Electronic Supporting Information

Design, synthesis and P-gp induction activity of aryl phosphonate esters: Identification of tetraethyl-2-phenylethene-1,1-diyldiphosphonate as an orally bioavailable P-gp inducer‡

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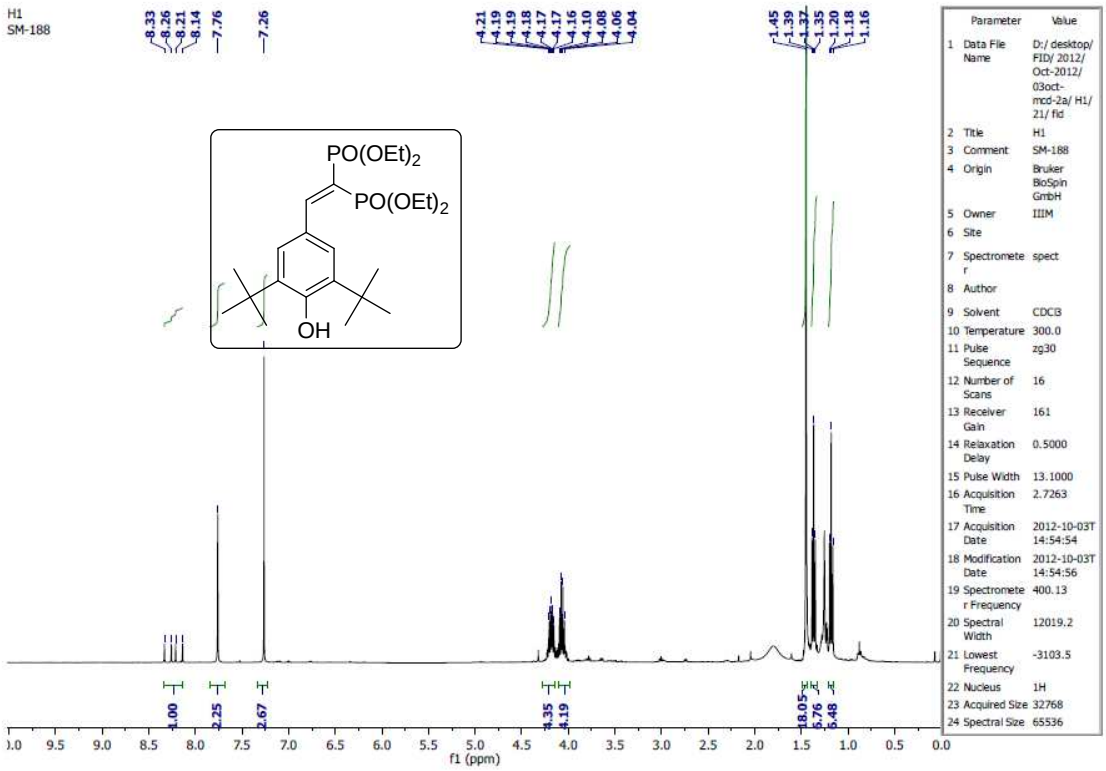
S1. NMR SPECTRA SCANS

1. ^{1}H, ^{13}C, DEPT135 and ^{31}PNMR spectra of Tetraethyl 2-(3, 5-di-t-butyl-4-hydroxyphenyl)ethene-1,1 diyldiphosphonate (6a)



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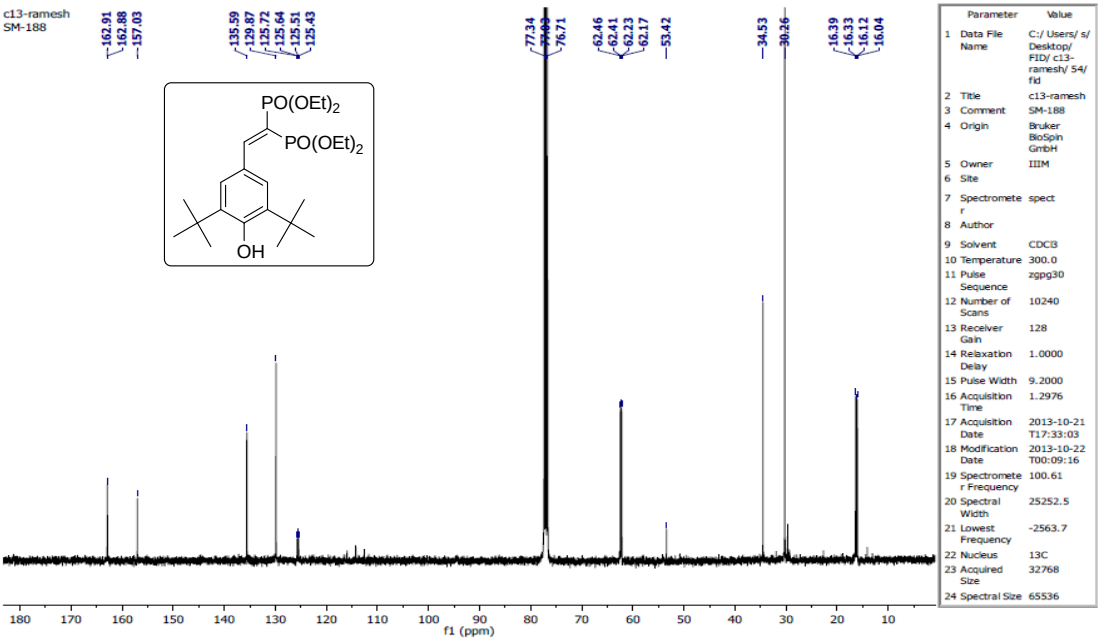

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22	Nucleus	13C
23	Acquired Size	32768
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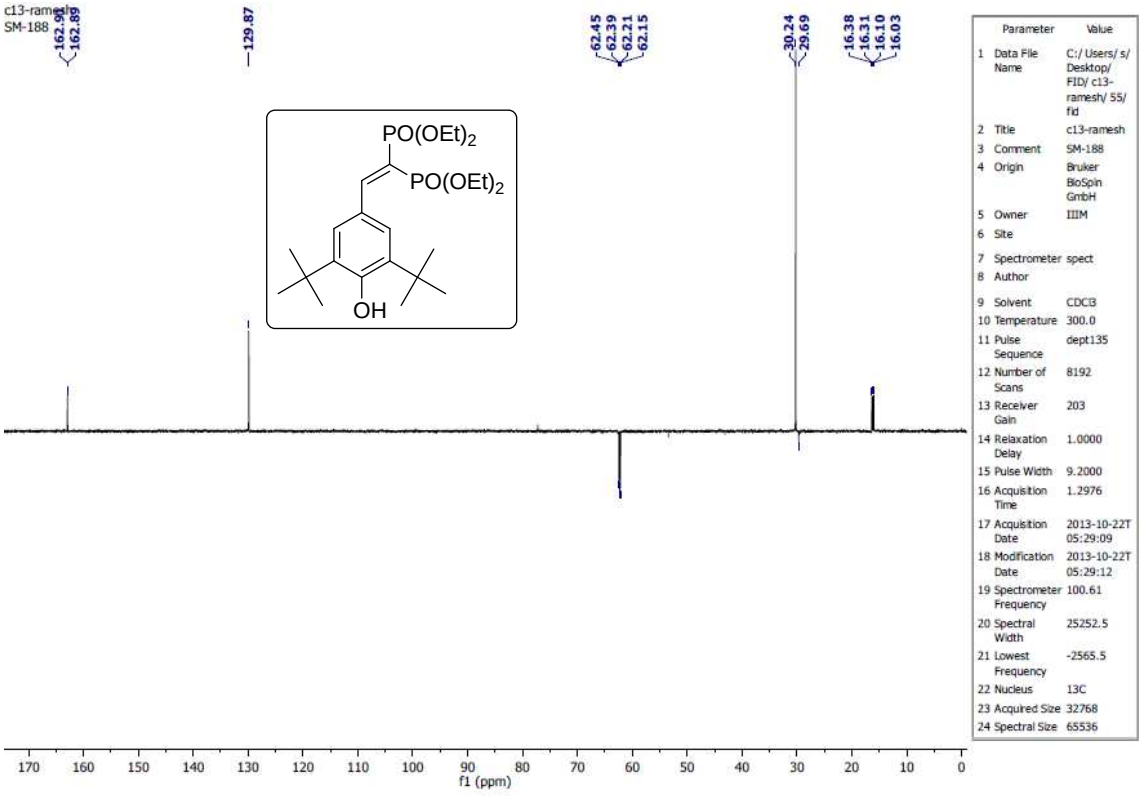

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23	Acquired Size	32768
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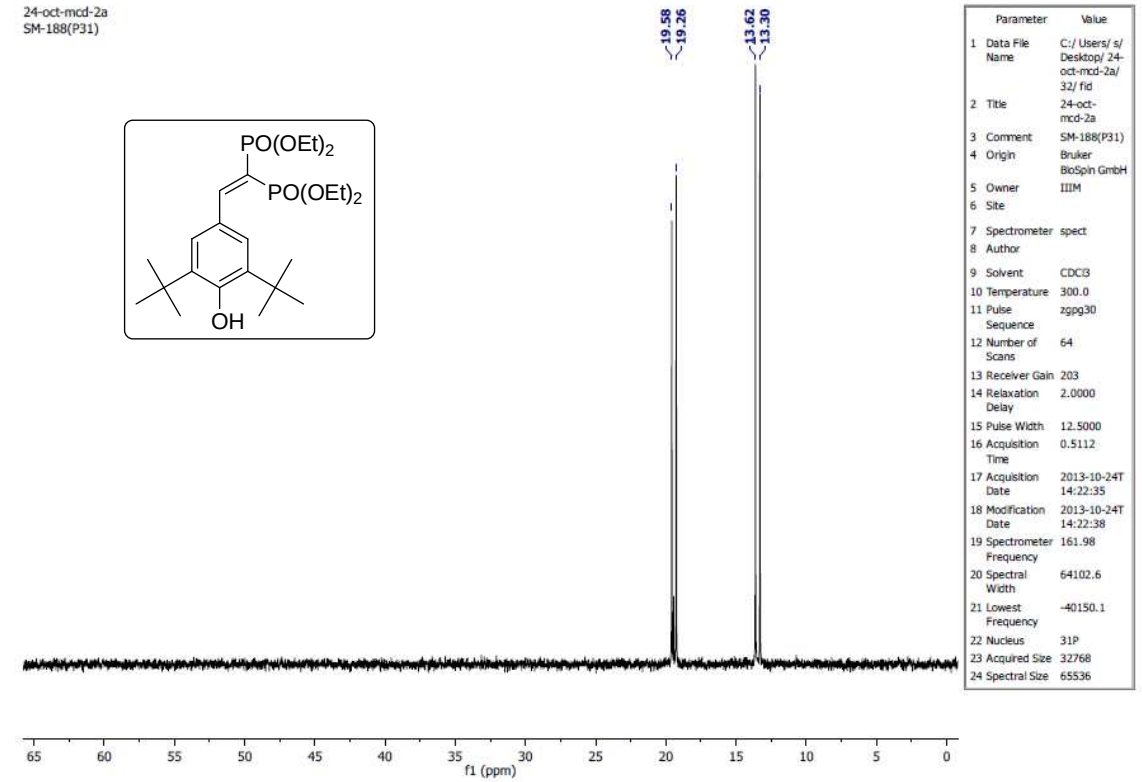

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8	Author	
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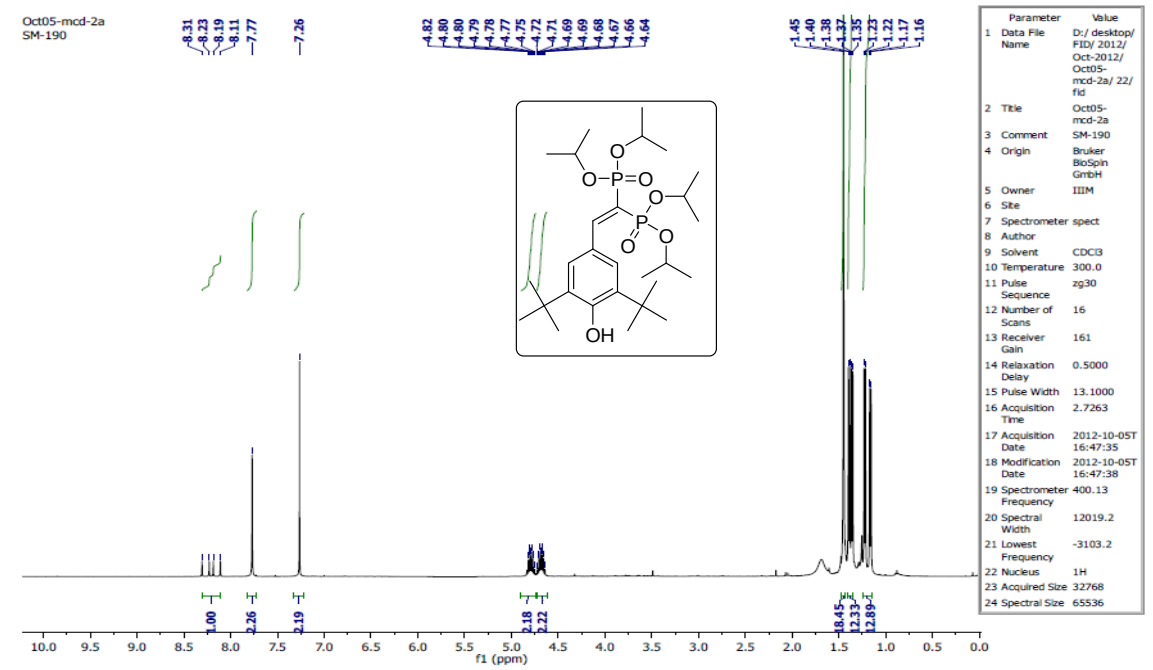
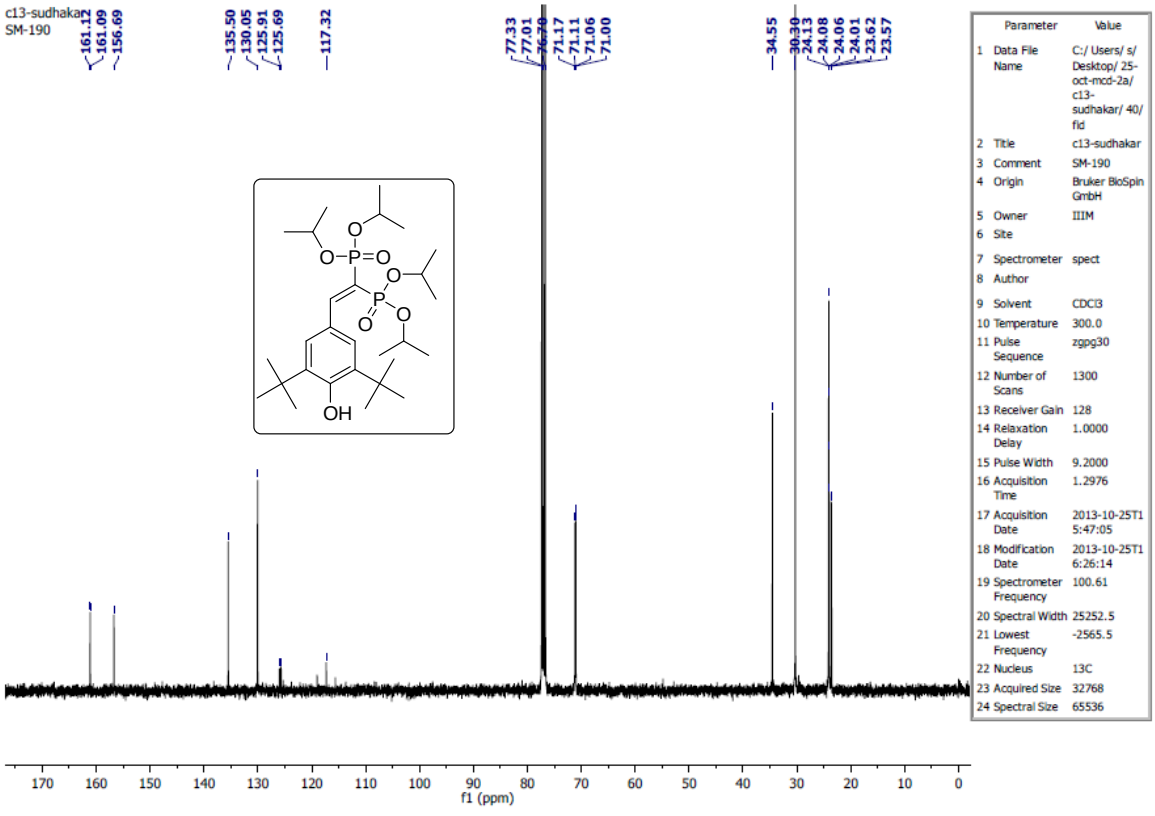
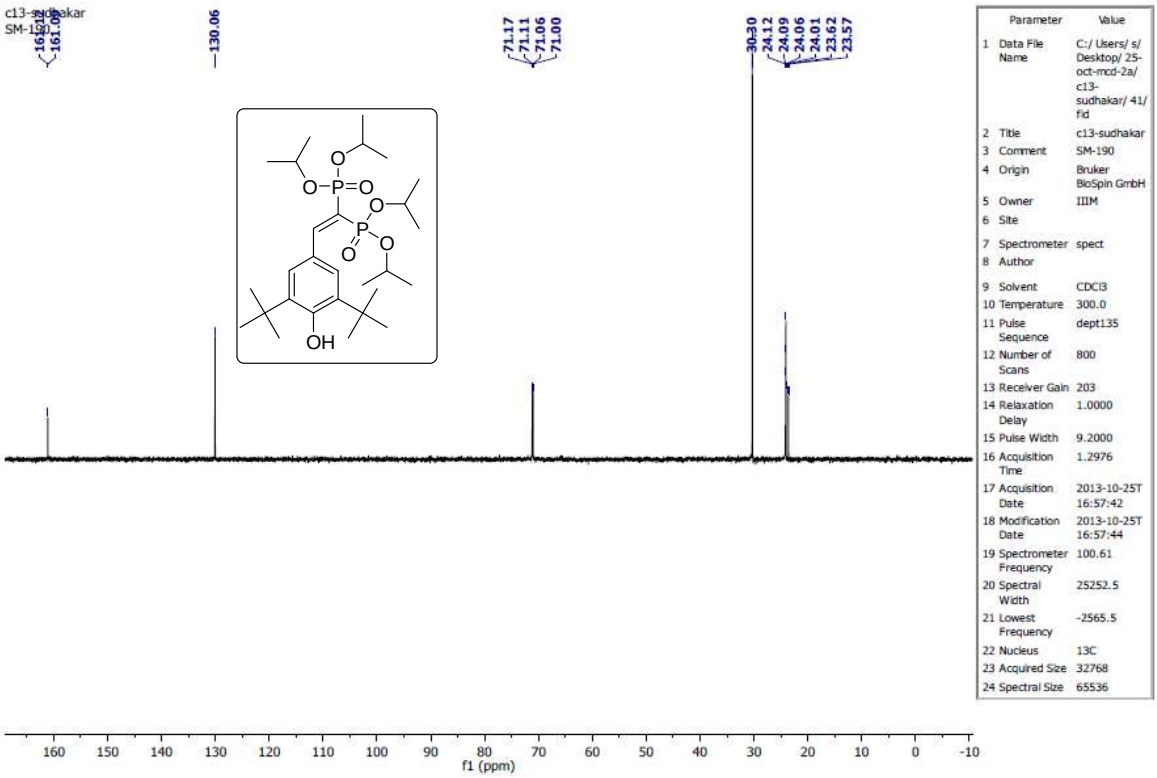
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

2. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraisopropyl 2-(3, 5-di-t-Butyl 4-hydroxy phenyl)ethene-1,1-diyldiphosphonate (6b)







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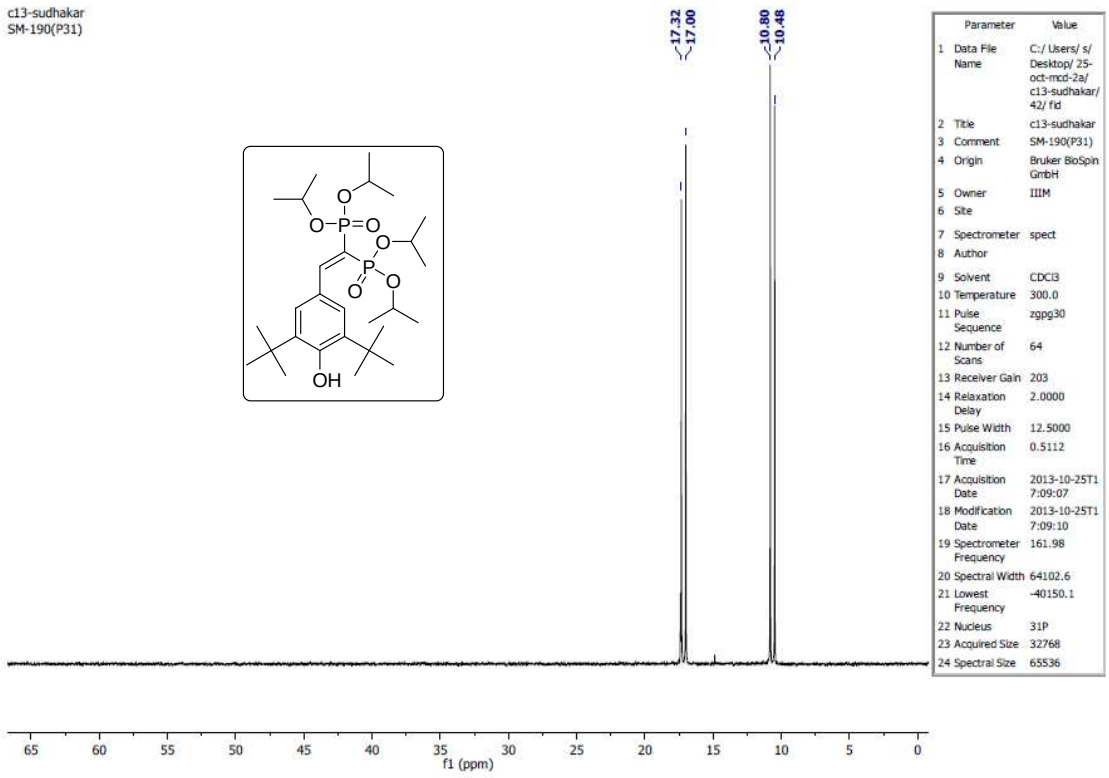

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21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
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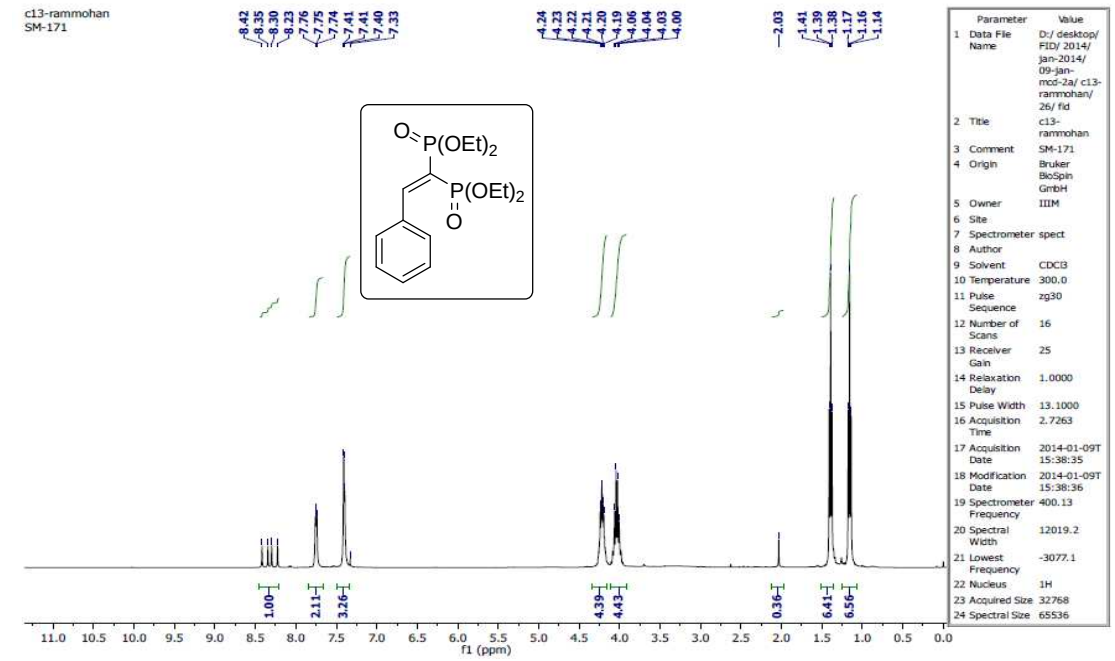
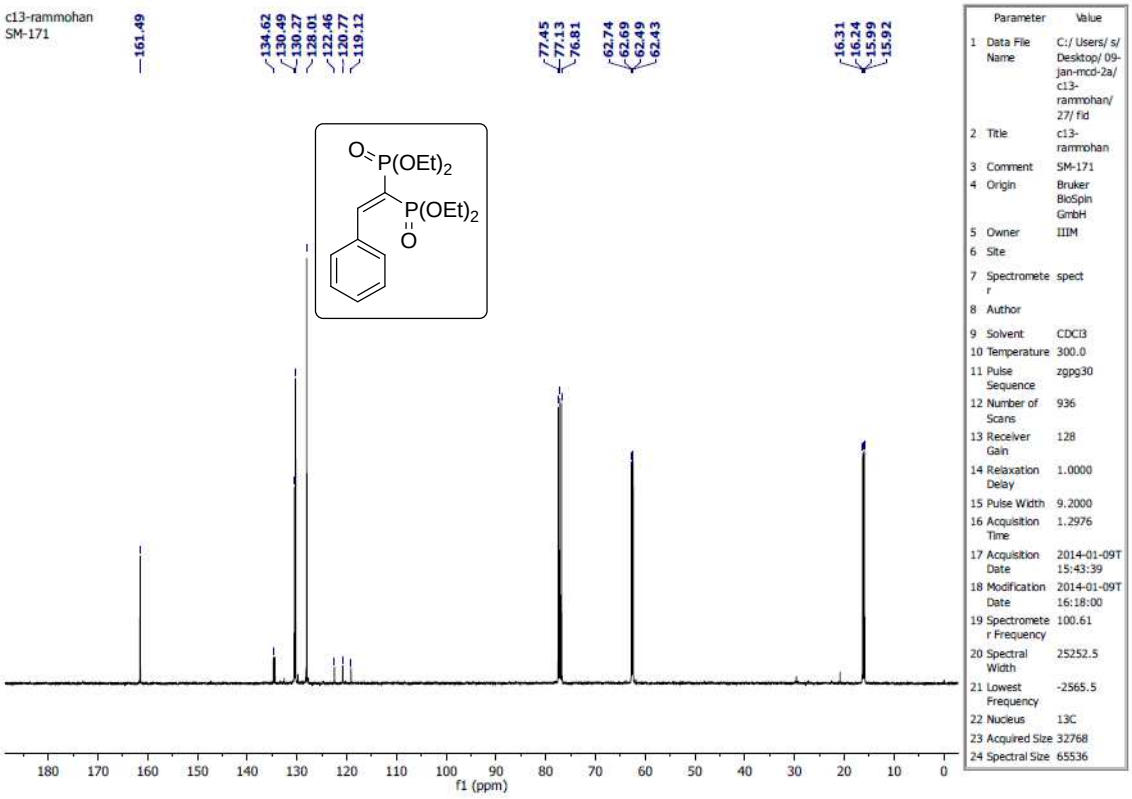
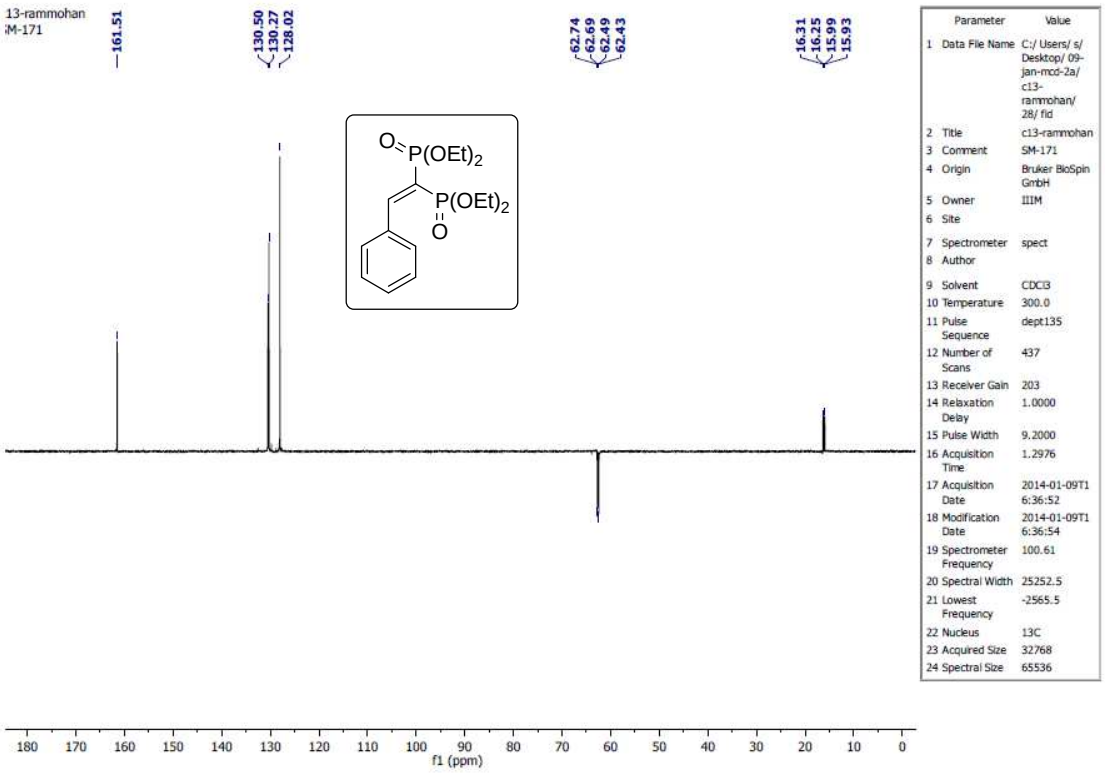
3. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraethyl 2-phenylethene-1,1-diyldiphosphonate (6c)







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8	Author	
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22	Nucleus	13C
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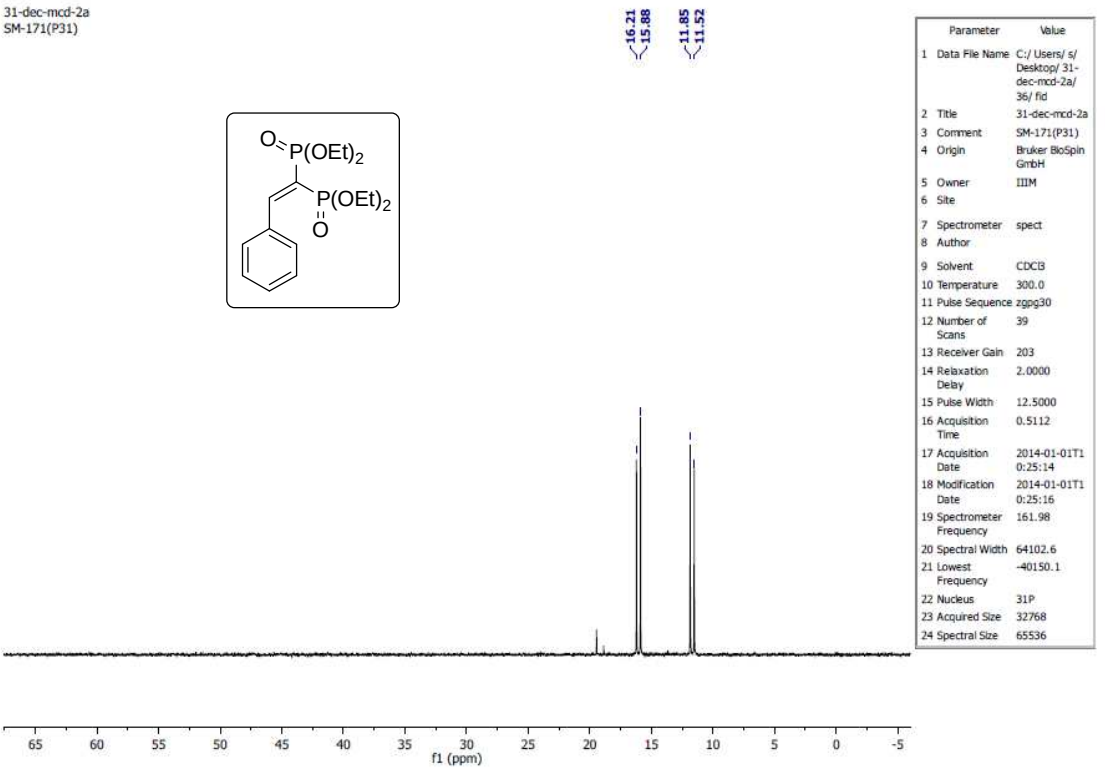

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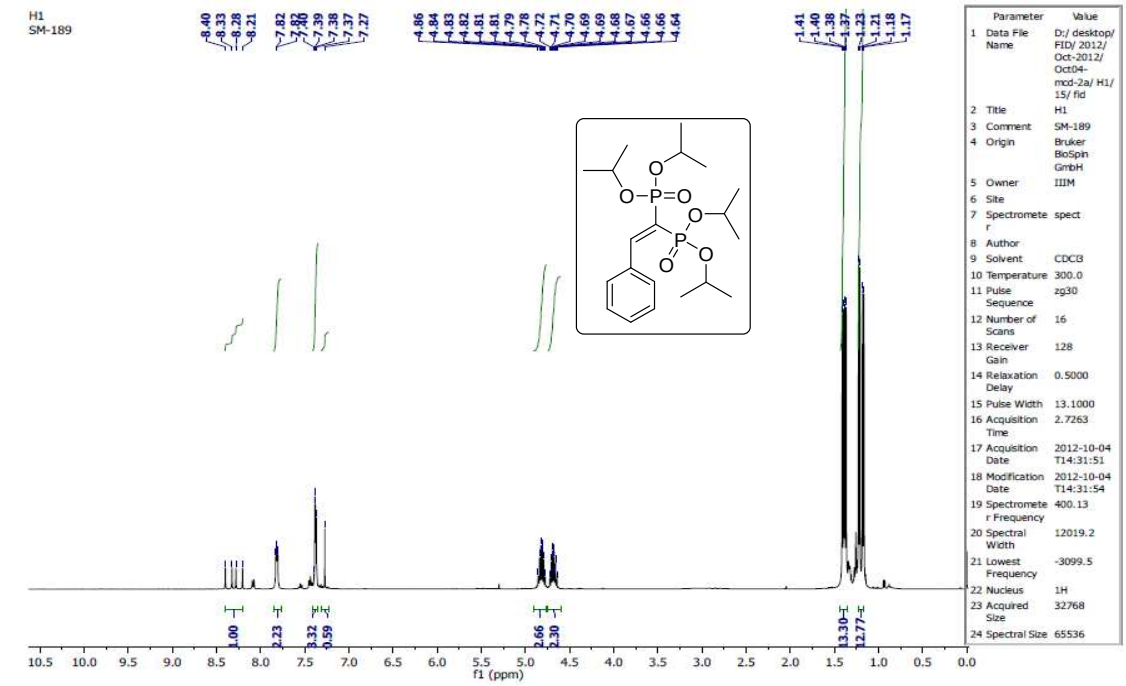
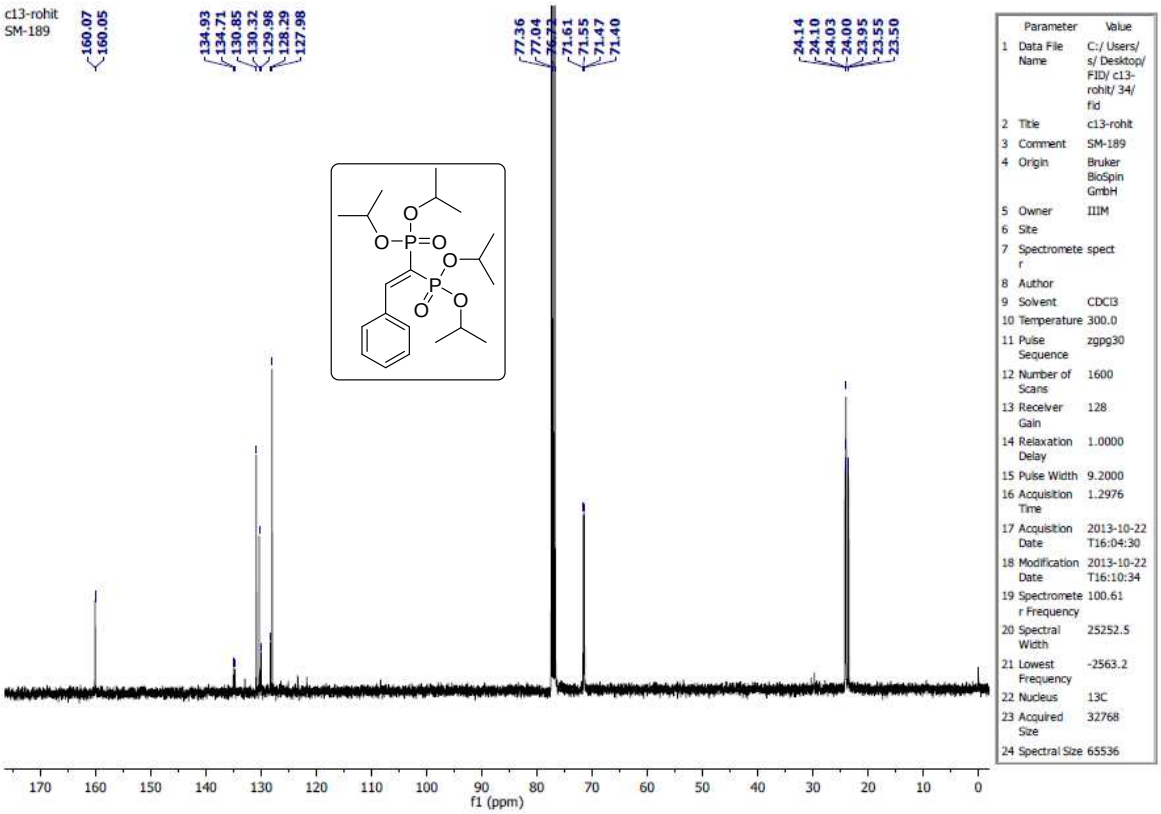
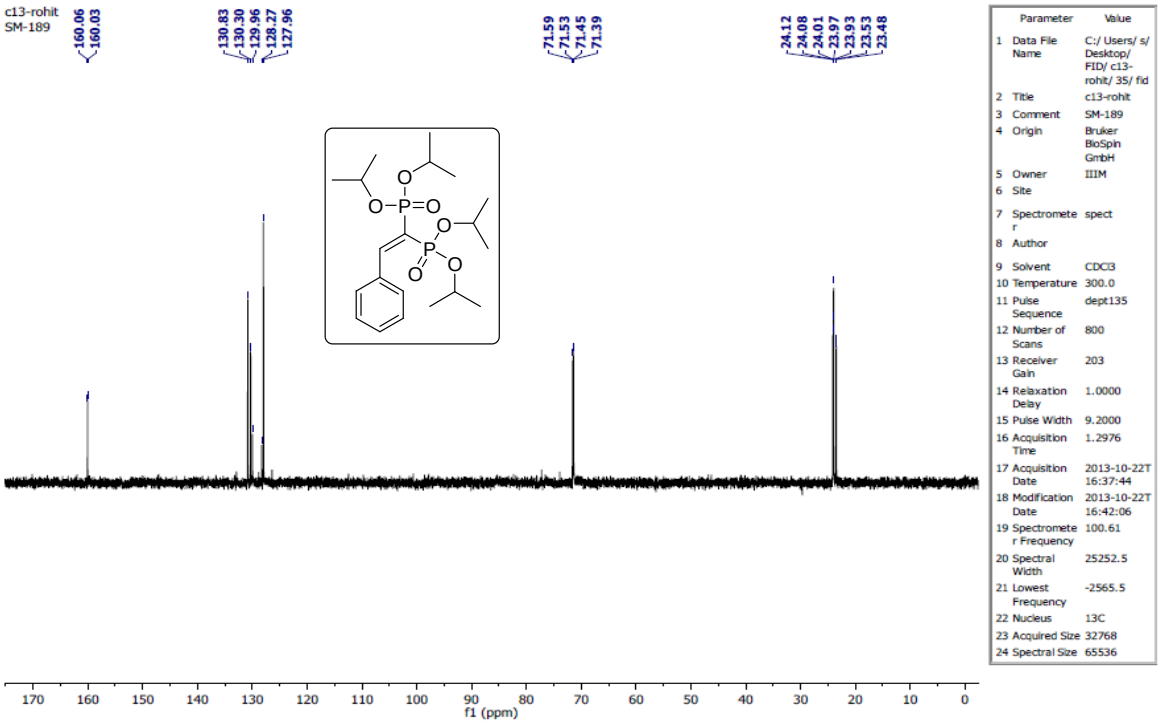
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

4. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraisopropyl-2-phenylethene-1,1-diyldiphosphonate (6d)







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22	Nucleus	13C
23	Acquired Size	32768
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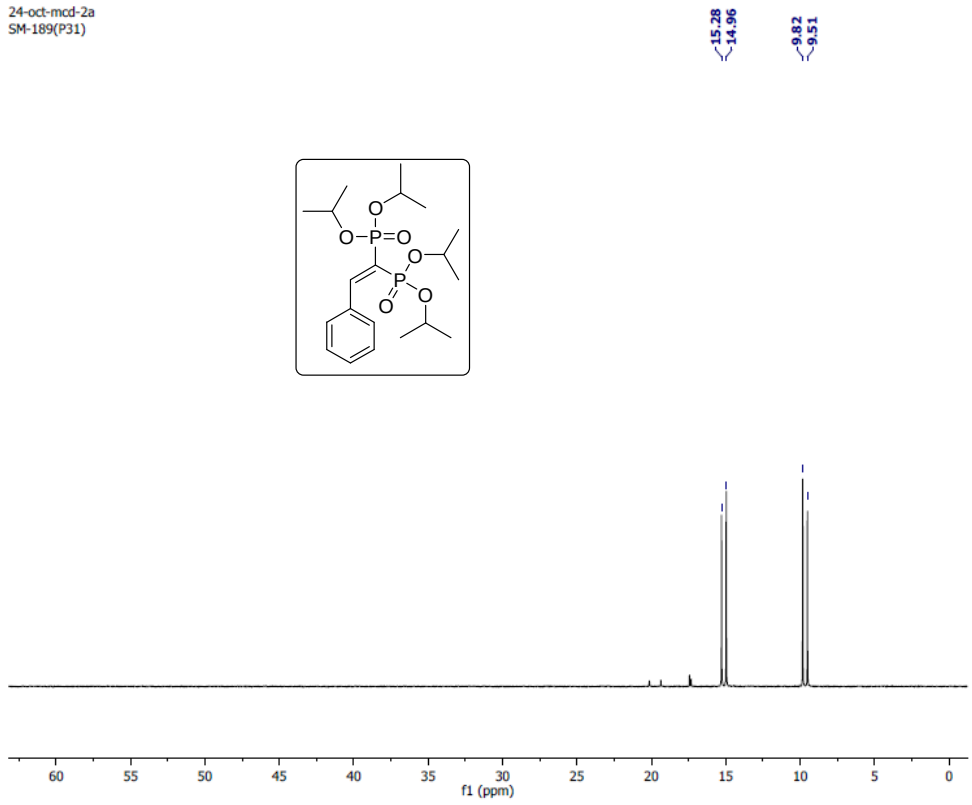

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22	Nucleus	31P
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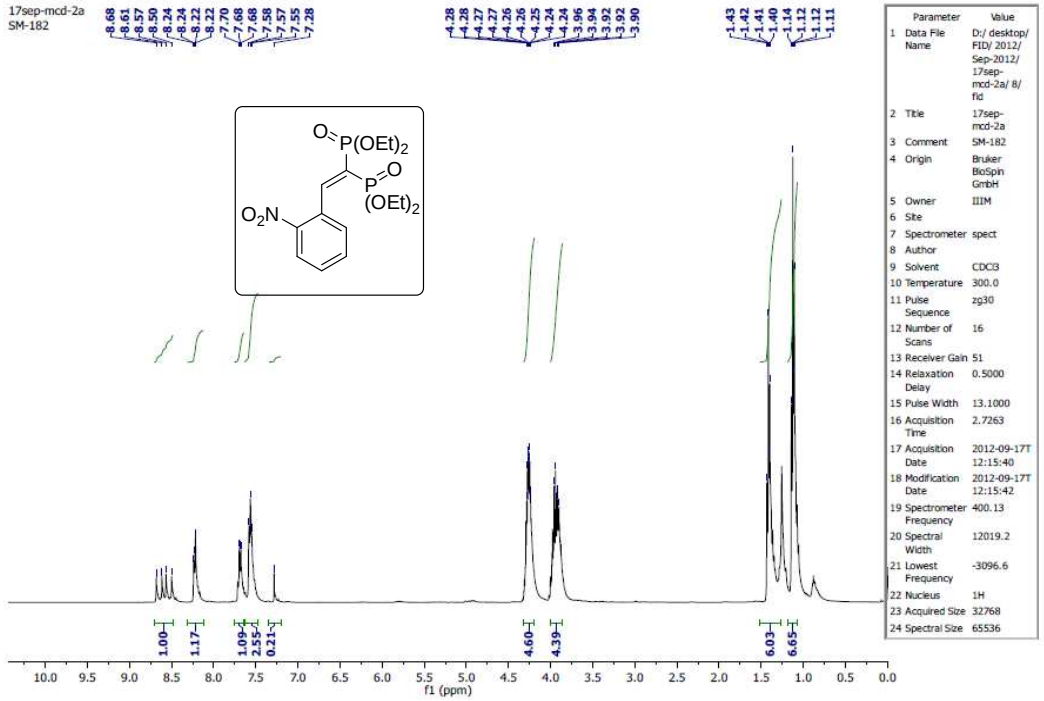
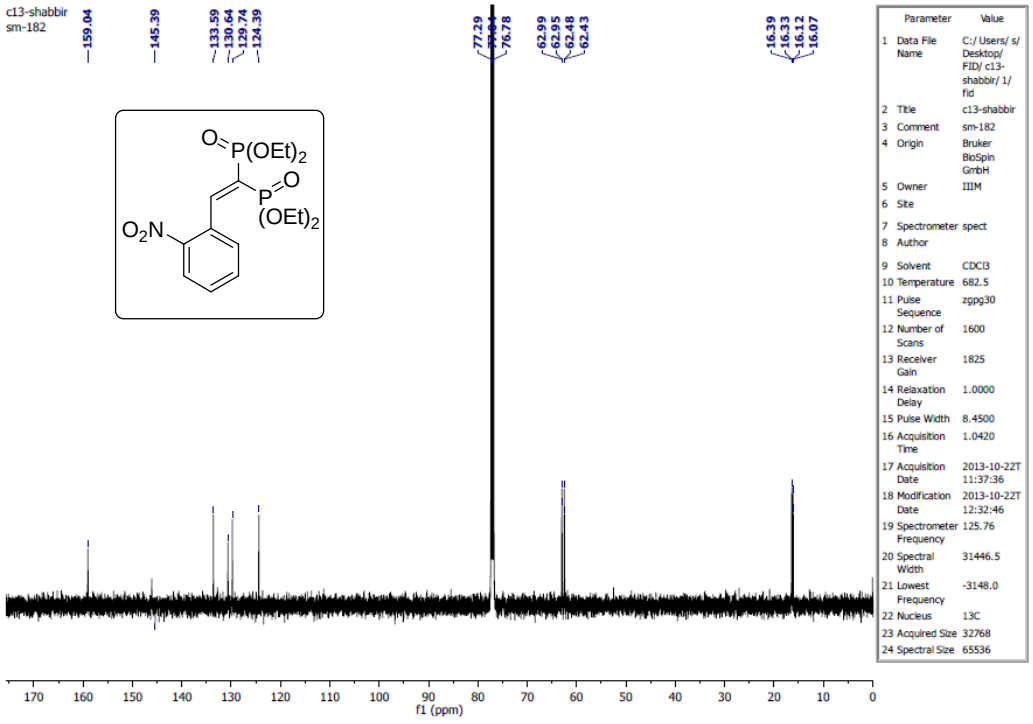
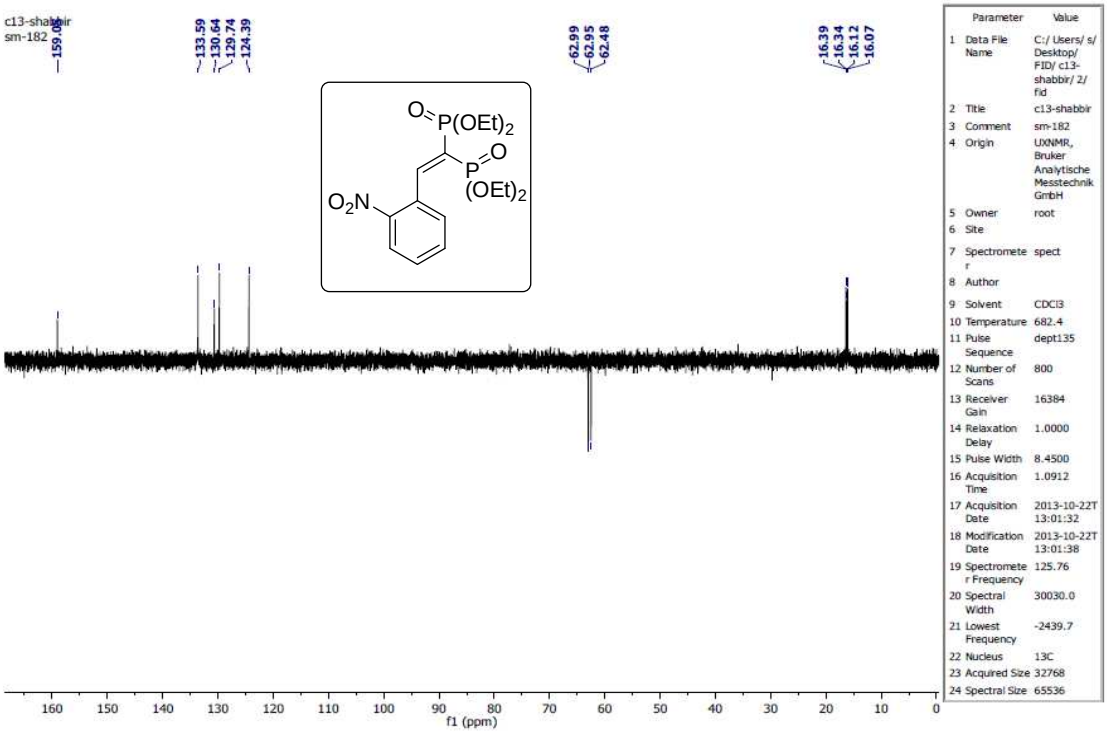
5. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraethyl 2-(2-nitrophenyl)ethene-1,1-diyldiphosphonate (6e)



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124.39
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62.48
16.39
16.34
16.12
16.07
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(OEt)2
O2N
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8 Author
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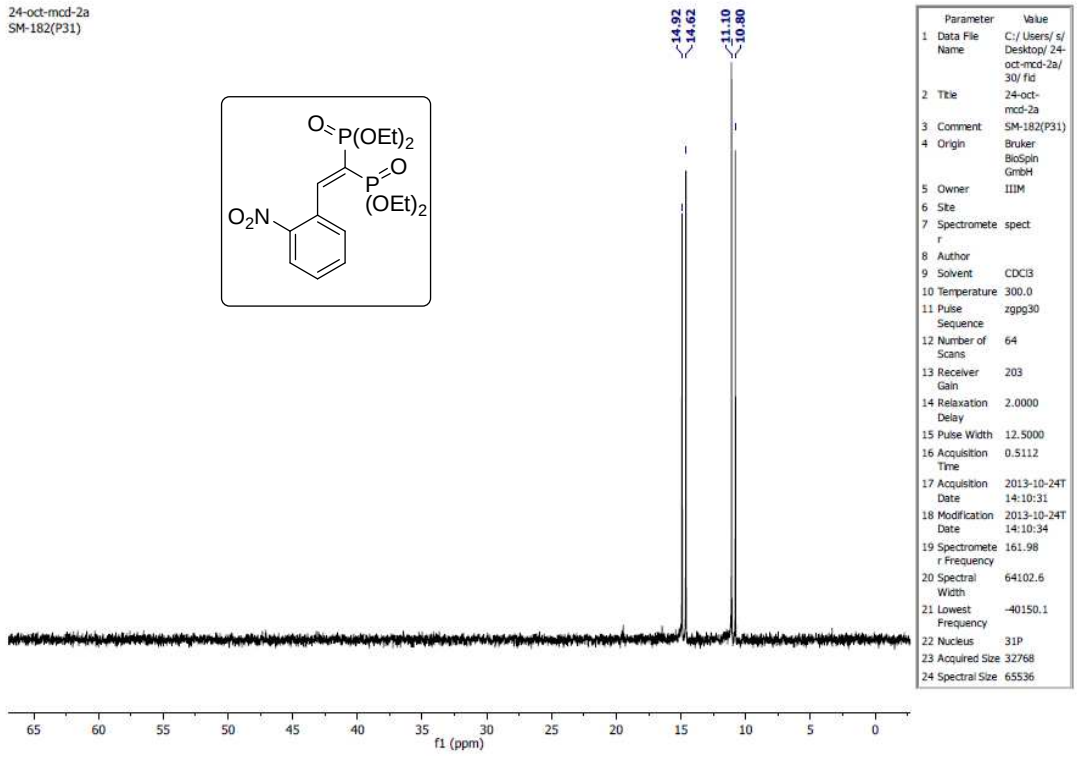
24 Spectral Size 65536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8 Author
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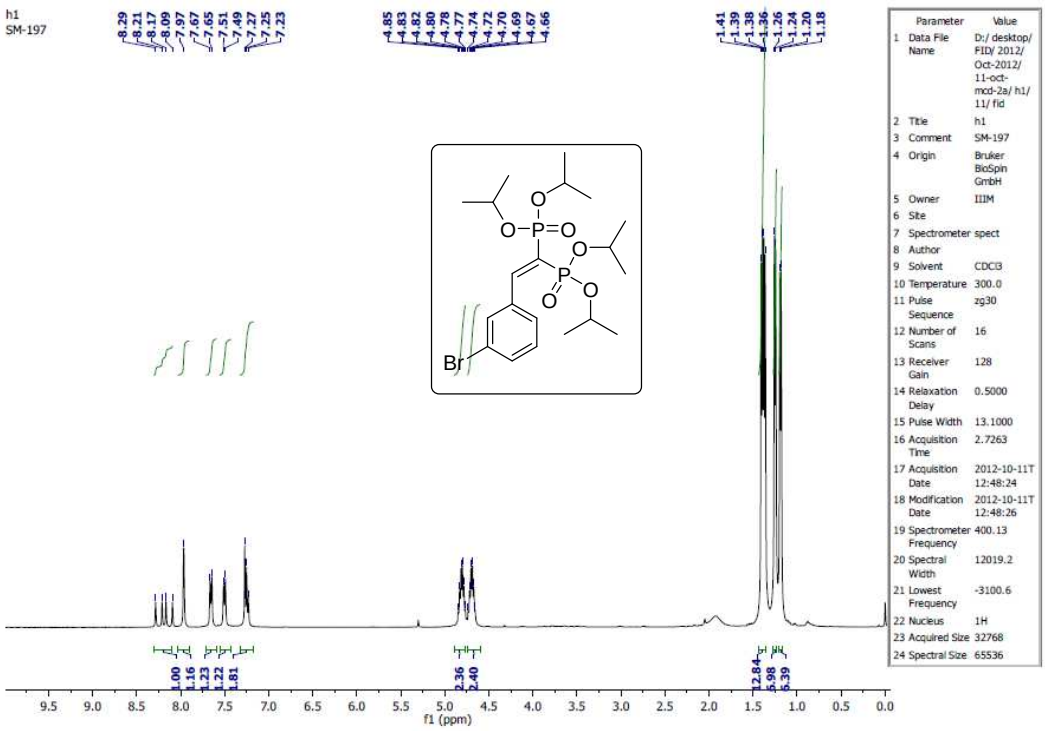
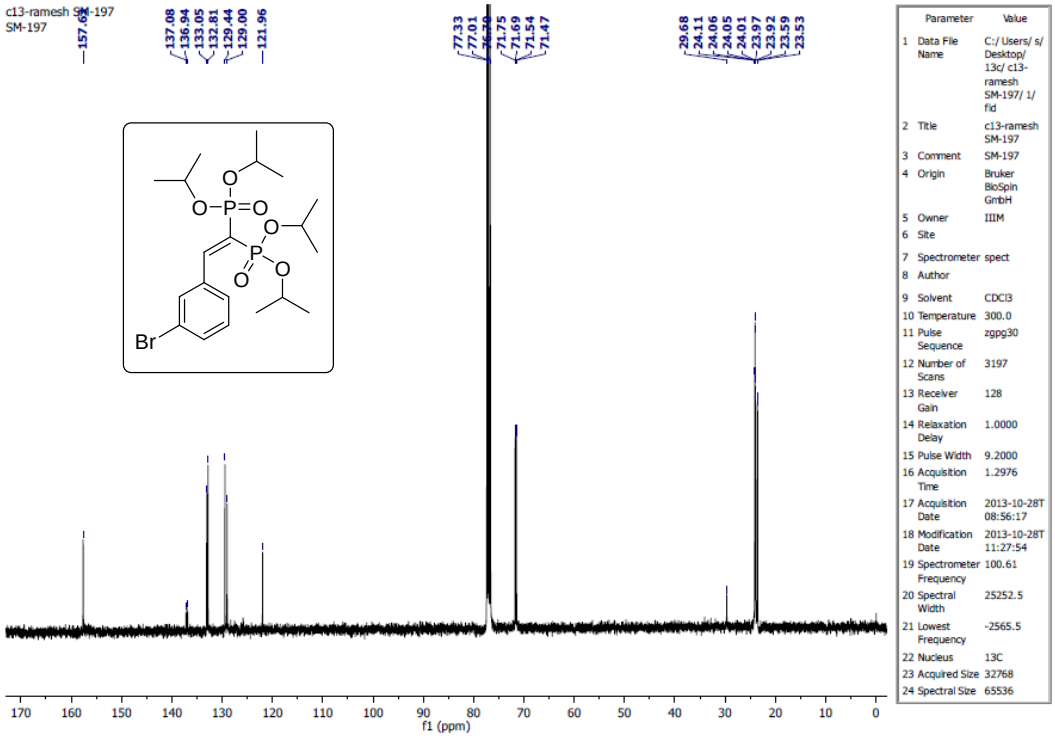
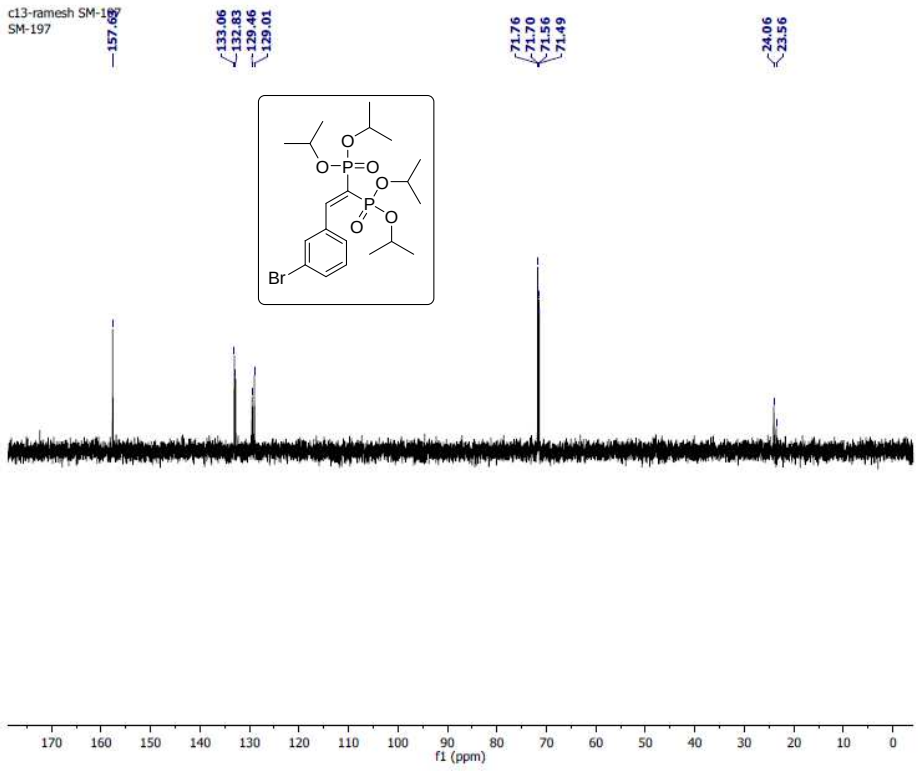
18 Modification Date 2013-10-24T 14:10:34
19 Spectrometer Frequency 161.98
20 Spectral Width 64102.6
21 Lowest Frequency -40150.1
22 Nucleus 31P
23 Acquired Size 32768
24 Spectral Size 65536

6. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraisopropyl,2-(3-bromophenyl)ethane-1,1-diyldiphosphonate (6f)







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8	Author	
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13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
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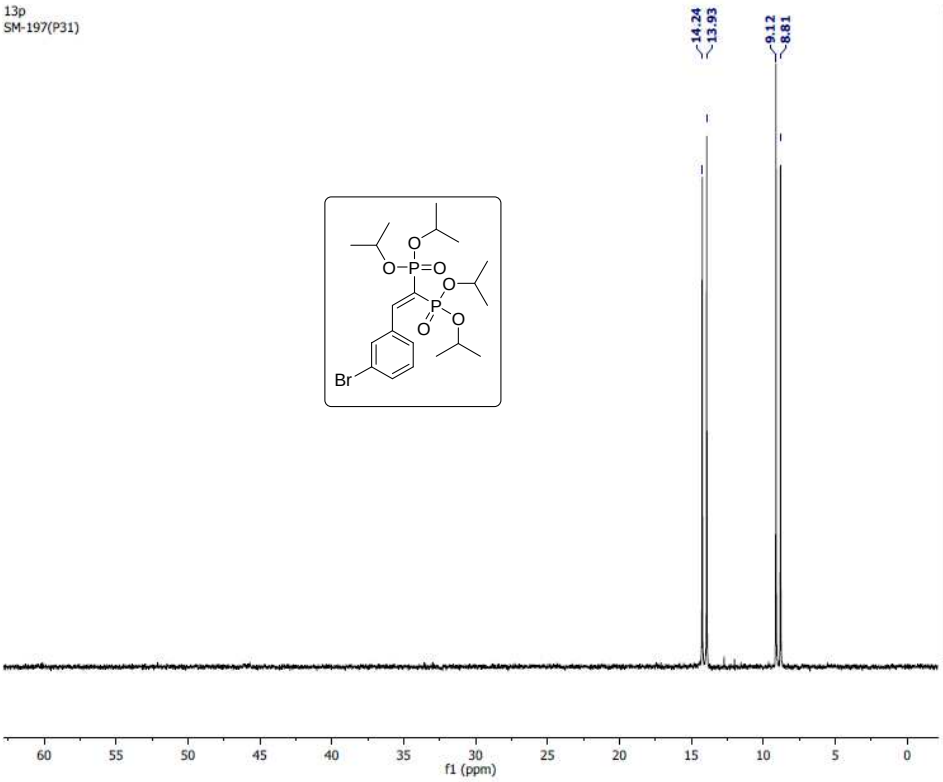
17	Acquisition Date	2013-10-28T 13:33:54
18	Modification Date	2013-10-28T 13:35:26
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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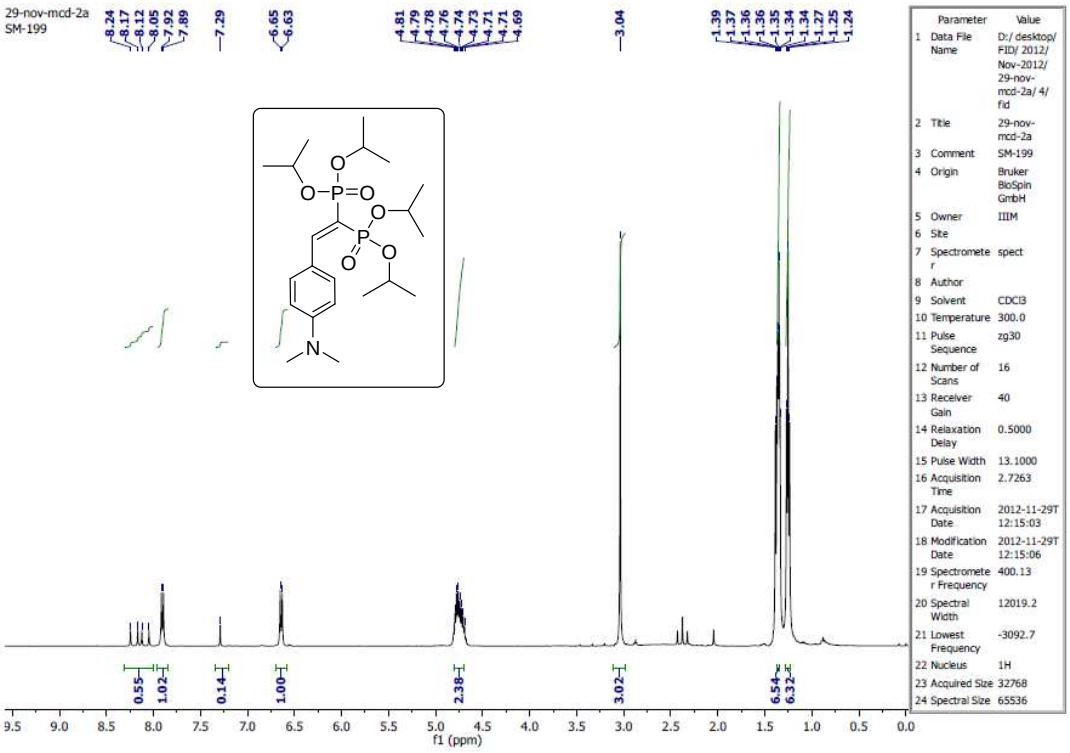
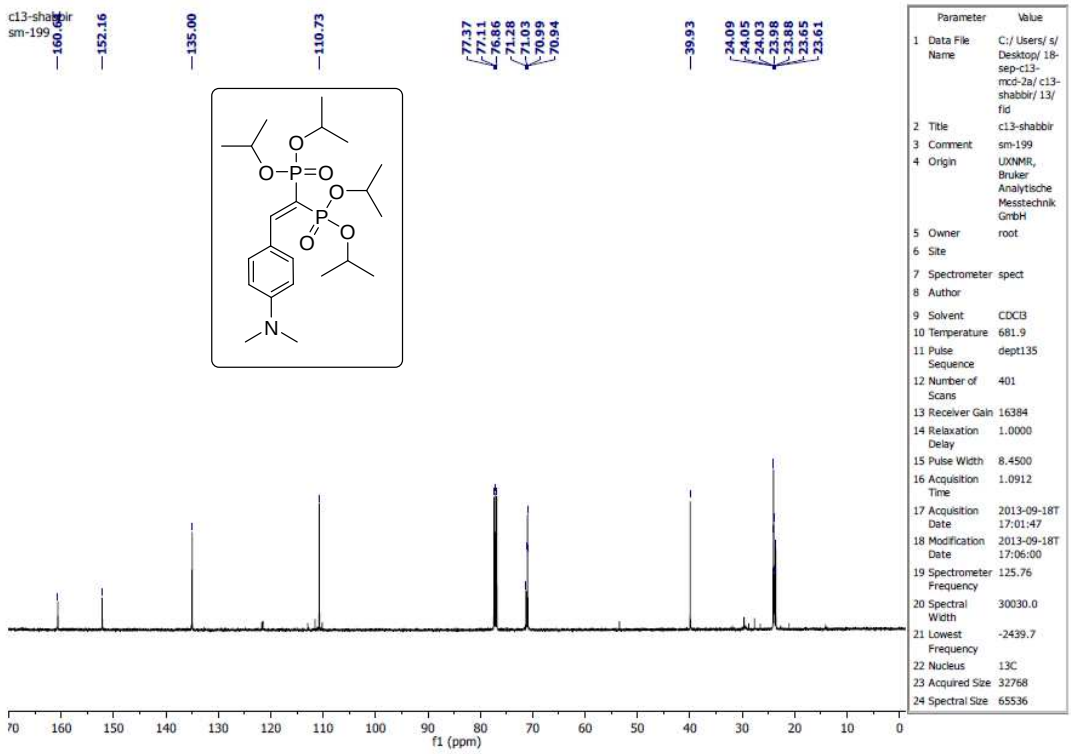
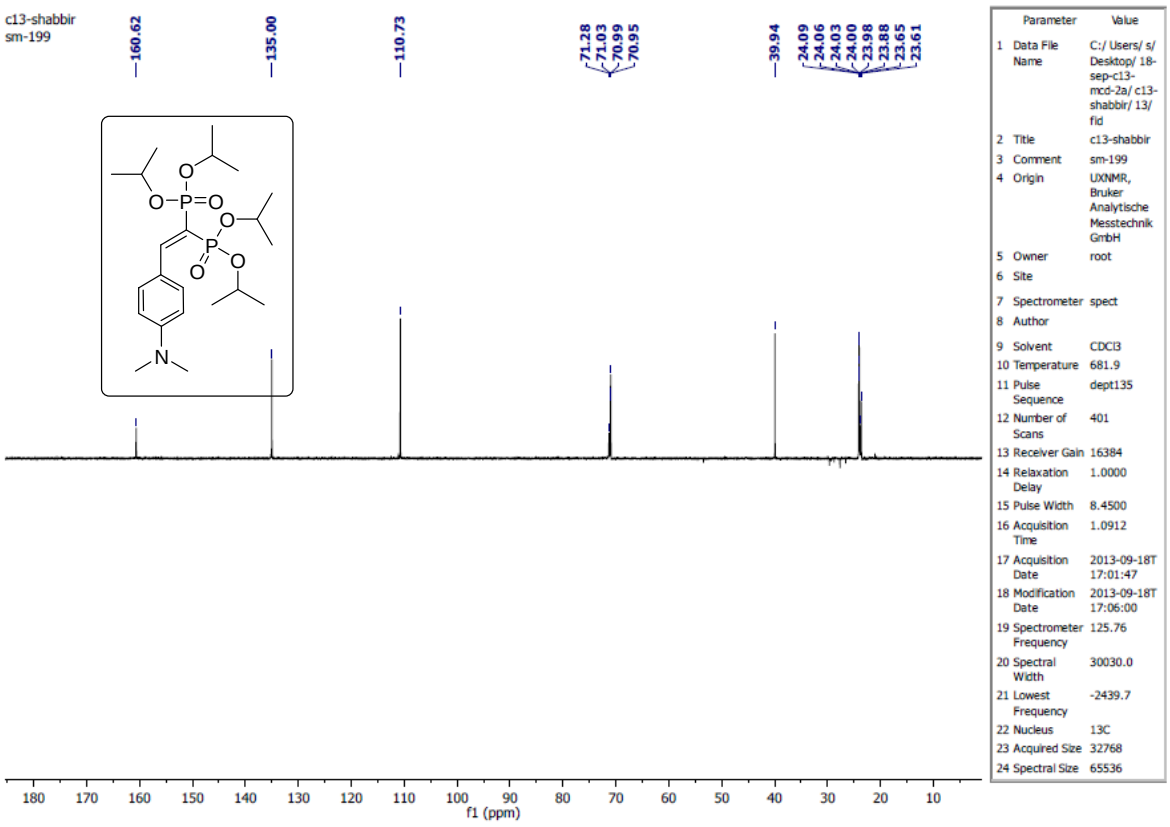
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

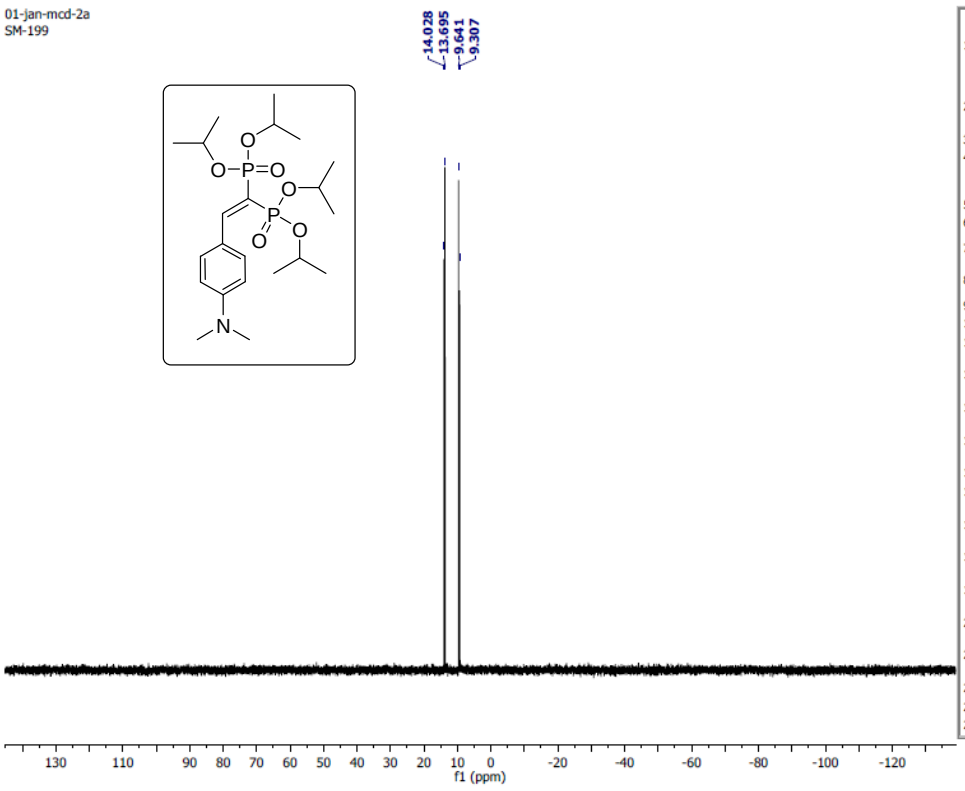
7. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraisopropyl2-(4-N,N-dimethylaminophenyl)ethene-1,1-diyldiphosphonate (6g)







	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 18-sep-c13-mcd-2a/ c13-shabbir/ 13/ fid
2	Title	c13-shabbir
3	Comment	sm-199
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	681.9
11	Pulse Sequence	dept135
12	Number of Scans	401
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-09-18T 17:01:47
18	Modification Date	2013-09-18T 17:06:00
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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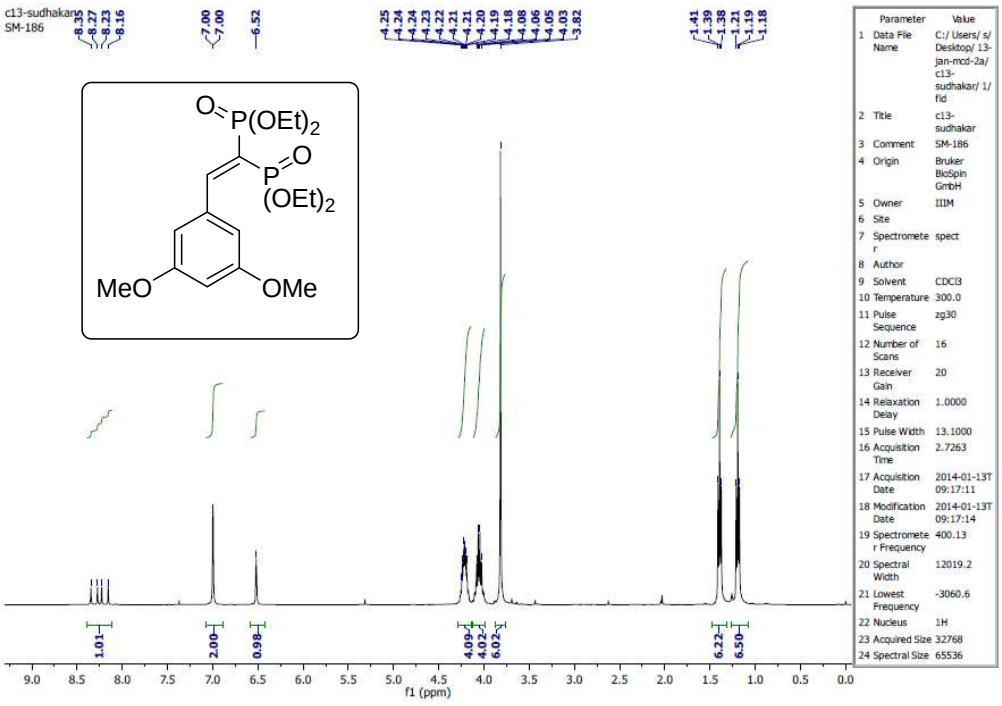
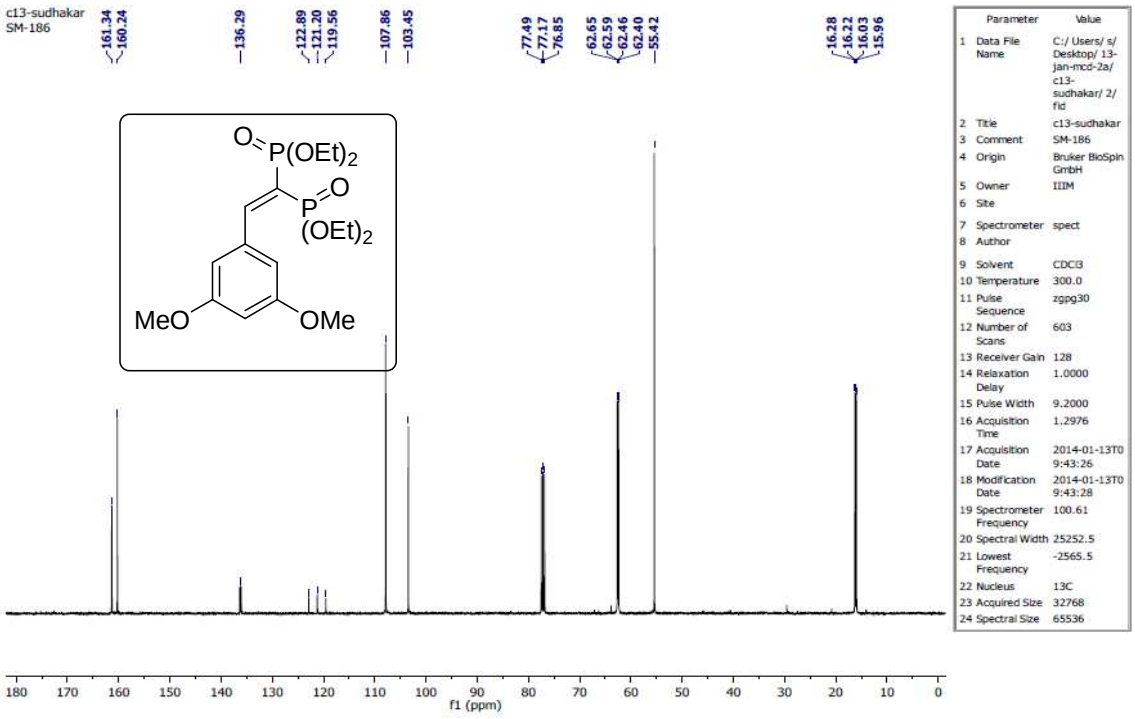
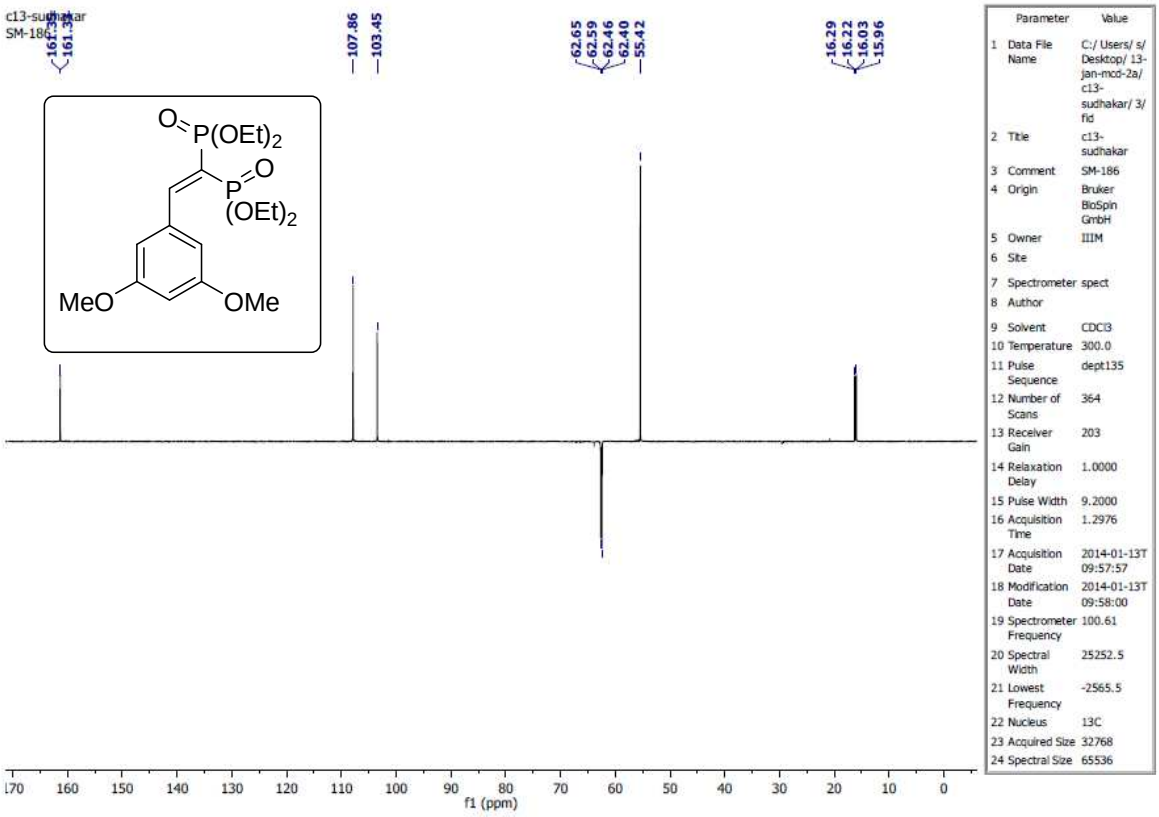
1	Data File Name	C:/ Users/ s/ Desktop/ 01-jan-mcd-2a/ 24/ fid
2	Title	01-jan-mcd-2a
3	Comment	SM-199
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2015-01-01T 15:49:10
18	Modification Date	2015-01-01T 15:49:12
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

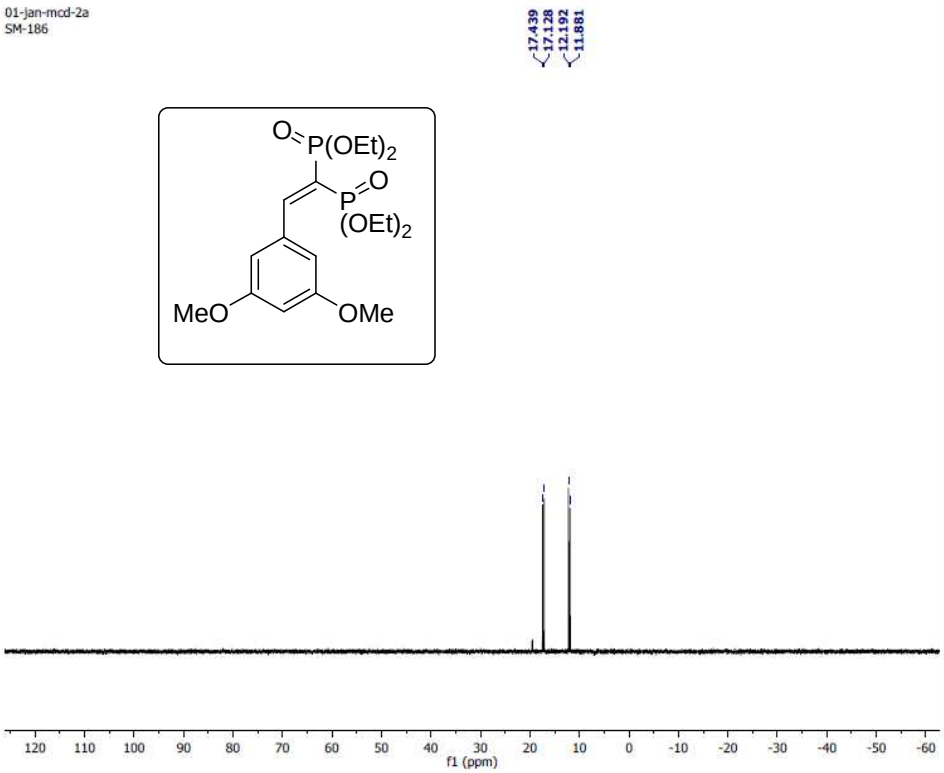
8. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraethyl2-(3,5dimethoxyphenyl)ethene-1,1 diyldiphosphonate (6h)





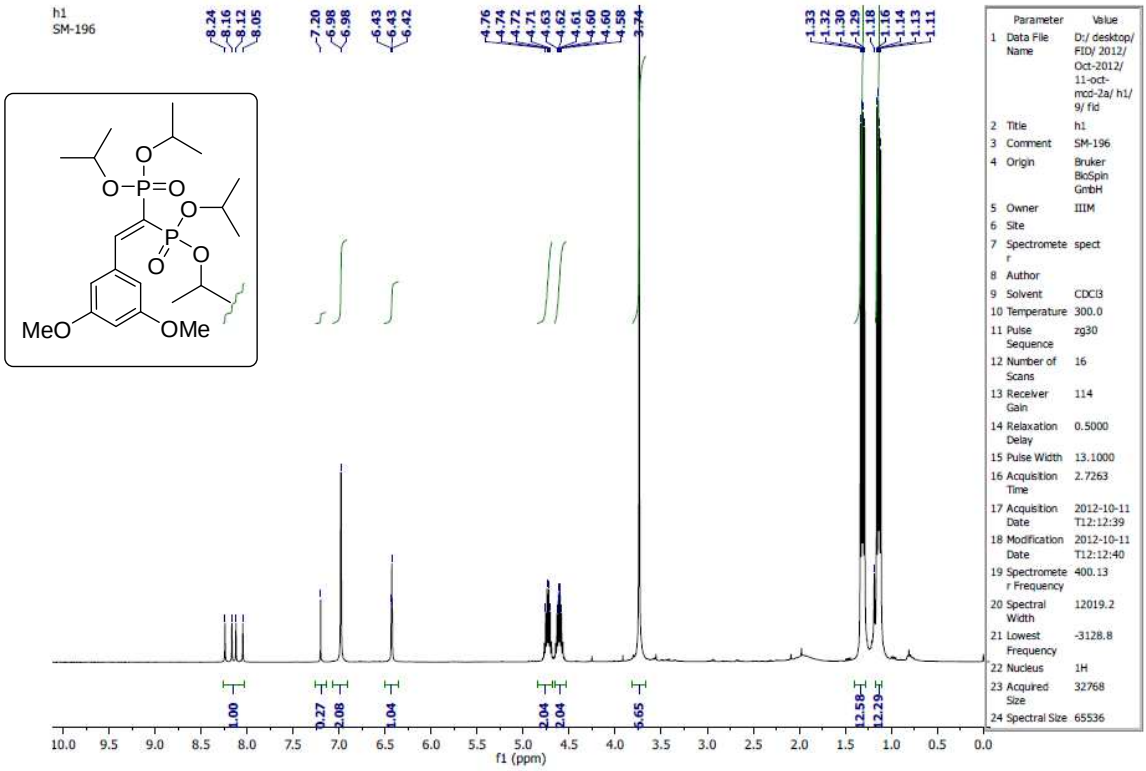


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 13-jan-mcd-2a/ c13-sudhakar/ 3/ fid
2	Title	c13-sudhakar
3	Comment	SM-186
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	364
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2014-01-13T 09:57:57
18	Modification Date	2014-01-13T 09:58:00
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 01-jan-mcd-2a/ 25/ fid
2	Title	01-jan-mcd-2a
3	Comment	SM-186
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	9
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2015-01-01T 15:54:01
18	Modification Date	2015-01-01T 15:54:04
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

9. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of Tetraisopropyl2-(3,5-dimethoxyphenyl)ethene-1,1 diyldiphosphonate (6i)



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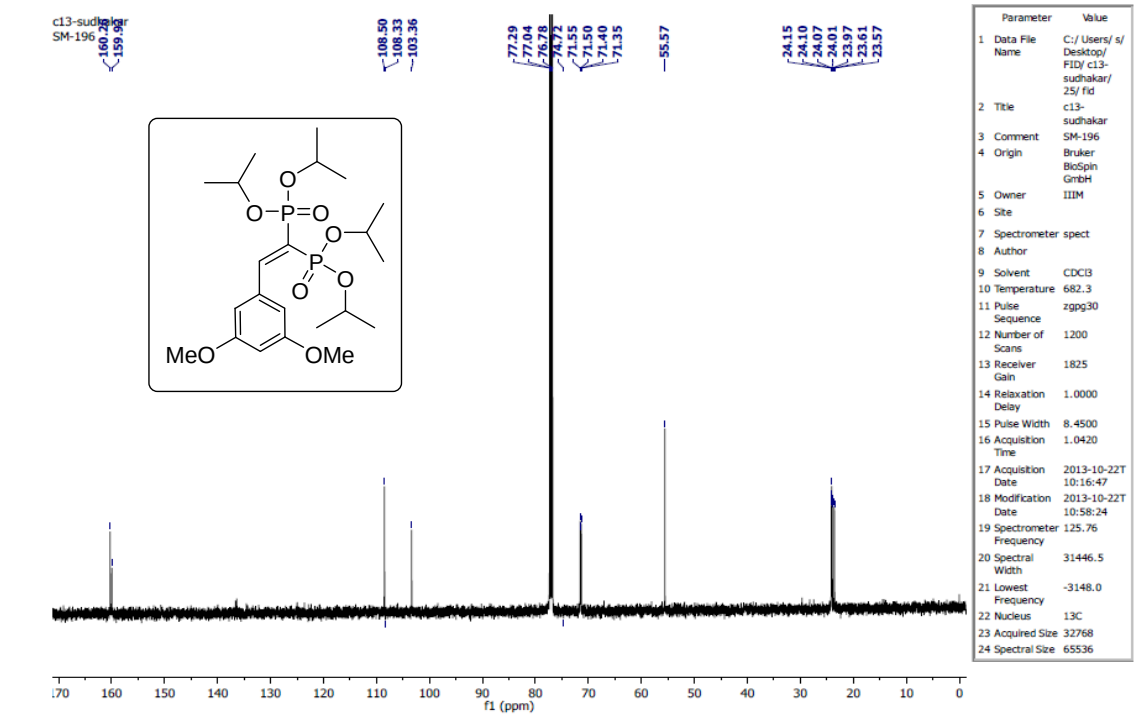
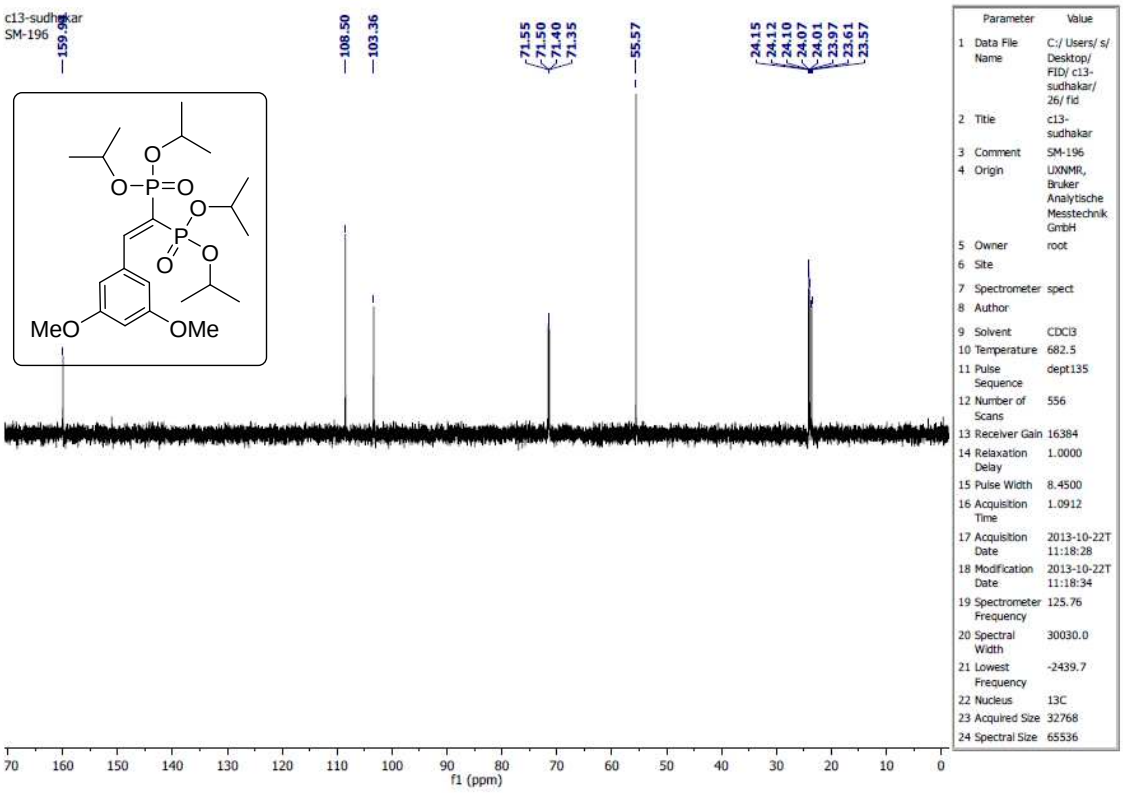
1	Data File Name	D:/ desktop/ FID/ 2012/ Oct-2012/ 11-oct-mcd-2a/ h1/ 9/ fid
2	Title	h1
3	Comment	SM-196
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	114
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-10-11 T12:12:39
18	Modification Date	2012-10-11 T12:12:40
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3128.8
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ FID/ c13-sudhakar/ 25/ fid
2	Title	c13-sudhakar
3	Comment	SM-196
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.3
11	Pulse Sequence	zgpg30
12	Number of Scans	1200
13	Receiver Gain	1825
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0420
17	Acquisition Date	2013-10-22T 10:16:47
18	Modification Date	2013-10-22T 10:58:24
19	Spectrometer Frequency	125.76
20	Spectral Width	31446.5
21	Lowest Frequency	-3148.0
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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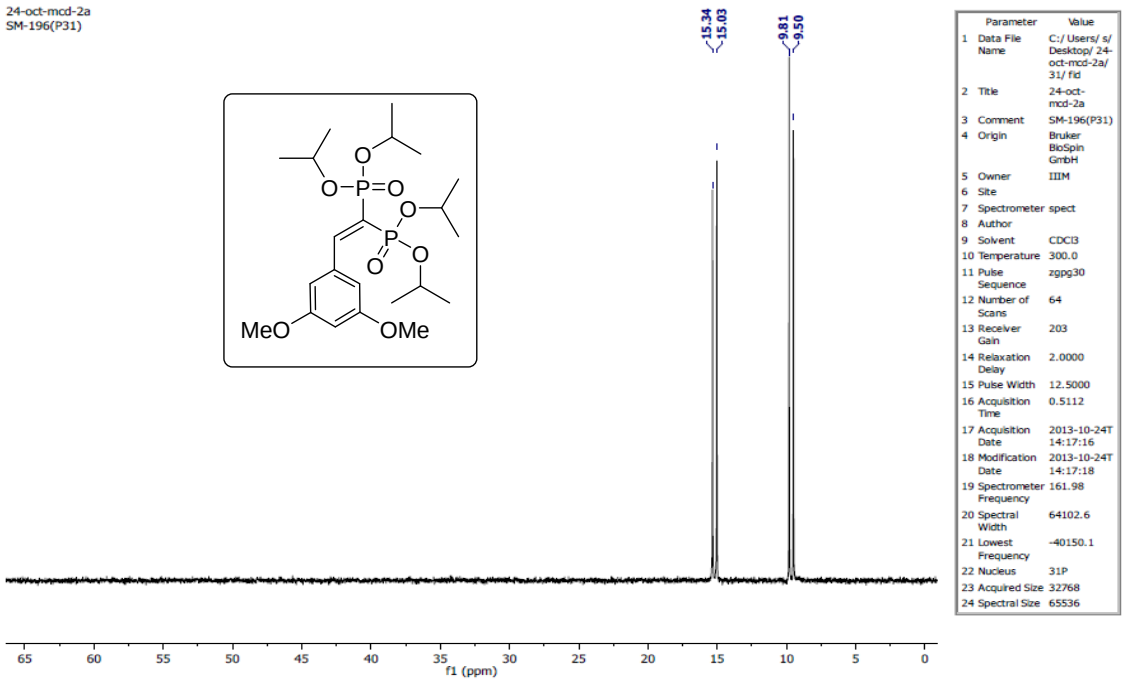
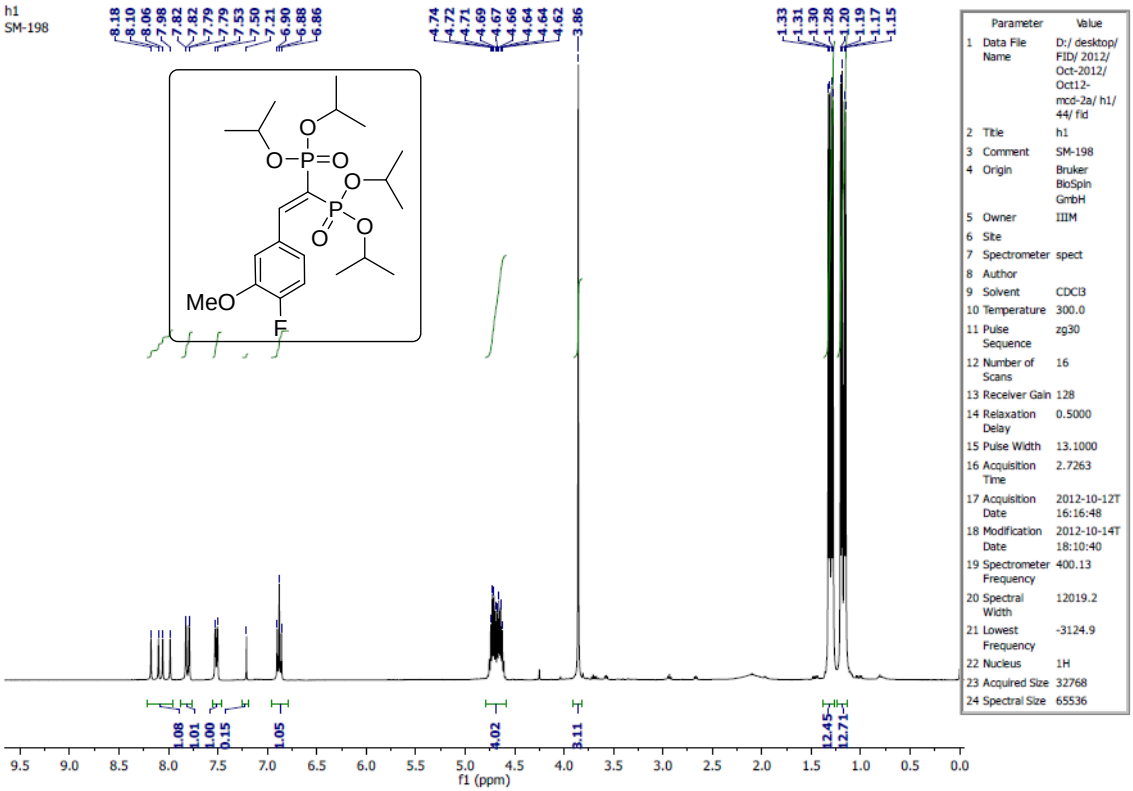
1	Data File Name	C:/ Users/ s/ Desktop/ FID/ c13-sudhakar/ 26/ fid
2	Title	c13-sudhakar
3	Comment	SM-196
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.5
11	Pulse Sequence	dept135
12	Number of Scans	556
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-10-22T 11:18:28
18	Modification Date	2013-10-22T 11:18:34
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 24-oct-mcd-2a/ 31/ fid
2	Title	24-oct-mcd-2a
3	Comment	SM-196(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	64
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-10-24T 14:17:16
18	Modification Date	2013-10-24T 14:17:18
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

10. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisopropyl-2-(3-methoxy4-fluorophenyl)ethene-1,1diyldiphosphonate (6j)



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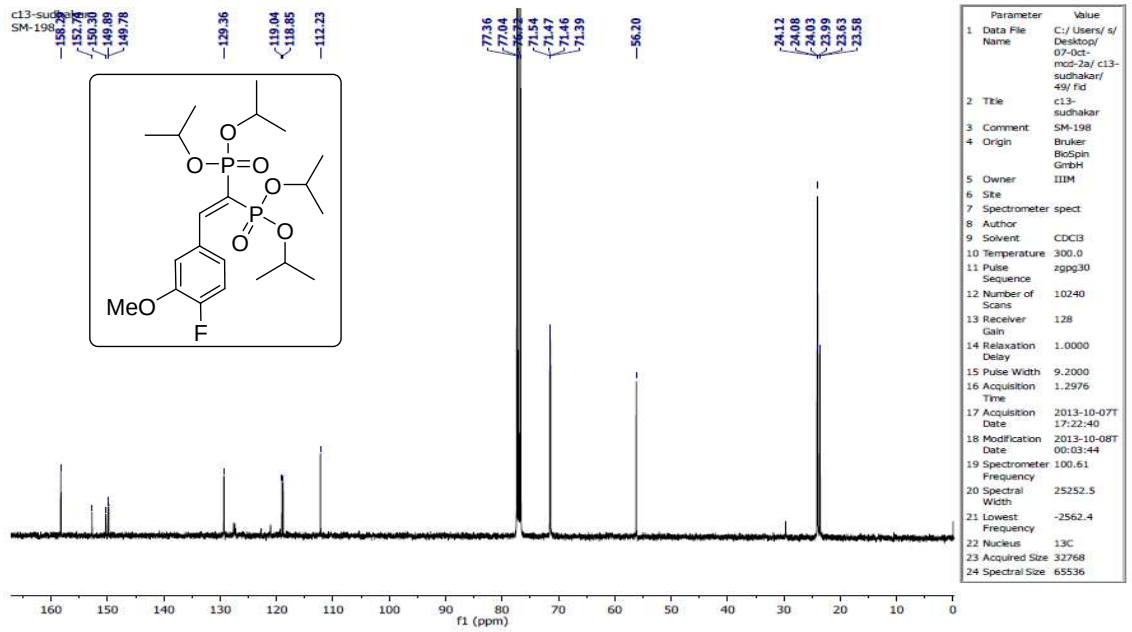
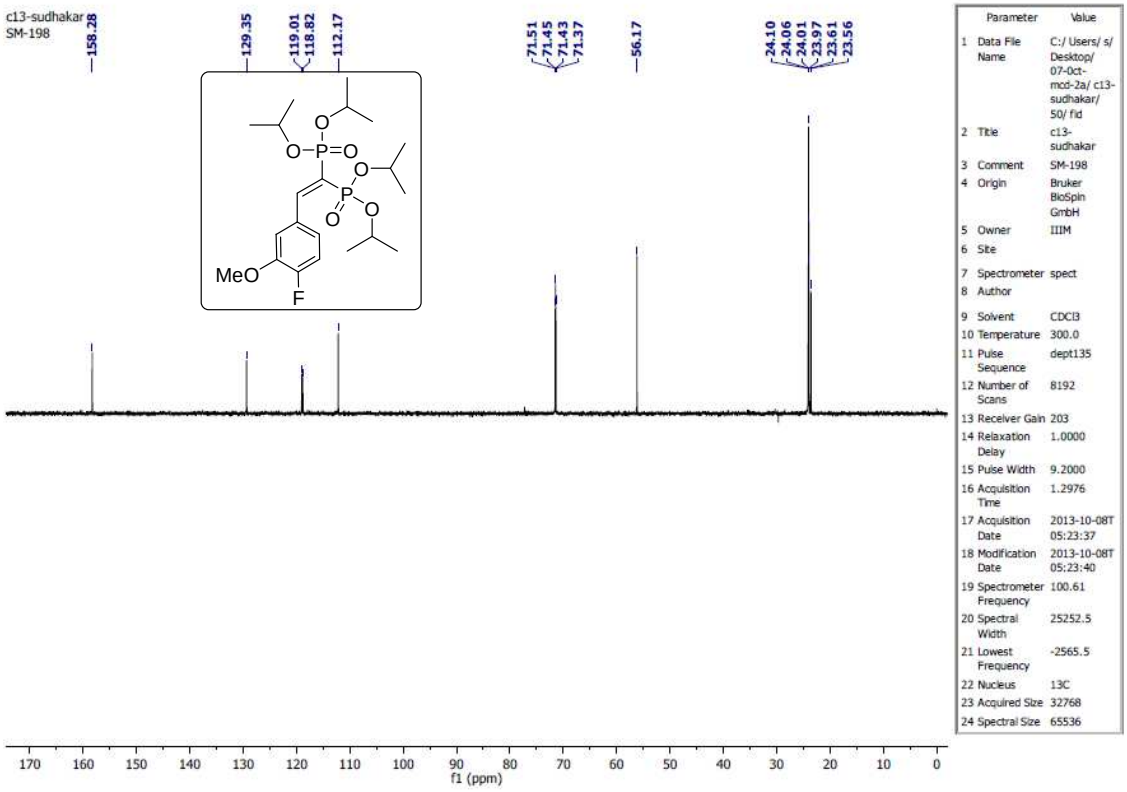
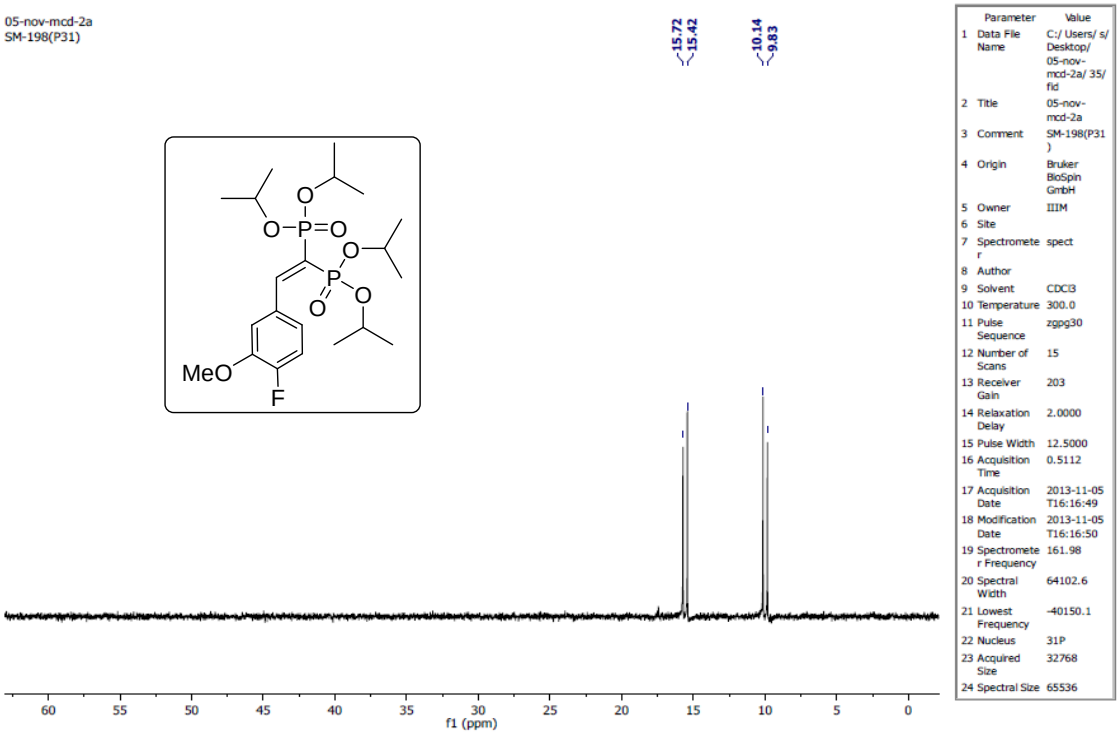
1	Data File Name	D:/ desktop/ FID/ 2012/ Oct-2012/ Oct12-mcd-2a/ h1/ 44/ fid
2	Title	h1
3	Comment	SM-198
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	128
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-10-12T 16:16:48
18	Modification Date	2012-10-14T 18:10:40
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3124.9
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 07-0ct-mcd-2a/ c13-sudhakar/ 49/ fid
2	Title	c13-sudhakar
3	Comment	SM-198
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	10240
13	Receiver Gain	128
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2013-10-07T 17:22:40
18	Modification Date	2013-10-08T 00:03:44
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2562.4
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

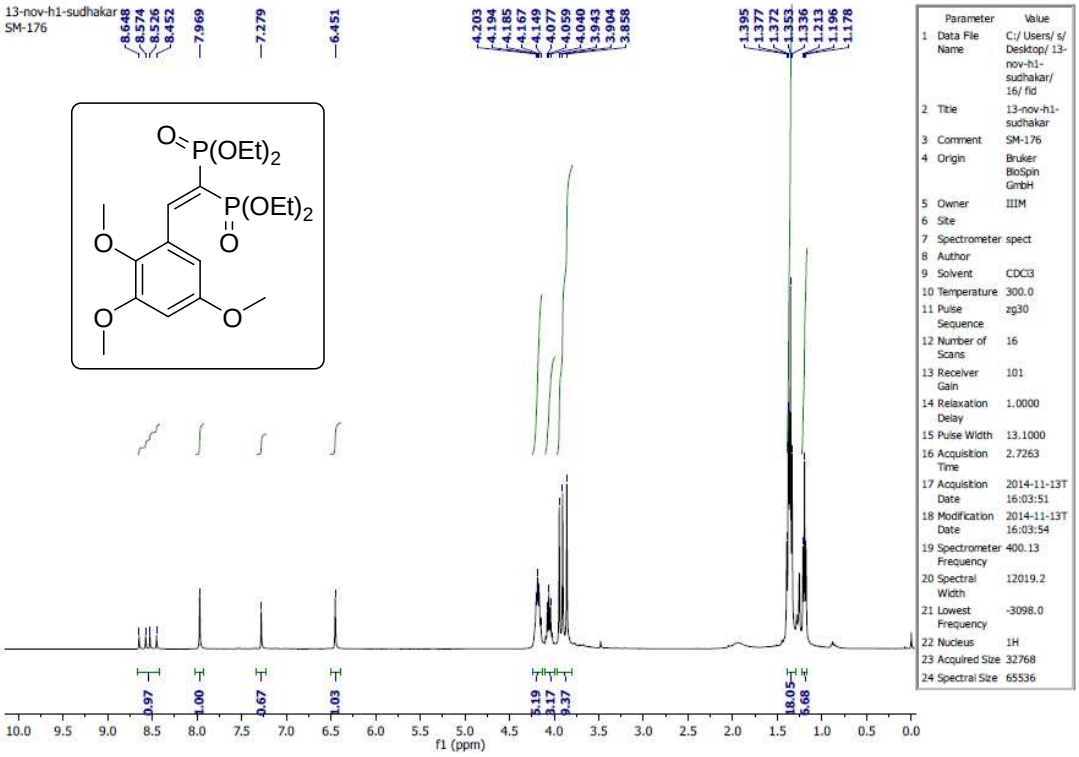


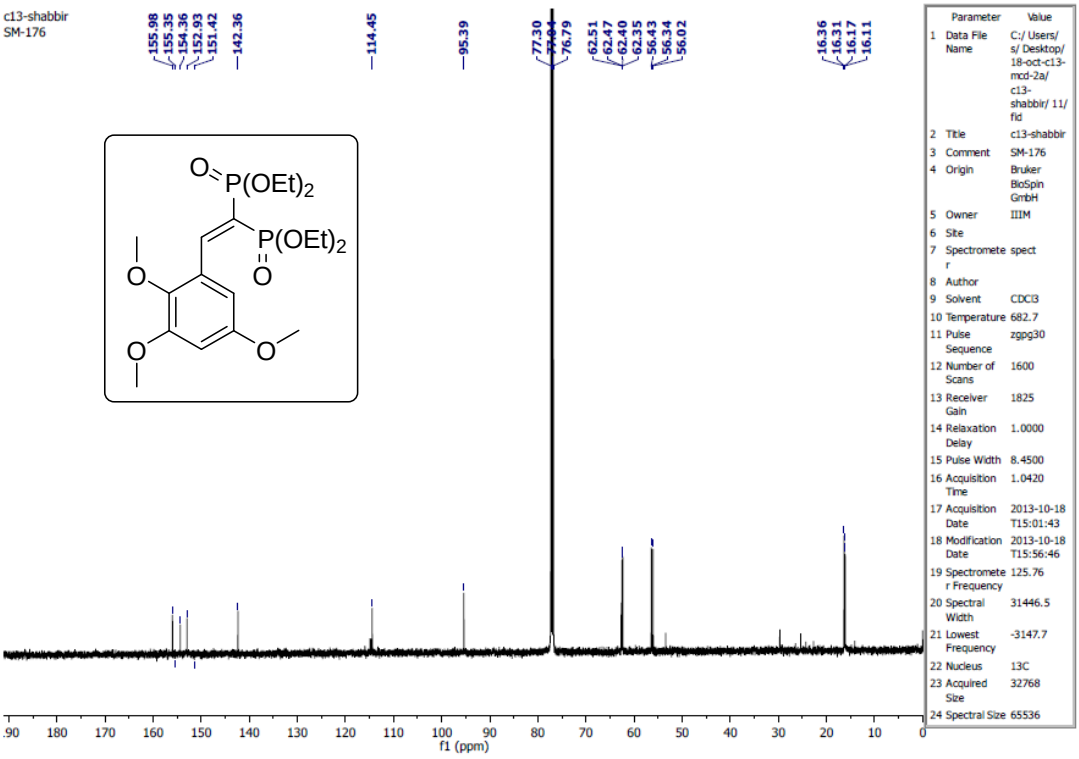
	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 07-0ct-mcd-2a/ c13-sudhakar/ 50/ fid
2	Title	c13-sudhakar
3	Comment	SM-198
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	8192
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2013-10-08T 05:23:37
18	Modification Date	2013-10-08T 05:23:40
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

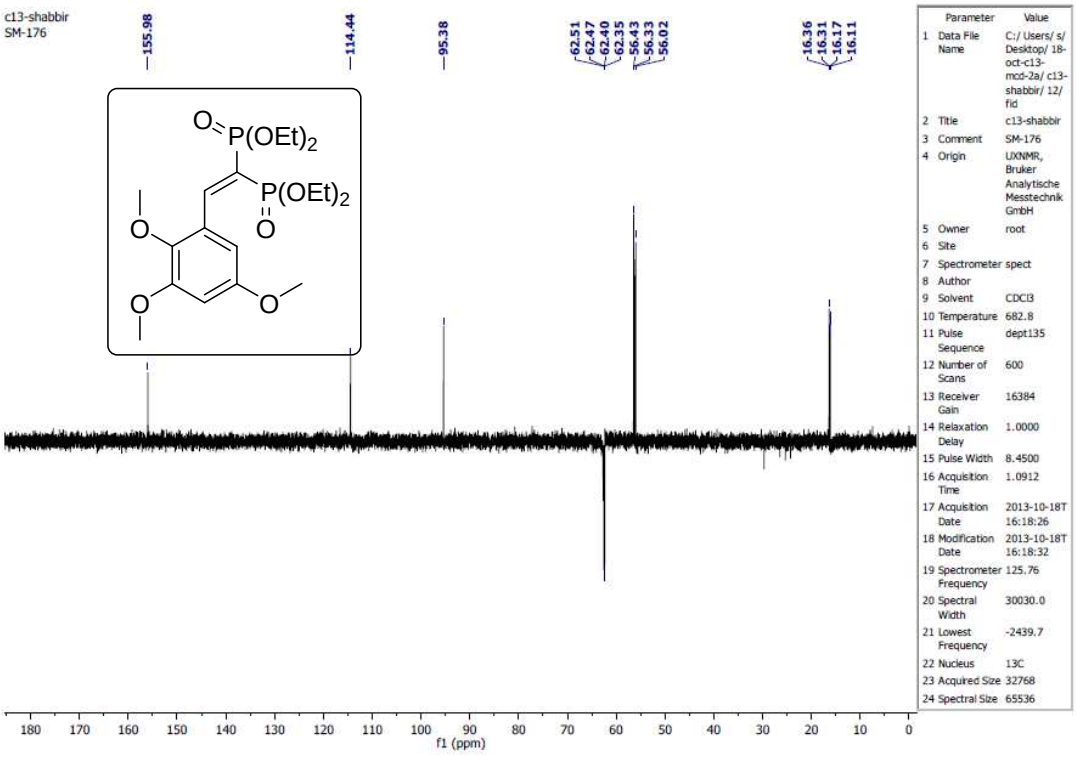


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 05-nov-mcd-2a/ 35/ fid
2	Title	05-nov-mcd-2a
3	Comment	SM-198(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	15
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-05 T16:16:49
18	Modification Date	2013-11-05 T16:16:50
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

11. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraethyl- 2(2,3,5-trimethoxyphenyl)ethane-1,1 diyldiphosphonate (6k)






c13-shabbir
SM-176
155.98
114.44
95.38
62.51
62.47
62.40
62.35
56.43
56.33
56.02
16.36
16.31
16.17
16.11
O
P(OEt)2
P(OEt)2
O
O
O
O
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 18-oct-c13-mcd-2a/ c13-shabbir/ 12/ fid
2 Title c13-shabbir
3 Comment SM-176
4 Origin UXNMR, Bruker Analytische Messtechnik GmbH
5 Owner root
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 682.8
11 Pulse Sequence dept135
12 Number of Scans 600
13 Receiver Gain 16384
14 Relaxation Delay 1.0000
15 Pulse Width 8.4500
16 Acquisition Time 1.0912
17 Acquisition Date 2013-10-18T 16:18:26
18 Modification Date 2013-10-18T 16:18:32
19 Spectrometer Frequency 125.76
20 Spectral Width 30030.0
21 Lowest Frequency -2439.7
22 Nucleus 13C
23 Acquired Size 32768
24 Spectral Size 65536
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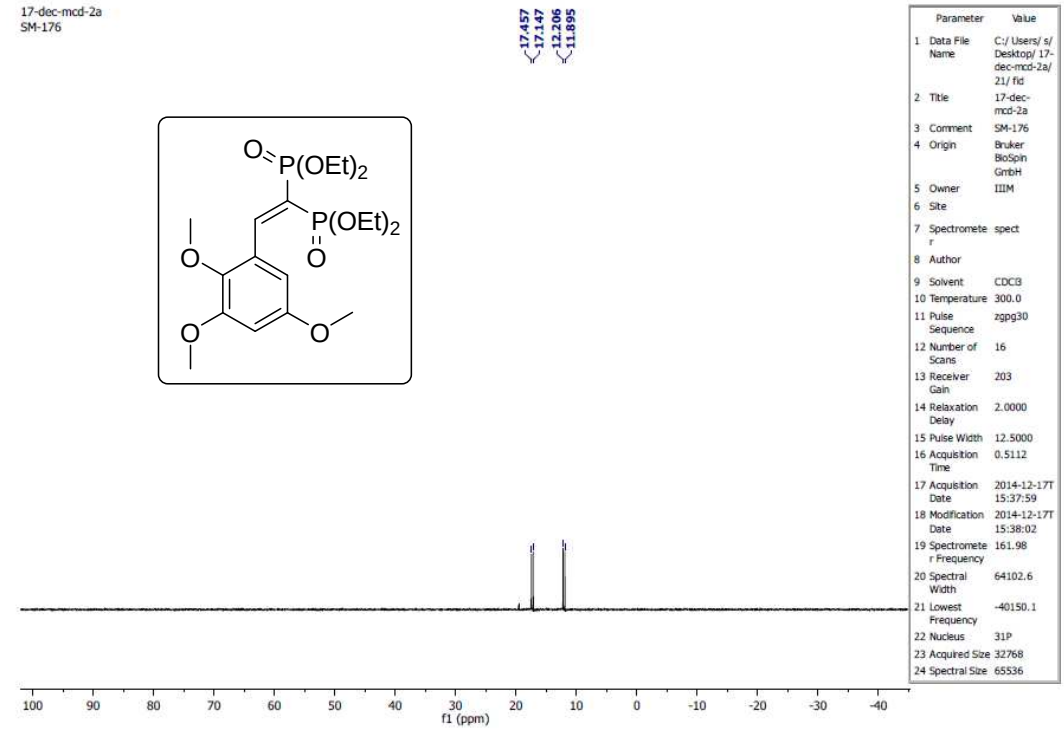
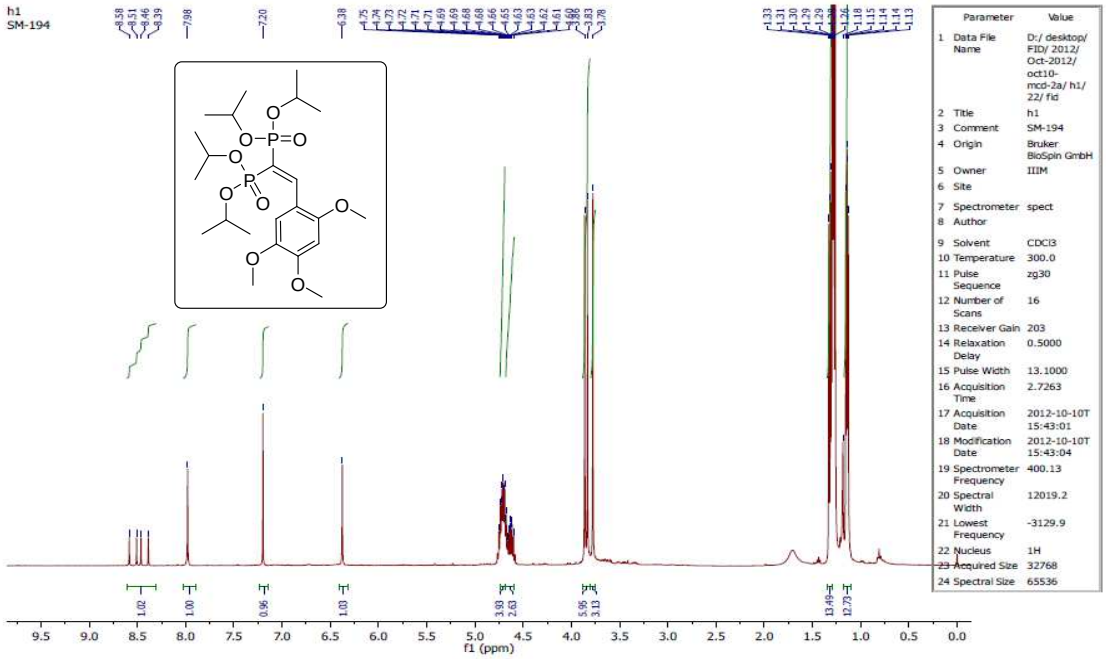
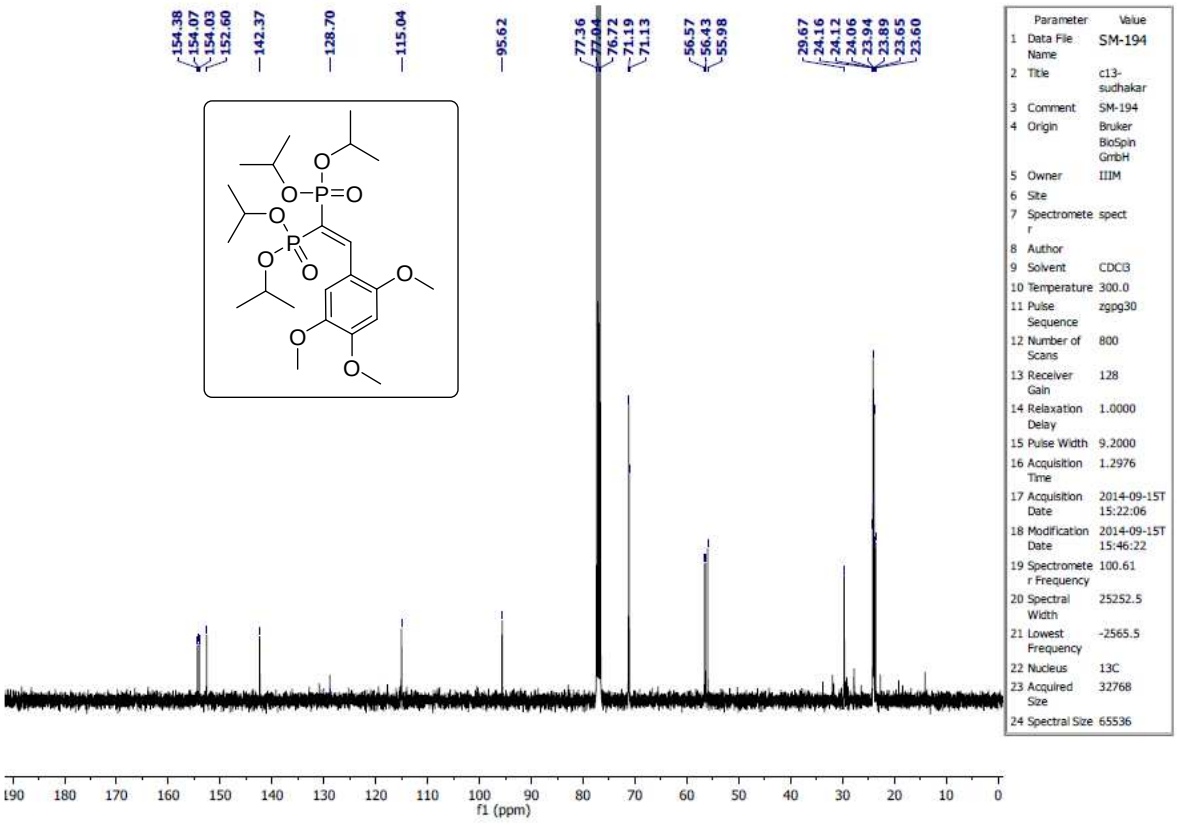
f1 (ppm)


17-dec-mcd-2a
SM-176
17.457
17.147
12.206
11.895
O
P(OEt)2
P(OEt)2
O
O
O
O
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 17-dec-mcd-2a/ 21/ fid
2 Title 17-dec-mcd-2a
3 Comment SM-176
4 Origin Bruker BioSpin GmbH
5 Owner IIIM
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 300.0
11 Pulse Sequence zgpg30
12 Number of Scans 16
13 Receiver Gain 203
14 Relaxation Delay 2.0000
15 Pulse Width 12.5000
16 Acquisition Time 0.5112
17 Acquisition Date 2014-12-17T 15:37:59
18 Modification Date 2014-12-17T 15:38:02
19 Spectrometer Frequency 161.98
20 Spectral Width 64102.6
21 Lowest Frequency -40150.1
22 Nucleus 31P
23 Acquired Size 32768
24 Spectral Size 65536
100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
f1 (ppm)

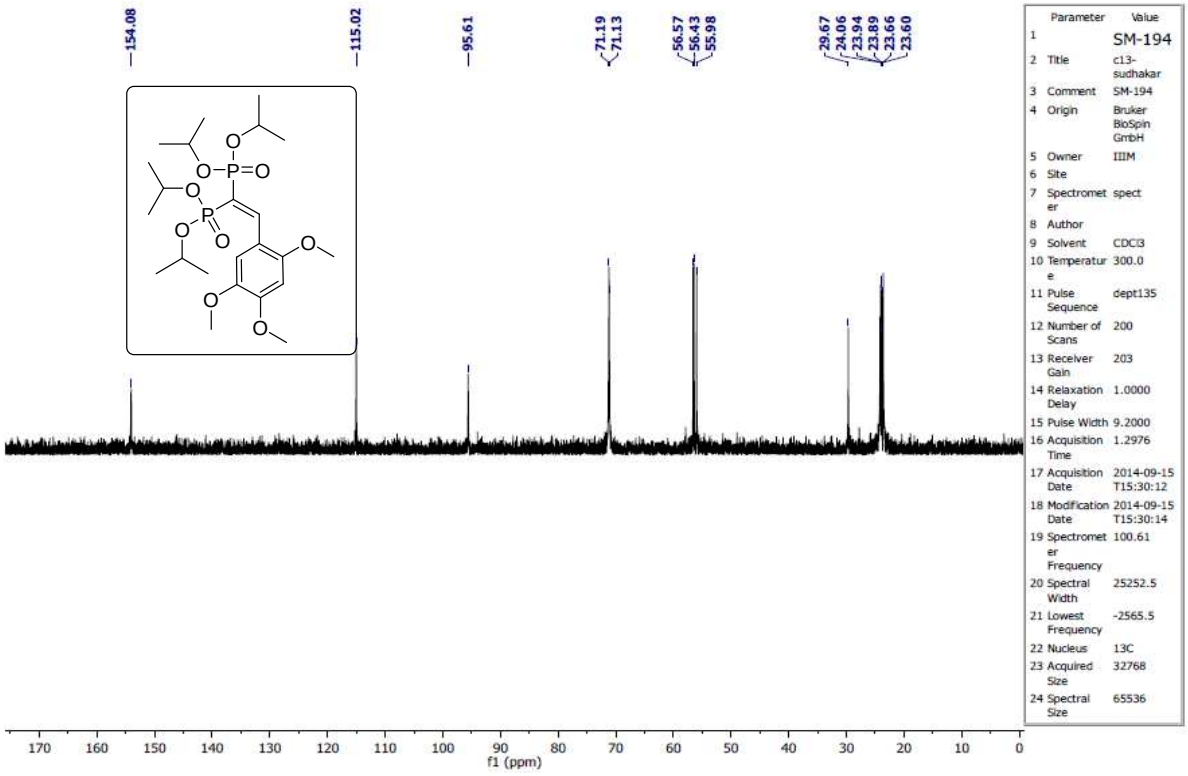
12. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisopropyl 2-(2,4,5-trimethoxyphenyl)ethene-1,1 diyldiphosphonate (6l)



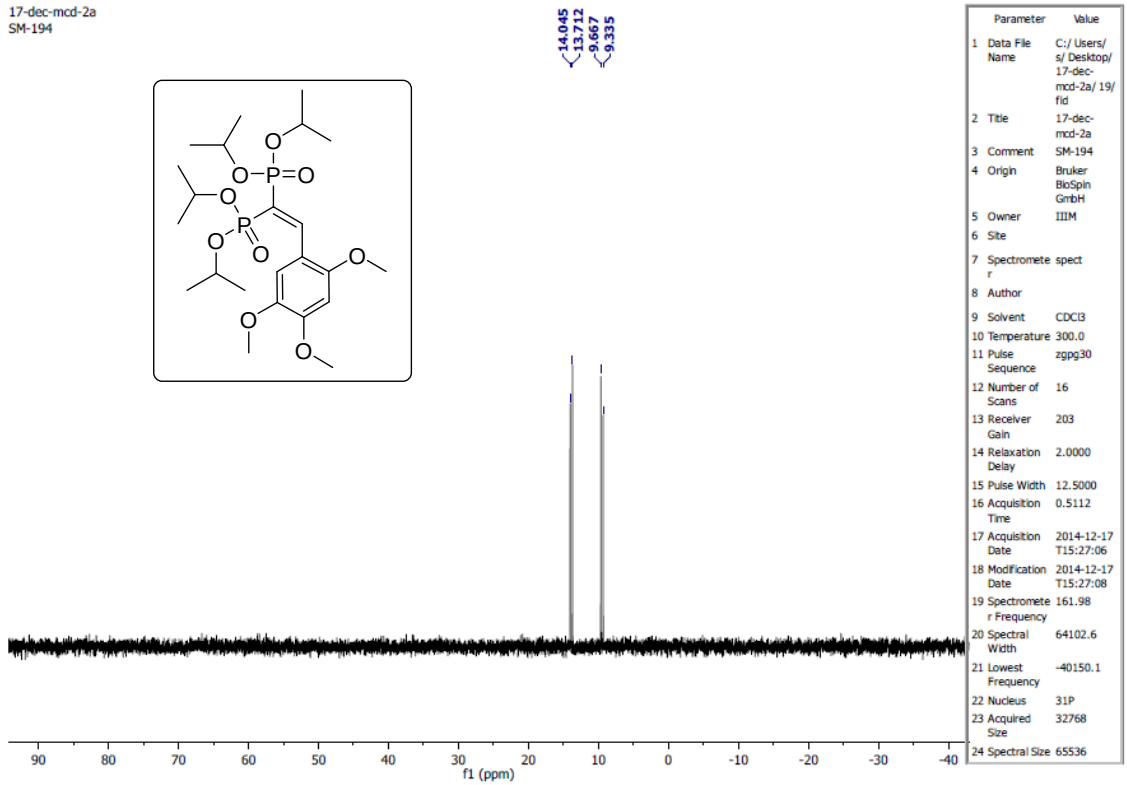
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Oct-2012/ oct10-mcd-2a/ h1/ 22/ fid
2	Title	h1
3	Comment	SM-194
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-10-10T 15:43:01
18	Modification Date	2012-10-10T 15:43:04
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3129.9
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	SM-194
2	Title	c13-sudhakar
3	Comment	SM-194
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	800
13	Receiver Gain	128
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2014-09-15T 15:22:06
18	Modification Date	2014-09-15T 15:46:22
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1		SM-194
2	Title	c13-sudhakar
3	Comment	SM-194
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	200
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2014-09-15 T15:30:12
18	Modification Date	2014-09-15 T15:30:14
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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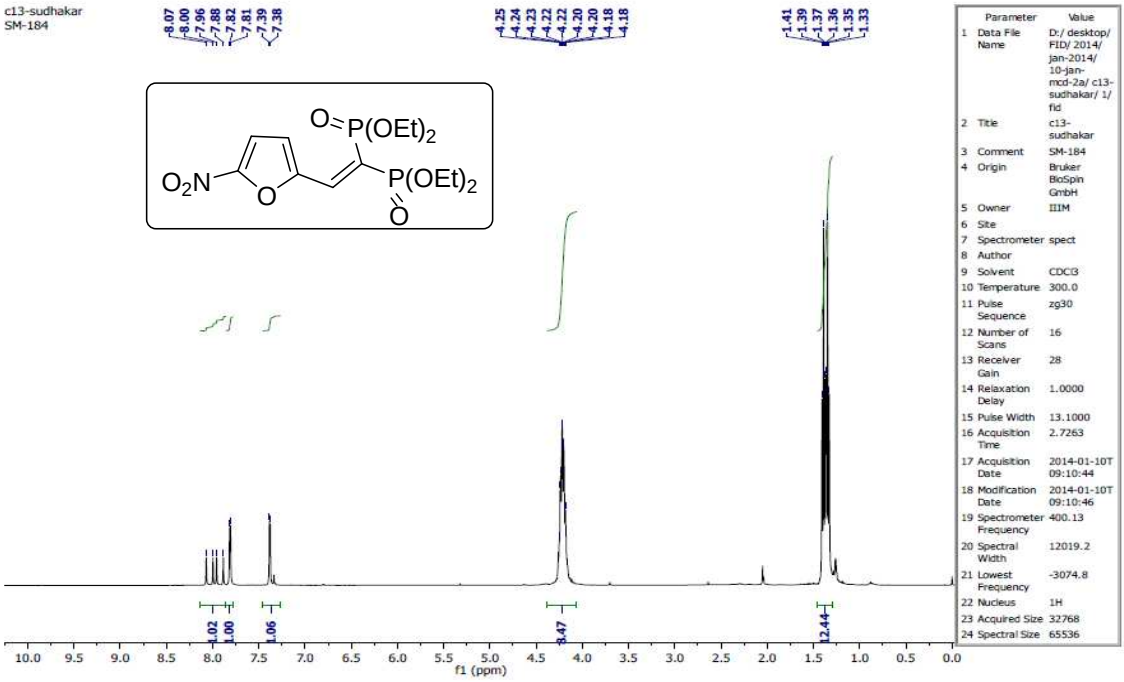
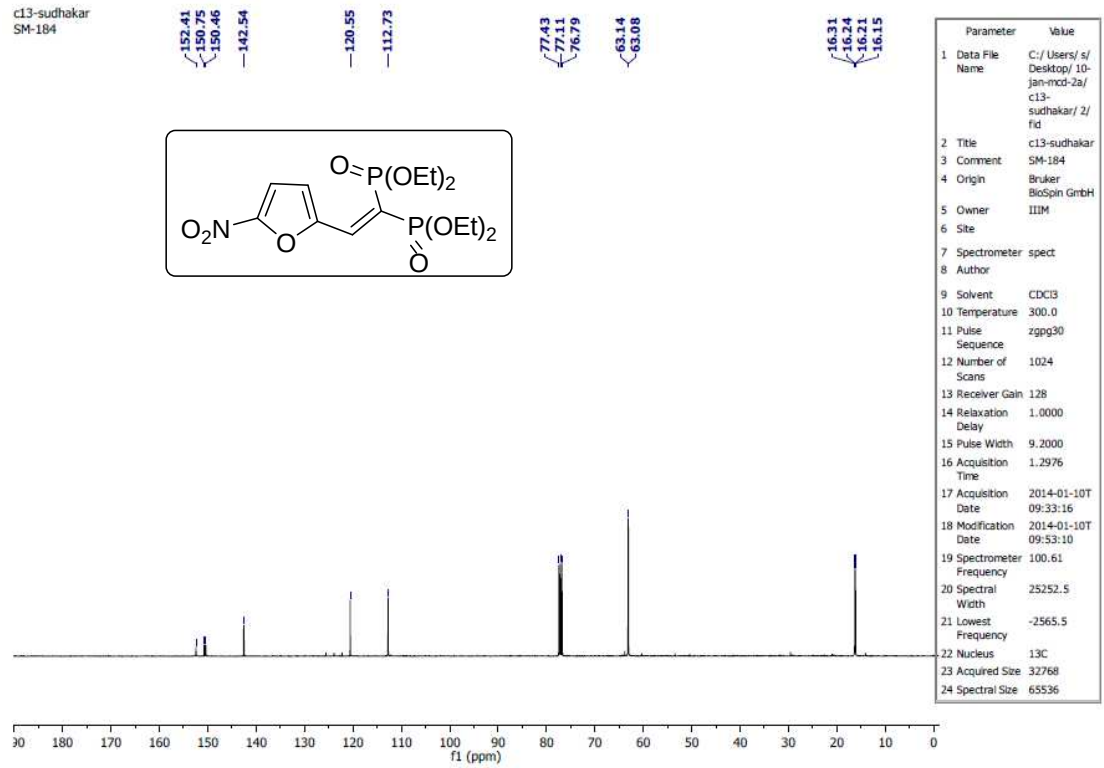
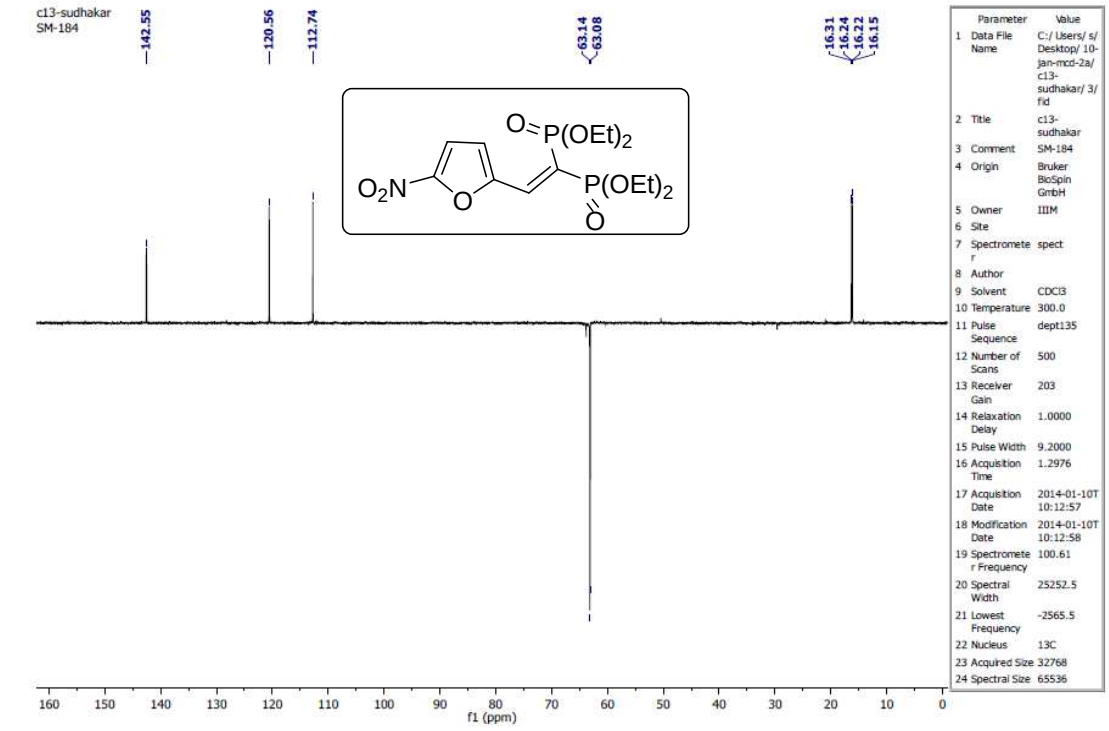
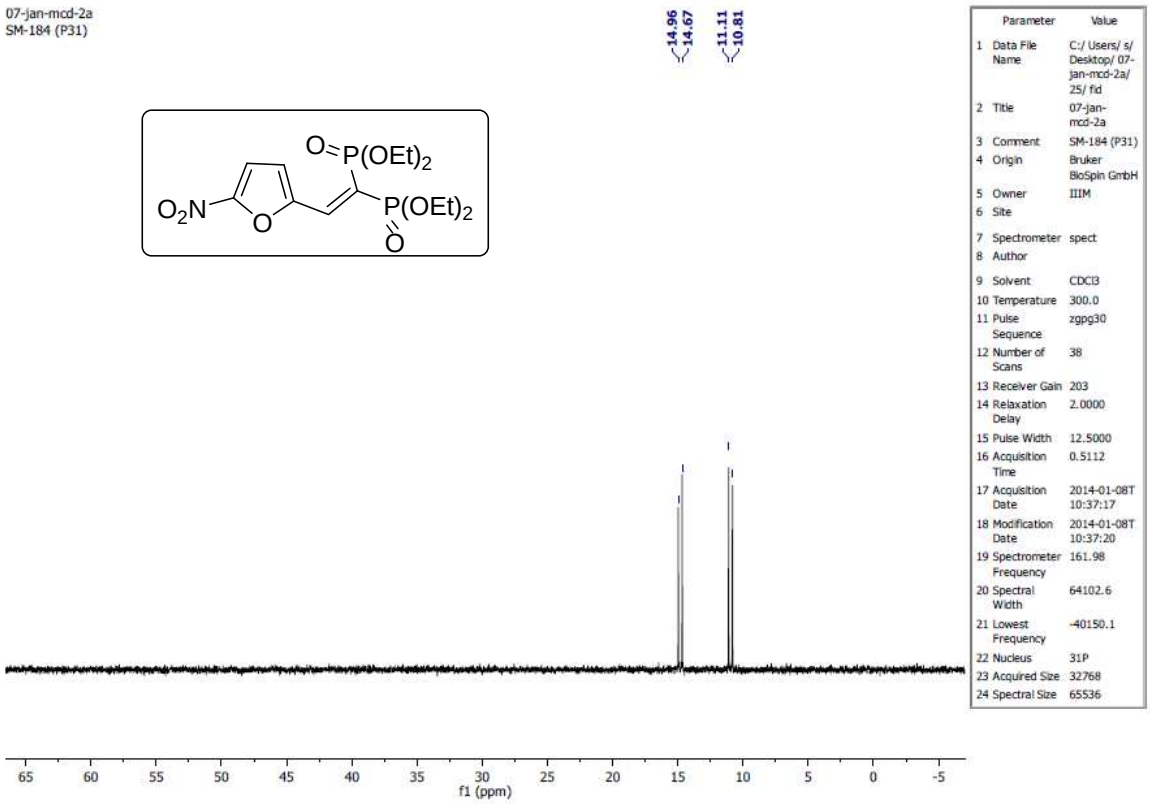
1	Data File Name	C:/Users/s/Desktop/17-dec-mcd-2a/19/fid
2	Title	17-dec-mcd-2a
3	Comment	SM-194
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2014-12-17 T15:27:06
18	Modification Date	2014-12-17 T15:27:08
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

13. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraethyl2-(5-nitrofuran-2-yl)ethene-1,1-diyldiphosphonate (6m)

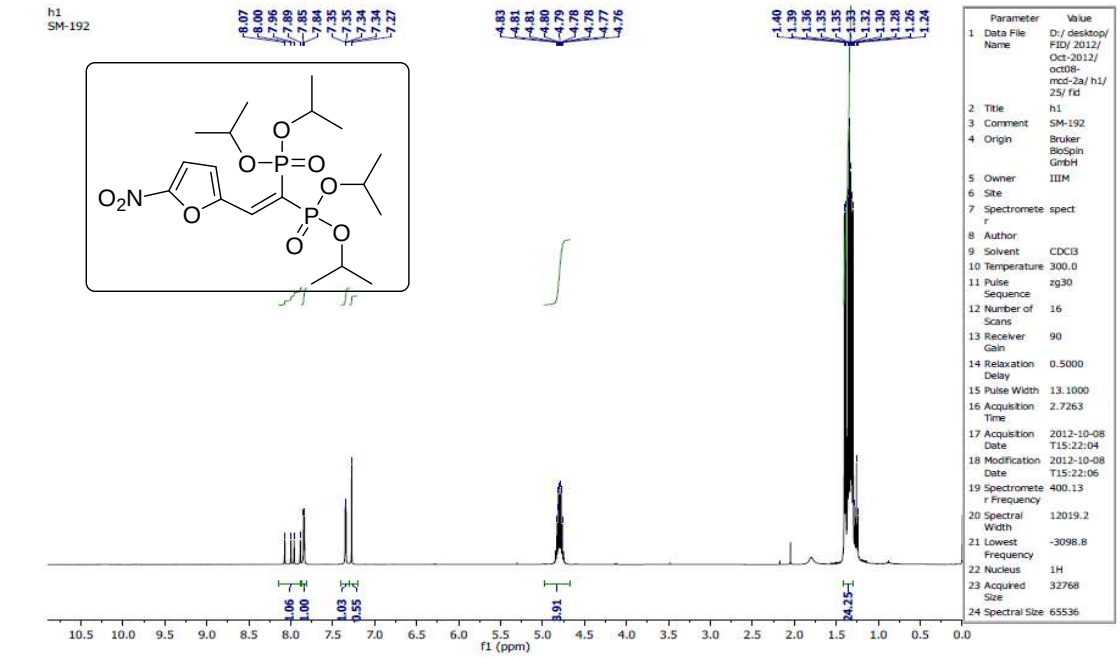


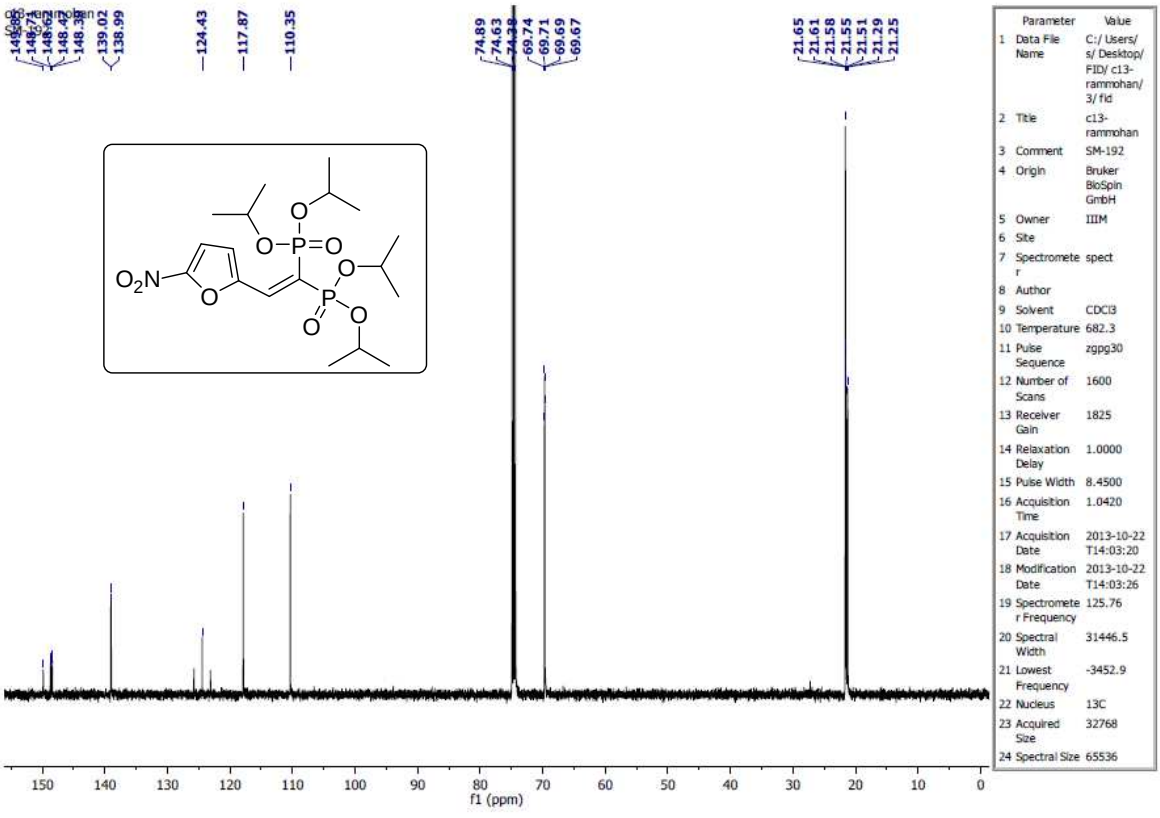


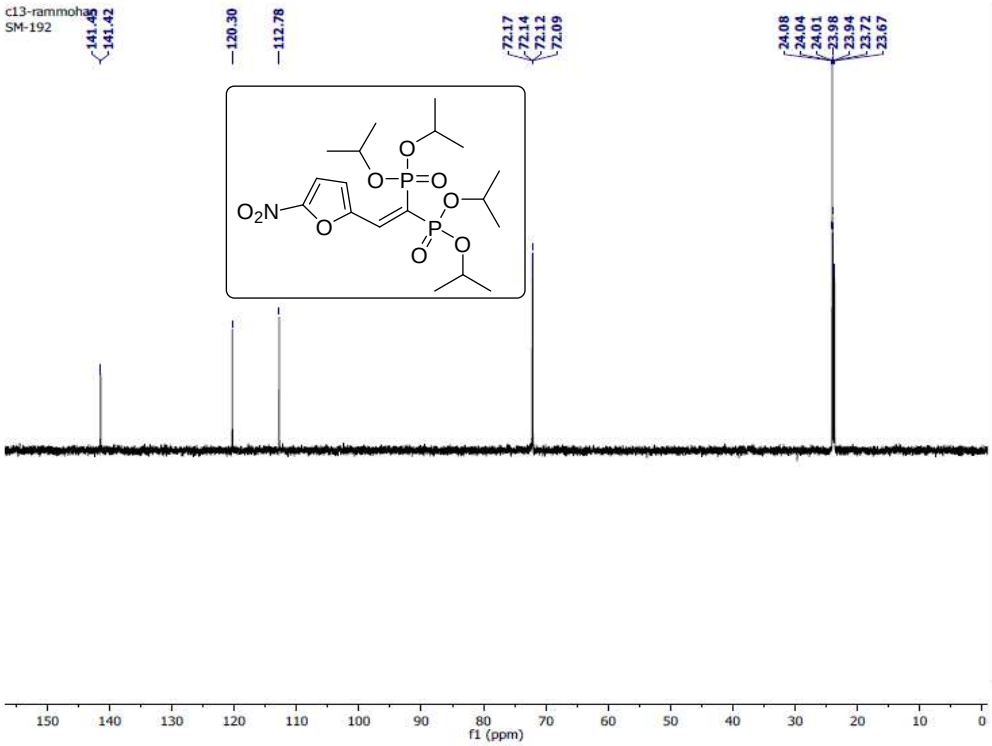

c13-sudhakar
SM-184
142.55
120.56
112.74
63.14
63.08
16.31
16.24
16.22
16.15
O=P(OEt)2
O2N
O
P(OEt)2
O
f1 (ppm)
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 10-jan-mcd-2a/ c13-sudhakar/ 3/ fid
2 Title c13-sudhakar
3 Comment SM-184
4 Origin Bruker BioSpin GmbH
5 Owner IIIM
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 300.0
11 Pulse Sequence dept135
12 Number of Scans 500
13 Receiver Gain 203
14 Relaxation Delay 1.0000
15 Pulse Width 9.2000
16 Acquisition Time 1.2976
17 Acquisition Date 2014-01-10T 10:12:57
18 Modification Date 2014-01-10T 10:12:58
19 Spectrometer Frequency 100.61
20 Spectral Width 25252.5
21 Lowest Frequency -2565.5
22 Nucleus 13C
23 Acquired Size 32768
24 Spectral Size 65536


07-jan-mcd-2a
SM-184 (P31)
14.96
14.67
11.11
10.81
O=P(OEt)2
O2N
O
P(OEt)2
O
f1 (ppm)
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 07-jan-mcd-2a/ 25/ fid
2 Title 07-jan-mcd-2a
3 Comment SM-184 (P31)
4 Origin Bruker BioSpin GmbH
5 Owner IIIM
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 300.0
11 Pulse Sequence zgpg30
12 Number of Scans 38
13 Receiver Gain 203
14 Relaxation Delay 2.0000
15 Pulse Width 12.5000
16 Acquisition Time 0.5112
17 Acquisition Date 2014-01-08T 10:37:17
18 Modification Date 2014-01-08T 10:37:20
19 Spectrometer Frequency 161.98
20 Spectral Width 64102.6
21 Lowest Frequency -40150.1
22 Nucleus 31P
23 Acquired Size 32768
24 Spectral Size 65536

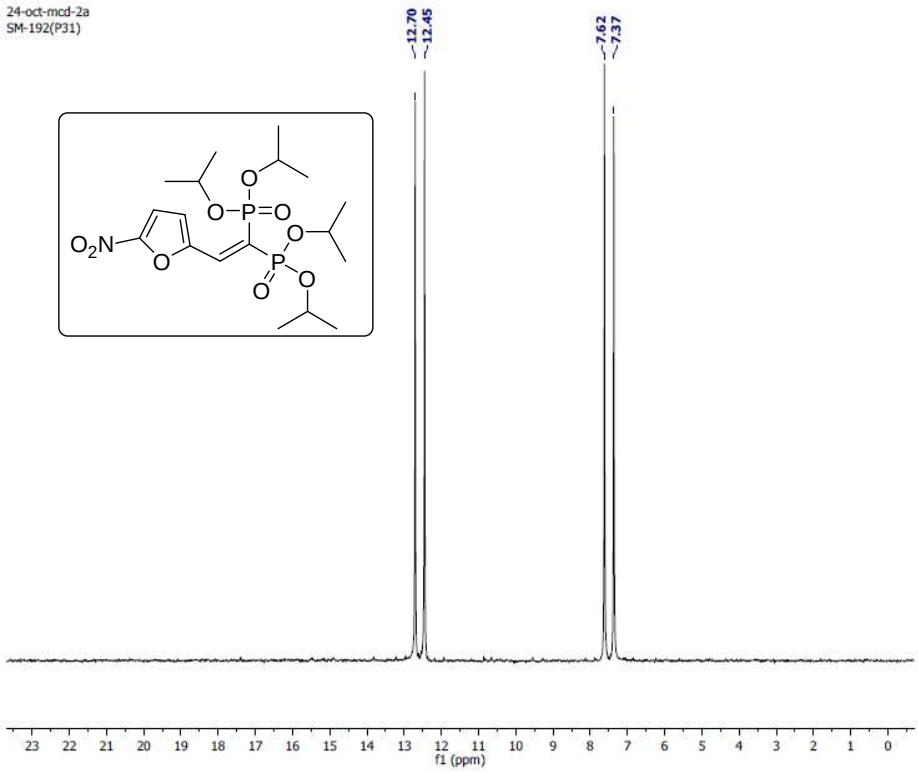
14. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisoproyl2-(5-nitrofuran-2-yl)ethene-1,1 diyldiphosphonate (6n)





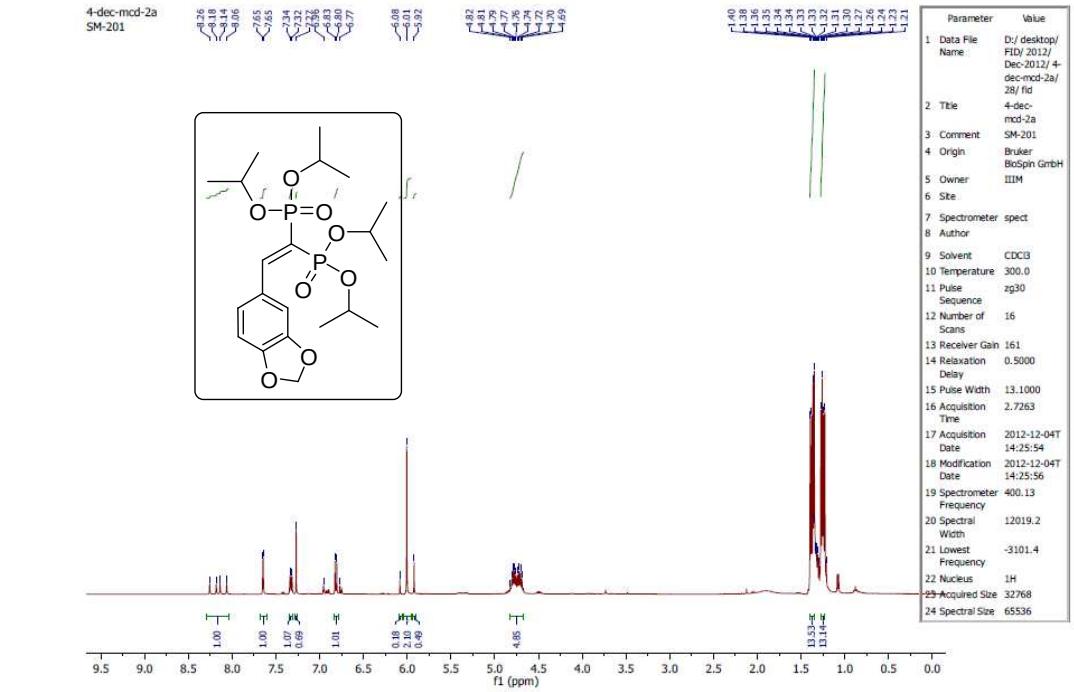


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ FID/ c13-rammohan/ 4/ fid
2	Title	c13-rammohan
3	Comment	SM-192
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.2
11	Pulse Sequence	dept135
12	Number of Scans	800
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-10-22T14:32:10
18	Modification Date	2013-10-22T14:32:16
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

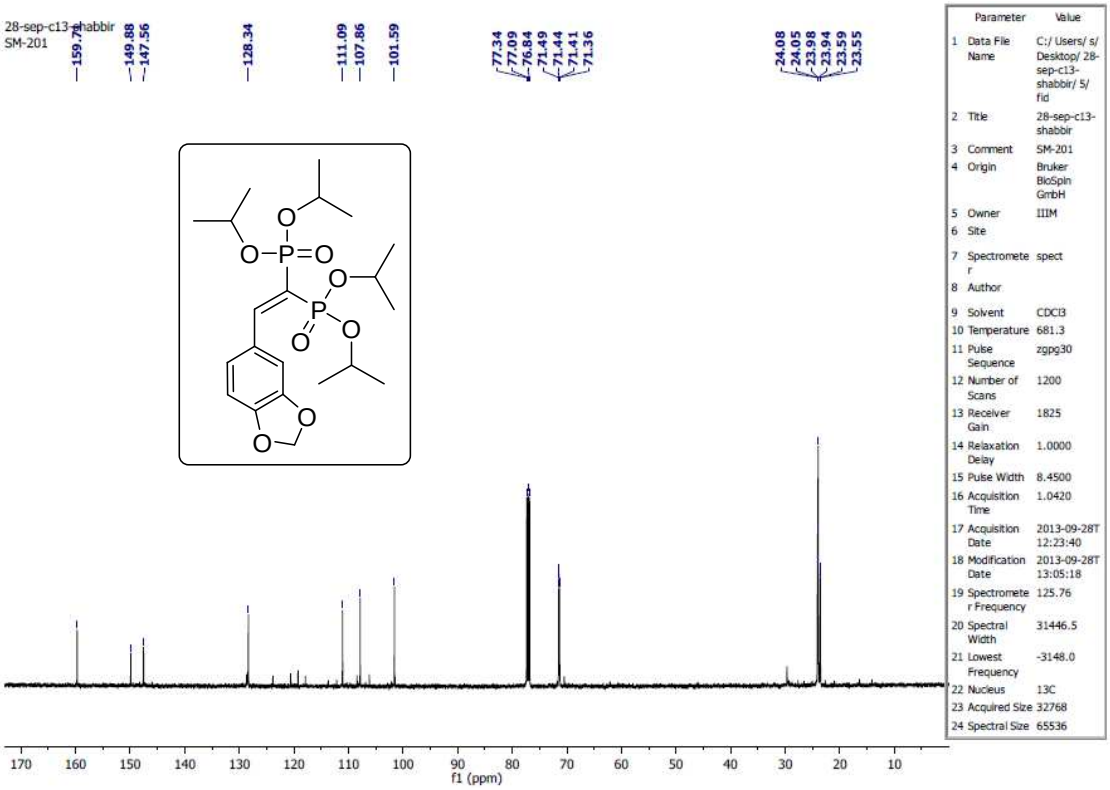


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 24-oct-mcd-2a/ 34/ fid
2	Title	24-oct-mcd-2a
3	Comment	SM-192(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	64
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-10-24T14:34:39
18	Modification Date	2013-10-24T14:34:42
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-4015O.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

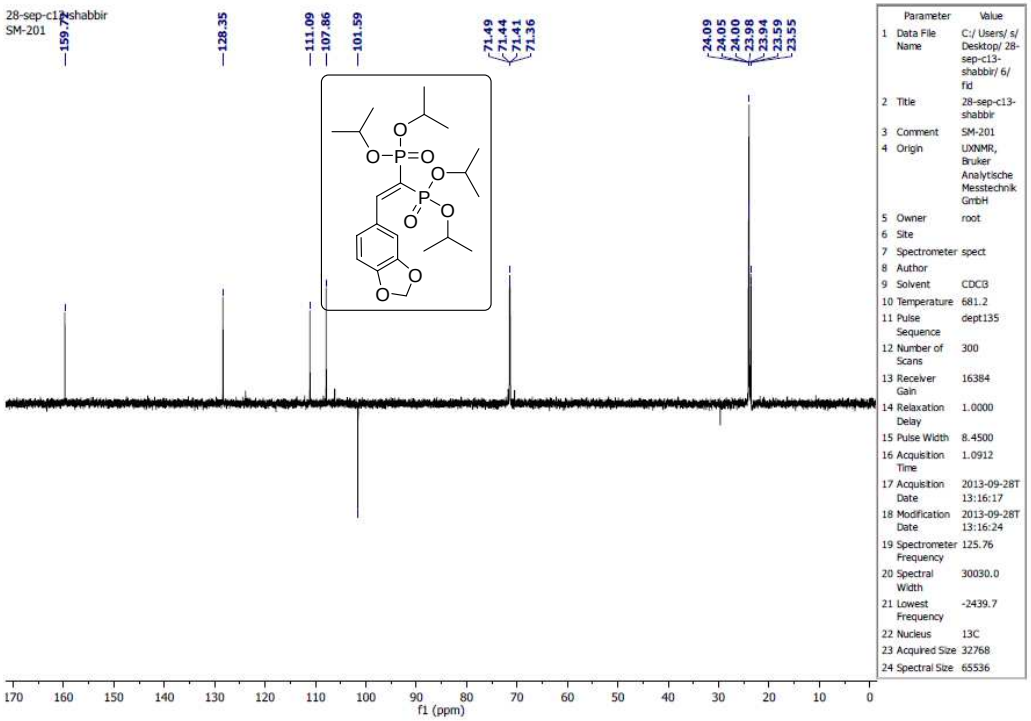
15. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisopropyl2-(benzo[d][1,3]dioxol-5-yl)ethene-1,1-diyldiphosphonate (6o)



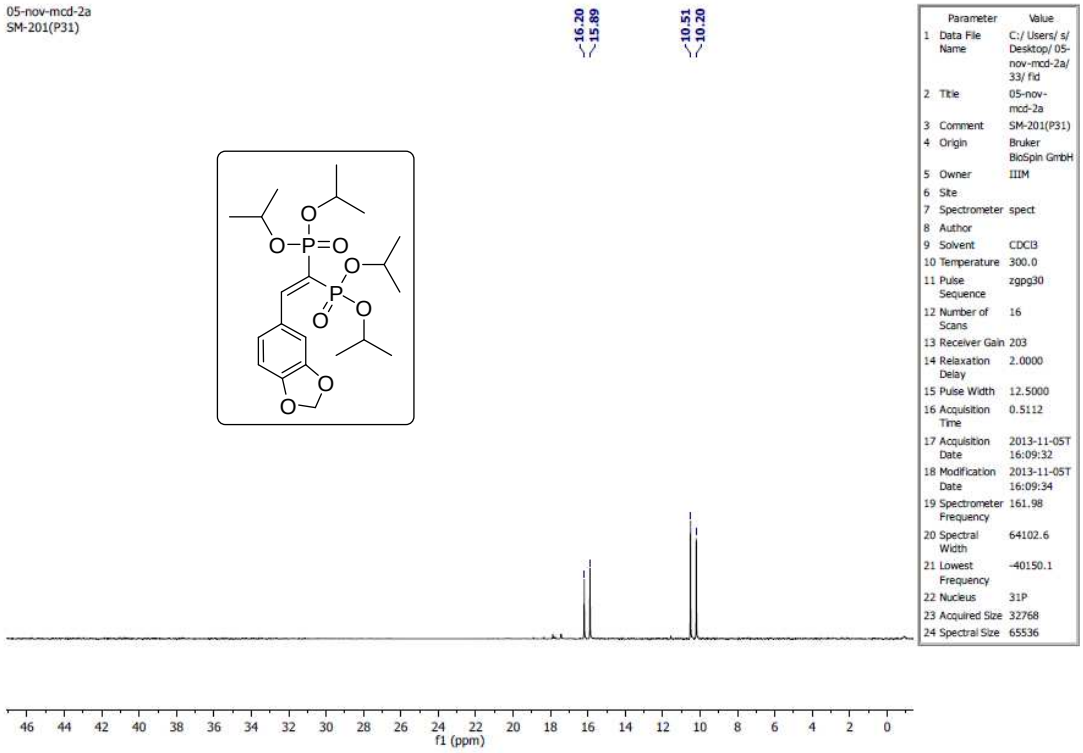
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Dec-2012/ 4-dec-mcd-2a/ 28/ fid
2	Title	4-dec-mcd-2a
3	Comment	SM-201
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	161
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-12-04T 14:25:54
18	Modification Date	2012-12-04T 14:25:56
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3101.4
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 28-sep-c13-shabbir/ 5/ fid
2	Title	28-sep-c13-shabbir
3	Comment	SM-201
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	681.3
11	Pulse Sequence	zgpg30
12	Number of Scans	1200
13	Receiver Gain	1825
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0420
17	Acquisition Date	2013-09-28T 12:23:40
18	Modification Date	2013-09-28T 13:05:18
19	Spectrometer Frequency	125.76
20	Spectral Width	31446.5
21	Lowest Frequency	-3148.0
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

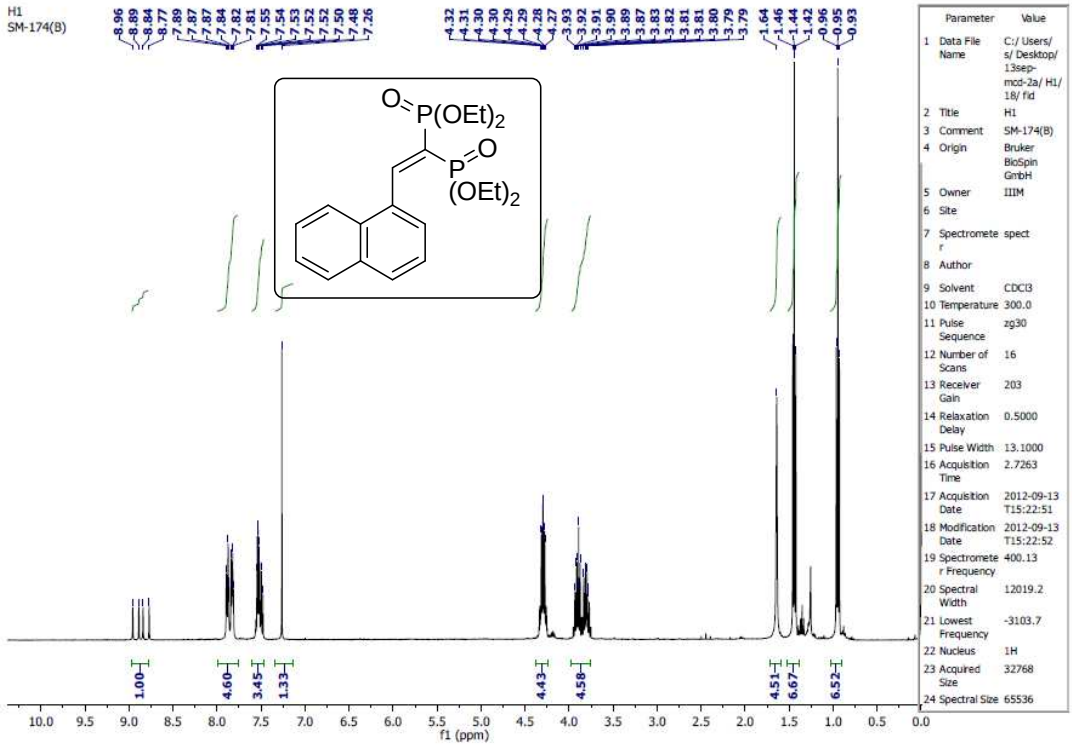


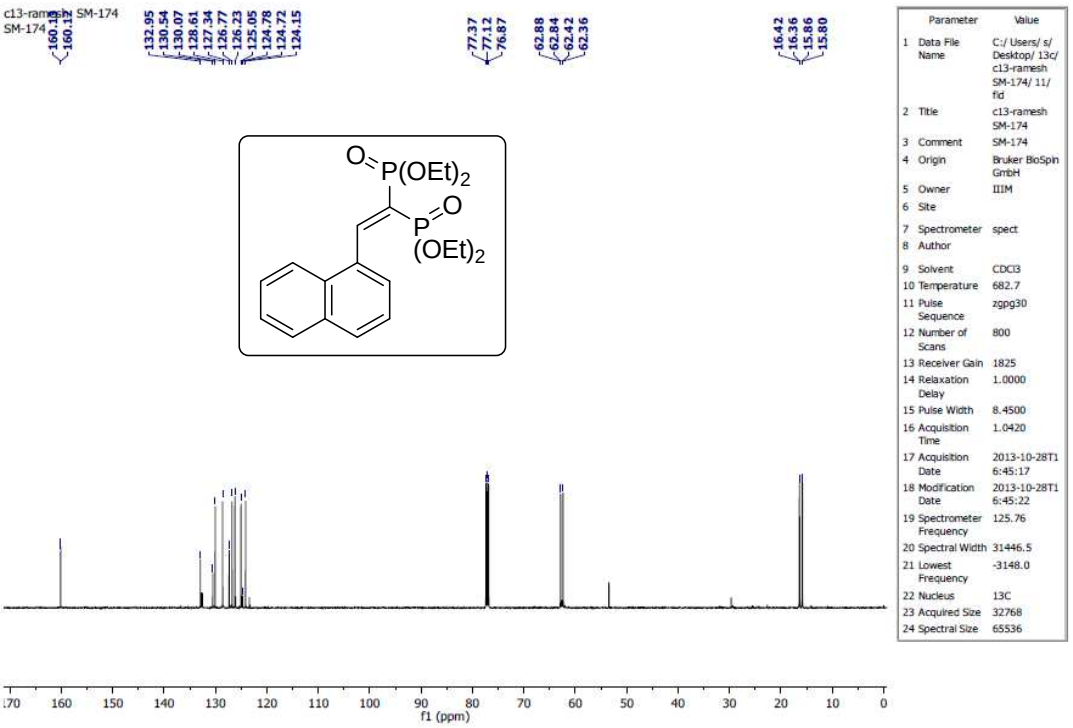
	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 28-sep-c13-shabbir/ 6/ fid
2	Title	28-sep-c13-shabbir
3	Comment	SM-201
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	681.2
11	Pulse Sequence	dept135
12	Number of Scans	300
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-09-28T 13:16:17
18	Modification Date	2013-09-28T 13:16:24
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

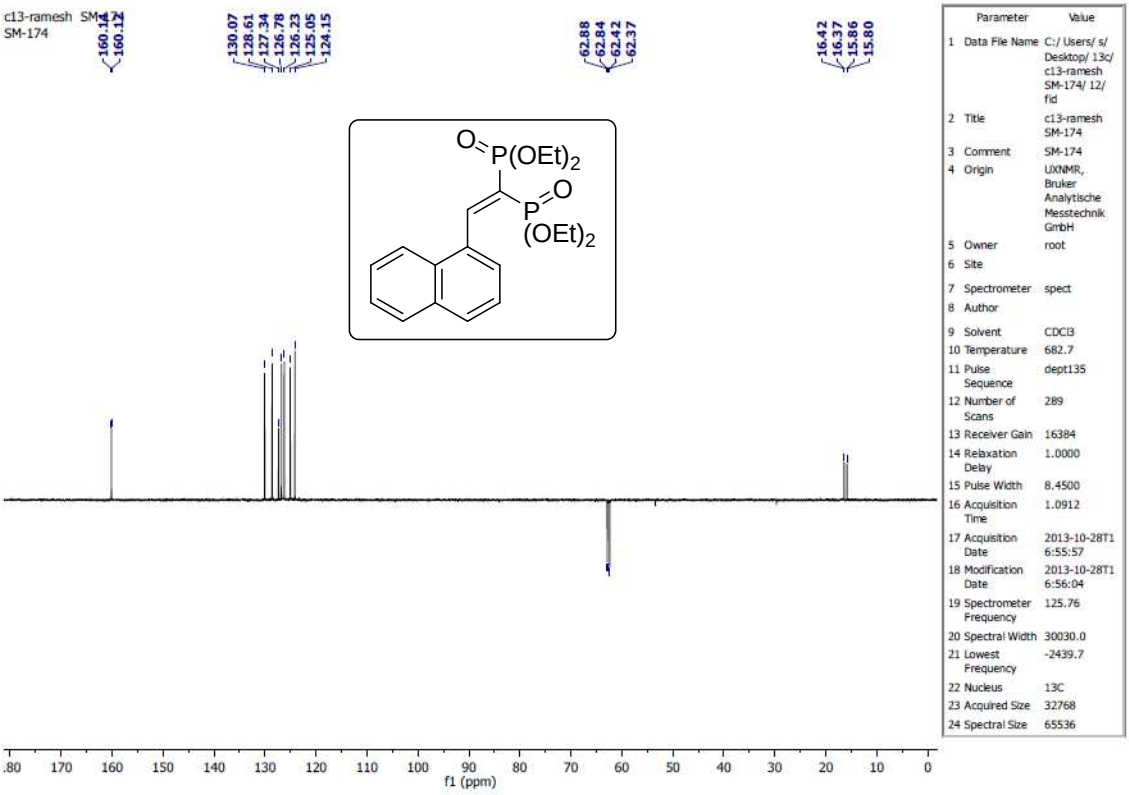


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 05-nov-mcd-2a/ 33/ fid
2	Title	05-nov-mcd-2a
3	Comment	SM-201(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-05T 16:09:32
18	Modification Date	2013-11-05T 16:09:34
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

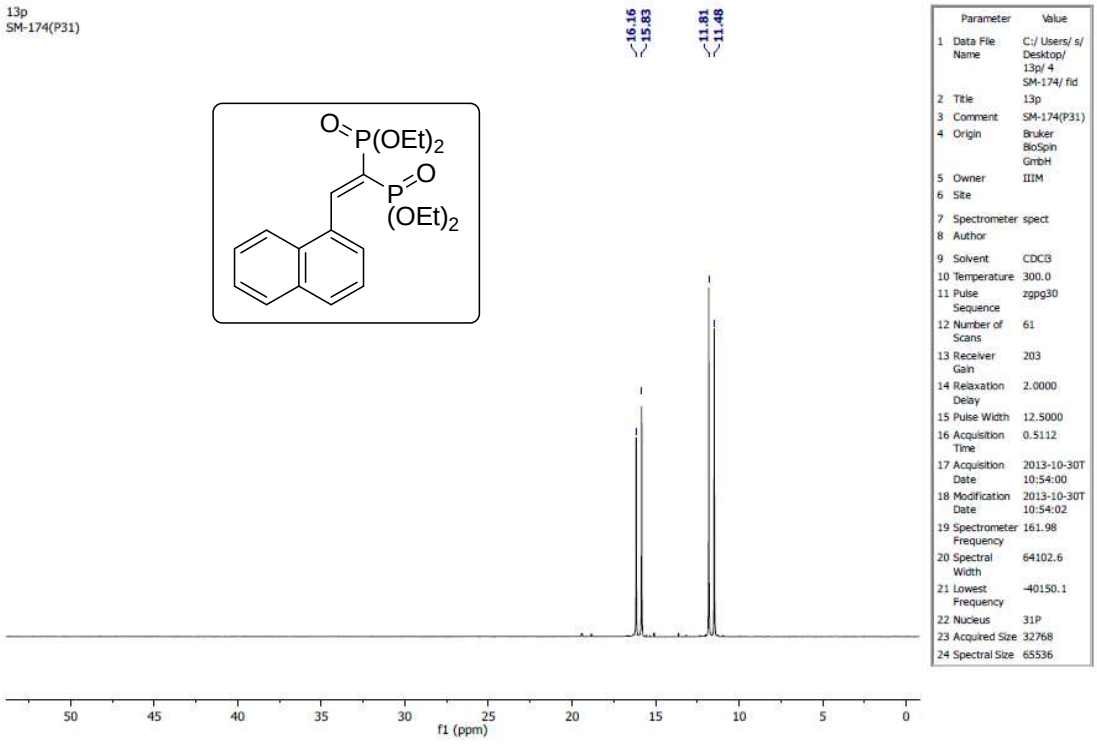
16. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraethyl 2-(naphthalen-1-yl)ethene-1,1-diyldiphosphonate (6p)





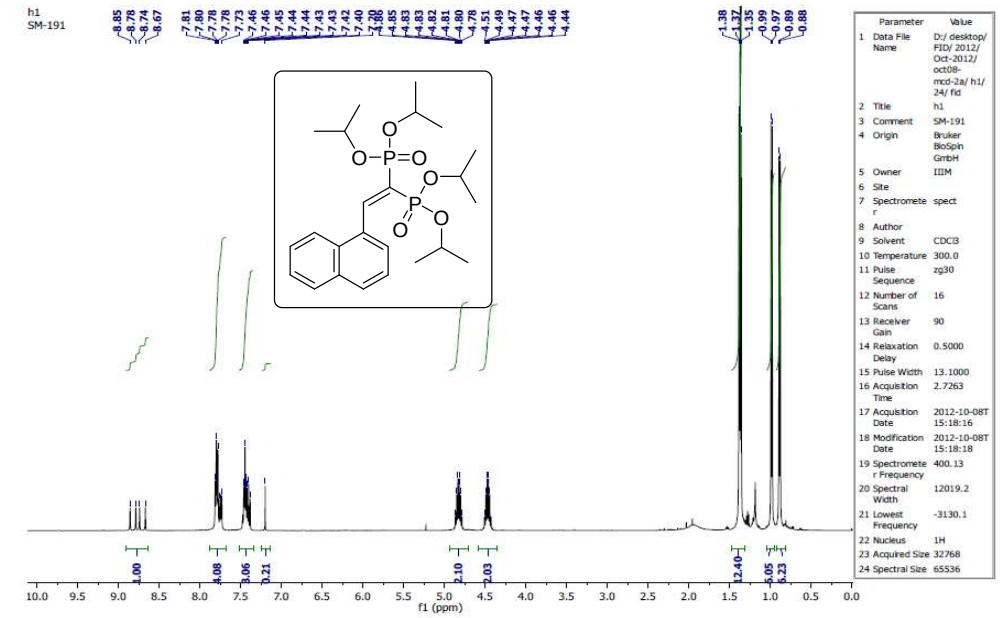


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 13c/ c13-ramesh SM-174/ 12/ fid
2	Title	c13-ramesh SM-174
3	Comment	SM-174
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.7
11	Pulse Sequence	dept135
12	Number of Scans	289
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-10-28T16:55:57
18	Modification Date	2013-10-28T16:56:04
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

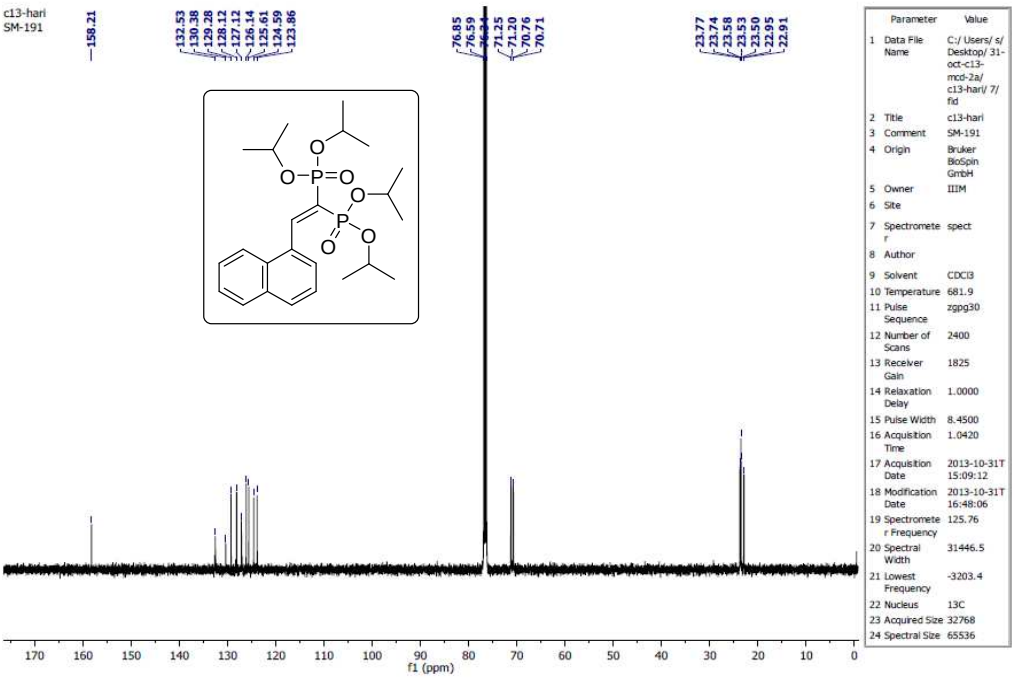


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 13p/ 4 SM-174/ fid
2	Title	13p
3	Comment	SM-174(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	61
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-10-30T10:54:00
18	Modification Date	2013-10-30T10:54:02
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

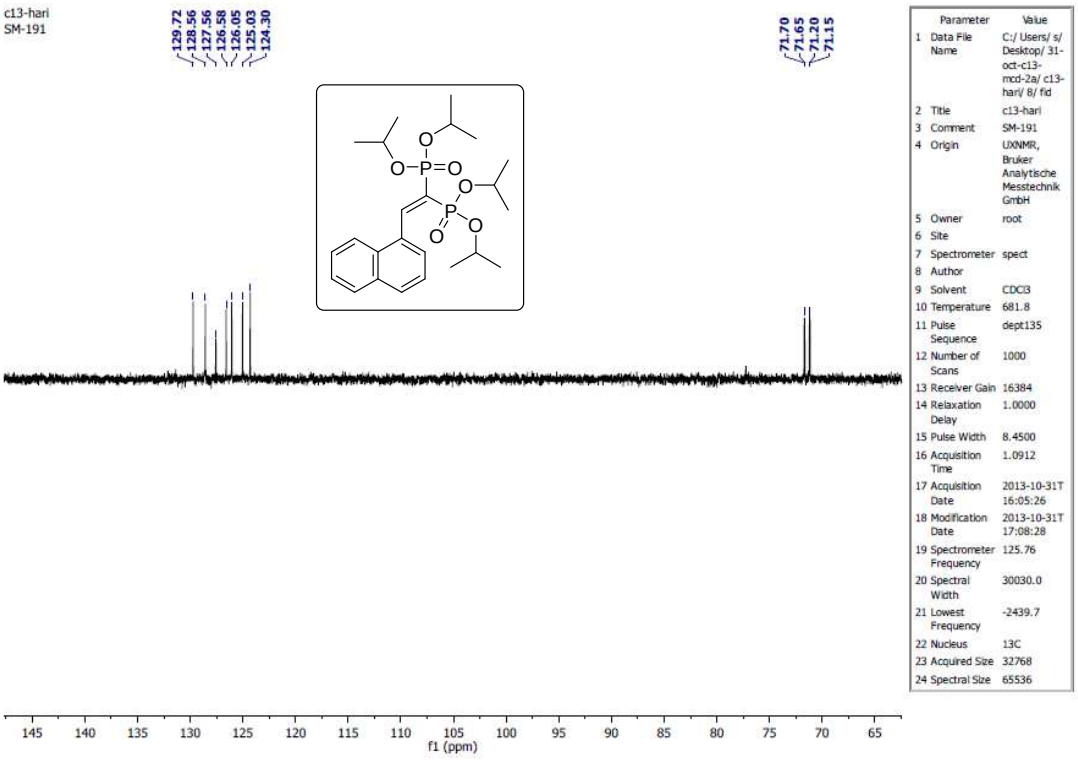
17. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisopropyl,2-(naphthalen-1-yl)ethene-1,1 diyldiphosphonate (6q)



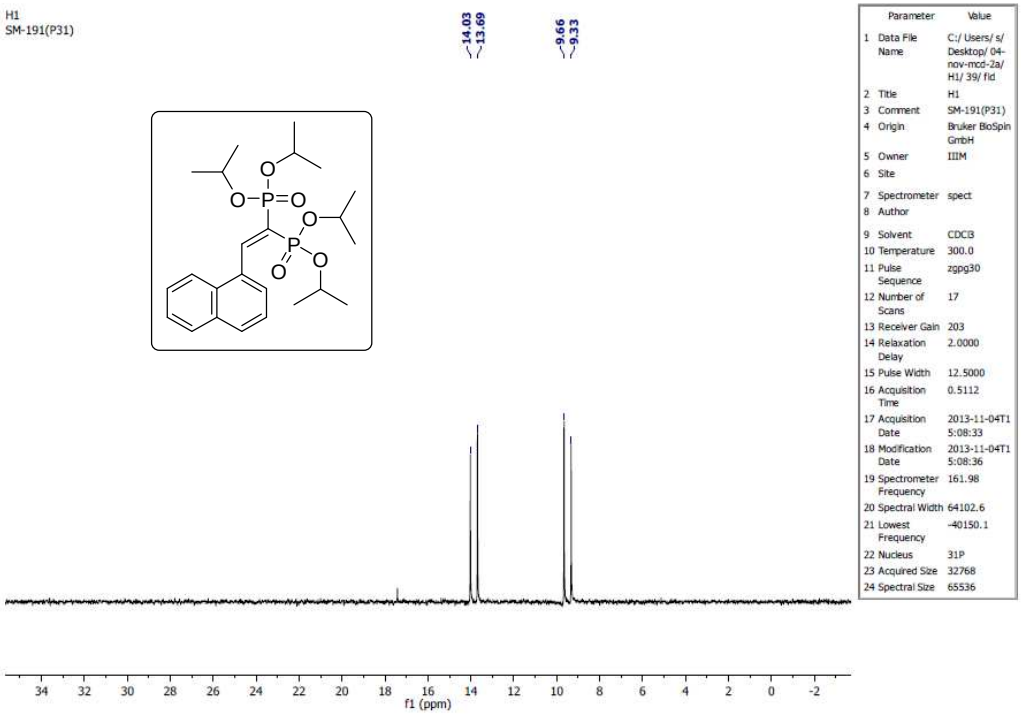
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Oct-2012/ oct08-mcd-2a/ h1/ 24/ fid
2	Title	h1
3	Comment	SM-191
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	90
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-10-08T 15:18:16
18	Modification Date	2012-10-08T 15:18:18
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3130.1
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 31-oct-c13-mcd-2a/ c13-hari/ 7/ fid
2	Title	c13-hari
3	Comment	SM-191
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	681.9
11	Pulse Sequence	zgpg30
12	Number of Scans	2400
13	Receiver Gain	1825
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0420
17	Acquisition Date	2013-10-31T 15:09:12
18	Modification Date	2013-10-31T 16:48:06
19	Spectrometer Frequency	125.76
20	Spectral Width	31446.5
21	Lowest Frequency	-3203.4
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

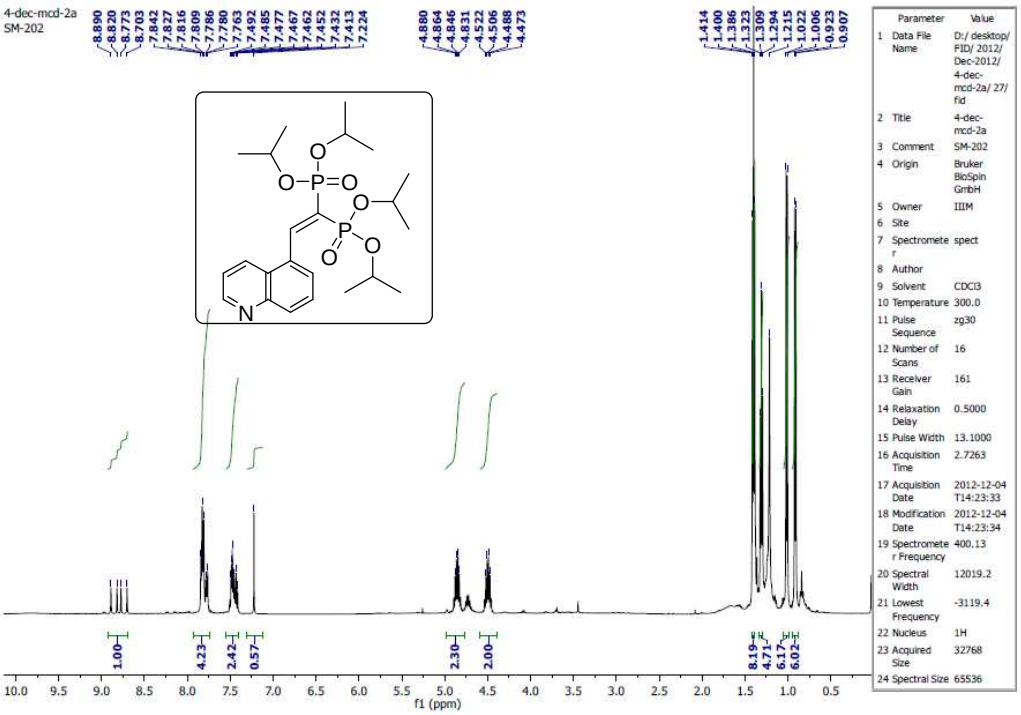


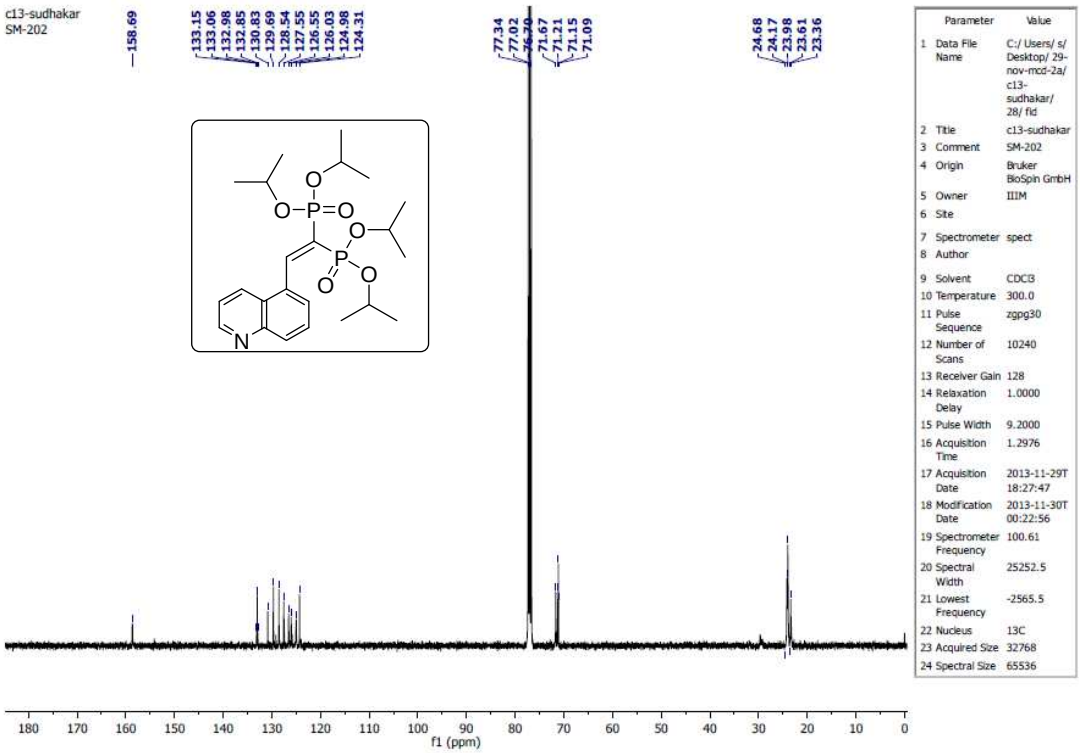
	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 31-oct-c13-mcd-2a/ c13-hari/ 8/ fid
2	Title	c13-hari
3	Comment	SM-191
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	681.8
11	Pulse Sequence	dept135
12	Number of Scans	1000
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-10-31T 16:05:26
18	Modification Date	2013-10-31T 17:08:28
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

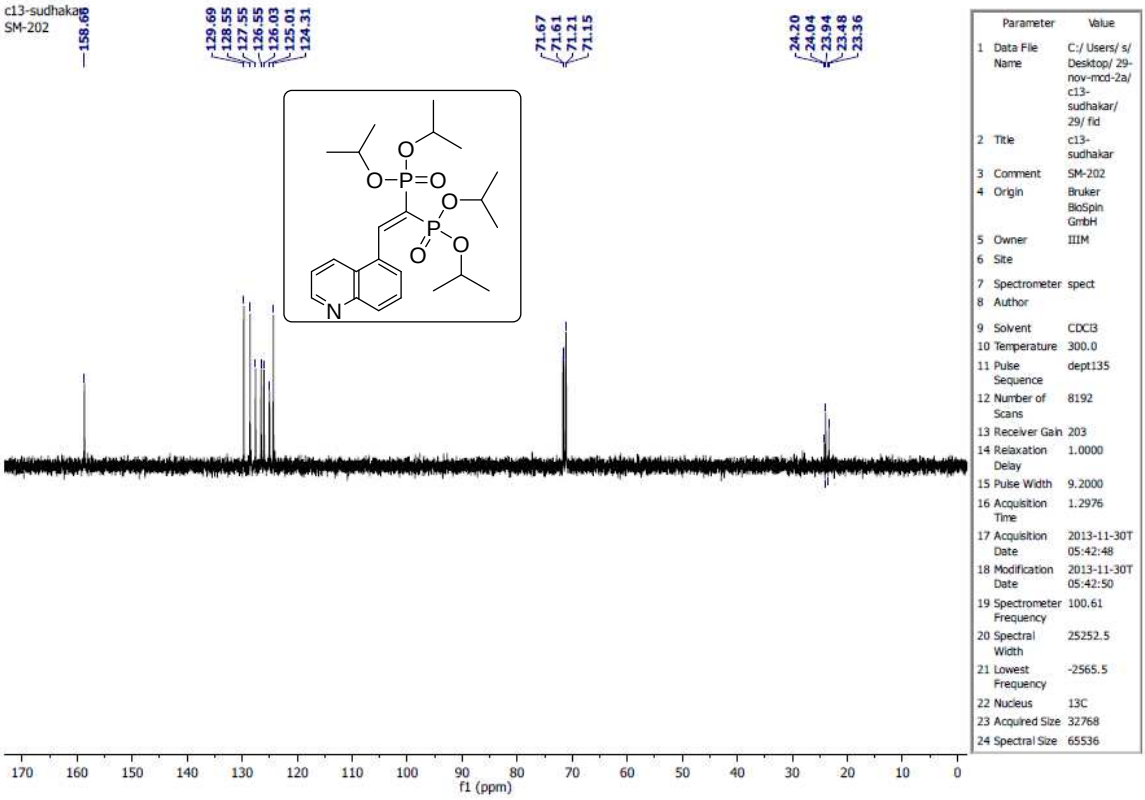


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 04-nov-mcd-2a/ H1/ 39/ fid
2	Title	H1
3	Comment	SM-191(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	17
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-04T1 5:08:33
18	Modification Date	2013-11-04T1 5:08:36
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

18. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraisopropyl2-(quinol-5-yl)ethene-1,1-diyldiphosphonate (6r)







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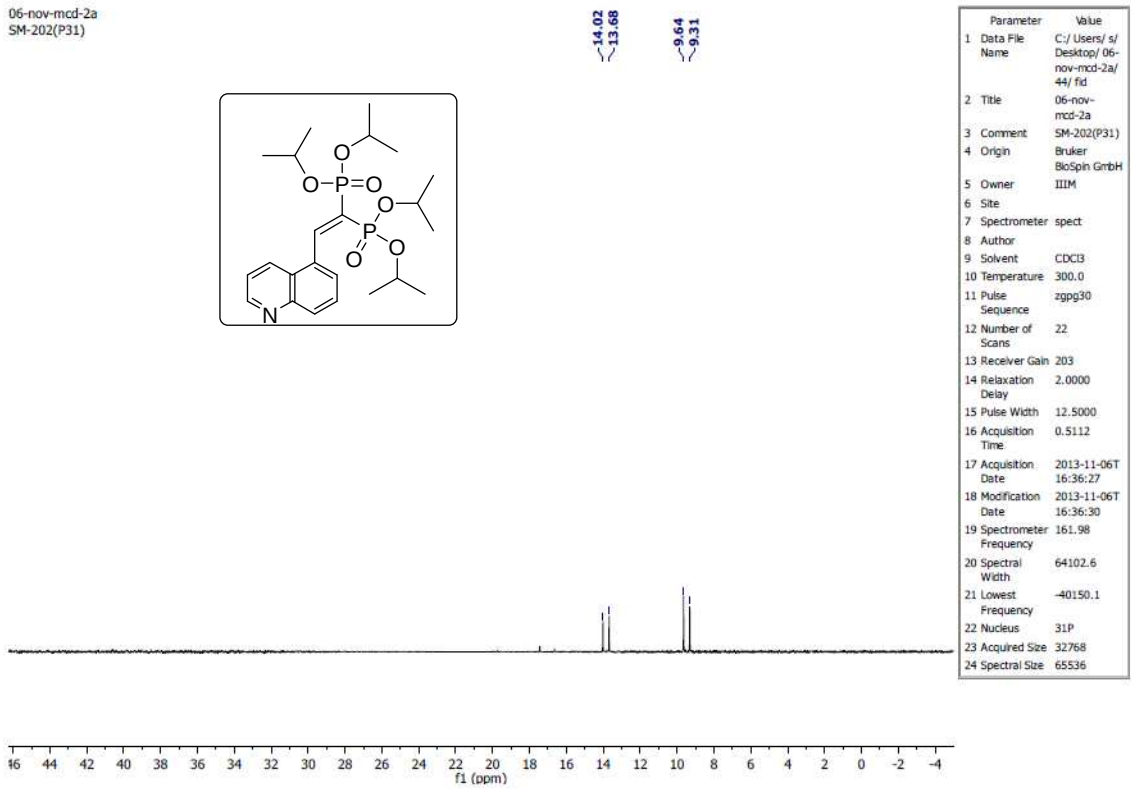
1	Data File Name	C:/ Users/ s/ Desktop/ 29-nov-mcd-2a/ c13-sudhakar/ 29/ fid
2	Title	c13-sudhakar
3	Comment	SM-202
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	8192
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2013-11-30T 05:42:48
18	Modification Date	2013-11-30T 05:42:50
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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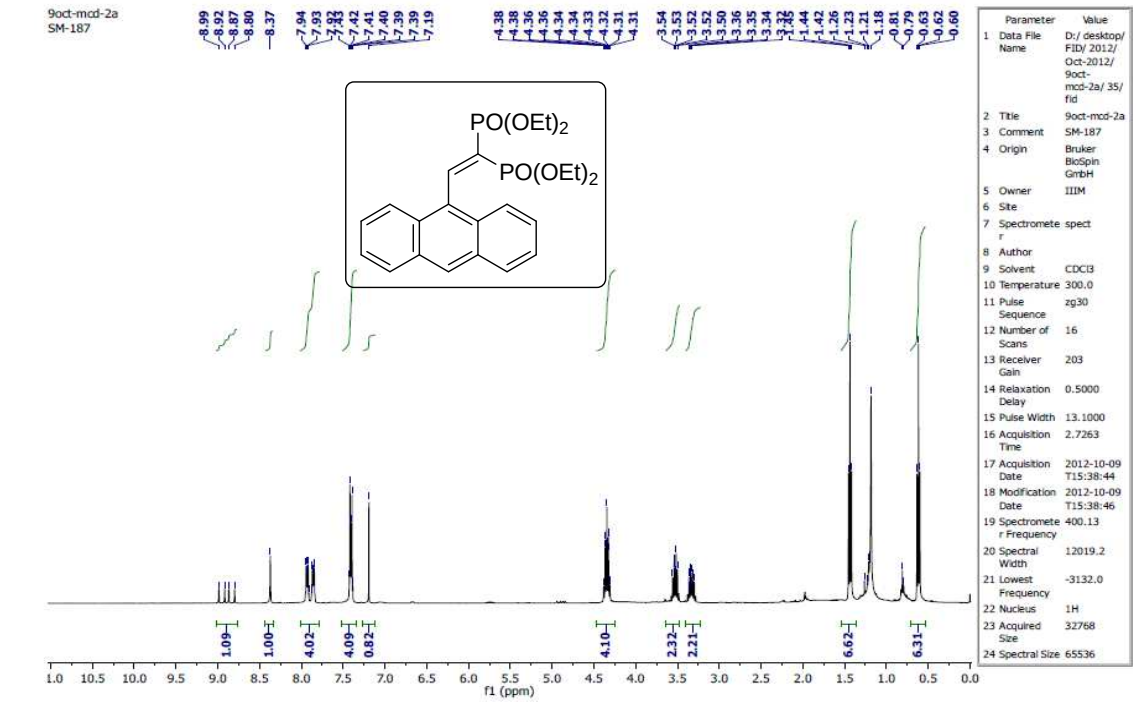
1	Data File Name	C:/ Users/ s/ Desktop/ 06-nov-mcd-2a/ 44/ fid
2	Title	06-nov-mcd-2a
3	Comment	SM-202(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	22
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-06T 16:36:27
18	Modification Date	2013-11-06T 16:36:30
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

19. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of tetraethyl2-(anthracene-10-yl)ethene-1,1-diyldiphosphonate (6s)



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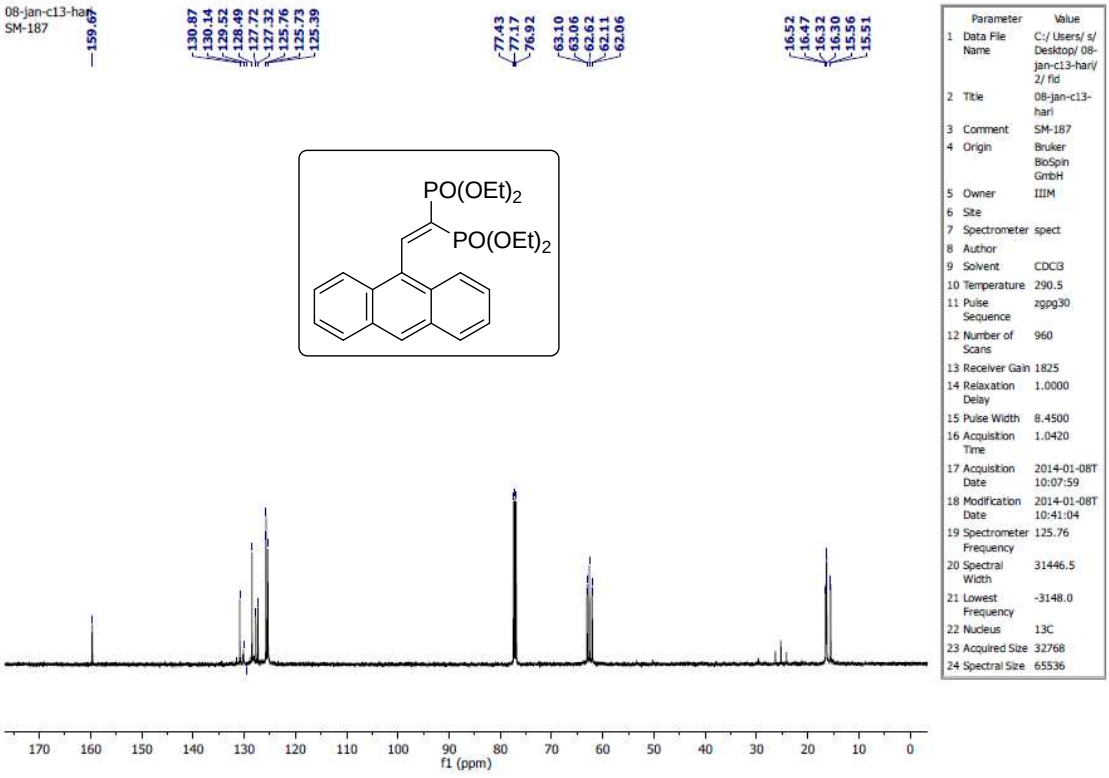
1	Data File Name	D:/ desktop/ FID/ 2012/ Oct-2012/ 9oct-mcd-2a/ 35/ fid
2	Title	9oct-mcd-2a
3	Comment	SM-187
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect r
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-10-09 T15:38:44
18	Modification Date	2012-10-09 T15:38:46
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3132.0
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



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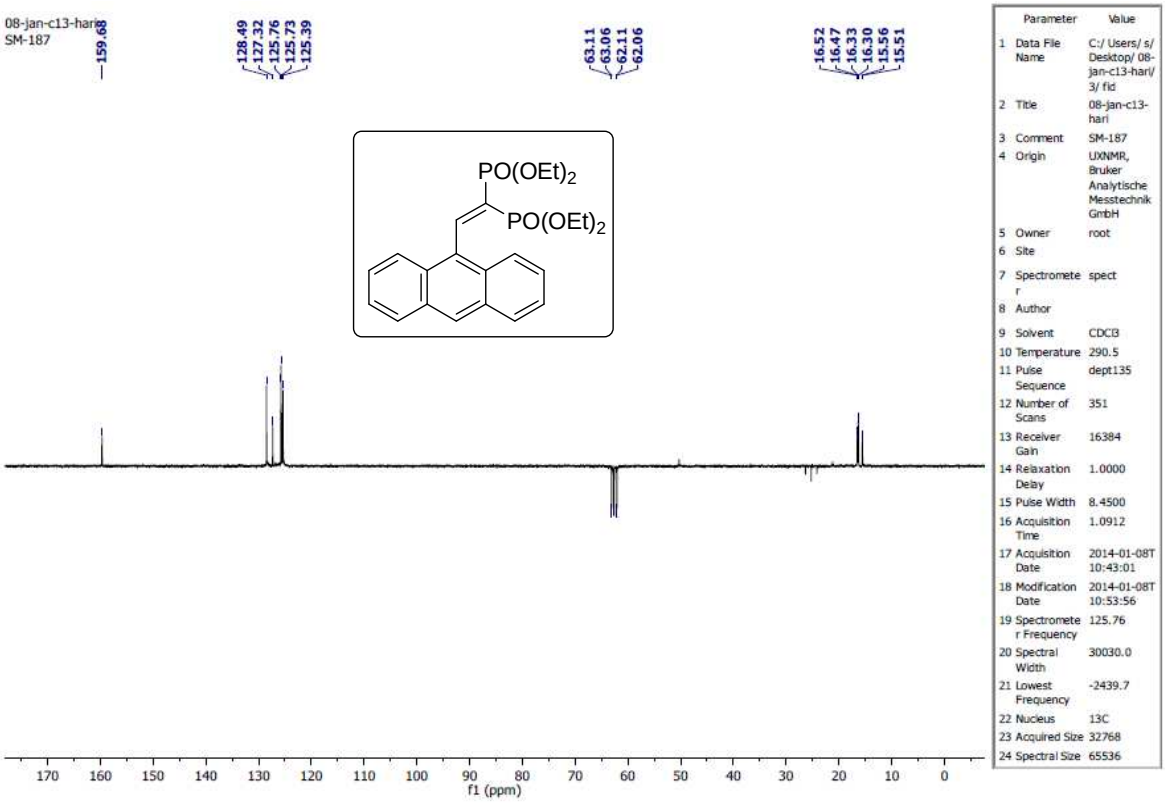
1	Data File Name	C:/ Users/ s/ Desktop/ 08-jan-c13-hari/ 2/ fid
2	Title	08-jan-c13-hari
3	Comment	SM-187
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	290.5
11	Pulse Sequence	zgpg30
12	Number of Scans	960
13	Receiver Gain	1825
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0420
17	Acquisition Date	2014-01-08T 10:07:59
18	Modification Date	2014-01-08T 10:41:04
19	Spectrometer Frequency	125.76
20	Spectral Width	31446.5
21	Lowest Frequency	-3148.0
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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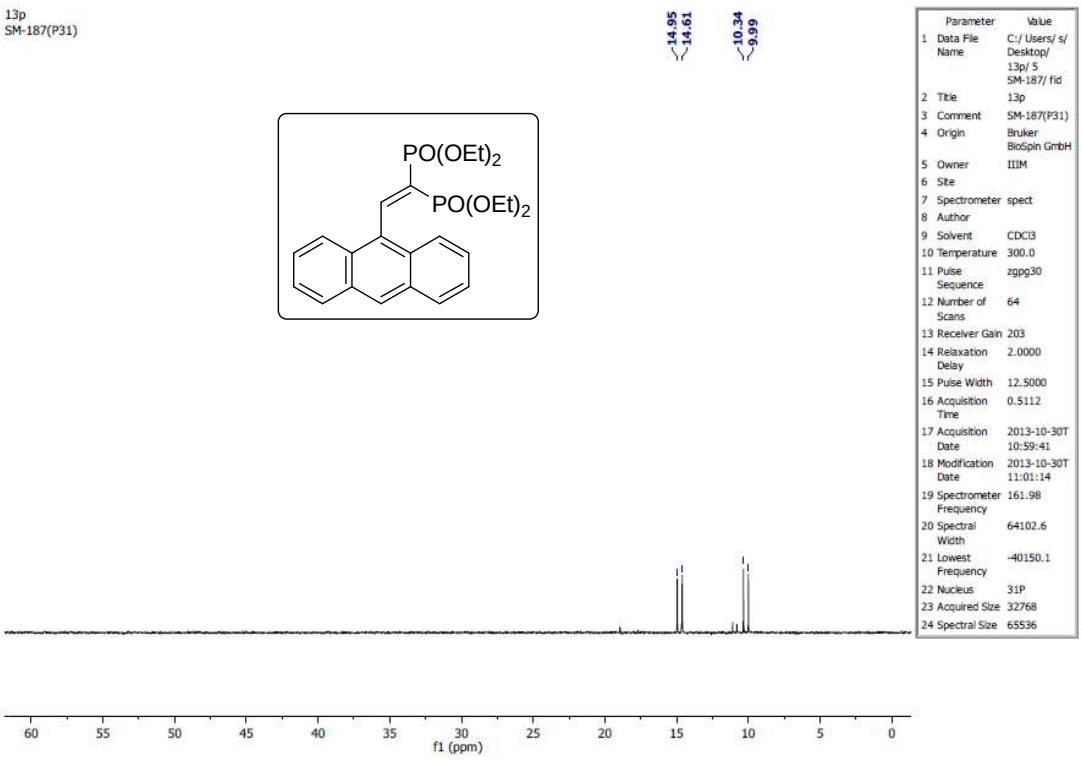
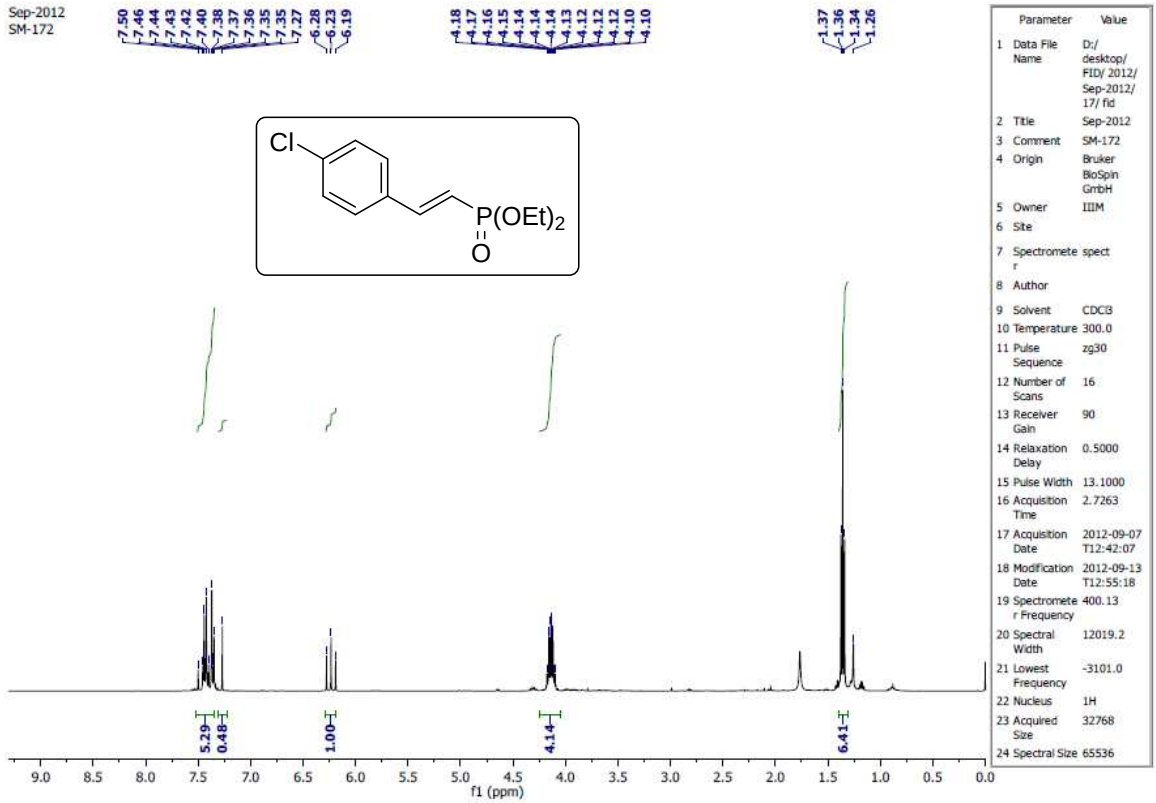
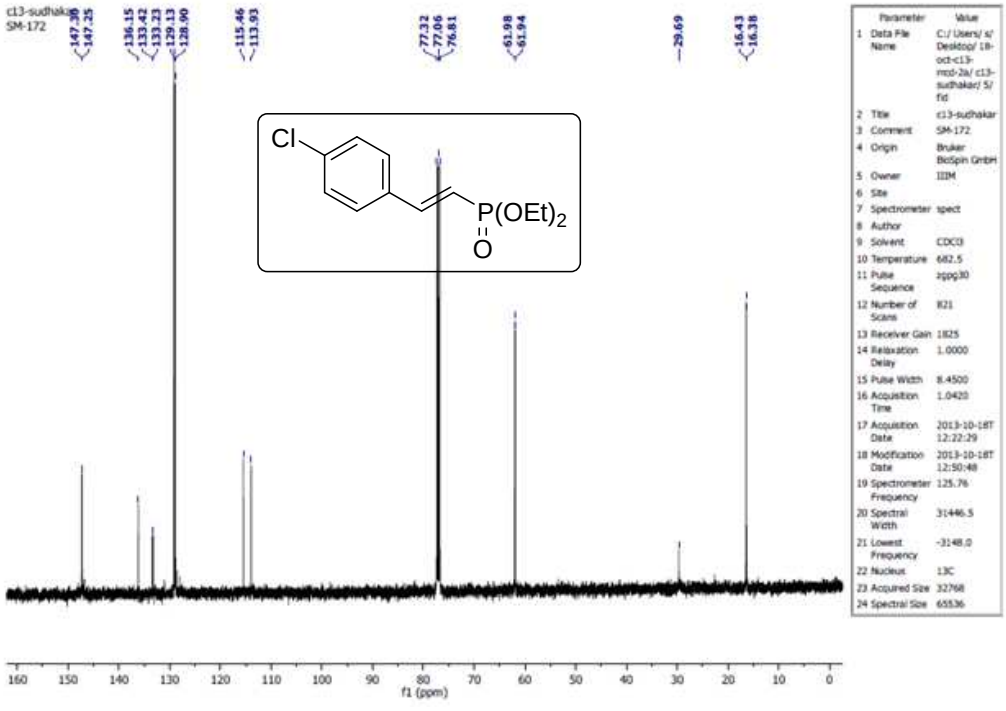
2	Title	08-jan-c13-hari
3	Comment	SM-187
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	290.5
11	Pulse Sequence	dept135
12	Number of Scans	351
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2014-01-08T 10:43:01
18	Modification Date	2014-01-08T 10:53:56
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

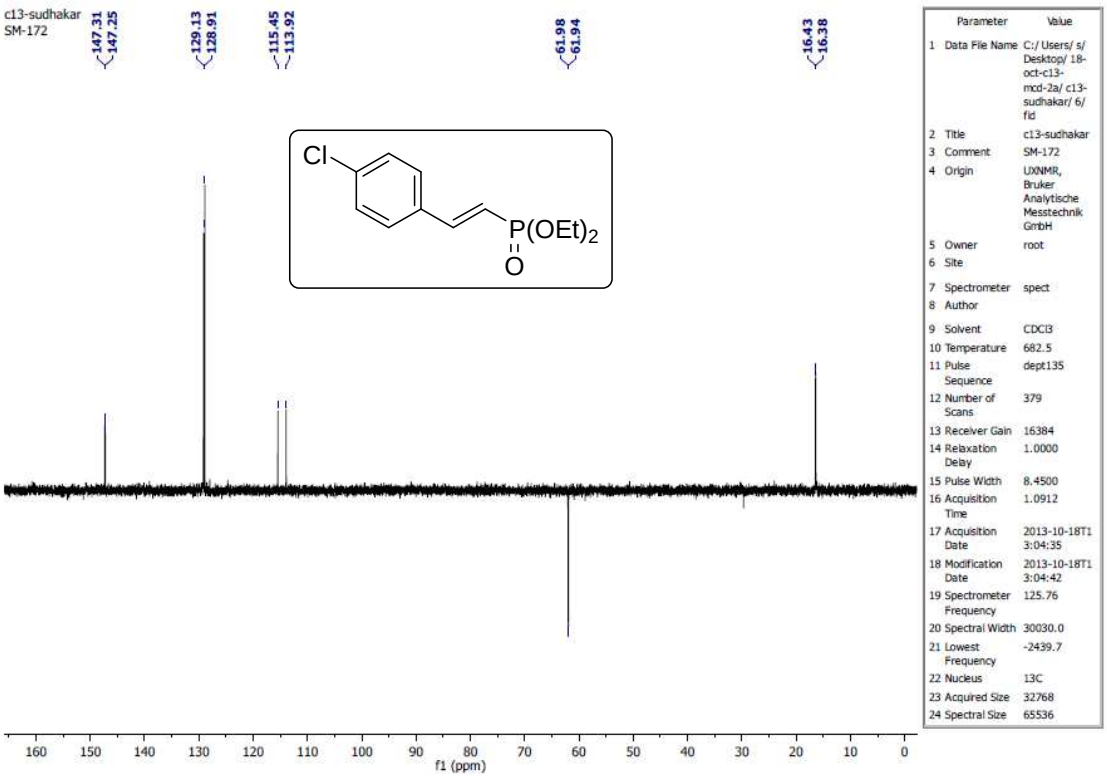


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 13p/ 5 SM-187/ fid
2	Title	13p
3	Comment	SM-187(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	64
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-10-30T 10:59:41
18	Modification Date	2013-10-30T 11:01:14
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

20. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of (E)-diethyl 4-chlorostyrylphosphonate (7a)







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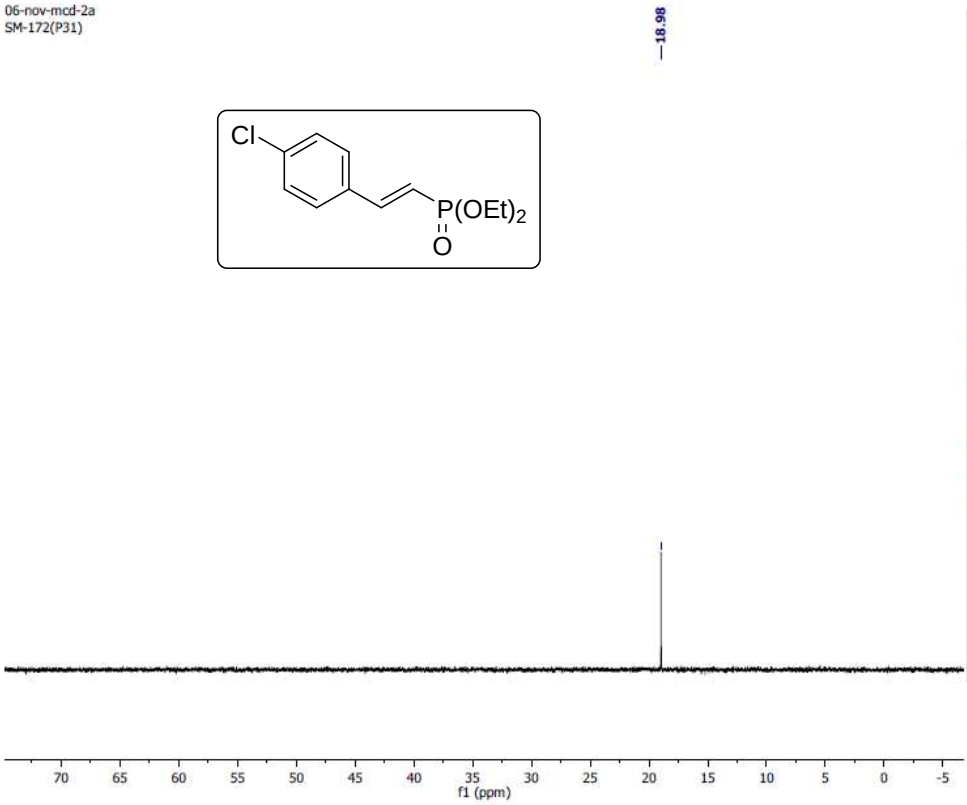
1	Data File Name	C:/ Users/ s/ Desktop/ 18-oct-c13-mcd-2a/ c13-sudhakar/ 6/ fid
2	Title	c13-sudhakar
3	Comment	SM-172
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.5
11	Pulse Sequence	dept135
12	Number of Scans	379
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-10-18T13:04:35
18	Modification Date	2013-10-18T13:04:42
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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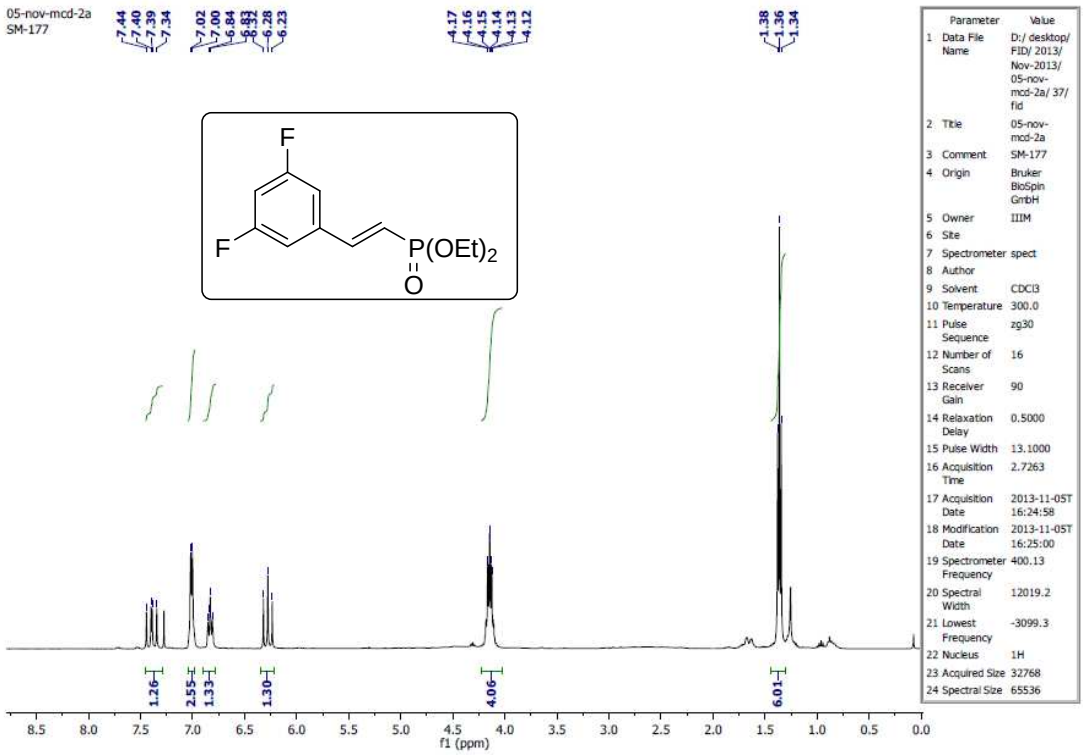
1	Data File Name	C:/ Users/ s/ Desktop/ 06-nov-mcd-2a/ 43/ fid
2	Title	06-nov-mcd-2a
3	Comment	SM-172(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-06T16:31:37
18	Modification Date	2013-11-06T16:31:38
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

21. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of (E)-diethyl 3, 5-difluoro styrylphosphonate (7b)



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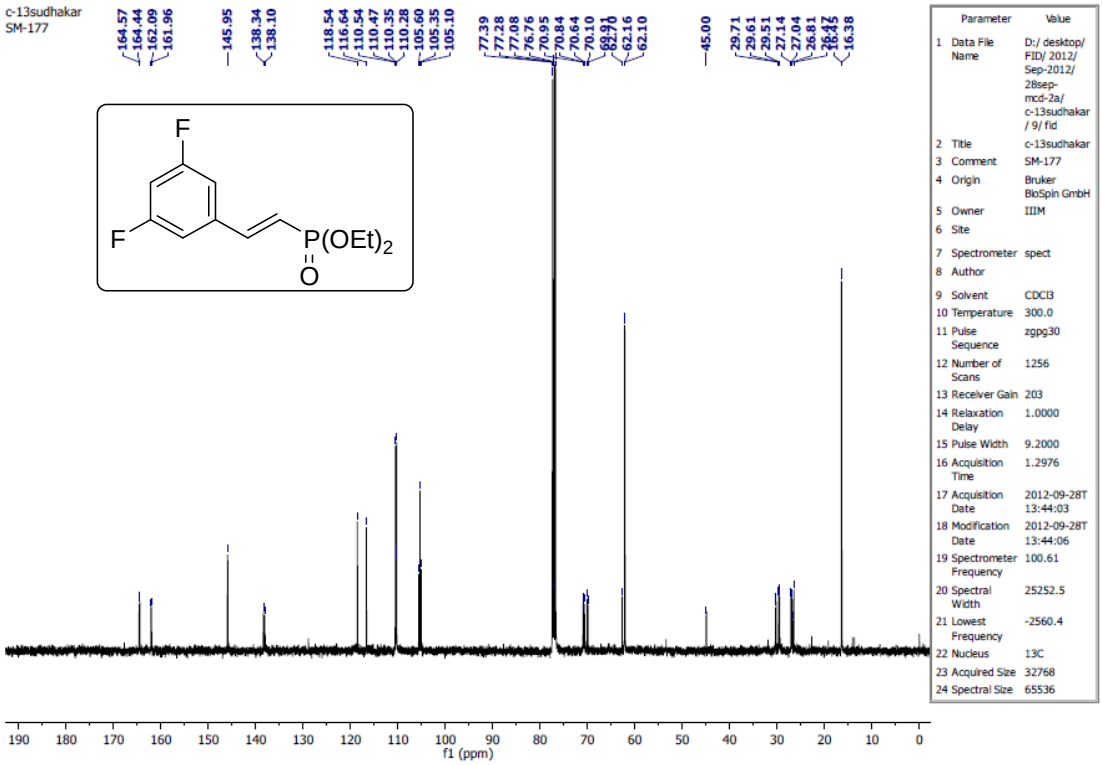
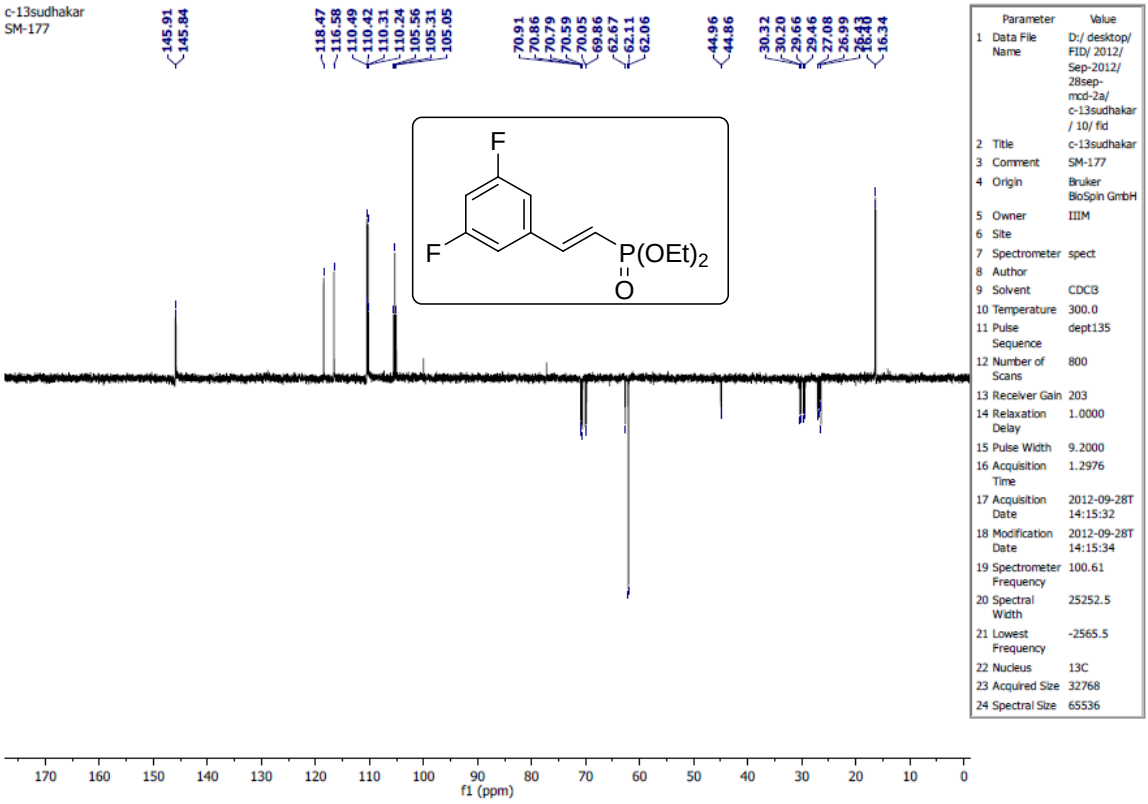
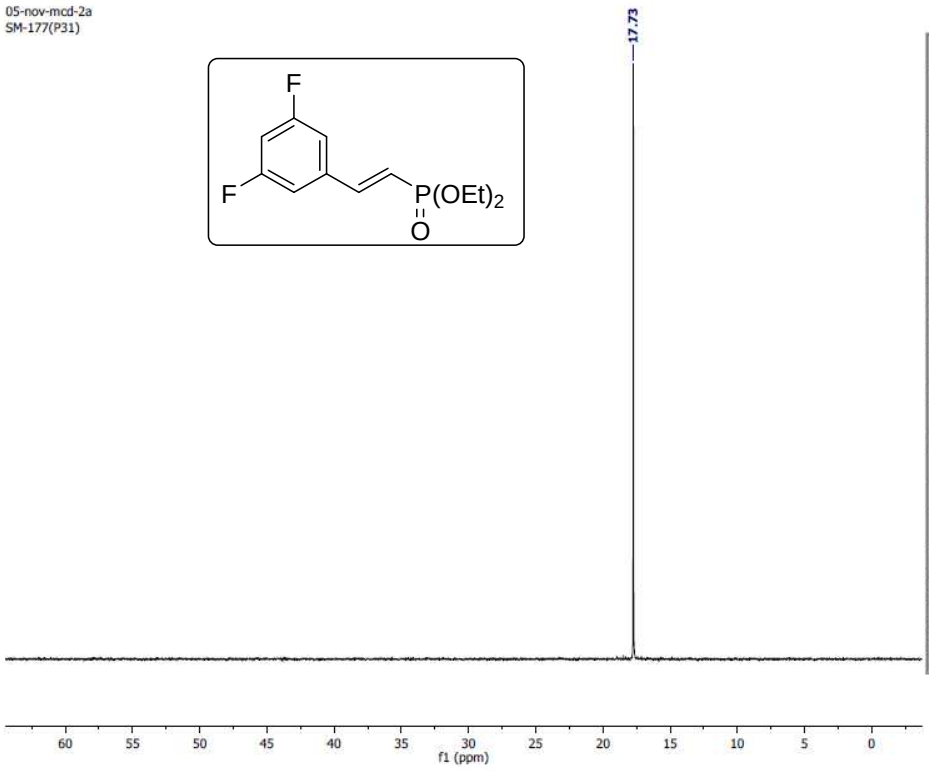
1	Data File Name	D:/ desktop/ FID/ 2013/ Nov-2013/ 05-nov-mcd-2a/ 37/ fid
2	Title	05-nov-mcd-2a
3	Comment	SM-177
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	90
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2013-11-05T 16:24:58
18	Modification Date	2013-11-05T 16:25:00
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3099.3
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Sep-2012/ 28sep-mcd-2a/ c-13sudhakar / 9/ fid
2	Title	c-13sudhakar
3	Comment	SM-177
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	1256
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2012-09-28T 13:44:03
18	Modification Date	2012-09-28T 13:44:06
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2560.4
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Sep-2012/ 28sep-mcd-2a/ c-13sudhakar / 10/ fid
2	Title	c-13sudhakar
3	Comment	SM-177
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	800
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2012-09-28T 14:15:32
18	Modification Date	2012-09-28T 14:15:34
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



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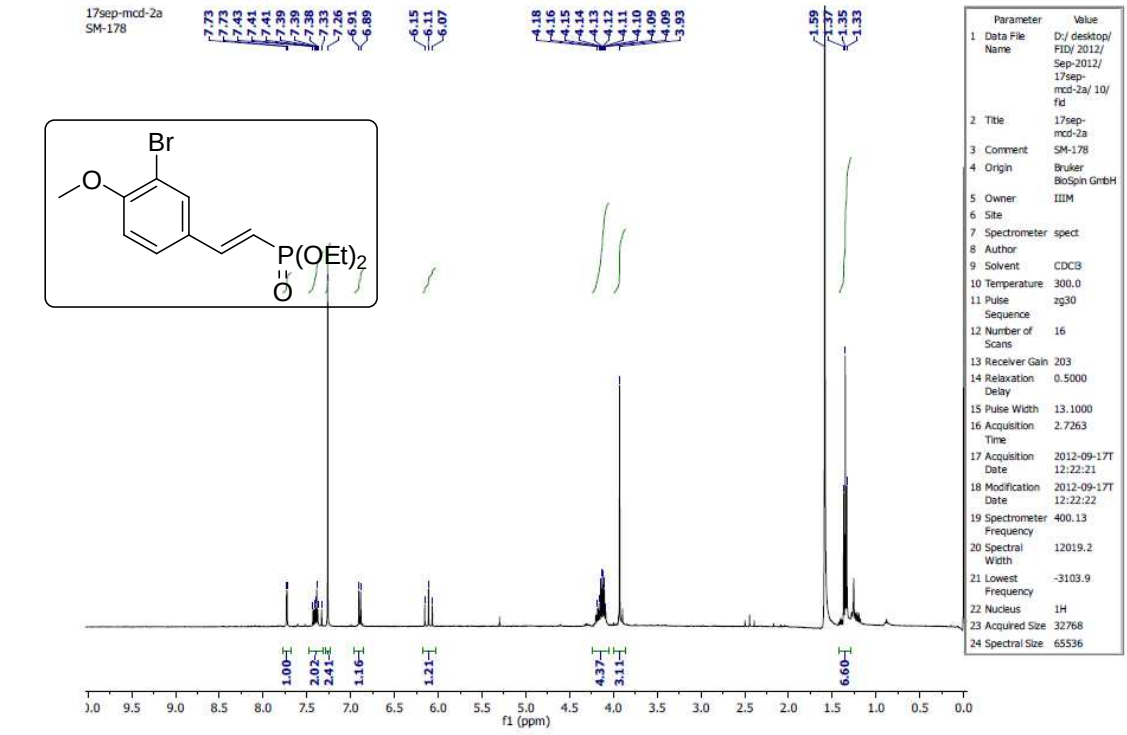
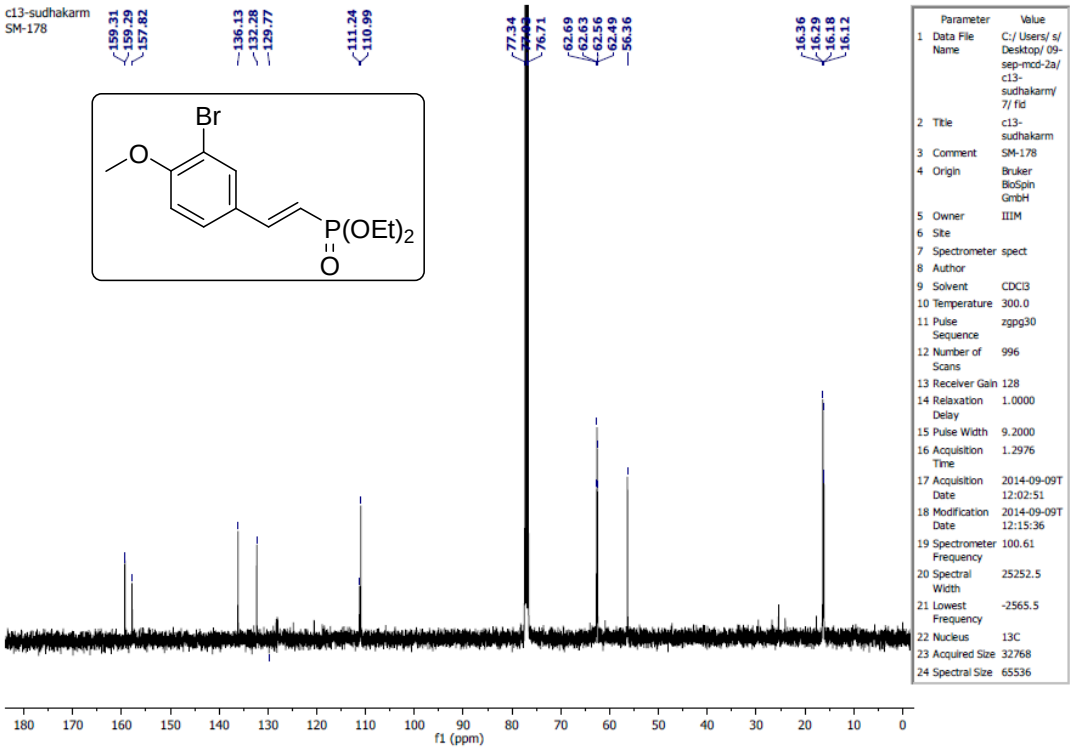
1	Data File Name	C:/ Users/ s/ Desktop/ 05-nov-mcd-2a/ 36/ fid
2	Title	05-nov-mcd-2a
3	Comment	SM-177(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	14
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-05T1 6:21:16
18	Modification Date	2013-11-05T1 6:21:18
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

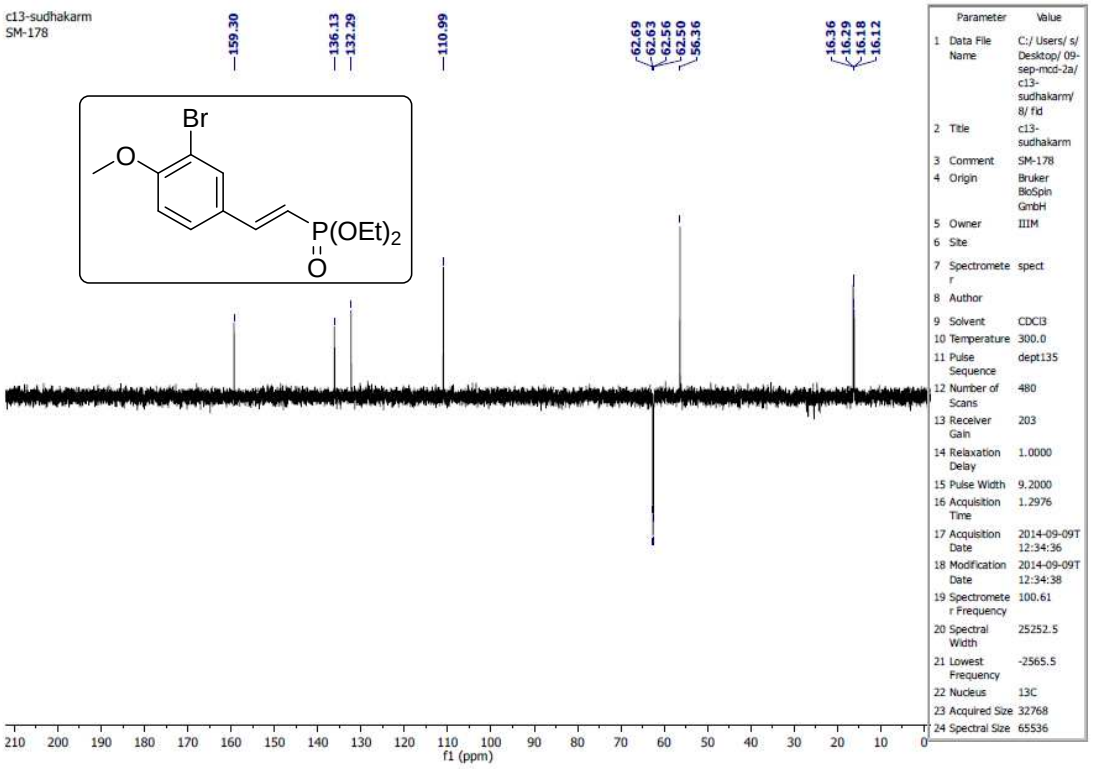
22. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of (E)-diethyl 3-bromo 4-methoxystyrylphosphonate (7c)



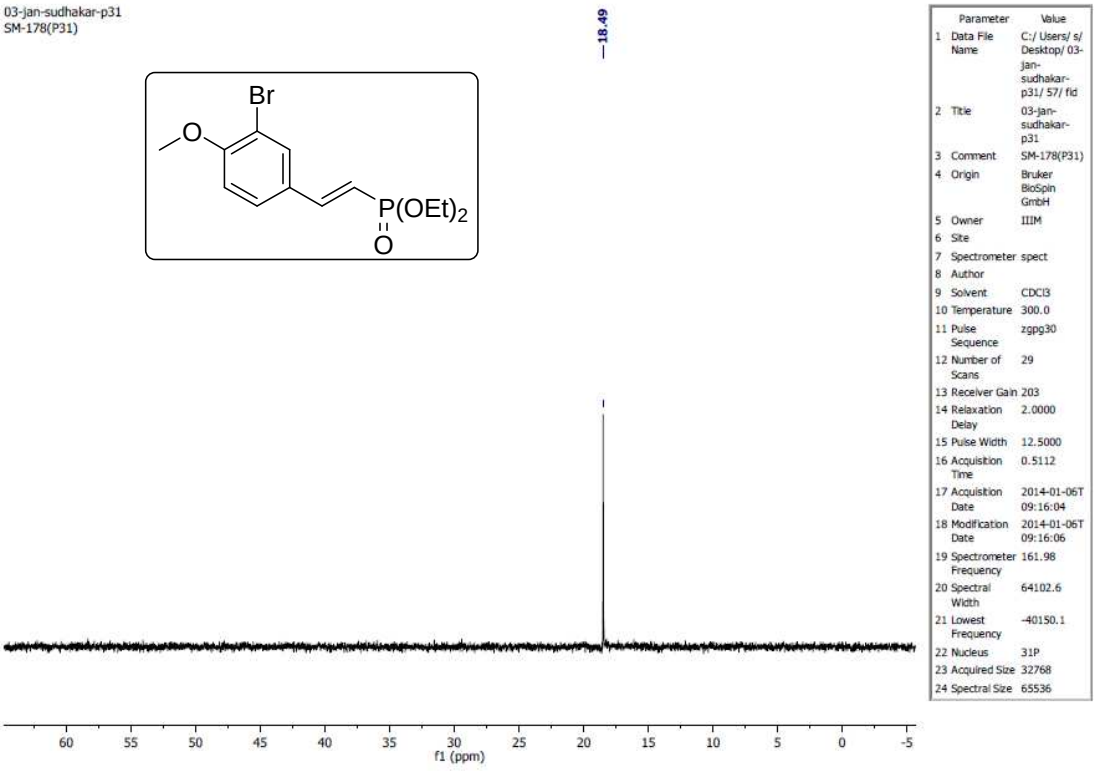
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Sep-2012/ 17sep-mcd-2a/ 10/ fid
2	Title	17sep-mcd-2a
3	Comment	SM-178
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	203
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-09-17T 12:22:21
18	Modification Date	2012-09-17T 12:22:22
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3103.9
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 09-sep-mcd-2a/ c13-sudhakarm/ 7/ fid
2	Title	c13-sudhakarm
3	Comment	SM-178
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	996
13	Receiver Gain	128
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2014-09-09T 12:02:51
18	Modification Date	2014-09-09T 12:15:36
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

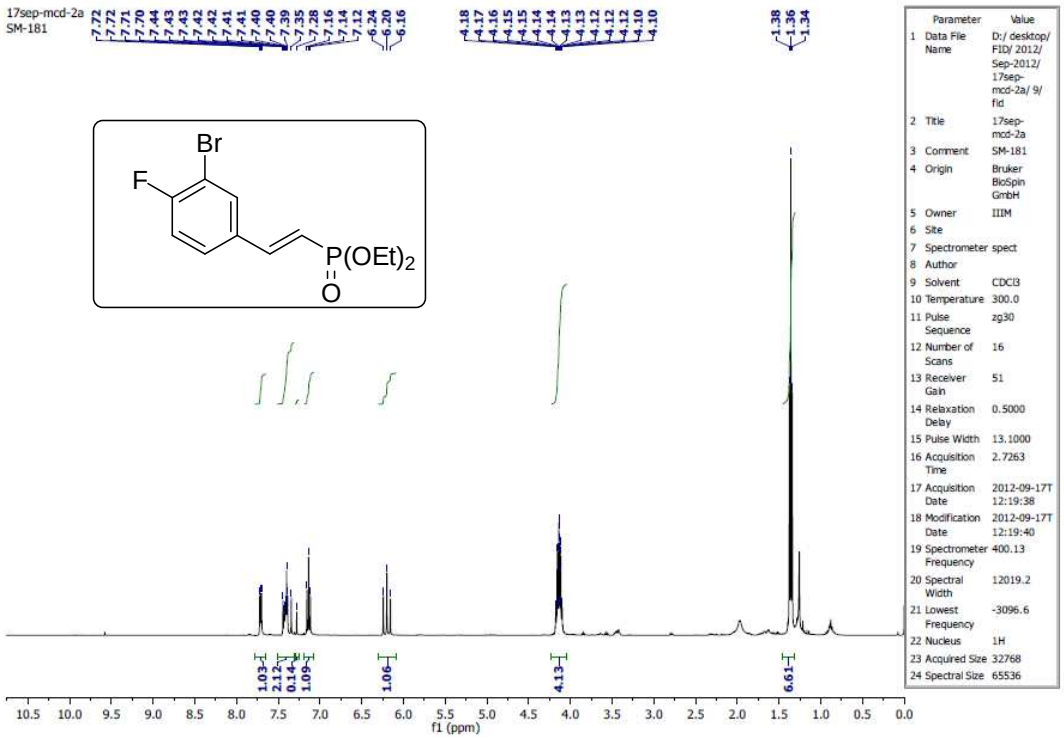


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 09-sep-mcd-2a/ c13-sudhakarm/ 8/ fid
2	Title	c13-sudhakarm
3	Comment	SM-178
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	480
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2014-09-09T 12:34:36
18	Modification Date	2014-09-09T 12:34:38
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

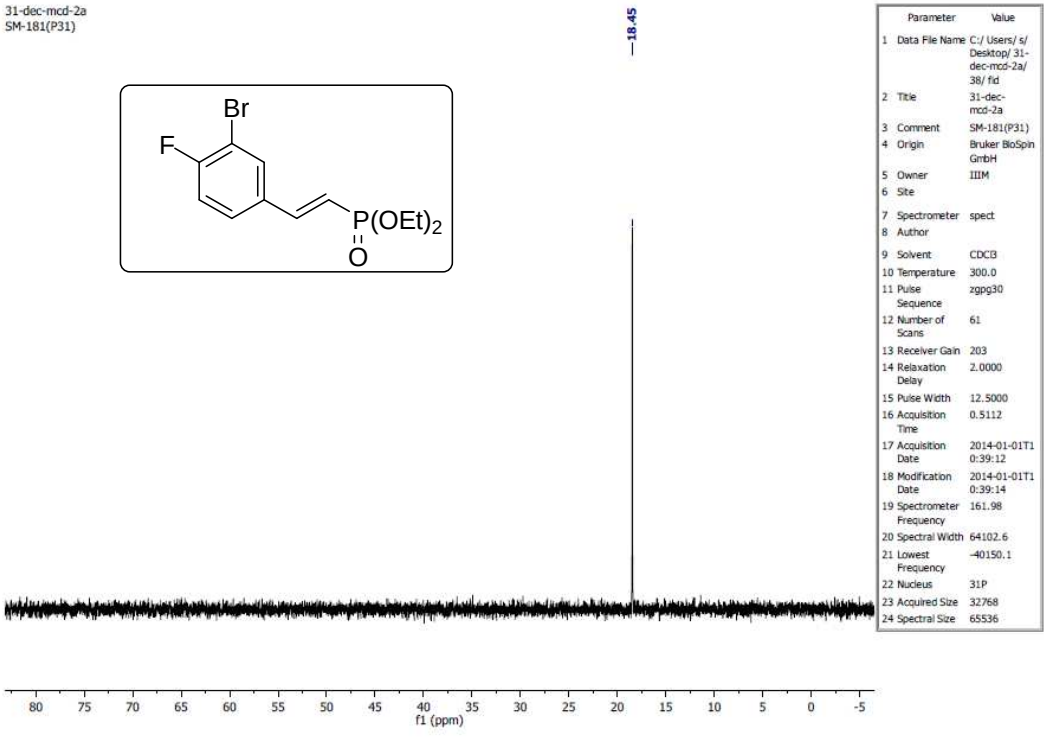


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 03-jan-sudhakar-p31/ 57/ fid
2	Title	03-jan-sudhakar-p31
3	Comment	SM-178(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	29
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2014-01-06T 09:16:04
18	Modification Date	2014-01-06T 09:16:06
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

23. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of (E)-diethyl 3-bromo-4-fluorostyrylphosphonate (7d)

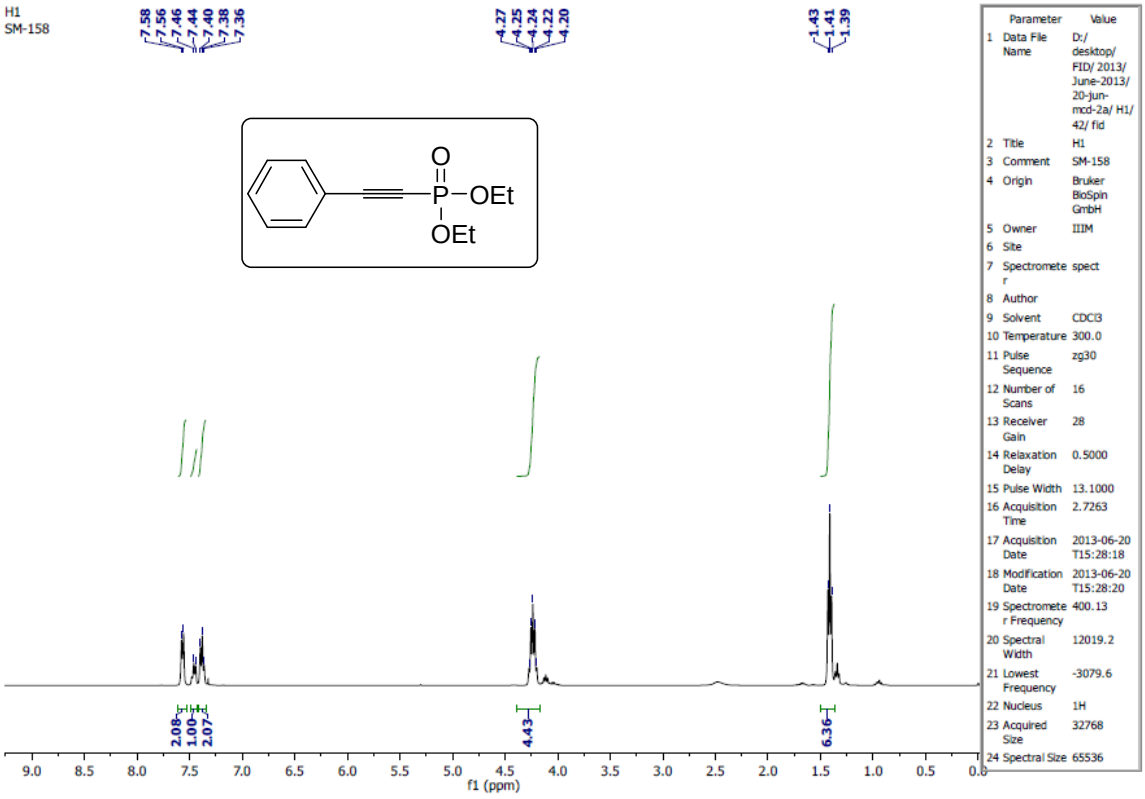


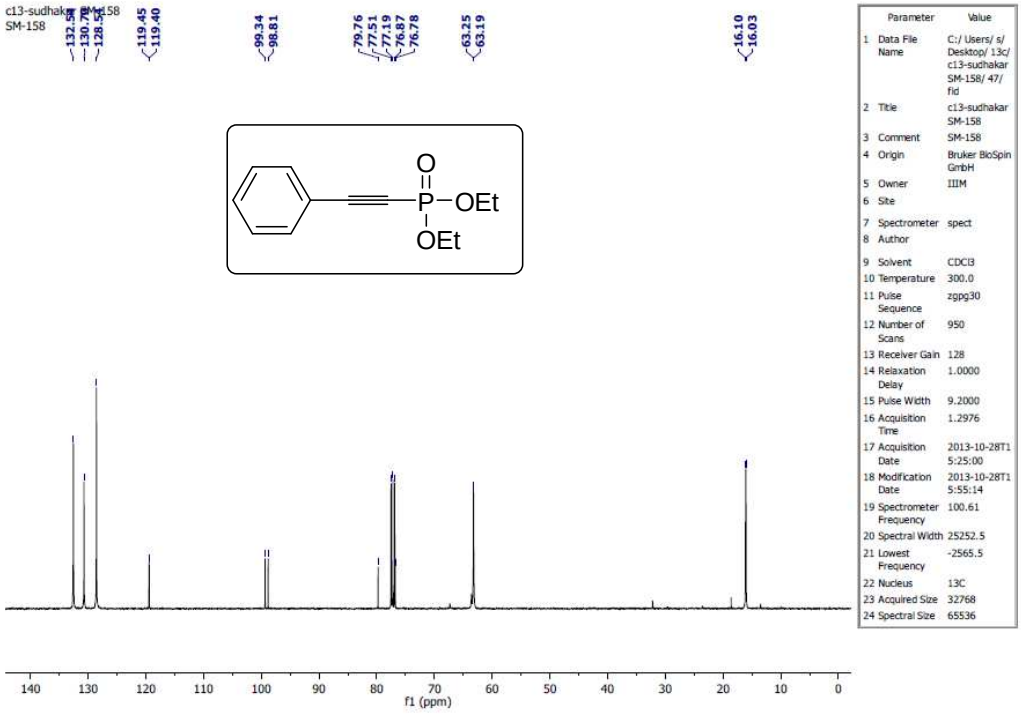
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2012/ Sep-2012/ 17sep-mcd-2a/ 9/ fid
2	Title	17sep-mcd-2a
3	Comment	SM-181
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	51
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2012-09-17T 12:19:38
18	Modification Date	2012-09-17T 12:19:40
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3096.6
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536

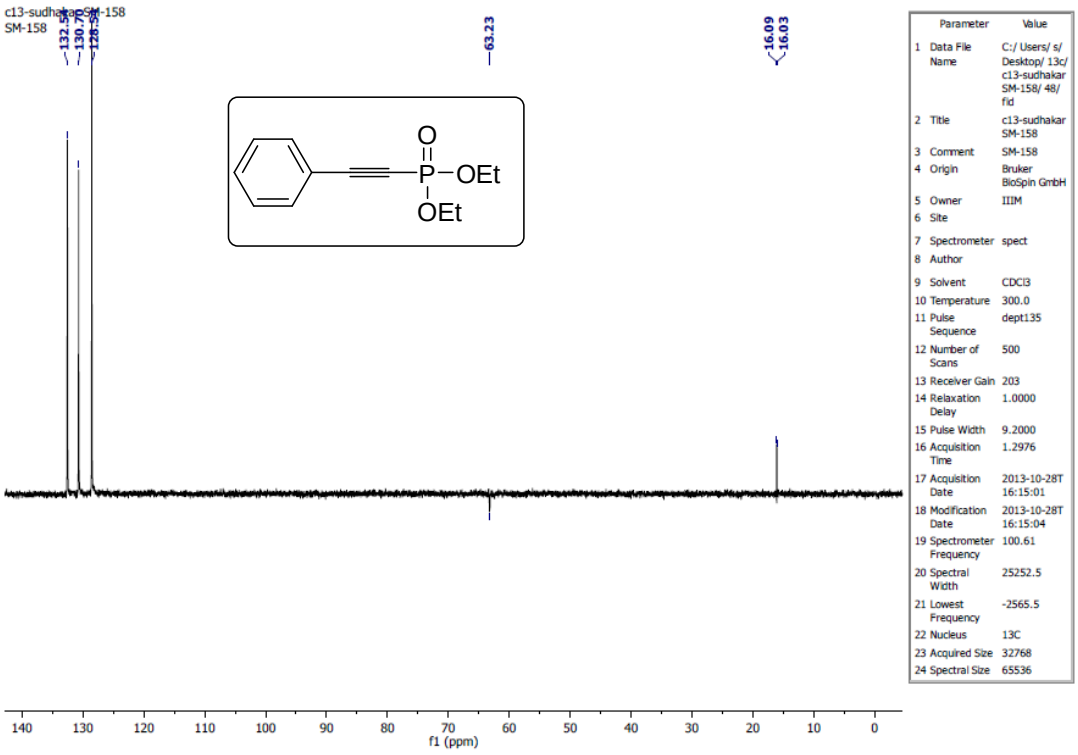


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 31-dec-mcd-2a/ 38/ fid
2	Title	31-dec-mcd-2a
3	Comment	SM-181(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	61
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2014-01-01T1 0:39:12
18	Modification Date	2014-01-01T1 0:39:14
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

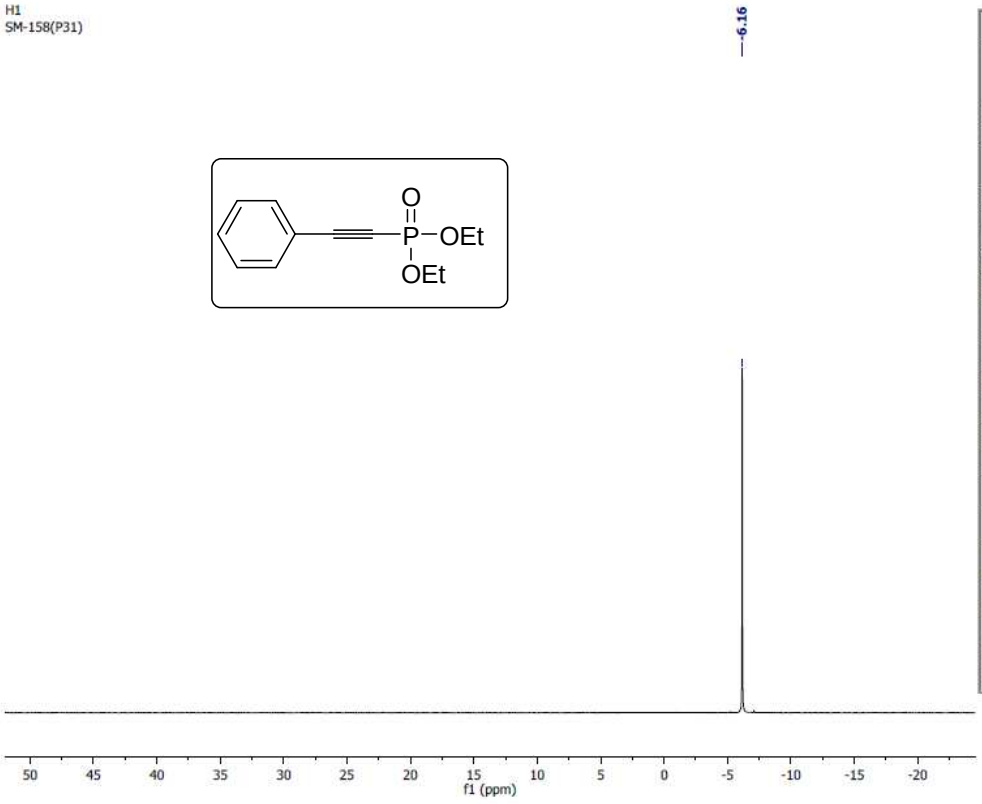
24. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of diethyl 2-phenylethynylphosphonate (8a)





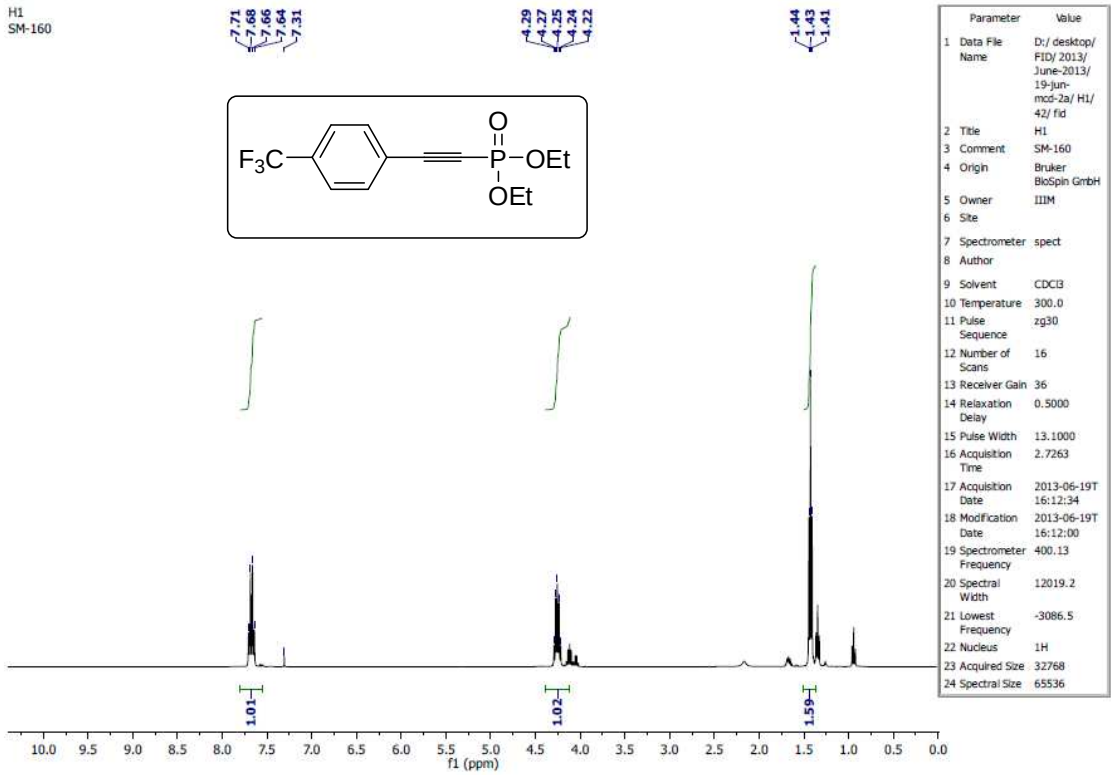


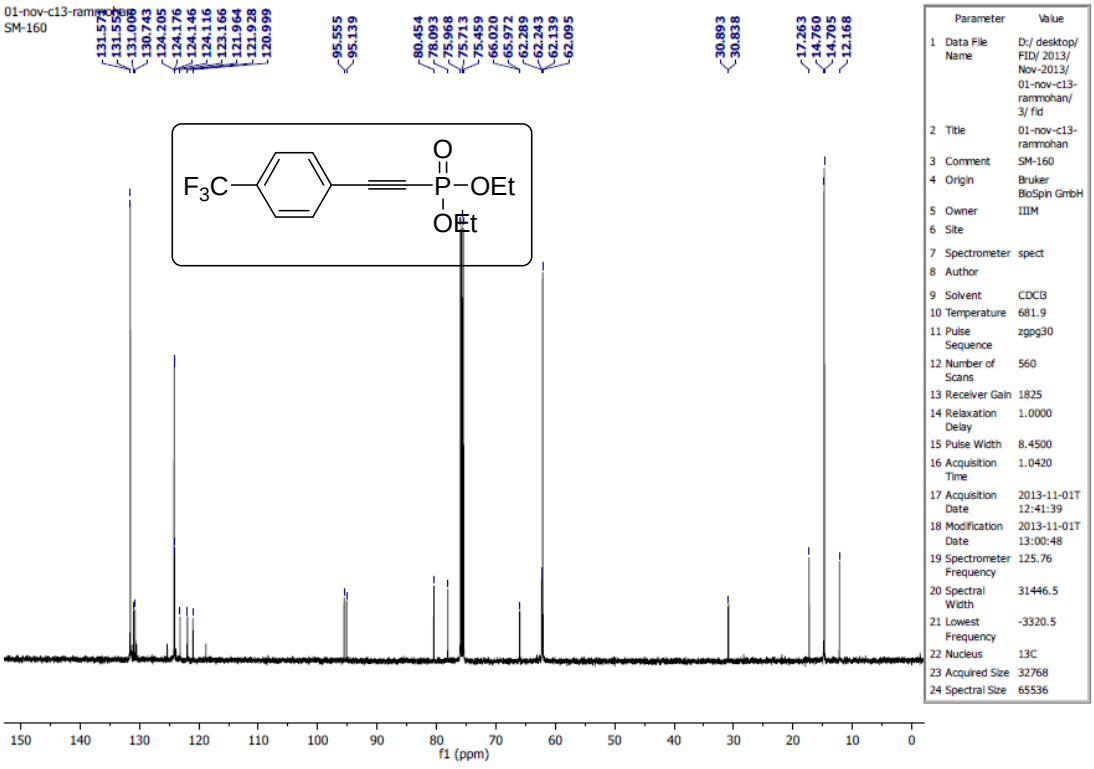
	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 13c/ c13-sudhakar SM-158/ 48/ fid
2	Title	c13-sudhakar SM-158
3	Comment	SM-158
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	500
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2976
17	Acquisition Date	2013-10-28T 16:15:01
18	Modification Date	2013-10-28T 16:15:04
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2565.5
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

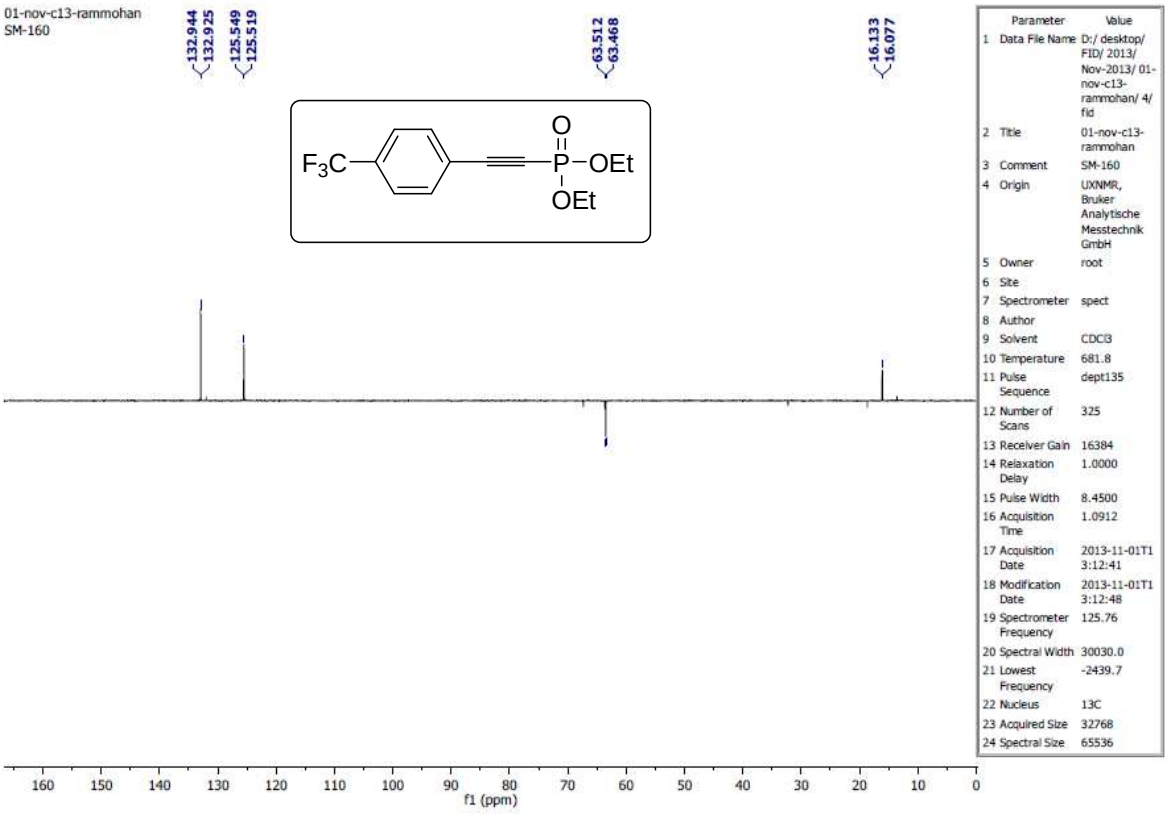


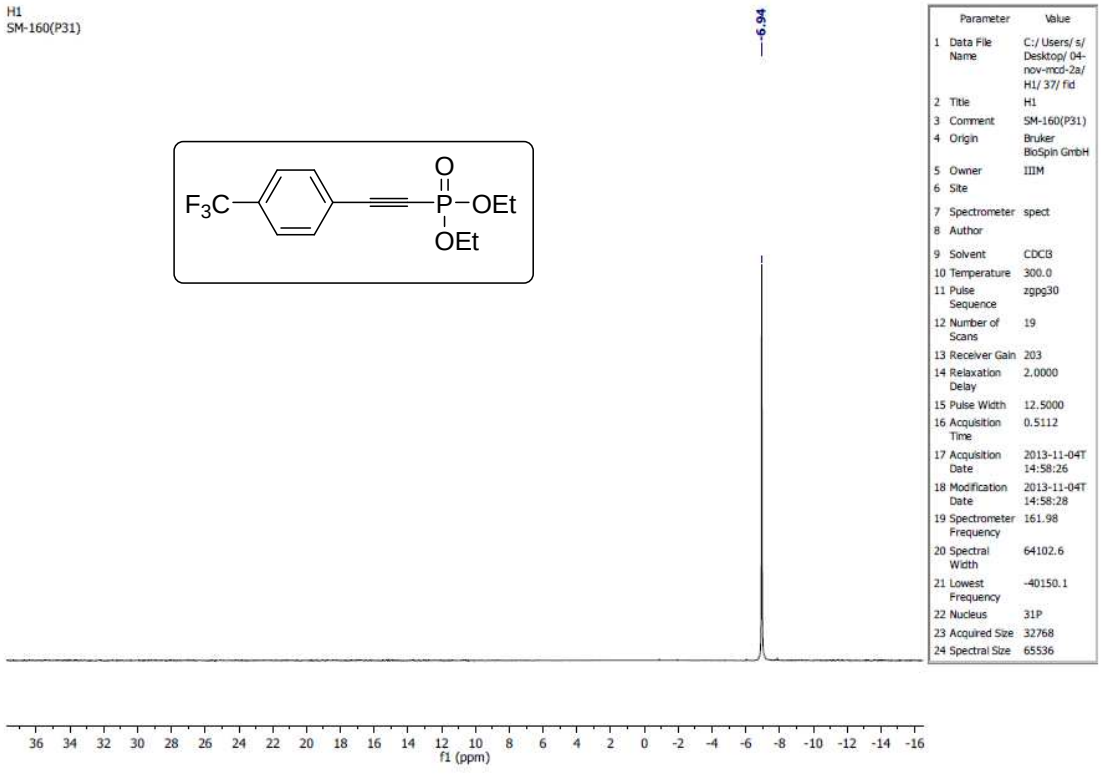
	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 04-nov-mcd-2a/ H1/ 36/ fid
2	Title	H1
3	Comment	SM-158(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	22
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-04T 14:52:35
18	Modification Date	2013-11-04T 14:52:36
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

25. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of diethyl-2-(4-(trifluoromethyl)pheny)lethynylphosphonate (8b)

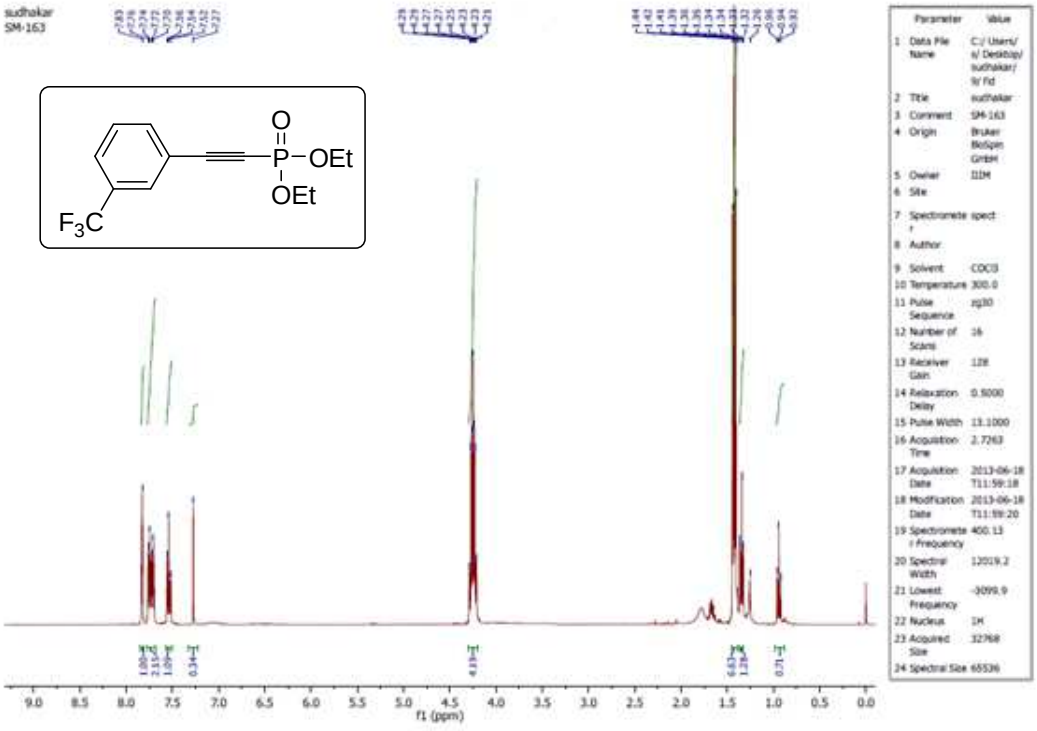




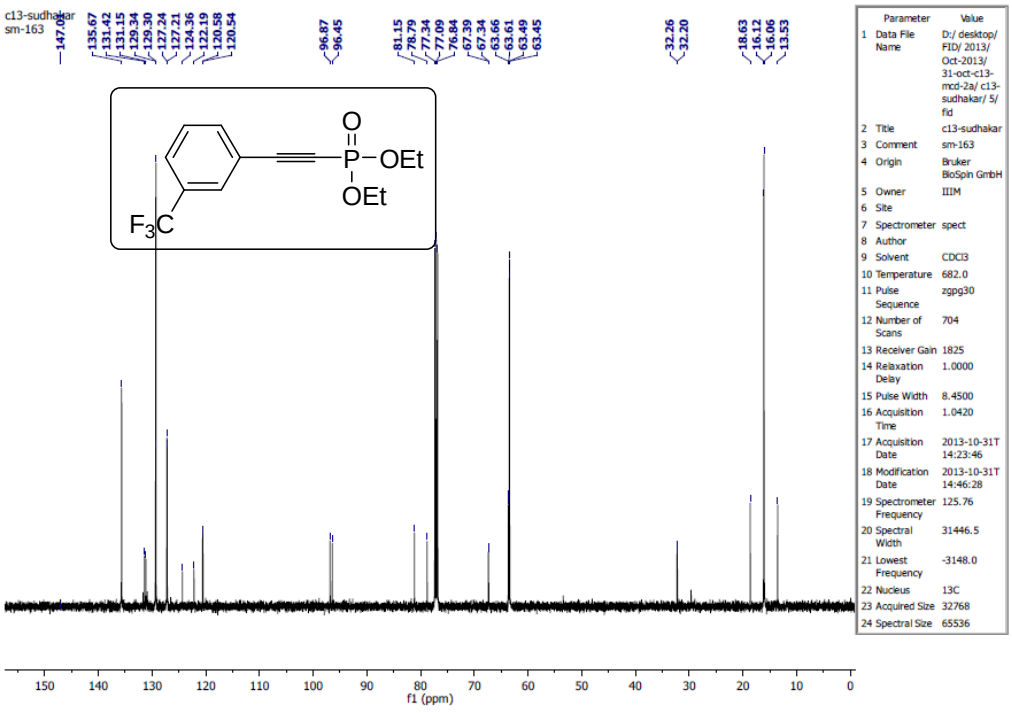

01-nov-c13-rammohan
SM-160
132.944
132.925
125.549
125.519
63.512
63.468
16.133
16.077
F3C
O
P
OEt
OEt
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)
Parameter Value
1 Data File Name D:/ desktop/ FID/ 2013/ Nov-2013/ 01-nov-c13-rammohan/ 4/ fid
2 Title 01-nov-c13-rammohan
3 Comment SM-160
4 Origin UXNMR, Bruker Analytische Messtechnik GmbH
5 Owner root
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 681.8
11 Pulse Sequence dept135
12 Number of Scans 325
13 Receiver Gain 16384
14 Relaxation Delay 1.0000
15 Pulse Width 8.4500
16 Acquisition Time 1.0912
17 Acquisition Date 2013-11-01T13:12:41
18 Modification Date 2013-11-01T13:12:48
19 Spectrometer Frequency 125.76
20 Spectral Width 30030.0
21 Lowest Frequency -2439.7
22 Nucleus 13C
23 Acquired Size 32768
24 Spectral Size 65536


H1
SM-160(P31)
6.94
F3C
O
P
OEt
OEt
36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12 -14 -16
f1 (ppm)
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 04-nov-mcd-2a/ H1/ 37/ fid
2 Title H1
3 Comment SM-160(P31)
4 Origin Bruker BioSpin GmbH
5 Owner IIIM
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 300.0
11 Pulse Sequence zgpg30
12 Number of Scans 19
13 Receiver Gain 203
14 Relaxation Delay 2.0000
15 Pulse Width 12.5000
16 Acquisition Time 0.5112
17 Acquisition Date 2013-11-04T14:58:26
18 Modification Date 2013-11-04T14:58:28
19 Spectrometer Frequency 161.98
20 Spectral Width 64102.6
21 Lowest Frequency -40150.1
22 Nucleus 31P
23 Acquired Size 32768
24 Spectral Size 65536

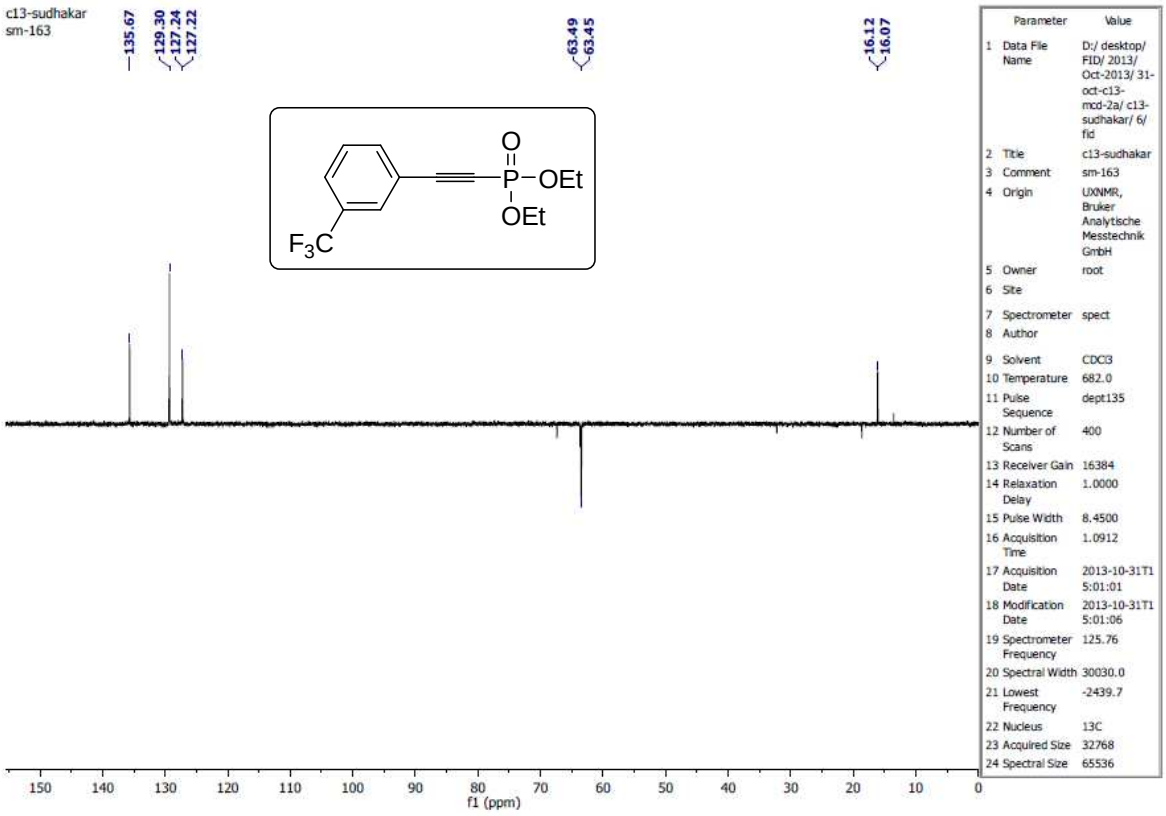
26. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of diethyl2-(3-(trifluoromethyl)pheny)lethynylphosphonate (8c)

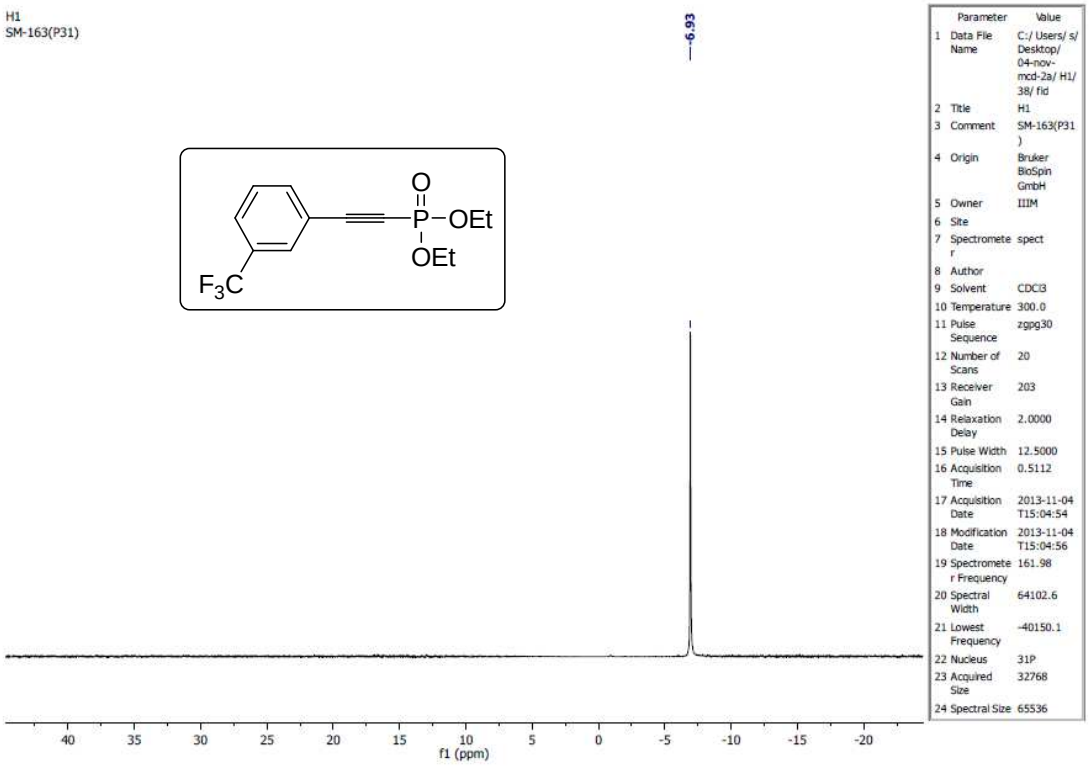


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ sudhakar/ ly/ fid
2	Title	sudhakar
3	Comment	SM-163
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect r
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zg30
12	Number of Scans	16
13	Receiver Gain	128
14	Relaxation Delay	0.5000
15	Pulse Width	13.1000
16	Acquisition Time	2.7263
17	Acquisition Date	2013-06-18 T11:59:18
18	Modification Date	2013-06-18 T11:59:20
19	Spectrometer Frequency	400.13
20	Spectral Width	12019.2
21	Lowest Frequency	-3099.9
22	Nucleus	1H
23	Acquired Size	32768
24	Spectral Size	65536

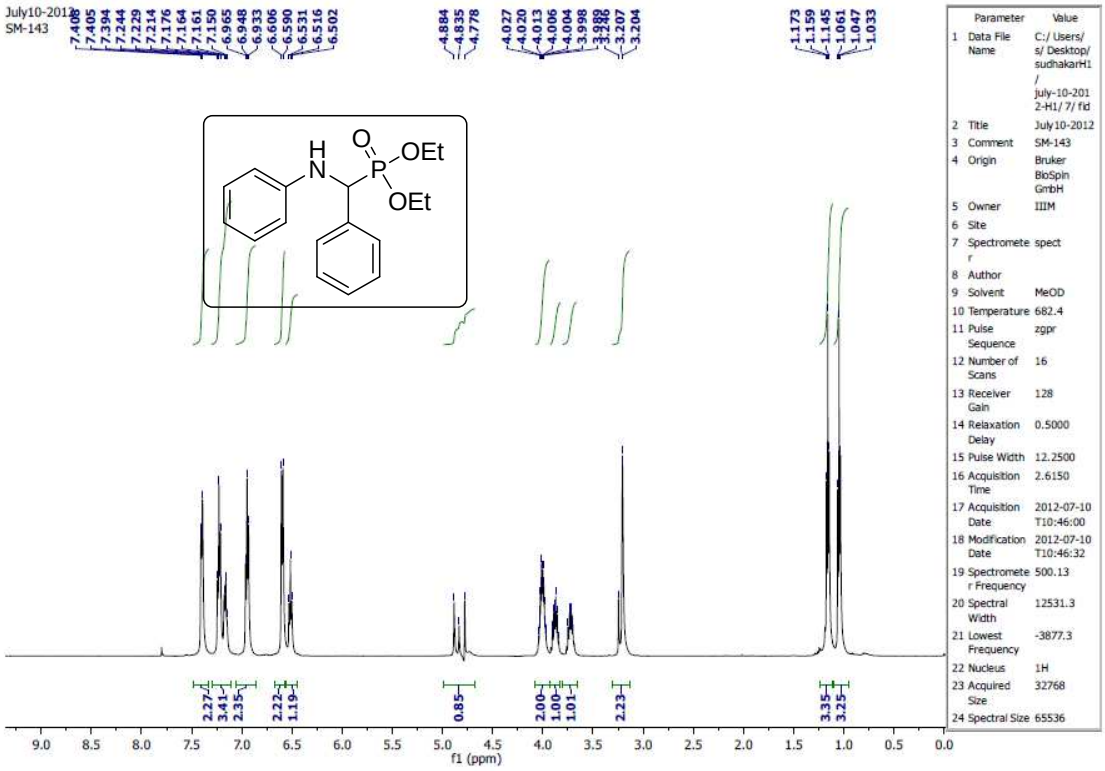


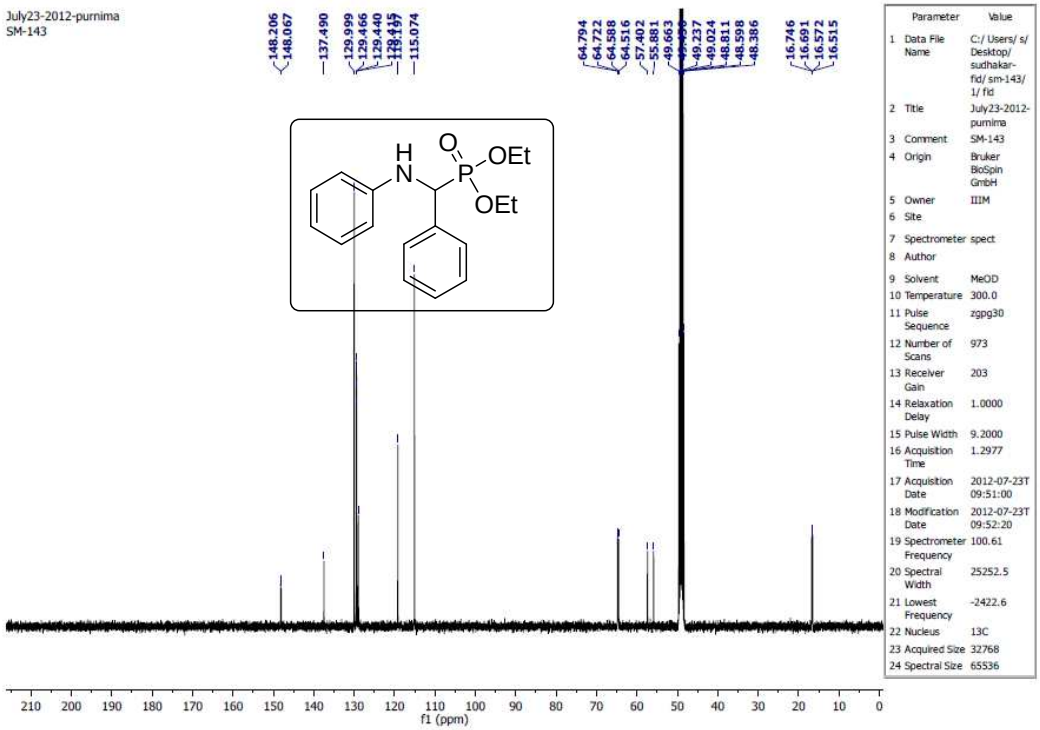
	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2013/ Oct-2013/ 31-oct-c13-mcd-2a/ c13-sudhakar/ 5/ fid
2	Title	c13-sudhakar
3	Comment	sm-163
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	682.0
11	Pulse Sequence	zgpg30
12	Number of Scans	704
13	Receiver Gain	1825
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0420
17	Acquisition Date	2013-10-31T 14:23:46
18	Modification Date	2013-10-31T 14:46:28
19	Spectrometer Frequency	125.76
20	Spectral Width	31446.5
21	Lowest Frequency	-3148.0
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

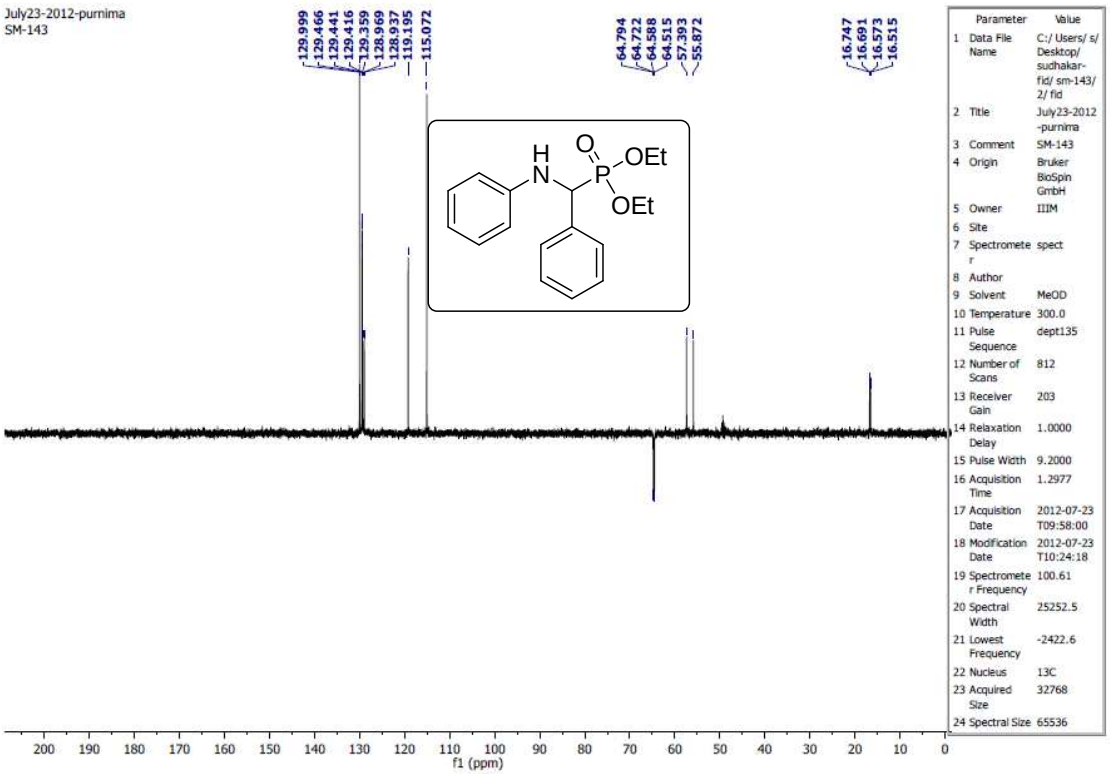

c13-sudhakar
sm-163
135.67
129.30
127.24
127.22
63.49
63.45
16.12
16.07
O
P
OEt
OEt
F3C
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)
Parameter Value
1 Data File Name D:/ desktop/ FID/ 2013/ Oct-2013/ 31-oct-c13-mcd-2a/ c13-sudhakar/ 6/ fid
2 Title c13-sudhakar
3 Comment sm-163
4 Origin UXNMR, Bruker Analytische Messtechnik GmbH
5 Owner root
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 682.0
11 Pulse Sequence dept135
12 Number of Scans 400
13 Receiver Gain 16384
14 Relaxation Delay 1.0000
15 Pulse Width 8.4500
16 Acquisition Time 1.0912
17 Acquisition Date 2013-10-31T15:01:01
18 Modification Date 2013-10-31T15:01:06
19 Spectrometer Frequency 125.76
20 Spectral Width 30030.0
21 Lowest Frequency -2439.7
22 Nucleus 13C
23 Acquired Size 32768
24 Spectral Size 65536


H1
SM-163(P31)
6.93
O
P
OEt
OEt
F3C
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
f1 (ppm)
Parameter Value
1 Data File Name C:/ Users/ s/ Desktop/ 04-nov-mcd-2a/ H1/ 38/ fid
2 Title H1
3 Comment SM-163(P31)
4 Origin Bruker BioSpin GmbH
5 Owner IIIM
6 Site
7 Spectrometer spect
8 Author
9 Solvent CDCl3
10 Temperature 300.0
11 Pulse Sequence zgpg30
12 Number of Scans 20
13 Receiver Gain 203
14 Relaxation Delay 2.0000
15 Pulse Width 12.5000
16 Acquisition Time 0.5112
17 Acquisition Date 2013-11-04T15:04:54
18 Modification Date 2013-11-04T15:04:56
19 Spectrometer Frequency 161.98
20 Spectral Width 64102.6
21 Lowest Frequency -40150.1
22 Nucleus 31P
23 Acquired Size 32768
24 Spectral Size 65536

27. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of diethyl phenyl(phenylamino)methylphosphonate (9a)







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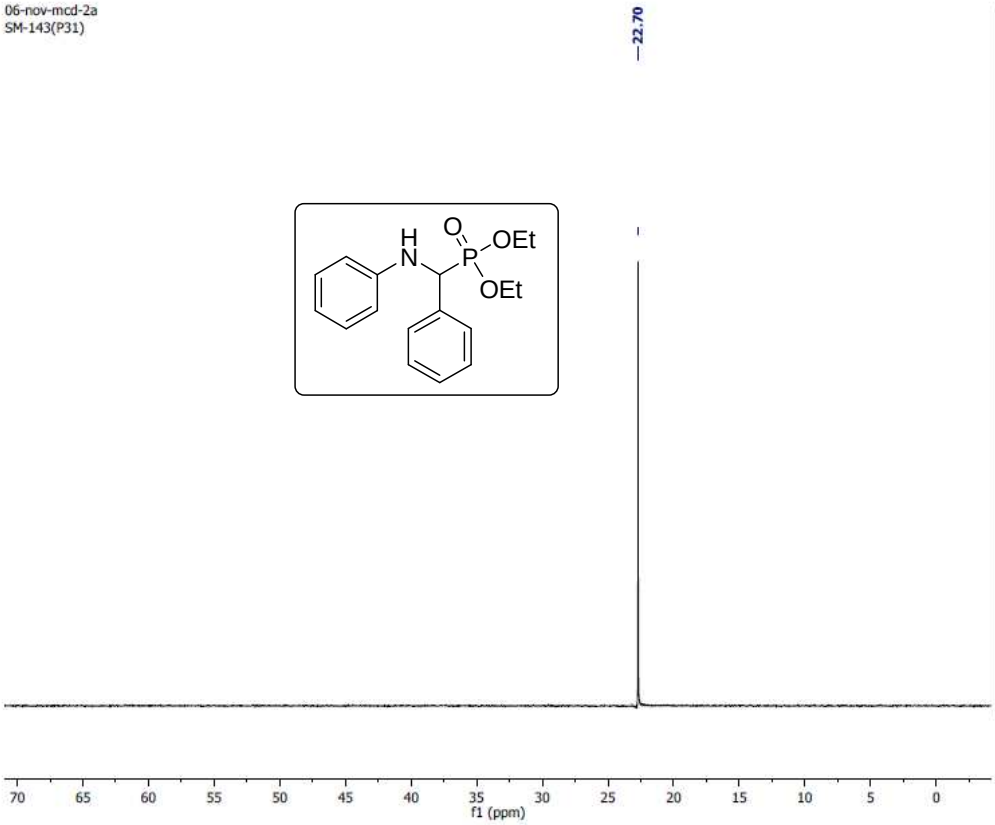
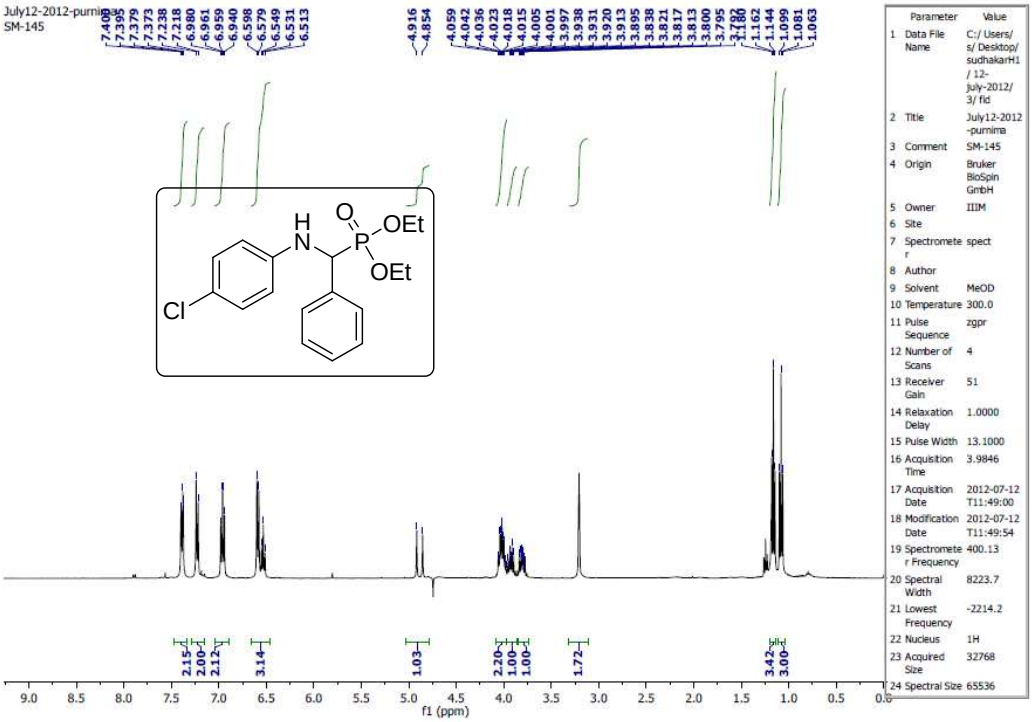
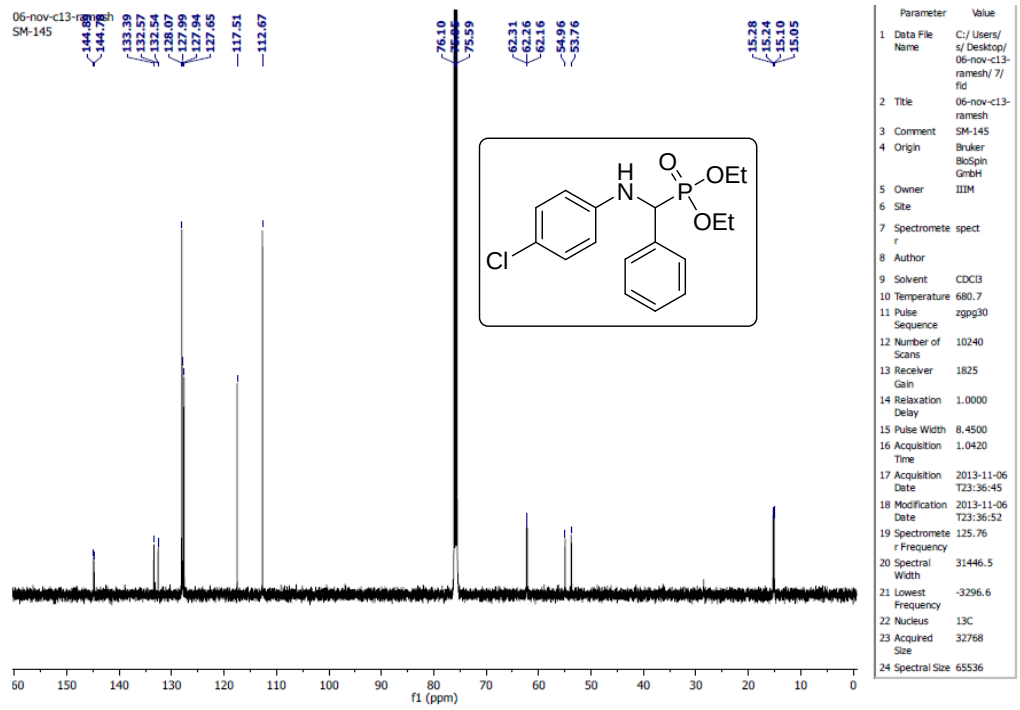
1	Data File Name	C:/ Users/ s/ Desktop/ sudhakar-fid/ sm-143/ 2/ fid
2	Title	July23-2012 -purnima
3	Comment	SM-143
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	MeOD
10	Temperature	300.0
11	Pulse Sequence	dept135
12	Number of Scans	812
13	Receiver Gain	203
14	Relaxation Delay	1.0000
15	Pulse Width	9.2000
16	Acquisition Time	1.2977
17	Acquisition Date	2012-07-23 T09:58:00
18	Modification Date	2012-07-23 T10:24:18
19	Spectrometer Frequency	100.61
20	Spectral Width	25252.5
21	Lowest Frequency	-2422.6
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536

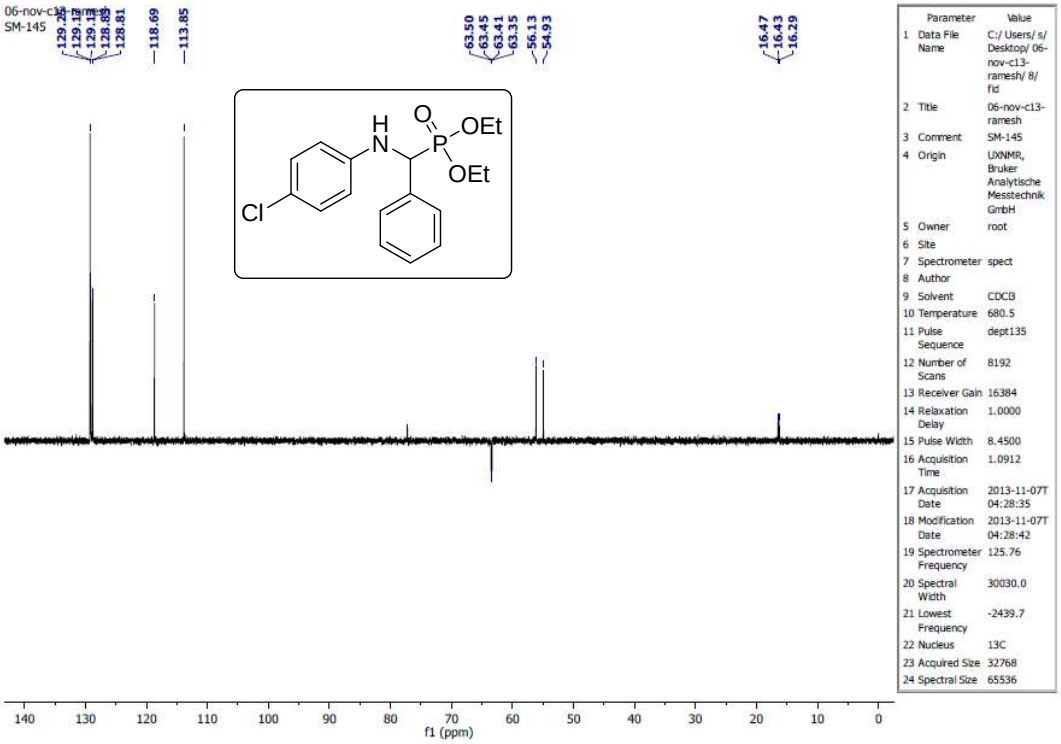


	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 06-nov-mcd-2a/ 45/ fid
2	Title	06-nov-mcd-2a
3	Comment	SM-143(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	18
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-06T 16:39:49
18	Modification Date	2013-11-06T 16:39:52
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

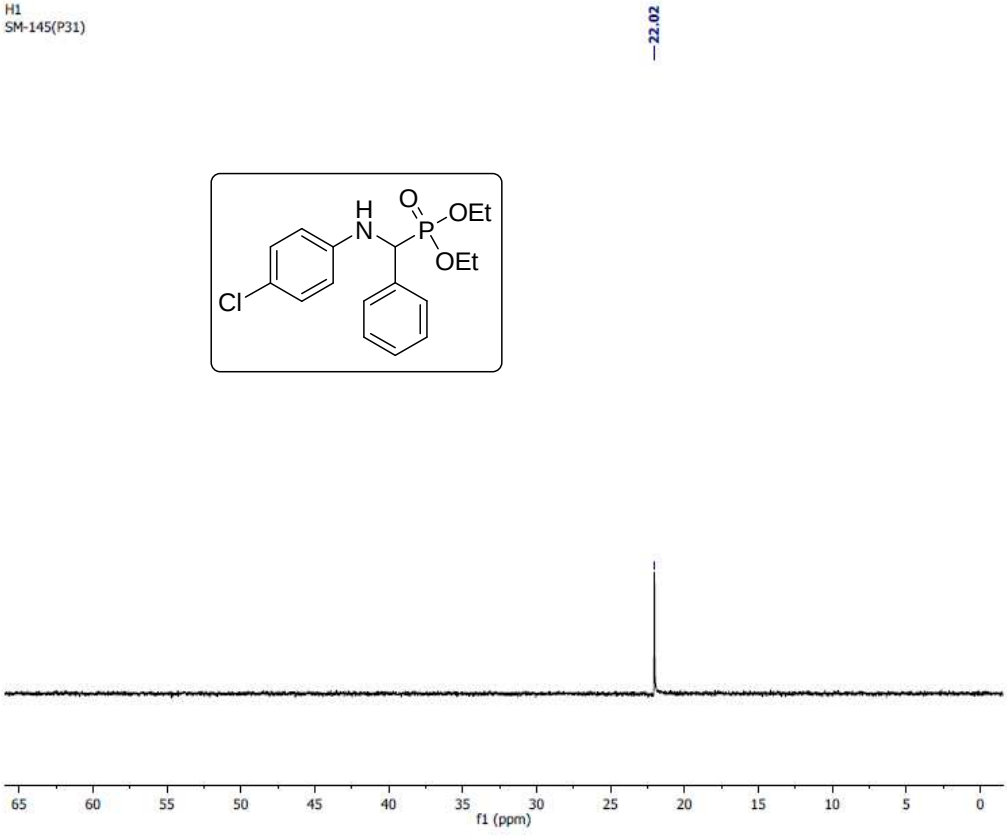
28. ^{1}H, ^{13}C, DEPT135 and ^{31}P NMR spectra of diethyl (4-chlorophenyl)(phenylamino)methylphosphonate (9b)







	Parameter	Value
1	Data File Name	C:/ Users/ s/ Desktop/ 06-nov-c13-ramesh/ 8/ fid
2	Title	06-nov-c13-ramesh
3	Comment	SM-145
4	Origin	UXNMR, Bruker Analytische Messtechnik GmbH
5	Owner	root
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	680.5
11	Pulse Sequence	dept135
12	Number of Scans	8192
13	Receiver Gain	16384
14	Relaxation Delay	1.0000
15	Pulse Width	8.4500
16	Acquisition Time	1.0912
17	Acquisition Date	2013-11-07T 04:28:35
18	Modification Date	2013-11-07T 04:28:42
19	Spectrometer Frequency	125.76
20	Spectral Width	30030.0
21	Lowest Frequency	-2439.7
22	Nucleus	13C
23	Acquired Size	32768
24	Spectral Size	65536



	Parameter	Value
1	Data File Name	D:/ desktop/ FID/ 2013/ Nov-2013/ 04-nov-mcd-2a/ H1/ 41/ fid
2	Title	H1
3	Comment	SM-145(P31)
4	Origin	Bruker BioSpin GmbH
5	Owner	IIIM
6	Site	
7	Spectrometer	spect
8	Author	
9	Solvent	CDCl3
10	Temperature	300.0
11	Pulse Sequence	zgpg30
12	Number of Scans	21
13	Receiver Gain	203
14	Relaxation Delay	2.0000
15	Pulse Width	12.5000
16	Acquisition Time	0.5112
17	Acquisition Date	2013-11-04T 15:22:25
18	Modification Date	2013-11-04T 15:22:28
19	Spectrometer Frequency	161.98
20	Spectral Width	64102.6
21	Lowest Frequency	-40150.1
22	Nucleus	31P
23	Acquired Size	32768
24	Spectral Size	65536

S2. HPLC chromatograms

HPLC analysis was done on Shimadzu HPLC system (model: SCL-10AVP) equipped with a PDA detector (model: RID-10A) using Inertsil RP-18(E-Merck, 5um, 4.0× 250 mm) column. Mobile phase used was Methanol: water (70: 30) isocratic elution at flow rate of 0.8 ml/min.

1. HPLC spectra of tetraethyl 2-(3, 5-di-t-butyl-4-hydroxyphenyl)ethene-1,1 diyldiphosphonate (6a)

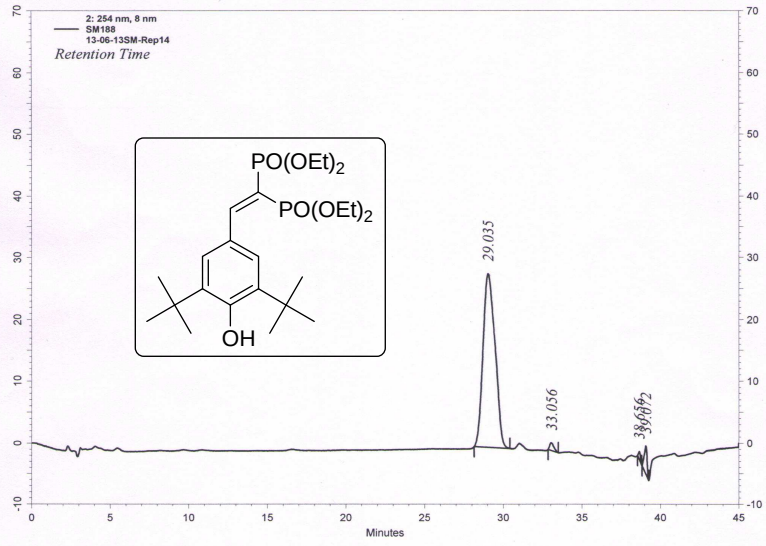
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM188
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep14 **Injection vial:** 30
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 3:25:35 AM
Printed: 2/11/2015 11:03:43 AM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

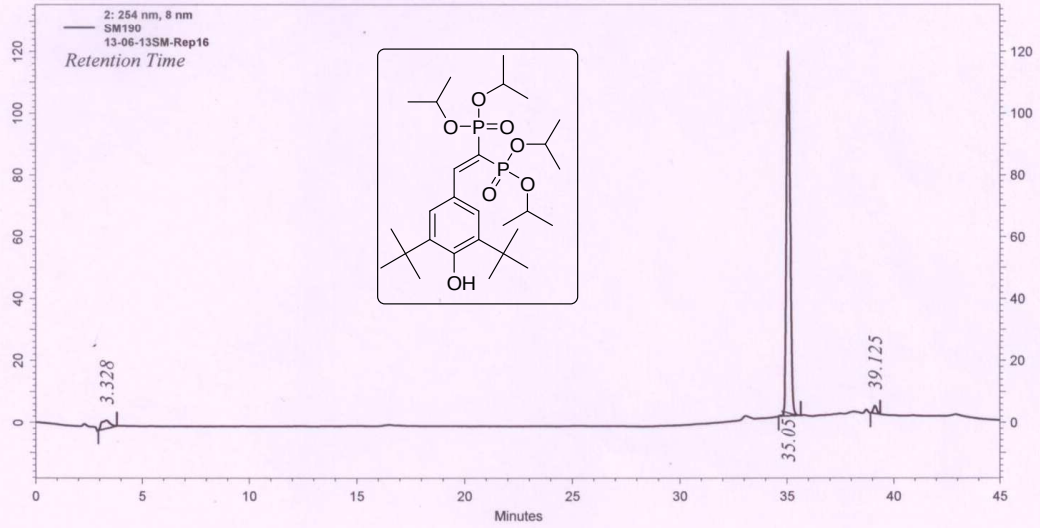
Pk #	Retention Time	Area	Area %	Height	Height %
1	29.035	1498708	94.151	28065	79.434
2	33.056	23414	1.471	1284	3.634
3	38.656	11244	0.706	1320	3.736
4	39.072	58445	3.672	4662	13.195
Totals		1591811	100.000	35331	100.000

2. HPLC spectra of tetraisopropyl 2-(3, 5-di-t-Butyl 4-hydroxy phenyl)ethene-1,1-diyldiphosphonate (6b)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM190
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep16 **Injection vial:** 32
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 4:58:21 AM
Printed: 6/14/2013 12:39:44 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.328	75131	4.708	2640	2.145
2	35.051	1492772	93.545	117903	95.812
3	39.125	27885	1.747	2513	2.042
Totals		1595788	100.000	123056	100.000

3. HPLC spectra of tetraethyl 2-phenylethene-1,1-diyldiphosphonate (6c)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM171

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep10 **Injection vial:** 27

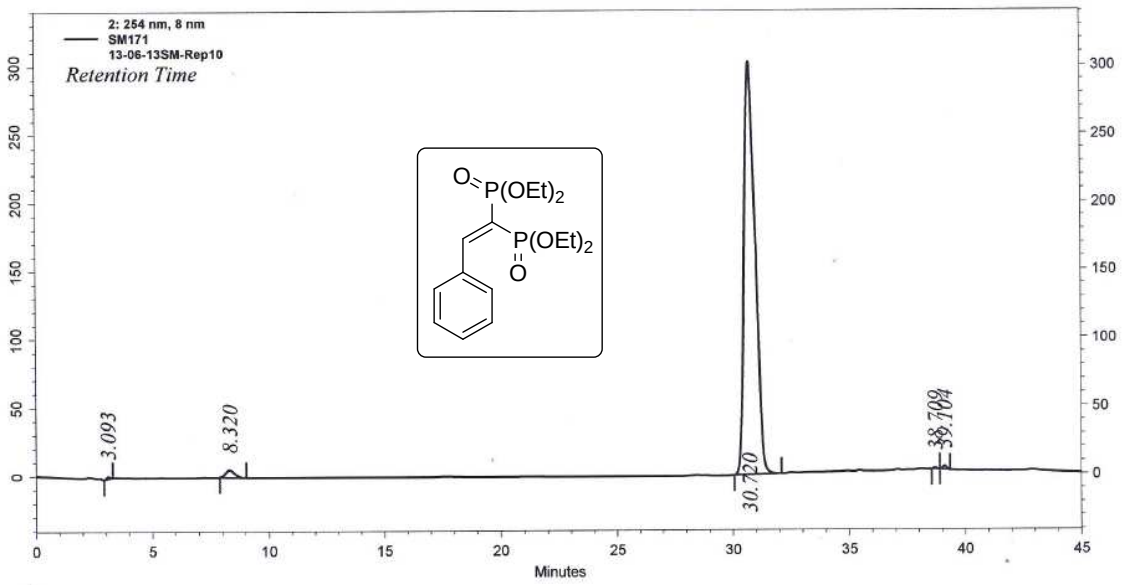
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/14/2013 12:19:58 AM

Printed: 6/14/2013 12:37:57 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

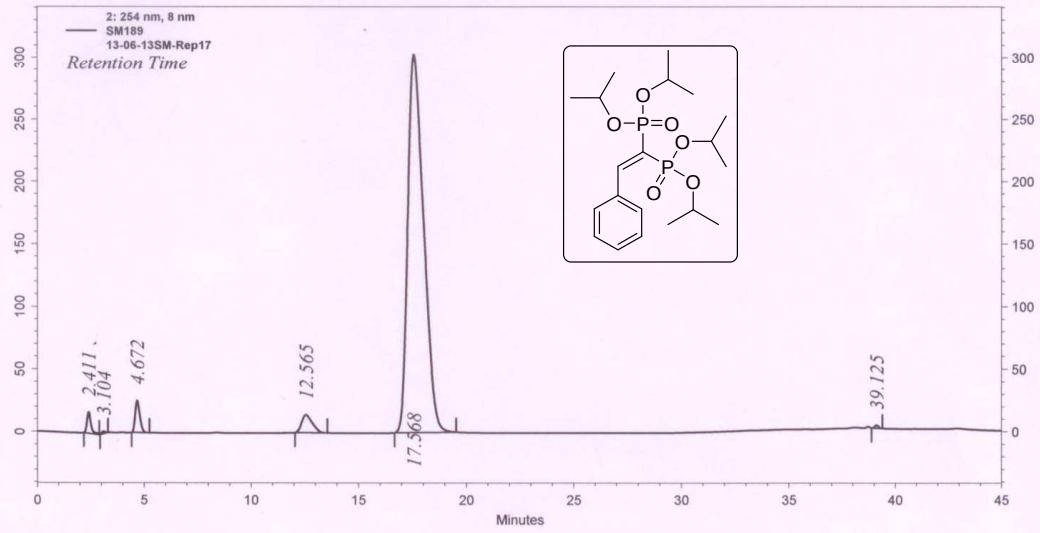
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.093	16727	0.166	1638	0.523
2	8.320	144175	1.431	5470	1.746
3	30.720	9875476	98.020	302630	96.574
4	38.709	10800	0.107	1146	0.366
5	39.104	27787	0.276	2483	0.792
Totals		10074965	100.000	313367	100.000

4. HPLC spectra of tetraisopropyl-2-phenylethene-1,1-diyldiphosphonate (6d)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM189
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep17 **Injection vial:** 33
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 5:44:42 AM
Printed: 6/14/2013 12:39:58 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.411	222549	1.345	17149	4.695
2	3.104	20372	0.123	1931	0.529
3	4.672	386863	2.338	25898	7.090
4	12.565	491768	2.971	14421	3.948
5	17.568	15399673	93.050	303350	83.042
6	39.125	28586	0.173	2549	0.698
Totals		16549811	100.000	365298	100.000

5. HPLC spectra of tetraethyl 2-(2-nitrophenyl)ethene-1,1-diyldiphosphonate (6e)

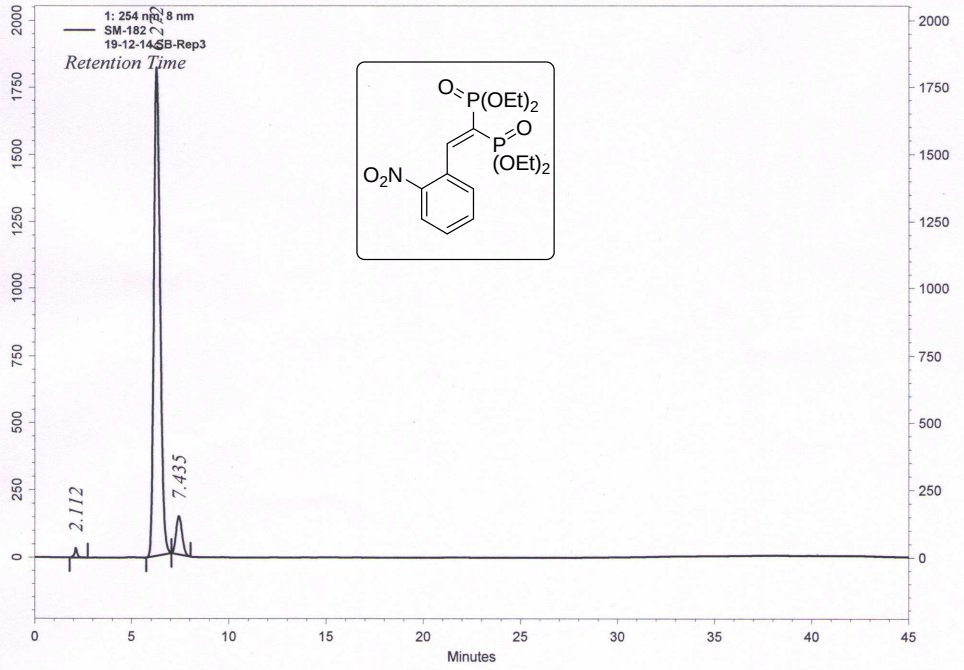
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM-182
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep3 **Injection vial:** 11
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 12/19/2014 12:41:01 PM
Printed: 12/19/2014 7:04:21 PM

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 de
rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.112	366181	0.829	35533	1.779
2	6.272	40698084	92.153	1820108	91.101
3	7.435	3099508	7.018	142257	7.120
Totals		44163773	100.000	1997898	100.000

6. HPLC spectra of tetraisopropyl,2-(3-bromophenyl)ethane-1,1-diyldiphosphonate (6f)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM197

Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep10 **Injection vial:** 7

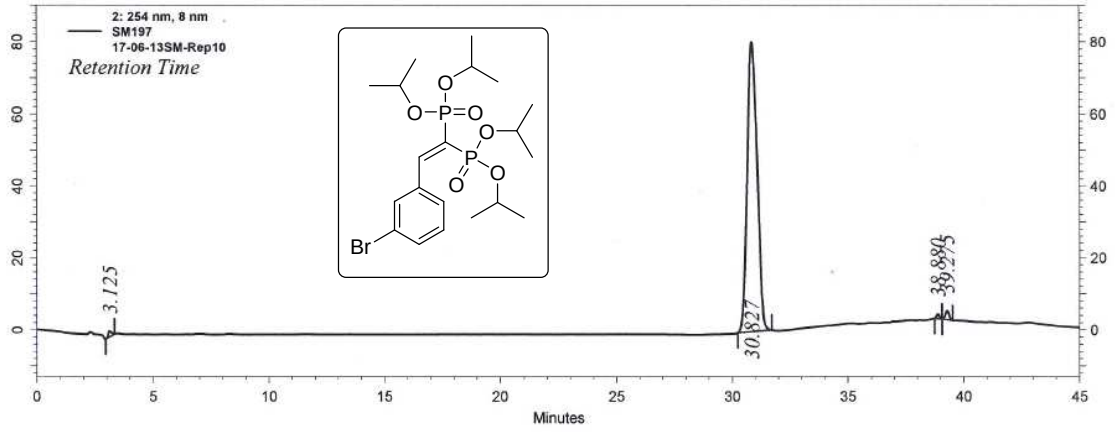
User: Niteen Narkhede **Injection Volume:** 10

Acquired: 6/18/2013 1:11:36 AM

Printed: 6/18/2013 10:25:27 AM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.125	15961	0.649	1555	1.815
2	30.827	2403052	97.784	80405	93.825
3	38.880	11382	0.463	1224	1.428
4	39.275	27108	1.103	2513	2.932
Totals		2457503	100.000	85697	100.000

7. HPLC spectra of tetraisopropyl-2-(4-N,N-dimethylaminophenyl)ethene-1,1-diyldiphosphonate (6g)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM199

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep9 **Injection vial:** 26

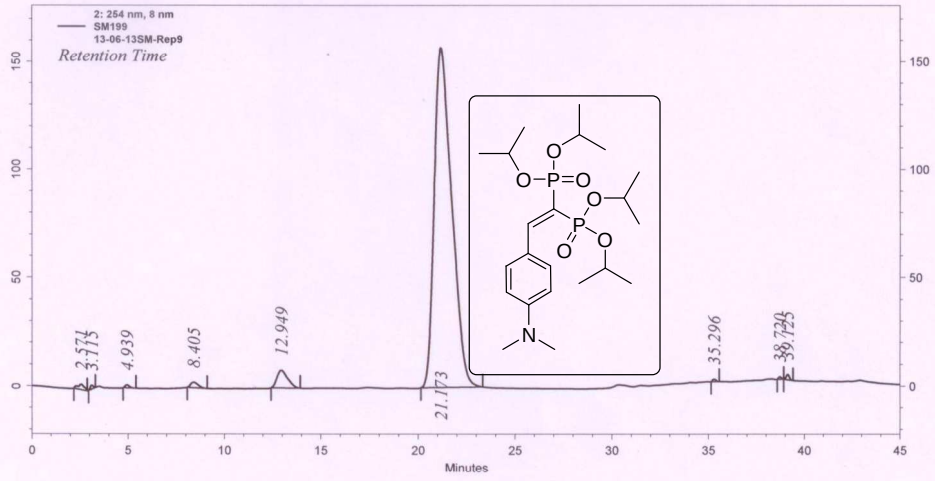
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/13/2013 11:33:38 PM

Printed: 6/14/2013 12:37:42 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.571	56953	0.550	2477	1.390
2	3.115	17741	0.171	1723	0.967
3	4.939	21047	0.203	1406	0.789
4	8.405	66950	0.646	2541	1.426
5	12.949	311526	3.007	8155	4.576
6	21.173	9834126	94.933	157206	88.219
7	35.296	12403	0.120	1107	0.621
8	38.720	10800	0.104	1130	0.634
9	39.125	27431	0.265	2455	1.378
Totals		10358977	100.000	178200	100.000

8. HPLC spectra of tetraethyl2-(3,5-dimethoxyphenyl)ethene-1,1 diyldiphosphonate (6h)

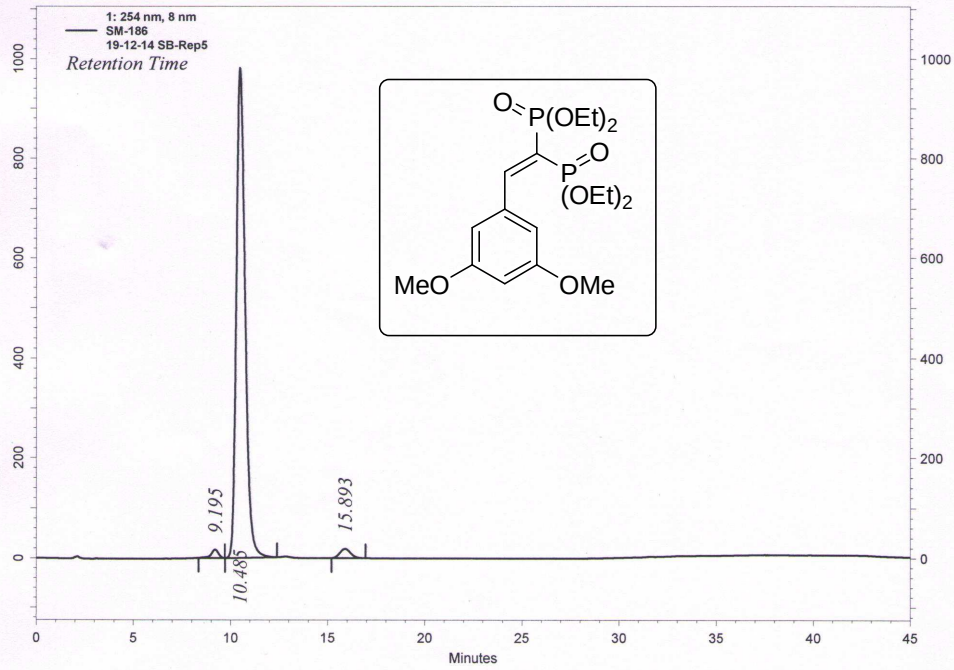
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM-186
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep5 **Injection vial:** 13
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 12/19/2014 2:13:51 PM
Printed: 12/19/2014 7:05:14 PM

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, flow rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	9.195	441281	1.377	17281	1.698
2	10.485	30871857	96.353	981700	96.454
3	15.893	727297	2.270	18815	1.849
Totals		32040435	100.000	1017796	100.000

9. HPLC spectra of tetraisopropyl-2-(3,5-dimethoxyphenyl)ethene-1,1 diyldiphosphonate (6i)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM196

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep6 **Injection vial:** 24

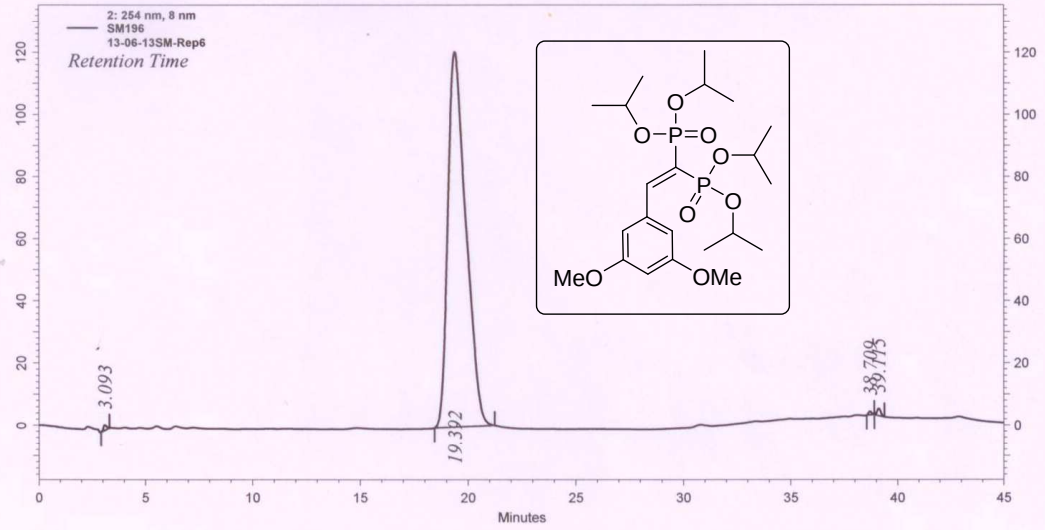
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/13/2013 9:14:24 PM

Printed: 6/14/2013 12:37:04 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.093	18606	0.264	1758	1.395
2	19.392	6996773	99.185	120727	95.822
3	38.709	11728	0.166	1160	0.921
4	39.115	27125	0.385	2346	1.862
Totals		7054232	100.000	125991	100.000

10. HPLC spectra of tetraisopropyl2-(3-methoxy4-fluorophenyl)ethene-1,1diyldiphosphonate (6j)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM198

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep15 **Injection vial:** 31

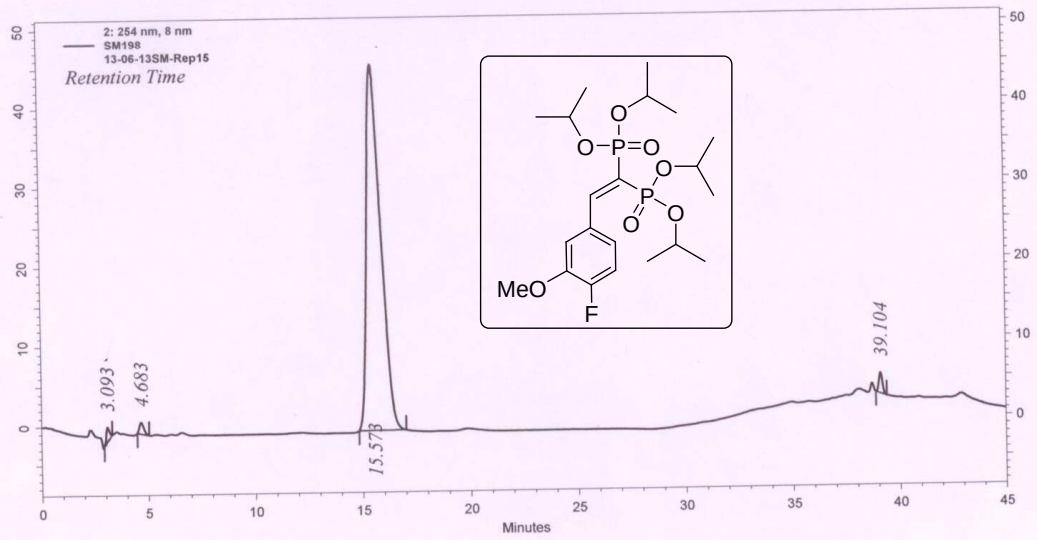
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/14/2013 4:11:59 AM

Printed: 6/14/2013 12:39:20 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

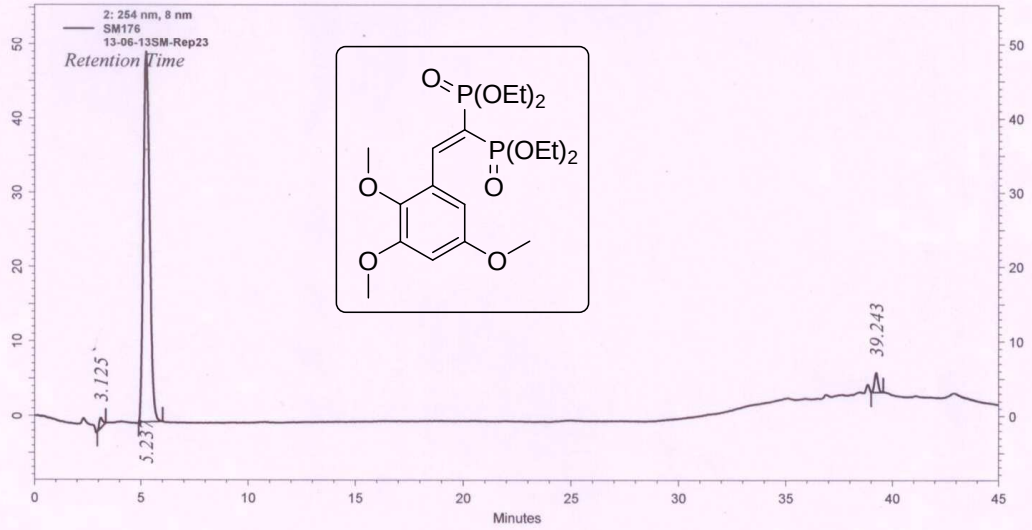
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.093	19071	0.877	1877	3.607
2	4.683	21333	0.981	1484	2.852
3	15.573	2105809	96.829	46143	88.677
4	39.104	28566	1.314	2531	4.864
Totals		2174779	100.000	52035	100.000

11. HPLC spectra of tetraethyl- 2(2,3,5-trimethoxyphenyl)ethane-1,1 diyldiphosphonate (6k)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM176
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep23 **Injection vial:** 38
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 10:23:10 AM
Printed: 6/14/2013 12:41:33 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.125	15616	1.479	1390	2.582
2	5.237	1010179	95.655	49861	92.604
3	39.243	30275	2.867	2592	4.814
Totals		1056070	100.000	53843	100.000

12. HPLC spectra of tetraisopropyl 2-(2,4,5-trimethoxyphenyl)ethene-1,1 diyldiphosphonate (6l)

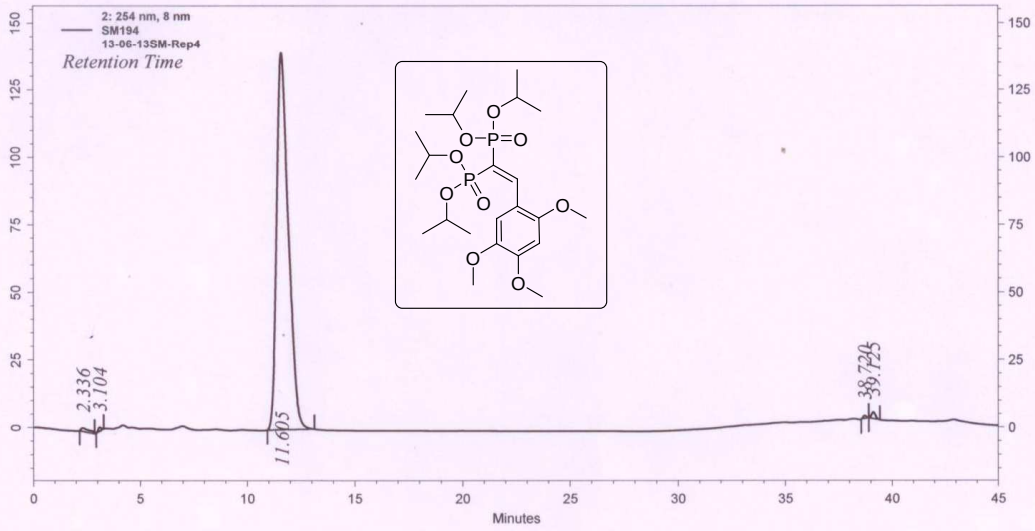
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM194
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep4 **Injection vial:** 22
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/13/2013 7:41:38 PM
Printed: 6/14/2013 12:36:32 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.336	35306	0.657	1261	0.865
2	3.104	14558	0.271	1449	0.994
3	11.605	5284765	98.311	139528	95.739
4	38.720	11065	0.206	1075	0.738
5	39.125	29860	0.555	2425	1.664
Totals		5375554	100.000	145738	100.000

13. HPLC spectra of tetraethyl2-(5-nitrofuran-2-yl)ethene-1,1-diyldiphosphonate (6m)

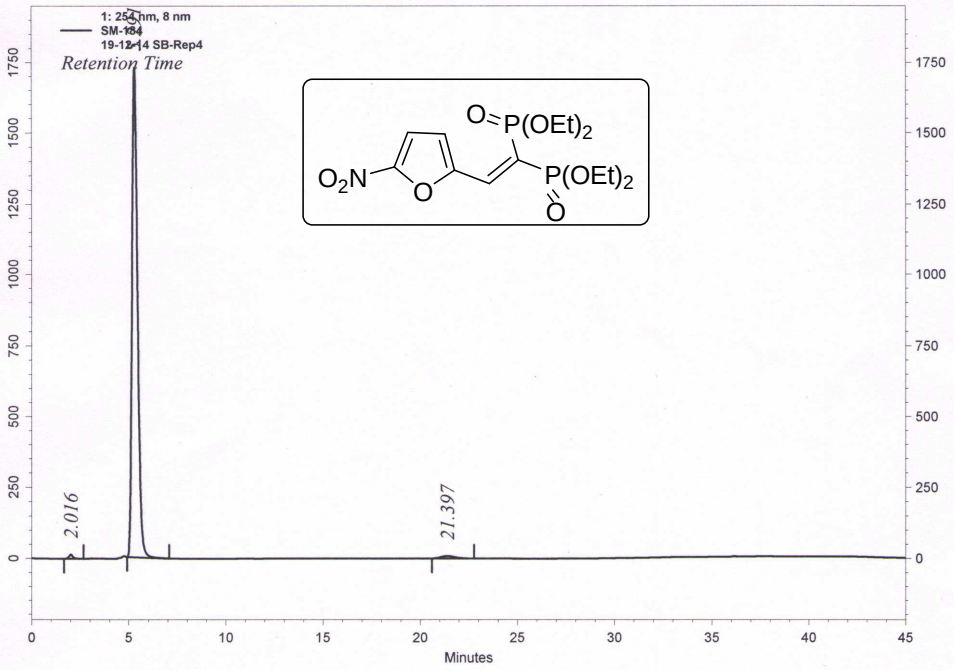
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM-184
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep4 **Injection vial:** 12
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 12/19/2014 1:27:27 PM
Printed: 12/19/2014 7:04:46 PM

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 degr rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

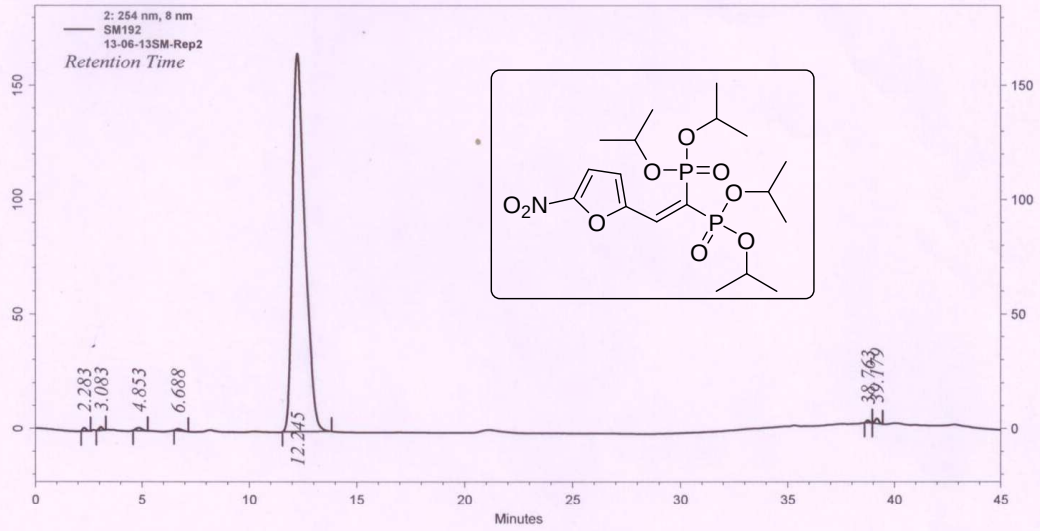
Pk #	Retention Time	Area	Area %	Height	Height %
1	2.016	228079	0.656	15812	0.902
2	5.291	34053111	98.015	1727859	98.602
3	21.397	461585	1.329	8686	0.496
Totals		34742775	100.000	1752357	100.000

14. HPLC spectra of tetraisoproyl2-(5-nitrofuran-2-yl)ethene-1,1 diyldiphosphonate (6n)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM192
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep2 **Injection vial:** 20
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/13/2013 6:08:44 PM
Printed: 6/14/2013 12:35:02 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.283	16852	0.249	1482	0.850
2	3.083	17876	0.265	1468	0.842
3	4.853	24378	0.361	1237	0.710
4	6.688	15452	0.229	817	0.469
5	12.245	6642747	98.313	165937	95.201
6	38.763	12068	0.179	1123	0.644
7	39.179	27342	0.405	2238	1.284
Totals		6756715	100.000	174302	100.000

15. HPLC spectra of tetraisopropyl2-(benzo[d][1,3]dioxol-5-yl)ethene-1,1-diyldiphosphonate (6o)

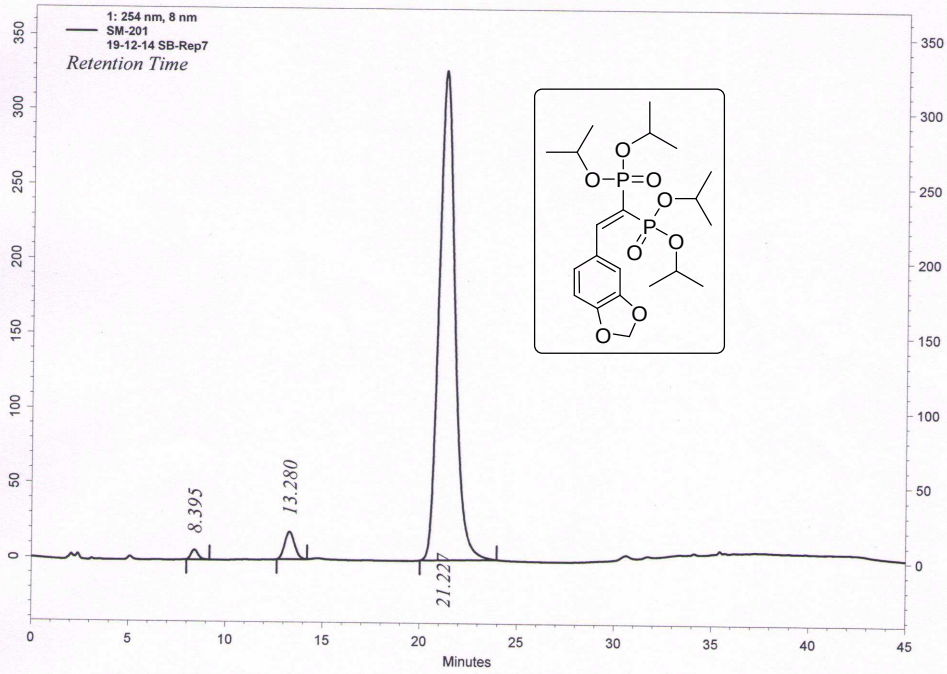
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep7
User: Rajinder Gupta
Acquired: 12/19/2014 3:46:40 PM
Printed: 12/19/2014 7:06:02 PM
Sample ID: SM-201
Injection vial: 15
Injection Volume: 10

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 deg rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

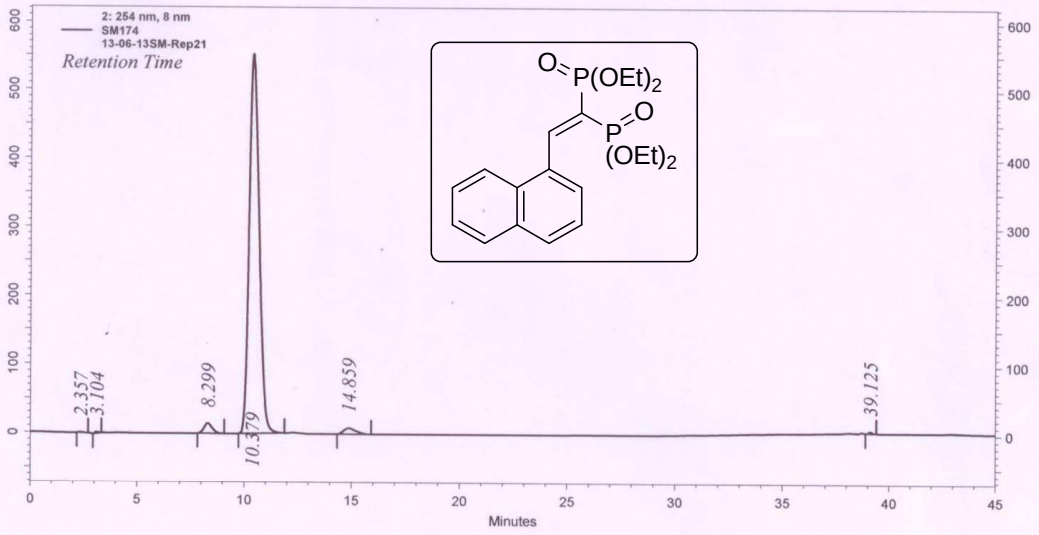
Pk #	Retention Time	Area	Area %	Height	Height %
1	8.395	163078	0.839	6529	1.855
2	13.280	652835	3.359	18333	5.208
3	21.227	18618131	95.802	327165	92.937
Totals		19434044	100.000	352027	100.000

16. HPLC spectra of tetraethyl 2-(naphthalen-1-yl)ethene-1,1-diyldiphosphonate (6p)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM174
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep21 **Injection vial:** 36
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 8:50:23 AM
Printed: 6/14/2013 12:40:56 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.357	13100	0.070	866	0.149
2	3.104	22580	0.121	2051	0.353
3	8.299	382906	2.054	14700	2.528
4	10.379	17856258	95.802	552734	95.037
5	14.859	334125	1.793	8648	1.487
6	39.125	29649	0.159	2599	0.447
Totals		18638618	100.000	581598	100.000

17. HPLC spectra of tetraisopropyl,2-(naphthalen-1-yl)ethene-1,1 diyldiphosphonate (6q)

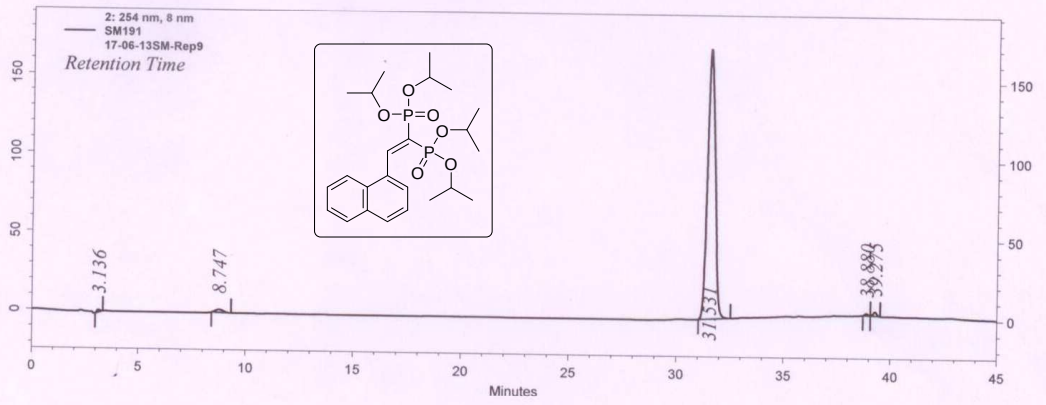
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM191
Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep9 **Injection vial:** 6
User: Niteen Narkhede **Injection Volume:** 10
Acquired: 6/18/2013 12:25:12 AM
Printed: 6/18/2013 10:25:12 AM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.136	16492	0.381	1549	0.871
2	8.747	48235	1.114	1910	1.074
3	31.531	4224193	97.593	170576	95.906
4	38.880	12453	0.288	1290	0.725
5	39.275	27021	0.624	2532	1.424
Totals		4328394	100.000	177857	100.000

18. HPLC spectra of tetraisopropyl2-(quinol-5-yl)ethene-1,1-diyldiphosphonate (6r)

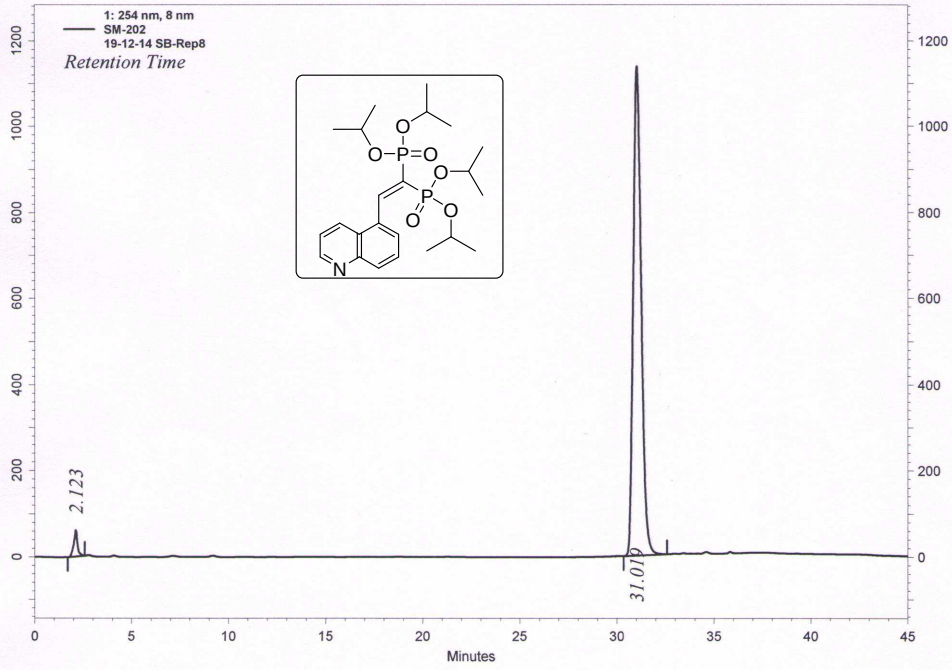
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM-202
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep8 **Injection vial:** 16
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 12/19/2014 4:33:07 PM
Printed: 12/19/2014 7:06:31 PM

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, flow rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

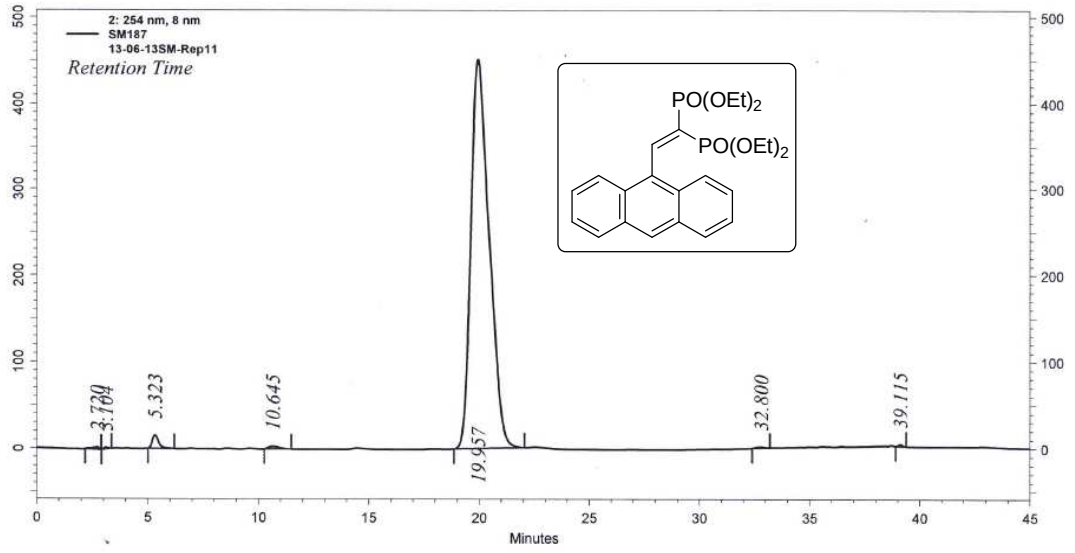
Pk #	Retention Time	Area	Area %	Height	Height %
1	2.123	851554	2.565	61570	5.137
2	31.019	32343942	97.435	1137015	94.863
Totals		33195496	100.000	1198585	100.000

19. HPLC spectra of tetraethyl2-(anthracene-10-yl)ethene-1,1-diyldiphosphonate (6s)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM187
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep11 **Injection vial:** 28
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 1:06:23 AM
Printed: 6/14/2013 12:38:13 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.720	51242	0.194	2334	0.489
2	3.104	19048	0.072	1652	0.346
3	5.323	311208	1.177	15184	3.184
4	10.645	93236	0.353	2942	0.617
5	19.957	25901528	97.994	451345	94.630
6	32.800	28236	0.107	1038	0.218
7	39.115	27227	0.103	2463	0.516
Totals		26431725	100.000	476958	100.000

20. HPLC spectra of (E)-diethyl 4-chlorostyrylphosphonate (7a)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM172

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep24 **Injection vial:** 39

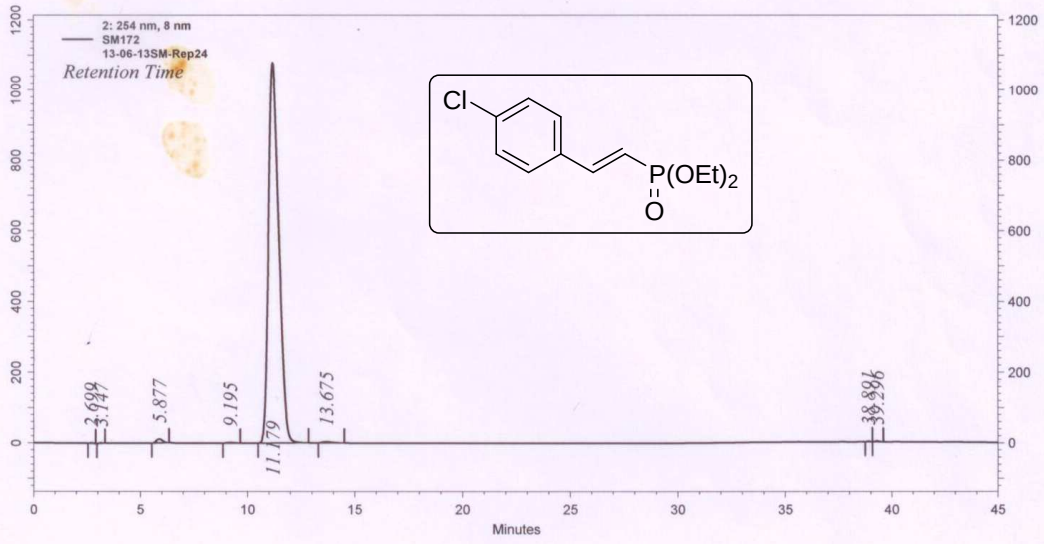
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/14/2013 11:09:33 AM

Printed: 6/14/2013 12:41:50 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.699	16112	0.044	1233	0.112
2	3.147	13640	0.038	1194	0.108
3	5.877	212089	0.585	10642	0.967
4	9.195	40883	0.113	1665	0.151
5	11.179	35813808	98.826	1079046	98.042
6	13.675	101552	0.280	3160	0.287
7	38.891	10832	0.030	1087	0.099
8	39.296	30350	0.084	2570	0.234
Totals		36239266	100.000	1100597	100.000

21. HPLC spectra of (E)-diethyl 3, 5-difluoro styrylphosphonate (7b)

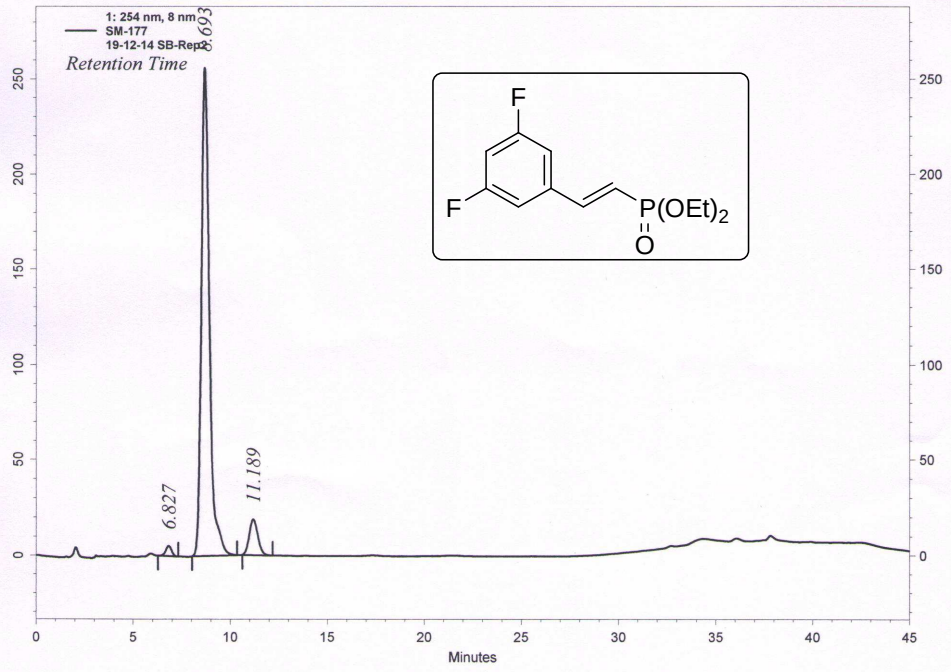
INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM-177
Data Name: C:\HPLC\DATA\19-12-14 SB-Rep2 **Injection vial:** 10
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 12/19/2014 11:53:55 AM
Printed: 12/19/2014 7:03:52 PM

Sample Description: Methanol (B), Water (A), Column RP-18(E- Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, flow rare 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



1: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	6.827	116276	1.443	5457	1.945
2	8.693	7361272	91.335	256332	91.368
3	11.189	582134	7.223	18759	6.687
Totals		8059682	100.000	280548	100.000

22. HPLC spectra of (E)-diethyl 3-bromo 4-methoxystyrylphosphonate (7c)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM178

Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep5 **Injection vial:** 3

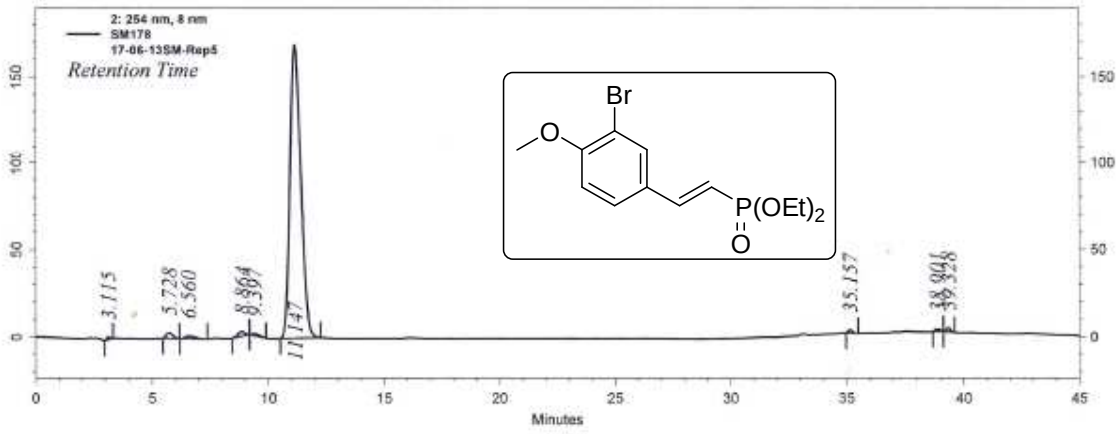
User: Niteen Narkhede **Injection Volume:** 10

Acquired: 6/17/2013 9:19:42 PM

Printed: 6/18/2013 10:23:55 AM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

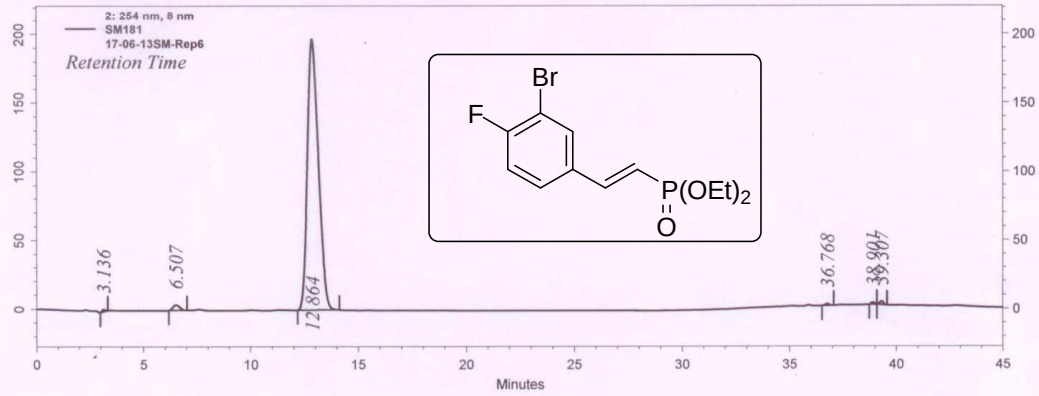
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.115	13992	0.243	1464	0.793
2	5.728	60271	1.047	3115	1.686
3	6.560	45848	0.796	1630	0.882
4	8.864	55992	0.972	2633	1.425
5	9.397	28095	0.488	1230	0.666
6	11.147	5491504	95.376	168909	91.442
7	35.157	21333	0.371	1861	1.007
8	38.901	14883	0.258	1449	0.784
9	39.328	25852	0.449	2426	1.313
Totals		5757770	100.000	184717	100.000

23. HPLC spectra of (E)-diethyl 3-bromo-4-fluorostyrylphosphonate (7d)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM181
Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep6 **Injection vial:** 4
User: Niteen Narkhede **Injection Volume:** 10
Acquired: 6/17/2013 10:06:03 PM
Printed: 6/18/2013 10:24:09 AM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

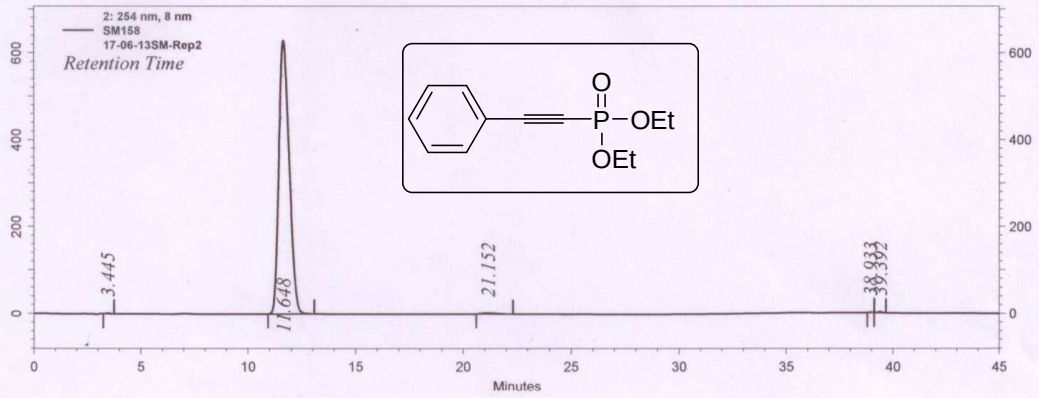
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.136	15437	0.215	1502	0.723
2	6.507	83224	1.159	3790	1.825
3	12.864	7023784	97.848	197145	94.957
4	36.768	14984	0.209	1272	0.613
5	38.901	14227	0.198	1429	0.688
6	39.307	26576	0.370	2477	1.193
Totals		7178232	100.000	207615	100.000

24. HPLC spectra of diethyl 2-phenylethynylphosphonate (8a)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM158
Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep2 **Injection vial:** 0
User: Niteen Narkhede **Injection Volume:** 10
Acquired: 6/17/2013 7:00:29 PM
Printed: 6/18/2013 10:22:05 AM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	3.445	21054	0.099	1693	0.266
2	11.648	21060848	99.138	629510	98.771
3	21.152	123279	0.580	2555	0.401
4	38.933	10284	0.048	1133	0.178
5	39.392	28410	0.134	2454	0.385
Totals		21243875	100.000	637345	100.000

25. HPLC spectra of diethyl-2-(4-(trifluoromethyl)pheny)lethynylphosphonate (8b)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM160

Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep3 **Injection vial:** 1

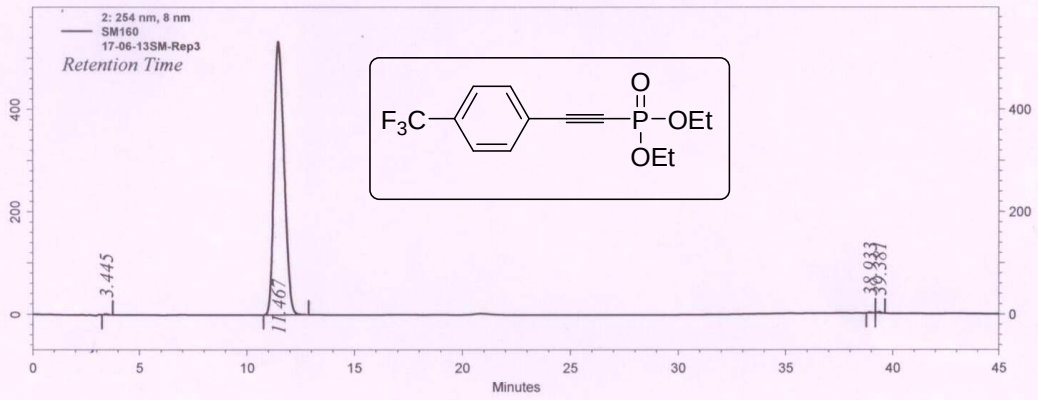
User: Niteen Narkhede **Injection Volume:** 10

Acquired: 6/17/2013 7:46:53 PM

Printed: 6/18/2013 10:23:16 AM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

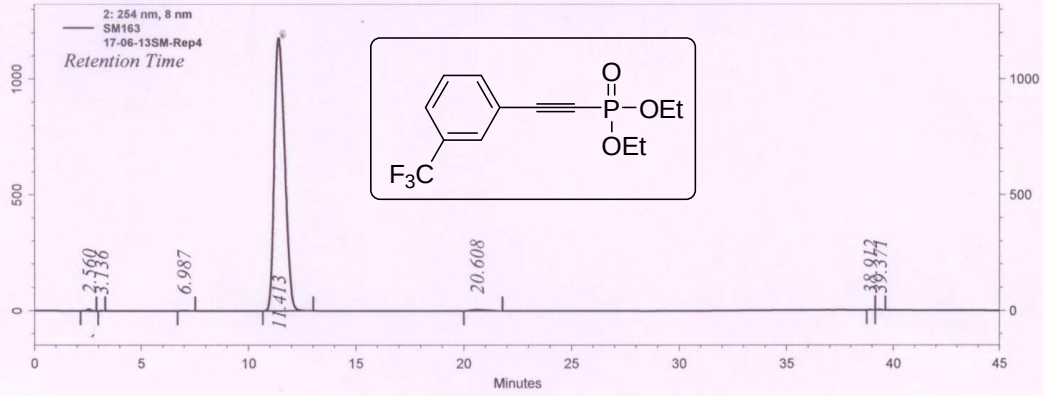
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.445	18202	0.105	1506	0.280
2	11.467	17349485	99.675	533432	99.036
3	38.933	15141	0.087	1423	0.264
4	39.381	23295	0.134	2261	0.420
Totals		17406123	100.000	538622	100.000

26. HPLC spectra of diethyl2-(3-(trifluoromethyl)pheny)lethynylphosphonate (8c)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM163
Data Name: C:\CLASS-VP\Data\17-06-13SM-Rep4 **Injection vial:** 2
User: Niteen Narkhede **Injection Volume:** 10
Acquired: 6/17/2013 8:33:19 PM
Printed: 6/18/2013 10:23:39 AM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.560	106509	0.265	7846	0.655
2	3.136	13197	0.033	1325	0.111
3	6.987	31390	0.078	1412	0.118
4	11.413	39713809	98.930	1178246	98.393
5	20.608	239272	0.596	4874	0.407
6	38.912	14866	0.037	1450	0.121
7	39.371	24420	0.061	2332	0.195
Totals		40143463	100.000	1197485	100.000

27. HPLC spectra of diethyl phenyl(phenylamino)methylphosphonate (9a)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**

Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM143

Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep18 **Injection vial:** 34

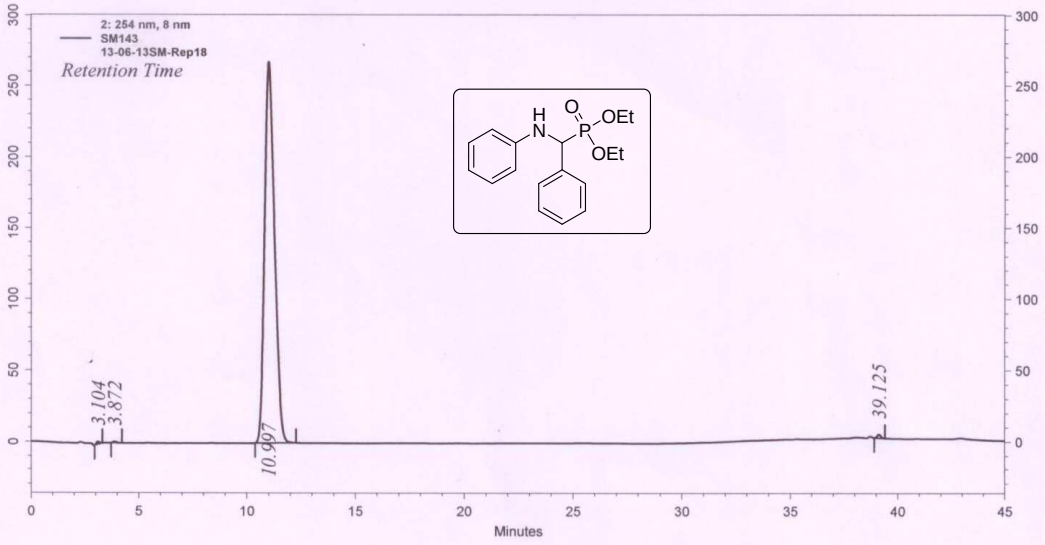
User: Rajinder Gupta **Injection Volume:** 10

Acquired: 6/14/2013 6:31:08 AM

Printed: 6/14/2013 12:40:13 PM

Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

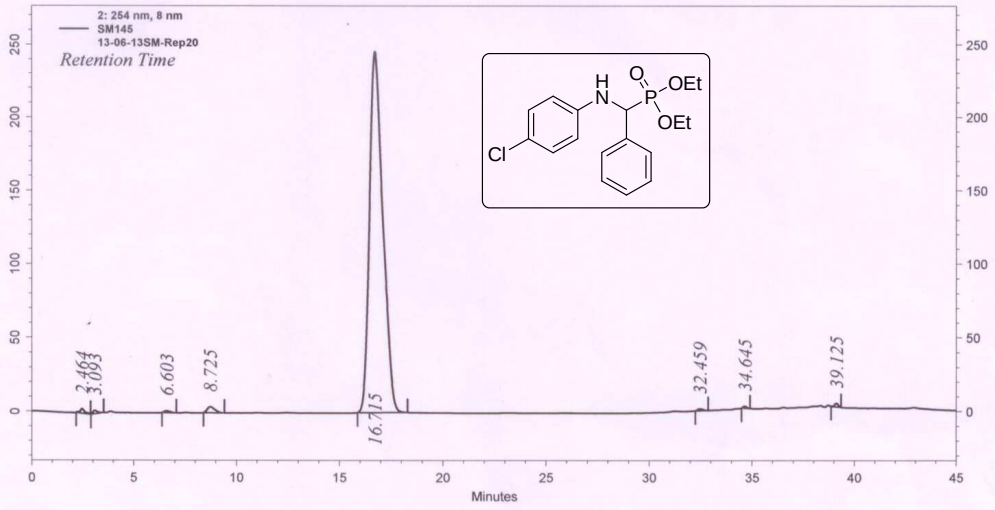
Pk #	Retention Time	Area	Area %	Height	Height %
1	3.104	19140	0.225	1846	0.676
2	3.872	11556	0.136	902	0.330
3	10.997	8451632	99.304	267867	98.064
4	39.125	28529	0.335	2541	0.930
Totals		8510857	100.000	273156	100.000

28. HPLC spectra of diethyl (4-chlorophenyl)(phenylamino)methylphosphonate (9b)

INSTRUMENTATION DIVISION, IIIM JAMMU

Shimadzu CLASS-VP V6.14 SP1 *Area % Report* **Page 1 of 1**
Method Name: C:\HPLC\METHOD\nitin.met **Sample ID:** SM145
Data Name: C:\CLASS-VP\Data\13-06-13SM-Rep20 **Injection vial:** 35
User: Rajinder Gupta **Injection Volume:** 10
Acquired: 6/14/2013 8:03:58 AM
Printed: 6/14/2013 12:36:14 PM
Sample Description: MeOH (B), Water (A), Column RP-18 (E-Merck, 5um, 4.0 x 250 mm), Column temp. 30 degree C, Flow rate 0.8 ml/min.

Time	0.01	20	30	35	40	45
B(%)	70	70	100	100	70	70



2: 254 nm, 8 nm

Pk #	Retention Time	Area	Area %	Height	Height %
1	2.464	49417	0.440	3044	1.163
2	3.093	34575	0.308	2284	0.872
3	6.603	24611	0.219	1305	0.498
4	8.725	100299	0.892	4040	1.543
5	16.715	10966055	97.539	246113	93.992
6	32.459	21940	0.195	1223	0.467
7	34.645	16528	0.147	1354	0.517
8	39.125	29333	0.261	2481	0.948
Totals		11242758	100.000	261844	100.000

S3. EXPERIMENTAL PROCEDURES AND SPECTRAL DATA

General. All chemicals were obtained from Sigma-Aldrich Company and used as received. ^{1}H, ^{13}C and DEPT NMR spectra were recorded on Brucker-Avance DPX FT-NMR 500 and 400 MHz instruments. Chemical data for protons are reported in parts per million (ppm) downfield from tetramethylsilane and are referenced to the residual proton in the NMR solvent ($CDCl_3$, 7.26 ppm). Carbon nuclear magnetic resonance spectra (^{13}C NMR) were recorded at 125 MHz or 100 MHz: chemical data for carbons are reported in parts per million (ppm, δ scale) downfield from tetramethylsilane and are referenced to the carbon resonance of the solvent ($CDCl_3$, 77.16 ppm). ESI-MS and HRMS spectra were recorded on Agilent 1100 LC-Q-TOF and HRMS-6540-UHD machines. IR spectra were recorded on Perkin-Elmer IR spectrophotometer. Melting points were recorded on digital melting point apparatus.

General procedure for preparation of alkylidne dphosphonate esters 6a-s and 7a-d: A flame-dried 25 ml round bottom flask with magnetic stir bar was charged with $TiCl_4$ (10 mmol) and 0.5 ml CCl_4 at 0 °C. 5 ml of dry THF was added dropwise to the flask and a bright yellow precipitate formed, and then commercially available different aldehydes **10a-s** (0.1g, 5 mmol) and diphosphonate ester **11a-b** (5 mmol) were added. A solution of 0.5 ml 4-methylmorpholine in 3.0 ml dry THF was then added dropwise to the stirring mixture over 12h. The reaction was allowed to warm to room temperature and stirred over night. The reaction was quenched with water and extracted with EtOAc. The organic layer was washed with brine and dried over Na_2SO_4. Concentration in *vacuo* followed by preparative thin-layer chromatography provided the corresponding alkylidene bisphosphonate **6a-s** and **7a-d** 50-65% yield.

Tetraethyl-2-(3,5-di-t-butyl-4-hydroxyphenyl)ethene-1,1 diyldiphosphonate (6a). Yellow oil; yield 60%; HPLC: t_R = 29.03 min (95% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.23 (dd, J_1 = 28

Hz, J_2 = 48 Hz, 1H), 7.76 (s, 2H), 4.21-4.16 (m, 4H), 4.10-4.04 (m, 4H), 1.45 (s, 18H), 1.37 (t, J = 8 Hz, 6H), 1.18 (t, J = 8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 162.91, 162.88, 157.03, 135.59, 129.87, 125.72, 125.64, 125.51, 125.43, 62.46, 62.41, 62.23, 62.17, 53.42, 34.53, 30.26, 16.39, 16.33, 16.12, 16.04; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 19.58-19.26 (d, J = 51.83 Hz), 13.62-13.30 (d, J = 51.83 Hz); IR ($CHCl_3$): ν_{max} 3436, 2957, 2927, 2871, 1616, 1596, 1558, 1424, 1391, 1242, 1162, 1025 cm^{-1}; ESI-MS: *m/z* 505 $[M+1]^+$; HRMS: *m/z* 505.2468 calcd for $C_{27}H_{43}O_7P_2+H^+$ (505.2478).

Tetraisopropyl-2-(3, 5-di-t-Butyl 4-hydroxy phenyl)ethene-1,1-diyldiphosphonate (6b). Yellow oil; yield 55%; HPLC: t_R = 35..05 min (93.5% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.21 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.77 (s, 2H), 4.82-4.75 (m, 2H), 4.72-4.64 (m, 2H), 1.45 (s, 18H), 1.40-1.35 (m, 12H), 1.25-1.16 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 161.12, 161.09, 156.69, 135.50, 130.05, 125.91, 125.69, 117.32, 71.17, 71.11, 71.06, 71.00, 34.55, 30.30, 24.13, 24.08, 24.06, 24.01, 23.62, 23.57; 31P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 17.32-17.00 (d, J = 51.83 Hz), 10.80-10.48 (d, J = 51.83 Hz);IR ($CHCl_3$): ν_{max} 3436. 2976, 2874, 1557, 1425, 1385, 1242, 1141, 1106, 1013 cm-1; ESI-MS: *m/z* 561 $[M+1]^+$; HRMS: *m/z* 561.3100 calcd for $C_{28}H_{51}O_7P_2+H^+$ (561.3104).

Tetraethyl-2-phenylethene-1,1-diyldiphosphonate (6c). Yellow oil; yield 60%; HPLC: t_R = 30.72 min (96.6% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.32 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.76-7.73 (m, 2H), 7.41-7.38 (m, 3H), 4.24-419 (m, 4H), 4.06-4.00 (m, 4H), 1.39 (t, J = 4 Hz, 6H), 1.16 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 161.49, 134.62, 130.49, 130.27, 128.01, 122.46, 120.77, 119.12, 62.74, 62.69, 62.49, 62.43, 16.31, 16.24, 15.99, 15.92; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz) δ 16.21-15.88 (d, J = 53.45 Hz), 11.85-11.52 (d, J = 53.45 Hz); IR

($CHCl_3$): ν_{max} 3449, 2982, 2929, 2861, 1727, 1586, 1567, 1445, 1392, 1368, 1248, 1097, 1026 cm^{-1}; ESI-MS: *m/z* 399.1 $[M+Na]^+$; HRMS: *m/z* 377.1286 cald for $C_{16}H_{26}O_6P_2+H^+$ (377.12046).

Tetraisopropyl-2-phenylethene-1,1-diyldiphosphonate (6d). Yellow oil; yield 54%; HPLC: t_R = 17.56 min (93% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.21 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.83-7.81 (m, 2H), 7.40-7.37 (m, 3H), 4.86-4.78 (m, 2H), 4.72-4.64 (m, 2H), 1.41-1.34 (m, 12H), 1.26-1.17 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 160.07, 134.93, 134.71, 130.85, 130.32, 129.98, 127.98, 71.61, 71.55, 71.47, 71.40, 24.14, 24.10, 24.03, 24.00, 23.95, 23.55, 23.50; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 15.28-14.96 (d, J = 51.83 Hz), 9.82-9.51 (d, J = 50.21 Hz); IR ($CHCl_3$): ν_{max} 3436, 2979, 2932, 2079, 1634, 1586, 1450, 1385, 1242, 1106 cm^{-1}; ESI-MS: *m/z* 433 $[M+1]^+$; HRMS: *m/z* 433.1905 calcd for $C_{20}H_{35}O_6P_2+H^+$ (433.1903).

Tetraethyl-2-(2-nitrophenyl)ethene-1,1-diyldiphosphonate (6e). Yellow oil; yield 50%; HPLC: t_R = 6.27 min (92.1% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8. (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 8.24-8.22 (m, 1H), 7.70-7.68 (m, 1H), 7.58-7.55 (m, 2H), 4.28-4.24 (m, 4H), 3.96-3.90 (m, 4H), 1.43-1.40 (m, 6H), 1.14-1.11 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 159.04, 145.39, 133.59, 130.64, 129.74, 124.39, 62.99, 62.95, 62.48, 62.45, 15.39, 16.33, 16.12,, 16.07; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.92-14.62 (d, J = 48.59 Hz), 11.10-10.80 (d, J = 48.59 Hz); IR ($CHCl_3$): ν_{max} 3467, 2983, 2928, 2855, 1734, 1589, 1570, 1525, 1442, 1392, 1345, 1248, 1163, 1023 cm^{-1}; ESI-MS: *m/z* 443.94 $[M+Na]^+$; HRMS: *m/z* 444.0954 calcd for $C_{16}H_{25}NO_8P_2+Na^+$ (444.0947).

Tetraisopropyl-2-(3-bromophenyl)ethane-1,1-diyldiphosphonate (6f). Yellow oil; yield 58%; HPLC: t_R = 30.82 min (97.8% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.19 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.97 (s, 1H), 7.66 (d, J = 8 Hz, 1H), 7.50 (d, J = 8Hz, 1H), 7.27-7.23 (m, 1H), 4.74-4.66 (m, 2H), 4.74-4.66 (m, 2H), 1.41-1.36 (m, 12H), 1.26-1.18 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 157.62, 137.08, 136.94, 133.05, 132.81, 129.44, 129.00, 121.96, 71.75, 71.69,

71.54, 71.47, 29.68, 24.11, 24.06, 24.05, 24.01, 23.97, 23.92, 23.59, 23.53; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.24-13.93 (d, *J* = 50.21 Hz), 9.12-8.81 (d, *J* = 50.21 Hz); IR ($CHCl_3$): ν_{max} 3436, 2978, 2930, 1581, 1385, 1242, 1105 cm-1; ESI-MS: *m/z* 534 $[M+Na]^+$; HRMS: *m/z* 511.1003 calcd for $C_{20}H_{34}BrO_6P_2+H^+$ (511.1008).

Tetraisopropyl-2-(4-N,N-dimethylaminophenyl)ethene-1,1-diyldiphosphonate (6g). Yellow oil; yield 52%; HPLC: t_R = 21.17 min (94.9% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.14 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.92-7.89 (d, *J* = 12 Hz, 2H), 6.64 (d, *J* = 8 Hz, 2H), 4.81-4.69 (m, 4H), 3.01 (s, 6H), 1.39-1.34 (m, 12H), 1.34-1.24 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 160.68, 152.16, 135.0, 110.73, 71.28, 71.03, 70.99, 70.95, 39.94, 24.09, 24.05, 24.03, 23.98, 23.88, 23.65, 23.61; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 18.46-18.14 (d, *J* = 51.83 Hz), 12.56-12.24 (d, *J* = 51.83 Hz); IR ($CHCl_3$): ν_{max} 3467, 2978, 2931, 2874, 1731, 1607, 1519, 1436 1384, 1373, 1242, 1196, 1141, 1107 cm-1; ESI-MS: *m/z* 476.1 $[M+1]^+$; HRMS: *m/z* 476.2317 calcd for $C_{22}H_{40}NO_6P_2$+H+ (476.2325).

Tetraethyl-2-(3,5dimethoxyphenyl)ethene-1,1 diyldiphosphonate (6h). Yellow oil; yield 58%; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.25 (dd, J_1 = 32 Hz, J_2 = 48 Hz, 1H), 6.99 (d, *J* = 8 Hz, 2H), 6.52 (s, 1H), 4.25-4.18 (m, 4H), 4.08-4.03 (m, 4H), 3.81 (s, 6H), 1.39 (t, *J* = 8 Hz, 6H), 1.19 (t, *J* = 8 Hz, 6H); ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz) δ 19.44 (s); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 161.34, 160.24, 136.29, 122.89, 121.20, 119.56, 107.86, 103.45, 62.65, 62.59, 62.46, 62.40, 55.42, 16.28, 16.22, 16.03, 15.96;; IR ($CHCl_3$): ν_{max} 3436, 2981, 2928, 1586, 1568, 1445, 1391, 1248, 1163, 1025 cm^{-1}; ESI-MS: *m/z* 437.00 $[M+1]^+$; HRMS: *m/z* 459.1308 calcd for $C_{18}H_{30}O_8P_2+Na^+$ (459.1308).

Tetraisopropyl-2-(3,5-dimethoxyphenyl)ethene-1,1 diyldiphosphonat (6i). Yellow oil; yield 55%; HPLC: t_R = 19.39 min (99.2% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.14 (dd, J_1 = 32 Hz, J_2

= 48 Hz, 1H), 6.98 (s, 2H), 6.43 (s, 1H), 4.77-4.69 (m, 2H), 4.63-4.58 (m, 2H), 3.74 (s, 6H), 1.33-1.26 (m, 12H), 1.18-1.11 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 160.26, 159.92, 108.50, 108.33, 103.36, 71.55, 71.50, 71.40, 71.35, 55.57, 24.15, 24.10, 24.07, 24.01, 23.97, 23.61, 23.57; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 15.34-15.03 (d, *J* = 50.21 Hz), 9.81-9.50 (d, *J* = 50.21 Hz); IR ($CHCl_3$): ν_{max} 3436, 2978, 2926, 2852, 1738, 1595, 1573, 1458, 1385, 1307, 1241, 1206, 1156, 1106, 1065 cm^{-1}; ESI-MS: *m/z* 493.1$[M+1]^+$; HRMS: *m/z* 493.2104 calcd for $C_{22}H_{39}O_8P_2+H^+$ (493.2114).

Tetraisopropyl-2-(4-fluoro3-methoxyphenyl)ethene-1,1diyldiphosphonat (6j). Yellow oil; yield 59%; HPLC: t_R = 15.57 min (96.8% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.08 (dd, J_1 = 32 Hz, J_2 = 48 Hz, 1H), 7.82-7.79 (m, 1H), 7.52 (d, *J* = 8.0 Hz, 1H), 6.90-6.86 (m, 1H), 4.74-4.62 (m, 4H), 1.36-1.28 (m, 12H), 1.20-1.18 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 158.28, 152.70, 150.30, 149.89, 129.36, 119.04, 118.85, 112.23, 71.54, 71.47, 71.46, 71.39, 56.20, 24.12, 24.08, 24.03, 23.99, 23.63, 23.58; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 15.72-15.42 (d, *J* = 48.59 Hz), 10.14-9.83 (d, *J* = 50.21 Hz); IR ($CHCl_3$): ν_{max} 3436, 2978, 2928, 1668, 1615, 1511, 1443, 1385, 1285, 1138, 1105, 1017 cm^{-1}; ESI-MS: *m/z* 481 $[M+1]^+$; HRMS: *m/z* 481.1908 calcd for $C_{21}H_{36}FO_7P_2+H^+$ (481.1914).

Tetraethyl-2(2,3,5-trimethoxyphenyl)ethane-1,1 diyldiphosphonate (6k). Yellow oil; yield 64%; HPLC: t_R = 5.23 min (95.6% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.54 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.96 (s, 1H), 6.45 (s, 1H), 4.23-4.14 (m, 6H), 4.09-4.02 (m, 2H), 3.94-3.86 (s, 9H), 1.39-1.18 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 155.98, 154.36, 152.93, 151.42, 142.36, 114.45, 95.39, 62.51, 62.47, 62.40, 62.35, 56.43, 56.34, 56.02, 16.36, 16.31, 16.17; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 19.22-18.89 (d, *J* = 53.45 Hz), 14.42-14.09 (d, *J* = 53.45 Hz); IR

($CHCl_3$): ν_{max} 3436, 2927, 1612, 1579, 1508, 1466, 1440, 1335, 1282, 1221, 1128, 1025 cm^{-1}; MS: *m/z* 467.20 $[M+1]^+$; HRMS: *m/z* 467.1596 calcd for $C_{19}H_{33}O_9P_2+H^+$ (467.1594).

Tetraisopropyl-2-(2,4,5-trimethoxyphenyl)ethene-1,1 diyldiphosphonate (6l). Yellow oil; yield 58%; HPLC: t_R = 11.60 min (98.3% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.48 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.98 (s, 1H), 6.38 (s, 1H), 4.75-4.60 (m, 4H), 3.86 (s, 3H), 3.83 (s, 3H), 3.78 (s, 3H), 1.33-1.29 (m, 12H), 1.15-1.13 (m,12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 154.38, 154.07, 154.03, 152.60, 142.37, 128.70, 115.04, 95.62, 71.19, 71.13, 56.57, 56.43, 55.98, 29.67, 24.16, 24.12, 24.06, 23.94, 23.89, 23.65, 23.60; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 17.11-16.77 (d, *J* = 55.07 Hz), 11.81-11.48 (d, *J* = 53.45 Hz); IR ($CHCl_3$): ν_{max} 3435, 2979, 2931, 1612, 1579, 1508, 1466, 1374, 1243, 1221, 1141 cm^{-1}; ESI-MS: *m/z* 523.1 $[M+1]^+$; HRMS: *m/z* 523.2222 calcd for $C_{23}H_{41}O_9P_2+H^+$ (523.2220).

Tetraethyl-2-(4-nitrofuran-2-yl)ethene-1,1-diyldiphosphonate (6m). Yellow oil; yield: 59%; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 7.98 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.81 (d, *J* = 4Hz, 1H), 7.38 (d, *J* = 4 Hz, 1H), 4.25-4.18 (m, 8H), 1.41-1.33 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 152.41, 150.75, 150.46, 142.54, 120.55, 112.73, 63.14, 63.08, 16.31, 16.24, 16.21, 16.15; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.96-14.67 (d, *J* = 46.97 Hz), 11.11-10.81 (d, *J* = 48.59 Hz); IR ($CHCl_3$): ν_{max} 3436, 2923, 1619, 1418, 1020, cm-1; ESI-MS: *m/z* 412 [M+1]+; HRMS: *m/z* 412.0921 calcd for $C_{14}H_{24}NO_9P_2+H^+$ (412.0920).

Tetraisopropyl-2-(4-nitrofuran-2-yl)ethene-1,1 diyldiphosphonate (6n). Yellow oil; yield: 57%; HPLC: t_R = 12.24 min (98.3% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 7.98 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.85 (d, *J* = 4Hz, 1H), 7.35-7.34 (m, 1H), 4.83-4.76 (m, 4H), 1.40-1.24 (m, 24H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 149.85, 148.62, 139.02, 124.43, 117.87, 110.35, 69.74, 69.71, 69.69, 69.67, 21.65, 21.61, 21.58, 21.55, 21.51, 21.29, 21.25; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98

MHz): δ 12.70-12.45 (d, *J* = 40.49 Hz), 7.62-7.37 (d, *J* = 40.49 Hz); IR ($CHCl_3$): ν_{max} 3436, 2980, 2928, 1591, 1530, 1454, 1386, 1351, 1247, 1142, 1104 cm^{-1}; ESI-MS: *m/z* 468 $[M+1]^+$; HRMS: *m/z* 468.1539 calcd for $C_{18}H_{32}NO_9P_2+H^+$ (468.1546).

Tetraisopropyl-2-(benzo[d][1,3]dioxol-5-yl)ethene-1,1-diyldiphosphonate (6o). Yellow oil; yield: 55%; ^1H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.16 (dd, J_1 = 32 Hz, J_2 = 48 Hz, 1H), 7.65 (s, 1H), 7.34-7.32 (d, *J* = 8 Hz, 1H), 6.83-6.80 (d, *J* = 12 Hz, 1H), 6.01 (s, 2H), 4.82-4.69 (m, 4H), 1.40-1.34 (m, 12H), 1.27-1.21 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 159.79, 149.88, 147.56, 128.34, 121.31, 120.0, 111.09, 107.86, 101.59, 71.49, 71.44, 71.41, 71.36, 24.08, 24.05, 23.98, 23.94, 23.59, 23.55; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 16.20-15.89 (d, *J* = 50.21 Hz), 10.51-10.20 (d, *J* = 50.21 Hz); IR ($CHCl_3$): ν_{max} 3447, 2979, 2932, 1725, 1620, 1564, 1505, 1490, 1449, 1244, 1106 cm^{-1}; ESI-MS: *m/z* 477 $[M+1]^+$; HRMS: *m/z* 477.1796 calcd for $C_{21}H_{35}O_8P_2+H^+$ (477.1801).

Tetraethyl-2-(naphthalen-1-yl)ethene-1,1-diyldiphosphonate (6p). Yellow oil; yield: 65%; HPLC: t_R = 10.37 min (95.8% purity); ^1H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.86 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H),7.89-7.81 (m, 4H), 7.56 -7.48 (m, 3H), 4.33-4.27 (m, 4H), 3.93-3.79 (m, 4H), 1.44 (t, *J* = 4 Hz, 6H), 0.95 (t, *J* = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 160.14, 160.12, 132.95, 132.02, 130.54, 130.07, 128.61, 127.34, 126.77, 126.23, 125.05, 124.78, 124.72, 124.15, 62.88, 62.84,62.42, 62.36, 16.42, 16.36, 15.86, 15.80; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 16.16-15.83 (d, *J* = 53.45 Hz), 11.81-11.48 (d, *J* = 53.45 Hz); IR ($CHCl_3$): ν_{max} 3437, 2929, 2983, 2095, 1634, 1392, 1238, 1162, 1022 cm^{-1}; ESI-MS: *m/z* 427.0 $[M+Na]^+$; HRMS: *m/z* 427.1430 calcd for $C_{20}H_{29}O_6P_2+H^+$ (427.1433).

Tetraisopropyl-2-(naphthalen-1-yl)ethene-1,1 diyldiphosphonate (6q).Yellow oil; yield: 60%; HPLC: t_R = 31.53 min (97.6% purity); ^1H NMR (400 MHz, $CDCl_3$, ppm): *δ* 8.76 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.86-7.78 (m, 4H), 7.46-7.20 (m, 3H), 4.85-4.78 (m, 2H), 4.51-4.44 (m, 2H), 1.38-

1.36 (m, 12H), 0.98 (d, J = 8Hz, 6H), 0.88 (d, J = 4Hz, 6H);^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 158.21, 132.53, 130.38, 129.72, 129.28, 128.12, 127.12, 126.14, 125.61, 124.59, 123.86, 71.25, 71.20, 70.76, 70.71, 23.77, 23.74, 23.58, 23.53, 23.50, 22.95, 22.91; 31P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.03-13.69 (d, J = 55.07 Hz), 9.66-9.33 (d, J = 53.45 Hz); IR ($CHCl_3$): ν_{max} 3436, 2979, 2930, 2079, 1633, 1452, 1385, 1240, 1177, 1106 cm^{-1}; ESI-MS: *m/z* 483 $[M+H]^+$; HRMS: *m/z* 483.2057 calcd for C24H37O6P2+H+ (483.2059).

Tetraisopropyl-2-(quinol-5-yl)ethene-1,1-diyldiphosphonate (6r). Yellow oil; yield: 62%; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.77 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 7.81-7.73 (m, 4H), 7.46-7.19 (m, 2H), 4.85-4.80 (m, 2H), 4.49-4.44 (m, 2H), 1.38-1.25 (m, 12H), 0.99-0.88 (m, 12H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 158.69, 133.15, 133.06, 132.98, 130.85, 130.83, 129.69, 128.54, 127.55, 126.55, 126.03, 124.98, 124.31, 71.67, 71.21, 71.15, 71.09, 24.68, 24.17, 23.98, 23.36; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.02-13.68 (d, J = 55.07 Hz), 9.64-9.31 (d, J = 53.45 Hz; IR ($CHCl_3$): ν_{max} 3435, 2978, 2928, 1586, 1452, 1385, 1374, 1241, 1141, 1105 cm^{-1}; ESI-MS: *m/z* 483.1 $[M]^+$.

Tetraethyl-2-(anthracene-10-yl)ethene-1,1-diyldiphosphonate (6s). Yellow oil; yield: 58%; HPLC: t_R = 19.95 min (98% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 8.89 (dd, J_1 = 28 Hz, J_2 = 48 Hz, 1H), 8.37 (s, 1H), 7.94-7.85 (m, 4H), 7.43-7.19 (m, 4H), 4.38-4.31 (m, 4H), 3.56-3.50 (m, 2H), 3.36-3.32 (m, 2H), 1.44 (t, J = 4 Hz, 6H), 0.62 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 159.67, 130.87, 130.14, 129.52, 128.49, 127.72, 127.32, 125.76, 125.73, 125.39, 63.10, 63.06, 62.11, 62.06, 16.52, 16.47, 16.32, 16.30, 15.56, 15.51; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 14.95-14.61 (d, J = 55.07 Hz), 10.34-9.99 (d, J = 56.69 Hz); IR ($CHCl_3$): ν_{max} 3435, 2919, 1601, 1404, 1360, 1280, 1186, 1148, 1019 cm^{-1}; ESI-MS: *m/z* 477 $[M+1]^+$; HRMS: *m/z* 477.1590 calcd for $C_{24}H_{31}O_6P_2+H^+$ (477.1590).

(E)-Diethyl 4-chlorostyrylphosphonate (7a). Yellow oil; yield: 55%; HPLC: t_R = 11.17 min (98.8% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 7.50-7.35 (m, 5H), 6.28 (t, J = 16 Hz, 1H), 4.18-4.10 (m, 4H), 1.36 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 147.31, 147.25, 136.15, 133.42, 129.13, 128.90, 115.46, 113.93, 61.98, 61.94, 16.43, 16.38; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz) δ 18.98 (s); IR ($CHCl_3$): ν_{max} 3449, 2981, 2928, 1593, 1618, 1443, 1246,1163,1052, 1025 1094, cm^{-1}; ESI-MS: *m/z* 296.94 $[M+Na]^+$; HRMS: *m/z* 275.0601 calcd for $C_{12}H_{17}ClO_3P+H^+$ (275.0598).

(E)-Diethyl 3, 5-difluoro styrylphosphonate (7b). Yellow oil; yield: 58%; HPLC: t_R = 8.69 min (91.3% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 7.44-7.34 (m, 1H), 7.01 (d, J = 8 Hz, 2H), 6.85-6.81 (m, 1H), 6.28 (t, J = 16 Hz, 1H), 4.17-4.12 (m, 4H), 1.36 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 163.33, (d, $^1J_{CF}$ = 249.5 Hz), 163.20 (d, $^1J_{CF}$ = 249.51 Hz), 145.95, 138.22 (d, $^2J_{CF}$ = 24.14 Hz), 118.54, 116.64, 110.47 (m), 105.35 (m), 70.10 (m), 62.10 (m), 45.00, 29.61 (m), 27.04 (m), 16.45, 16.38; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 17.73 (s); IR (CHCl3): ν_{max} 3436, 2980, 2926, 2851, 2461, 1615, 1596, 1497, 1458, 1441, 1394, 1265, 1245, 1192, 1162, 1097, 1050, 1021 cm^{-1}; MS: *m/z* 277.10 $[M+1]^+$; HRMS: *m/z* 299.0618 calcd for $C_{12}H_{15}F_2O_3P+Na^+$ (299.0618).

(E)-Diethyl 3-bromo 4-methoxystyrylphosphonate (7c). Yellow oil; yield 60%; HPLC: t_R = 11.1 min (95.4% purity); ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 7.73 (s, 1H), 7.43-7.38 (m, 2H), 6.90 (d, J = 8 Hz, 1H), 6.11 (t, J = 16 Hz, 1H), 4.18-4.09 (m, 4H), 3.93 (s, 3H), 1.35 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 159.31, 159.29, 157.82, 136.13, 132.28, 129.77, 111.24, 110.99, 62.69, 62.63, 62.56, 62.49, 56.36, 16.36, 16.29, 16.18, 16.12; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz) δ 18.49 (s); IR ($CHCl_3$): ν_{max} 3457, 2981, 2929, 2849, 1730, 1615, 1596, 1555, 1497, 1461,

1442, 1394, 1297, 1265, 1247, 1163, 1097, 1051, 1024 cm^{-1}; ESI-MS: *m/z* 351 $[M+2]^+$; HRMS: *m/z* 349.0202 calcd for $C_{13}H_{19}BrO_4P_2+H^+$ (349.0198).

(E)-Diethyl 3-bromo-4-fluorostyrylphosphonate (7d). Yellow oil; yield: 65%; HPLC: t_R = 12.86 min (97.8% purity); ^1H NMR (400 MHz, $CDCl_3$, ppm): δ 7.72-7.70 (m, 1H), 7.44-7.35 (m, 2H), 7.14 (t, *J* = 8 Hz, 1H), 6.20 (t, *J* = 16 Hz, 1H), 4.18-4.10 (m, 4H), 1.36 (t, *J* = 8 Hz, 6H); ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz) δ 18.45 (s); IR ($CHCl_3$): ν_{max} 3436, 2985, 2930, 2079, 1633, 1494, 1443, 1393, 1249, 1047, 1026 cm^{-1}; ESI-MS: *m/z* 336.88 $[M+1]^+$; HRMS: *m/z* 336.9999 calcd for $C_{12}H_{16}BrFO_3P_2+H^+$ (336.9999).

General procedure for preparation of alkynylphosphonates 8a-c. To a solution of ethynyl-benzene **12a-c** (0.1 ml, 18.2 mmol) in dry THF (5ml) was added *n*-BuLi (0.2ml, 20 mmol) under nitrogen at –78 °C. The mixture was stirred at –78 °C for 2 hours, then diethylchlorophosphate **13** (0.3 ml, 20 mmol) in dry THF (5 ml) was added at –78 °C. The solution was stirred for 1 hour at –78 °C, warmed to room temperature and stirred for 3 hours. The mixture was evaporated, and the resulting residue was purified by column chromatography on silica gel to produced **8a-c** 80-85% yield.

Diethyl 2-phenylethynylphosphonate (8a). Yellow oil; yield 75%; HPLC: t_R = 11.64 min (98.8% purity); ^1H NMR (400 MHz, CH_3OD, ppm): δ 7.57 (d, *J* = 8Hz, 2H), 7.45 (d, *J* = 8Hz, 1H), 7.40-7.32 (m, 2H), 4.27-4.20 (m, 4H), 1.41 (t, *J* = 8Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 132.54, 130.70, 128.54, 119.45, 119.40, 99.34, 98.81, 79.76, 63.25, 63.19, 16.10, 16.03; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ -6.16 (s); IR ($CHCl_3$): ν_{max} 3480, 3061, 2909, 2985, 2187, 2081, 1638, 1490, 1227, 1263, 1024, cm^{-1}; ESI-MS: *m/z* 239 $[M+1]^+$. HRMS: *m/z* 239.0826 calcd for $C_{12}H_{16}O_3P+H^+$ (239.0831).

Diethyl-2-(4-(trifluoromethyl)pheny)lethynylphosphonate (8b). Yellow oil; yield: 80%; HPLC: t_R = 11.46 min (99% purity); ^{1}H NMR (400 MHz, CH_3OD, ppm): δ 7.71- 7.64 (m, 4H), 4.29-4.22 (m, 4H), 1.42 (t, J = 4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 131.55, 124.20, 124.18, 124.15, 124.12, 95.55, 95.14, 80.45, 78.09, 62.14, 62.09, 14.76, 14.70; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ -6.94 (s); IR ($CHCl_3$): ν_{max} 3486, 3101, 2936, 2986, 2641, 2192, 2085, 1614, 1479, 1445, 1405, 1325, 1266, 1170, 1132, 1066 cm^{-1}; ESI-MS: *m/z* 307 $[M+1]^+$; HRMS: *m/z* 307.0701 calcd for $C_{13}H_{15}F_3O_3P+H^+$ (307.0705).

Diethyl-2-(3-(trifluoromethyl)pheny)lethynylphosphonate (8c). Yellow oil; yield: 85%; HPLC: t_R = 11.41 min (98.4% purity); ^{1}H NMR (400 MHz, CH_3OD, ppm): δ 7.83 (s, 1H), 7.76-7.70 (m, 2H), 7.54 (t, J = 8Hz, 1H), 4.29-4.21 (m, 4H), 1.44-1.41 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ 135.67, 131.42, 129.30, 127.24, 123.27 (d, $^1J_{CF}$ = 271.25 Hz), 120.58, 96.66 (d, $^2J_{CF}$ = 52.50 Hz), 81.15, 67.39, 63.61 (m), 32.26, 18.63, 16.12, 13.55; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ -6.93 (s); IR ($CHCl_3$): ν_{max} 3436, 2931, 2979, 1579, 1612, 1508, 1385, 1335, 1281, 1245, 1106 cm^{-1}; MS: *m/z* 307 $[M+1]^+$; HRMS: *m/z* 307.0703 calcd for $C_{13}H_{15}F_3O_3P+H^+$ (307.0705).

General procedure for preparation of α-amino alkynylphosphonates 9a-b: To a solution of benzaldehyde **10a-b** (0.1ml, 2 mmol) in aceto nitrile (5 ml) was added amines **14a-b** (0.1 ml, 2 mmol) and diethyl phosphite **15** (0.1 ml, 2 mmol) then stirring the mixture for 2 h at room temperature. After complete reaction extracted with EtOAc and water. The organic layer was dried over Na_2SO_4. Concentration in *vacuo* followed by column chromatography on silica gel provided the corresponding α-amino alkynylphosphonates **9a-b** with 80-85% yield.

Diethyl phenyl(phenylamino)methylphosphonate (9a). White powder; yield 80%; m.p. 86-88 °C; HPLC: t_R = 10.99 min (98% purity); ^{1}H NMR (400 MHz, CH_3OD, ppm): δ 7.40-7.39 (m, 2H), 7.24-7.15 (m, 3H), 6.96-6.93 (m, 2H), 6.60 (d, J = 6.4 Hz, 2H), 6.50-6.51 (t. J = 6.0 Hz, 1H), 4.85 (d, $^1J_{PH}$

= 19.6 Hz, 1H), 4.04-3.96 (m, 2H), 3.89-3.35 (m, 1H), 3.75-3.70 (m, 1H), 1.15 (t, *J* = 5.6 Hz, 3H), 1.04 (t, *J* = 5.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 148.20, 148.06, 137.48, 129.99, 129.43, 128.93, 119.19, 115.07, 64.79, 64.72, 64.58, 64.51, 56.64 (d, $^1J_{CP}$ = 152.1 Hz), 16.75, 16.69, 16.57, 16.51; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 22.70 (s); IR ($CHCl_3$): ν_{max} 3435, 3294, 3029, 2981, 1605, 1497, 1454, 1386, 1234, 1057, 1024 cm^{-1}; ESI-MS: *m/z* 342.18 $[M+Na]^+$; HRMS: *m/z* 320.1408 calcd for $C_{17}H_{23}NO_3P+H^+$ (320.1410).

Diethyl-(4-chlorophenyl)(phenylamino)methylphosphonate (9b). White solid power; yield: 90%; m.p. 60-62 °C; HPLC: t_R = 16.71 min (93.99% purity); ^{1}H NMR (400 MHz, CH_3OD, ppm): *δ* 7.40-7.37 (m, 2H), 7.22 (d, *J* = 8.0 Hz 2H), 6.98-6.94 (m, 2H), 6.59-6.51 (m, 3H), 4.88 (d, $^1J_{PH}$ = 24.8 Hz, 1H), 4.05-3.97 (m, 2H), 3.95- 3.89 (m, 1H), 3.83-3.77 (m, 1H), 1.16 (t, *J* = 8.0 Hz, 3H), 1.08 (t, *J* = 8.0 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): *δ* 144.88, 133.39, 132.57, 132.54, 128.07, 127.99, 127.94, 127.65, 117.51, 112.67, 62.31, 62.26, 62.16, 54.36 (d, $^1J_{CP}$ = 150 Hz), 15.28, 15.24, 15.10, 15.05; ^{31}P NMR ($CDCl_3$, H_3PO_4, 161.98 MHz): δ 22.02 (s); IR ($CHCl_3$): ν_{max} 3436, 2927, 2317, 1603, 1498, 1235, 1051, 1020 cm^{-1}; ESI-MS: *m/z* 376.15$[M+Na]^+$; HRMS: *m/z* 376.0848 calcd for $C_{17}H_{21}ClNNaO_3P+H^+$ (376.0839).

Cell culture and treatments. Human colorectal adenocarcinoma LS180 cells were purchased from ECACC, England. These cells were grown in MEM growth medium. The media for cell line was supplemented with 1% MEM non-essential amino acids along with 10% FCS, 100 U penicillin G and 100 µg/ml of streptomycin. Cells were grown in 5% CO_2 at 37 °C with 95% humidity. All the test compounds were dissolved in DMSO for treatment of LS180 cells, while the untreated control cultures received only the vehicle (DMSO< 0.2%).

P-gp-induction assay. All synthesized compounds were screened for their ability to induce P-gp using rhodamine 123 cell exclusion method.[1] In this method, the P-gp function was evaluated in

terms of rhodamine 123 accumulation and efflux.[2] Briefly, the protocol used was as follows: Colorectal LS180 cells were seeded at a density of 2×10^4 per well of 96 well plate and were allowed to grow for next 24 h. Cells were further incubated with the test compounds, and were diluted to a final concentration of 5 µM and rifampicin (positive control) to a final concentration of 10 µM in complete media for 48 h. The final concentration of DMSO was kept at 0.1%. Drugs were removed and cells were incubated with HANKS buffer for 40 minutes before further incubation with HANKS buffer (containing 10 µM of Rh123 as a P-gp substrate) for 90 minutes. At the end of Rh123 treatment cells were washed four times with cold PBS followed by cell lysis for 1 h using 200 µl of lysis buffer (0.1% Triton X 100 and 0.2 N NaOH). A total of 100 µl of lysate was used for reading fluorescence of Rh123 at 485/529 nm. Samples were normalized by dividing fluorescence of each sample with total protein present in the lysate.

Cell viability assay. The cell proliferation assay was done in human colorectal adenocarcinoma LS180 cells. Cells (1×10^4) were seeded into each well of 96-well microplate for 24 h. Cells were treated with 30 µM of each compound for 24 h. The MTT dye was then added to each well 4 h prior to the termination of experiment. Formazan crystals were dissolved in DMSO before taking absorbance at 570 nm. Cell viability of the untreated control sample was considered to be 100%, while viability of test samples was calculated using the following formula:

$$\% \text{ cell viability} = \frac{\text{OD (test)}}{\text{OD (control)}} \text{ x } 100$$

Western-blot analysis of compounds 6c and 6s in LS180 cells. Protein was measured employing Bio-Rad protein assay kit using bovine serum albumin as standard. Proteins aliquots (70 µg) were resolved on SDS-PAGE and then electro transferred to PVDF membrane overnight at 4 °C at 30V. Nonspecific binding was blocked by incubation with 5 % non-fat milk in Tris-buffered saline

containing 0.1% Tween-20 (TBST) for 1 h at room temperature. The blots were probed with anti-Pgp antibody for 4 h and washed three times with TBST. Blot was then incubated with horseradish peroxidase conjugated antimouse secondary antibody for 1 h, washed again three times with TBST and signals detected using ECL plus chemiluminescence's kit on BioRad ChemiDoc XRS system.

Aqueous solubility, CYP liability and Caco-2 permeability and pharmacokinetic analysis was performed as reported in our earlier papers.[3]

The pharmacokinetic study was carried out at Jubilant Biosys Limited Bangalore (India) on a commercial basis. These experiments were approved by the Jubilant Biosys Institutional Animal Ethics Committee, Bangalore, India (IAEC/JDC/2012/27) and were in accordance with the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Social Justice and Environment, Government of India.

Statistical analysis. Data is expressed as mean ± SD of three independent experiments unless otherwise indicated. The comparisons were made between control and treated groups or the entire intra group using Bonferroni test through Instat-2 software. p -values *<0.5 were considered significant.

S4. REFERENCES ASSOCIATED WITH ESI

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