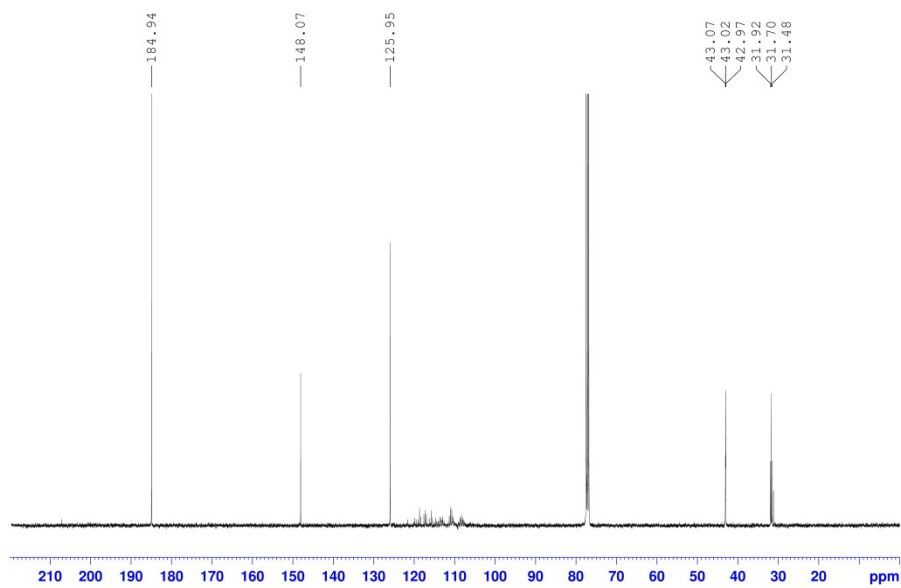
100611-19-1B_a #1-35 RT: 0.01-0.50 AV: 35 NL: 8.48E7
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

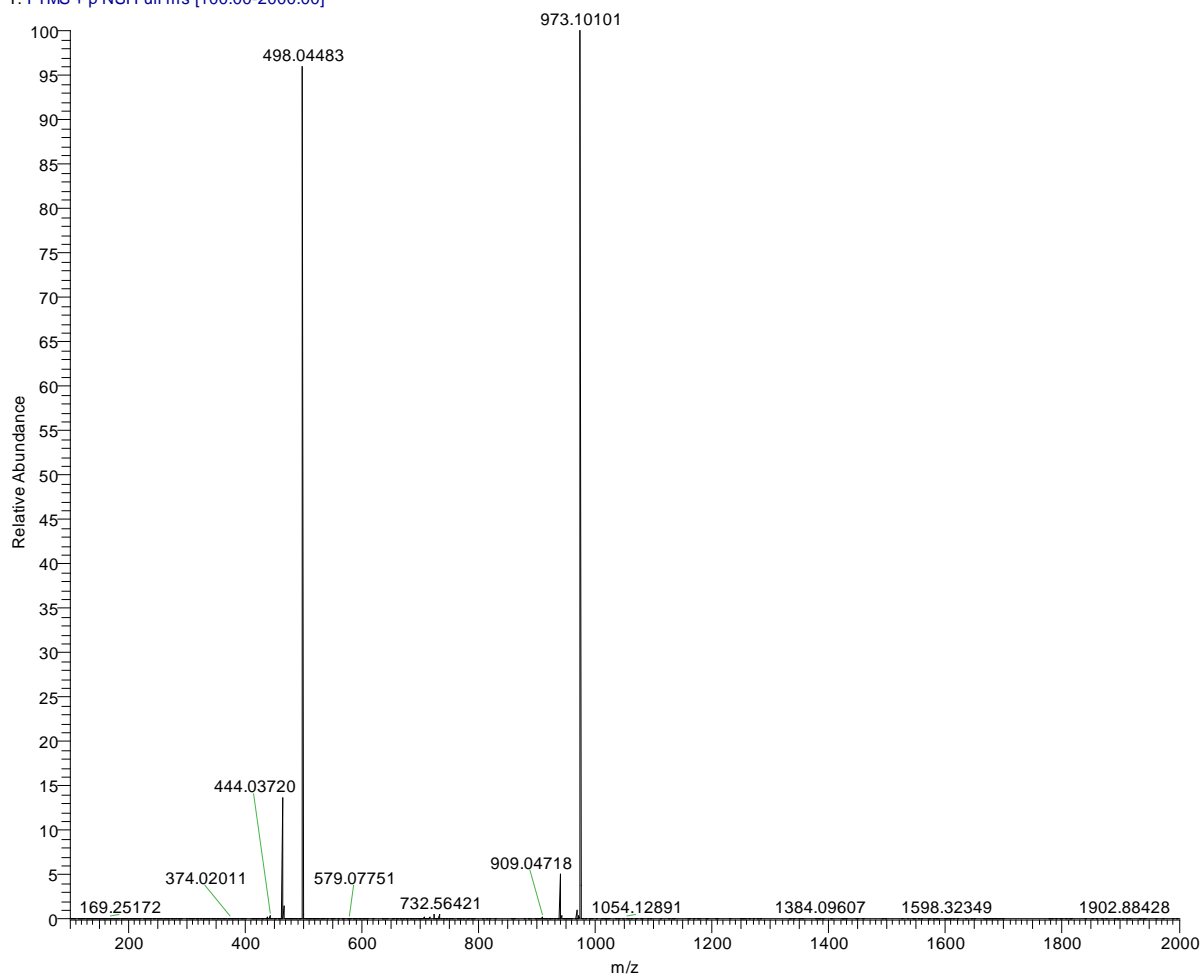


¹H NMR (400 MHz, CDCl₃)

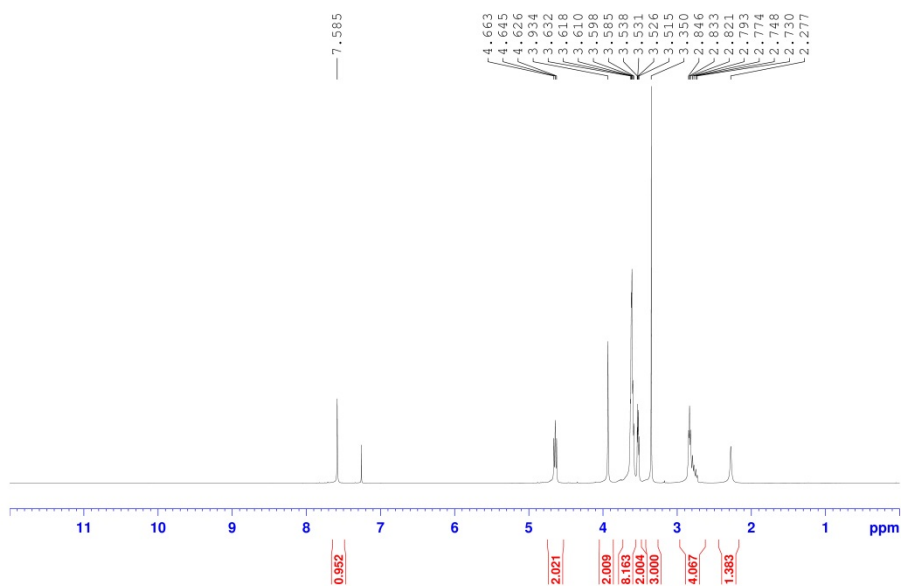
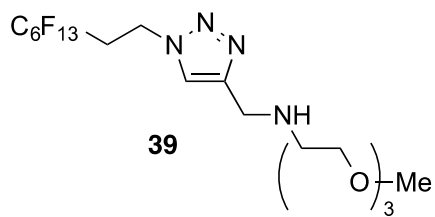


¹³C NMR (100 MHz, CDCl₃)

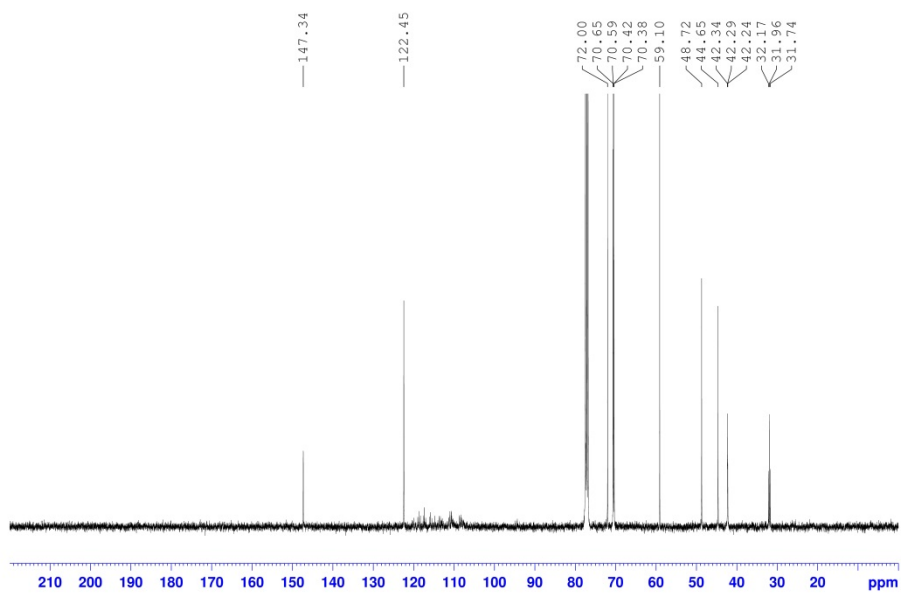
041012-86-1B_Pos_Full #1 RT: 0.00 AV: 1 NL: 1.56E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

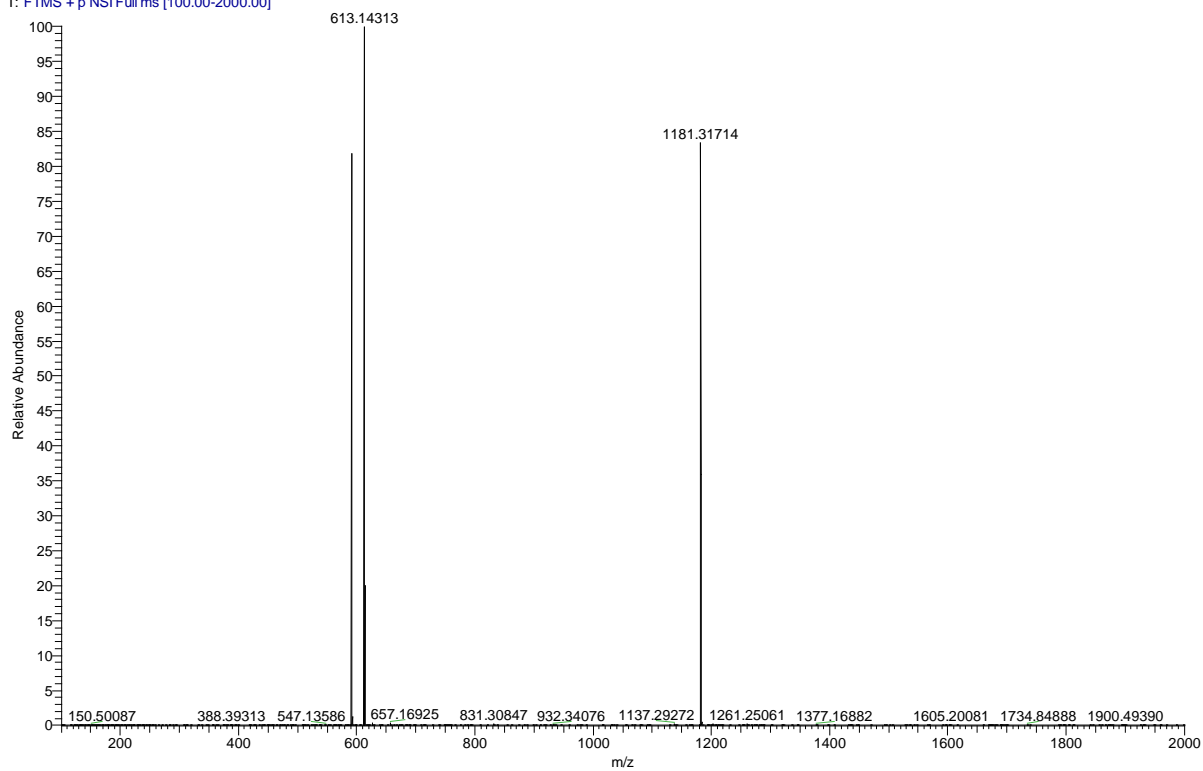


¹H NMR (400 MHz, CDCl₃)

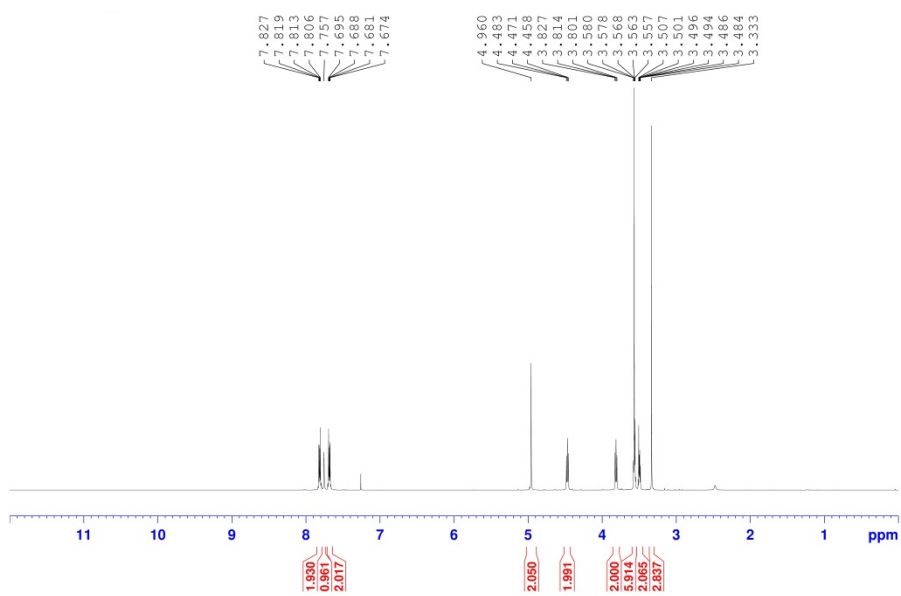
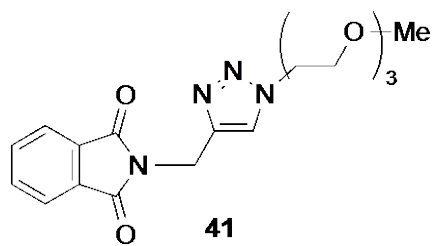


¹³C NMR (100 MHz, CDCl₃)

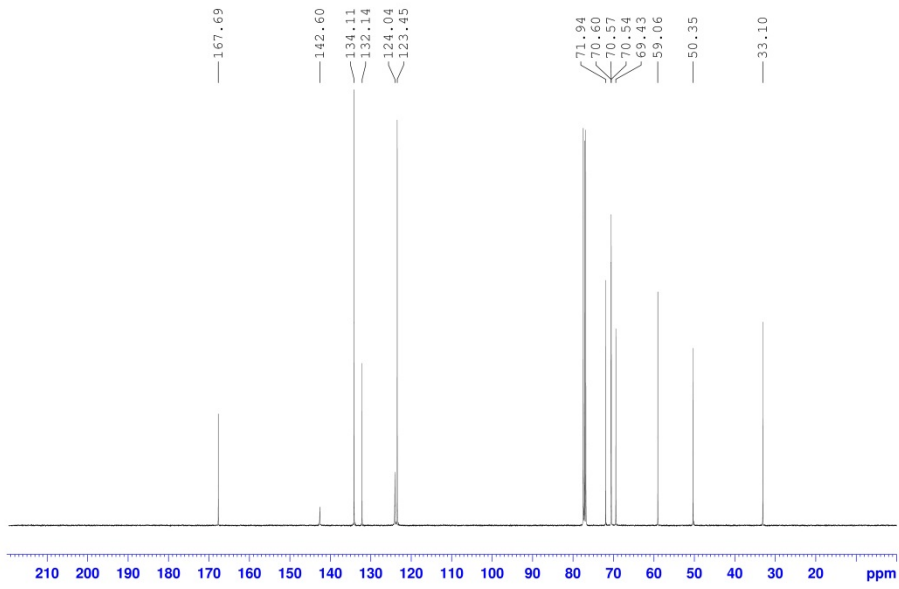
190313-67-1A_Pos_Full#1 RT: 0.01 AV: 1 NL: 1.08E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

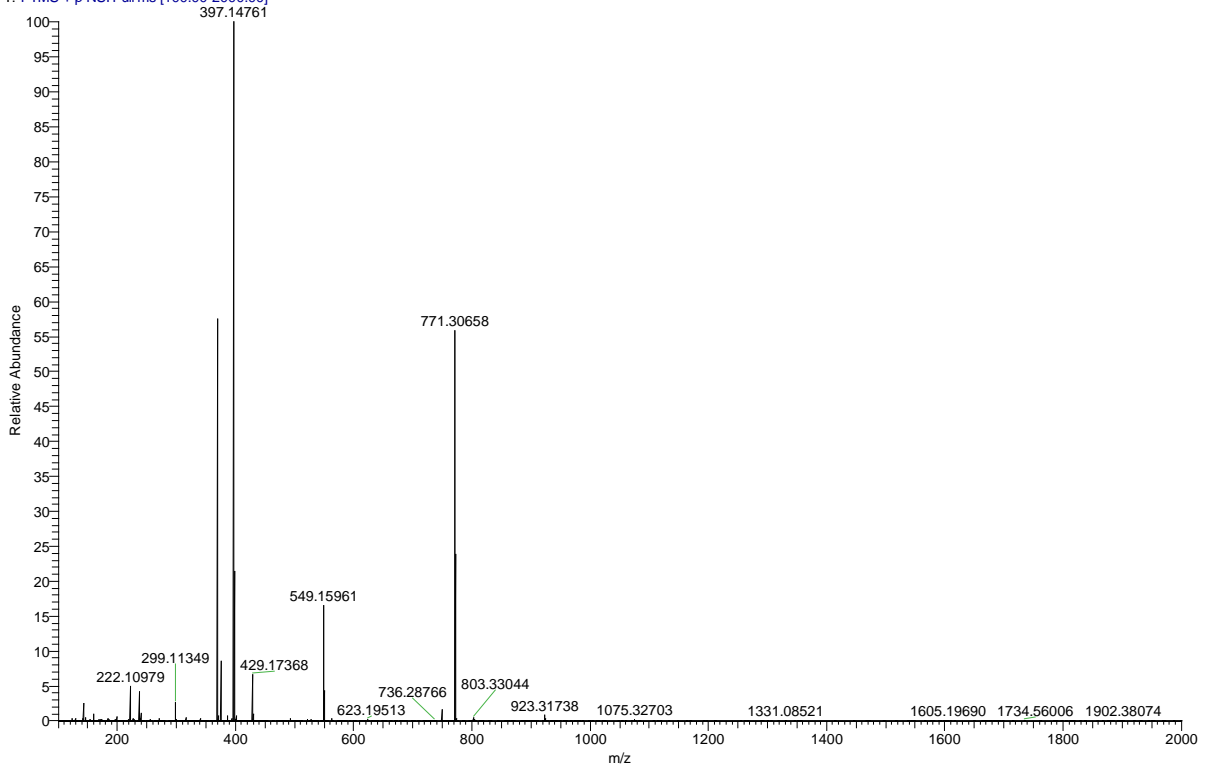


¹H NMR (400 MHz, CDCl₃)

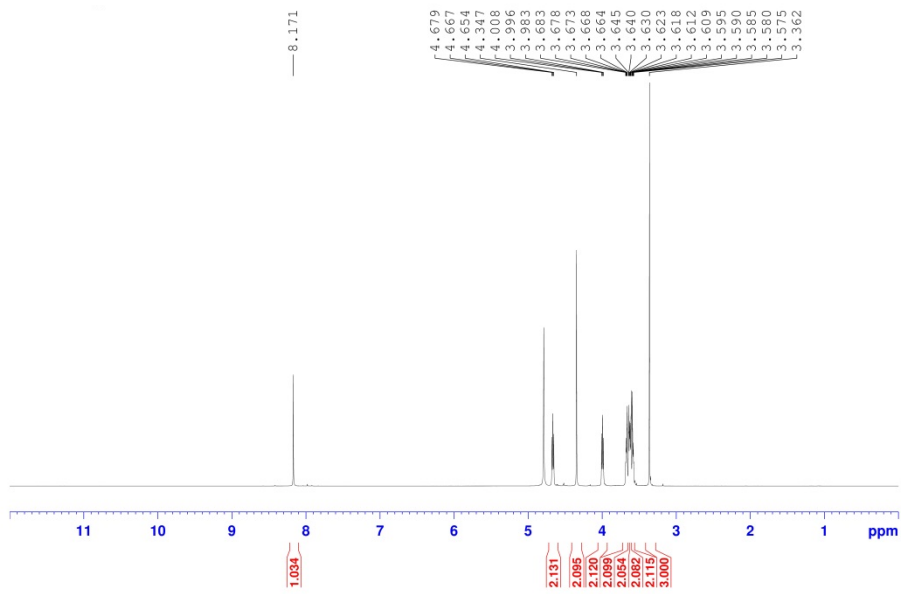
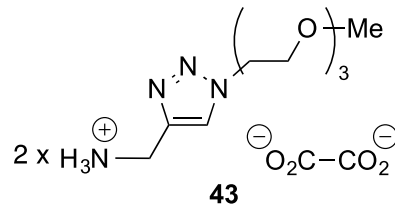


^{13}C NMR (100 MHz, CDCl_3)

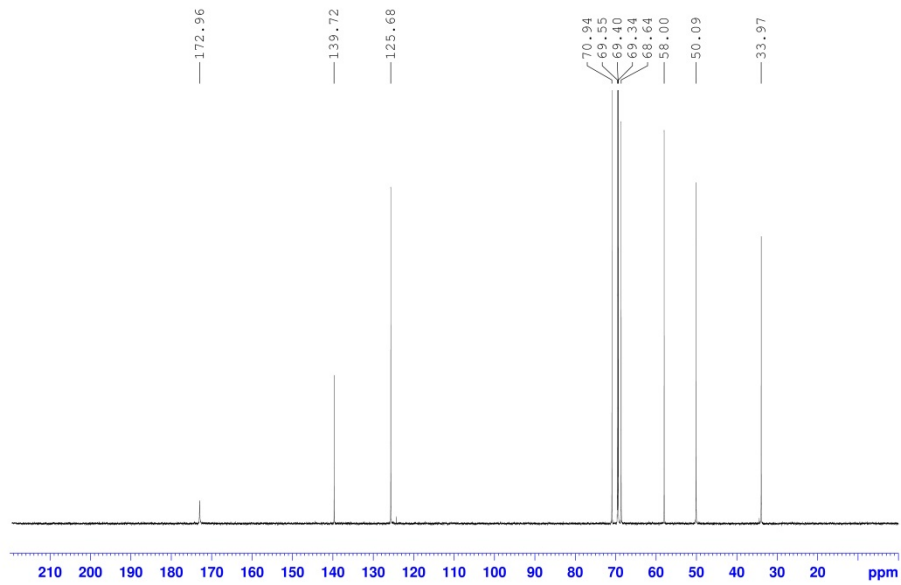
180313-66-1A_Pos_Full#1 RT: 0.01 AV: 1 NL: 1.22E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

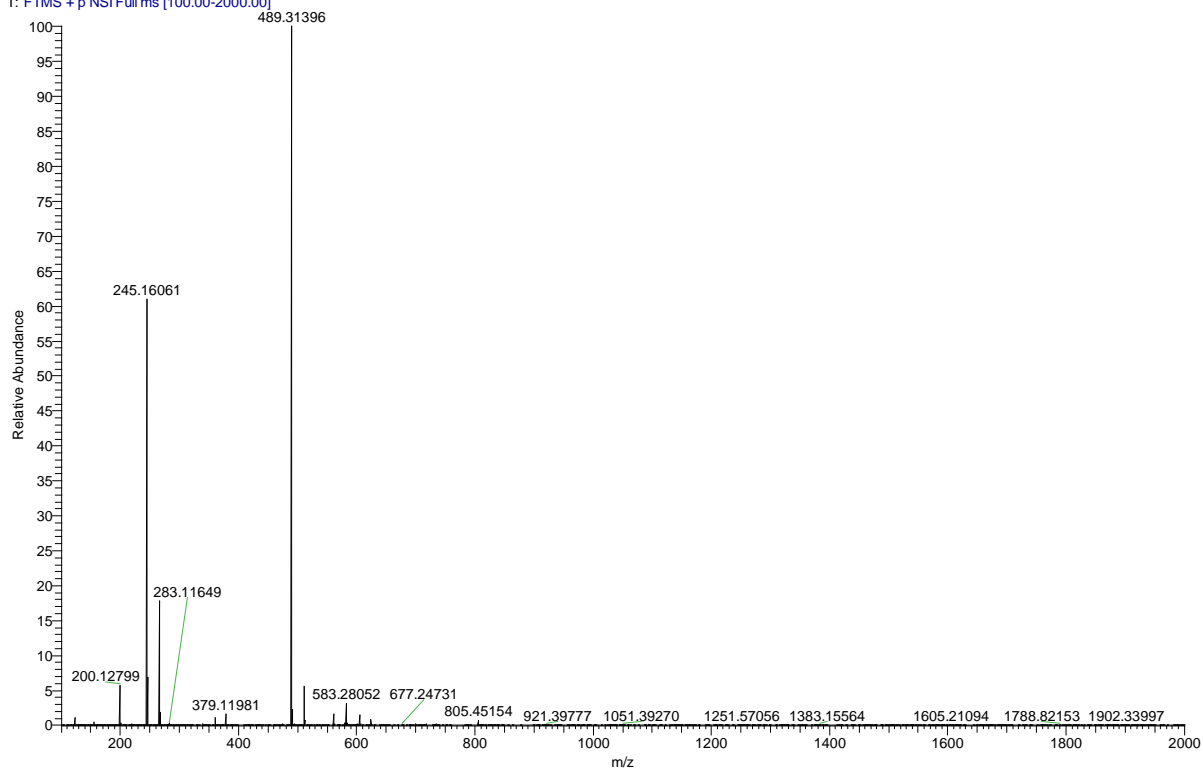


^1H NMR (400 MHz, D_2O)

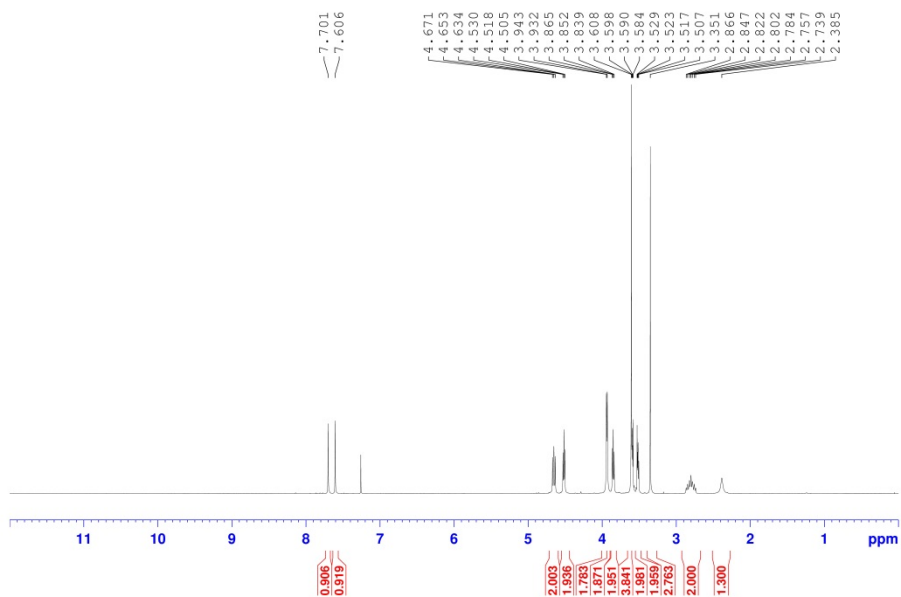
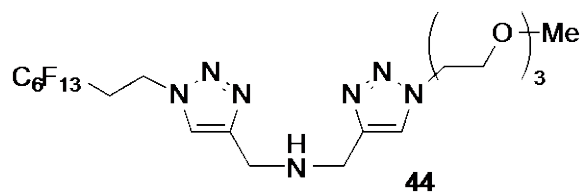


^{13}C NMR (100 MHz, D_2O)

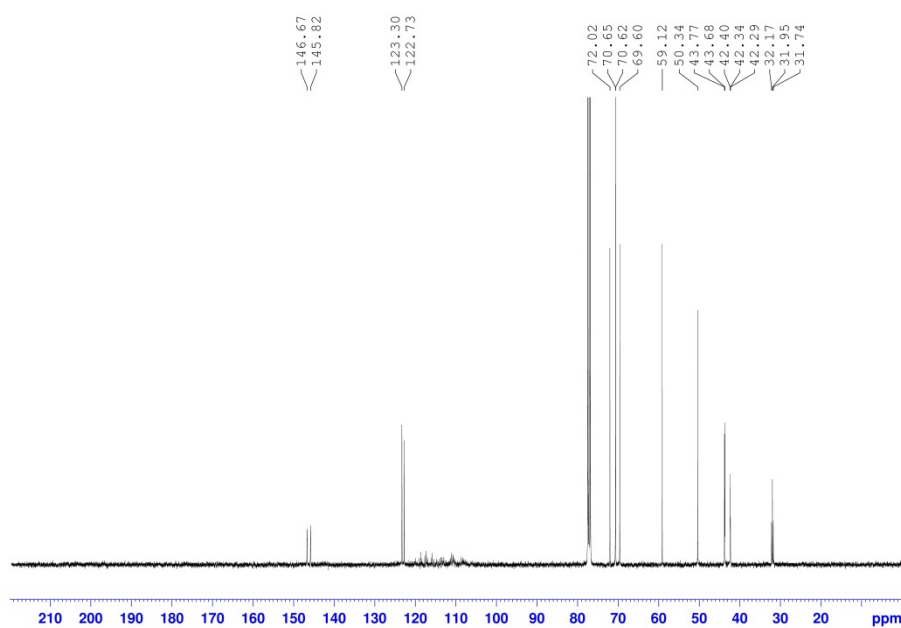
120413-93-1B_Pos_Full#1 RT: 0.02 AV: 1 NL: 1.43E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

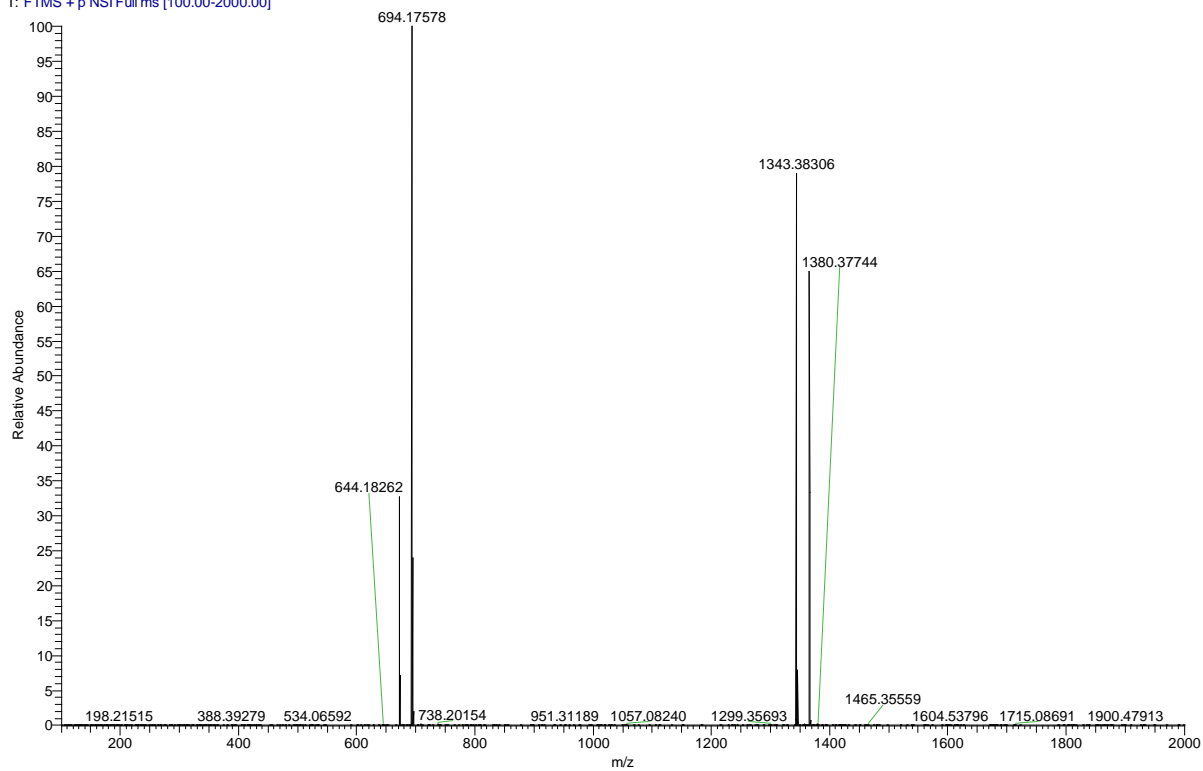


¹H NMR (400 MHz, CDCl₃)

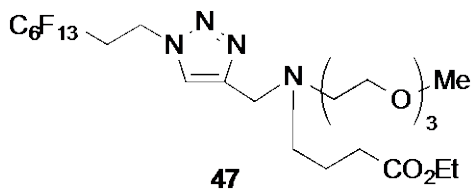


¹³C NMR (100 MHz, CDCl₃)

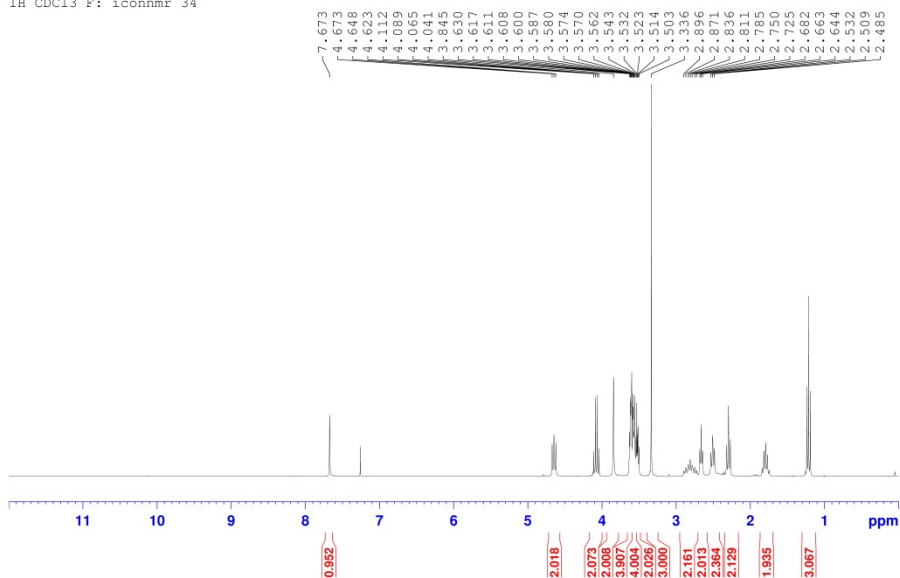
230413-105-1B_Pos_Full #1 RT: 0.02 AV: 1 NL: 8.67E7
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

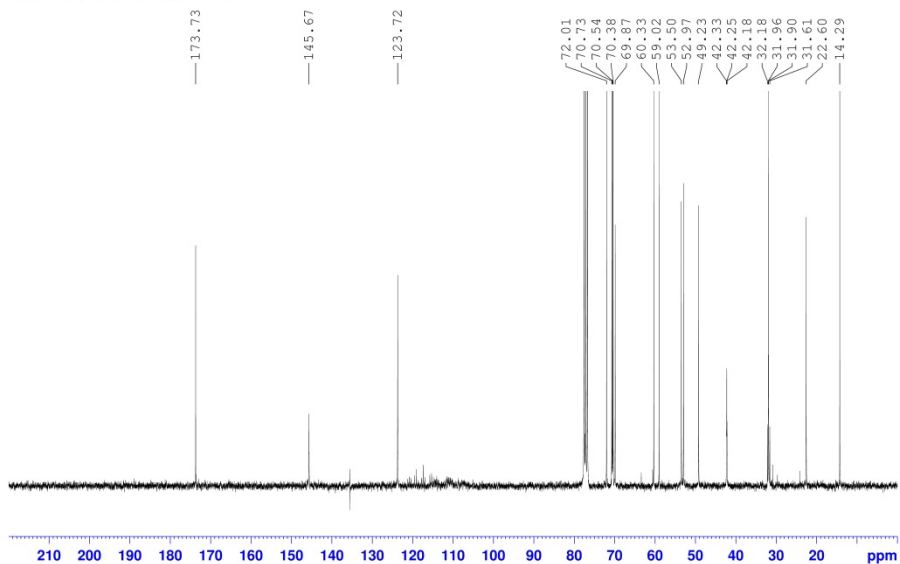


Supervisor Read
 030413-79-1A C6F13 triazolyl amino PEG butyrate
 1H CDCl3 F: iconnmr 34



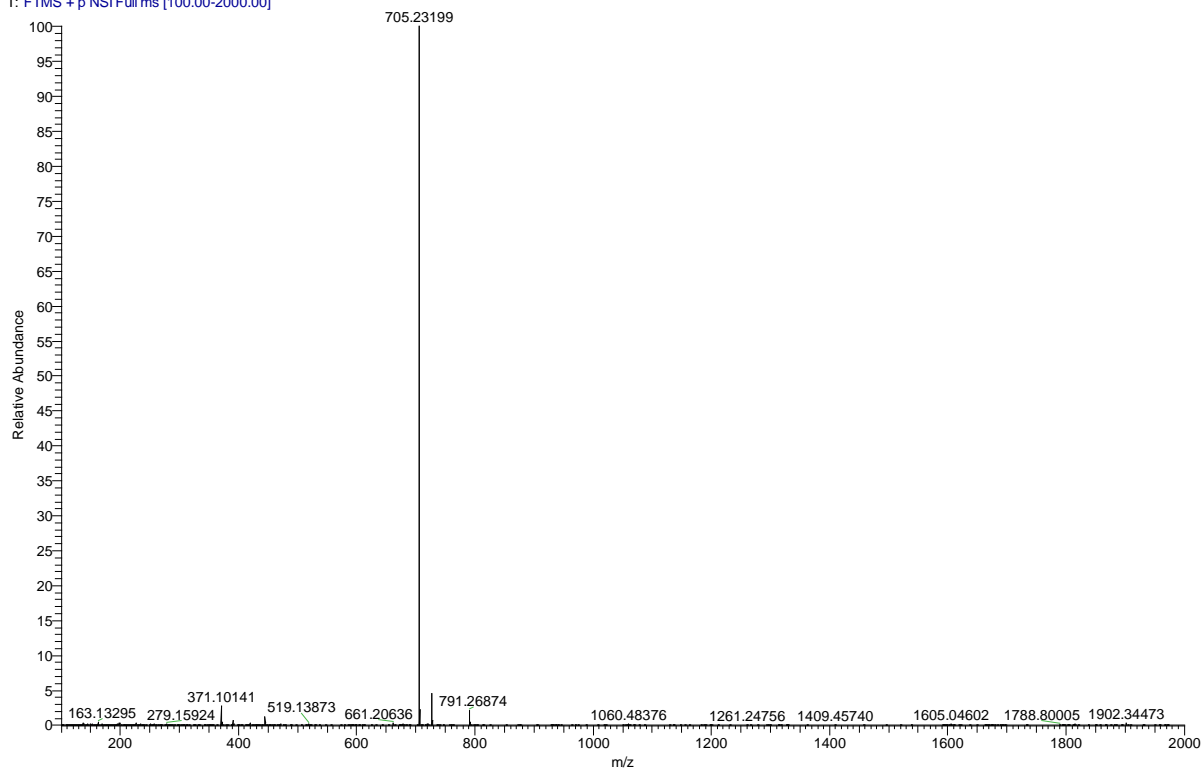
¹H NMR (300 MHz, CDCl₃)

Supervisor Read
 030413-79-1A C6F13 triazolyl amino PEG butyrate
 13C{1H} CDCl3 F: iconnmr 34

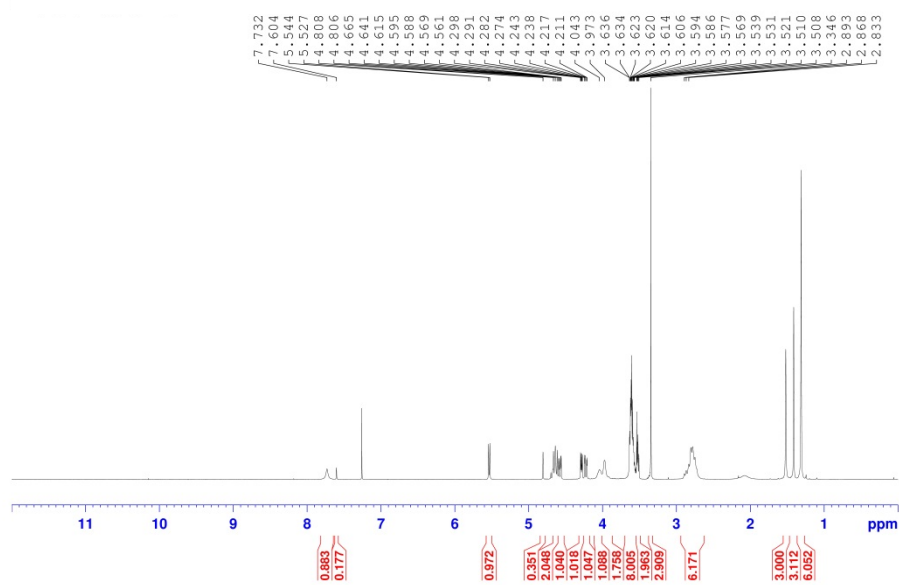
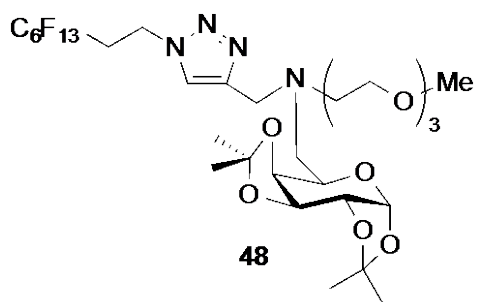


¹³C NMR (75 MHz, CDCl₃)

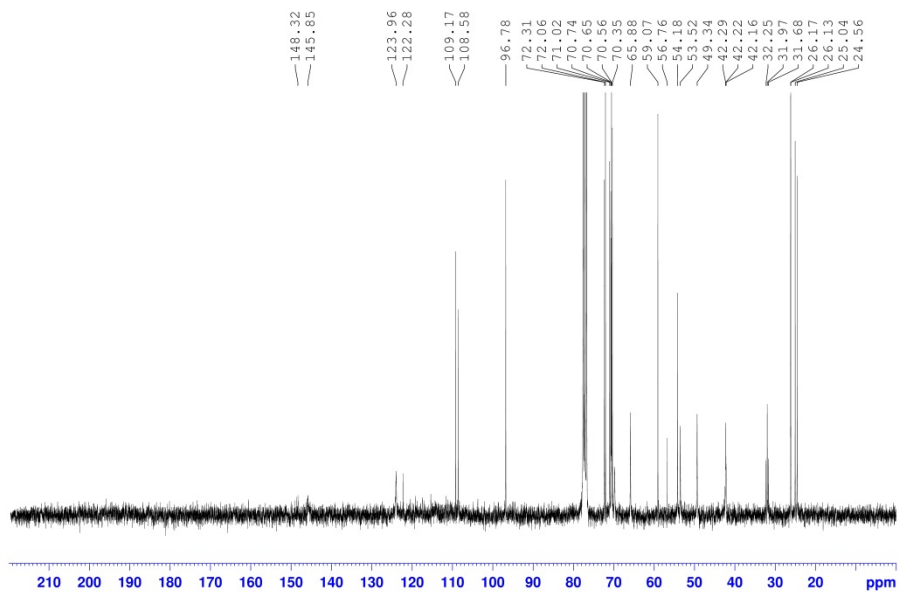
030413-79-1A_Pos_Full#1 RT: 0.02 AV: 1 NL: 3.84E7
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

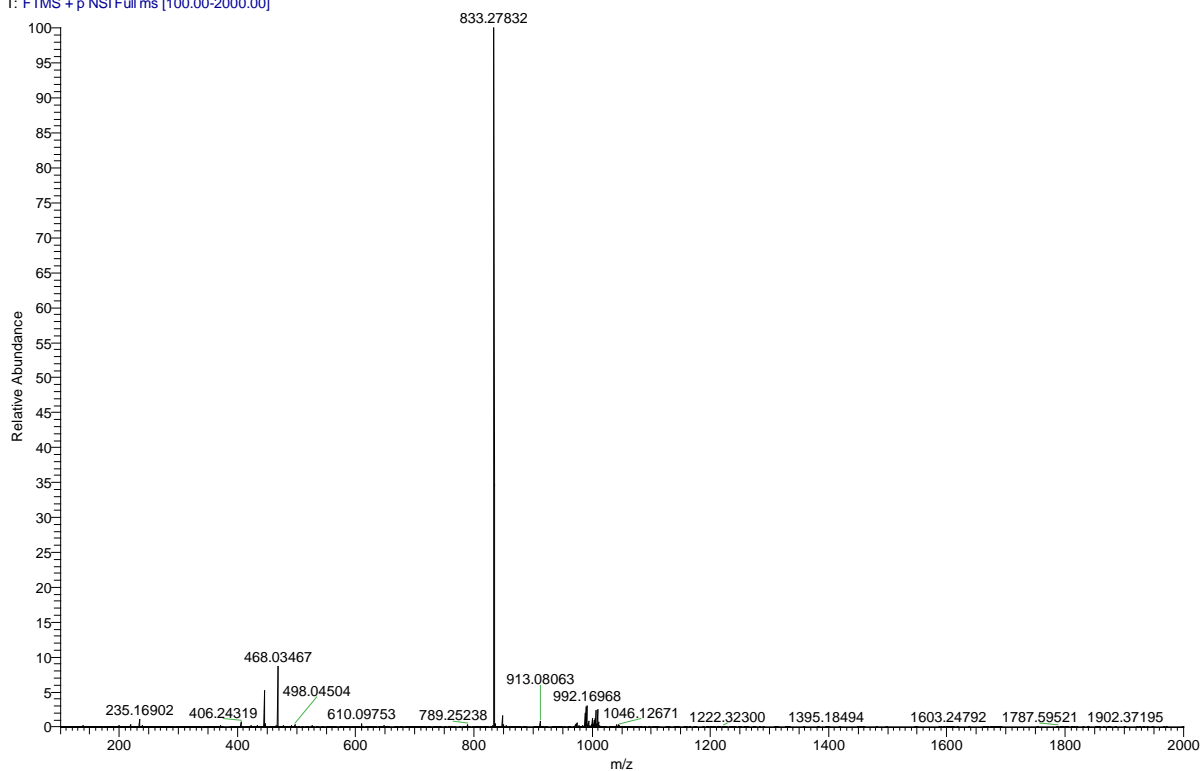


¹H NMR (300 MHz, CDCl₃)

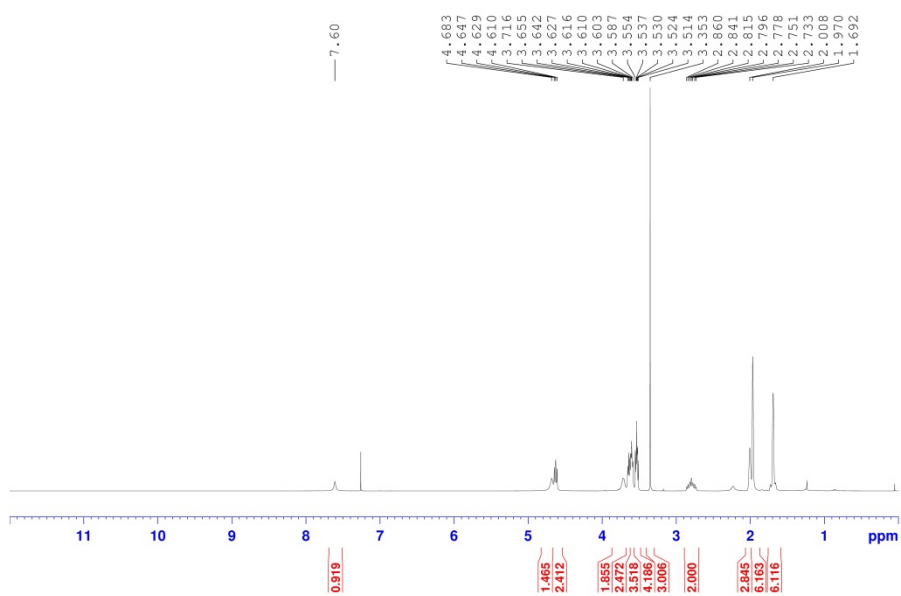
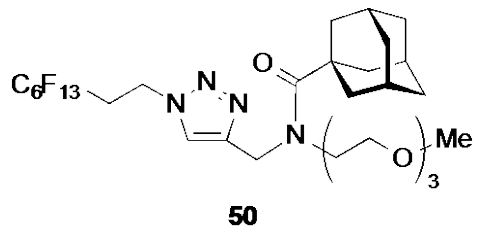


^{13}C NMR (75 MHz, CDCl_3)

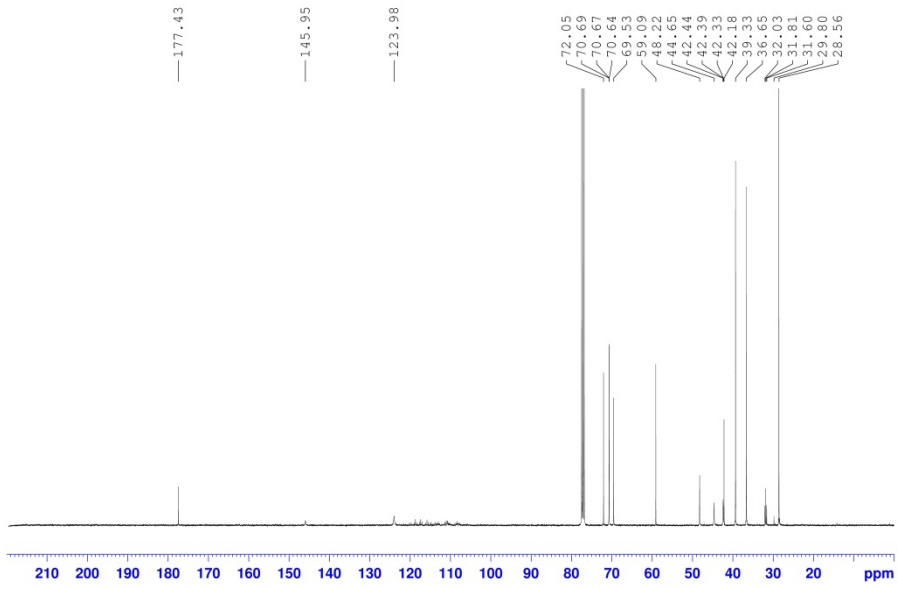
010413-103-1A_Pos_Full #1 RT: 0.02 AV: 1 NL: 1.32E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

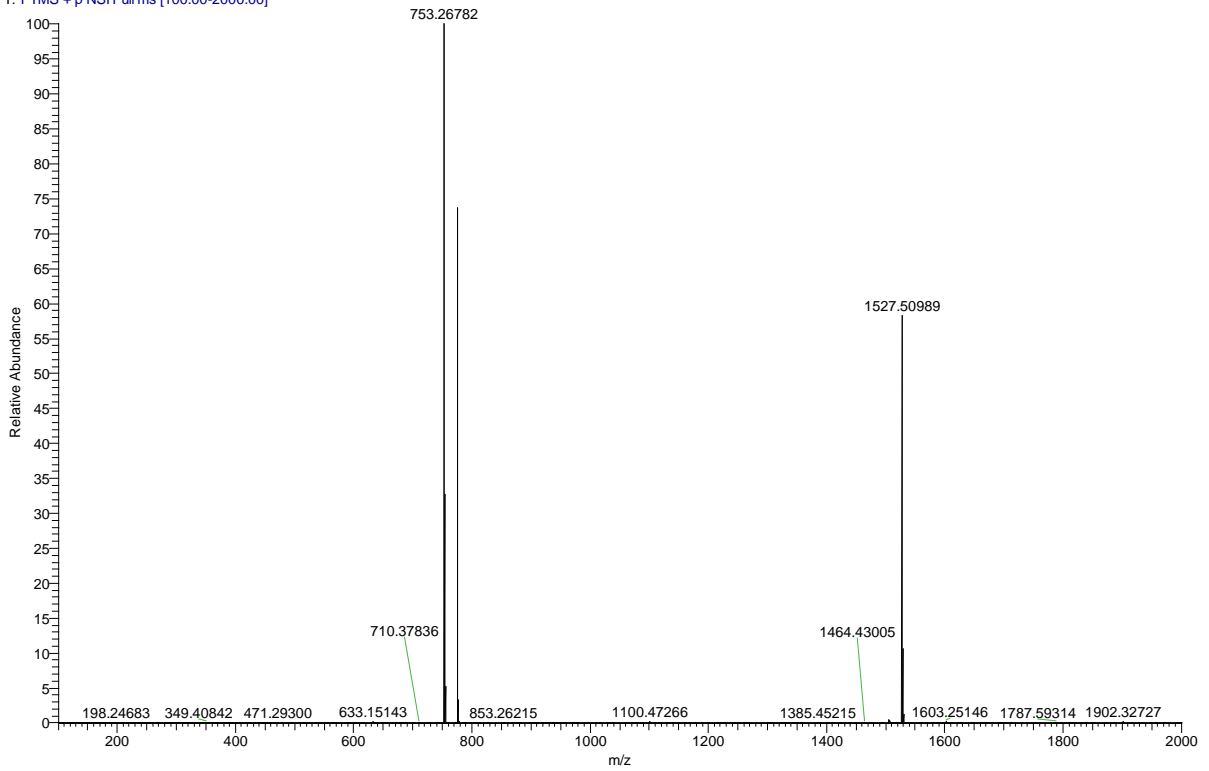


^1H NMR (400 MHz, CDCl_3)

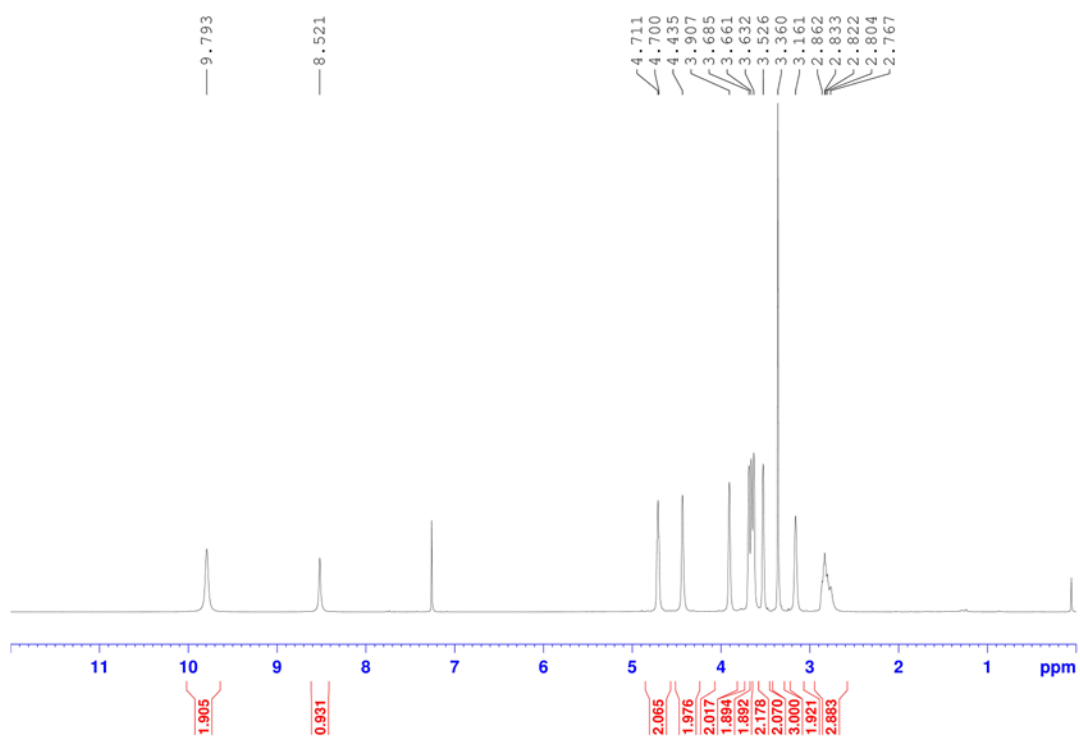
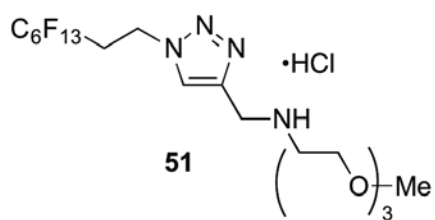


^{13}C NMR (100 MHz, CDCl_3)

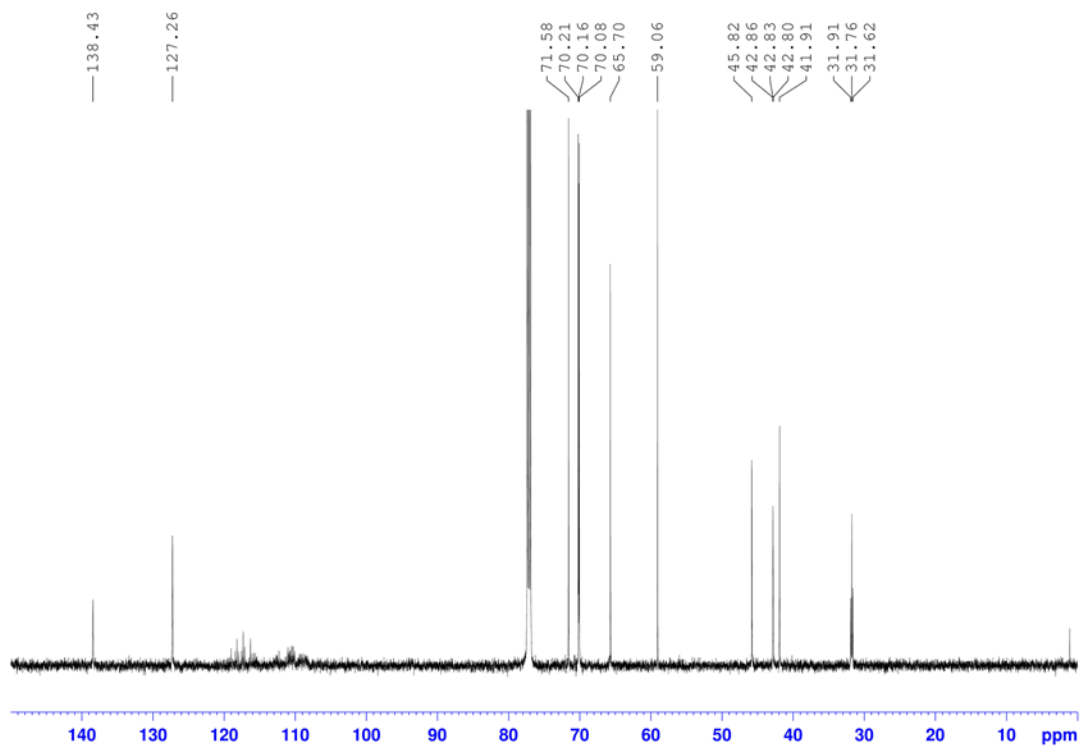
010413-104-1A_Pos_Full_a#1 RT: 0.01 AV: 1 NL: 8.30E7
T: FTMS + p NSI Full ms [100.00-2000.00]



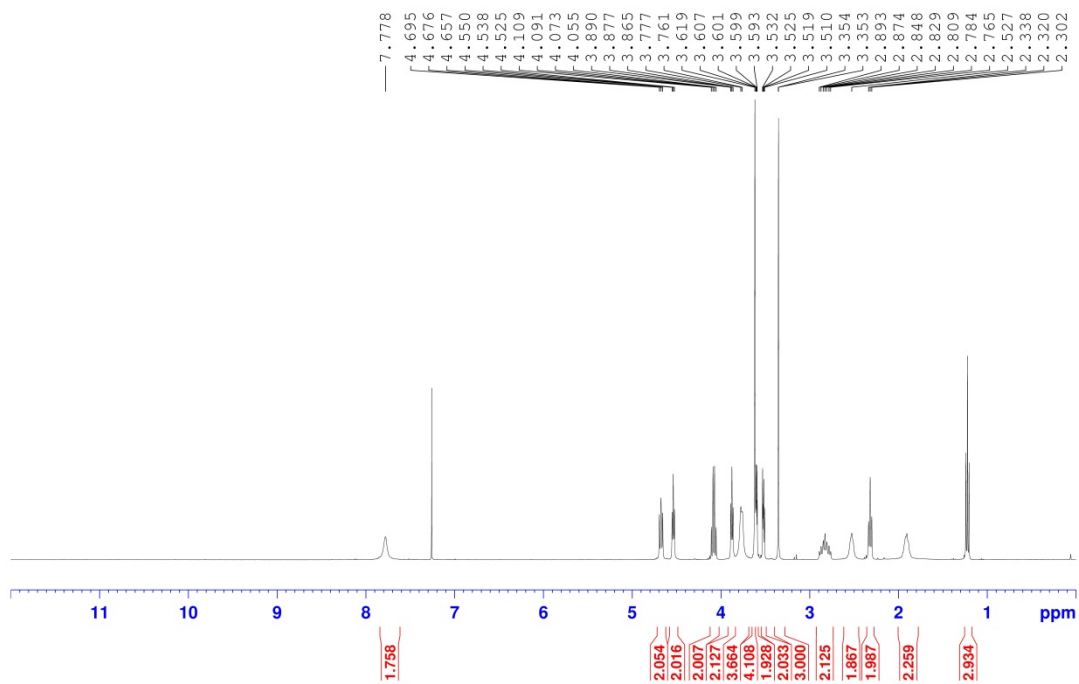
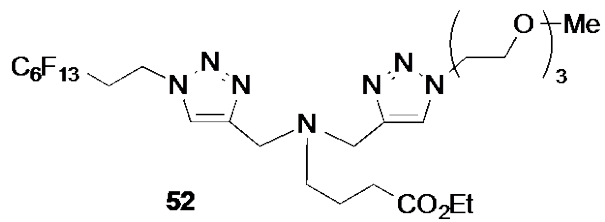
High resolution MS (MeOH)



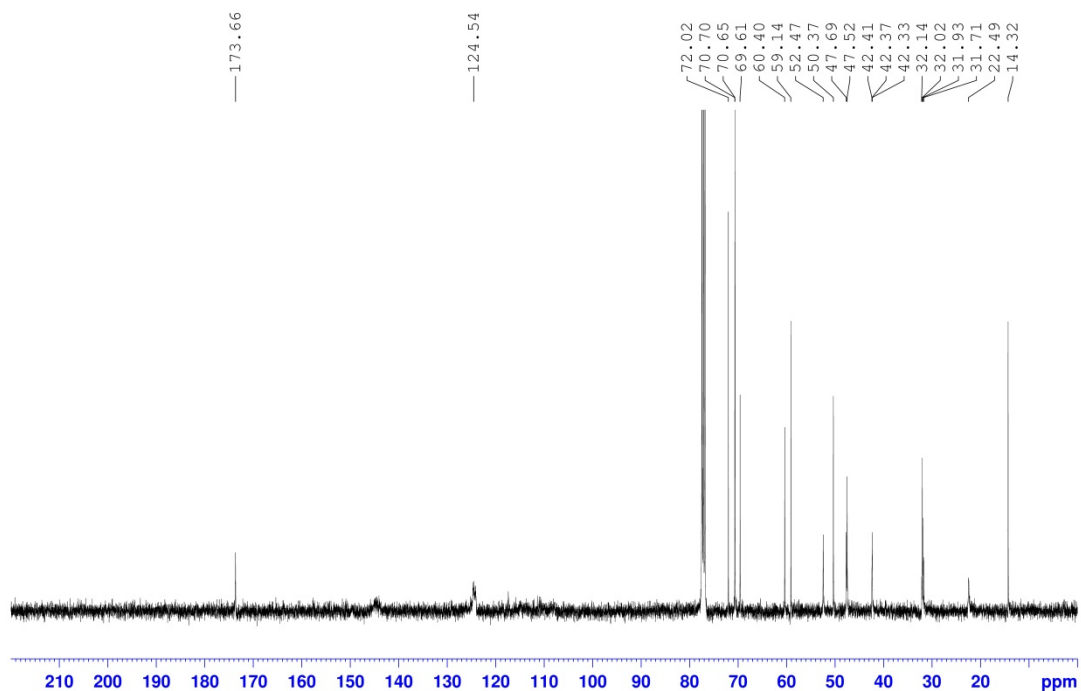
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR (100 MHz, CDCl_3)

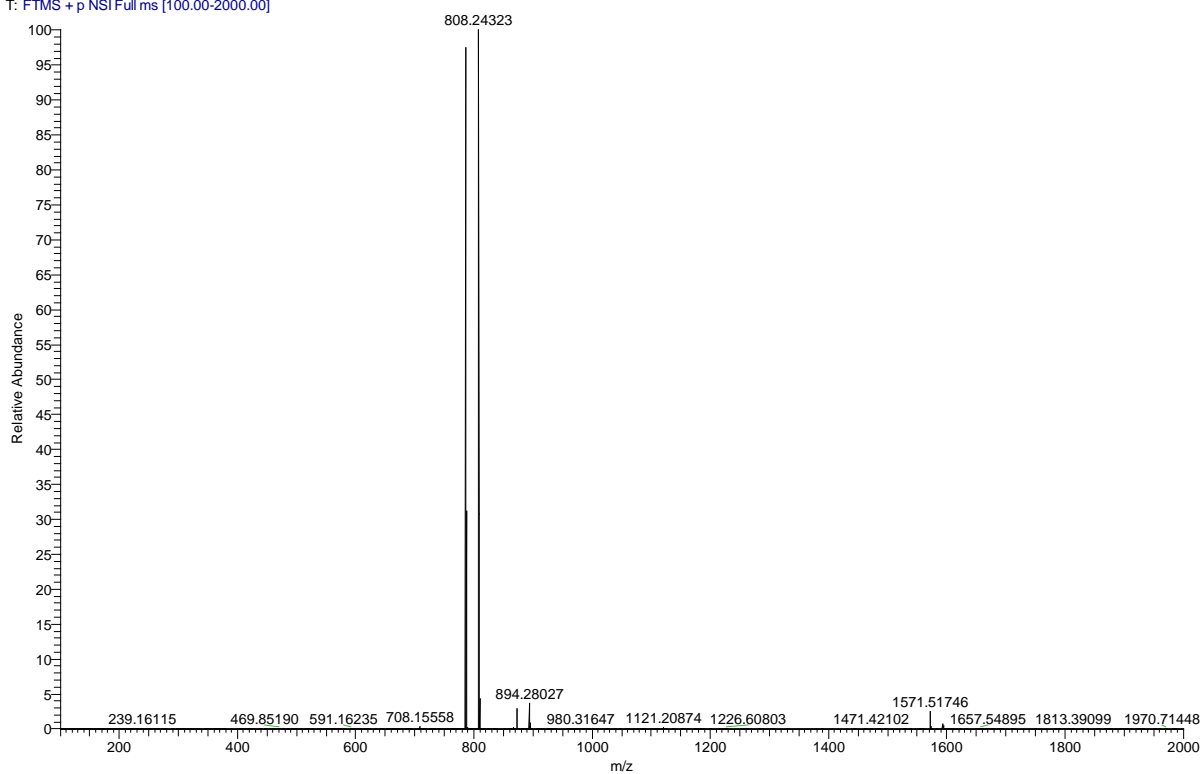


¹H NMR (400 MHz, CDCl₃)

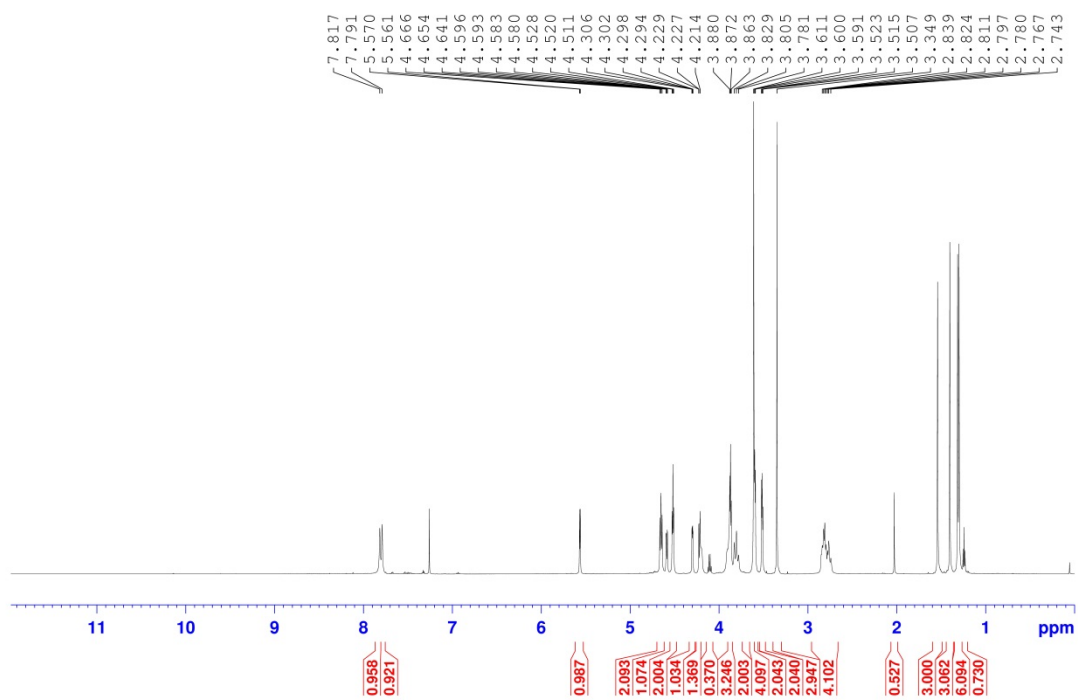
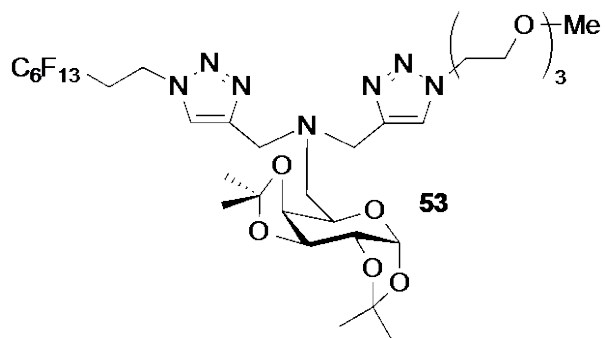


¹³C NMR (100 MHz, CDCl₃)

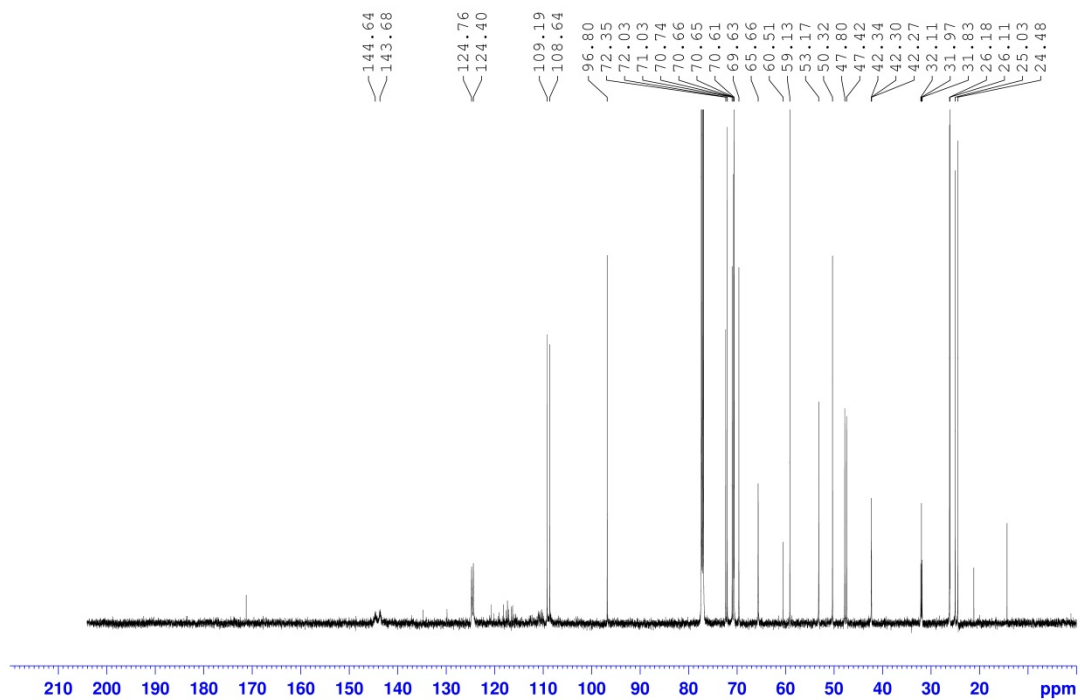
300413-111-1A_Pos_Full #1 RT: 0.02 AV: 1 NL: 1.09E8
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)

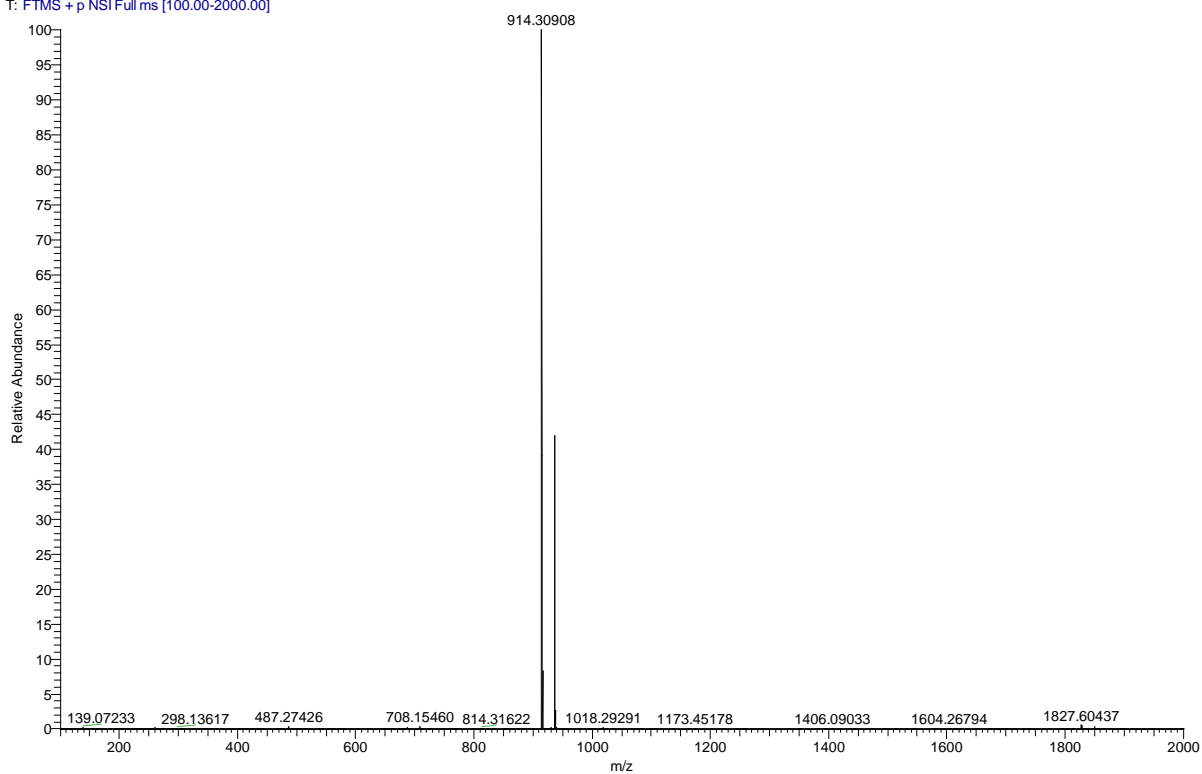


¹H NMR (600 MHz, CDCl₃)



^{13}C NMR (150 MHz, CDCl_3)

300413-112-1A_Pos_Full_a #1 RT: 0.01 AV: 1 NL: 7.49E7
T: FTMS + p NSI Full ms [100.00-2000.00]



High resolution MS (MeOH)