

Supplementary Information

Stereoselective synthesis of spiro-decalin oxindole derivatives *via* sequential organocatalytic Michael–domino Michael/aldol reaction

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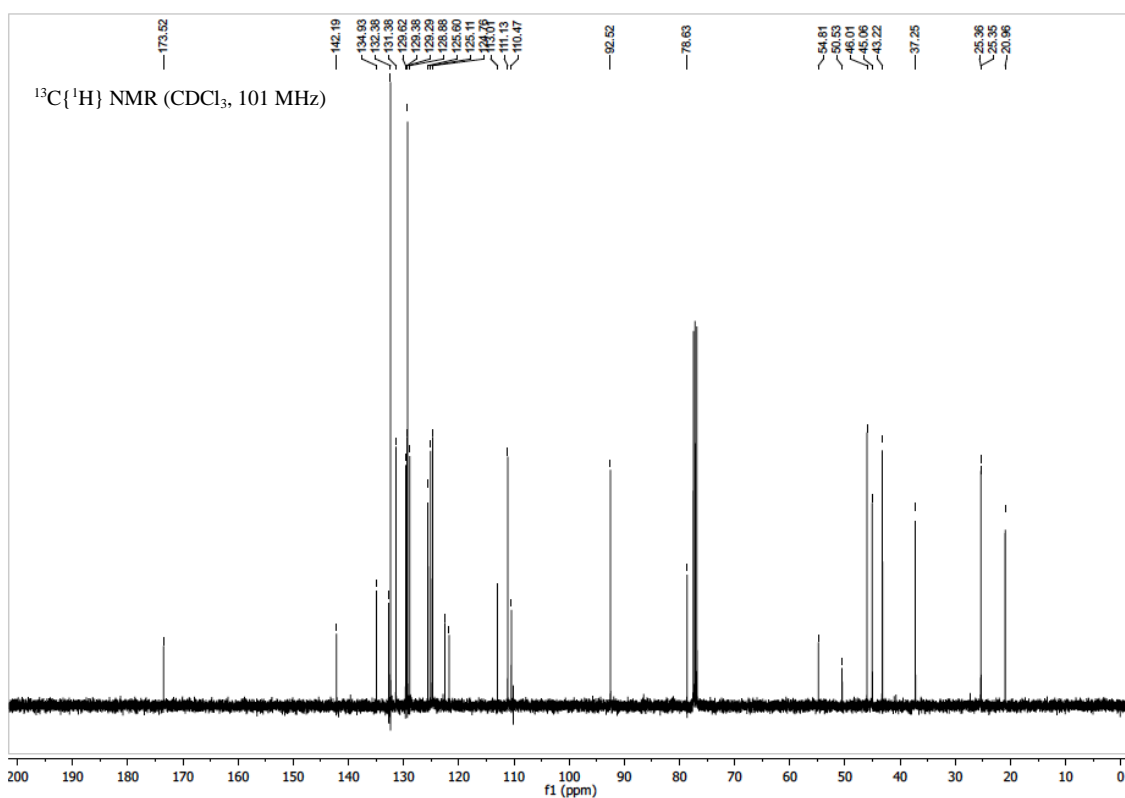
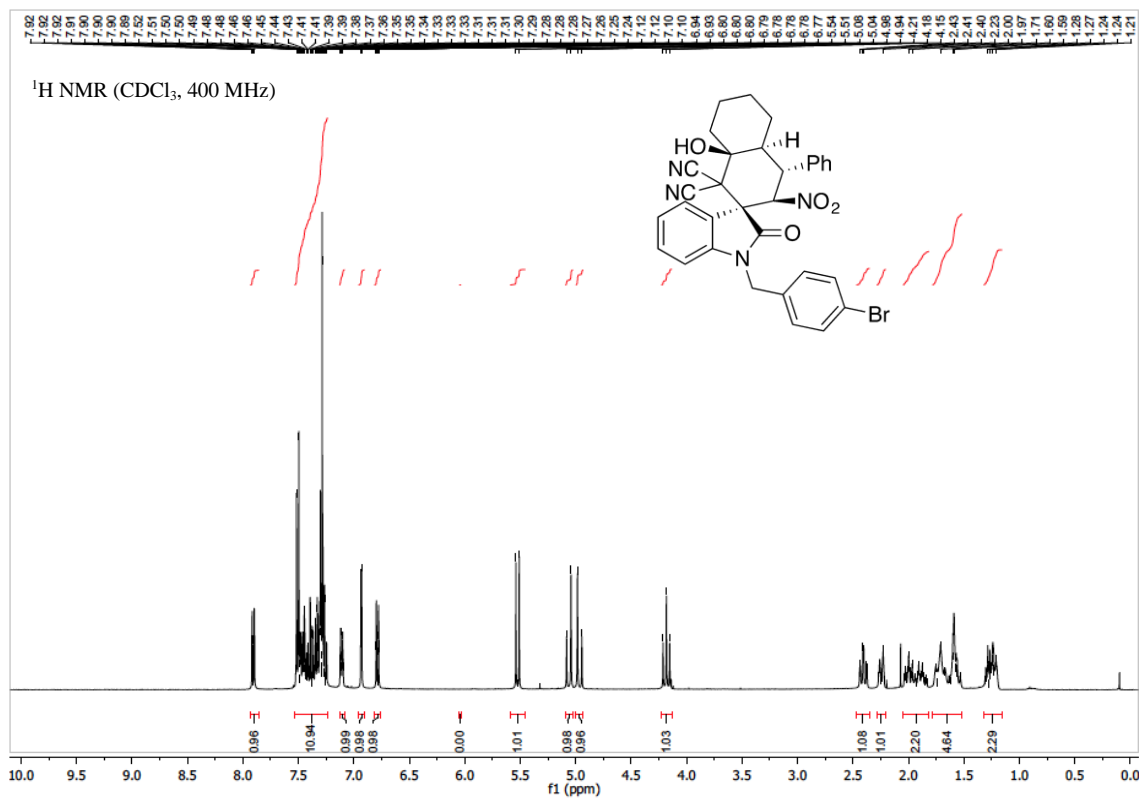
**email: fabrizio.vetica@uniroma1.it*

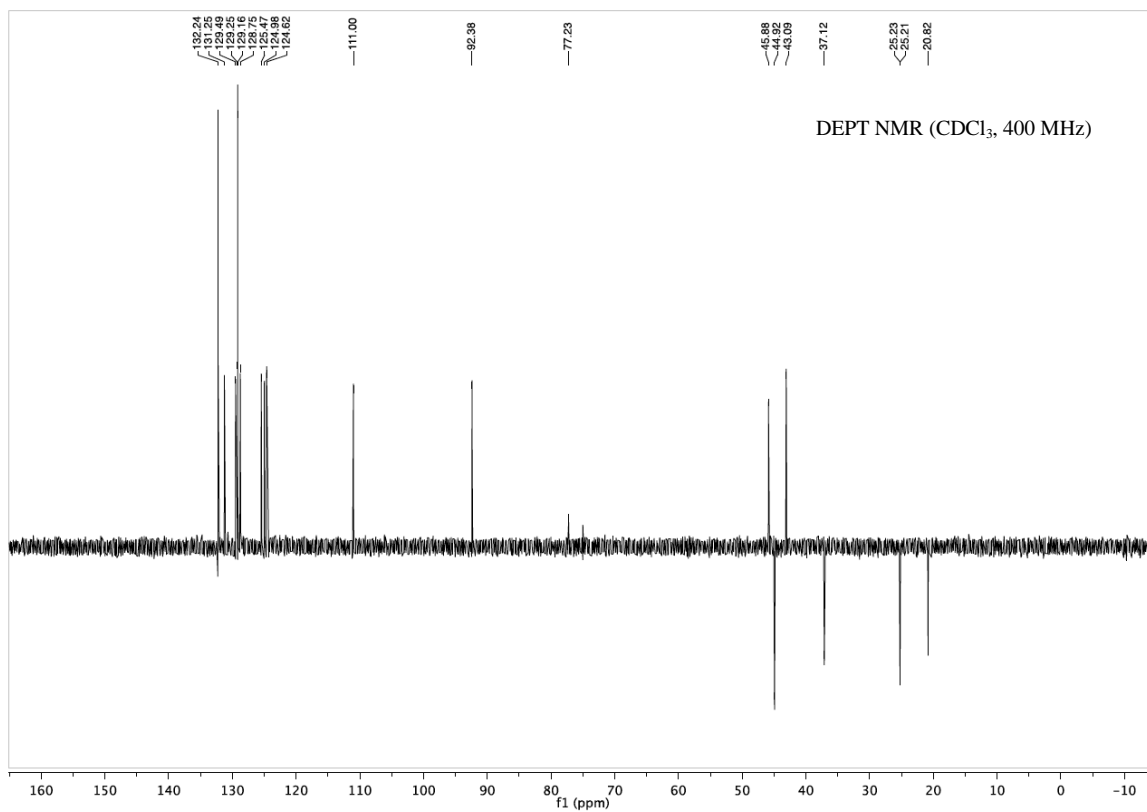
Table of Contents

NMR SPECTRA, HPLC CHROMATOGRAMS AND HRMS SPECTRA	S2
(3S,3'R,4'R,4a'S,8a'S)-1-(4-bromobenzyl)-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5a)	S2
(3S,3'R,4'R,4a'S,8a'S)-1-benzyl-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5b)	S6
(3S,3'R,4'R,4a'S,8a'S)-1-benzyl-5-chloro-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5c)	S9
(3S,3'R,4'R,4a'S,8a'S)-1-benzyl-5-bromo-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5d)	S12
(3S,3'R,4'R,4a'S,8a'S)-1-benzyl-8a'-hydroxy-5-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5e)	S15
(3S,3'R,4'R,4a'S,8a'S)-8a'-hydroxy-1-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5f)	S18
(3S,3'R,4'R,4a'S,8a'S)-5-chloro-8a'-hydroxy-1-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5g)	S21
(3S,3'R,4'R,4a'S,8a'S)-8a'-hydroxy-1,5-dimethyl-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5h)	S24
(3S,3'R,4'R,4a'S,8a'S)-1-ethyl-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5i)	S27
(3S,3'R,4'R,4a'S,8a'S)-5-chloro-1-ethyl-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5j)	S30
(3S,3'R,4'R,4a'S,8a'S)-1-ethyl-8a'-hydroxy-5-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5k)	S33

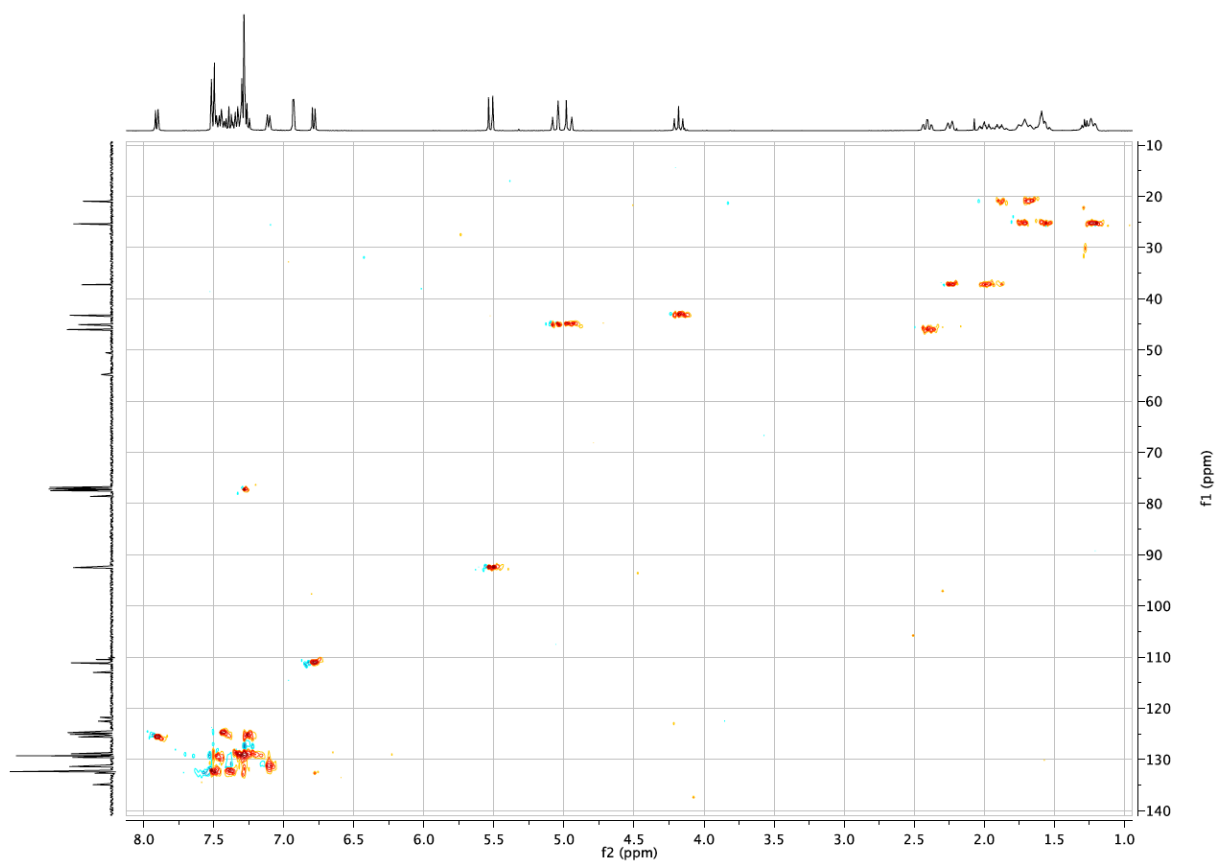
NMR SPECTRA, HPLC CHROMATOGRAMS AND HRMS SPECTRA

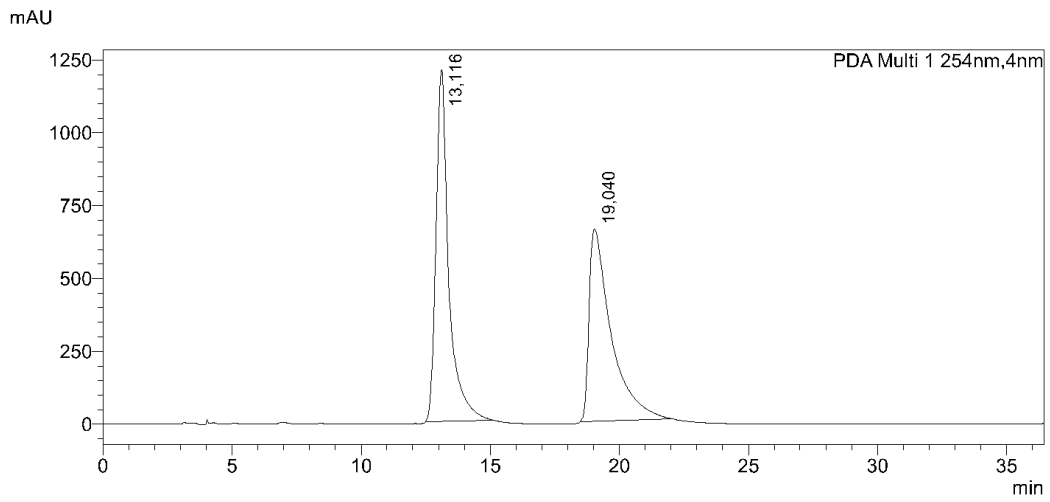
(3S,3'R,4'R,4a'S,8a'S)-1-(4-bromobenzyl)-8a'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4a',5',6',7',8',8a'-octahydro-1'H-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5a)



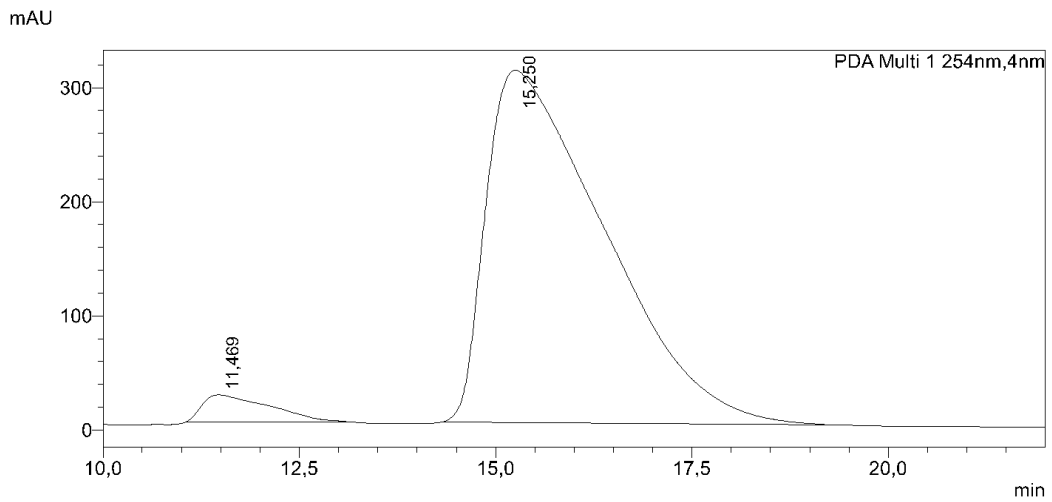


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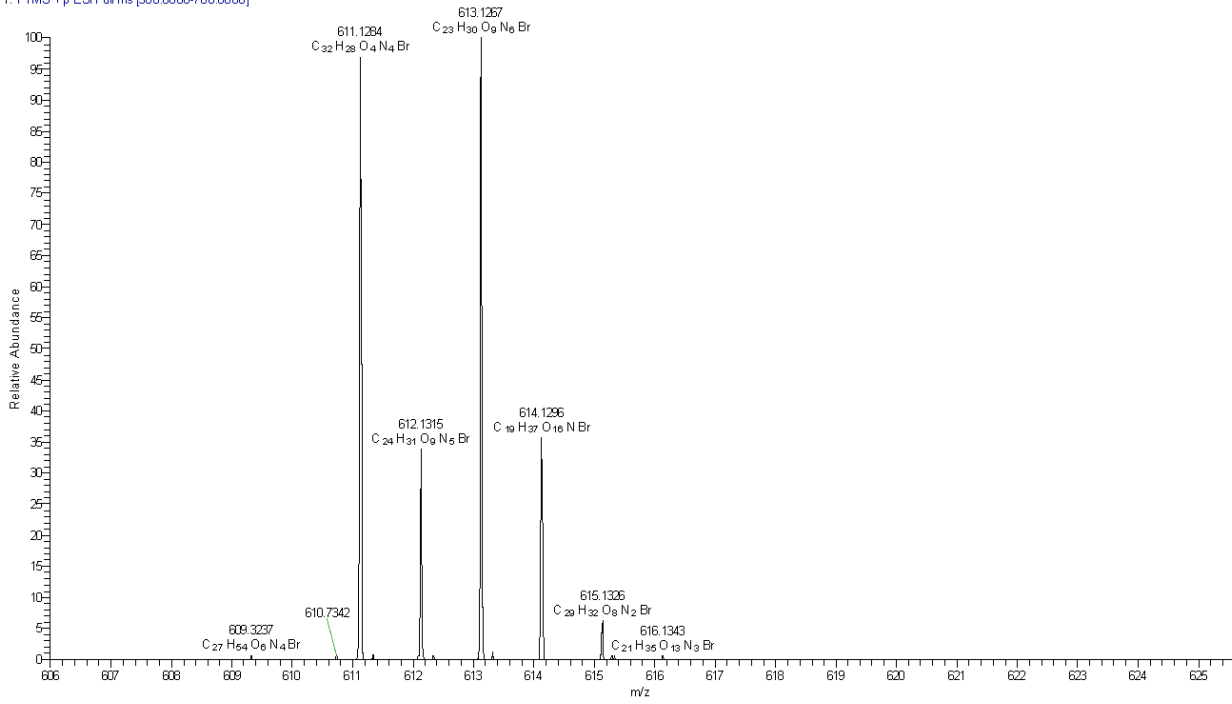


PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13,116	41243019	1206820	51,187		M	
2	19,040	39329827	660092	48,813		M	
Total		80572846	1866912				

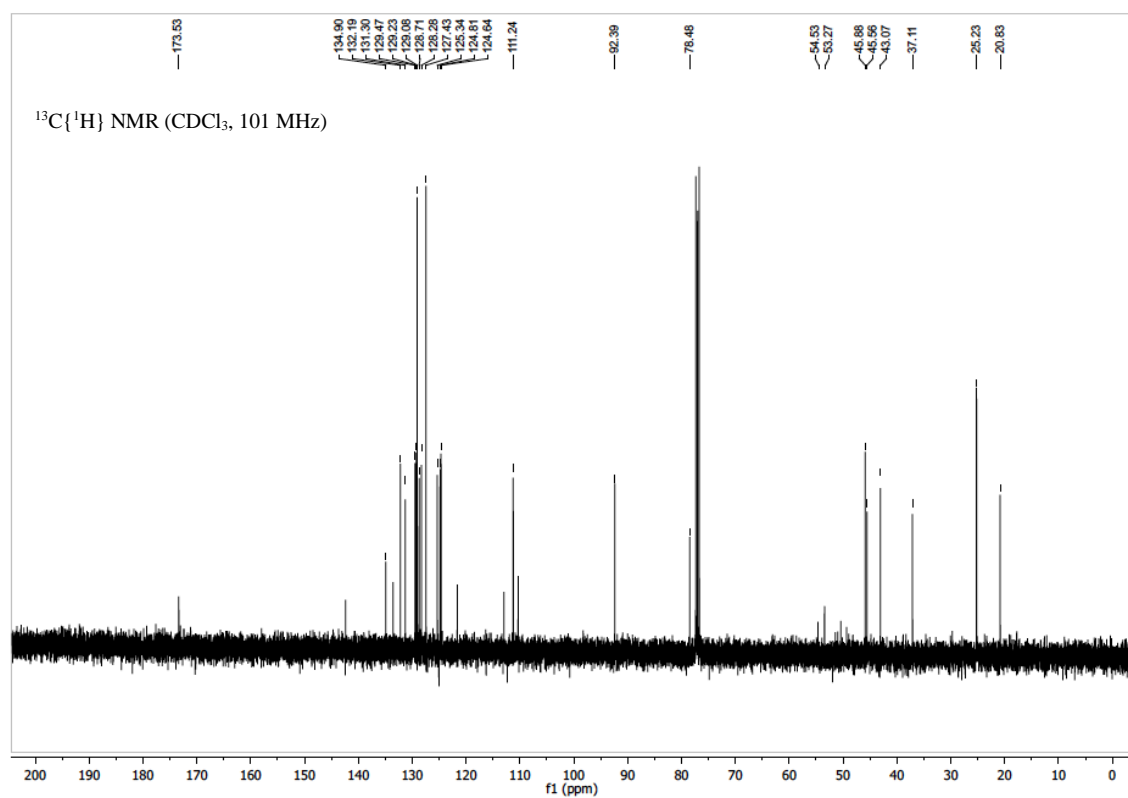
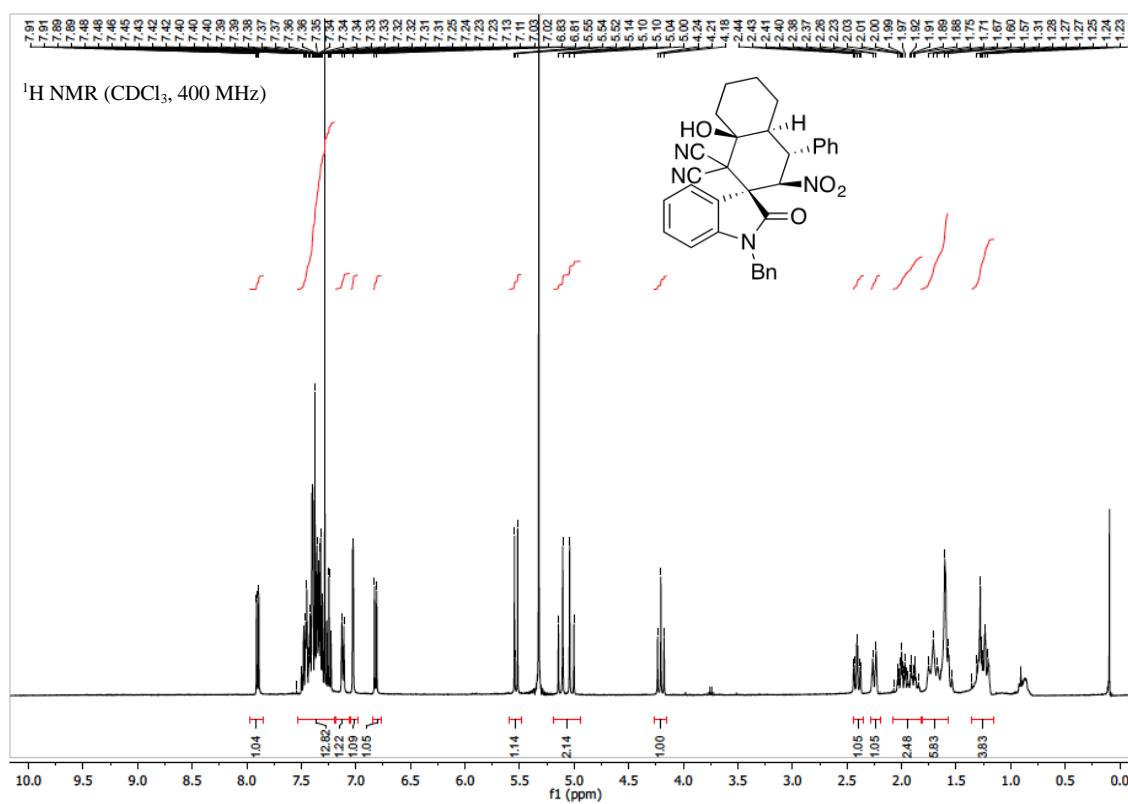


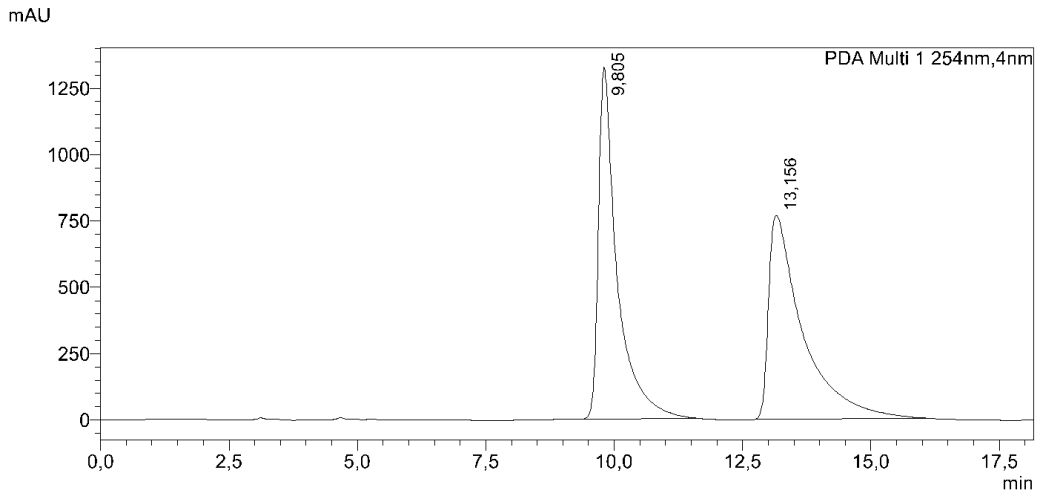
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Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	11,469	1387260	23620	4,098		M	
2	15,250	32461677	308595	95,902		M	
Total		33848936	332215				

LS121 #295 RT: 0.69 AV: 1 NL: 3.99E7
T: FTMS +p ESI Full ms [500.0000-700.0000]

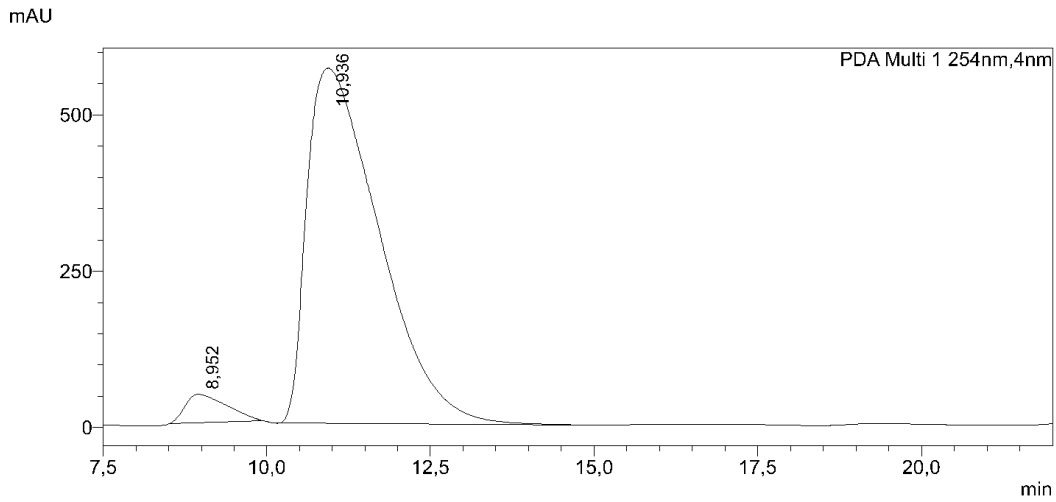


(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-benzyl-8*a*'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1'*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5b)



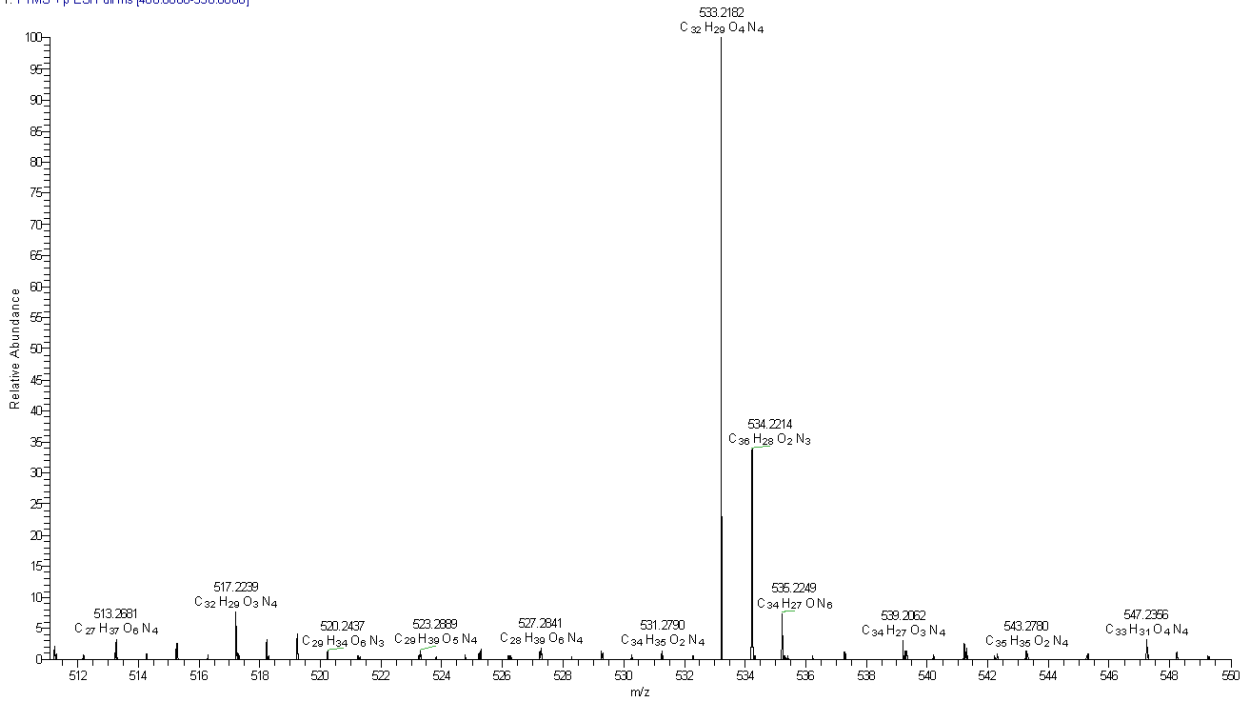


Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9,805	33585958	1324829	48,597		M	
2	13,156	35525057	769282	51,403		M	
Total		69111015	2094112				

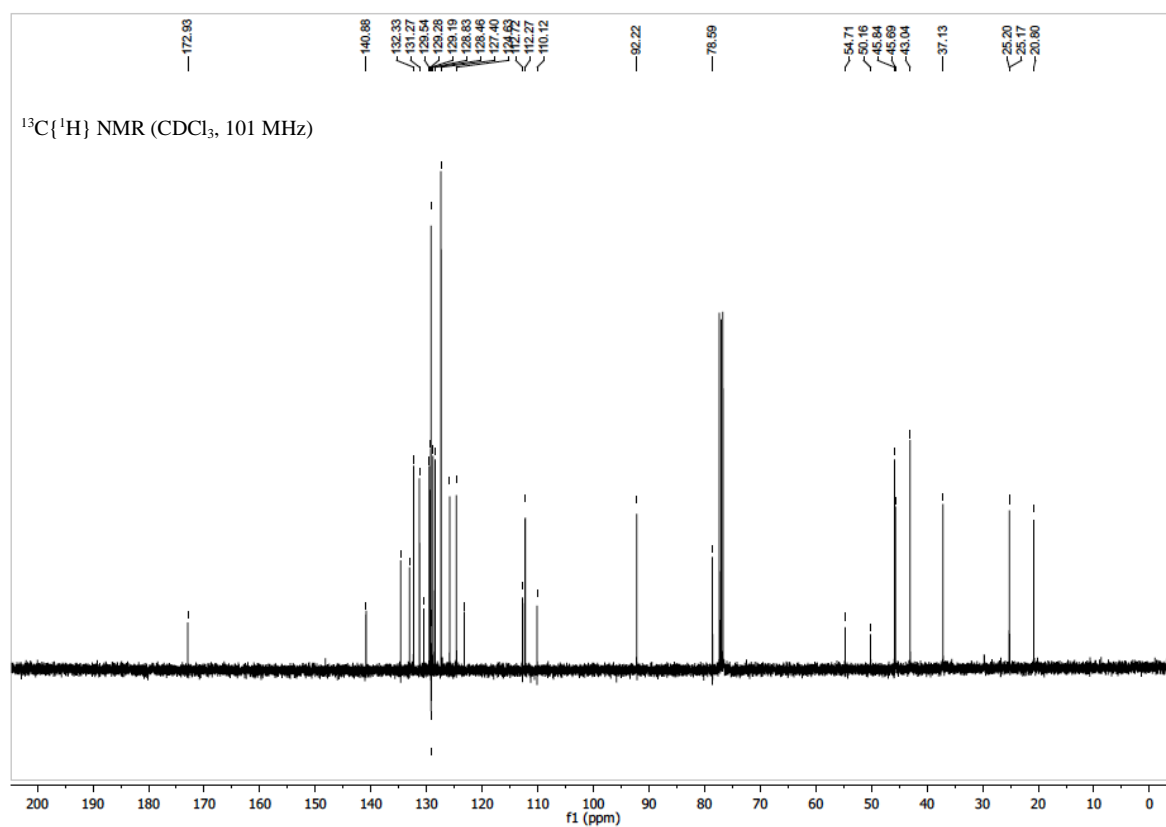
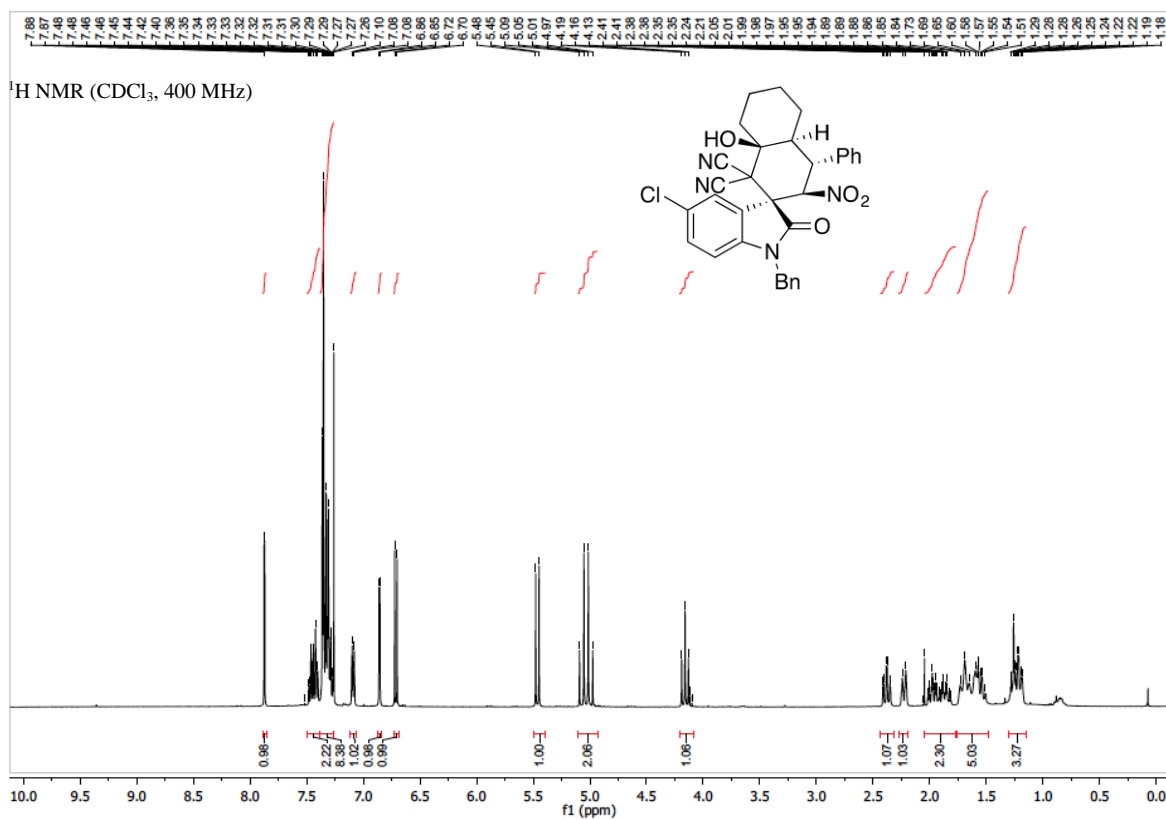


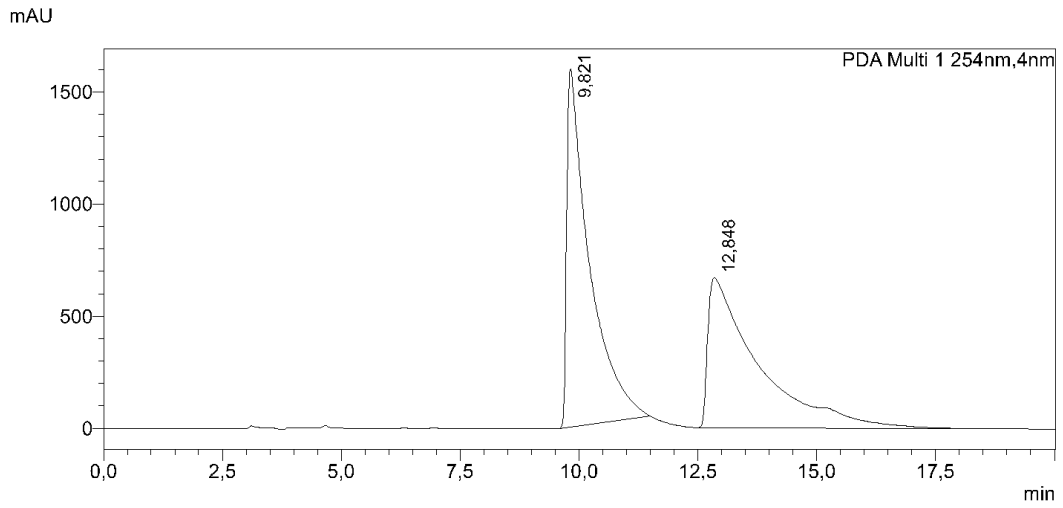
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	8,952	2024020	45852	4,426		M	
2	10,936	43703724	567601	95,574		M	
Total		45727745	613452				

LS46 #206 RT: 0.48 AV: 1 NL: 3.00E7
T: FTMS +p ESI Full ms [400.0000-550.0000]

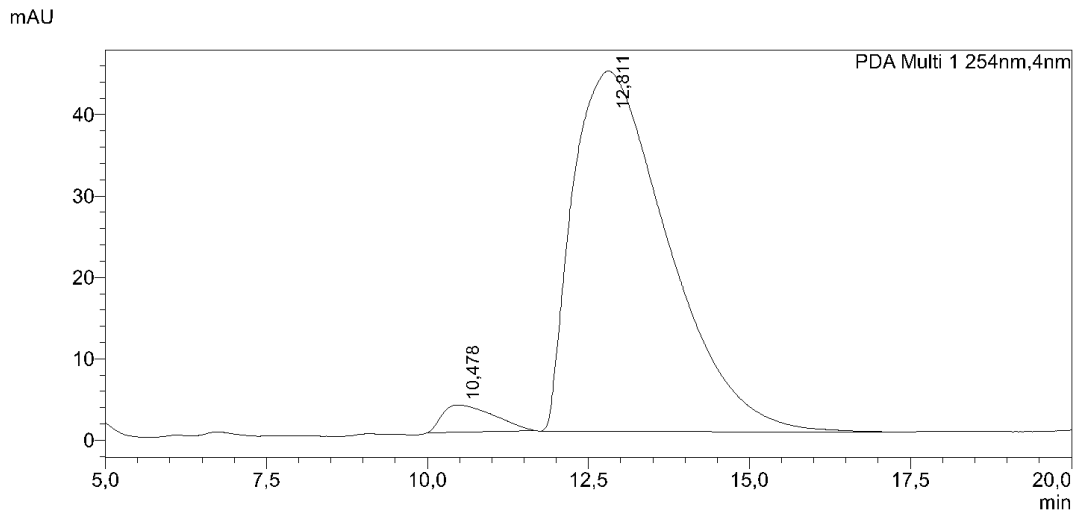


(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-benzyl-5-chloro-8*a*'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5c)

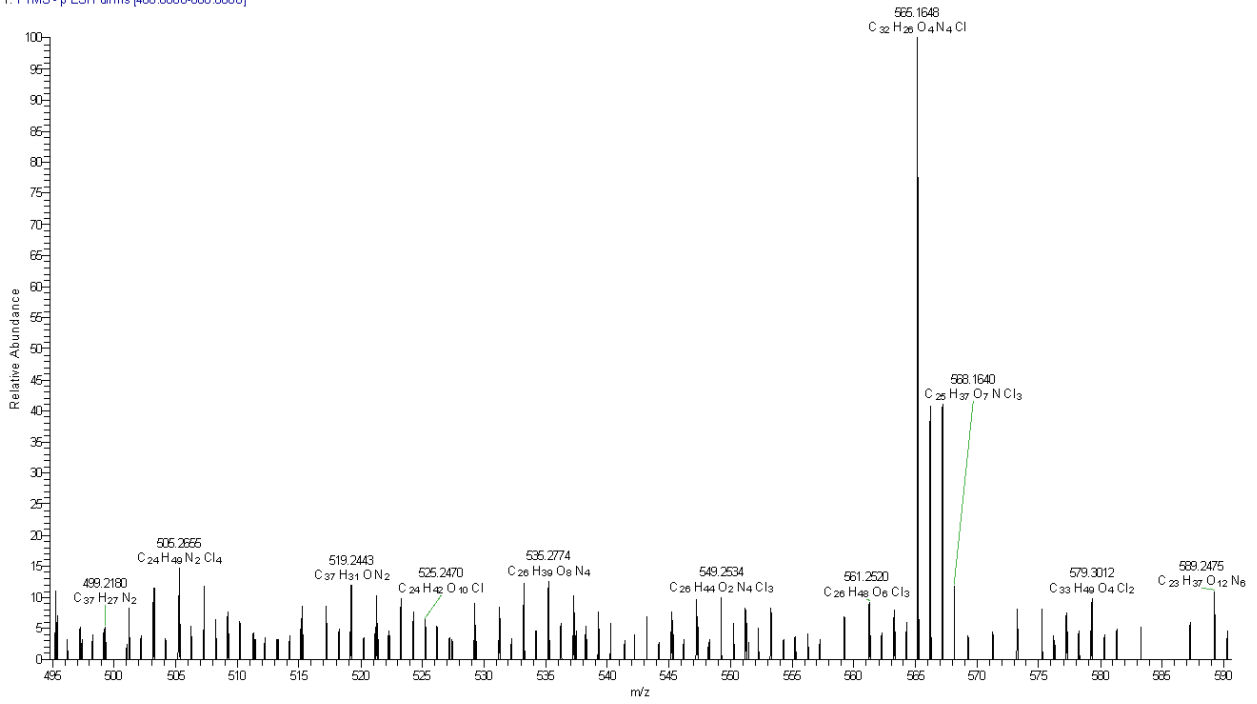




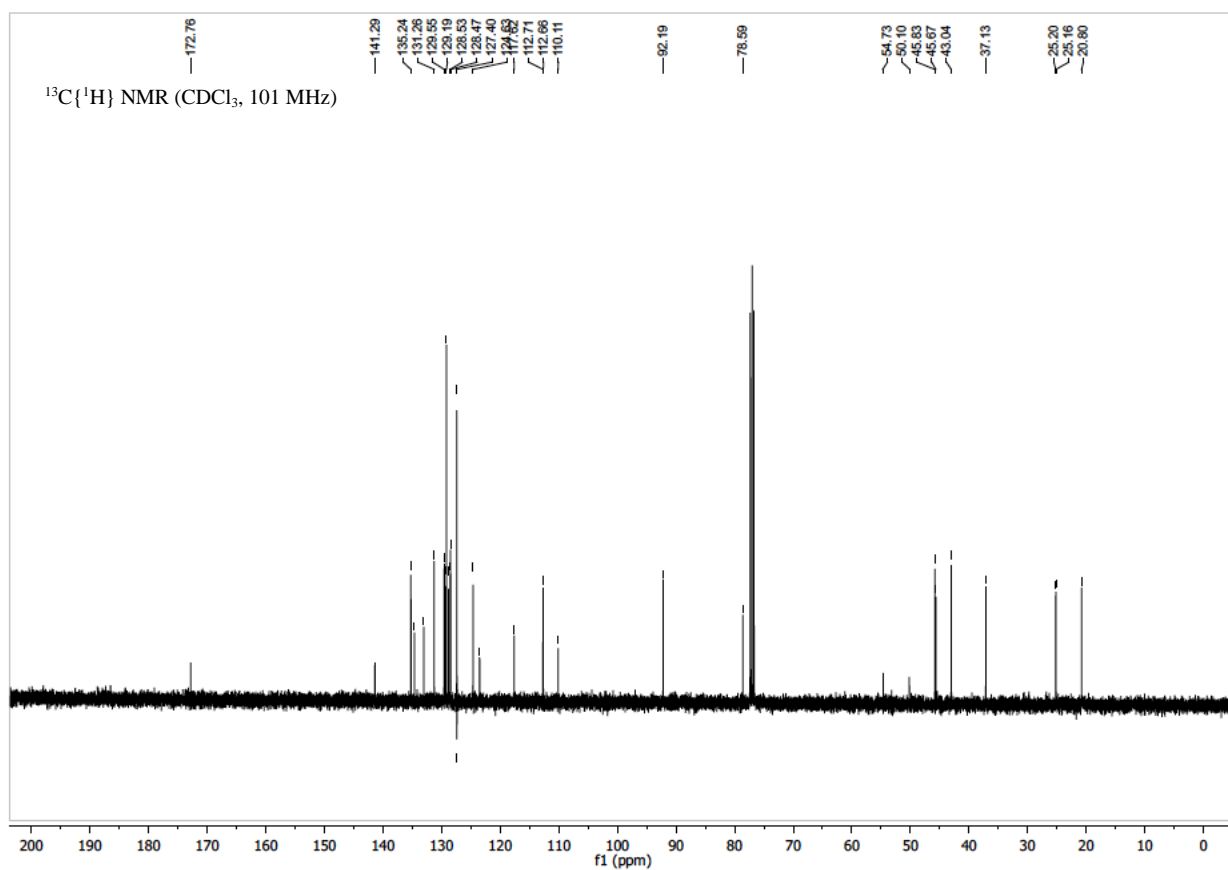
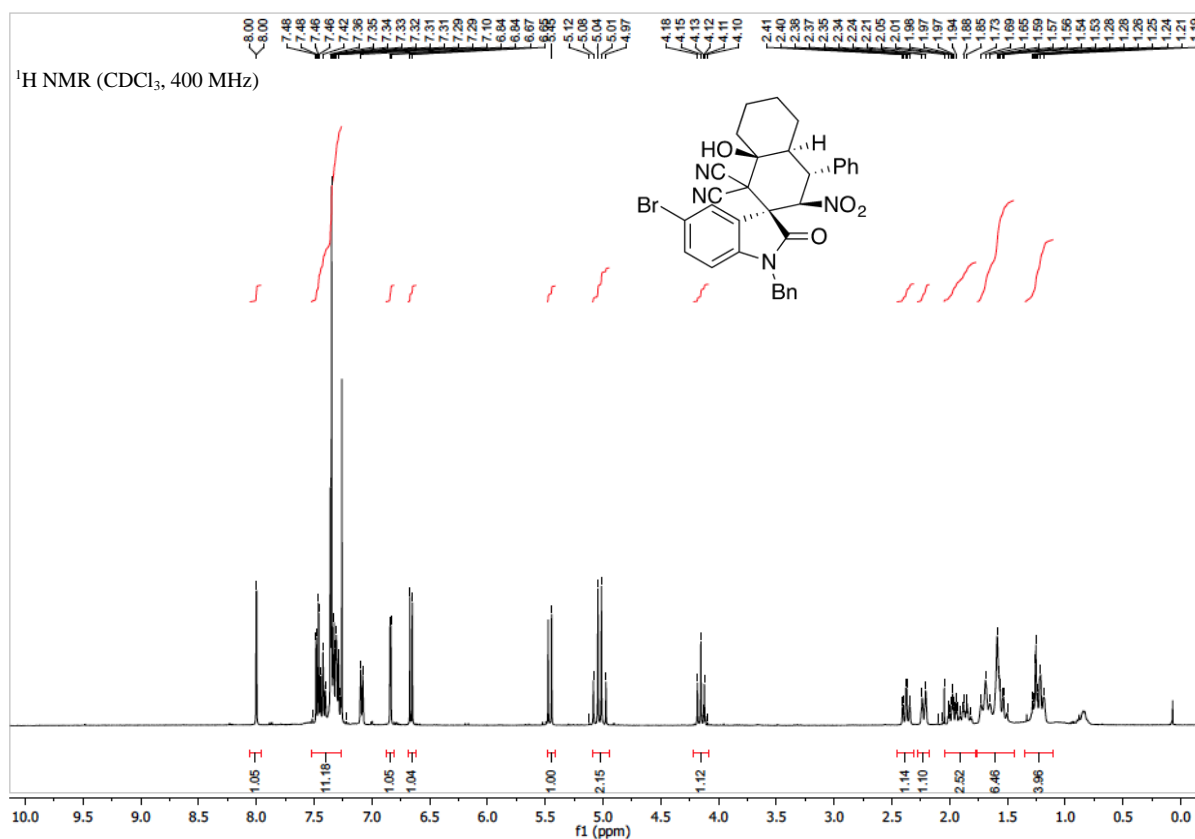
PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9,821	52685758	1596186	51,850		M	
2	12,848	48925444	667175	48,150		M	
Total		101611202	2263361				



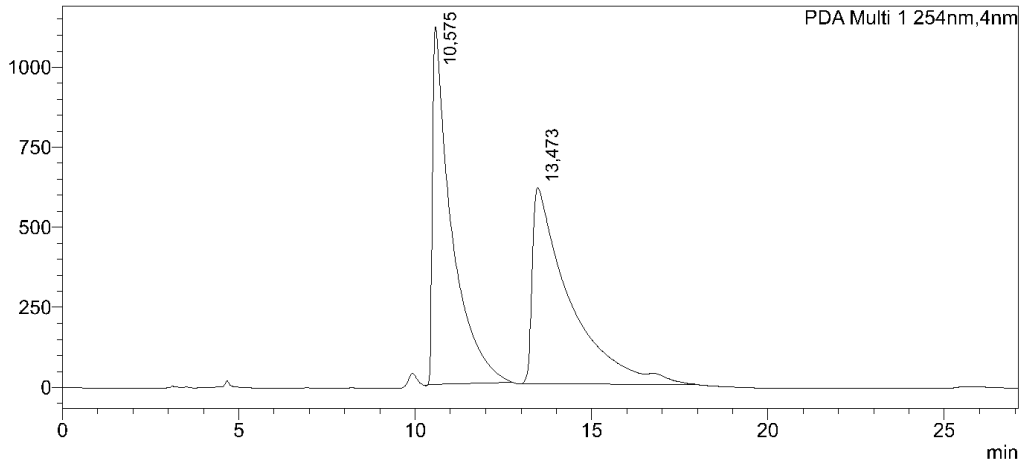
PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10,478	187162	3360	3,952		M	
2	12,811	4548302	44276	96,048		M	
Total		4735464	47635				



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-benzyl-5-bromo-8*a*'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5d)



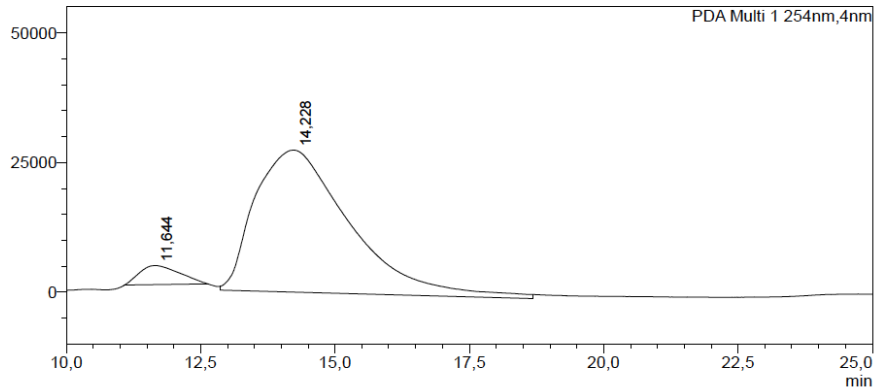
mAU



Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10,575	41662998	1117514	48,076		M	
2	13,473	44996923	612734	51,924		M	
Total		86659921	1730248				

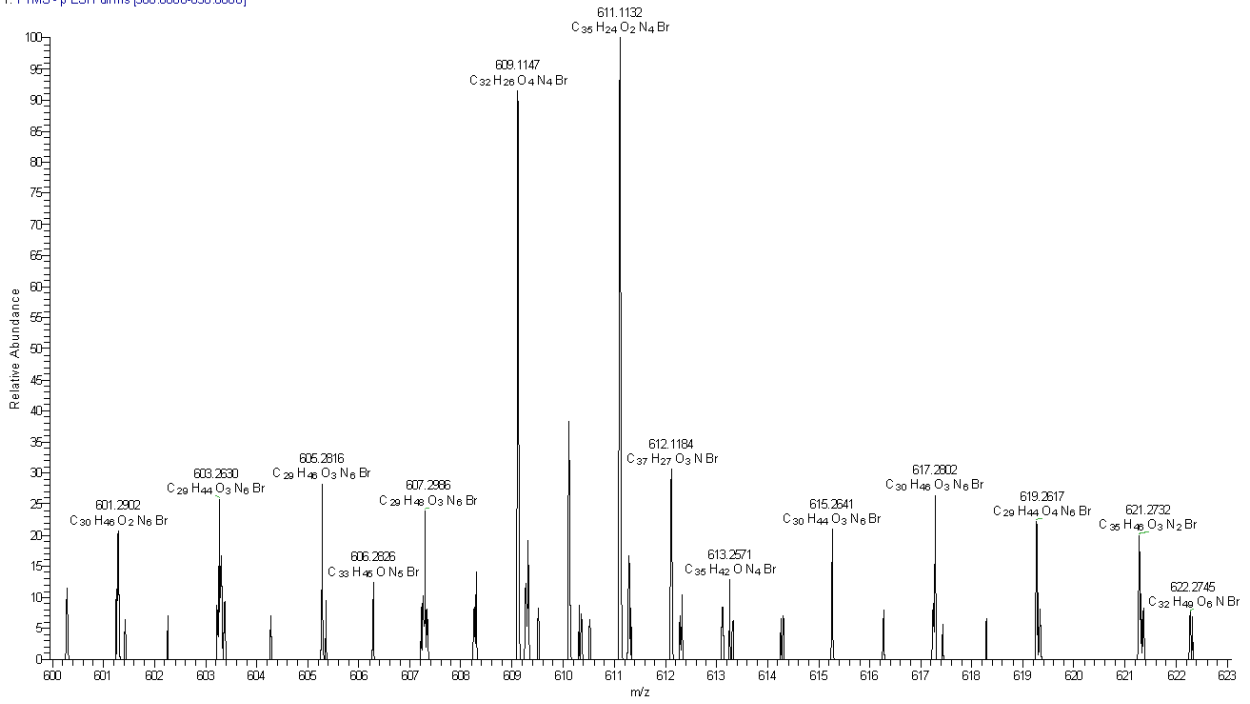
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uAU

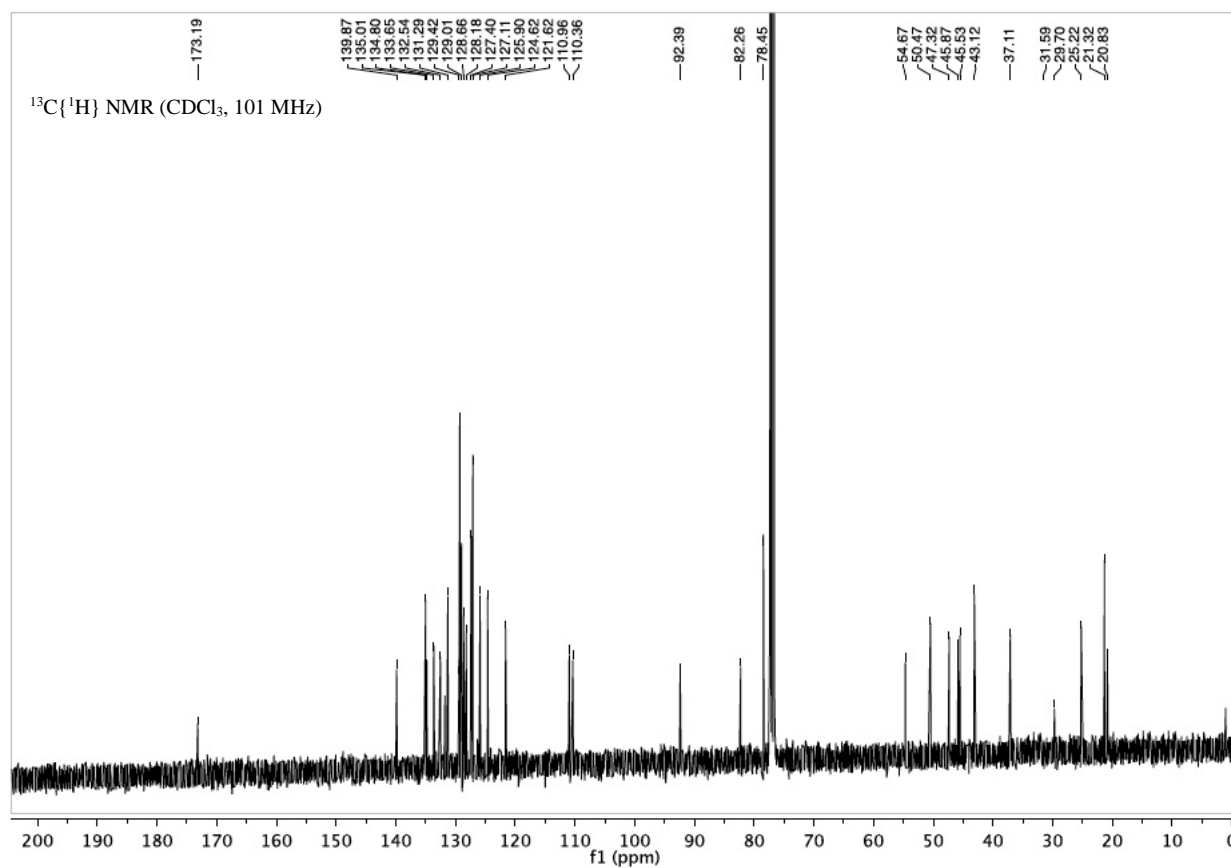
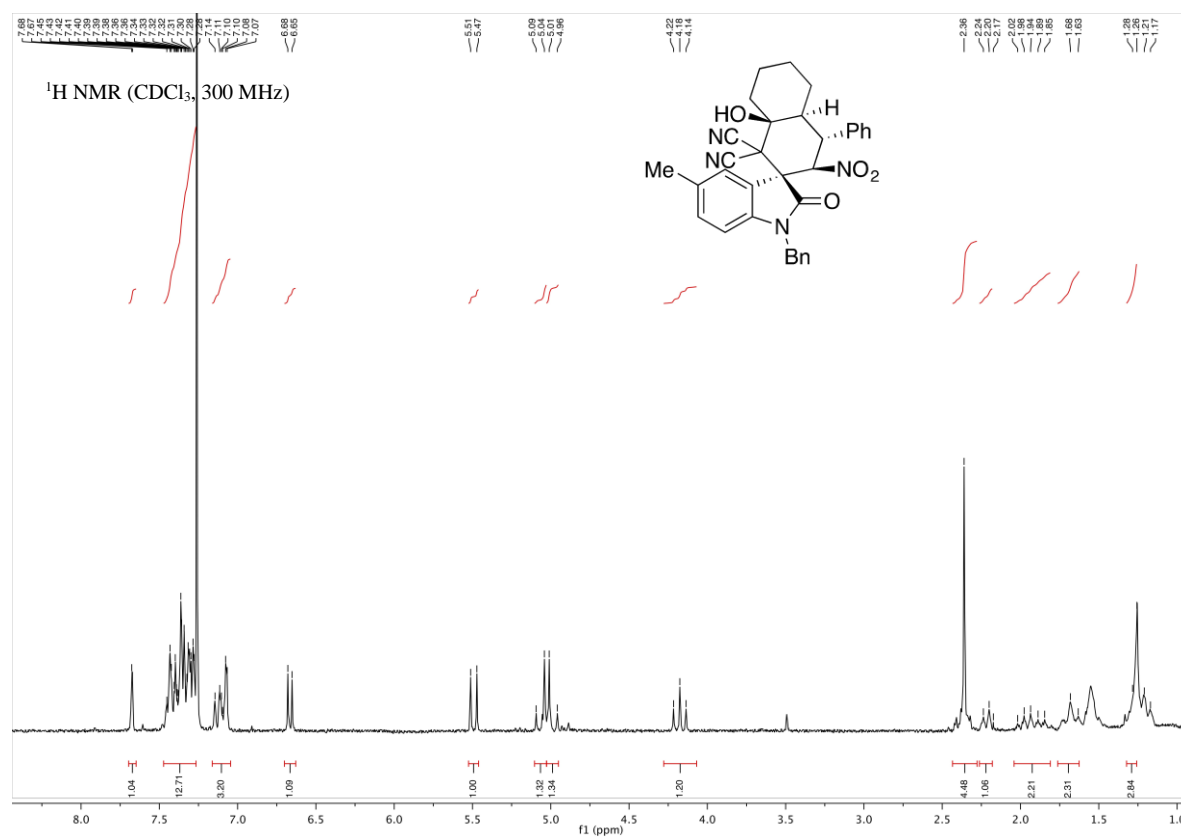


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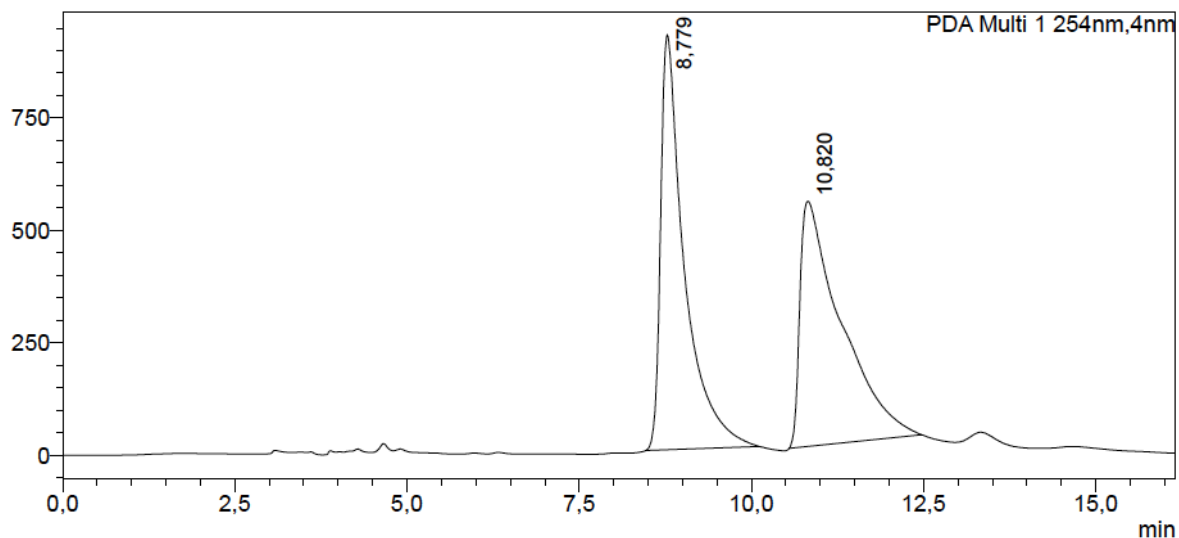
Peak#	Ret. Time	Area	Height	Area%
1	11,644	191403	3666	5,353
2	14,228	3384015	27399	94,647
Total		3575418	31066	100,000



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-benzyl-8*a*'-hydroxy-5-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5e)



mAU

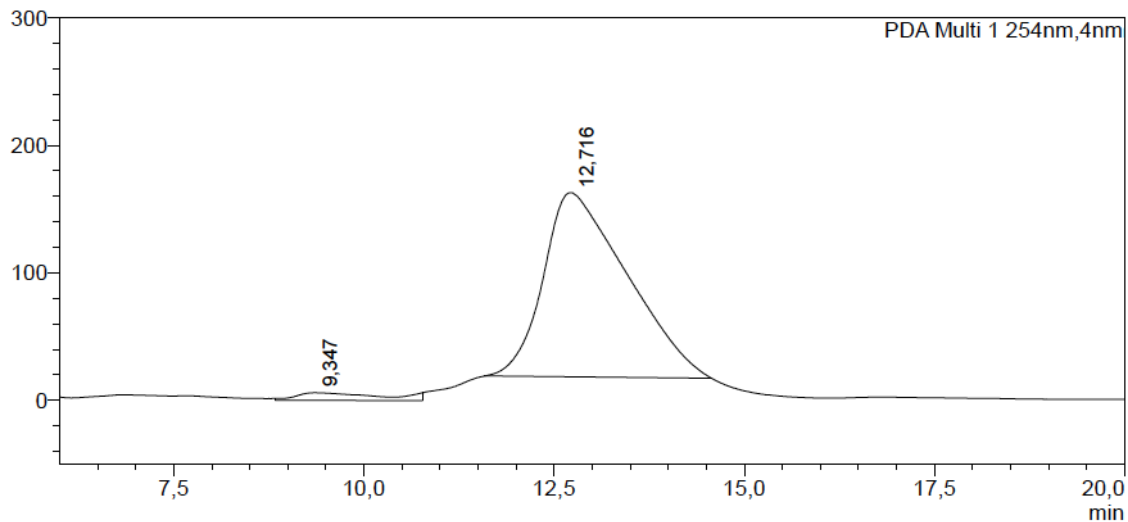


PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	8,779	22163078	922671	49,397		M	
2	10,820	22704417	545795	50,603		M	
Total		44867496	1468466				

<Chromatogram>

mAU

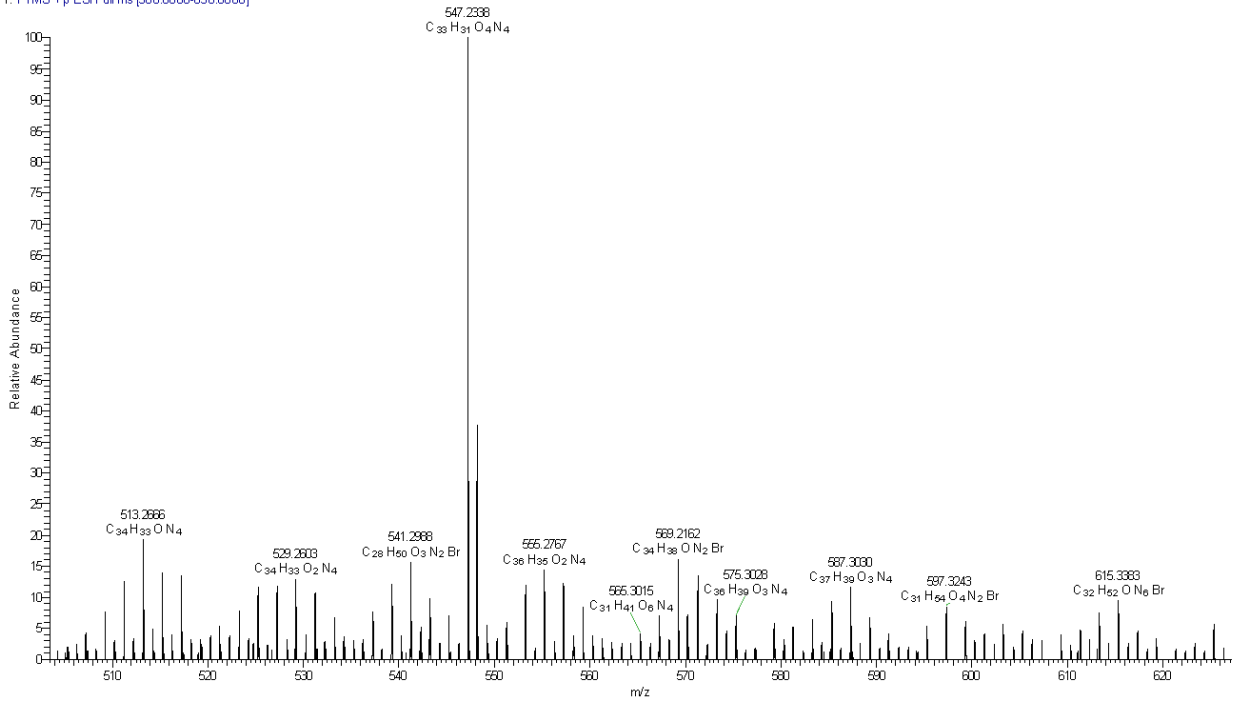


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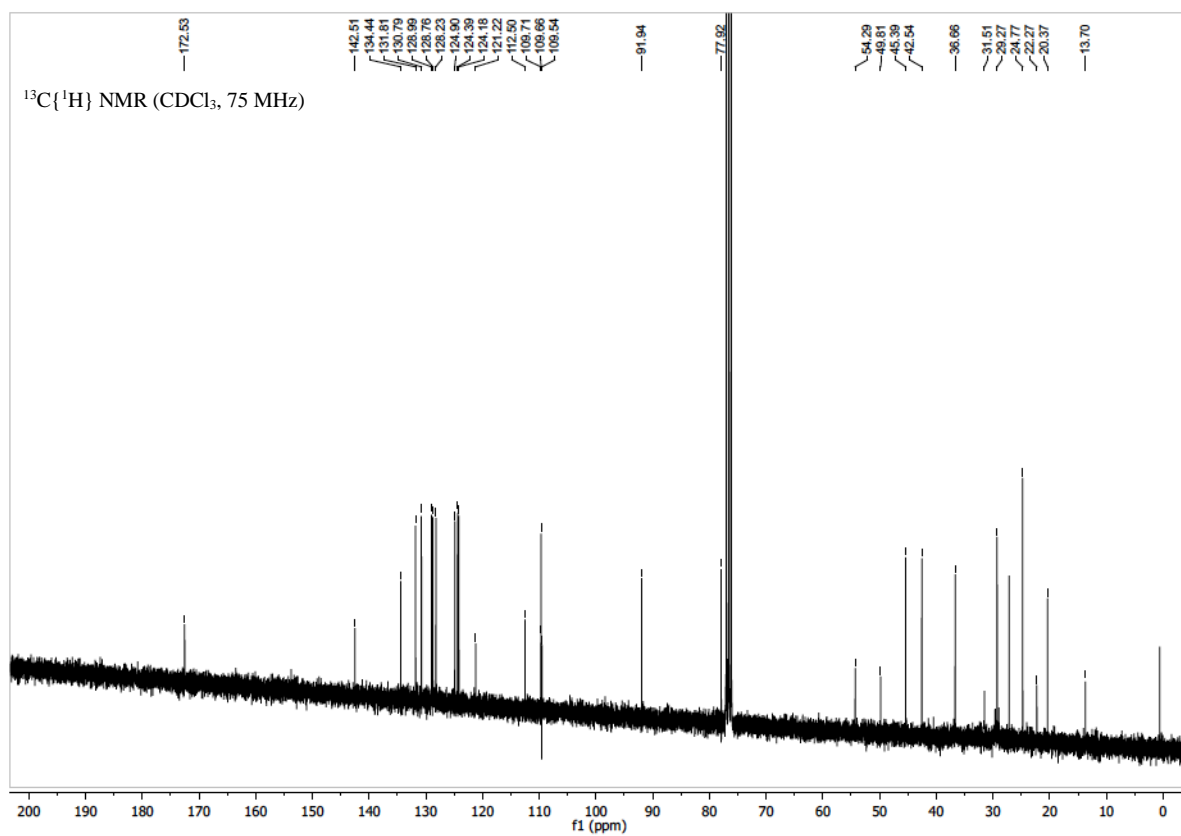
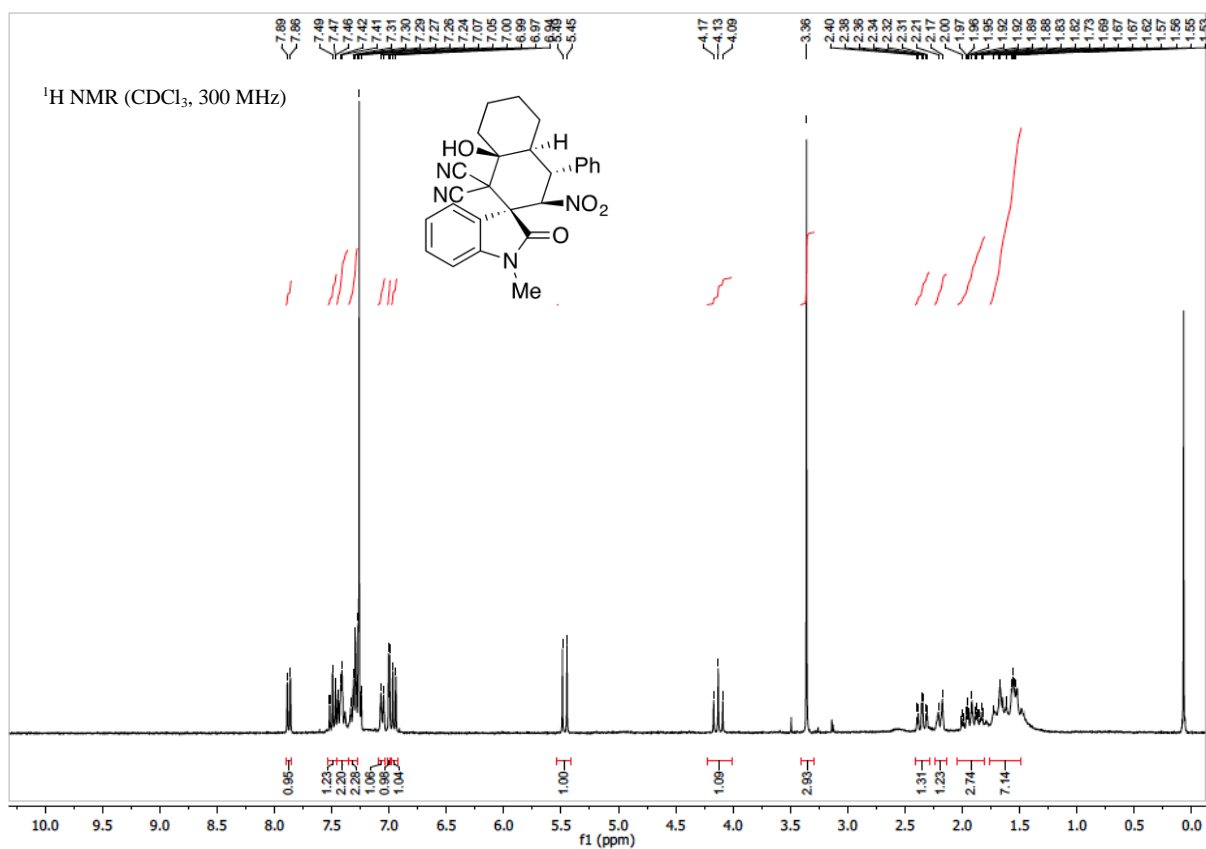
PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9,347	472637	6004	4,089		M	
2	12,716	11085423	144679	95,911		M	
Total		11558060	150683				

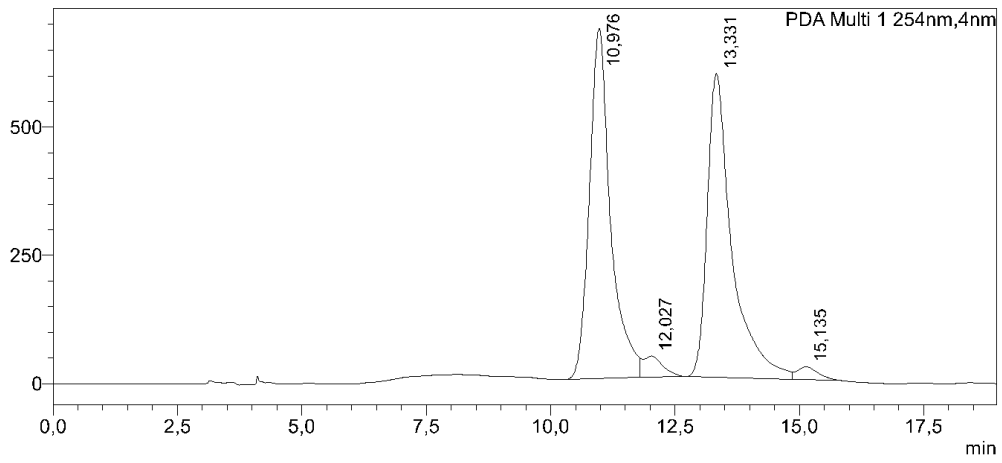
LS49 #133 RT: 0.31 AV: 1 NL: 1.04E7
T: FTMS +p ESI Full ms [500.0000-650.0000]



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-8*a*'-hydroxy-1-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1'*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5f)



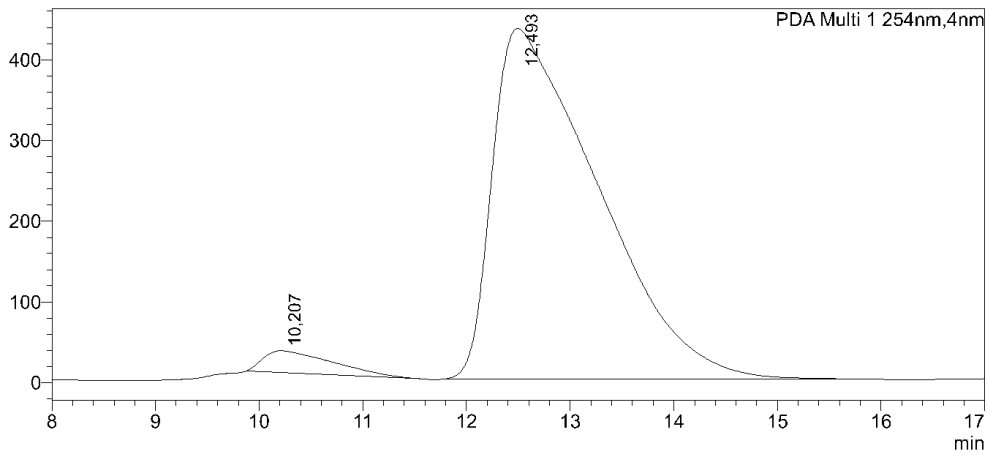
mAU



PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10,976	20193590	682610	47,520		M	
2	12,027	1203268	41767	2,832		V M	
3	13,331	20372904	592141	47,942		M	
4	15,135	725158	24646	1,706		V M	
Total		42494919	1341164				

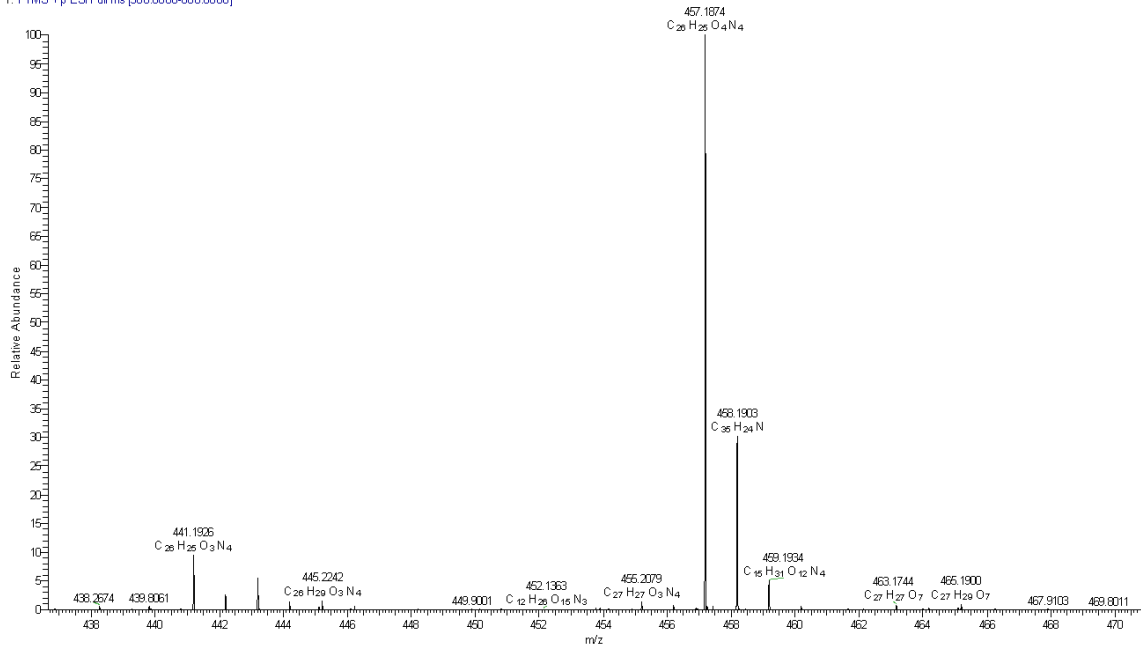
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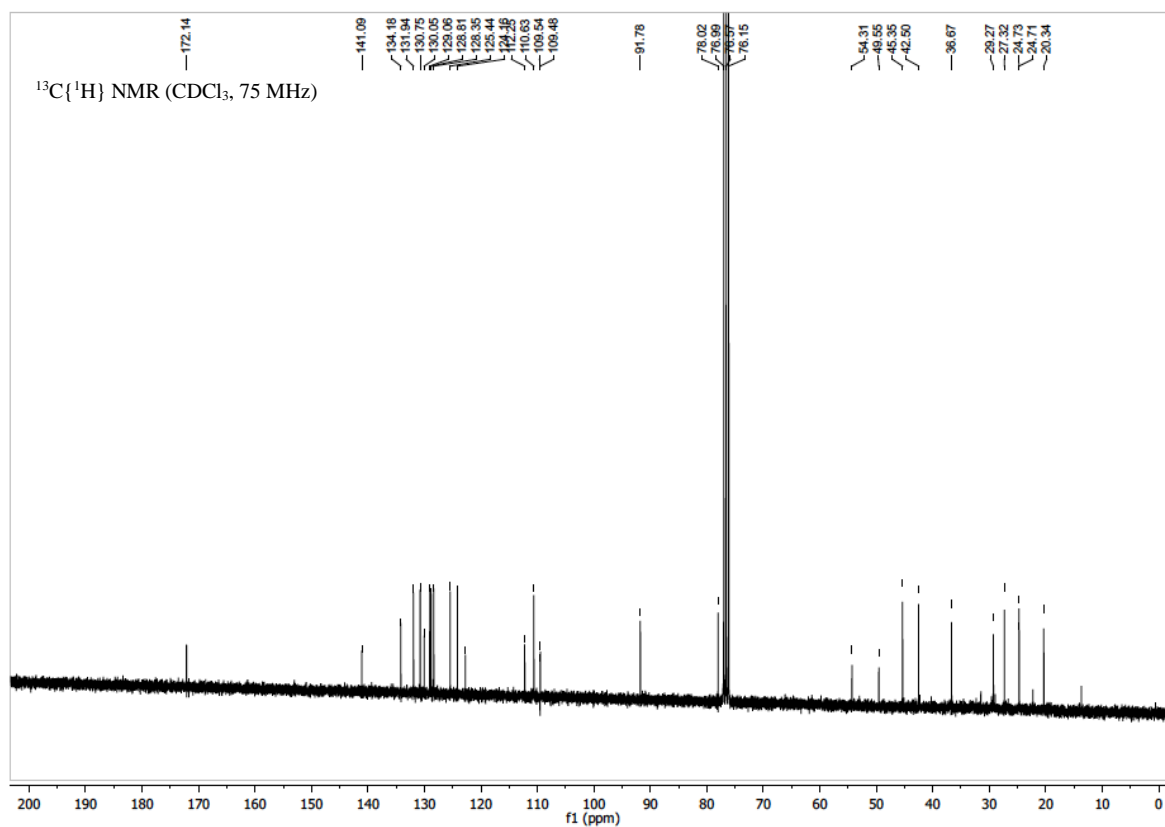
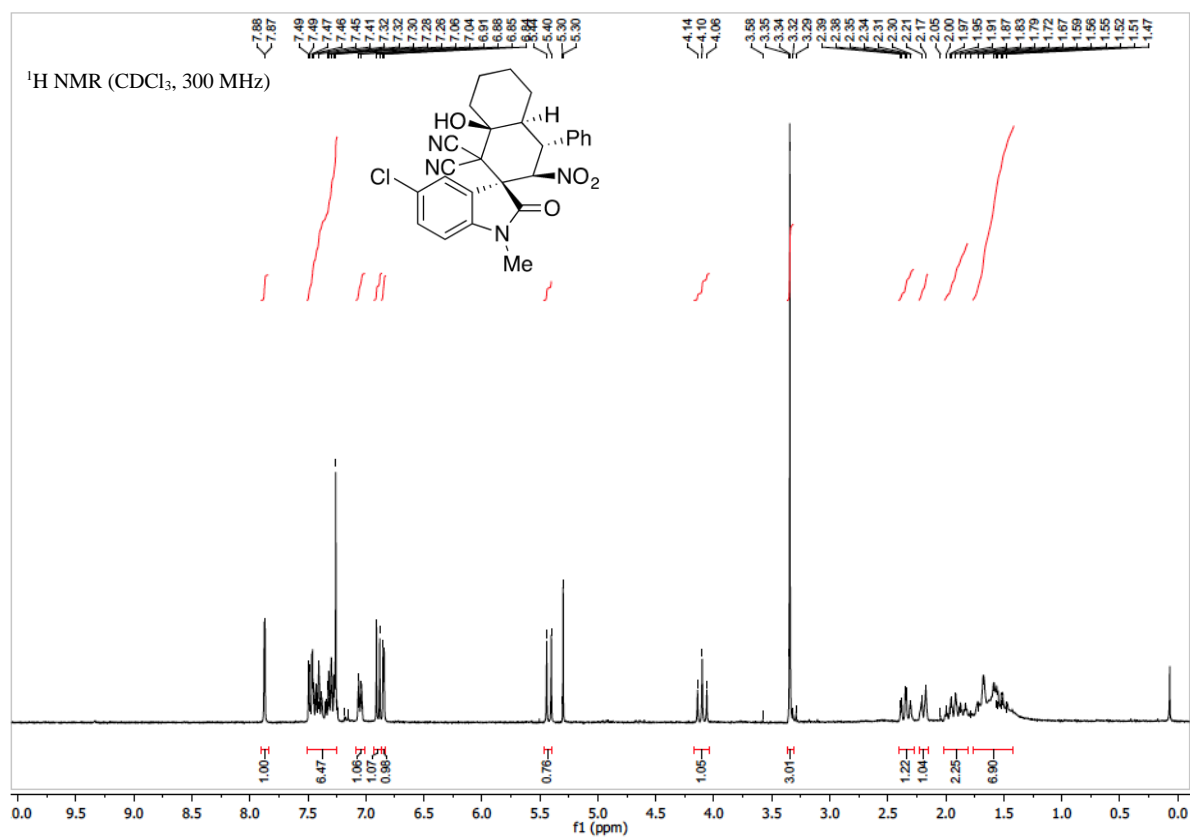
PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10,207	1259437	26801	3,927		M	
2	12,493	30813386	434631	96,073		M	
Total		32072823	461433				

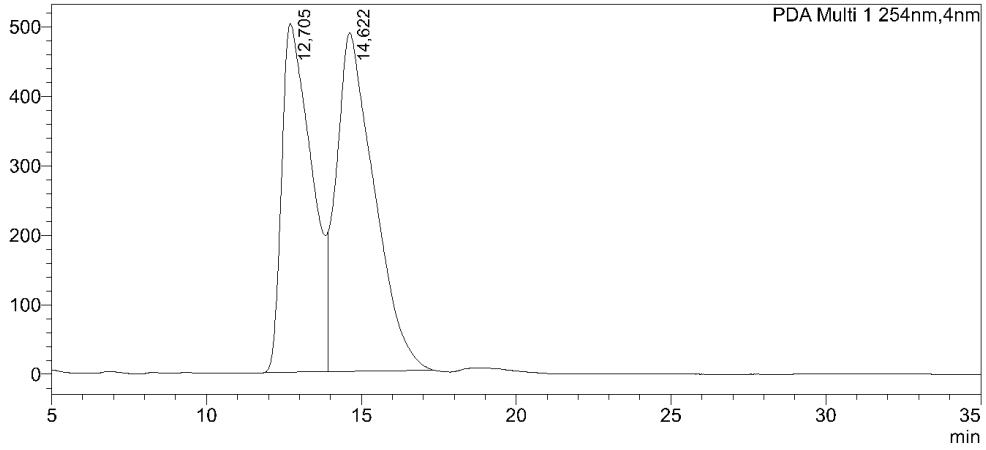
LS107 #431 RT: 1.00 AV: 1 NL: 6.51E7
T: FTMS +p ESI Full ms [300.0000-800.0000]



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-5-chloro-8*a*'-hydroxy-1-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1,1'-dicarbonitrile (5g)

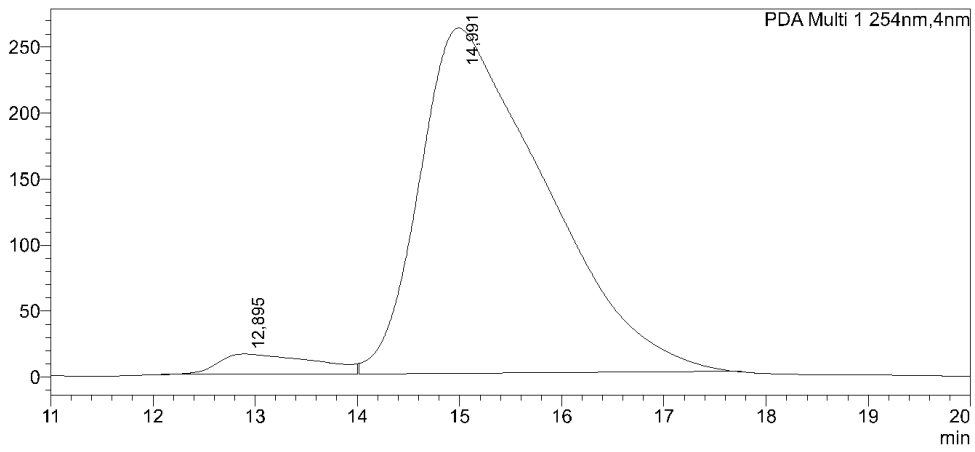


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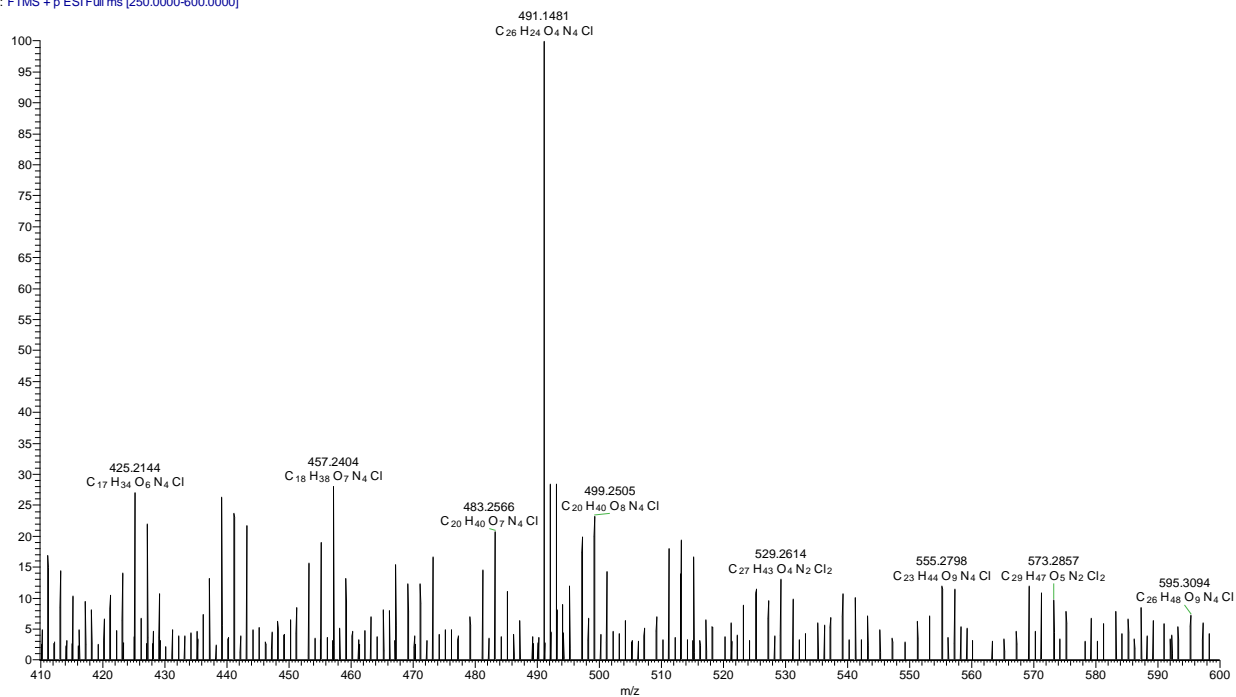
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12,705	33985775	501598	45,211		M	
2	14,622	41185706	487092	54,789		V M	
Total		75171481	988690				

mAU

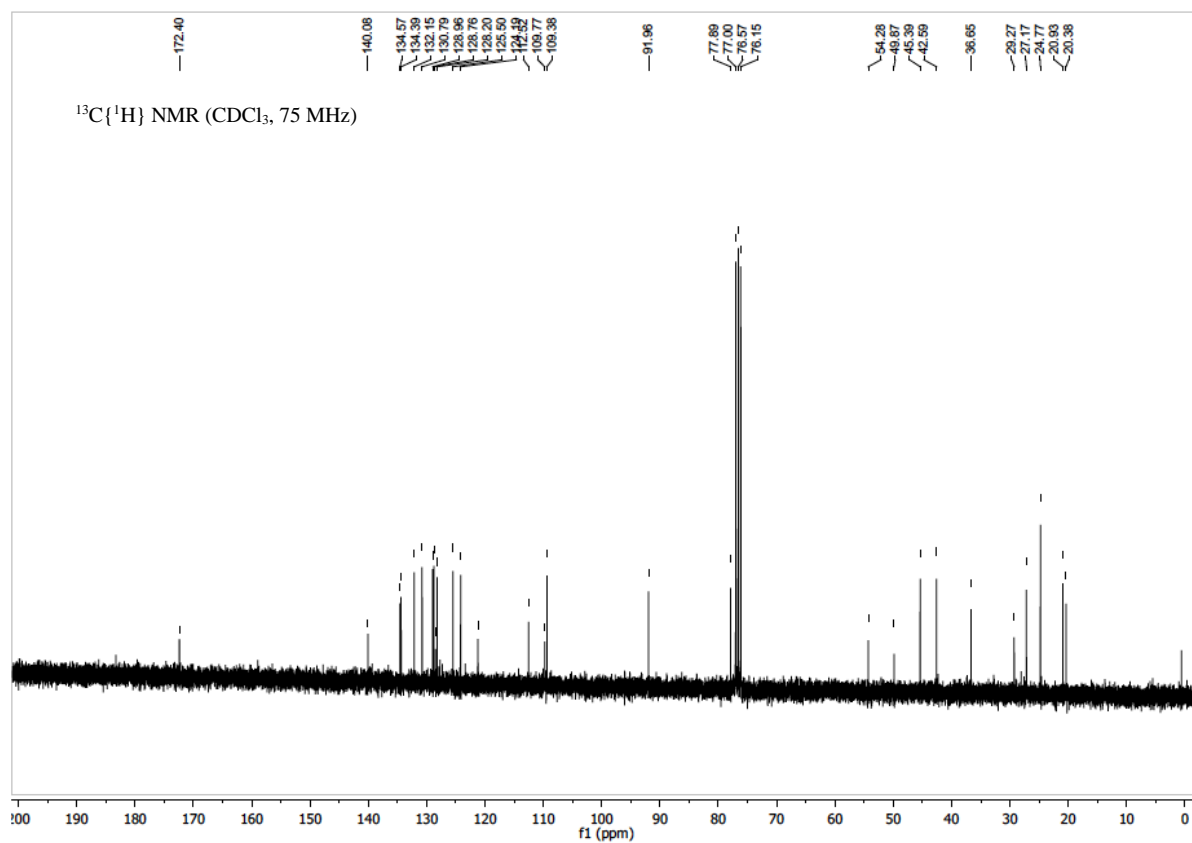
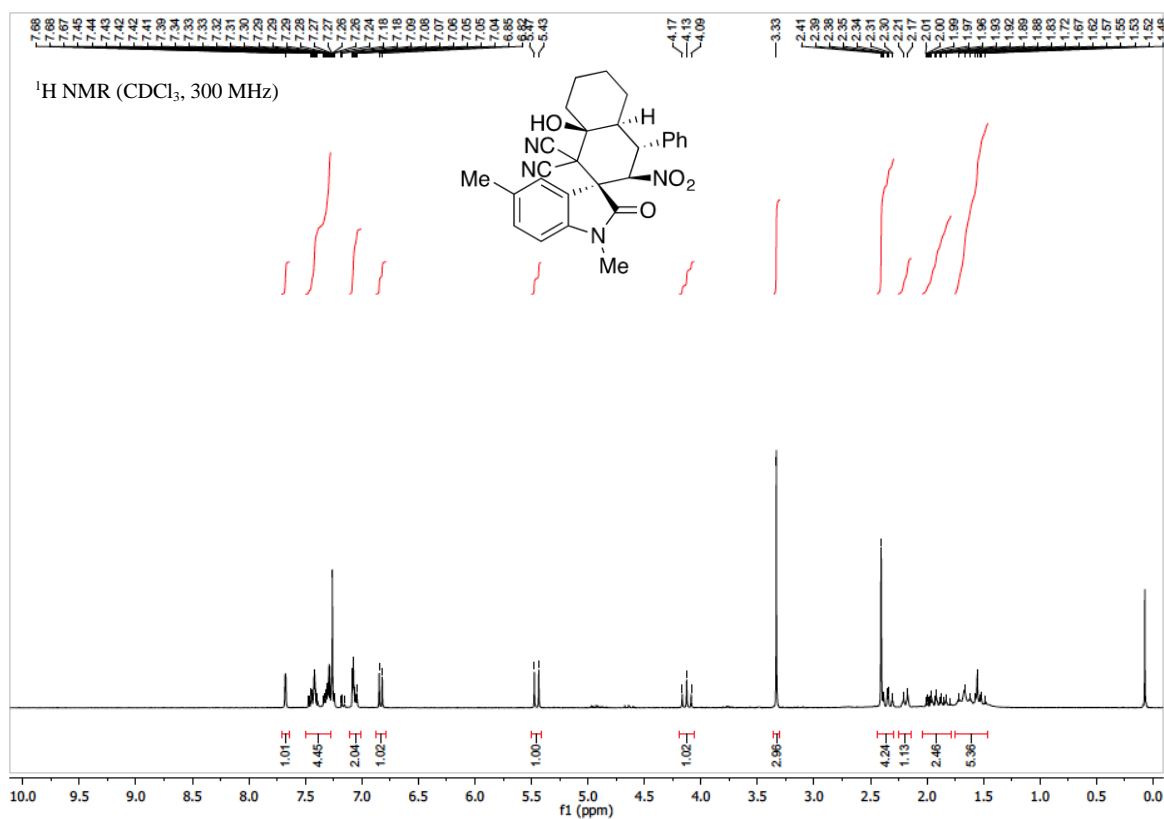


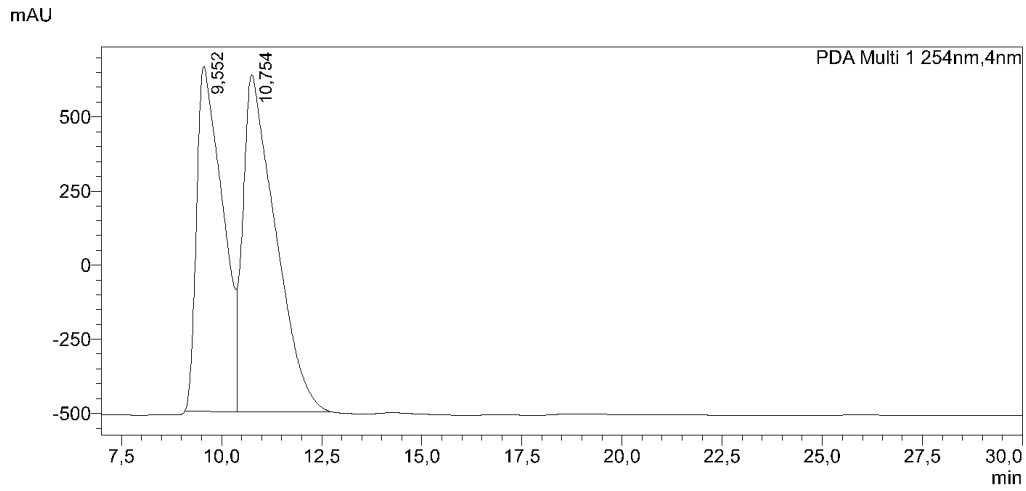
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12,895	971148	14945	4,161		M	
2	14,991	22367689	261478	95,839		M	
Total		23338837	276423				

LS109#146 RT: 0.34 AV: 1 NL: 1.60E7
T: FTMS + p ESI Full ms [250.0000-600.0000]

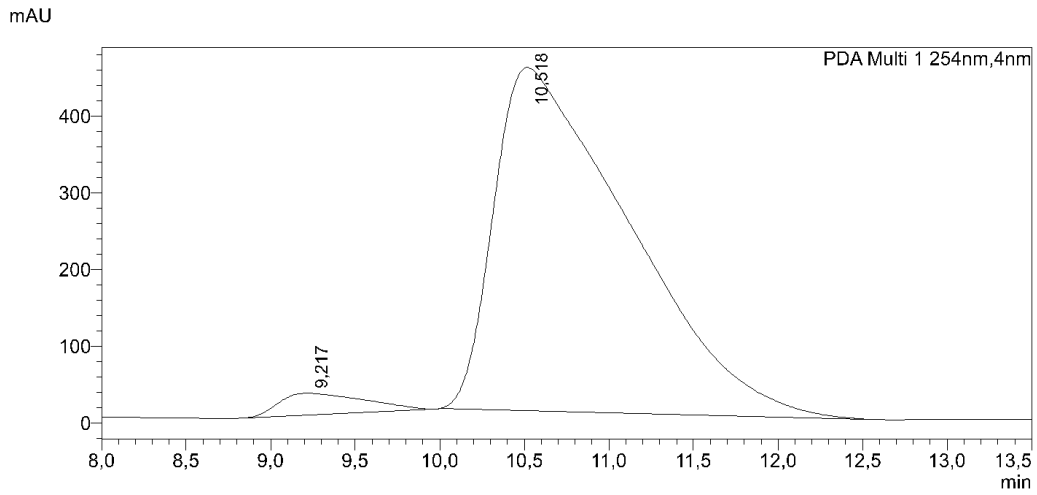


(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-8*a*'-hydroxy-1,5-dimethyl-3-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1'*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5*h*)



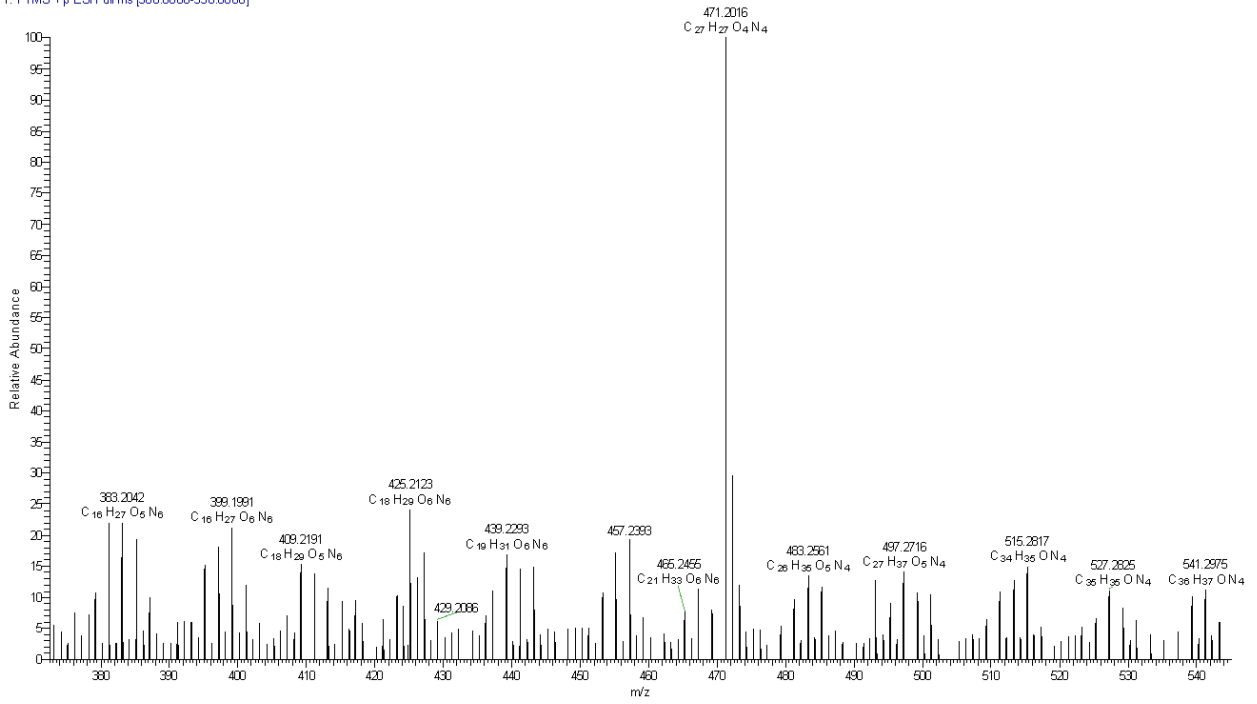


PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9,552	52886476	1164120	45,199		M	
2	10,754	64121295	1136693	54,801		V M	
Total		117007771	2300813				

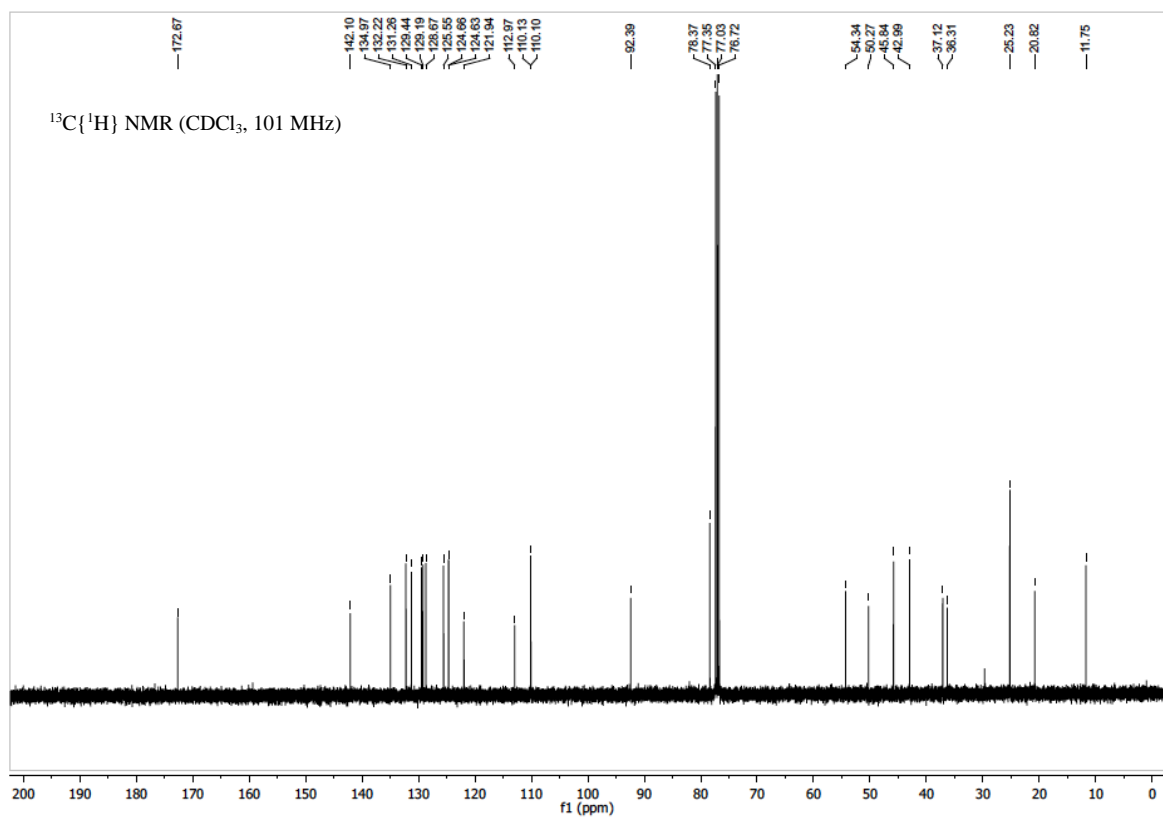
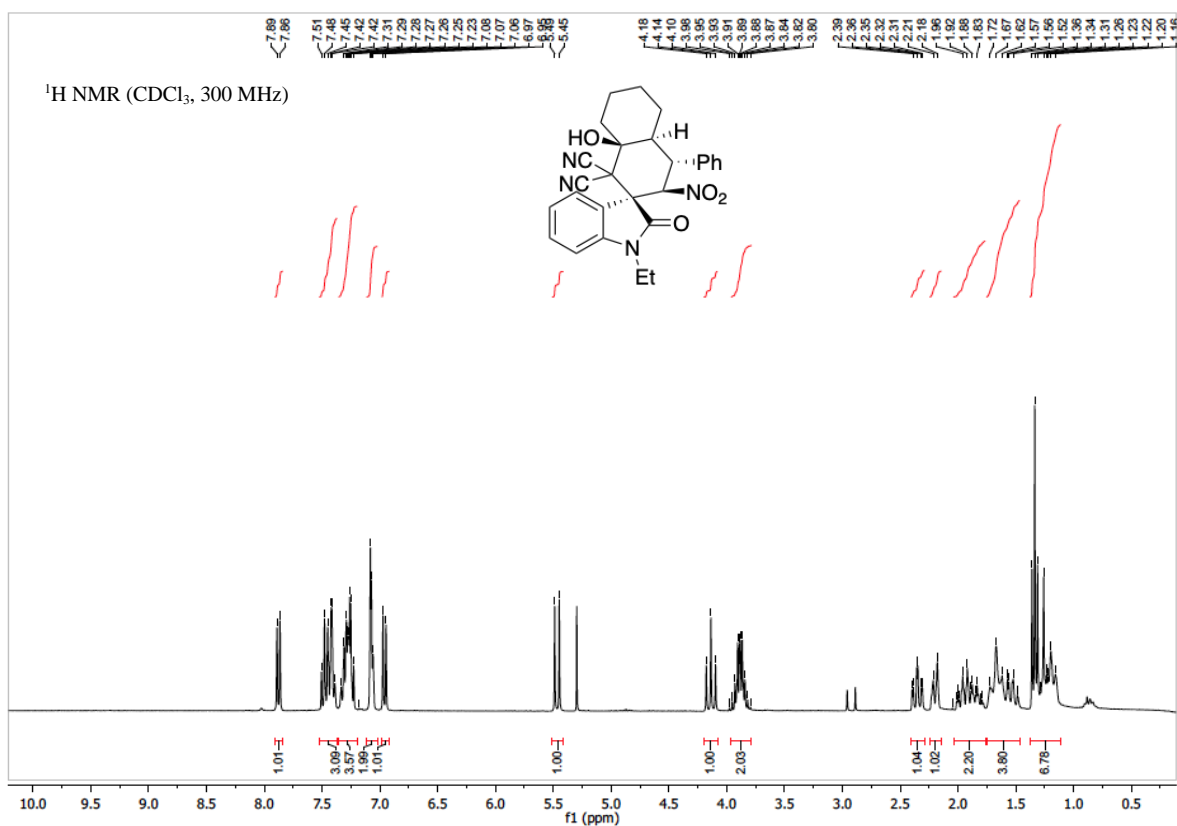


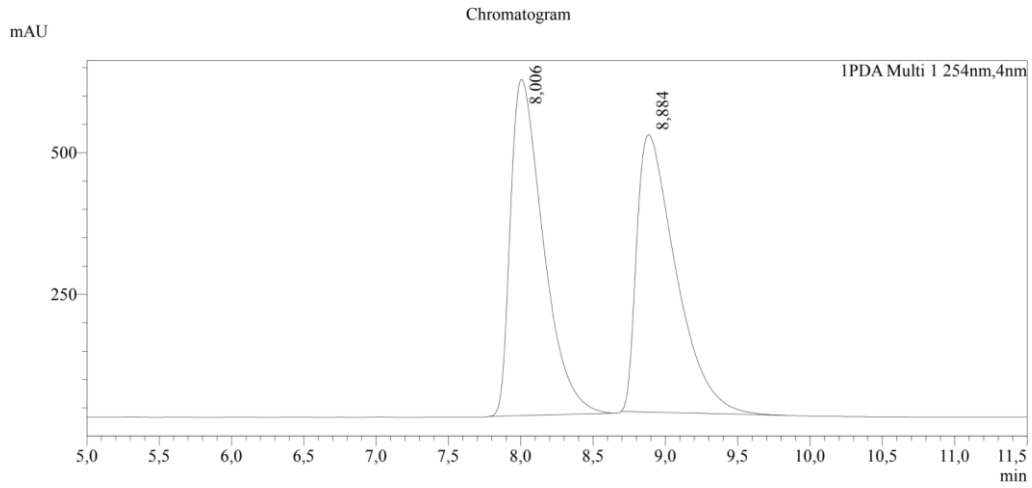
PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9,217	973022	28347	3,758		M	
2	10,518	24918183	447555	96,242		M	
Total		25891206	475902				

LS108 #210 RT: 0.49 AV: 1 NL: 1.51E7
T: FTMS +p ESI Full ms [300.0000-550.0000]



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-ethyl-8*a*'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1'*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5i)

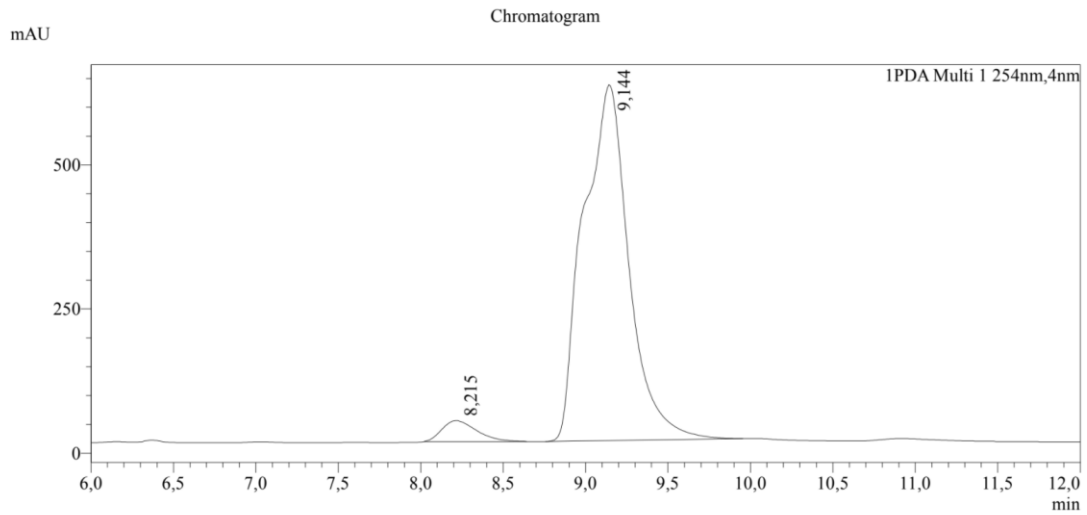




<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	8,006	10422698	658312	50,378		M	
2	8,884	10266235	543883	49,622		M	
Total		20688933	1202195				

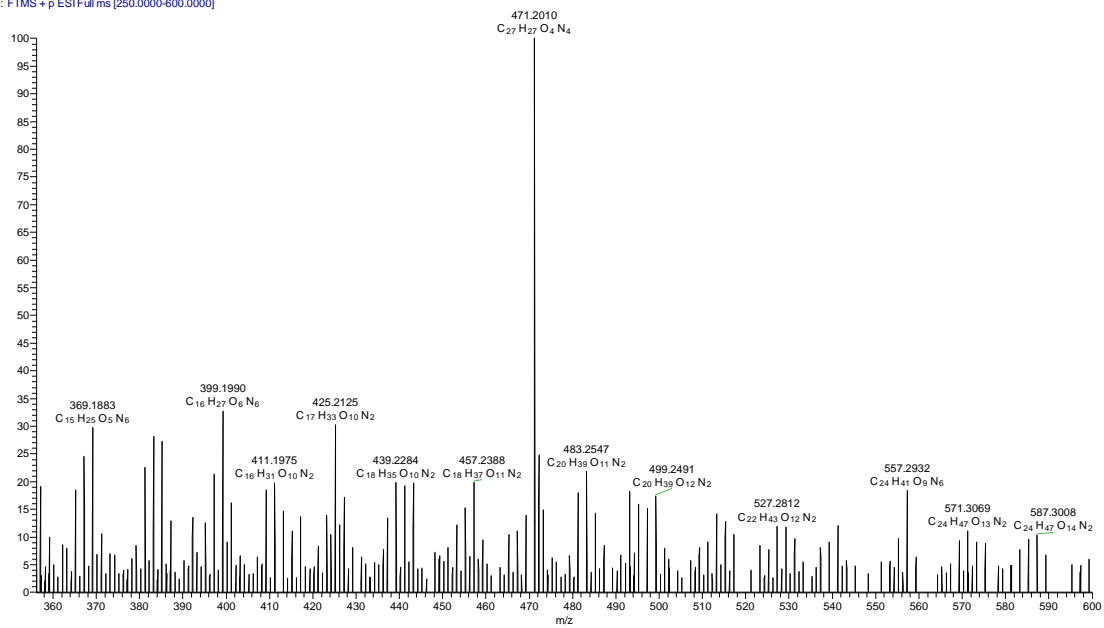


<Peak Table>

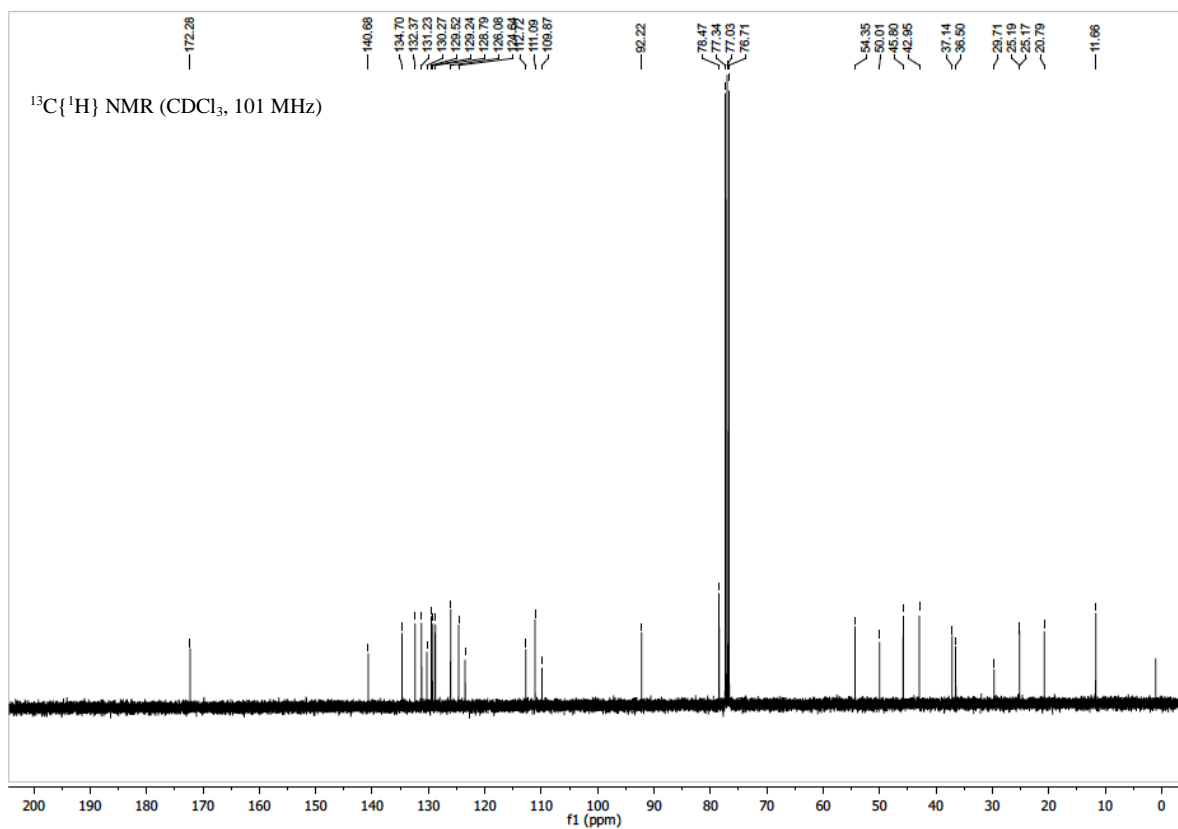
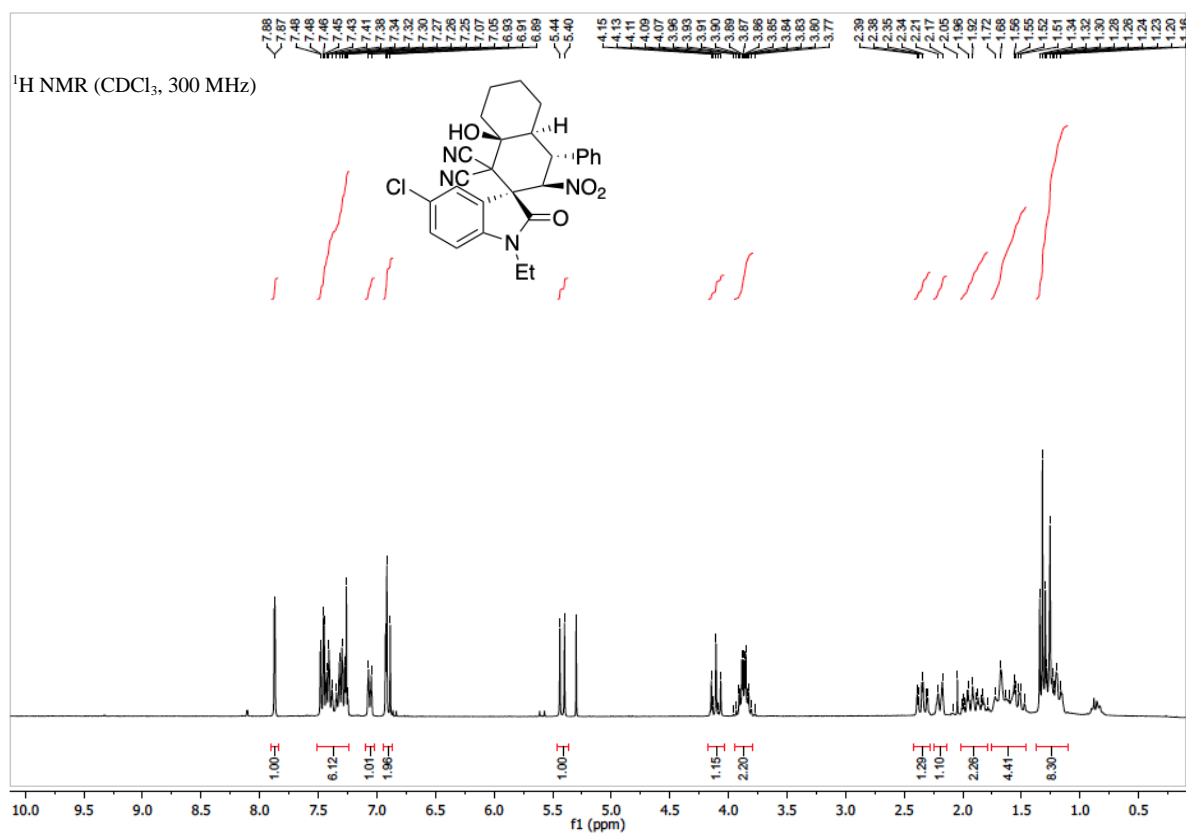
PDA Ch1 254nm

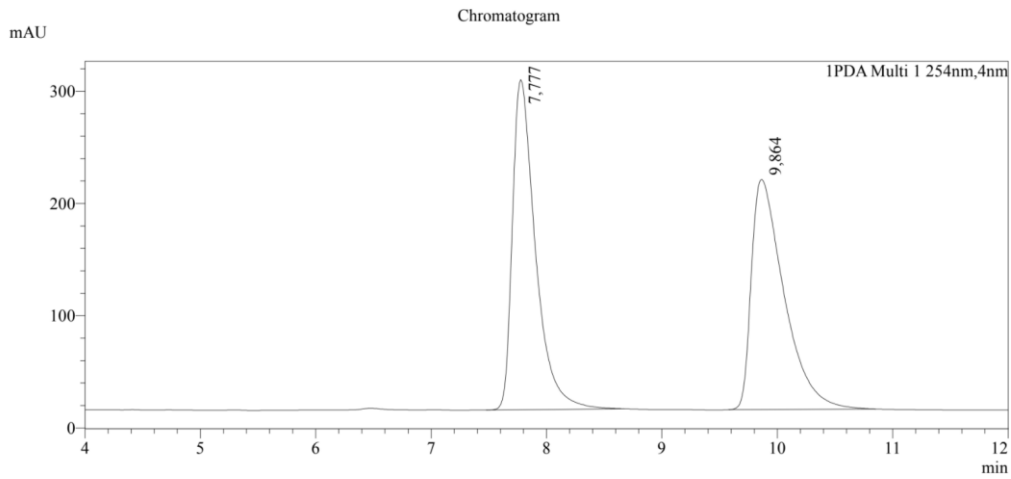
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	8,215	582040	40088	4,238		M	
2	9,144	13151724	685933	95,762		M	
Total		13733764	726022				

VF43 #253 RT: 0.59 AV: 1 NL: 1.49E7
T: FTMS - p ESI Full ms [250.0000-600.0000]



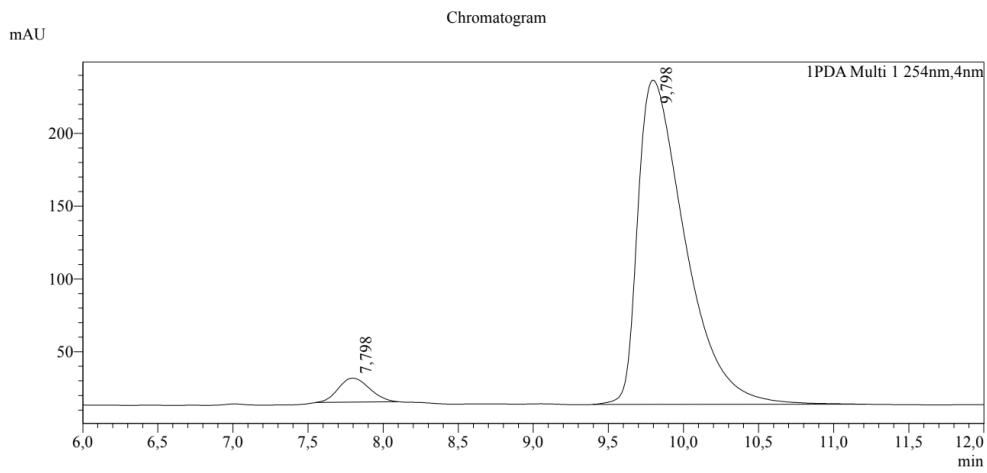
(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-5-chloro-1-ethyl-8*a*'-hydroxy-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5j)





<Peak Table>

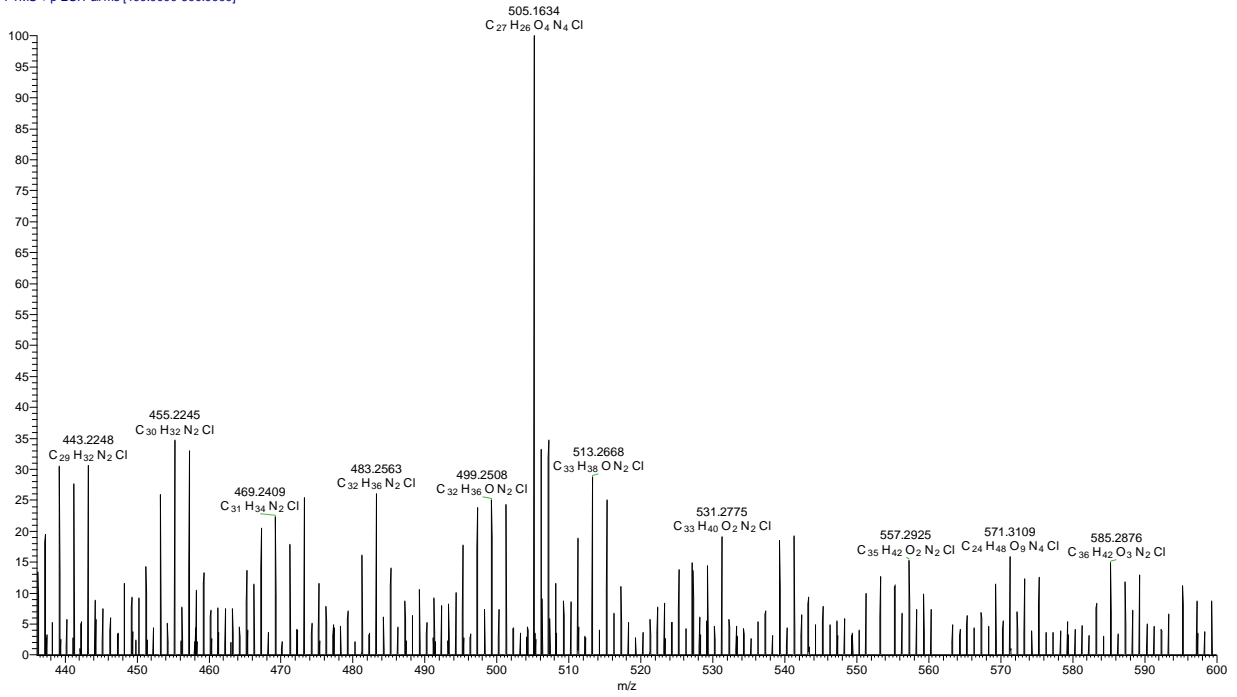
PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	7,777	4539867	326794	50,291		M	
2	9,864	4487340	227804	49,709		M	
Total		9027207	554598				



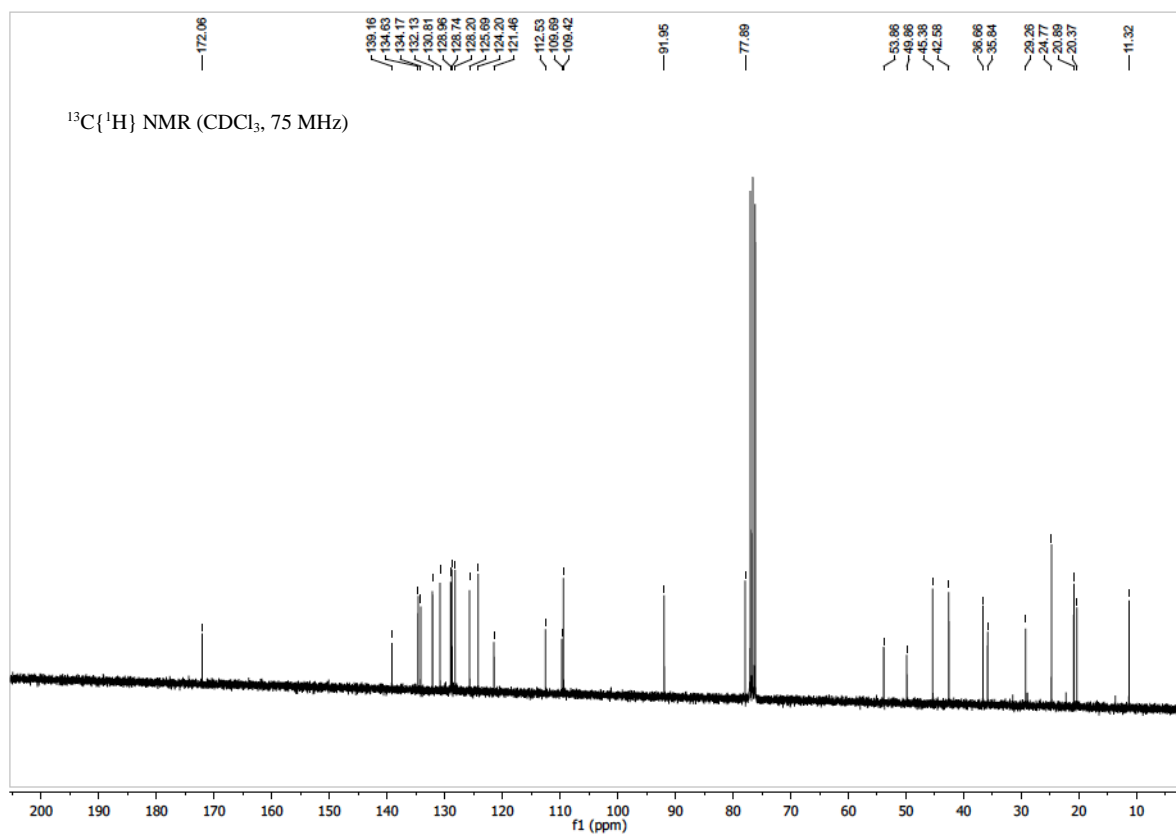
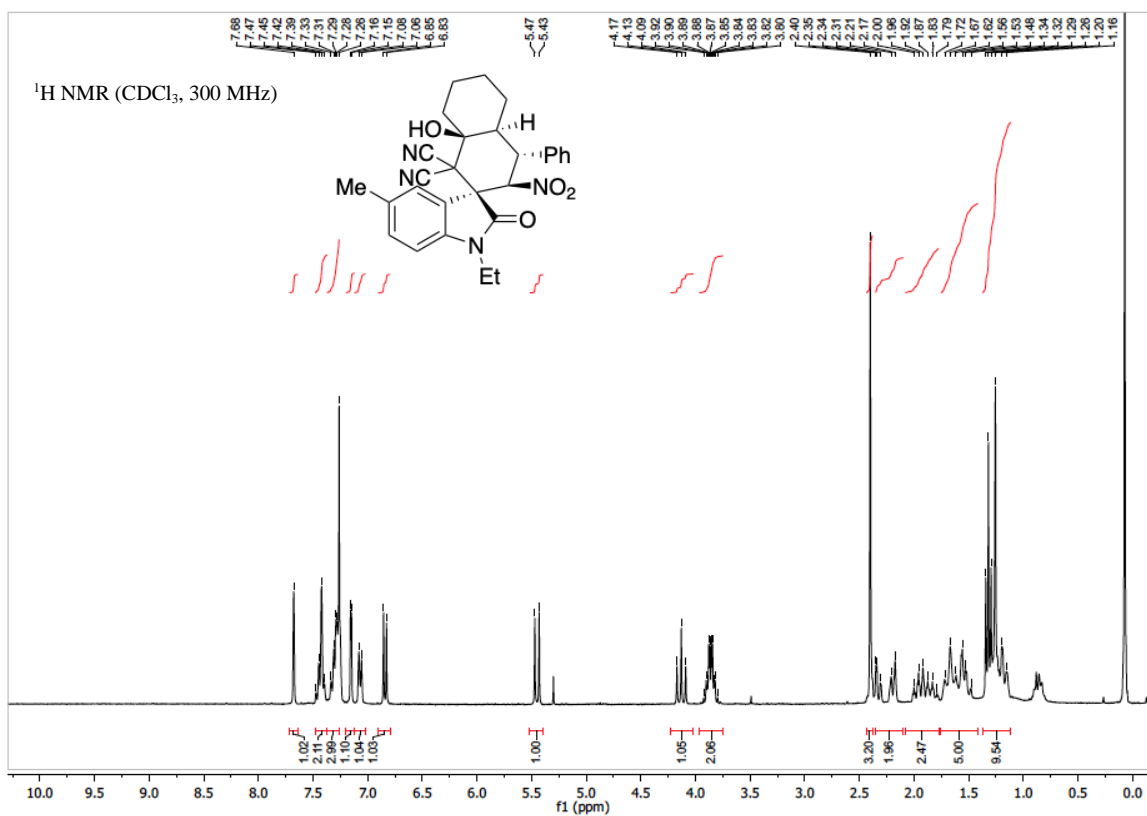
<Peak Table>

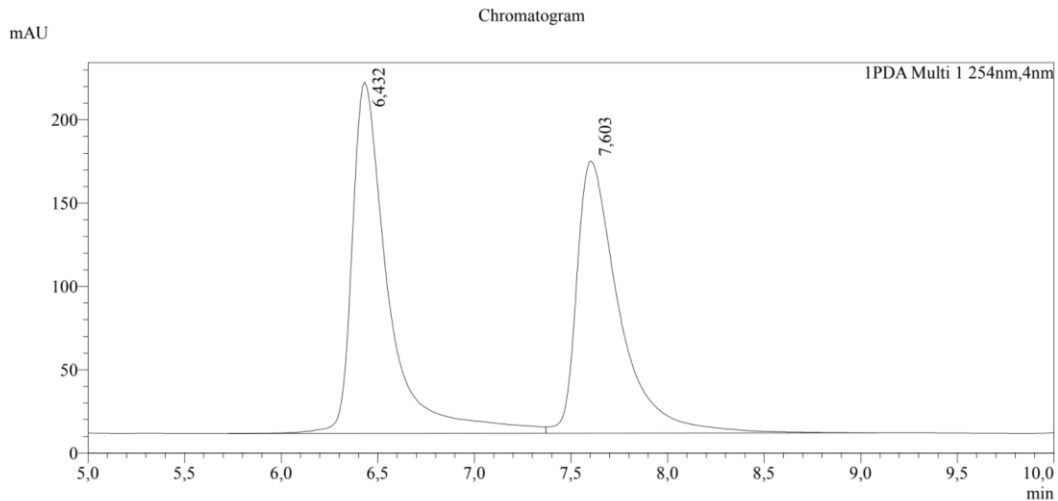
PDA Ch1 254nm							
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	7,798	265651	18356	4,662		M	
2	9,798	5432799	247416	95,338		M	
Total		5698450	265772				

VF41 #76 RT: 0.18 AV: 1 NL: 1.12E7
T: FTMS + p ESI Full ms [400.0000-600.0000]



(3*S*,3'*R*,4'*R*,4*a*'*S*,8*a*'*S*)-1-ethyl-8*a*'-hydroxy-5-methyl-3'-nitro-2-oxo-4'-phenyl-3',4',4*a*',5',6',7',8',8*a*'-octahydro-1*H*-spiro[indoline-3,2'-naphthalene]-1',1'-dicarbonitrile (5k)

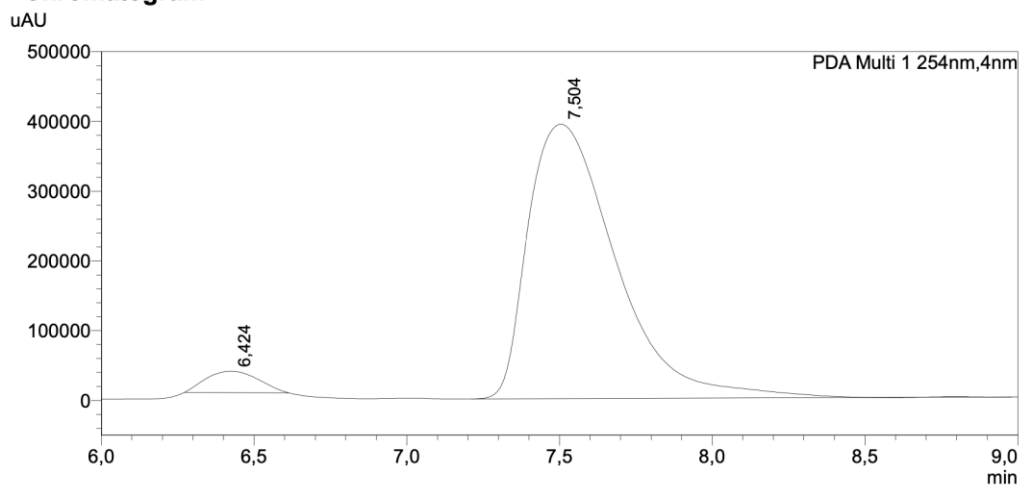




<Peak Table>

PDA Ch1 254nm						
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark
1	6,432	3063889	234266	52,467		
2	7,603	2775764	181635	47,533		V
Total		5839653	415901			

<Chromatogram>



<Peak Table>

PDA Ch1 254nm				
Peak#	Ret. Time	Area	Height	Area%
1	6,424	365596	30537	4,426
2	7,504	7894499	393399	95,574
Total		8260095	423937	100,000

VF40 #280 RT: 0.65 AV: 1 NL: 2.26E7
T: FTMS + p ESI Full ms [400.0000-600.0000]

