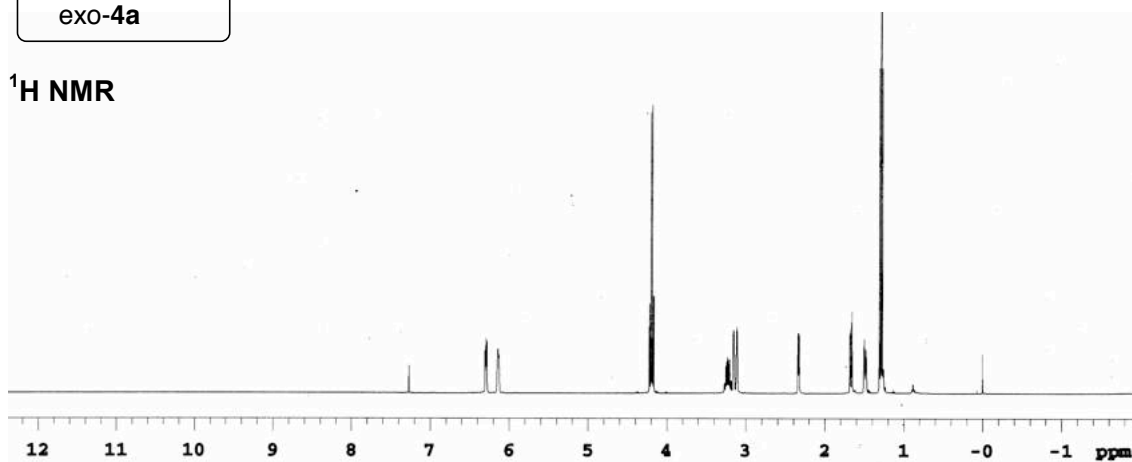
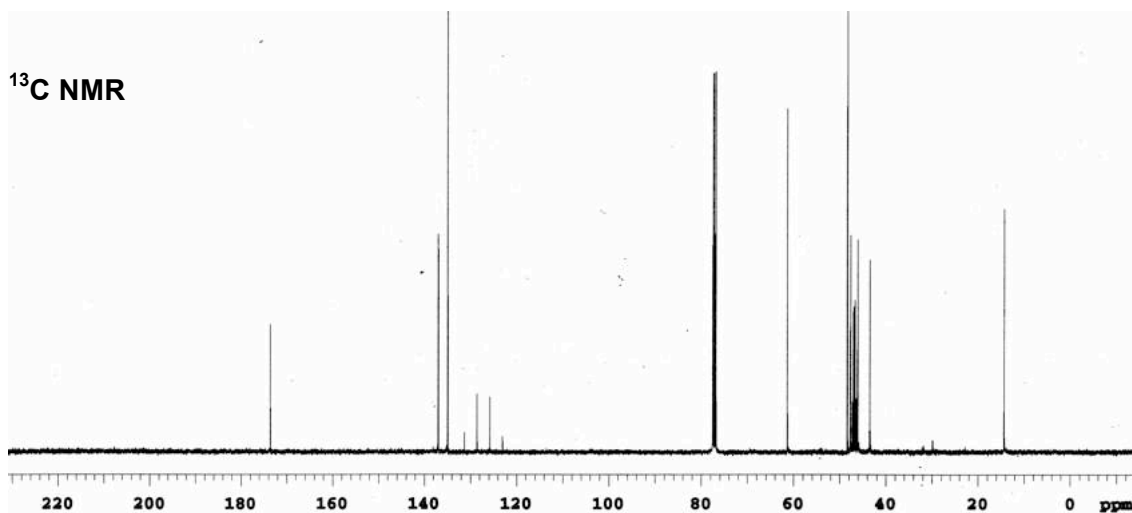


<sup>1</sup>H NMR



<sup>13</sup>C NMR

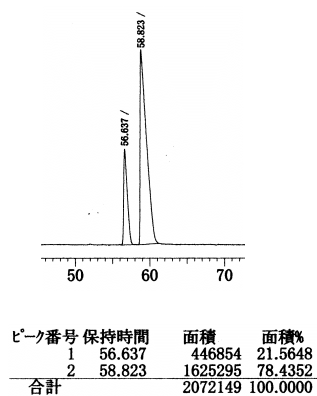
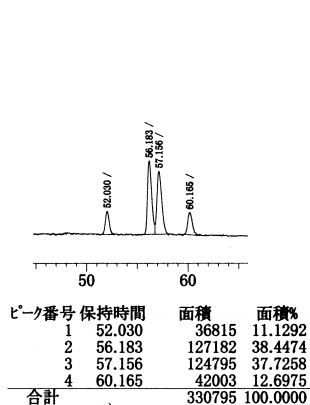


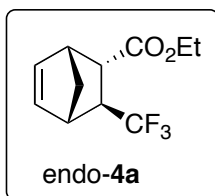
GC *racemic*

(exo/endo = 24/76)

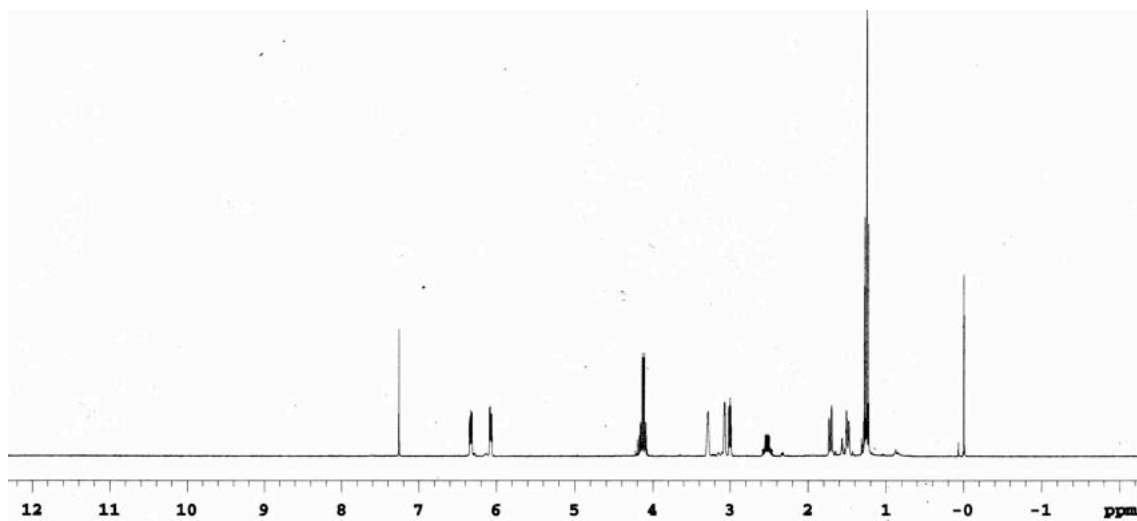
GC *optically active*

(exo/endo = 22/78)

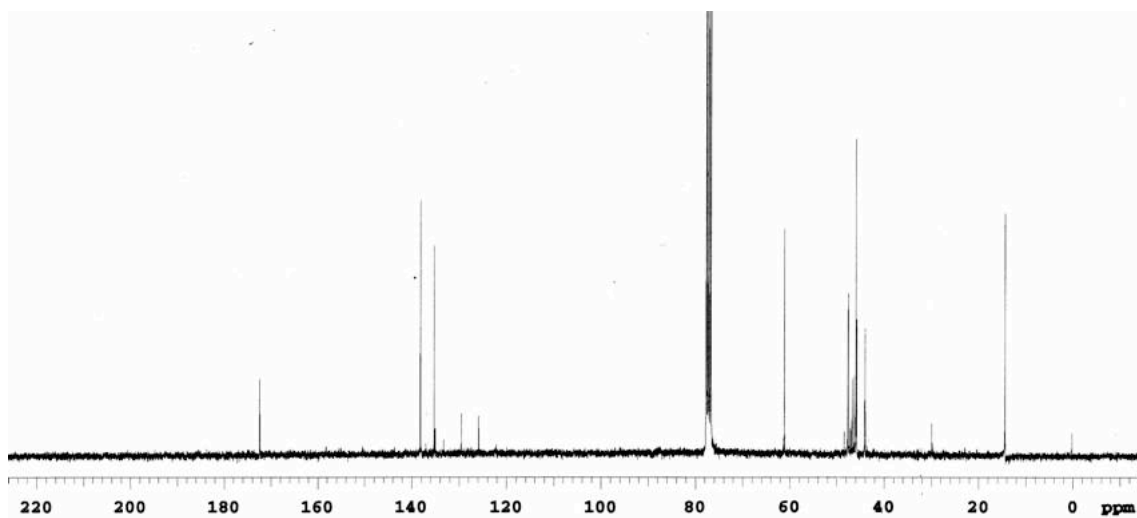


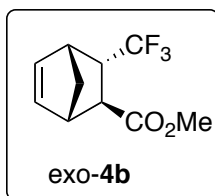


**$^1\text{H}$  NMR**

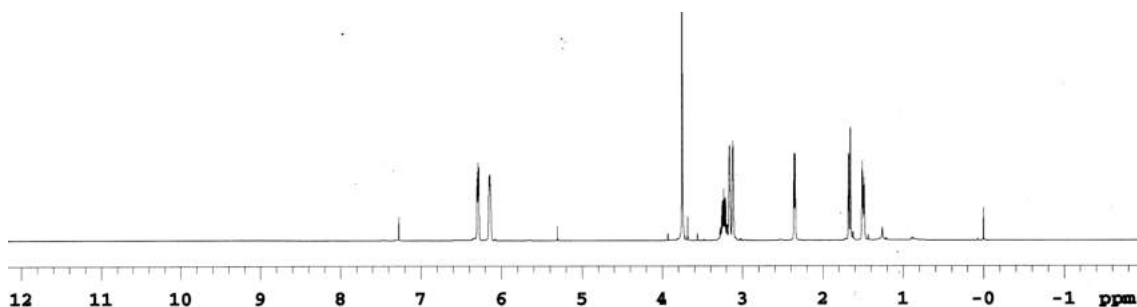


**$^{13}\text{C}$  NMR**

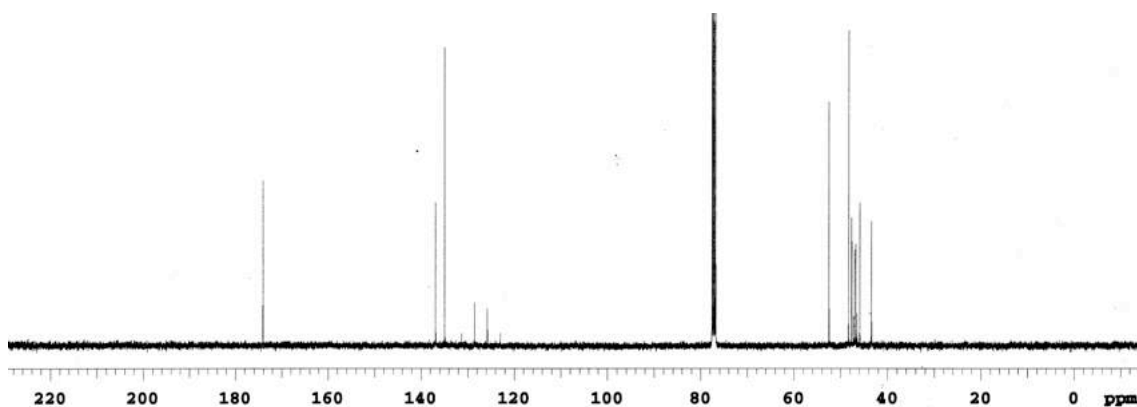




**<sup>1</sup>H NMR**



**<sup>13</sup>C NMR**

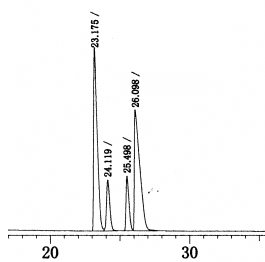


**GC racemic**

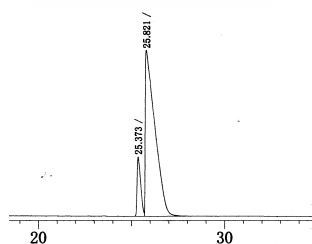
(exo/endo = 80/20)

**GC optically active**

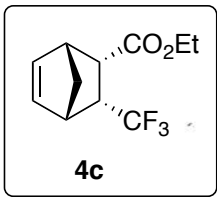
(exo/endo = 88/12)



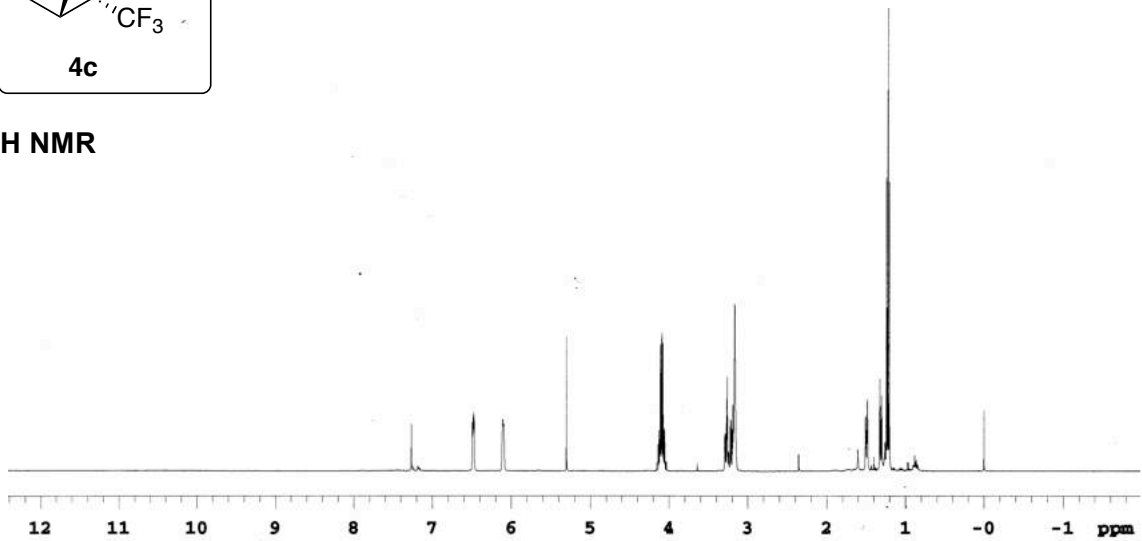
ピーク番号	保持時間	面積	面積%
1	23.175	1608071	40.0084
2	24.119	410494	10.2130
3	25.498	393917	9.8005
4	26.098	1606855	39.9781
合計		4019337	100.0000



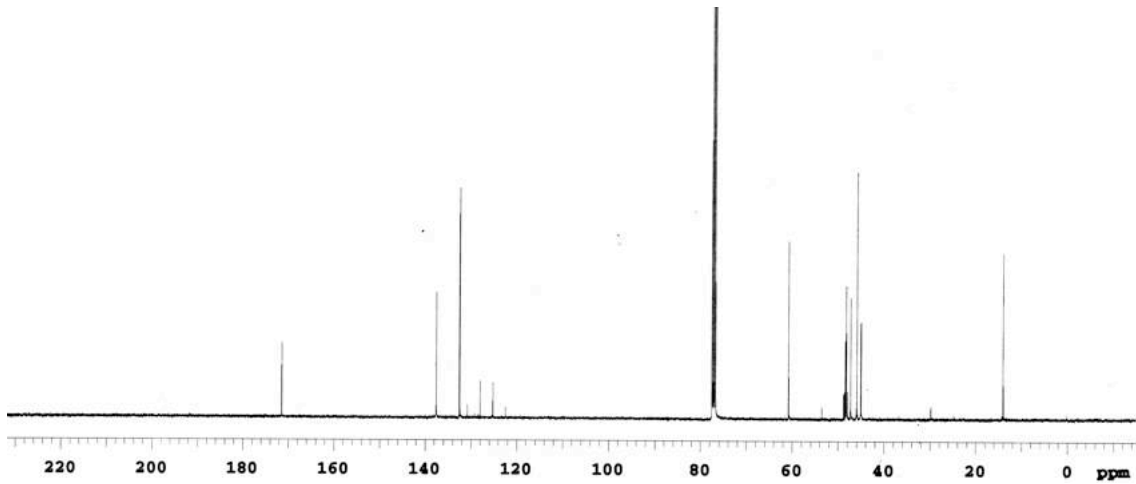
ピーク番号	保持時間	面積	面積%
1	25.373	438044	11.8053
2	25.821	3272522	88.1947
合計		3710566	100.0000



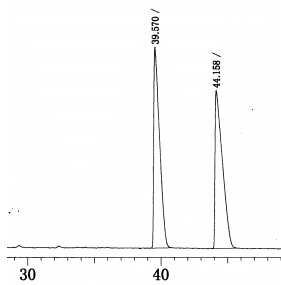
<sup>1</sup>H NMR



<sup>13</sup>C NMR

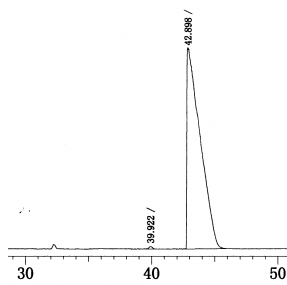


GC *racemic*



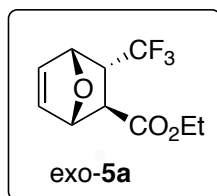
ピーク番号	保持時間	面積	面積%
1	39.570	865302	50.0083
2	44.158	865015	49.9917
合計		1730317	100.0000

GC *optically active*

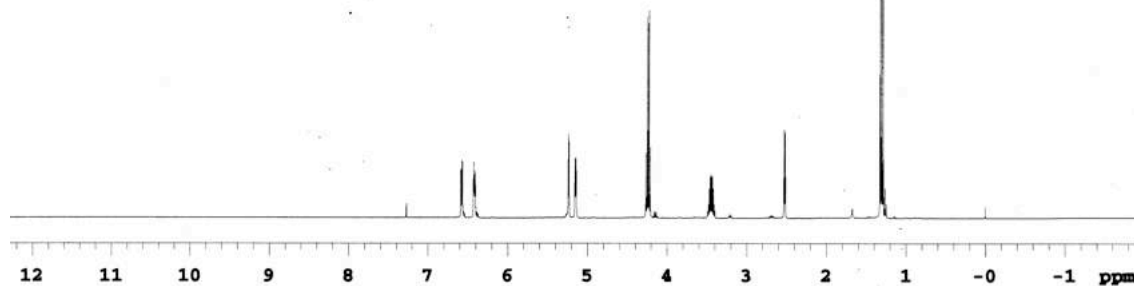


ピーク番号	保持時間	面積	面積%
1	39.922	13511	0.3287
2	42.898	4096674	99.6713
合計		4110185	100.0000

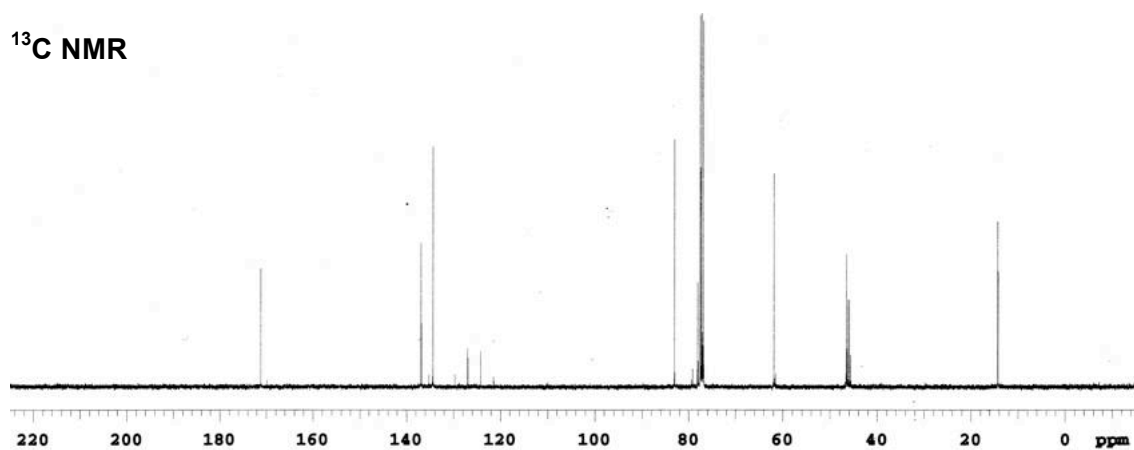




<sup>1</sup>H NMR

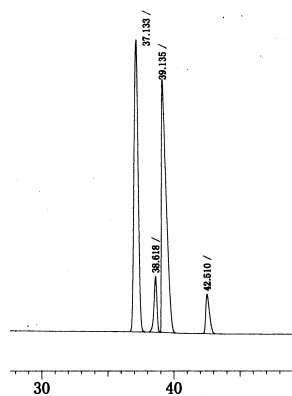


<sup>13</sup>C NMR



GC racemic

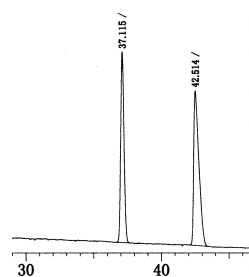
(exo/endo = 20/80)



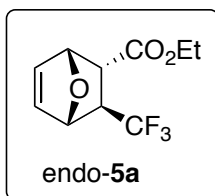
ピーク番号	保持時間	面積	面積%
1	37.133	1425938	44.4291
2	38.618	191750	5.9745
3	39.135	1418732	44.2046
4	42.510	173047	5.3918
合計		3209467	100.0000

GC optically active (exo/endo = 76/24)

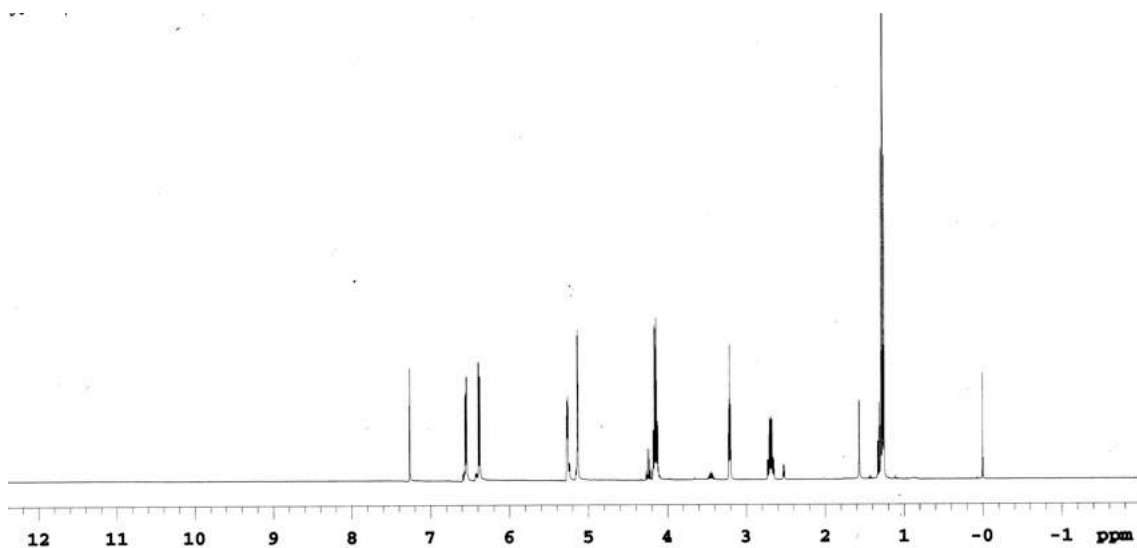
t = 37.1 (endo), t = 42.5 (exo)



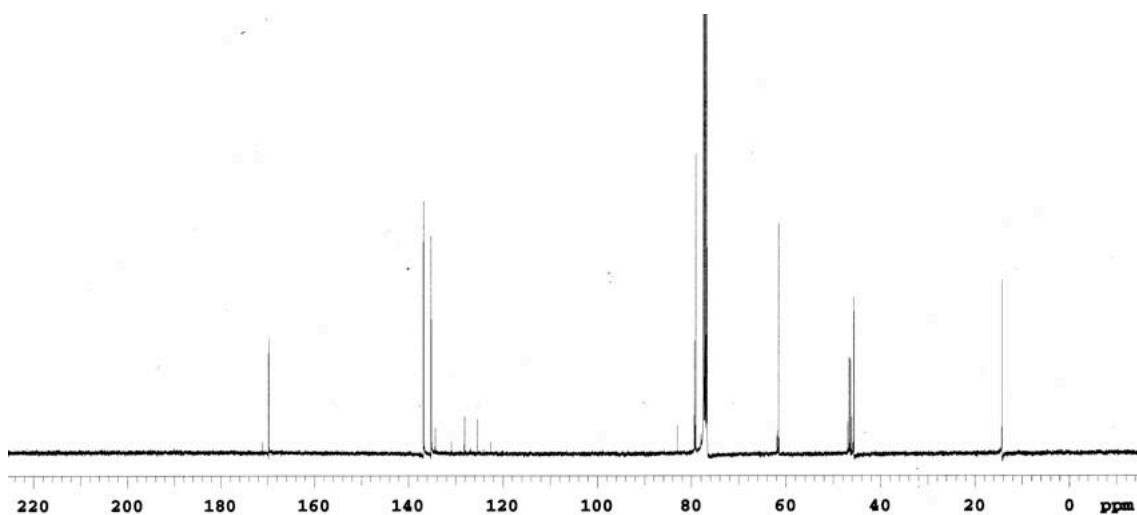
ピーク番号	保持時間	面積	面積%
1	37.115	239232	44.1395
2	42.514	302759	55.8605
合計		541991	100.0000

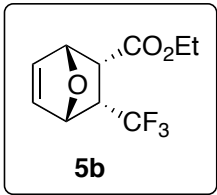


**$^1\text{H}$  NMR**

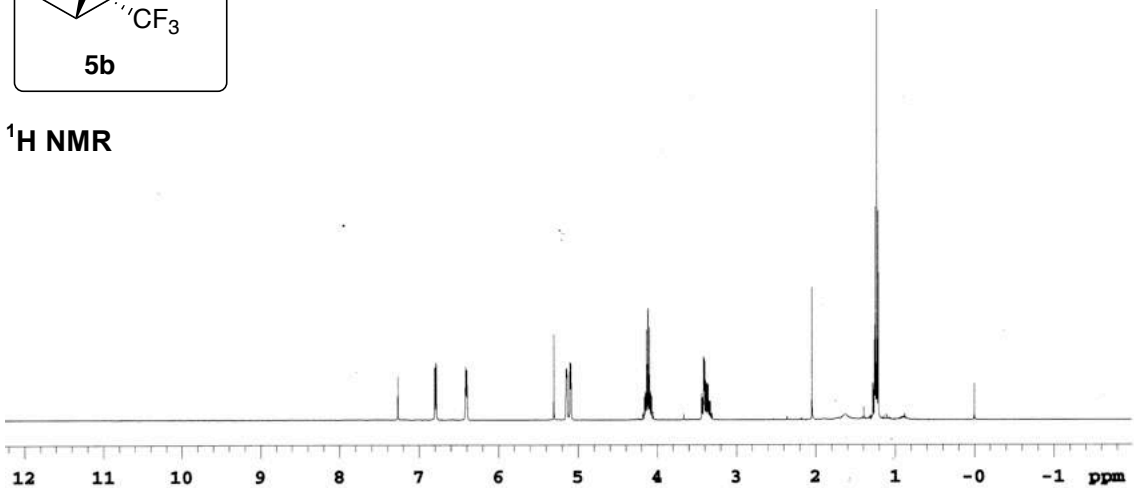


**$^{13}\text{C}$  NMR**

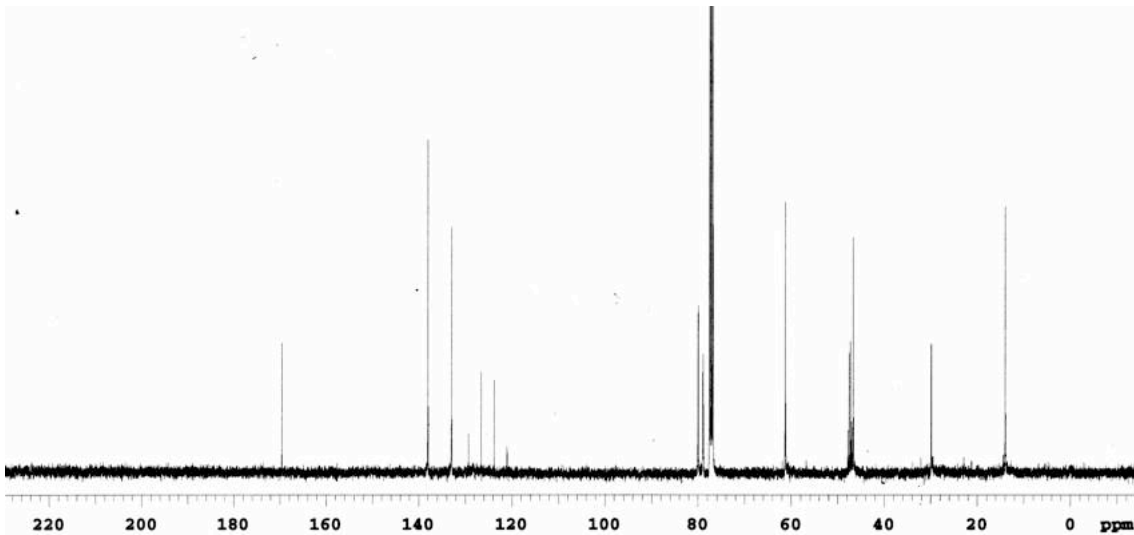




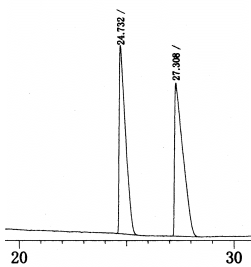
<sup>1</sup>H NMR



<sup>13</sup>C NMR

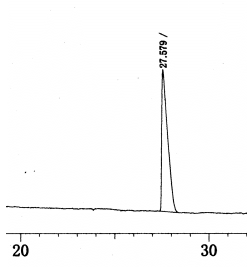


GC *racemic*

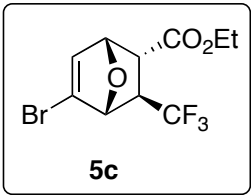


ピーク番号	保持時間	面積	面積%
1	24.732	368080	47.8645
2	27.308	400924	52.1355
合計		769004	100.0000

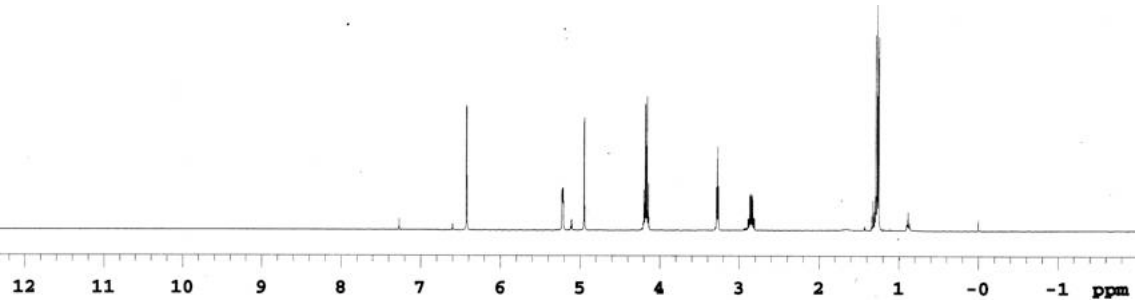
GC *optically active*



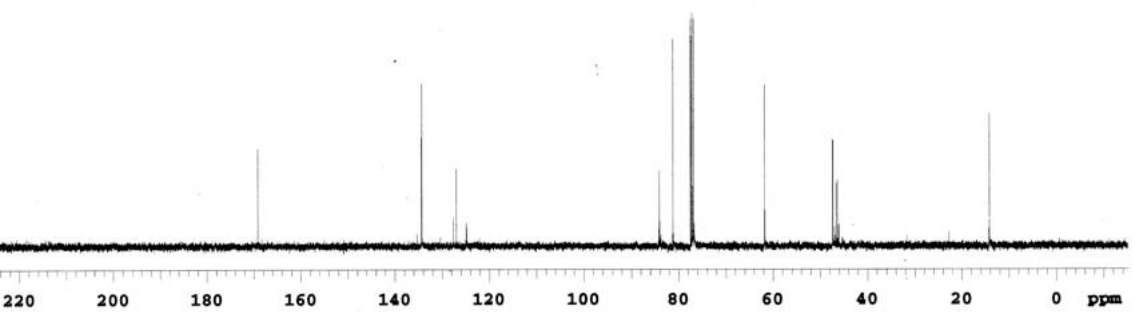
ピーク番号	保持時間	面積	面積%
1	27.579	227282	100.0000
合計		227282	100.0000



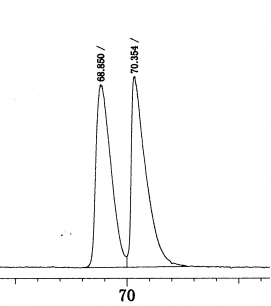
<sup>1</sup>H NMR



<sup>13</sup>C NMR

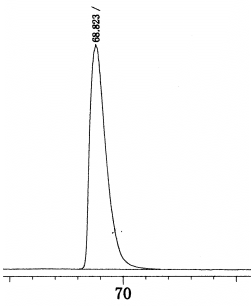


GC *racemic*

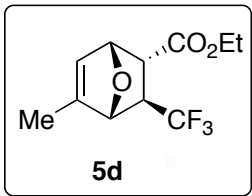


ピーク番号	保持時間	面積	面積%
1	68.850	1444019	49.6016
2	70.354	1467215	50.3984
合計		2911234	100.0000

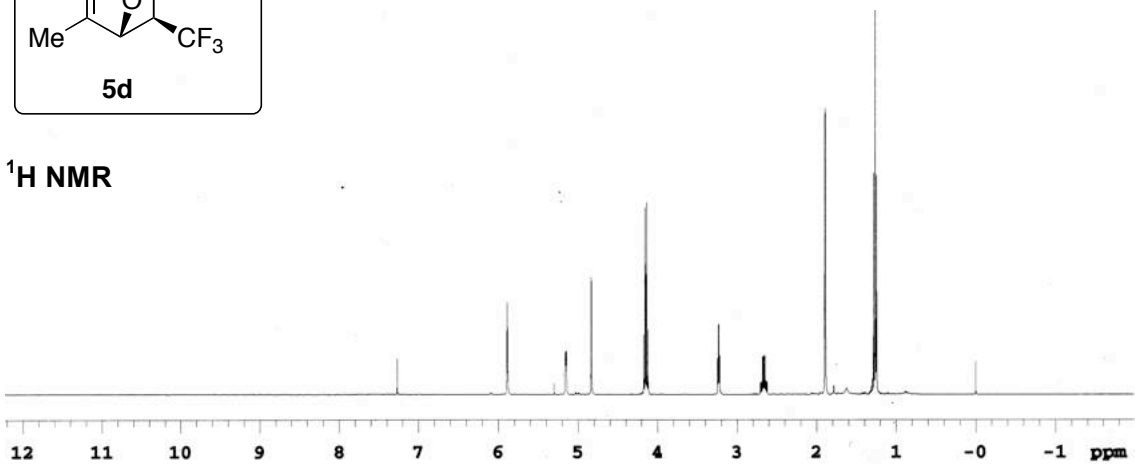
GC *optically active*



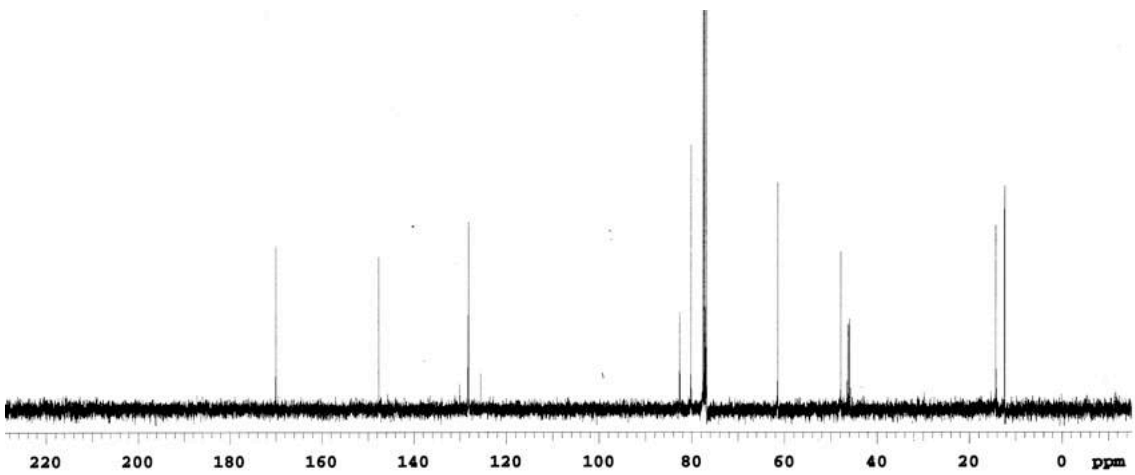
ピーク番号	保持時間	面積	面積%
1	68.823	3128106	100.0000
合計		3128106	100.0000



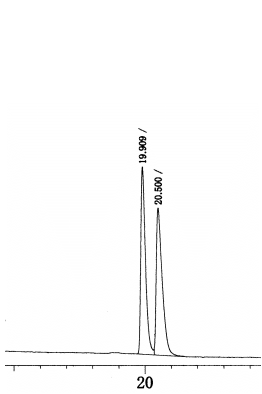
<sup>1</sup>H NMR



<sup>13</sup>C NMR

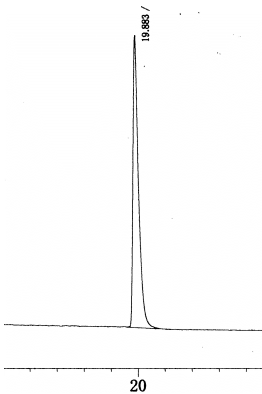


GC *racemic*

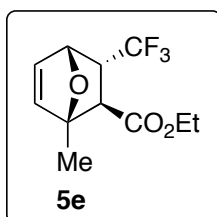


ピーク番号	保持時間	面積	面積%
1	19.909	648674	50.0290
2	20.500	647921	49.9710
合計		1296595	100.0000

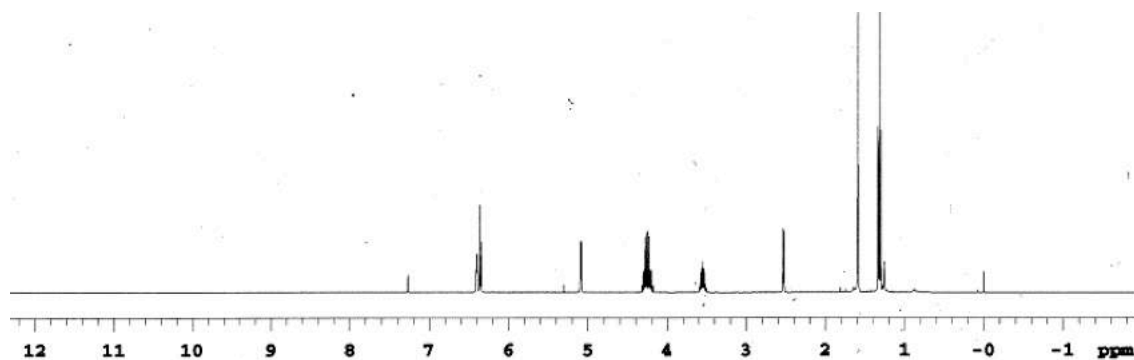
GC *optically active*



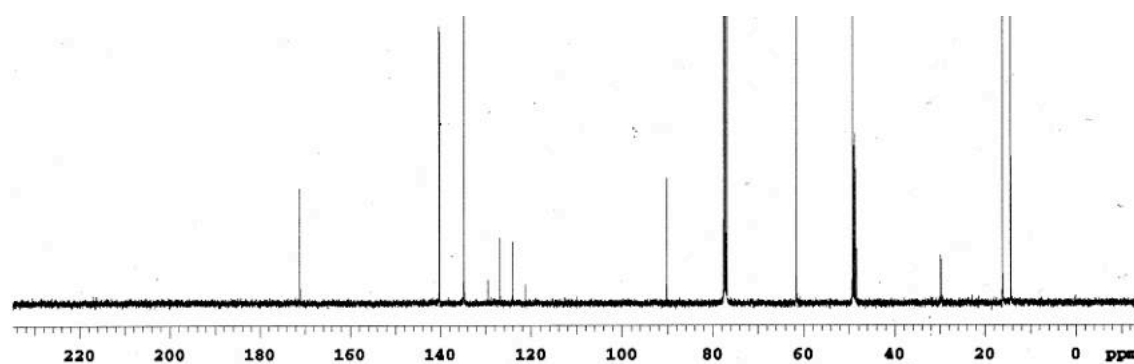
ピーク番号	保持時間	面積	面積%
1	19.883	1069959	100.0000
合計		1069959	100.0000



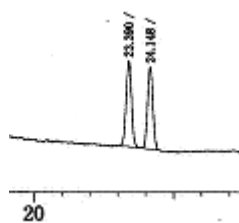
**<sup>1</sup>H NMR**



**<sup>13</sup>C NMR**

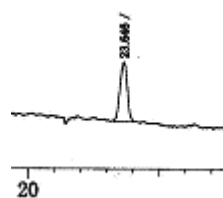


**HPLC *racemic***

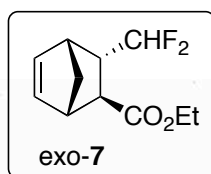


ピーク番号	保持時間	面積	面積%
1	23.390	54600	51.3558
2	24.148	51717	48.6442
合計		106317	100.0000

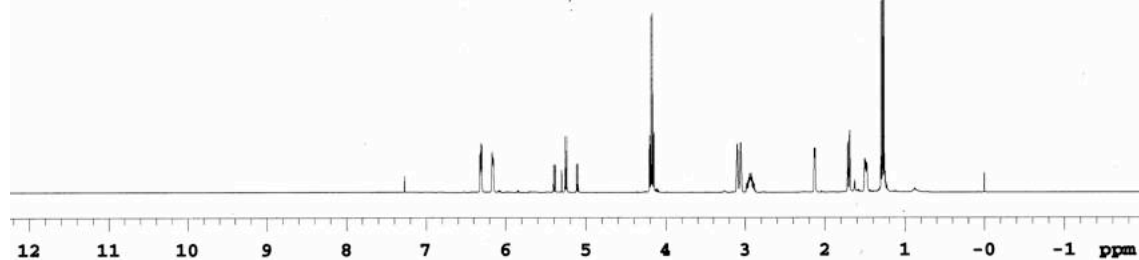
**HPLC *optically active***



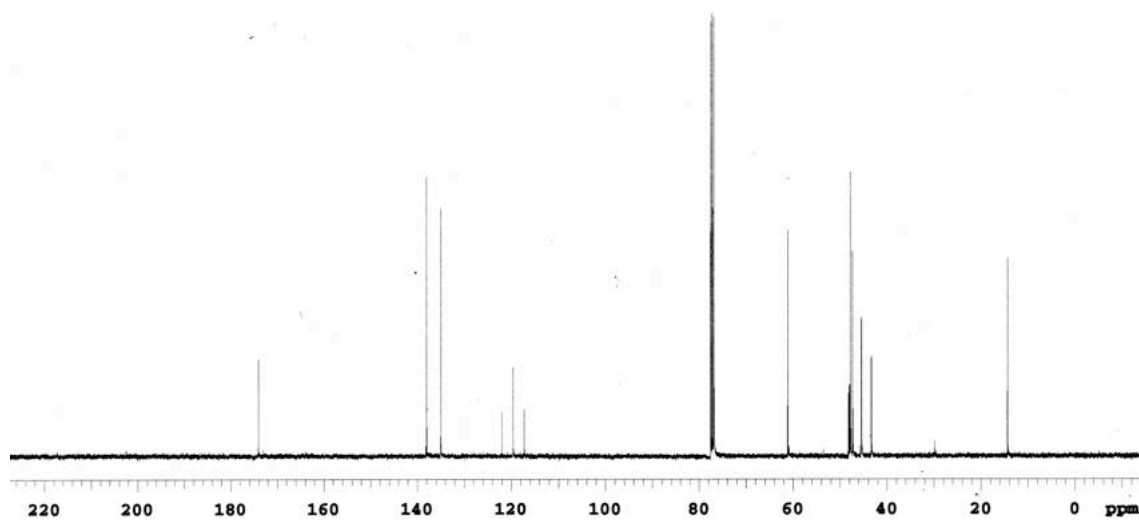
ピーク番号	保持時間	面積	面積%
1	23.646	37553	100.0000
合計		37553	100.0000



<sup>1</sup>H NMR

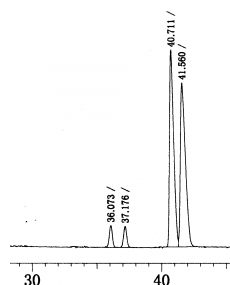


<sup>13</sup>C NMR

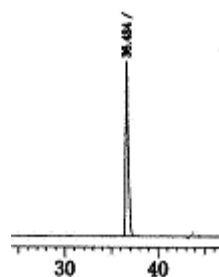


GC racemic (exo/endo = 14/86)

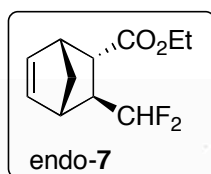
GC optically active



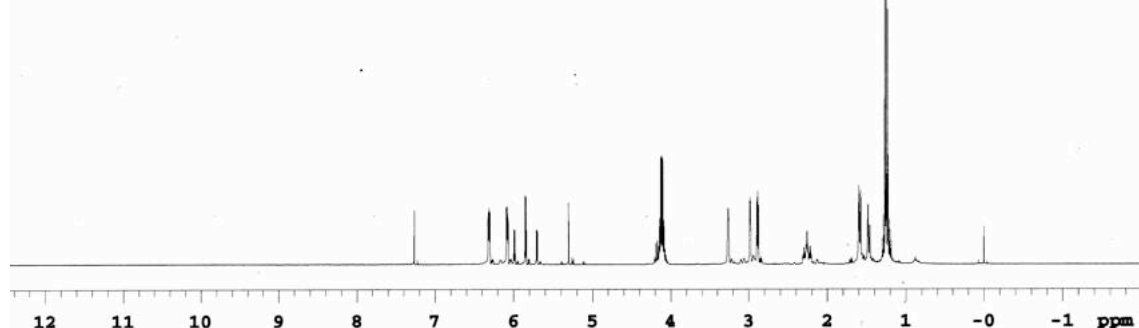
ピーク番号	保持時間	面積	面積%
1	36.073	41942	3.8606
2	37.176	41450	3.8154
3	40.711	499273	45.9569
4	41.560	503728	46.3670
合計		1086393	100.0000



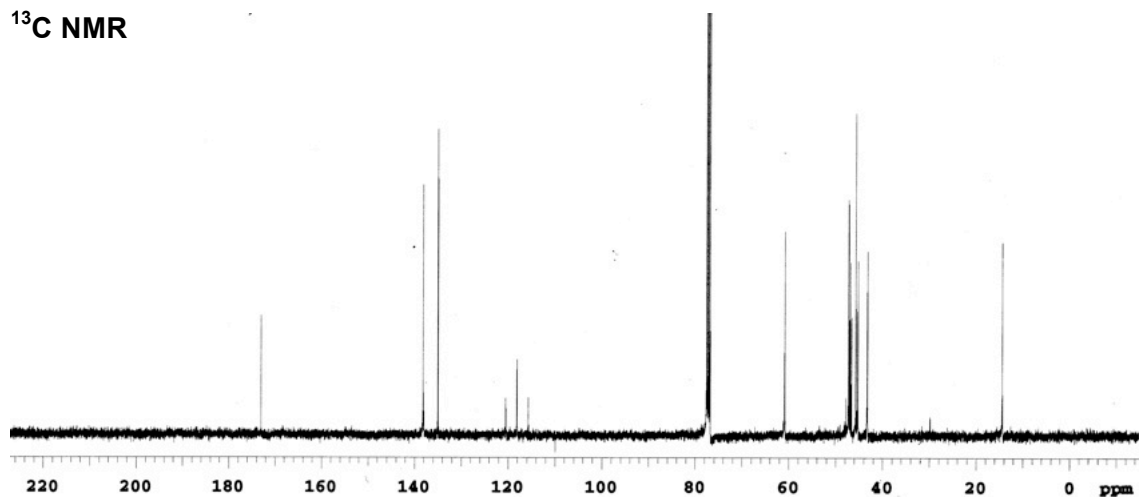
ピーク番号	保持時間	面積	面積%
1	36.484	2971050	100.0000
合計		2971050	100.0000



<sup>1</sup>H NMR

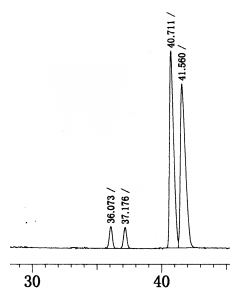


<sup>13</sup>C NMR



**GC racemic**

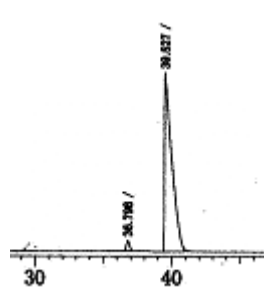
(exo/endo = 14/86)



ピーク番号	保持時間	面積	面積%
1	36.073	41942	3.8606
2	37.176	41450	3.8154
3	40.711	499273	45.9569
4	41.560	503728	46.3670
合計		1086393	100.0000

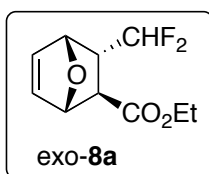
**GC optically active**

(contains small amount of exo isomer)

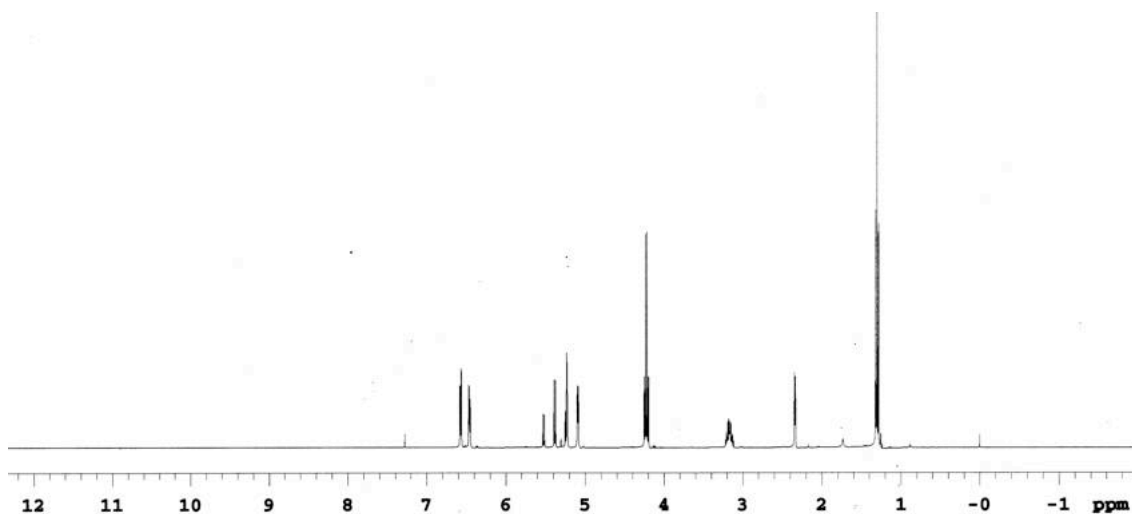


ピーク番号	保持時間	面積	面積%
1	36.798	77495	2.6578
2	39.527	2838253	97.3422
合計		2915748	100.0000

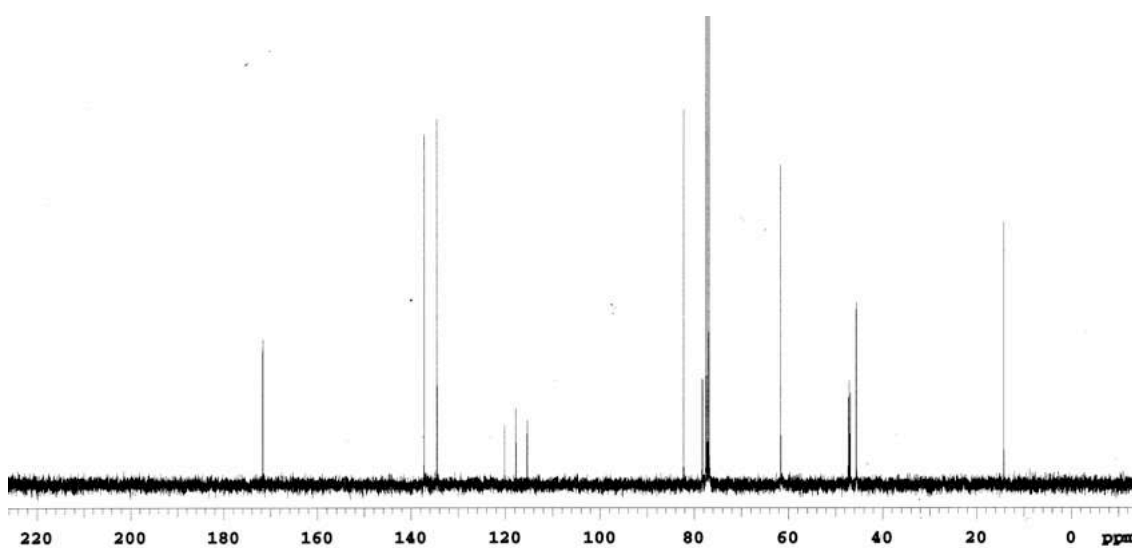




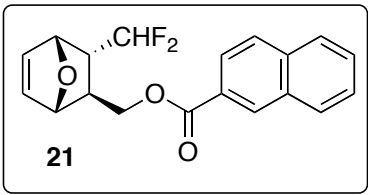
<sup>1</sup>H NMR



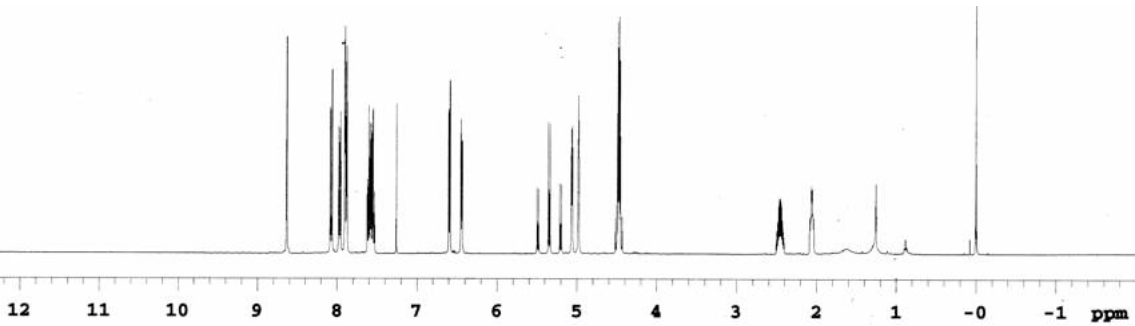
<sup>13</sup>C NMR



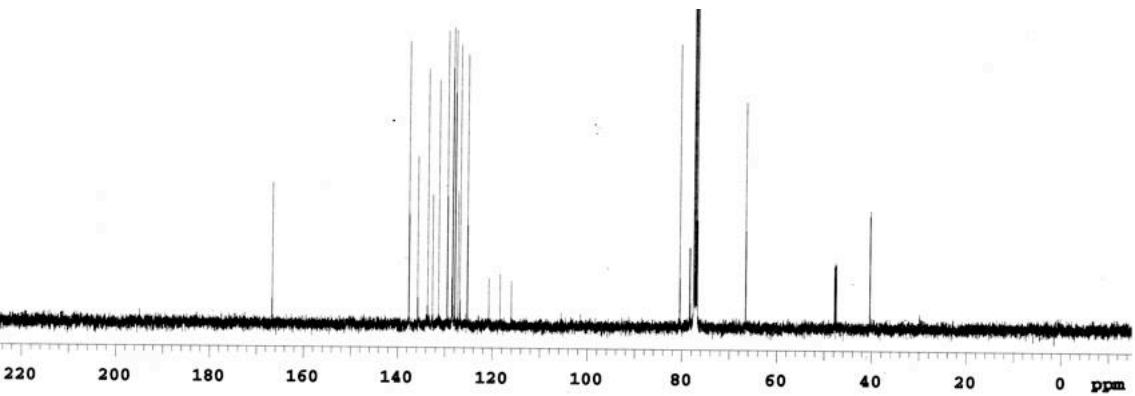
Ee was determined after converted into **21**.



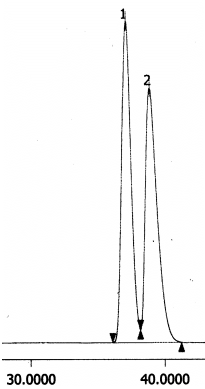
<sup>1</sup>H NMR



<sup>13</sup>C NMR



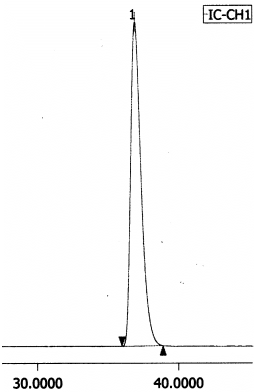
HPLC *racemic*



ピーク情報

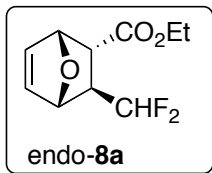
#	ピーク名	CH	tR [min]	面積 [μV·sec]	高さ [μV]	面積%	高さ%
1	Unknown	1	37.025	4169464	86235	49.840	55.804
2	Unknown	1	38.792	4196180	68297	50.160	44.196

HPLC *optically active*

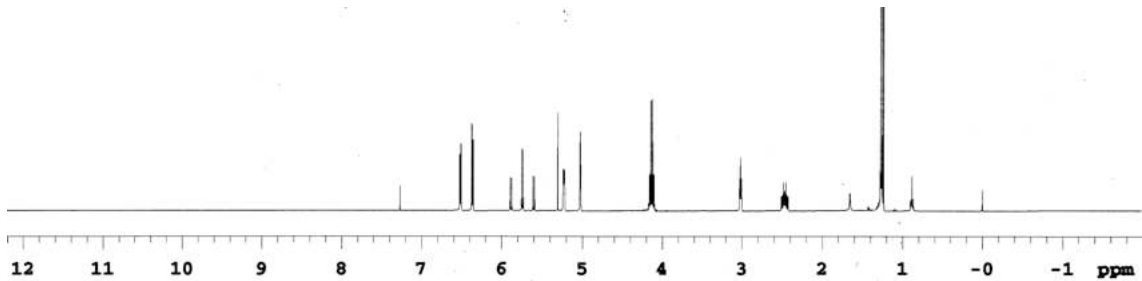


ピーク情報

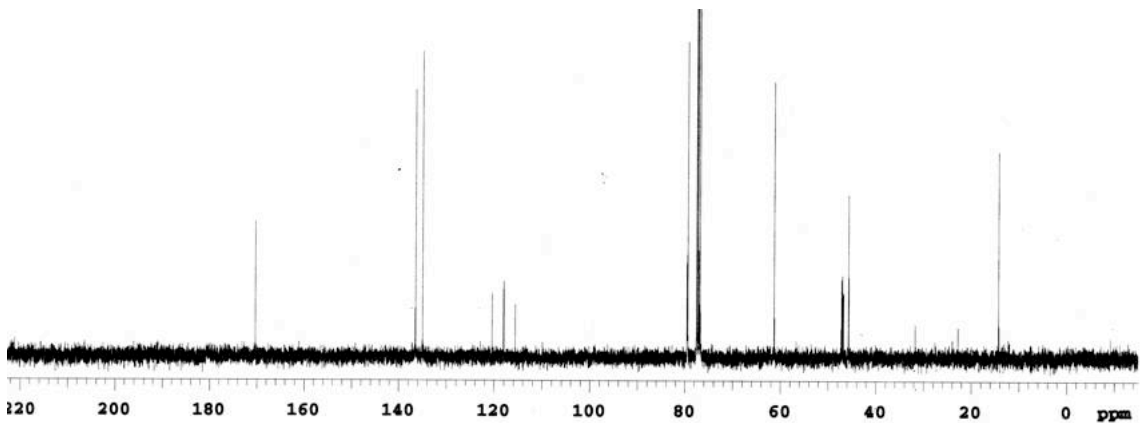
#	ピーク名	CH	tR [min]	面積 [μV·sec]	高さ [μV]	面積%	高さ%
1	Unknown	1	36.875	5161368	100561	100.000	100.000



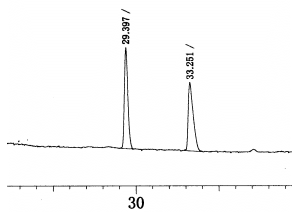
<sup>1</sup>H NMR



<sup>13</sup>C NMR

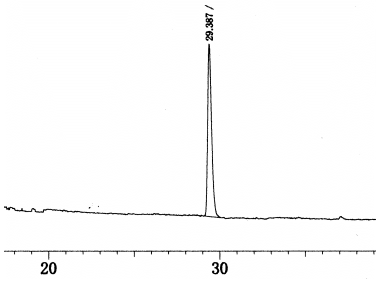


GC *racemic*

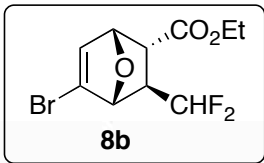


ピーク番号	保持時間	面積	面積%
1	29.397	89019	50.9708
2	33.251	85628	49.0292
合計		174647	100.0000

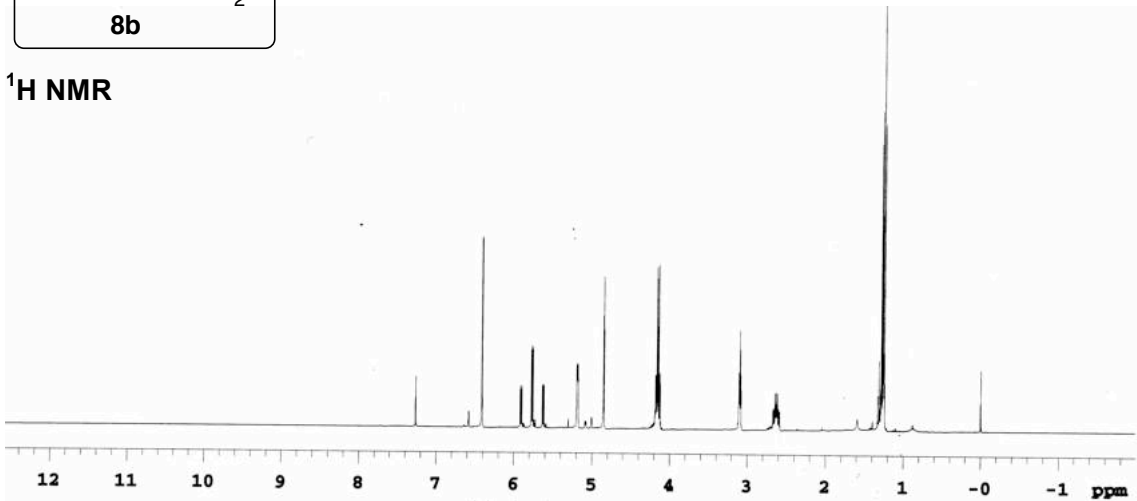
GC *optically active*



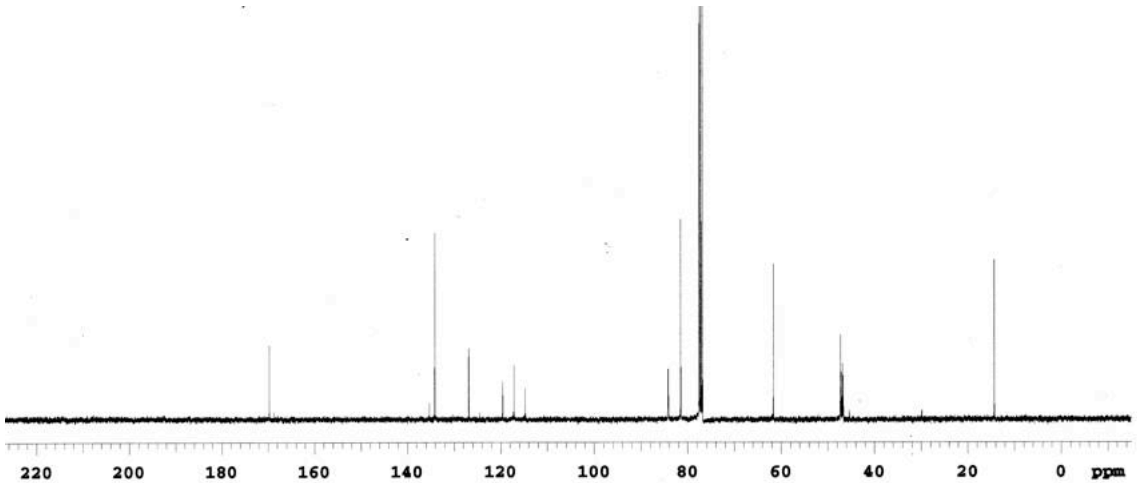
ピーク番号	保持時間	面積	面積%
1	29.387	164602	100.0000
合計		164602	100.0000



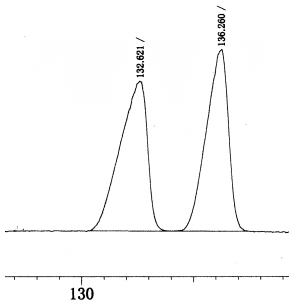
<sup>1</sup>H NMR



<sup>13</sup>C NMR

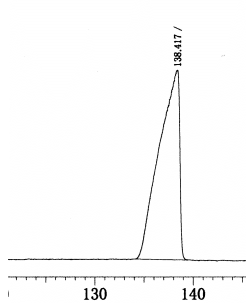


GC racemic

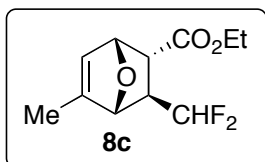


ピーク番号	保持時間	面積	面積%
1	132.621	761722	50.3610
2	136.260	750802	49.6390
合計		1512524	100.0000

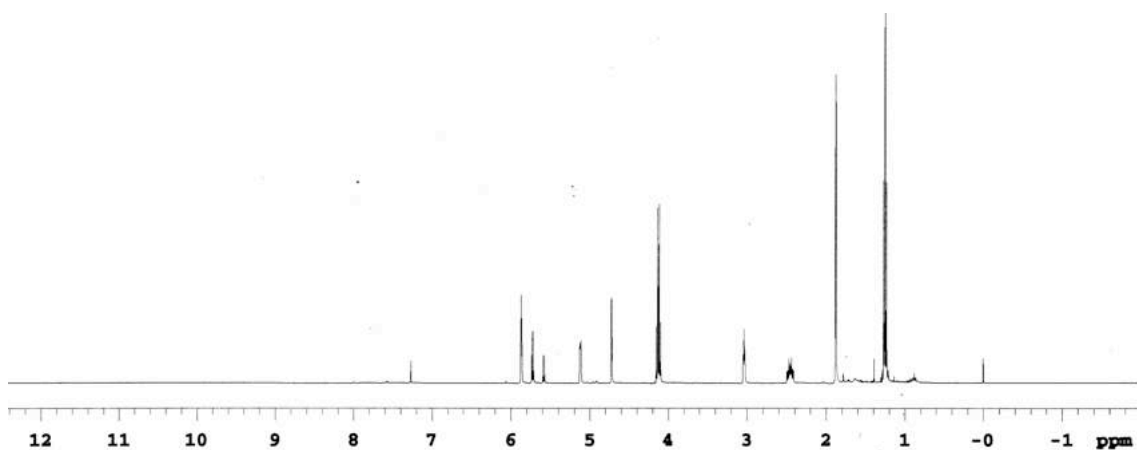
GC optically active



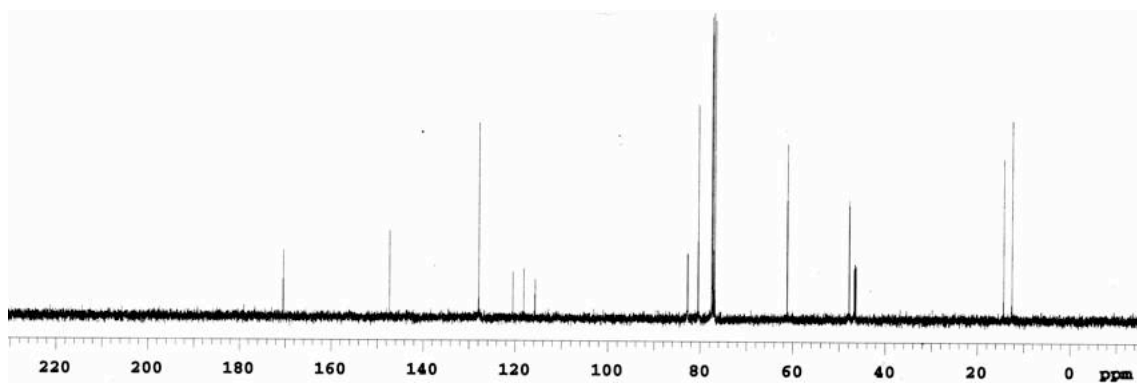
ピーク番号	保持時間	面積	面積%
1	138.417	3874919	100.0000
合計		3874919	100.0000



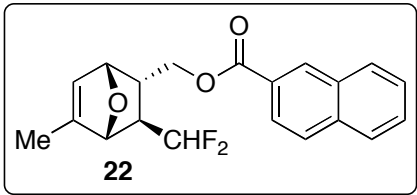
<sup>1</sup>H NMR



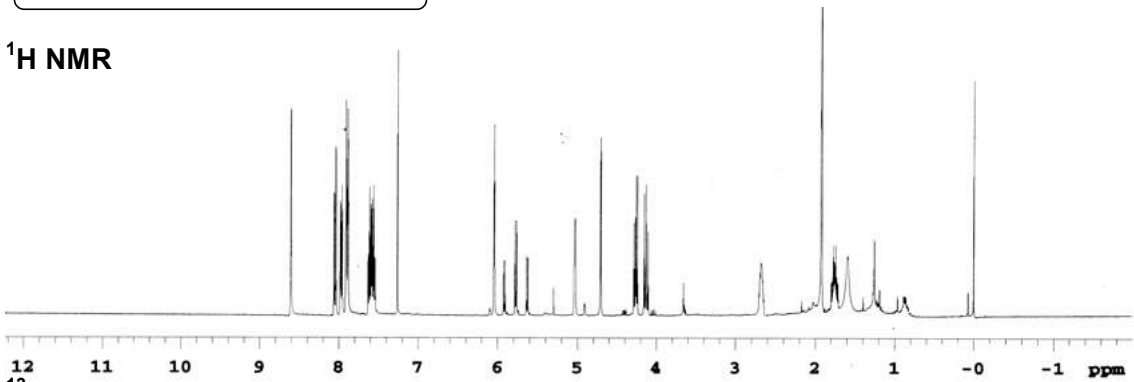
<sup>13</sup>C NMR



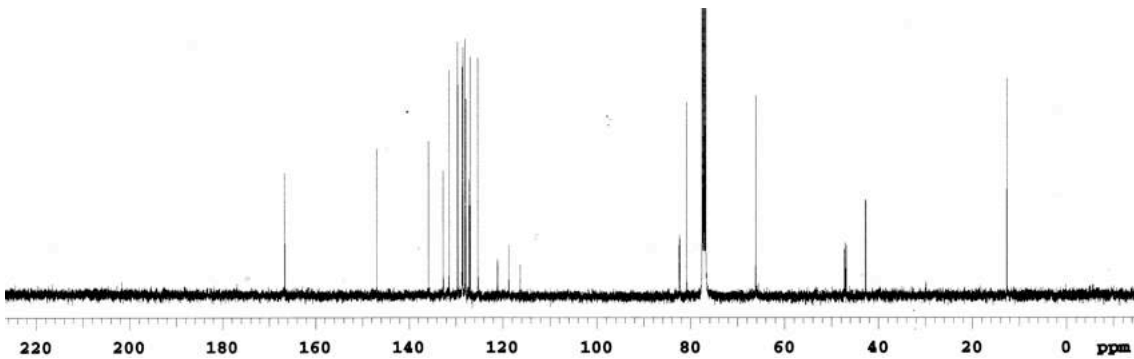
Ee was determined after converted into **22**.



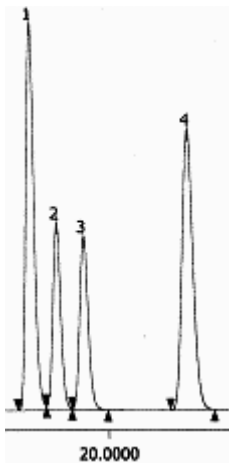
<sup>1</sup>H NMR



<sup>13</sup>C NMR



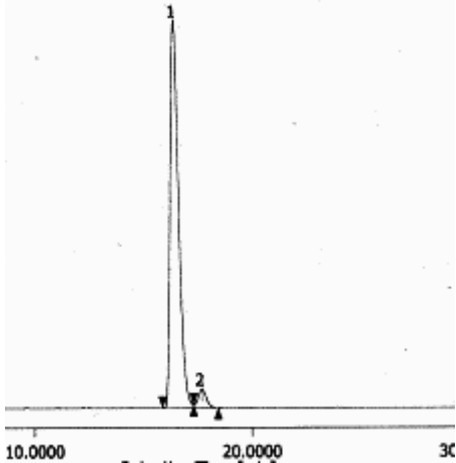
**HPLC *racemic***  
(contains 47% of regio isomer)



ピーク情報

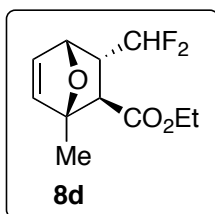
#	ピーク名	CH	tR [min]	面積 [μVsec]	高さ [μV]	面積%	高さ%
3	Unknown	1	16.325	3069739	122590	33.759	37.681
4	Unknown	1	17.597	1490545	59136	16.282	18.178
5	Unknown	1	18.808	1474043	54858	16.211	16.863
6	Unknown	1	23.597	3069668	88738	33.748	27.278

**HPLC *optically active***  
(contains small amount of regio isomer)

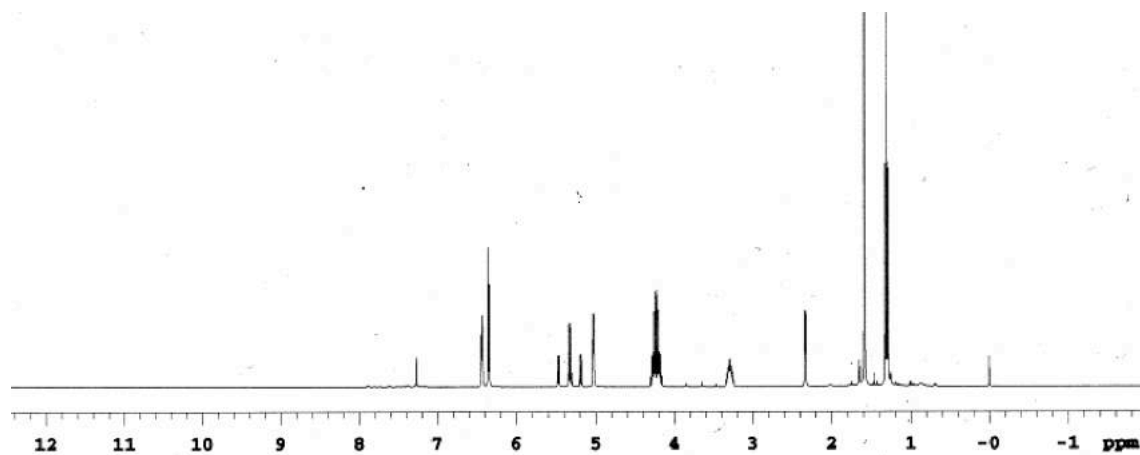


ピーク情報

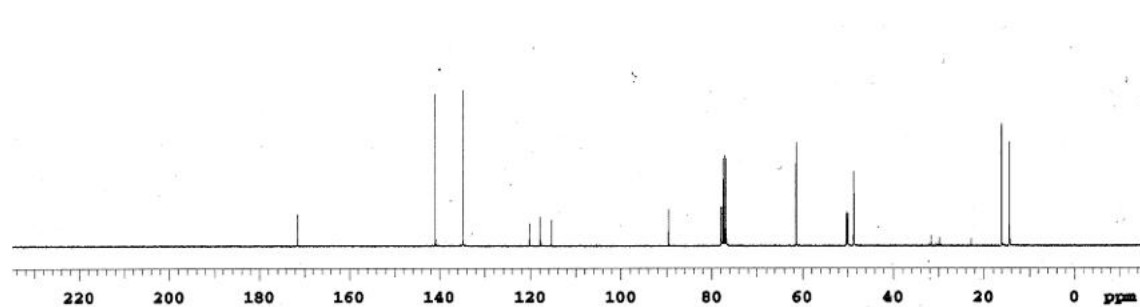
#	ピーク名	CH	tR [min]	面積 [μVsec]	高さ [μV]	面積%	高さ%
3	Unknown	1	16.383	7374209	280438	95.379	95.385
2	Unknown	1	17.675	357512	13578	4.624	4.615



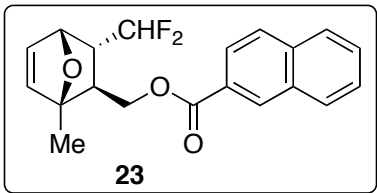
**<sup>1</sup>H NMR**



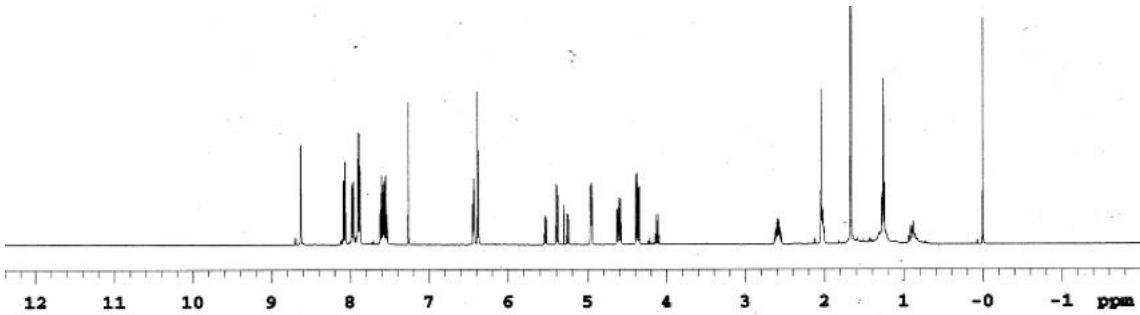
**<sup>13</sup>C NMR**



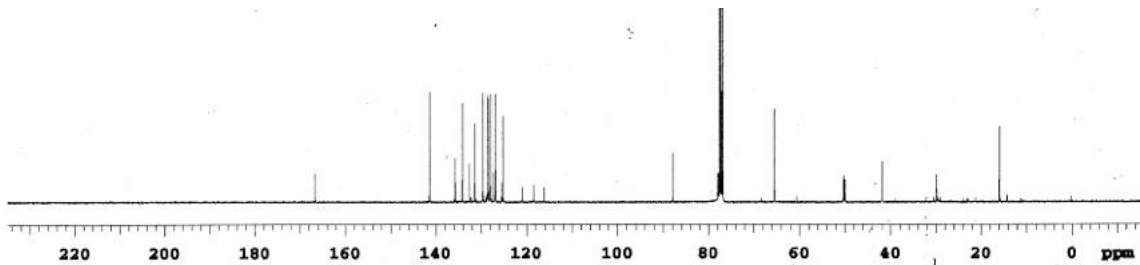
Ee was determined after converted into **23**.



<sup>1</sup>H NMR

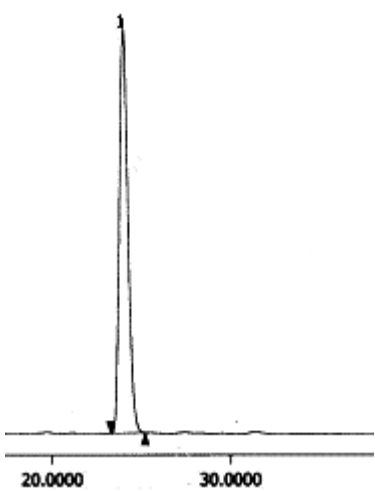
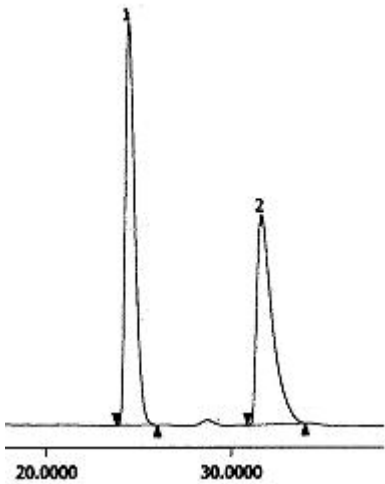


<sup>13</sup>C NMR



HPLC *racemic*

HPLC *optically active*



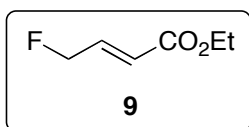
ピーク情報

ピーク番号	CH	時間	面積	強度	純度
Unknown	1	24.488	9262742	257417	54.100
Unknown	1	31.817	7856260	134500	45.892

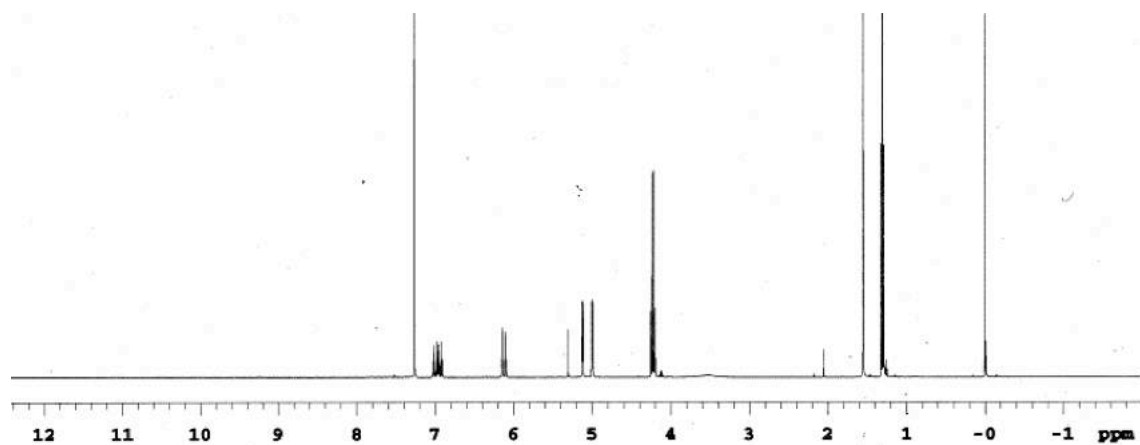
ピーク情報

ピーク番号	CH	時間	面積	強度	純度
Unknown	1	23.950	3703710	110648	100.000

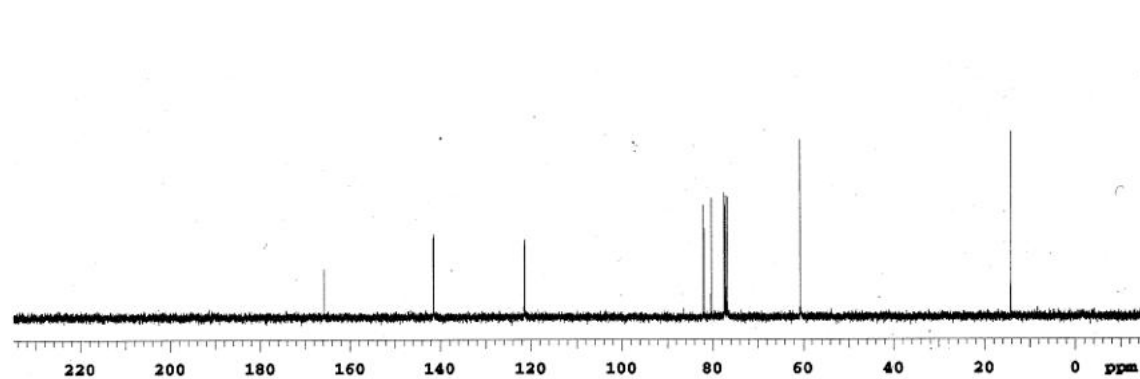


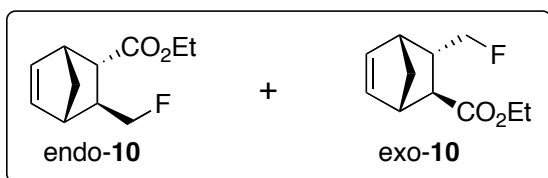


**<sup>1</sup>H NMR**

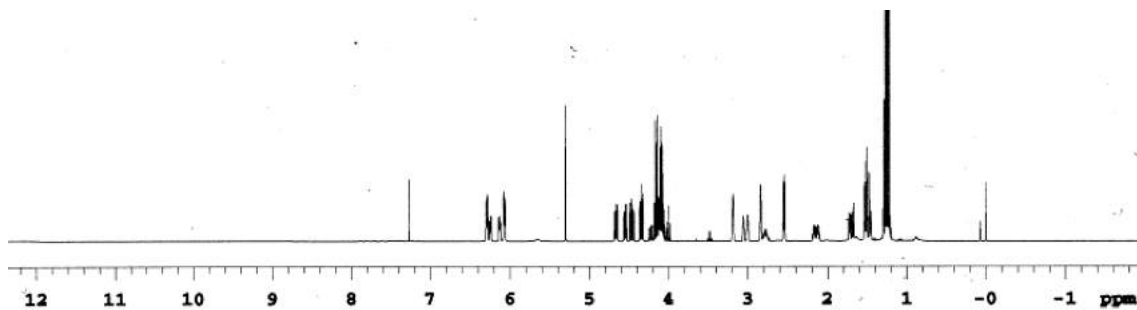


**<sup>13</sup>C NMR**

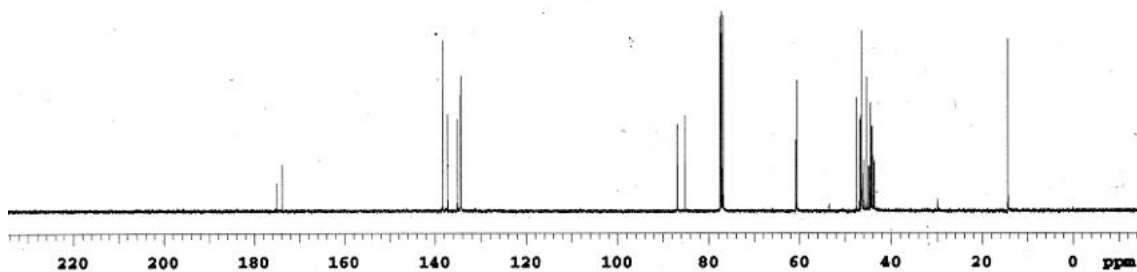




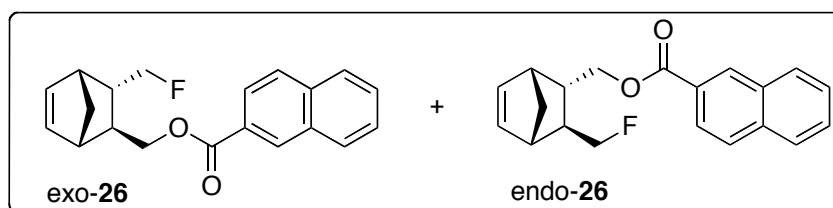
<sup>1</sup>H NMR



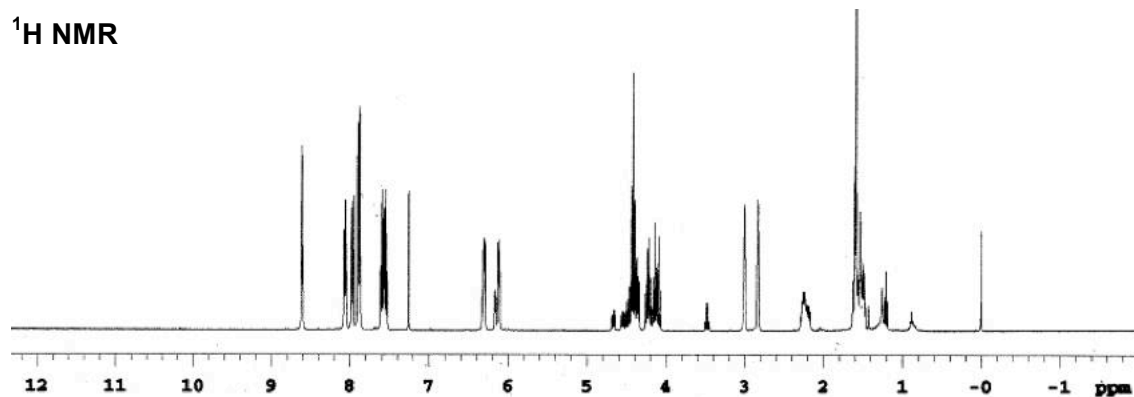
<sup>13</sup>C NMR



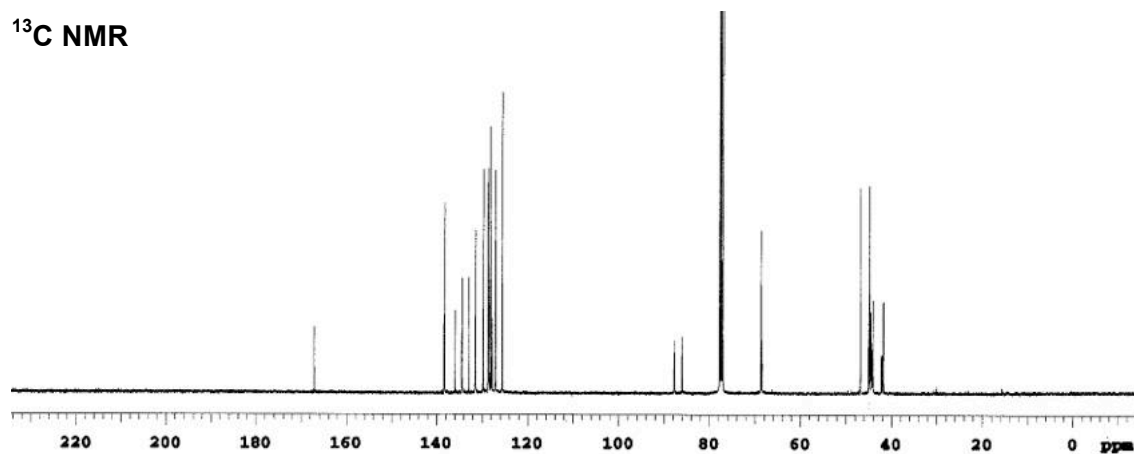
Ee was determined after converted into **26**.



<sup>1</sup>H NMR

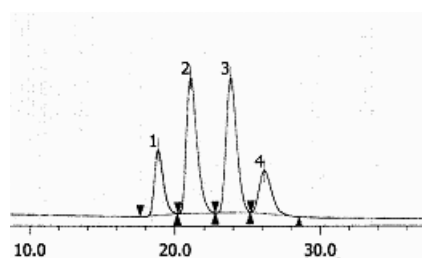


<sup>13</sup>C NMR



HPLC *racemic*

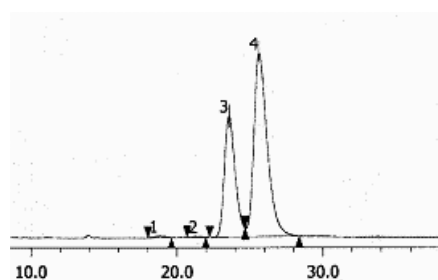
(exo/endo = 72/28)



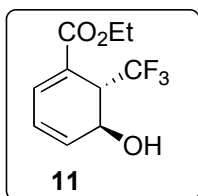
#	ピーク名	CH	tR [min]	面積 [μV·sec]	高さ [μV]	面積%
1	Unknown	1	18.833	286277	6713	14.607
2	Unknown	1	21.058	701939	14028	35.815
3	Unknown	1	23.817	703844	13908	35.912
4	Unknown	1	26.150	267845	4455	13.666

HPLC *optically active*

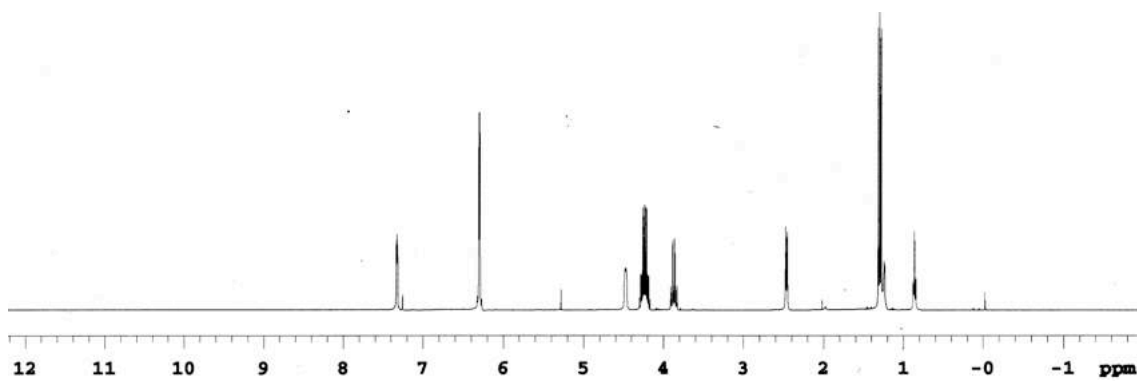
(exo/endo = 34/66)



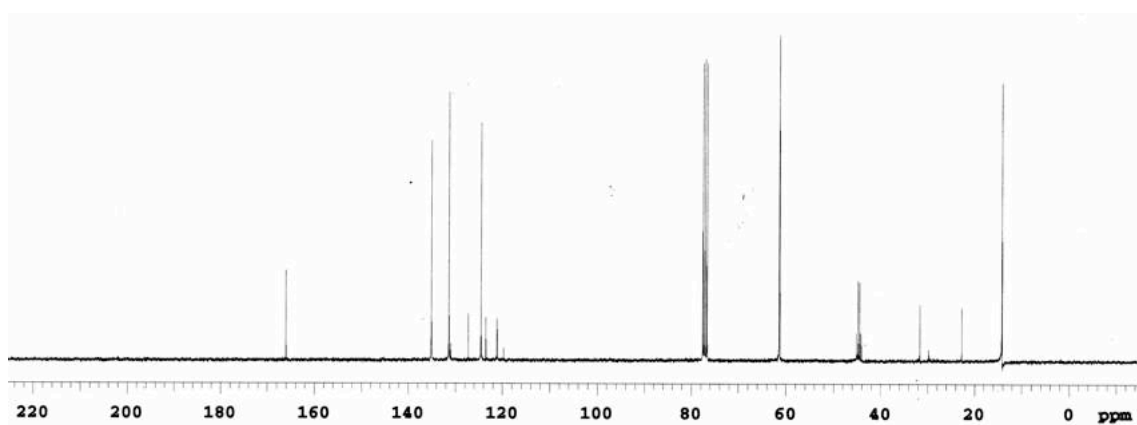
#	ピーク名	CH	tR [min]	面積 [μV·sec]	高さ [μV]	面積%
1	Unknown	1	18.733	8390	173	0.453
2	Unknown	1	21.425	2957	84	0.160
3	Unknown	1	23.558	641992	12412	34.632
4	Unknown	1	25.625	1200442	18786	64.756

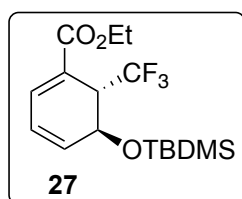


**<sup>1</sup>H NMR**

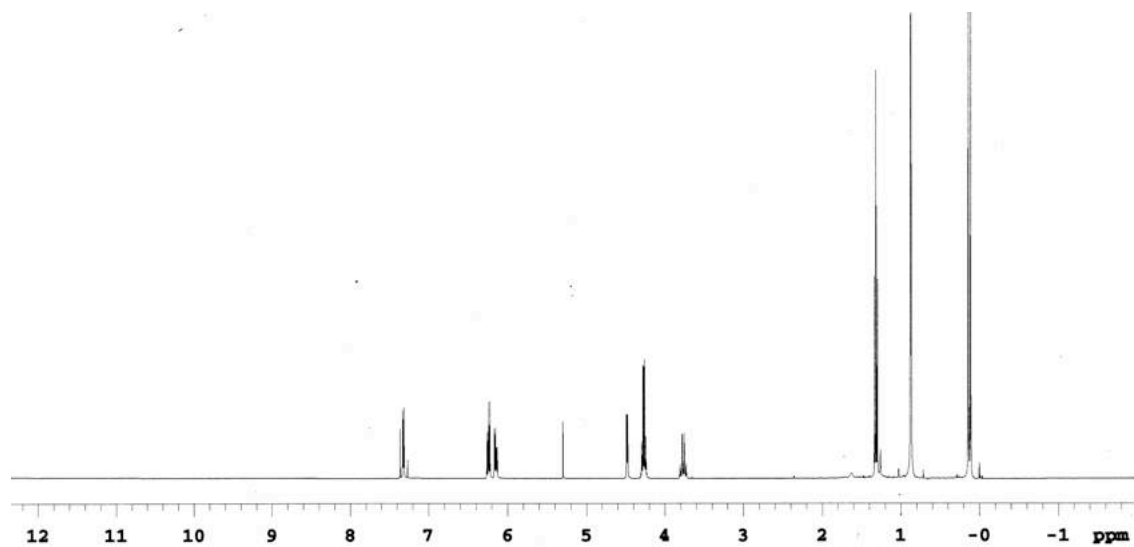


**<sup>13</sup>C NMR**

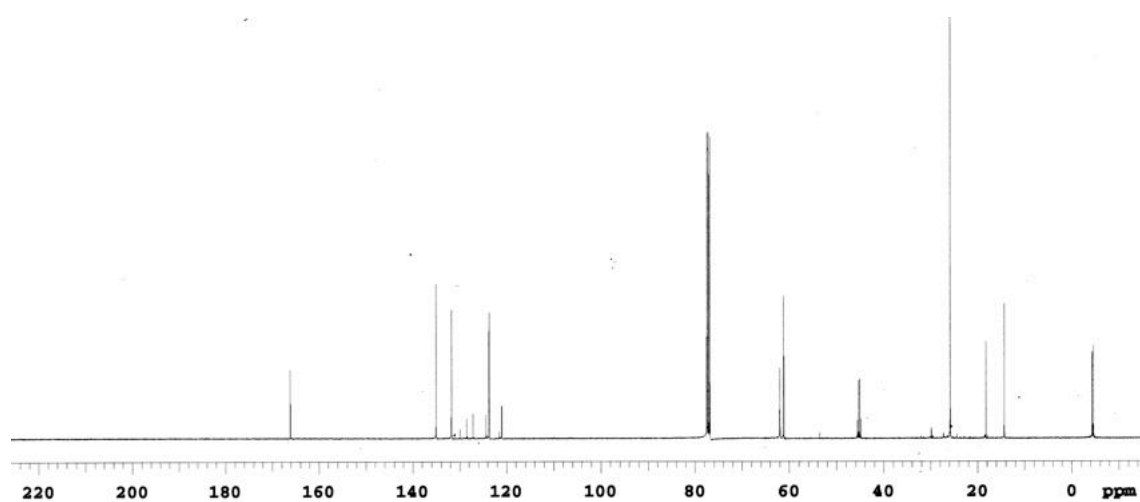


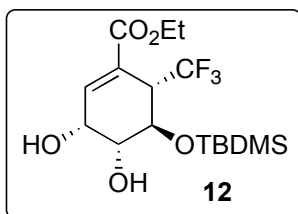


**$^1\text{H}$  NMR**

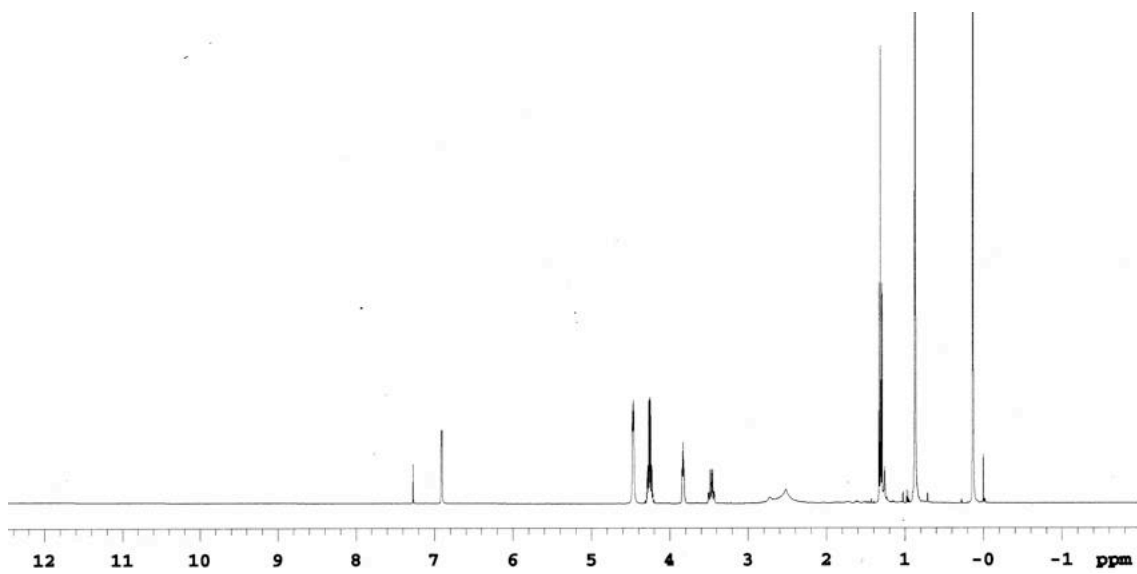


**$^{13}\text{C}$  NMR**

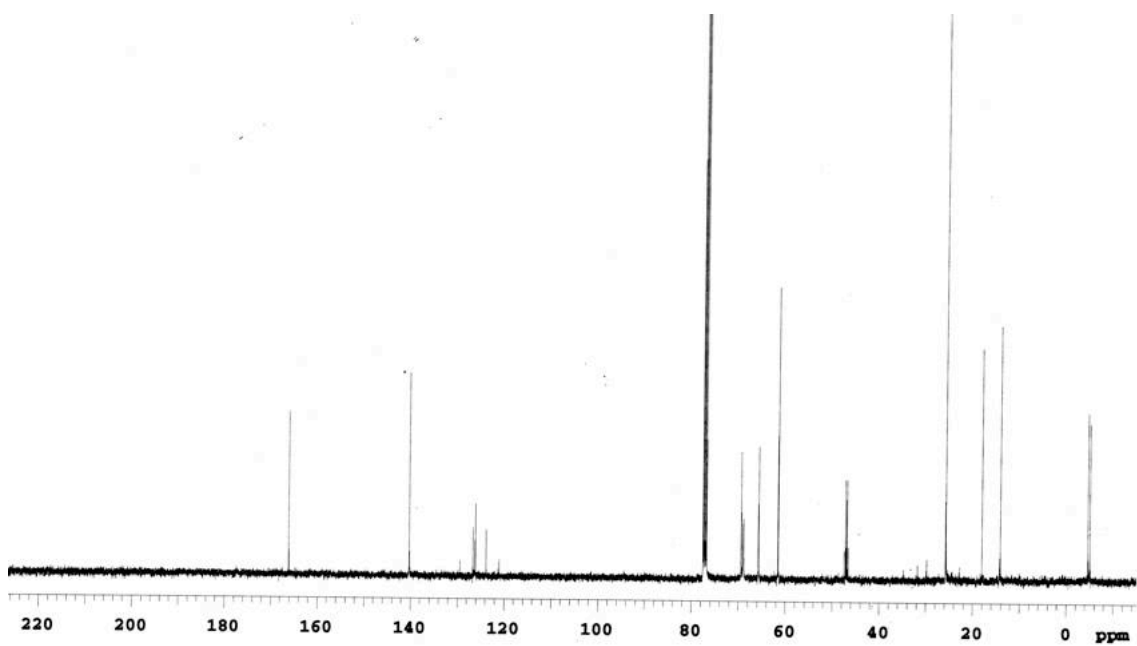


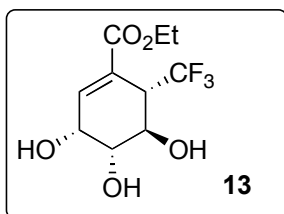


**$^1\text{H}$  NMR**

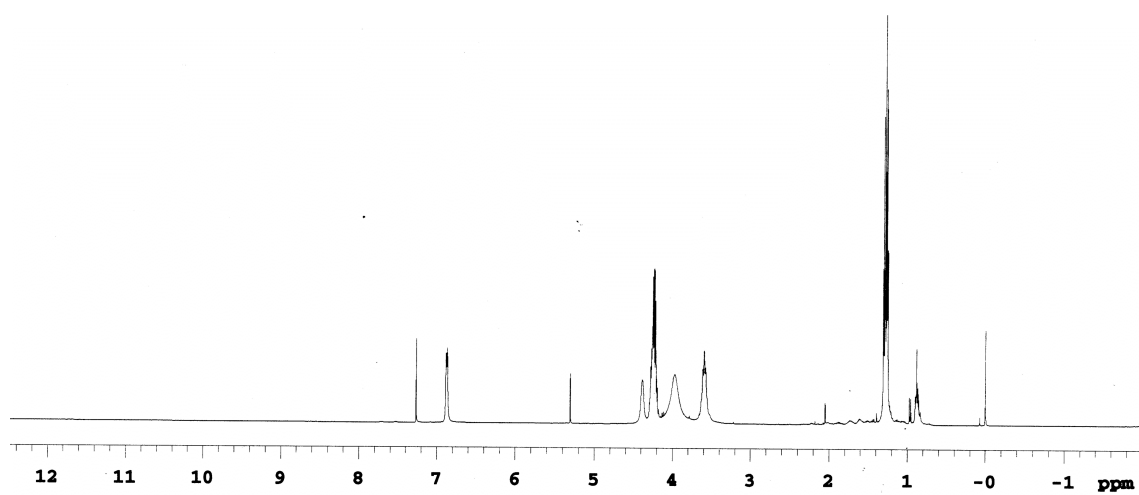


**$^{13}\text{C}$  NMR**

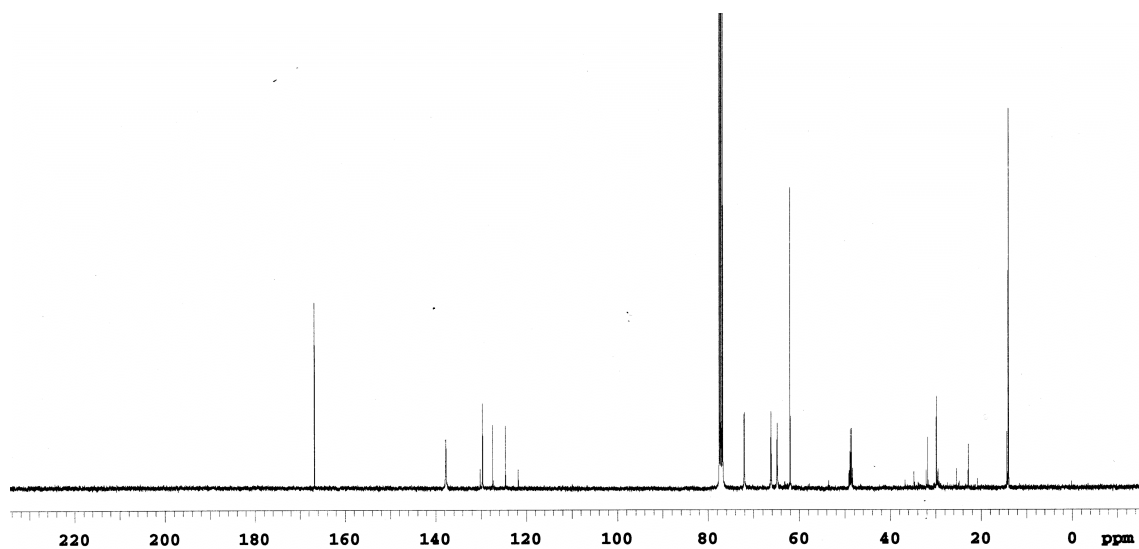


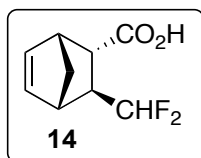


**$^1\text{H}$  NMR**

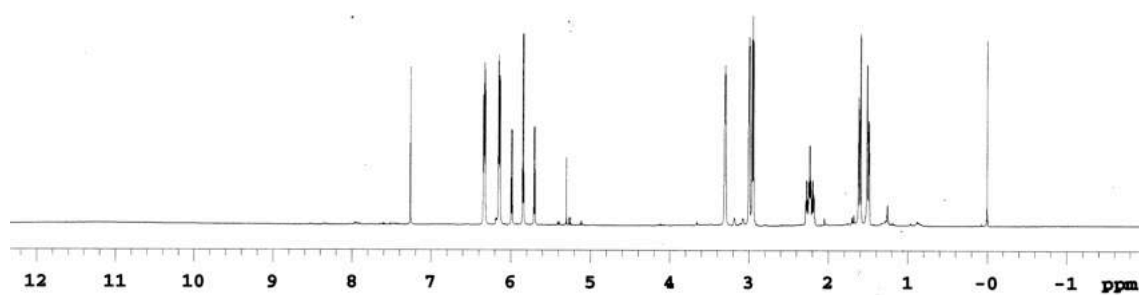


**$^{13}\text{C}$  NMR**

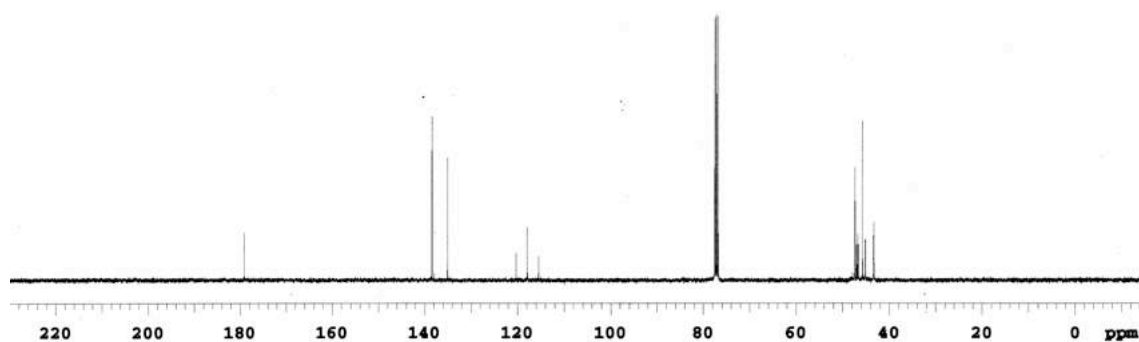




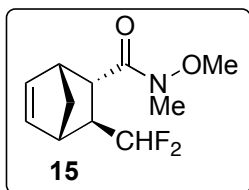
**$^1\text{H}$  NMR**



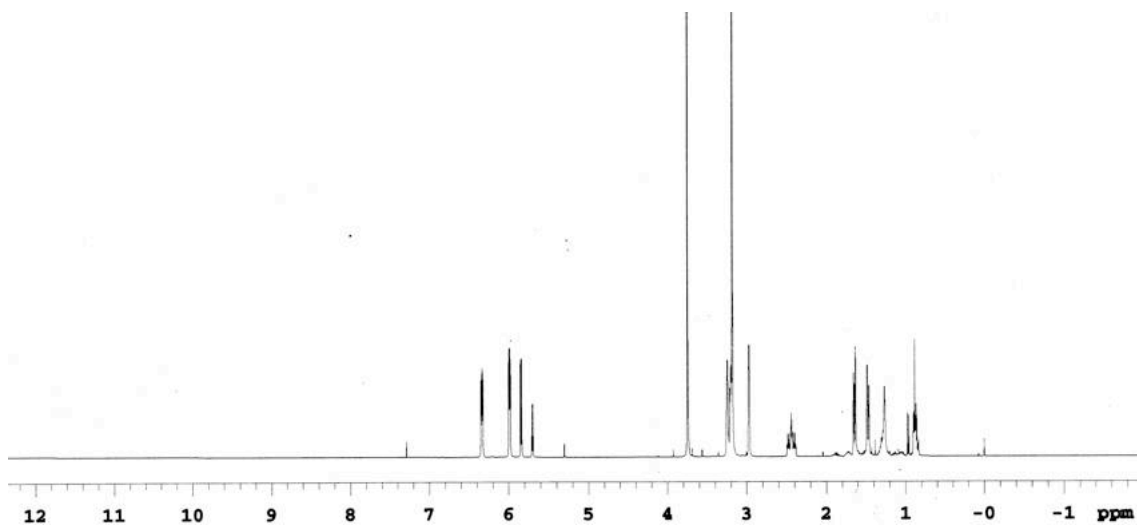
**$^{13}\text{C}$  NMR**



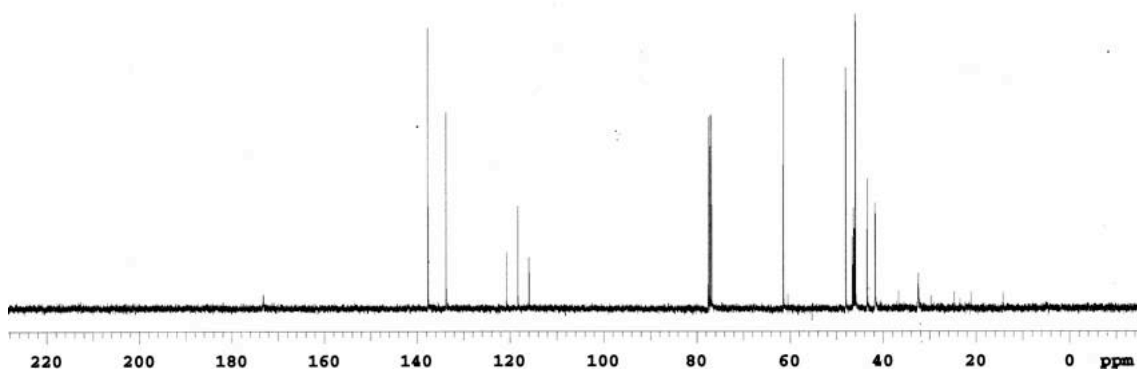


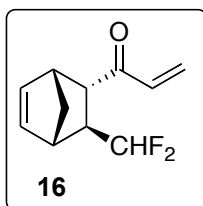


**$^1\text{H}$  NMR**

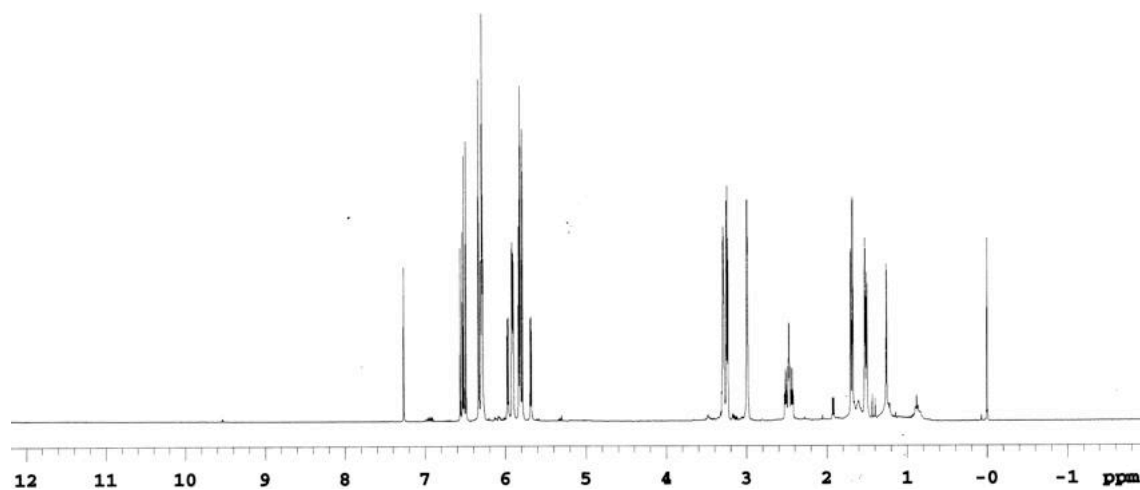


**$^{13}\text{C}$  NMR**

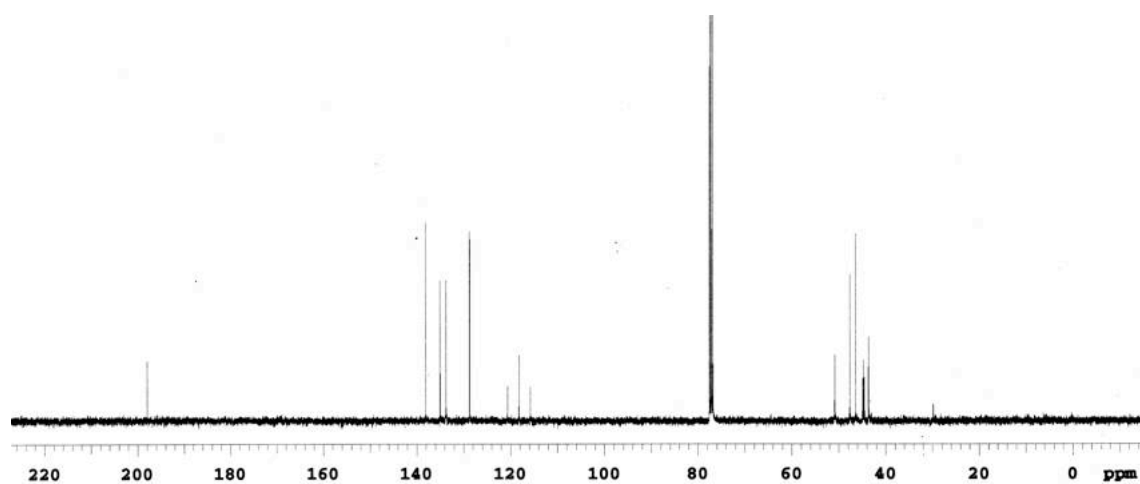


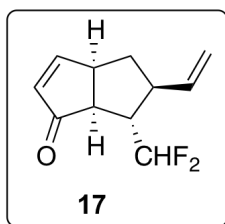


**<sup>1</sup>H NMR**

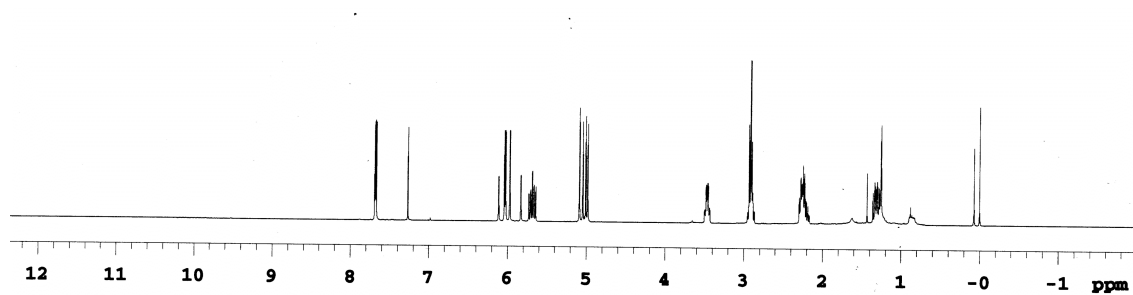


**<sup>13</sup>C NMR**

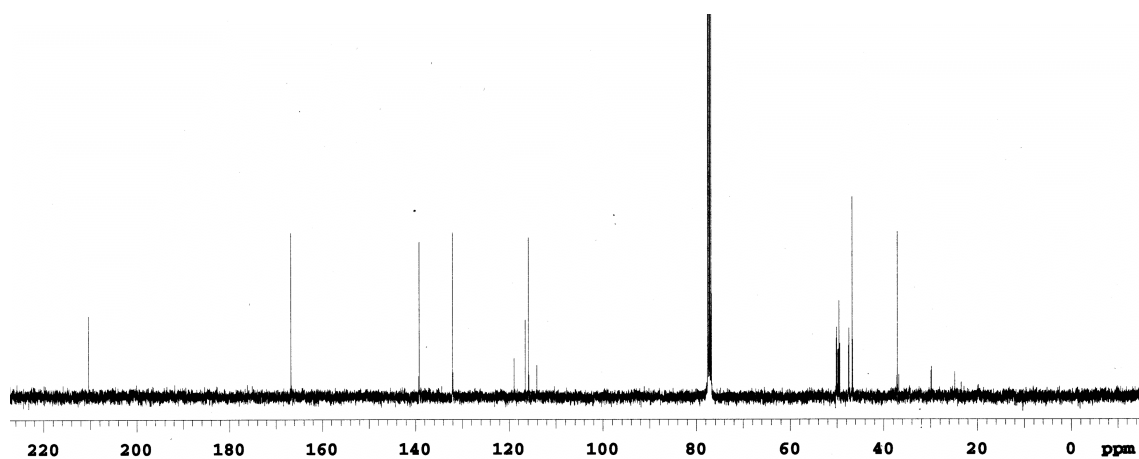


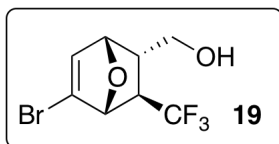


**$^1\text{H}$  NMR**

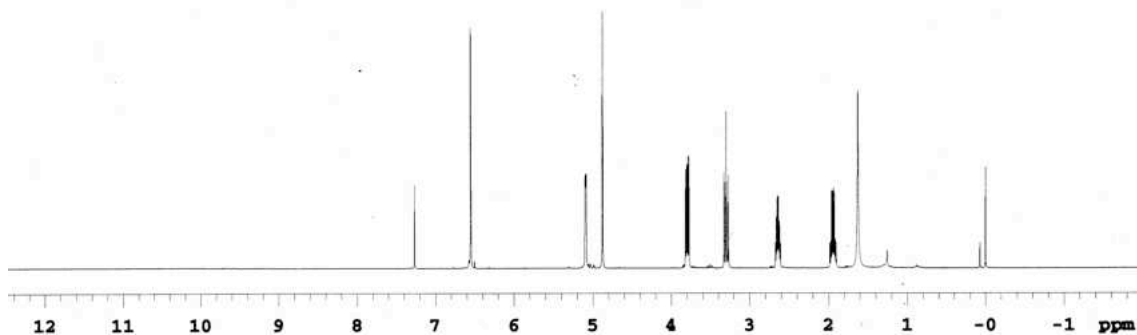


**$^{13}\text{C}$  NMR**

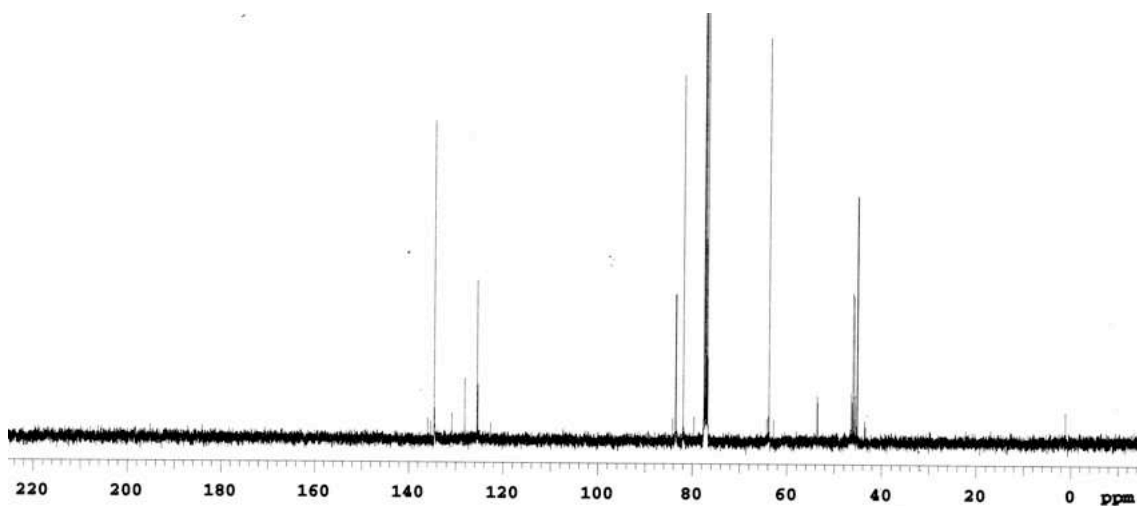


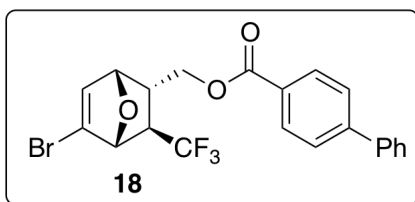


**<sup>1</sup>H NMR**

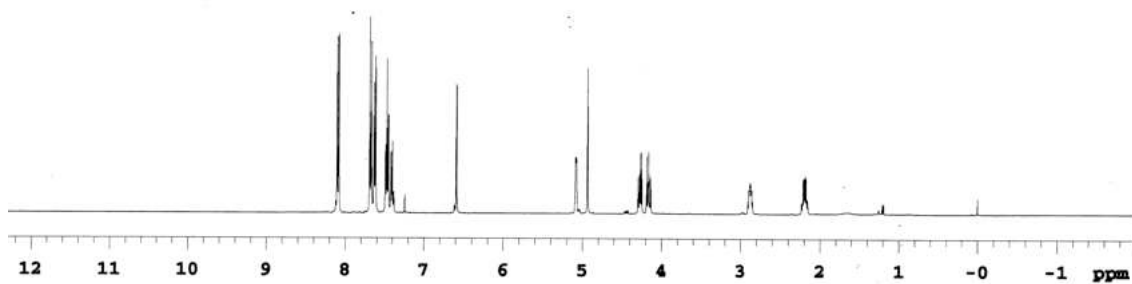


**<sup>13</sup>C NMR**





**<sup>1</sup>H NMR**



**<sup>13</sup>C NMR**

