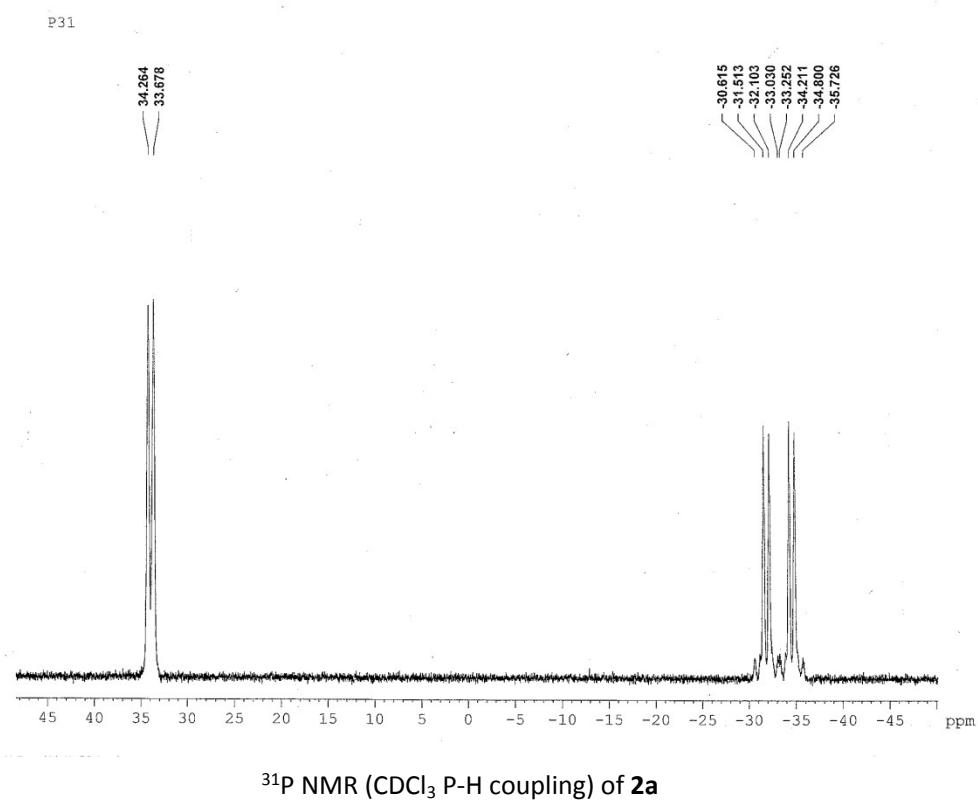
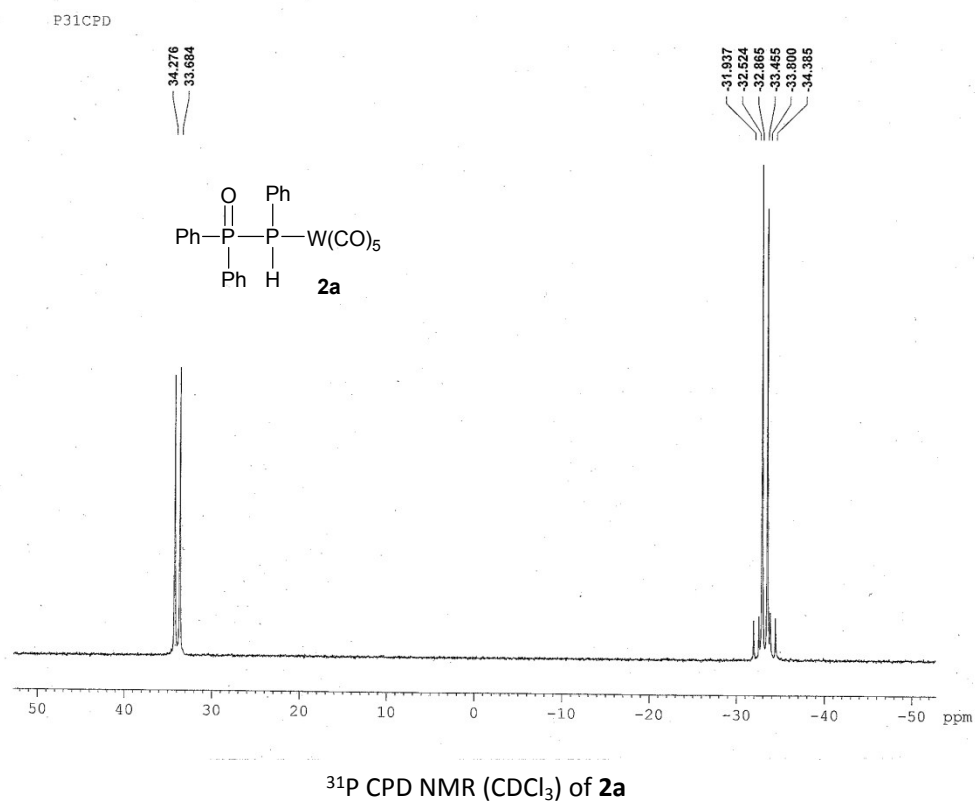
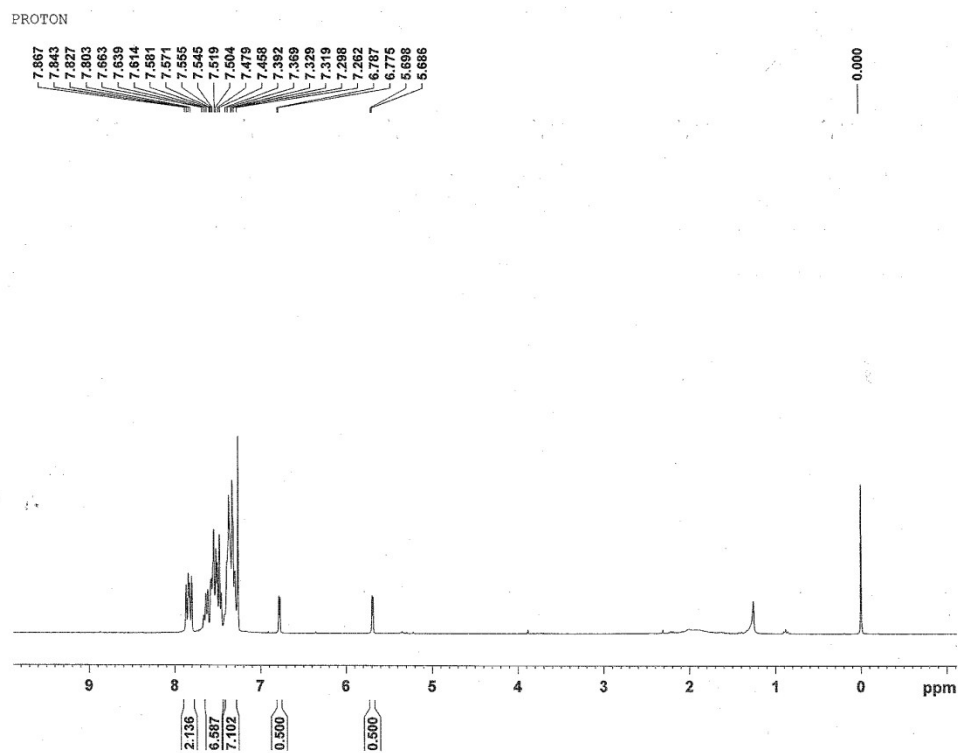
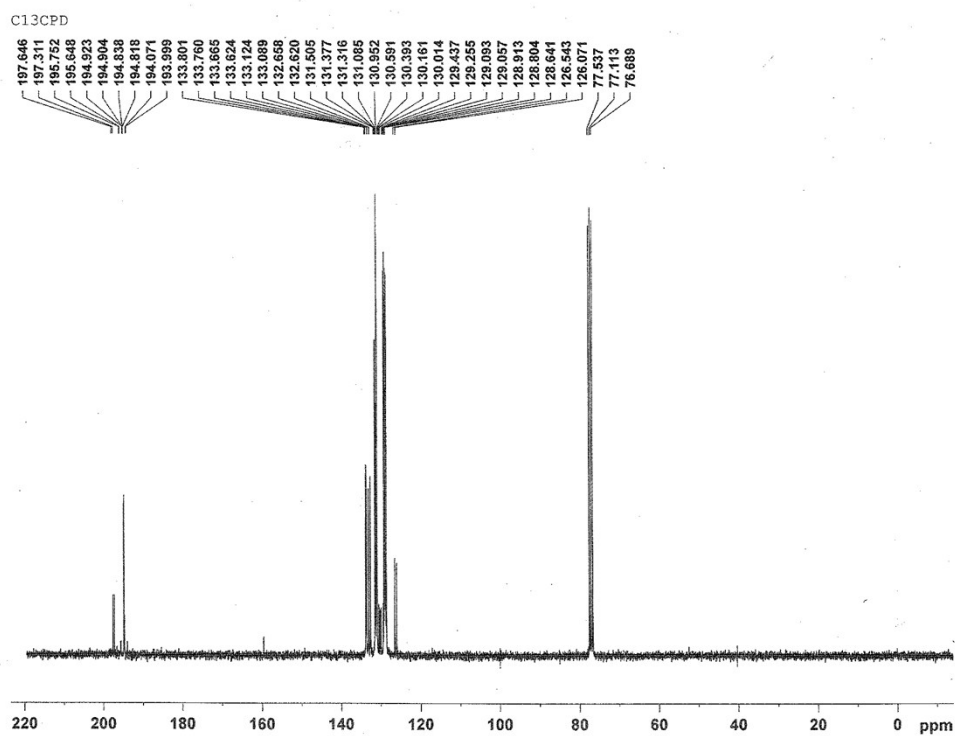


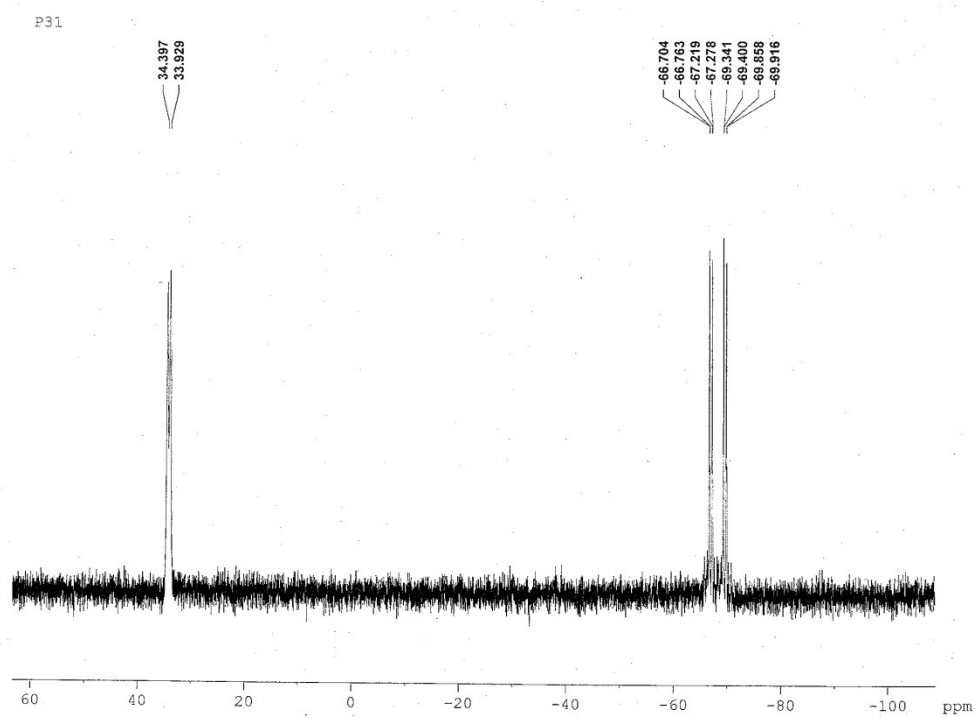




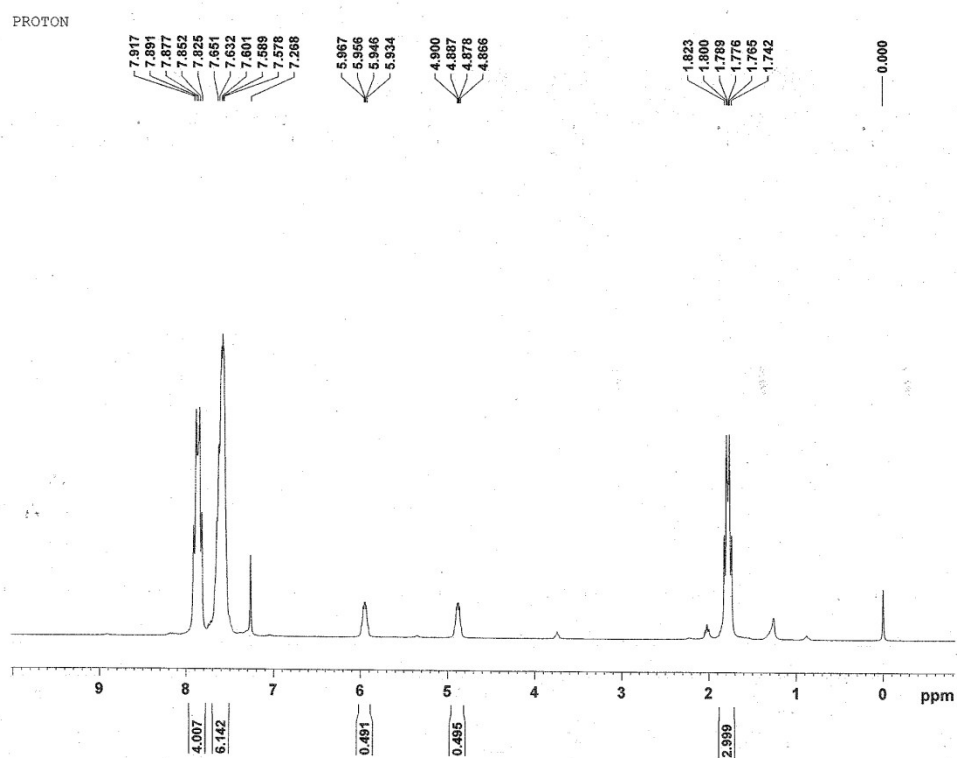
^1H NMR (CDCl_3) of **2a**



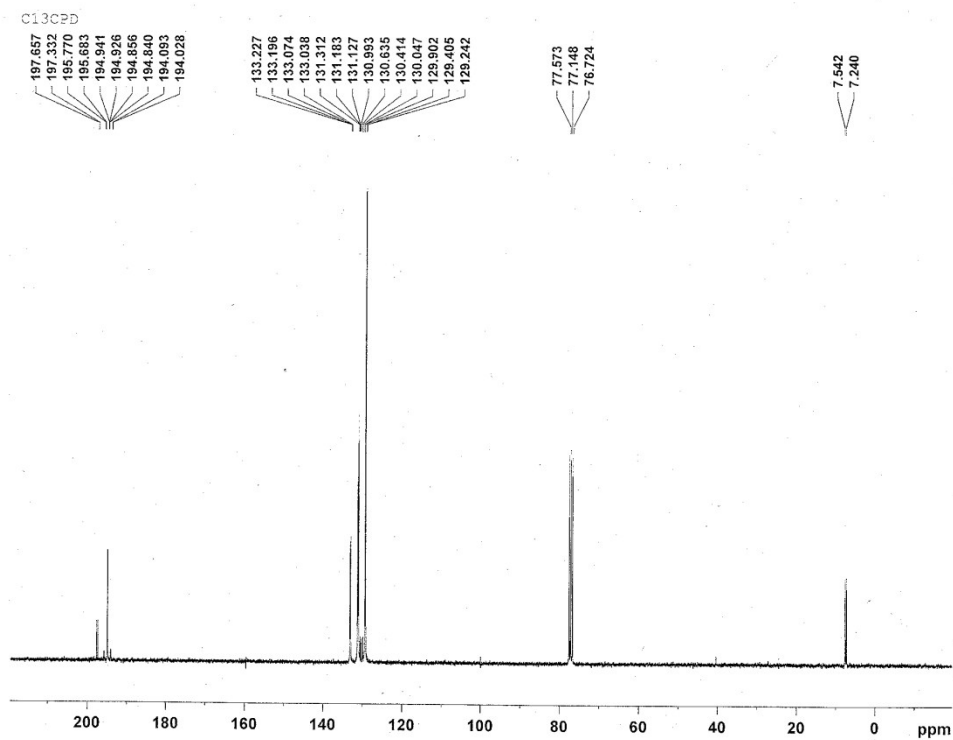
^{13}C NMR (CDCl_3) of **2a**



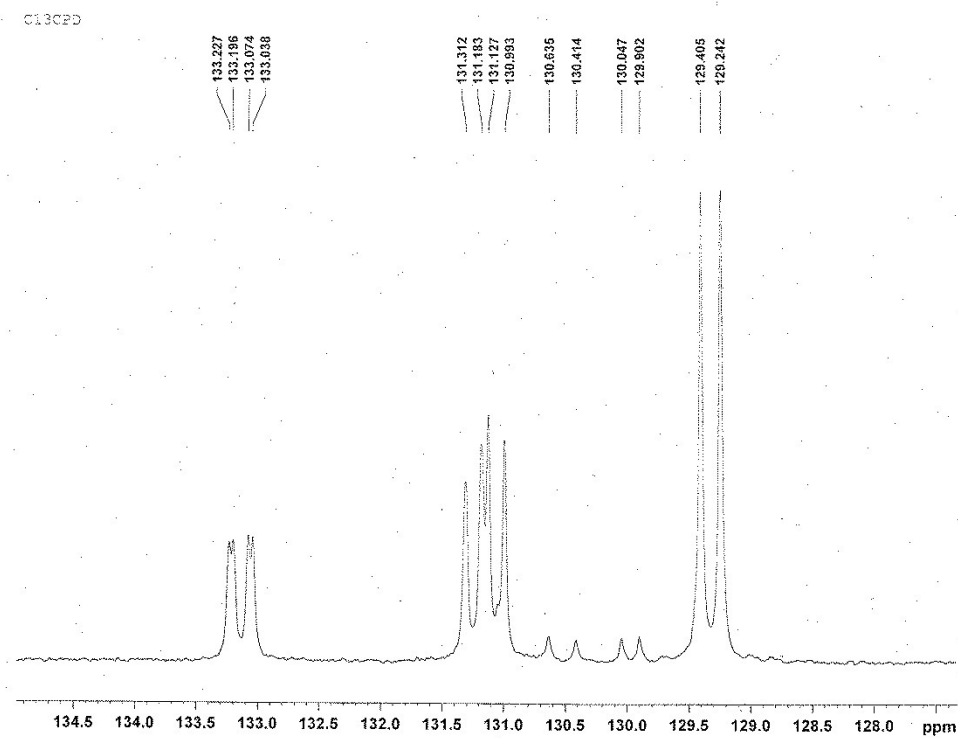
³¹P NMR (CDCl₃ P-H coupling) of **2b**



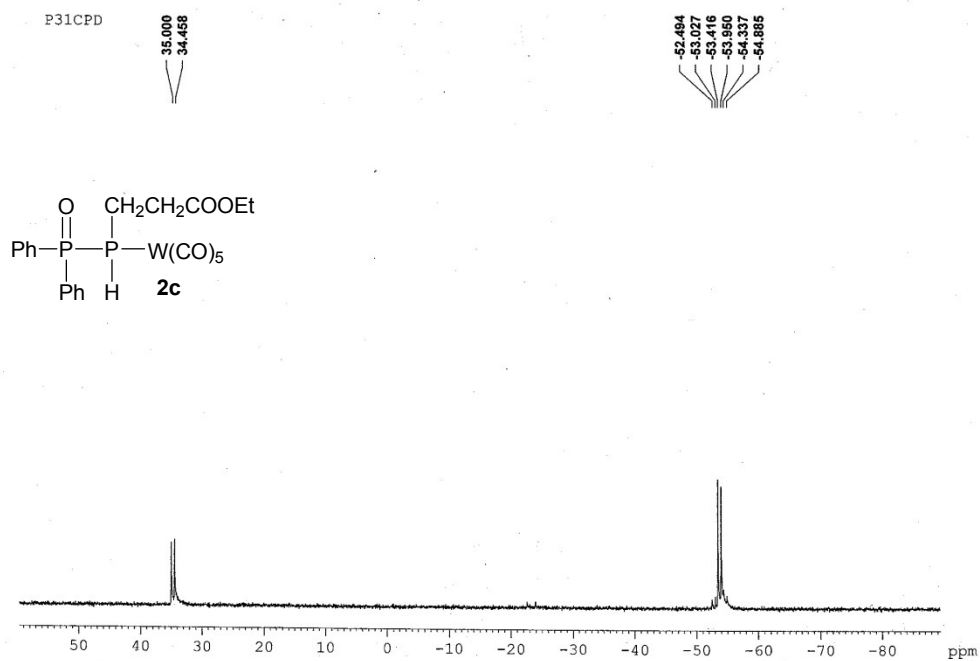
¹H NMR (CDCl₃) of **2b**



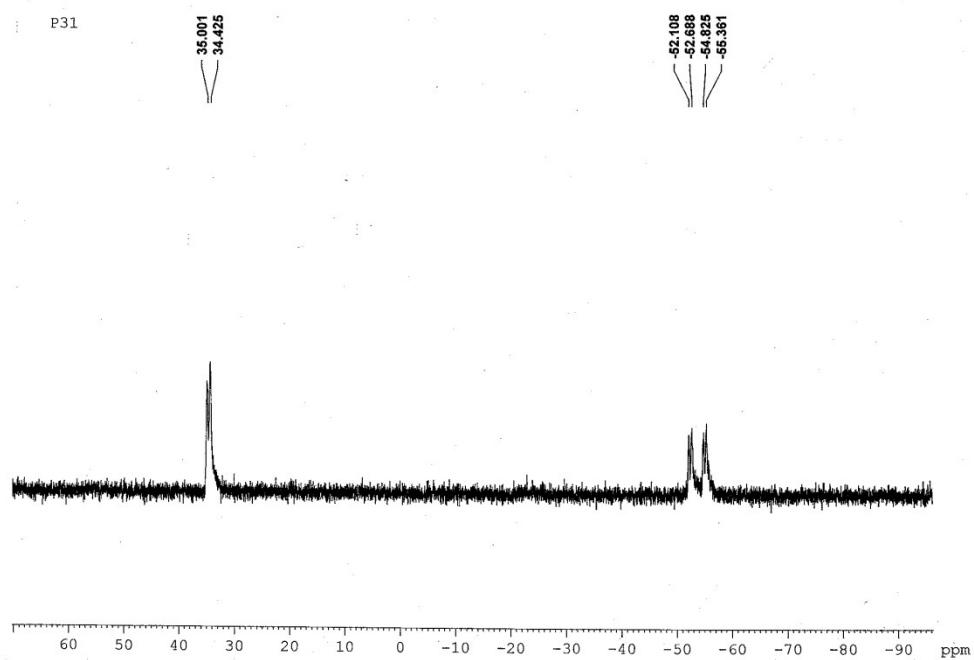
¹³C NMR (CDCl₃) of 2b



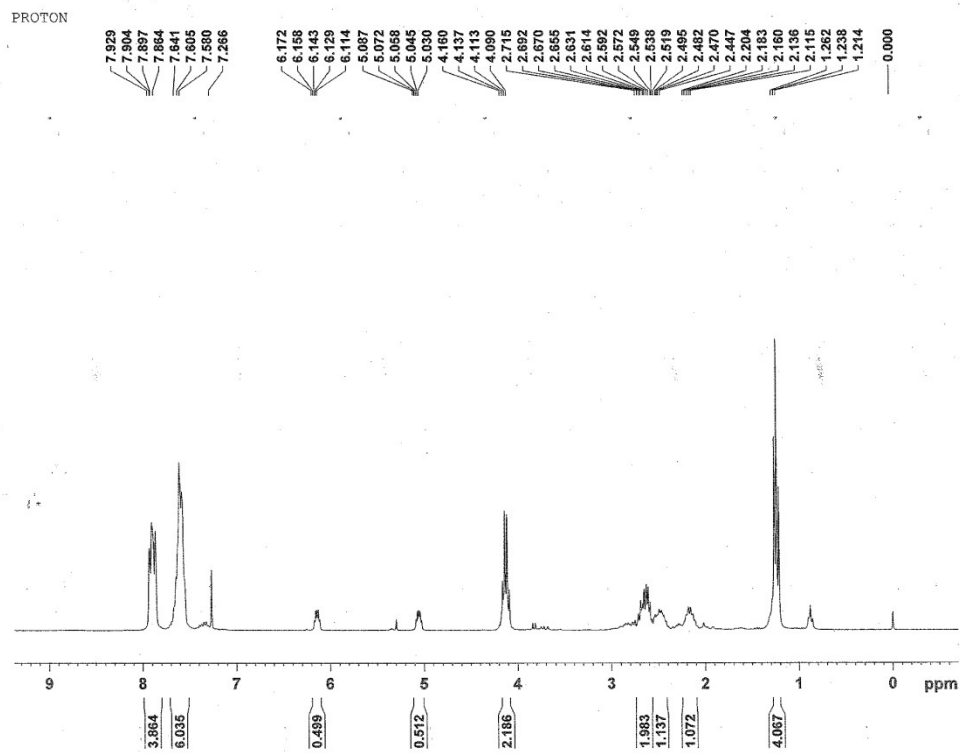
¹³C NMR (CDCl₃) of 2b



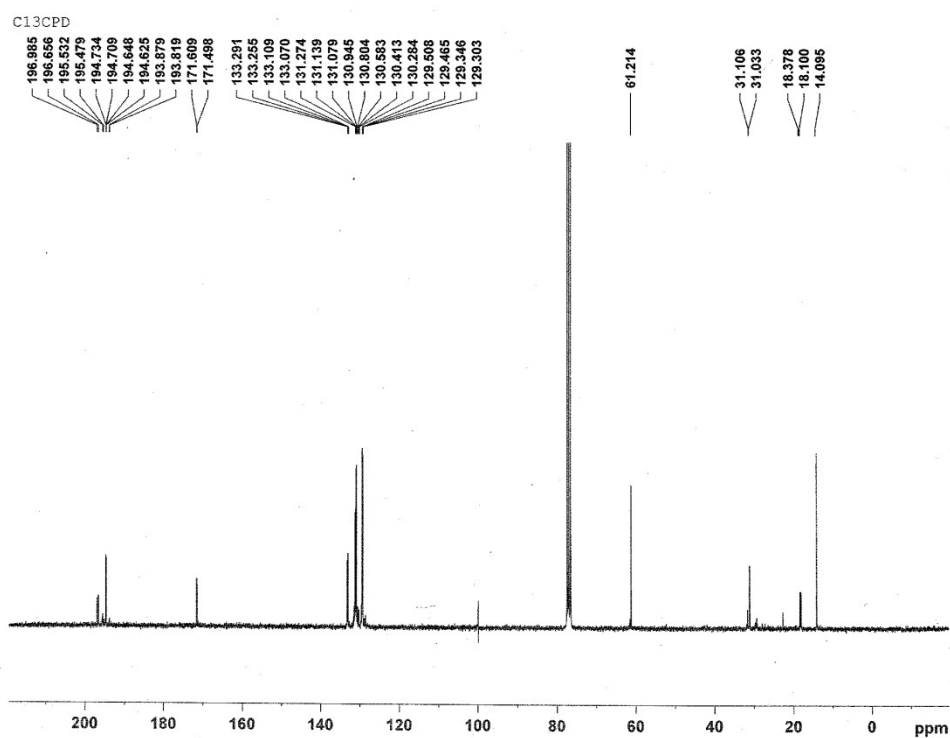
^{31}P CPD NMR (CDCl_3) of **2c**



^{31}P NMR (CDCl_3 P-H coupling) of **2c**

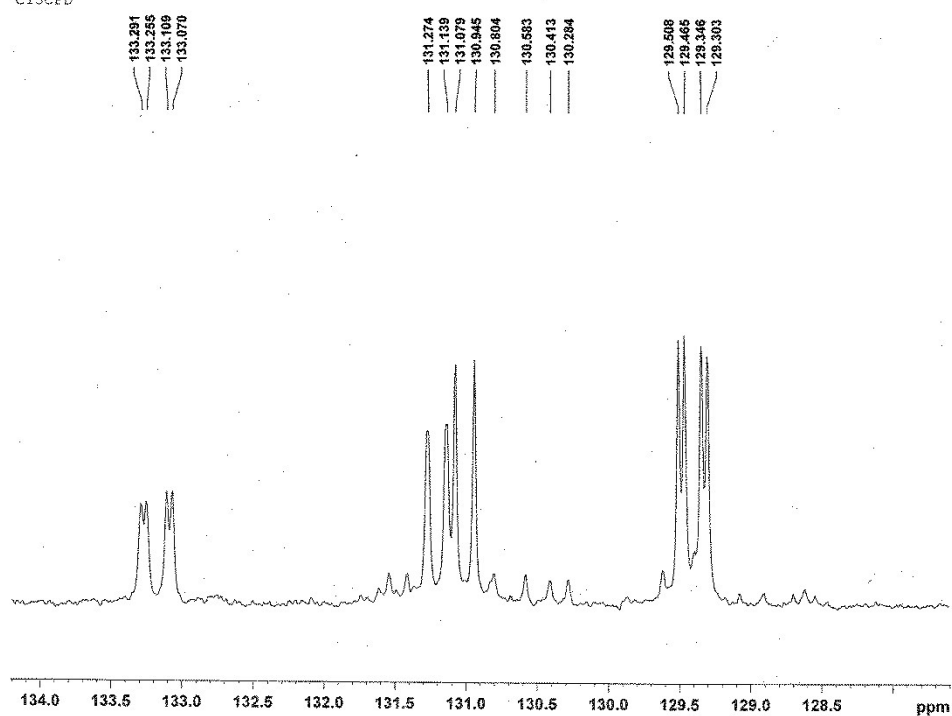


^1H NMR (CDCl_3) of **2c**



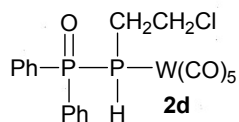
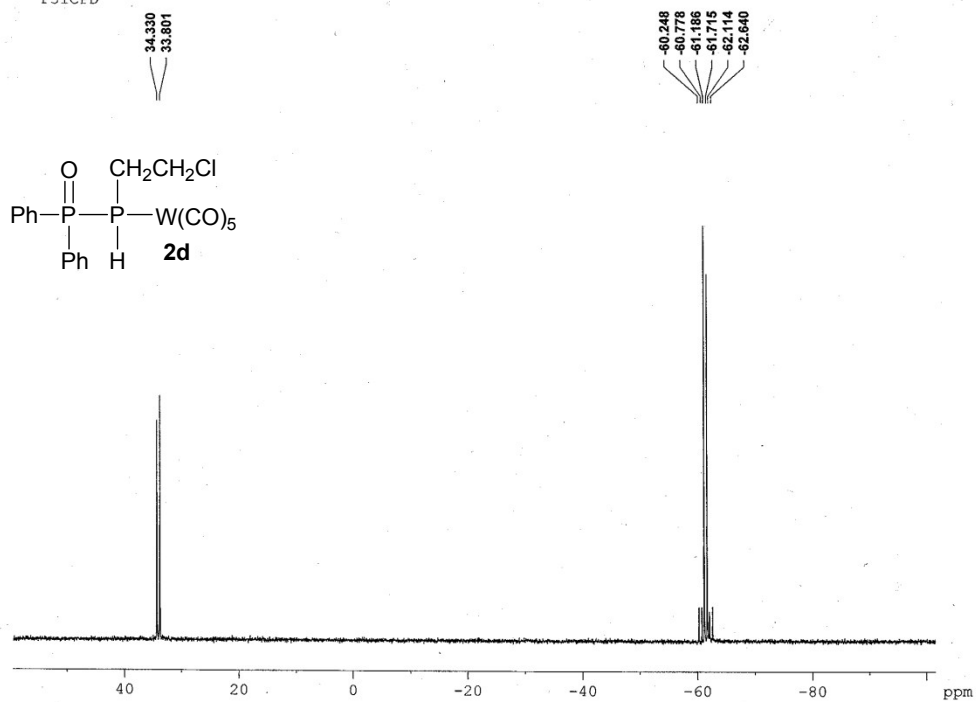
^{13}C NMR (CDCl_3) of **2c**

C13CPD

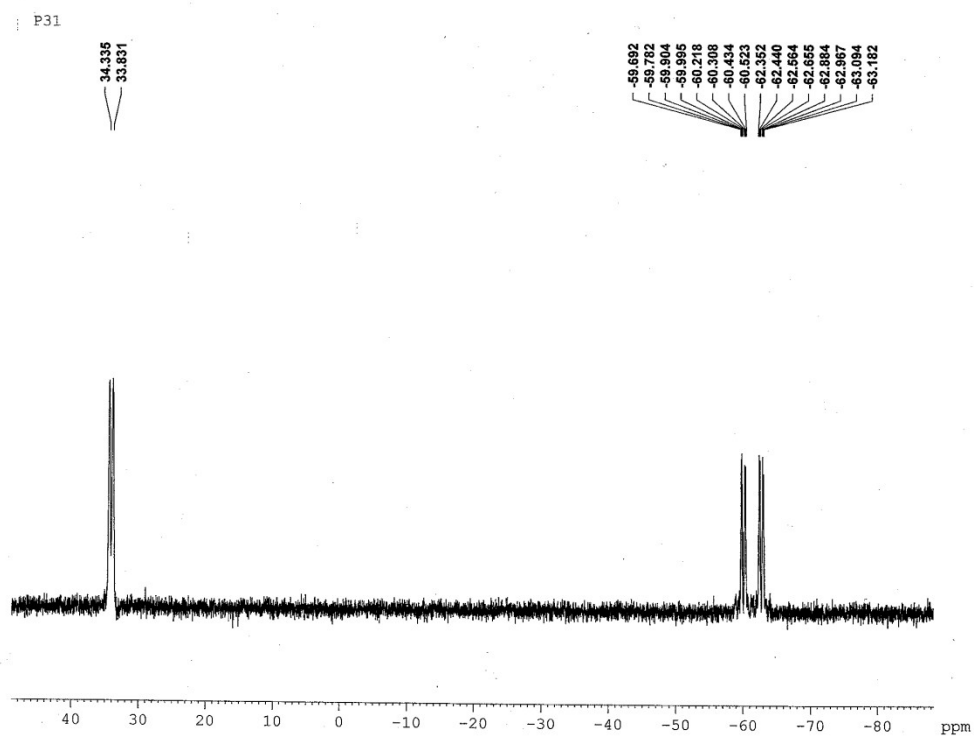


^{13}C NMR (CDCl_3) of **2c**

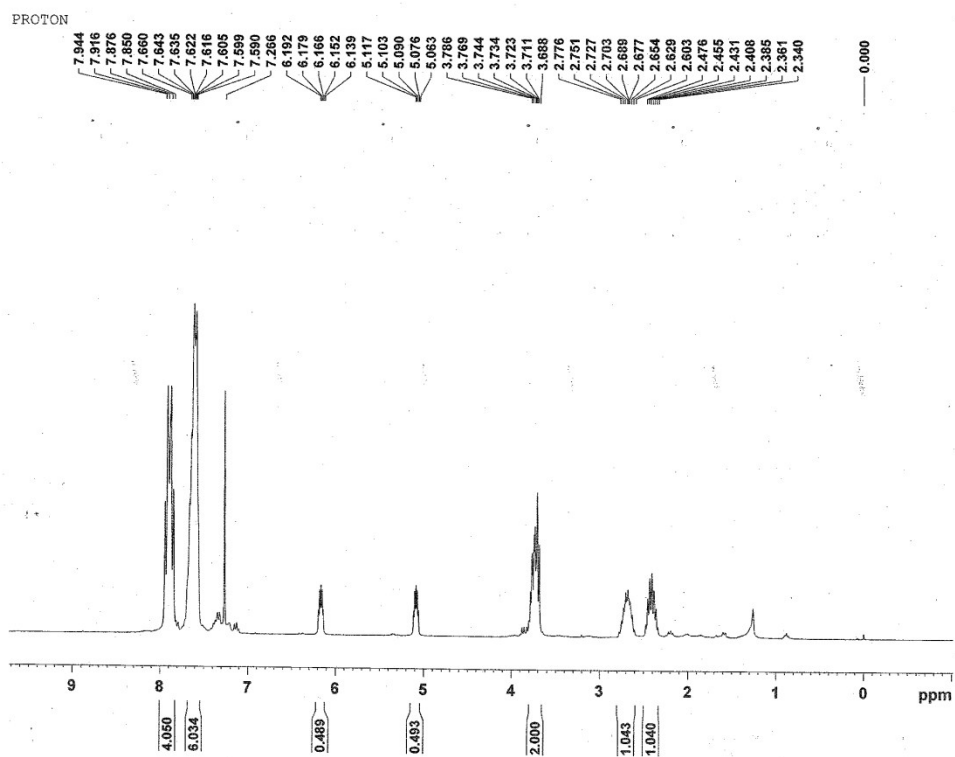
P31CPD



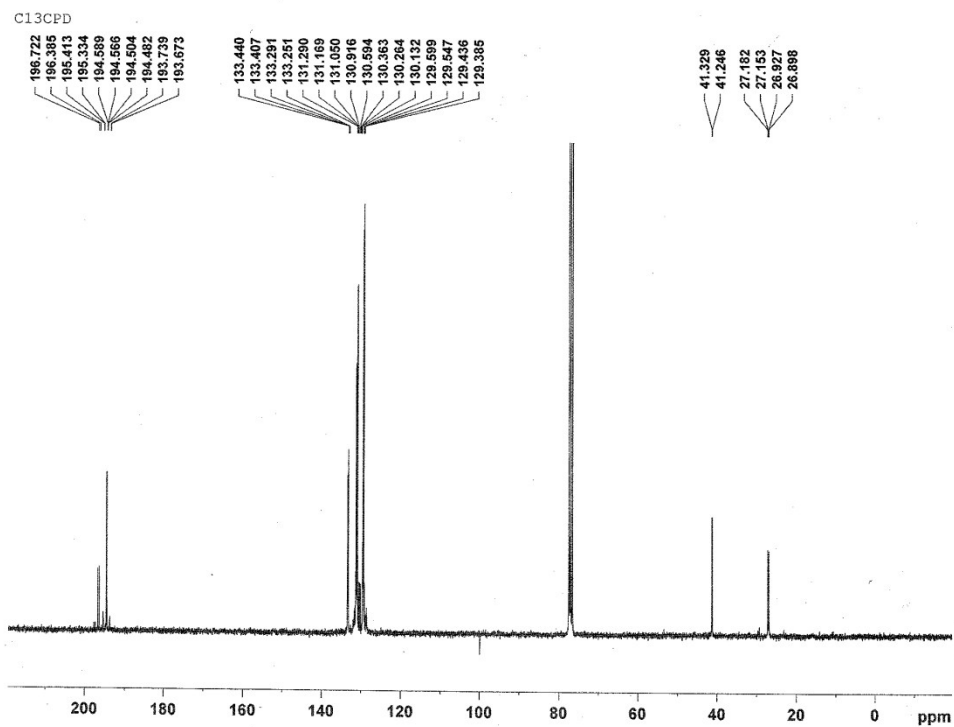
^{31}P CPD NMR (CDCl_3) of **2d**



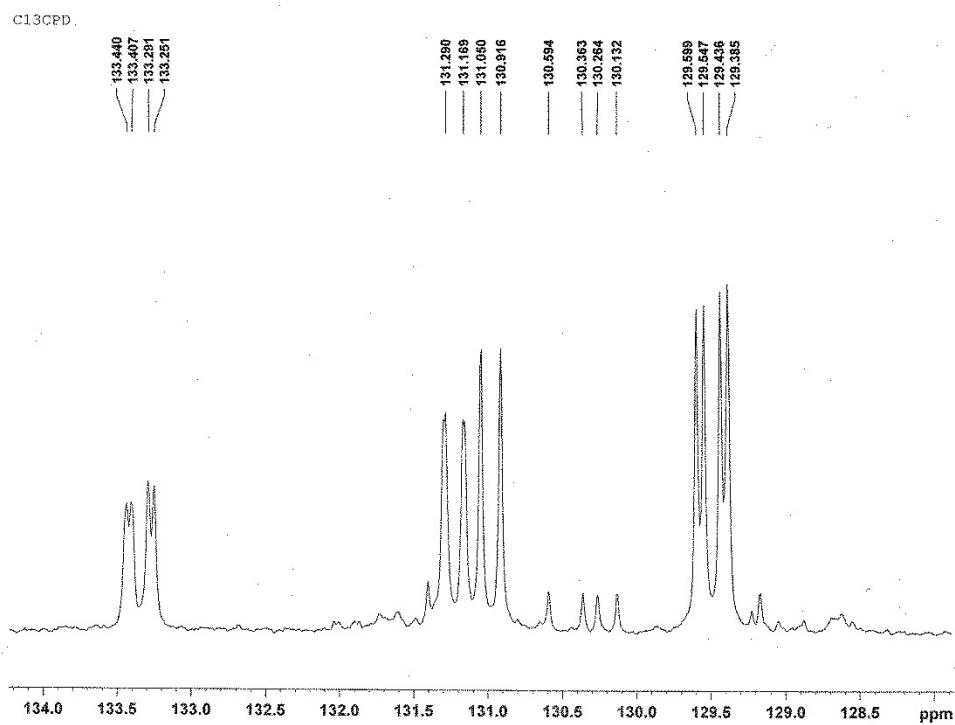
^{31}P NMR (CDCl_3 P-H coupling) of **2d**



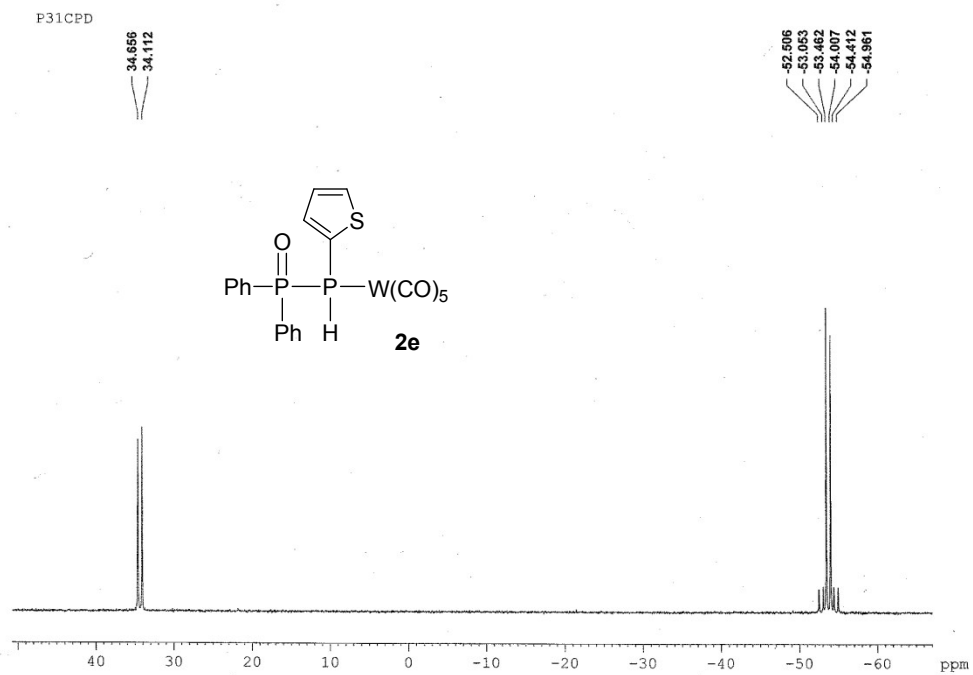
^1H NMR (CDCl_3) of **2d**



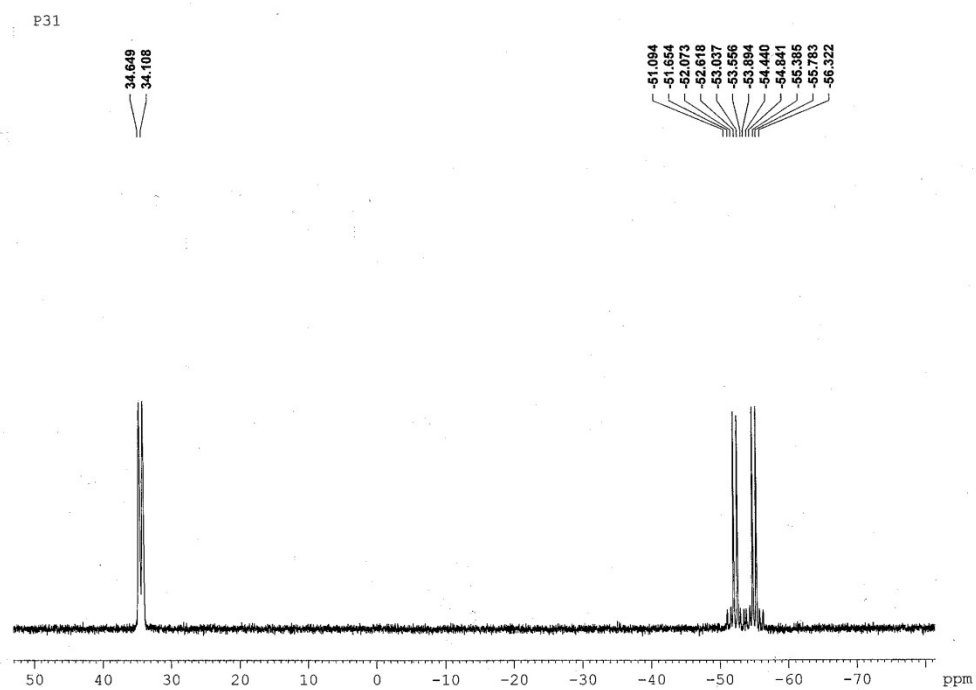
¹³C NMR (CDCl₃) of 2d



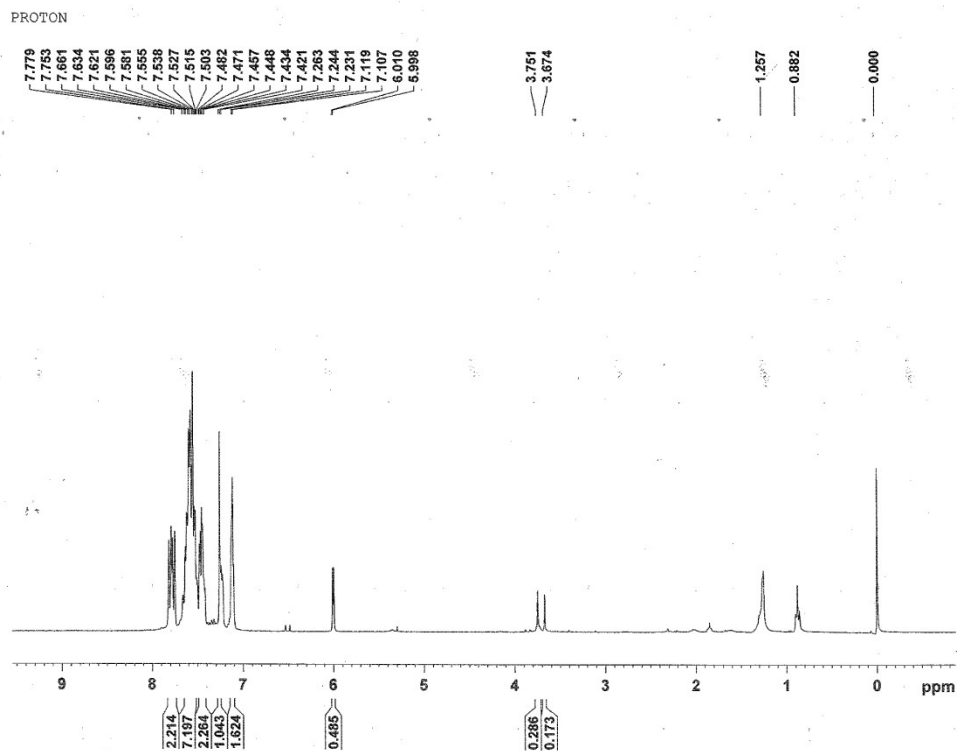
¹³C NMR (CDCl₃) of 2d



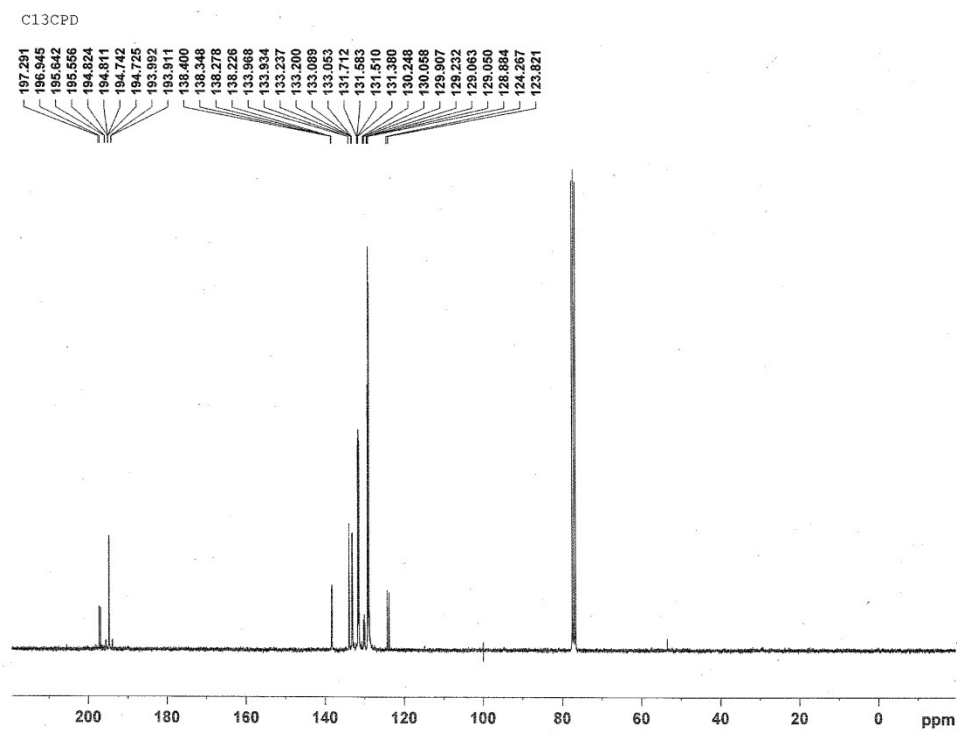
^{31}P CPD NMR (CDCl_3) of **2e**



^{31}P NMR (CDCl_3 P-H coupling) of **2e**

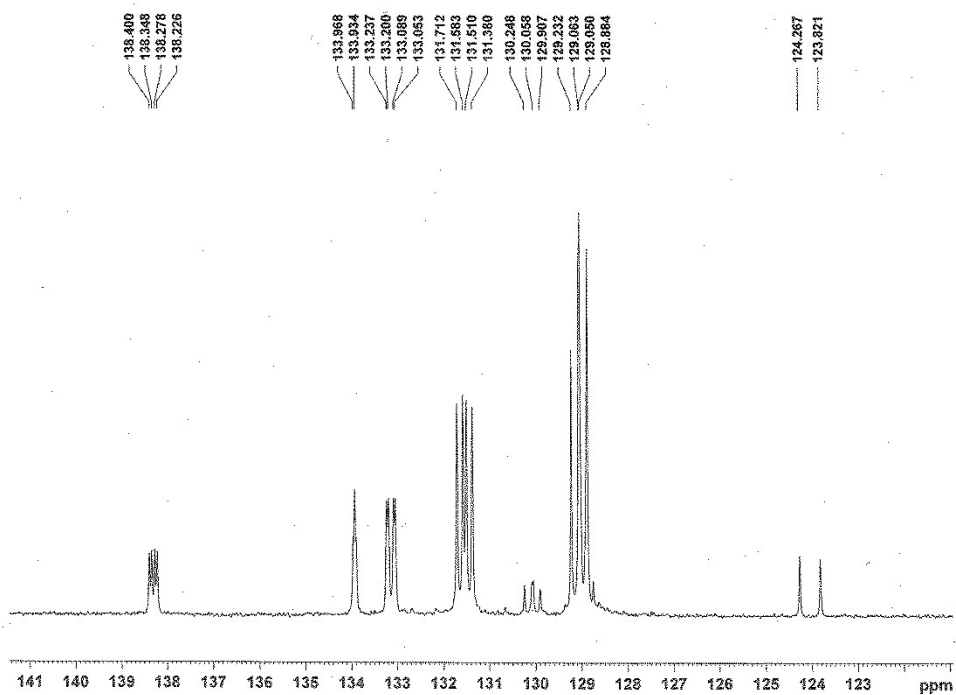


^1H NMR (CDCl_3) of **2e**



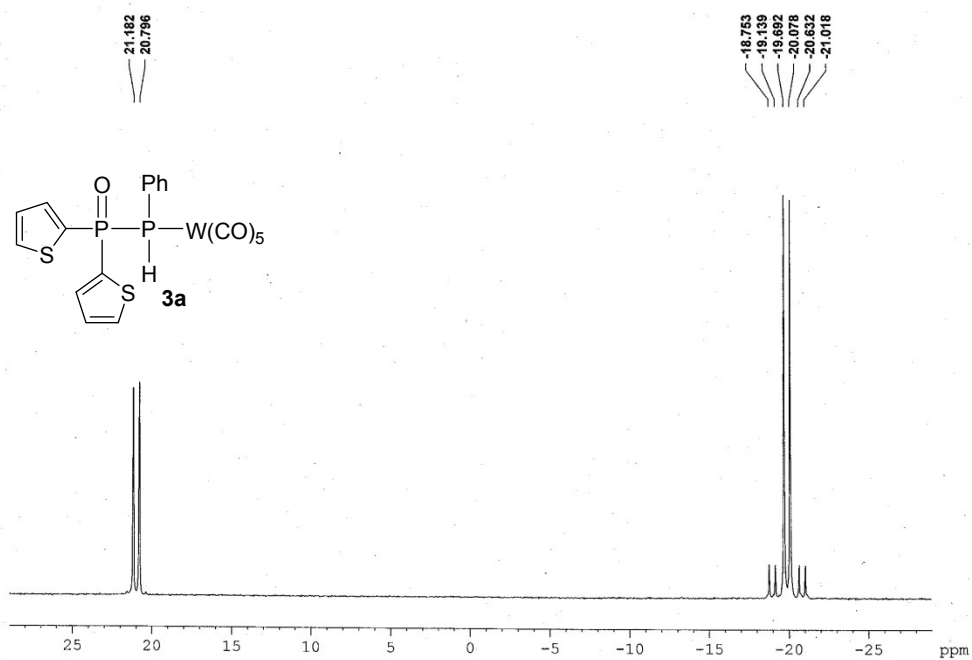
^{13}C NMR (CDCl_3) of **2e**

C13CPD



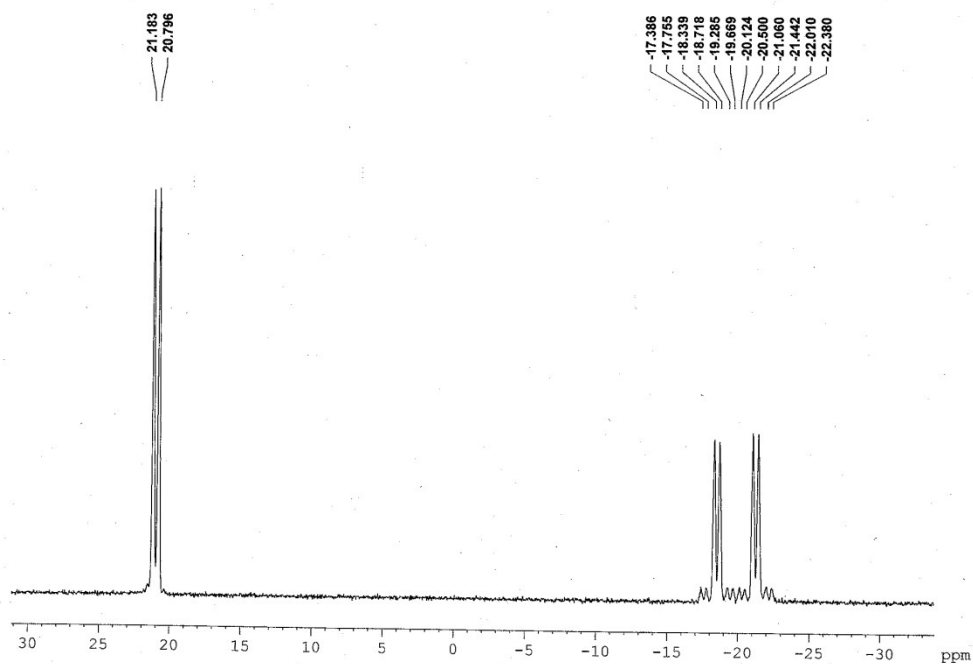
^{13}C NMR (CDCl_3) of **2e**

P31CPD



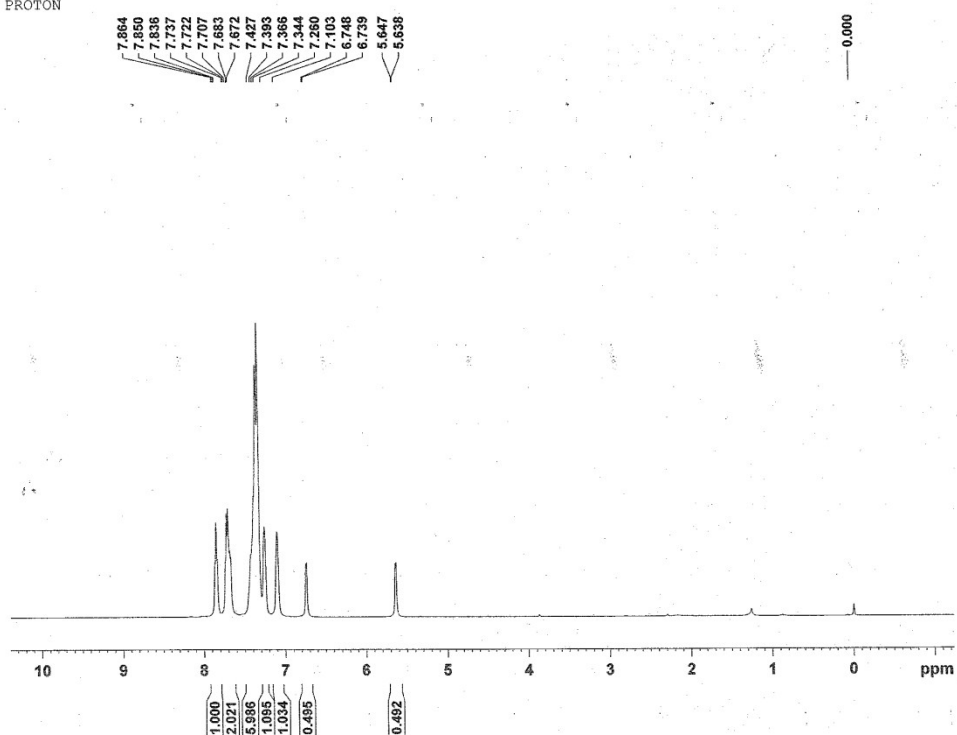
^{31}P CPD NMR (CDCl_3) of **2f**

P31



³¹P NMR (CDCl₃ P-H coupling) of **2f**

PROTON

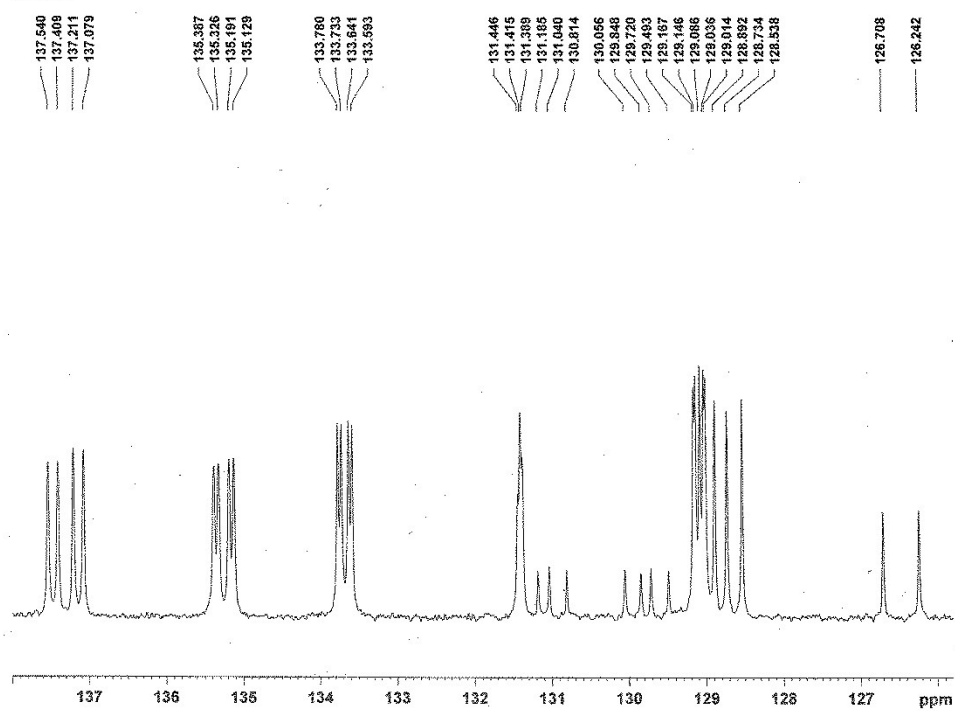


¹H NMR (CDCl₃) of **2f**

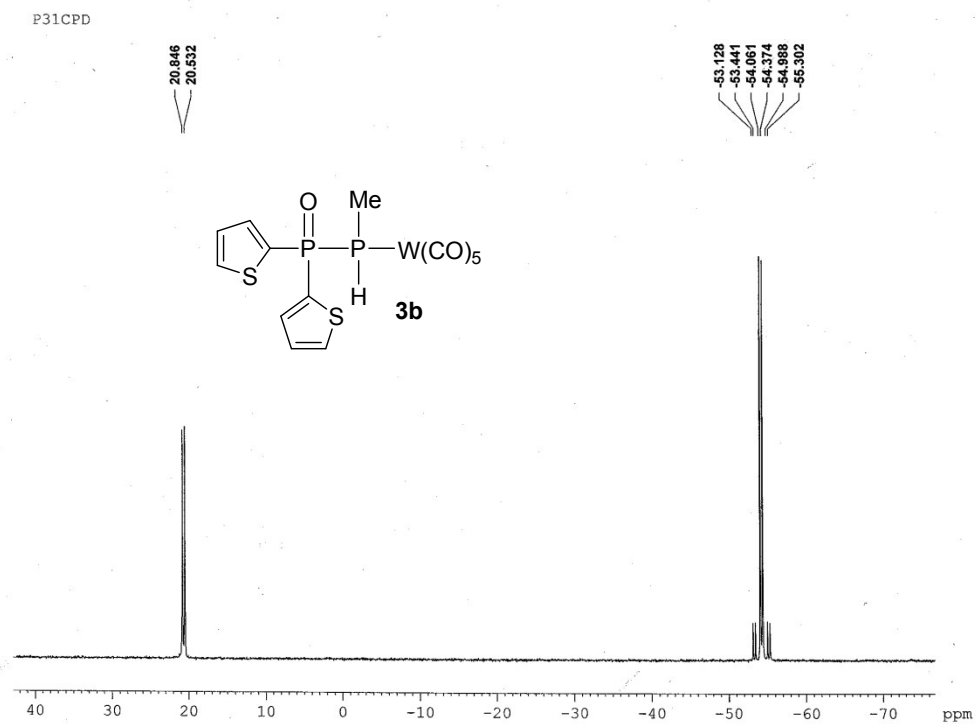


^{13}C NMR (CDCl_3) of **2f**

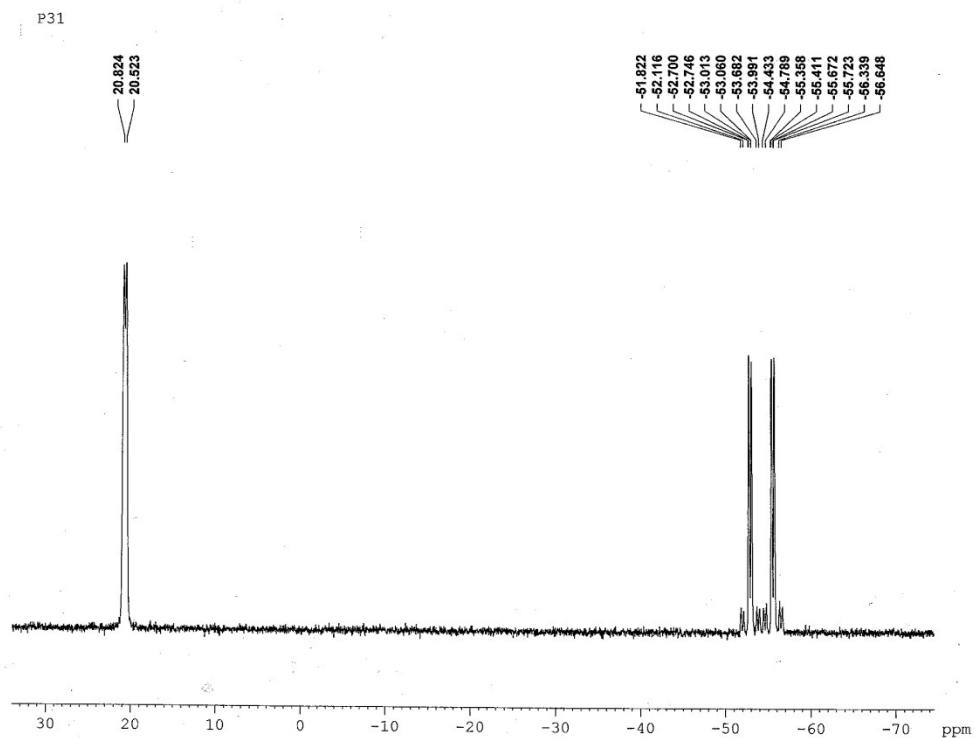
Q13CPD



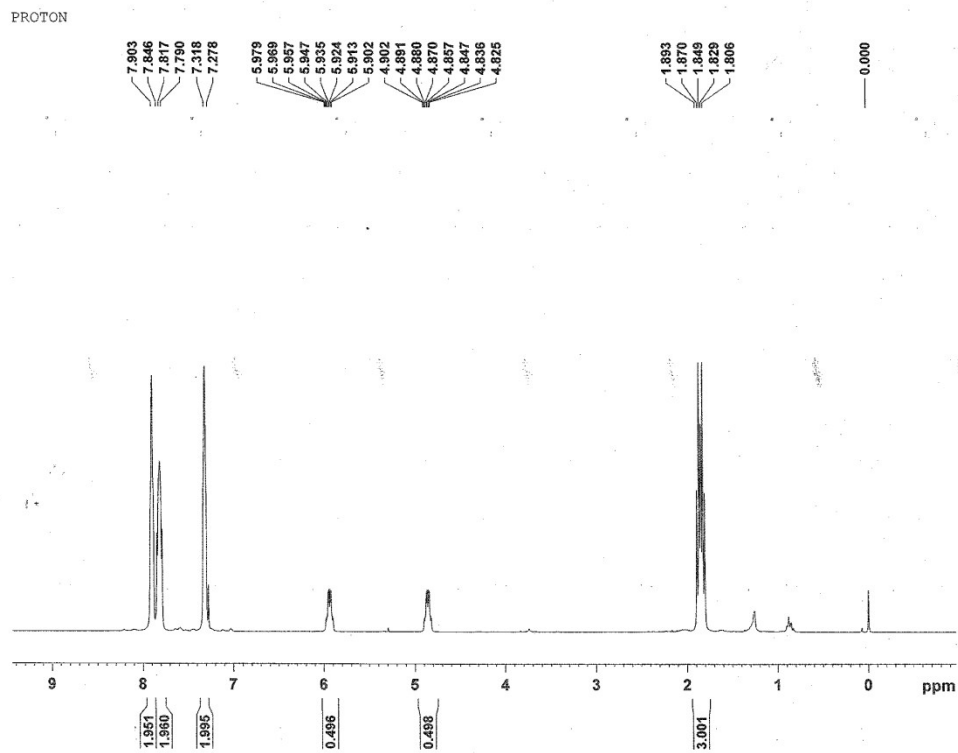
^{13}C NMR (CDCl_3) of **2f**



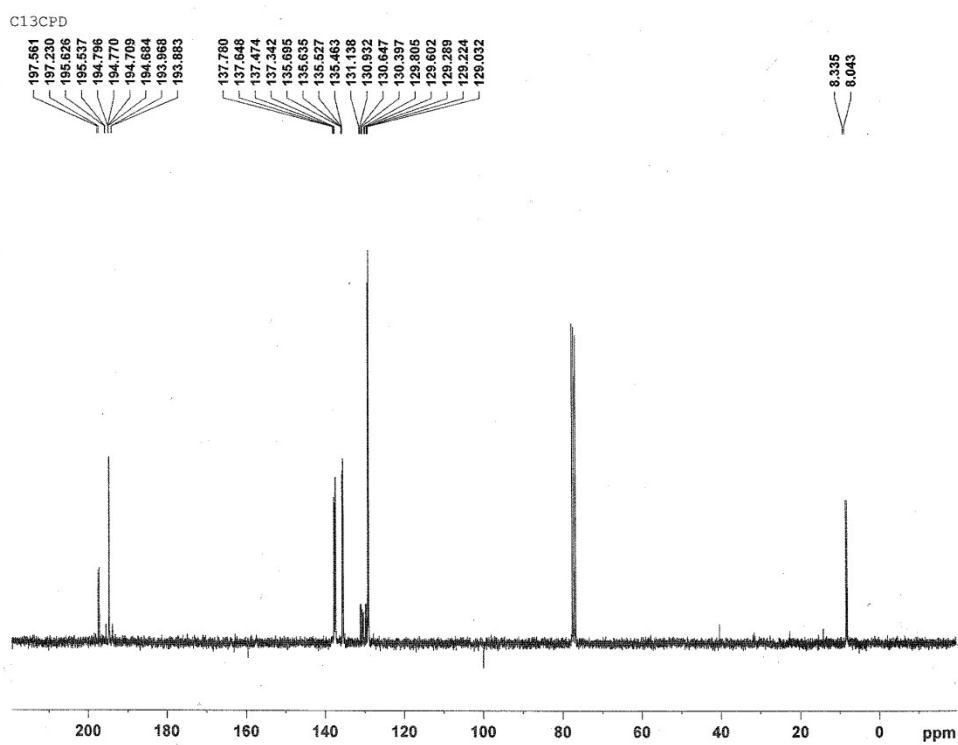
^{31}P CPD NMR (CDCl_3) of **2g**



^{31}P NMR (CDCl_3 P-H coupling) of **2g**

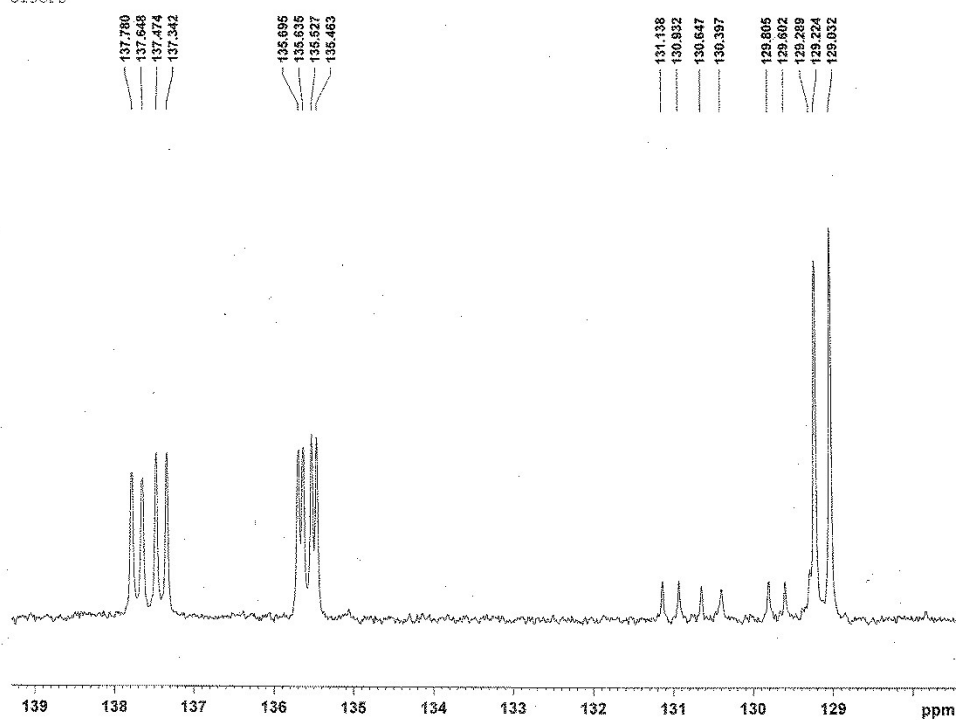


^1H NMR (CDCl_3) of **2g**



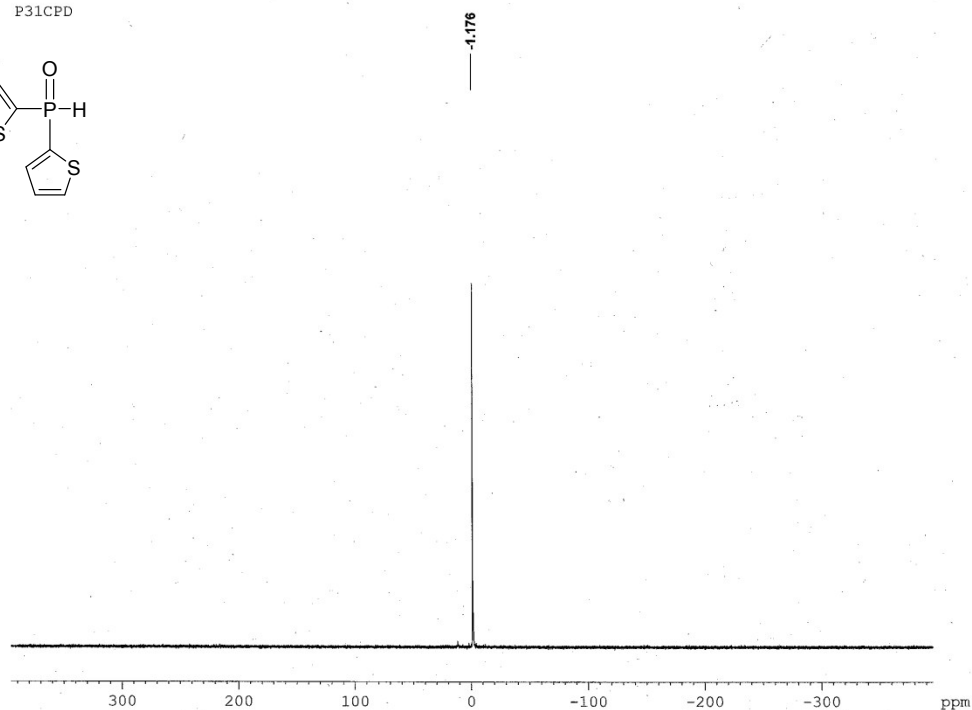
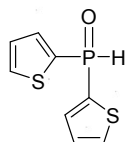
^{13}C NMR (CDCl_3) of **2g**

C13CPD



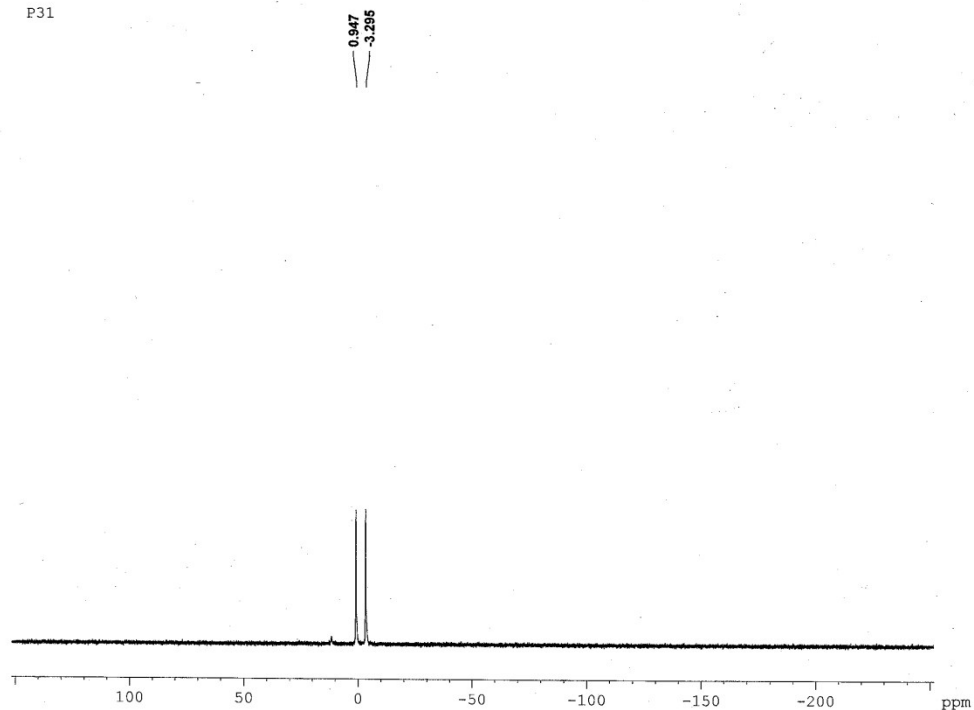
^{13}C NMR (CDCl_3) of **2g**

P31CPD



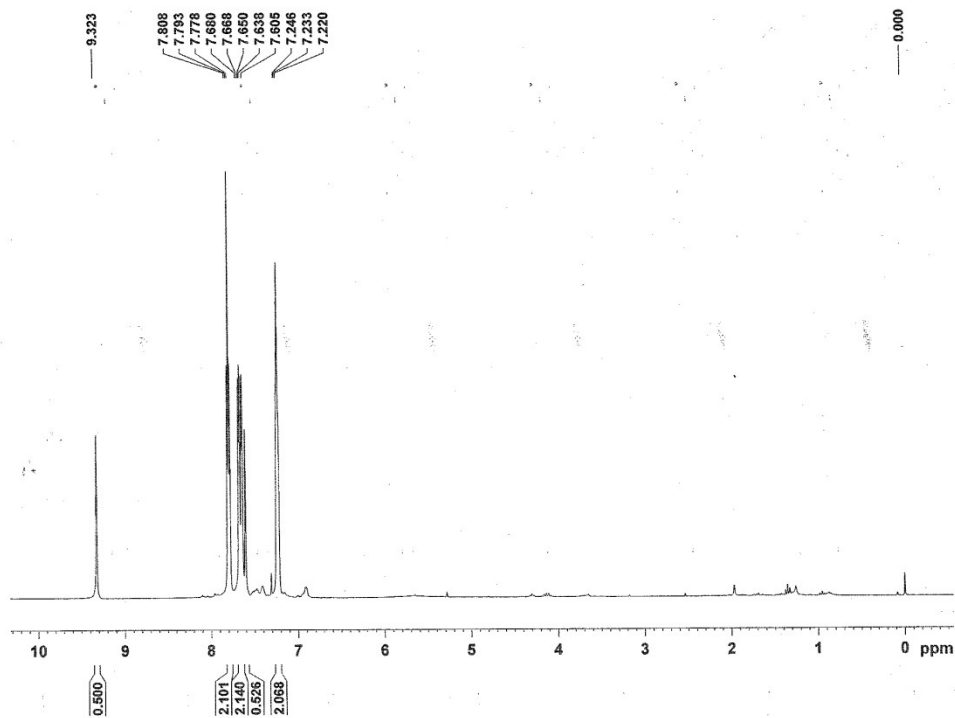
^{31}P CPD NMR (CDCl_3) of dithienylphosphine oxide

P31



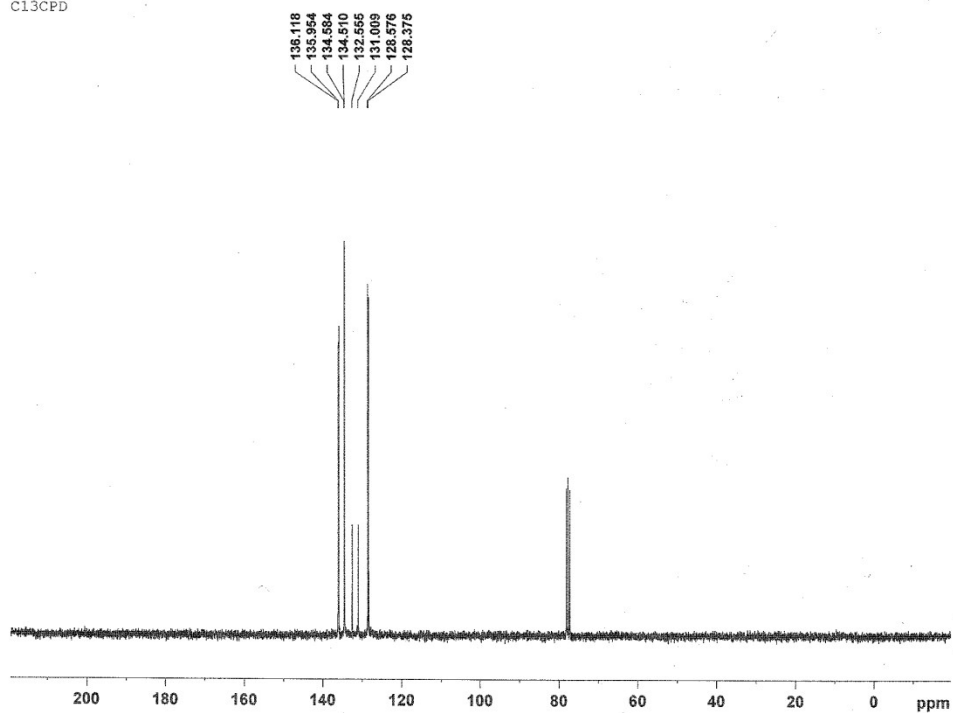
³¹P NMR (CDCl₃ P-H coupling) of dithienylphosphine oxide

PROTON



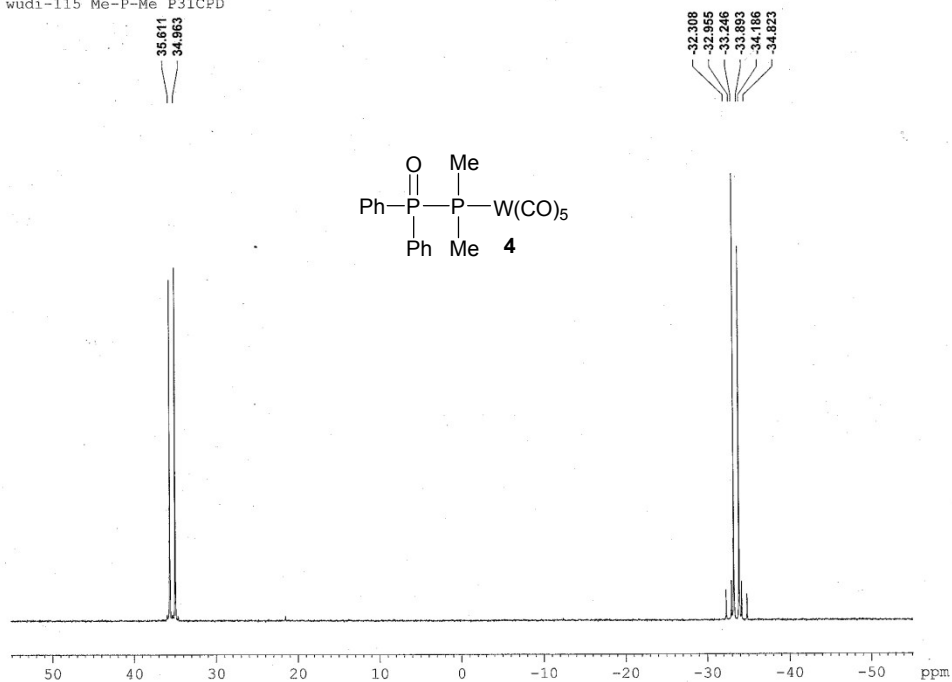
¹H NMR (CDCl₃) of dithienylphosphine oxide

C13CPD



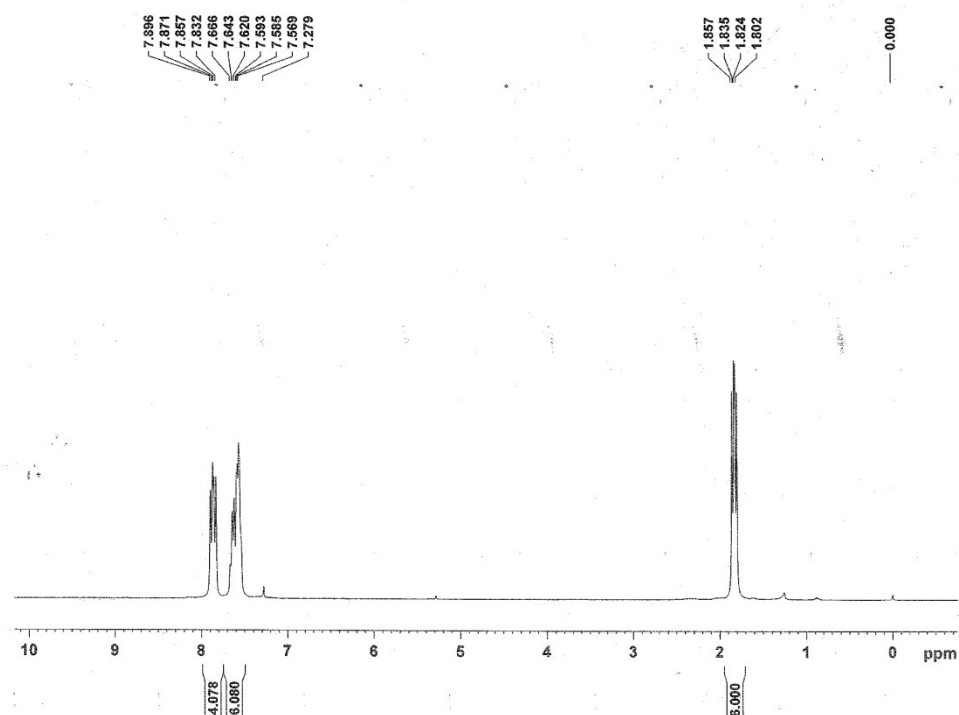
¹³C NMR (CDCl₃) of dithienylphosphine oxide

wudi-115 Me-P-Me P31CPD



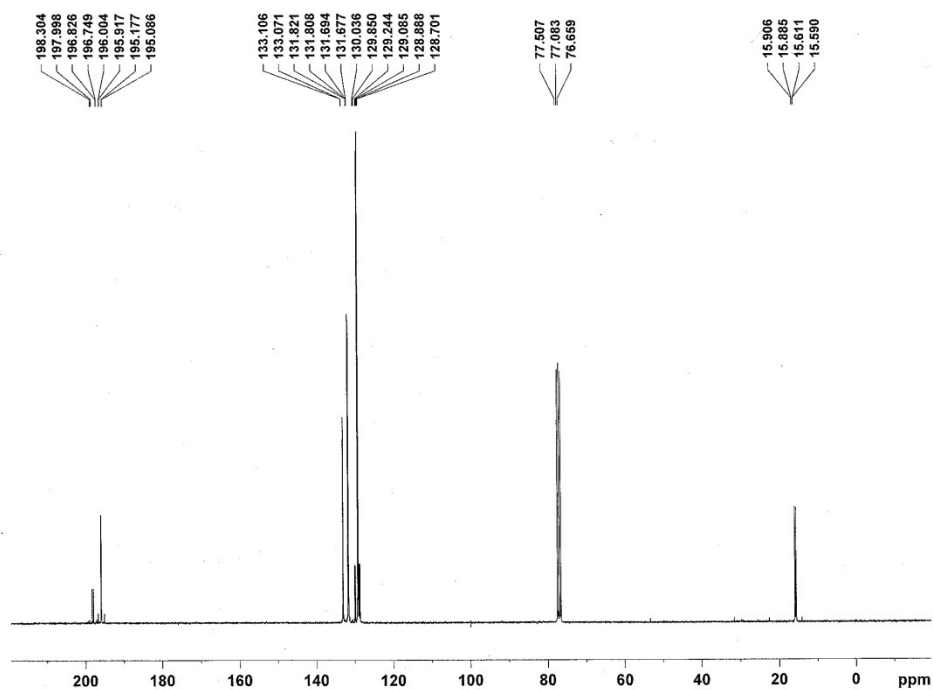
³¹P CPD NMR (CDCl₃) of **4**

product Me-P-Me PROTON



¹H NMR (CDCl₃) of 4

wudi-115 Me-P-Me C13CPD



¹³C NMR (CDCl₃) of 4

$$\begin{array}{c} \text{O} \\ \parallel \\ \text{Ph}-\text{P}-\text{P} \\ | \quad | \\ \text{Ph} \quad \text{W(CO)}_5 \end{array}$$
5

35.291
34.226

-224.509
-225.497
-226.560
-227.545

ppm

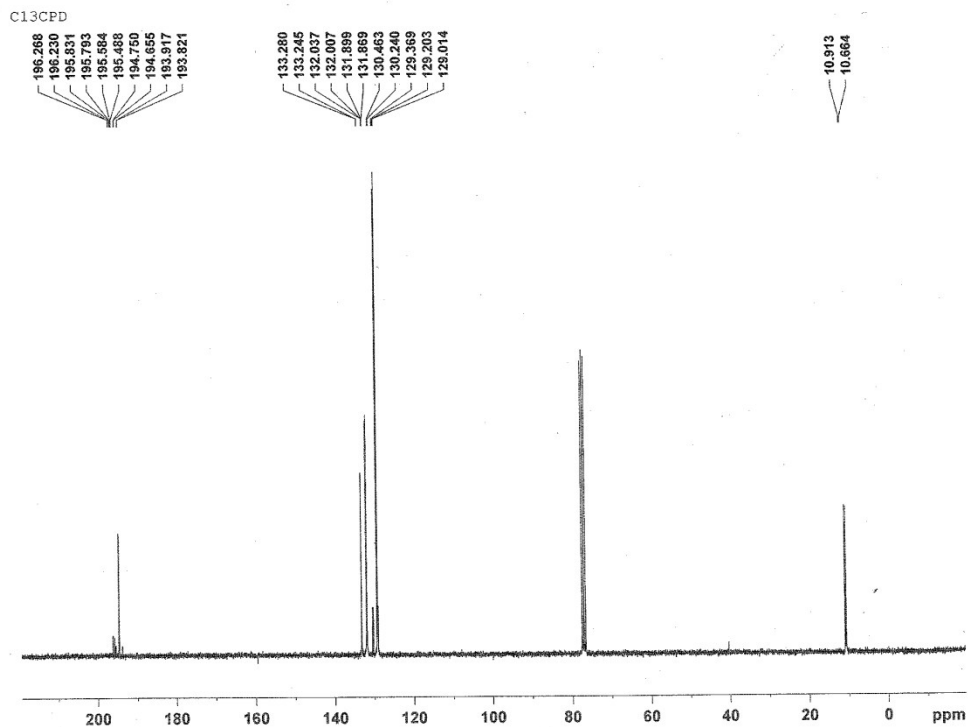
proton

7.553, 7.533, 7.517, 7.491, 7.575, 7.550, 7.527, 7.594, 7.585, 7.569, 7.561, 7.267, 2.244, 2.217, 2.194, 2.170, 2.147, 1.614, 1.589, 1.564, 1.540, 0.000

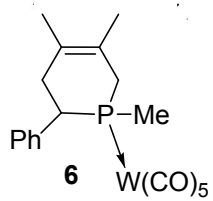
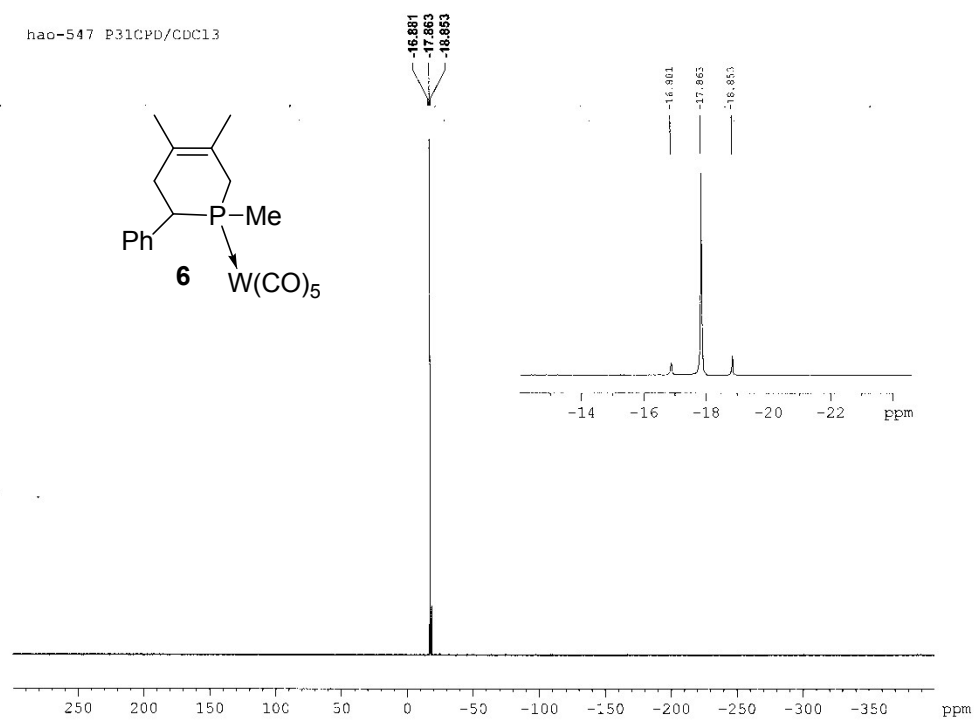
4.073, 6.221, 2.000, 1.981

ppm

¹H NMR (CDCl₃) of **5**

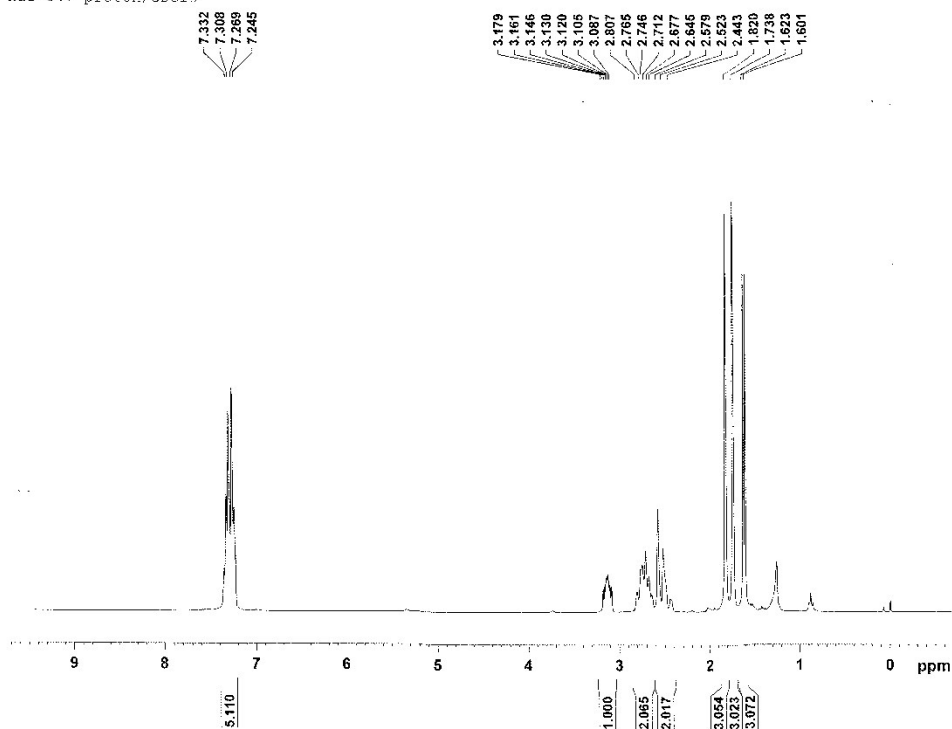


^{13}C NMR (CDCl_3) of **5**



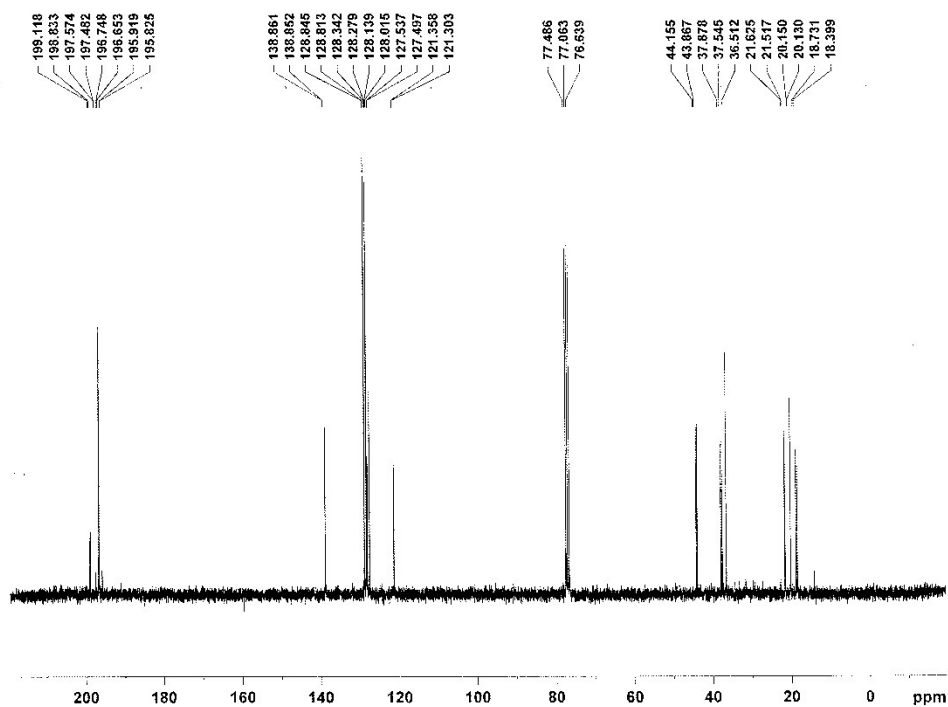
^{31}P CPD NMR (CDCl_3) of **6**

hao-547 proton/CDCl₃

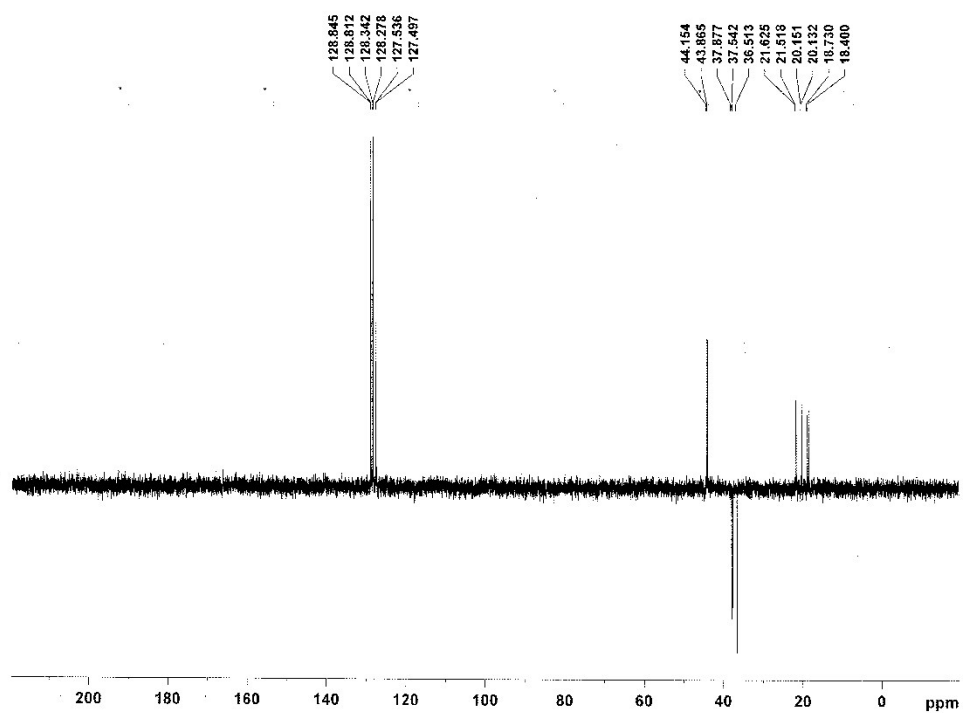


¹H NMR (CDCl₃) of 6

hao-547 C13CPD/CDCl₃

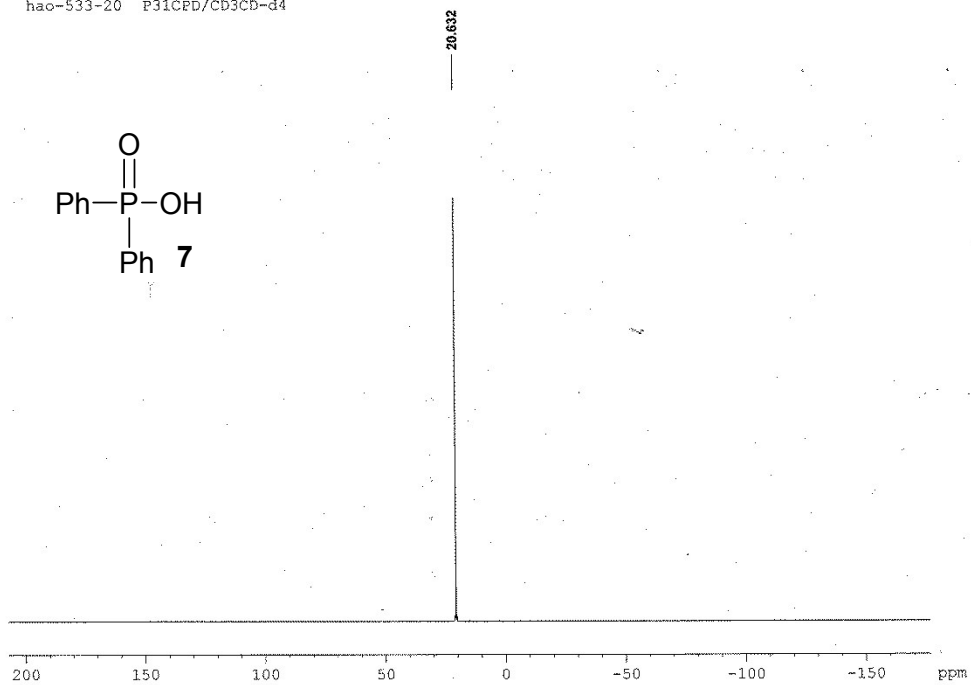


¹³C NMR (CDCl₃) of 6



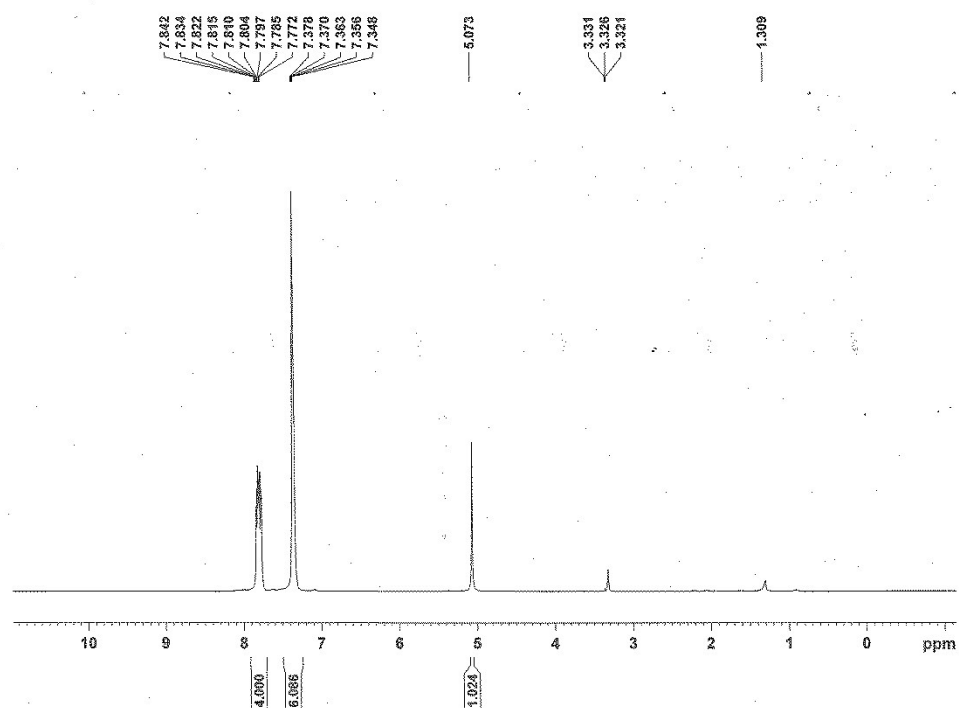
$^{135}\text{Dept}$ NMR (CDCl_3) of **6**

hao-533-20 P31CPD/ $\text{CD}_3\text{CD}_2\text{d}_4$



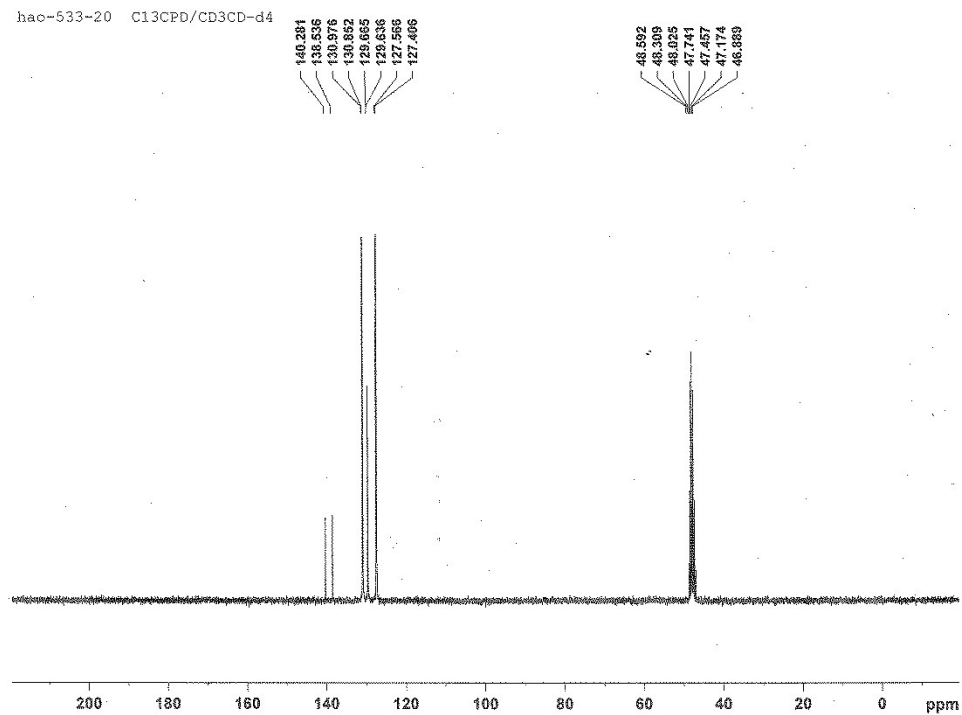
^{31}P CPD NMR (CDCl_3) of **7**

hao-533 proton/CDCl₃



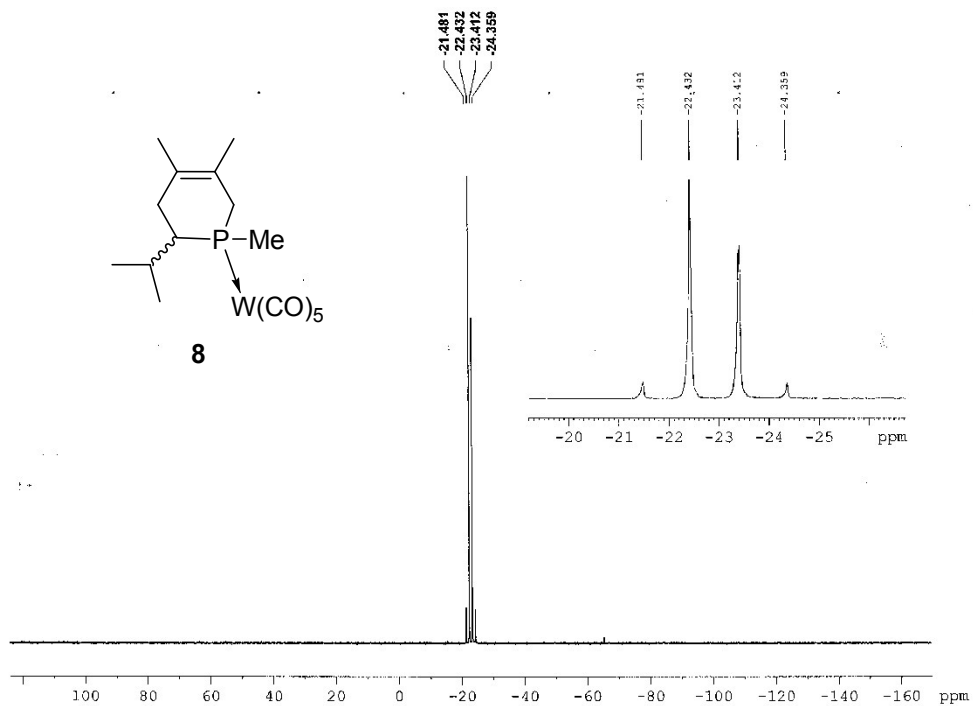
¹H NMR (CDCl₃) of **7**

hao-533-20 C13CPD/CD₃CD₄



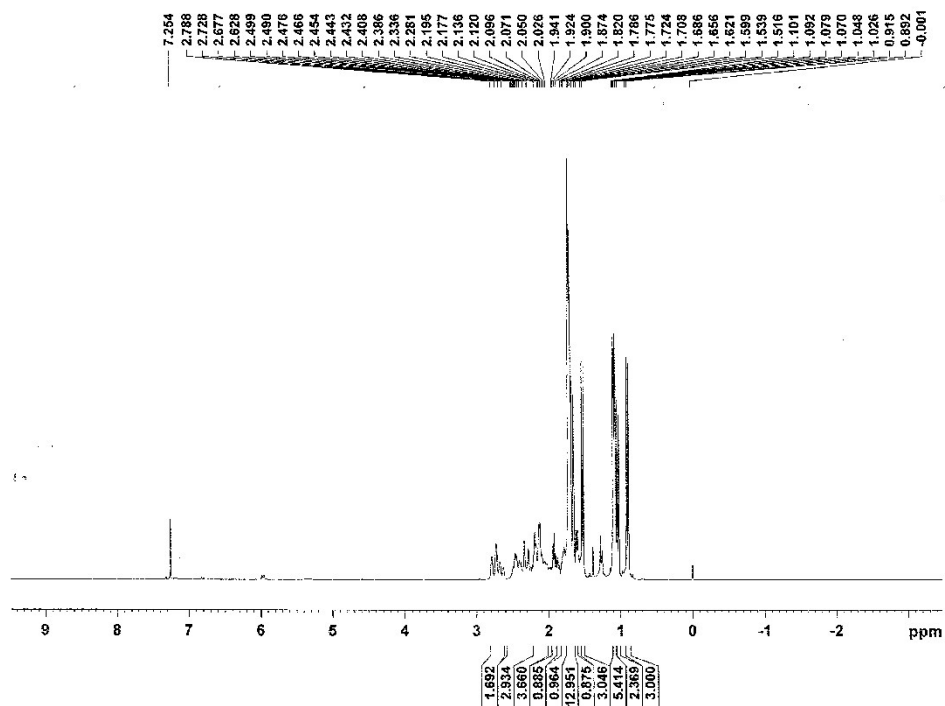
¹³C NMR (CDCl₃) of **7**

hao-552 P31CPD/CDC13



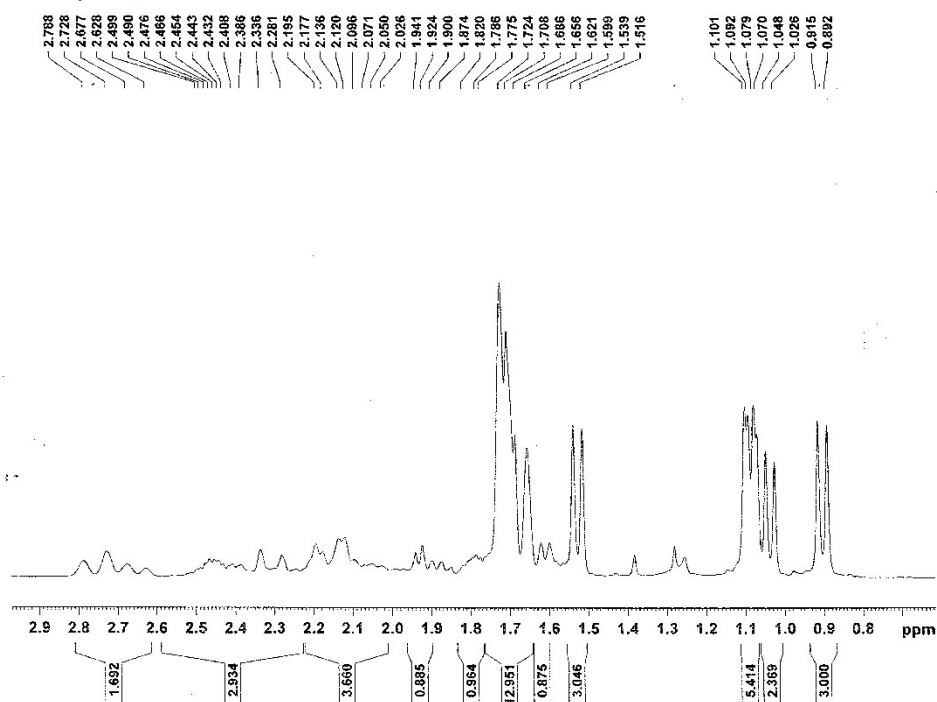
^{31}P CPD NMR (CDCl₃) of **8a,b**

hao-552 proton/CDCl3



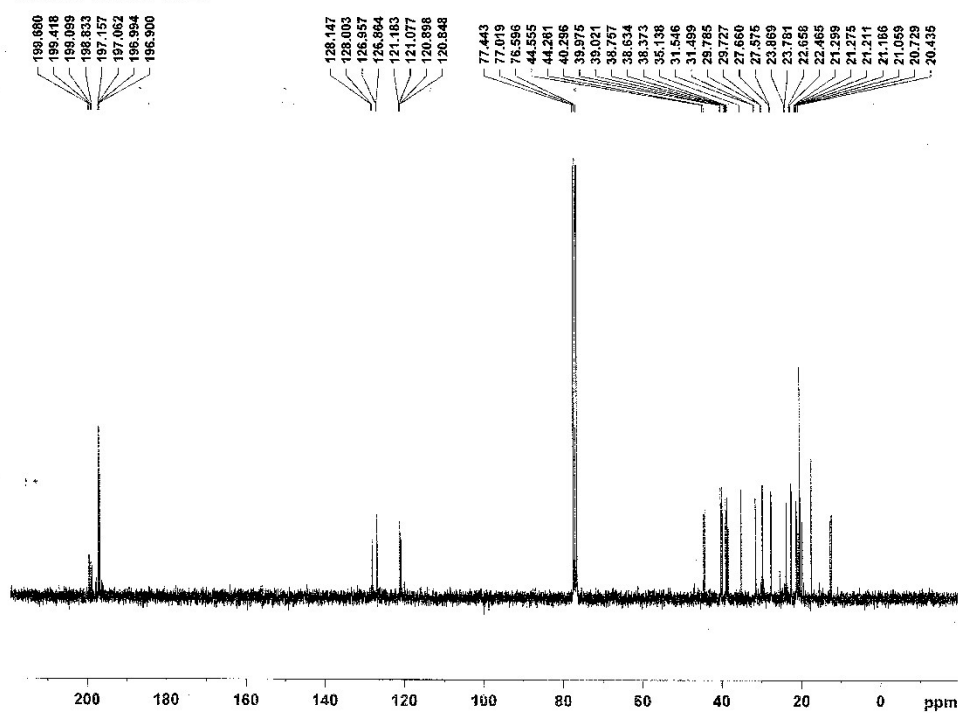
1H NMR (CDCl₃) of **8a,b**

hao-552 proton/CDCl₃



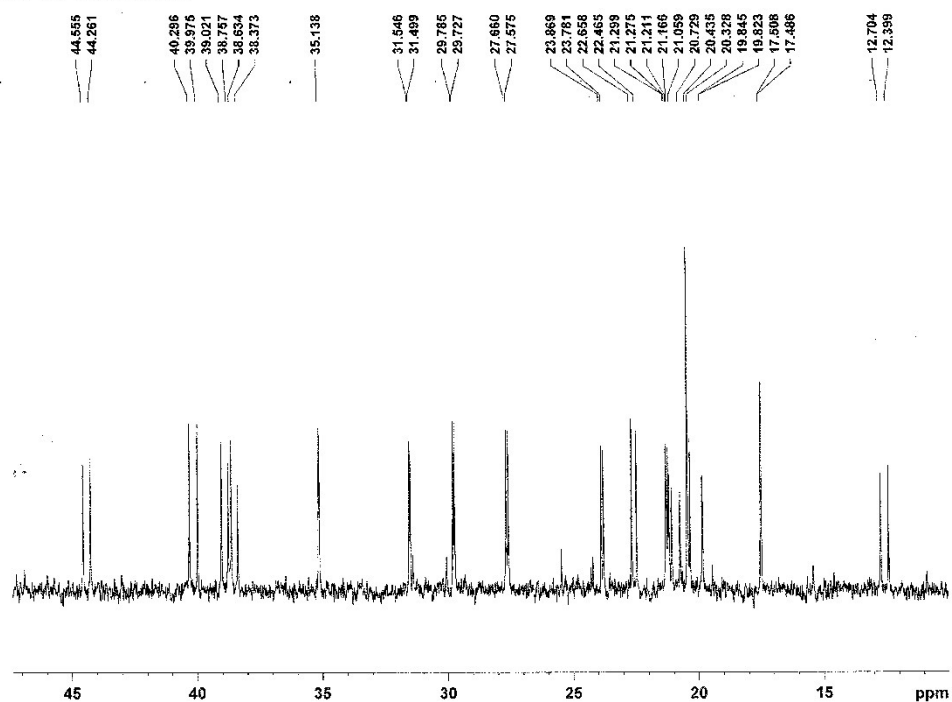
¹H NMR (CDCl₃) of **8a,b**

hao-552 C13CPD/CDCl₃



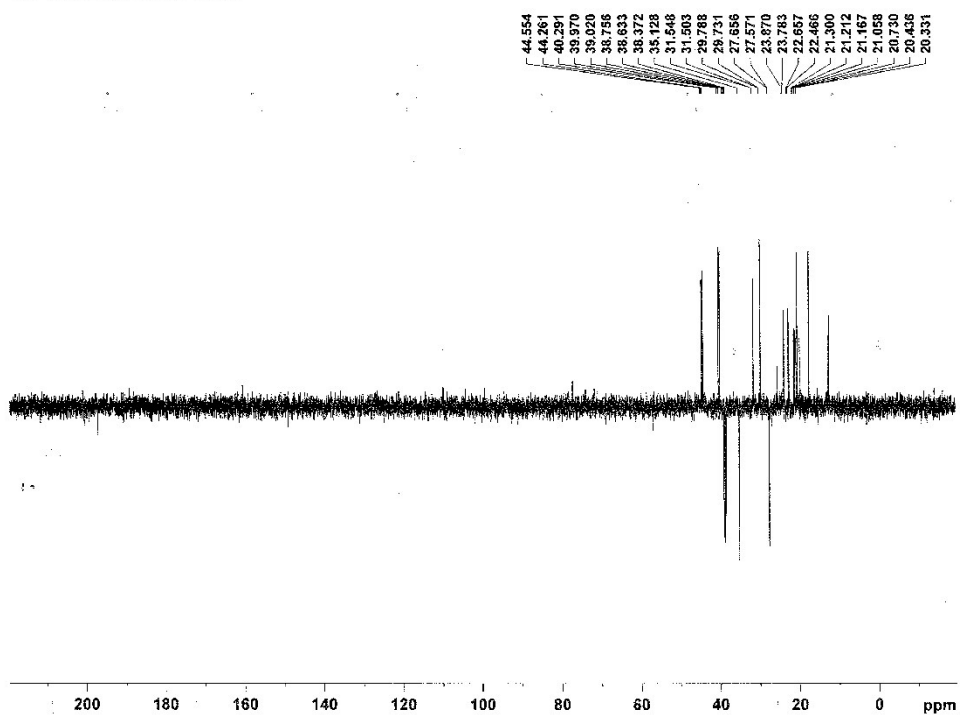
¹³C NMR (CDCl₃) of **8a,b**

hao-552 C13CPD/CDC13

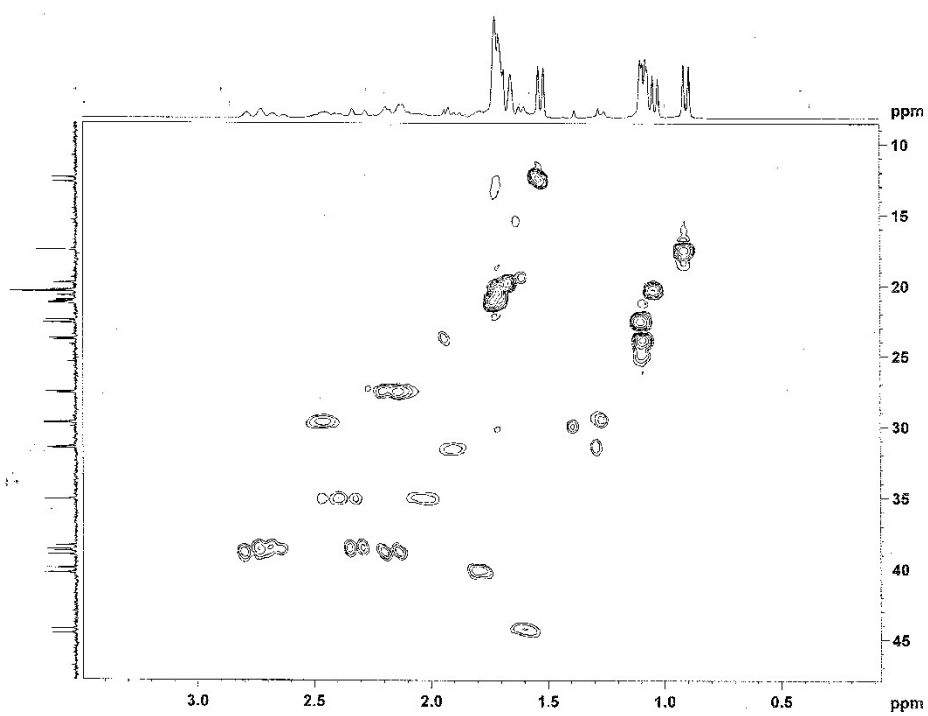


^{13}C NMR (CDCl_3) of **8a,b**

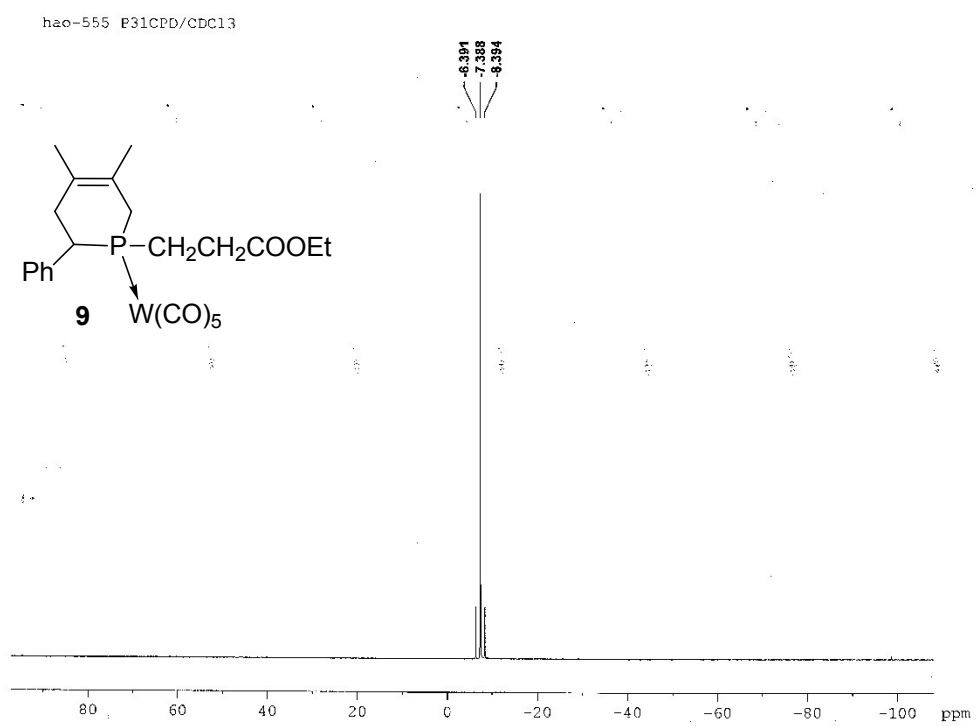
hao-552 C13dept135/CDC13



$^{135}\text{Dept}$ NMR (CDCl_3) of **8a,b**

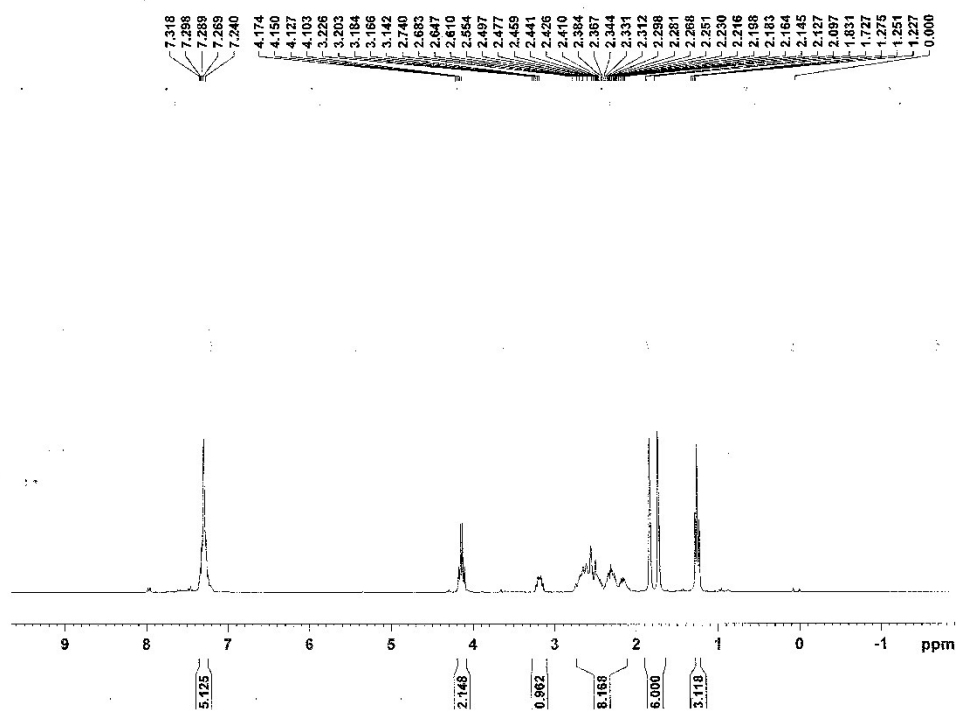


HSQC(C-H) NMR (CDCl_3) of **8a,b**



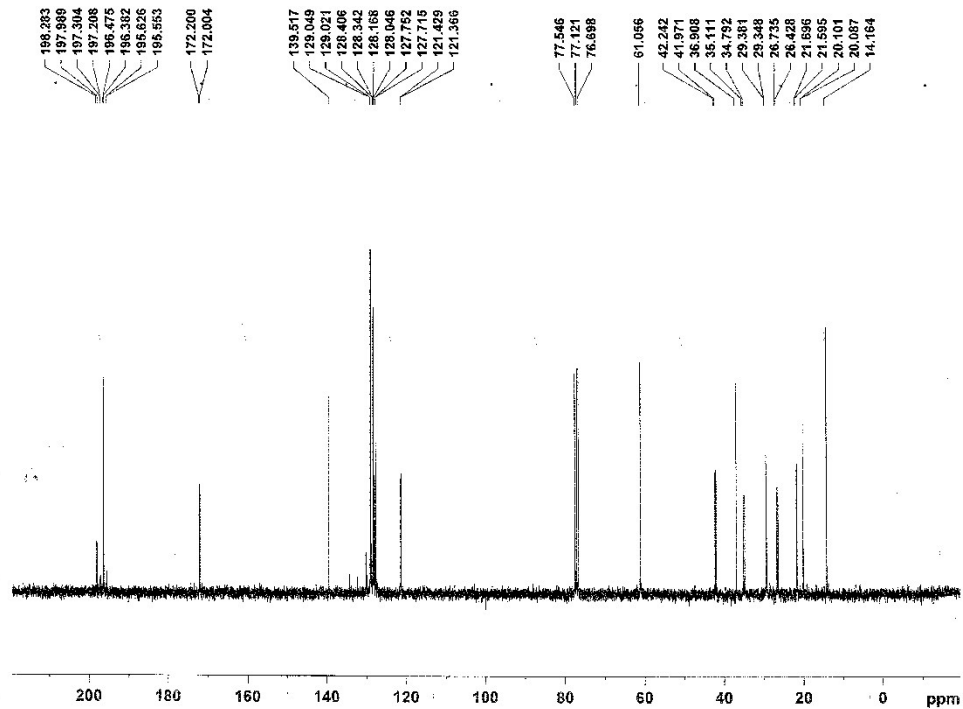
^{31}P CPD NMR (CDCl_3) of **9**

hao-555 PROTON/CDCl3



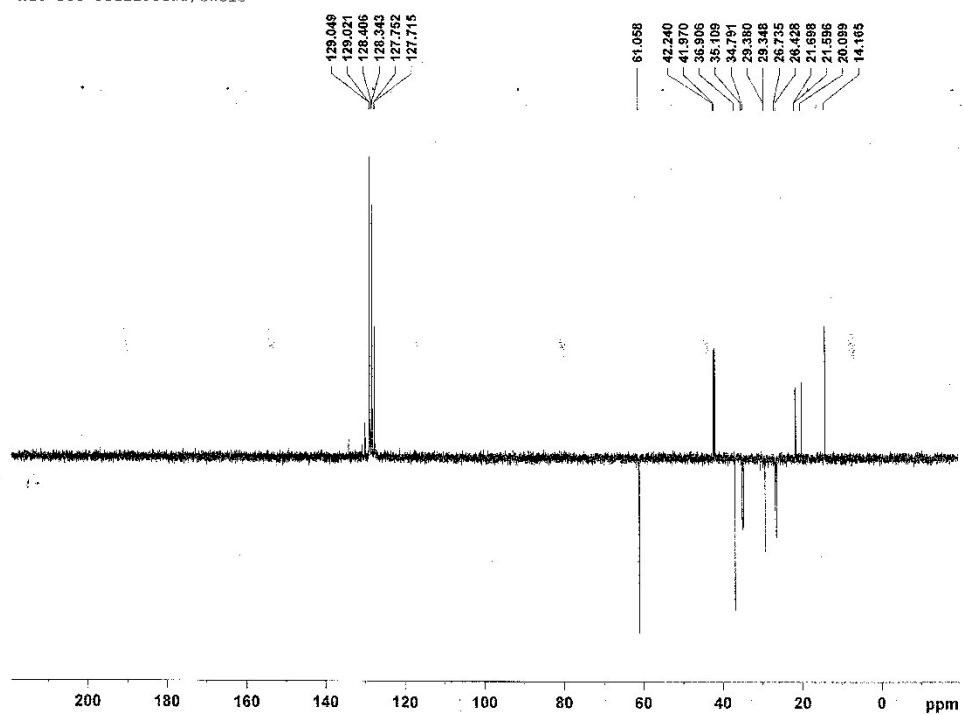
¹H NMR (CDCl₃) of 9

hao-555 C13CPD/CDCl3



¹³C NMR (CDCl₃) of 9

hao-555 F31DEPT135/CDCl3



$^{135}\text{Dept}$ NMR (CDCl_3) of 9