

Ugi reaction on α -phosphorated ketimines for the synthesis of tetrasubstituted α -aminophosphonates and their applications as antiproliferative agents.

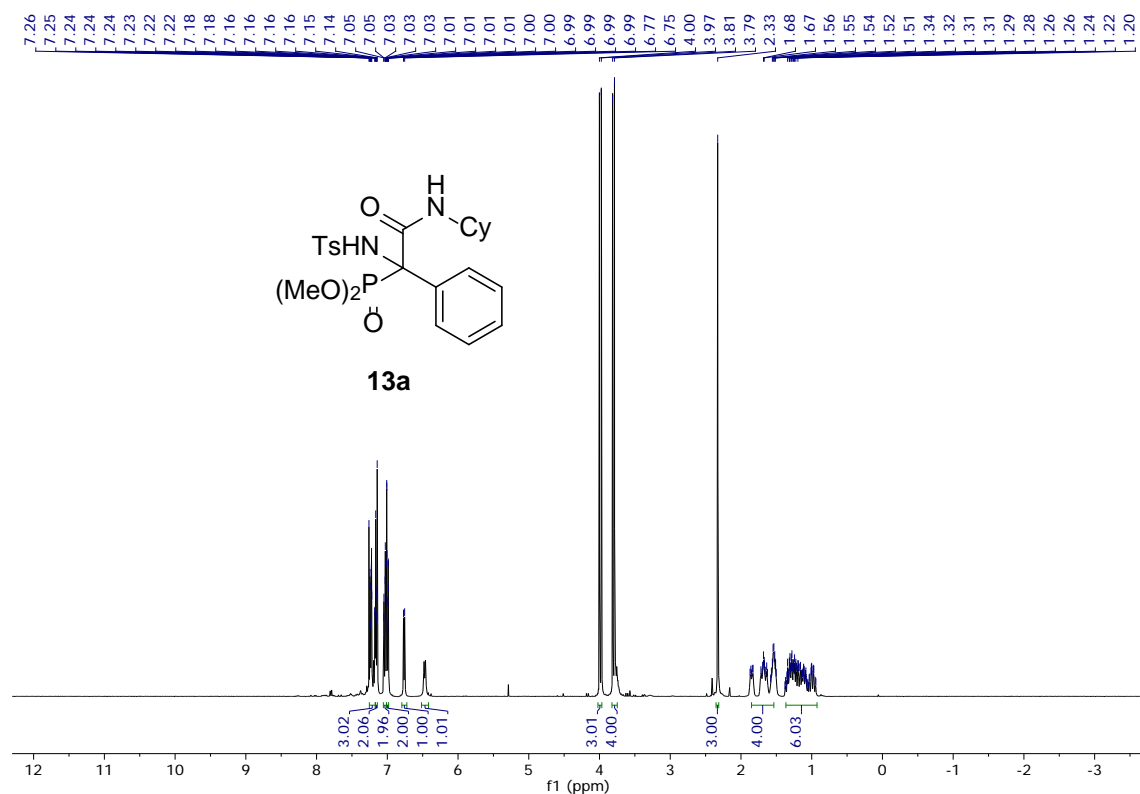
Adrián López-Francés,¹ Xabier del Corte,¹ Edorta Martínez de Marigorta,¹ Francisco Palacios^{1,*} and Javier Vicario^{1,*}

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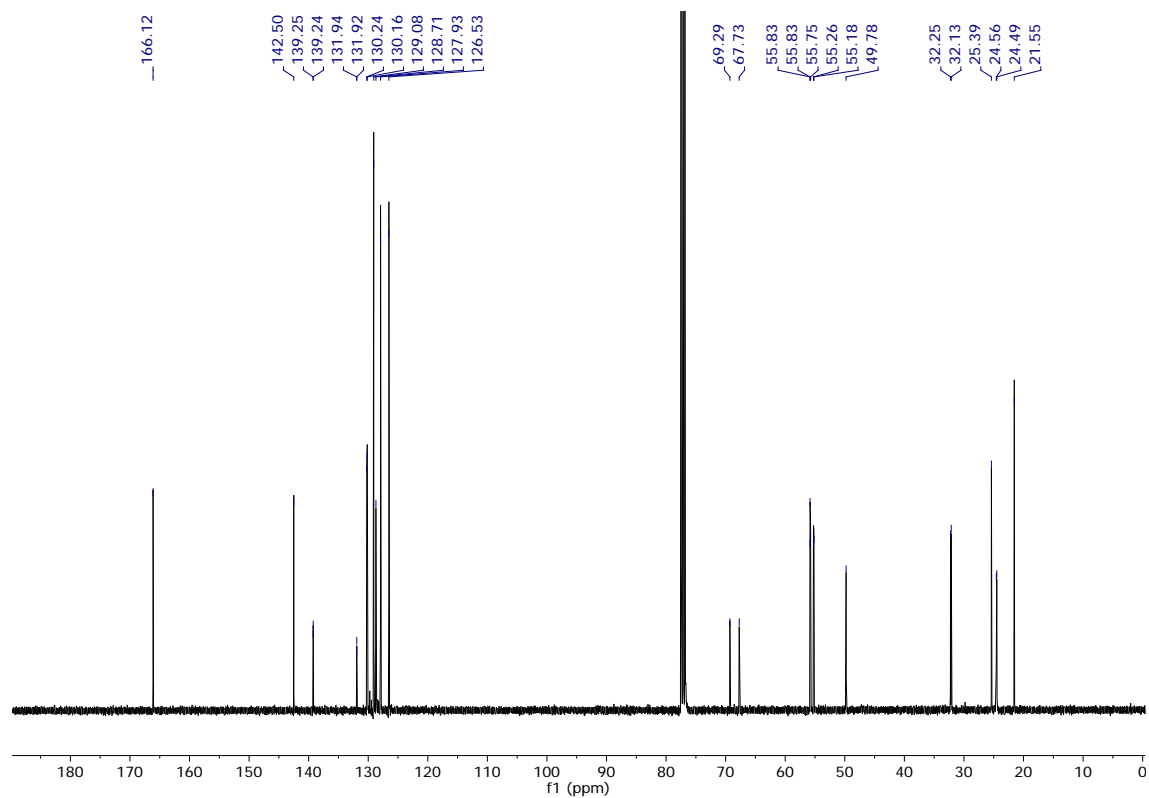
* Correspondence: francisco.palacios@ehu.eus (F. P.) / javier.vicario@ehu.eus (J. V.)

Dimethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (**13a**).

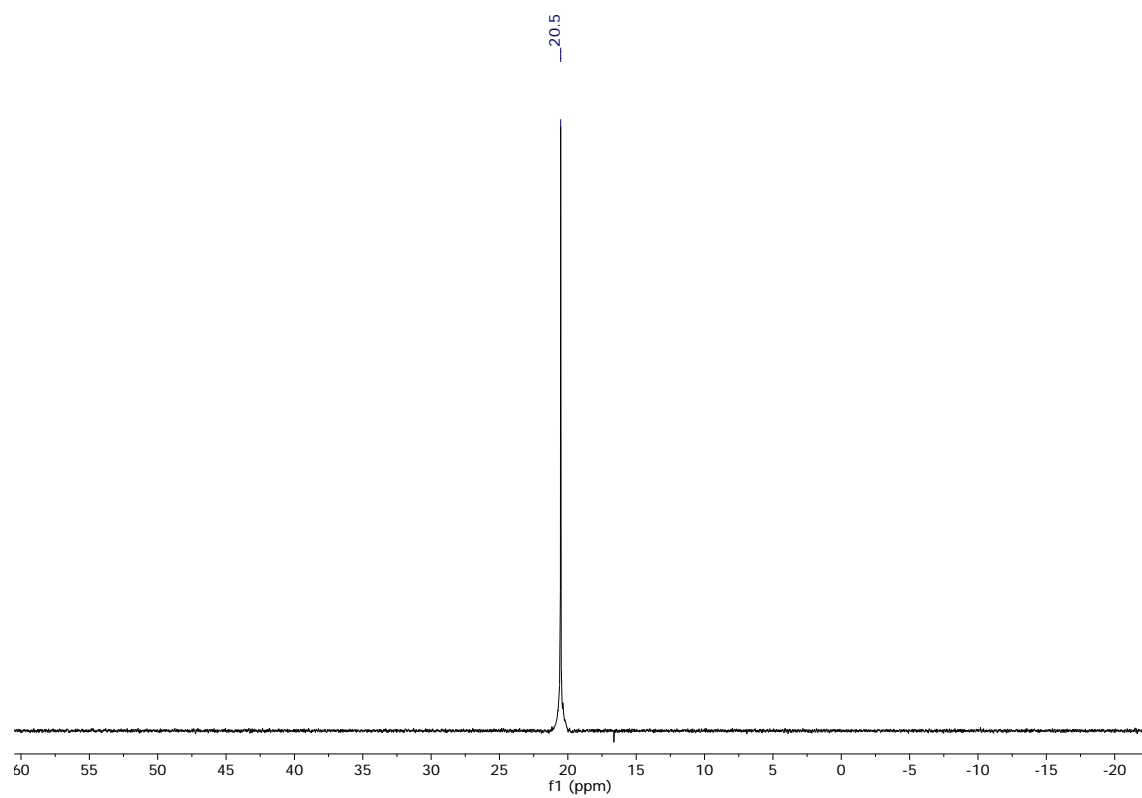
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR { ^1H } (101 MHz, CDCl_3)

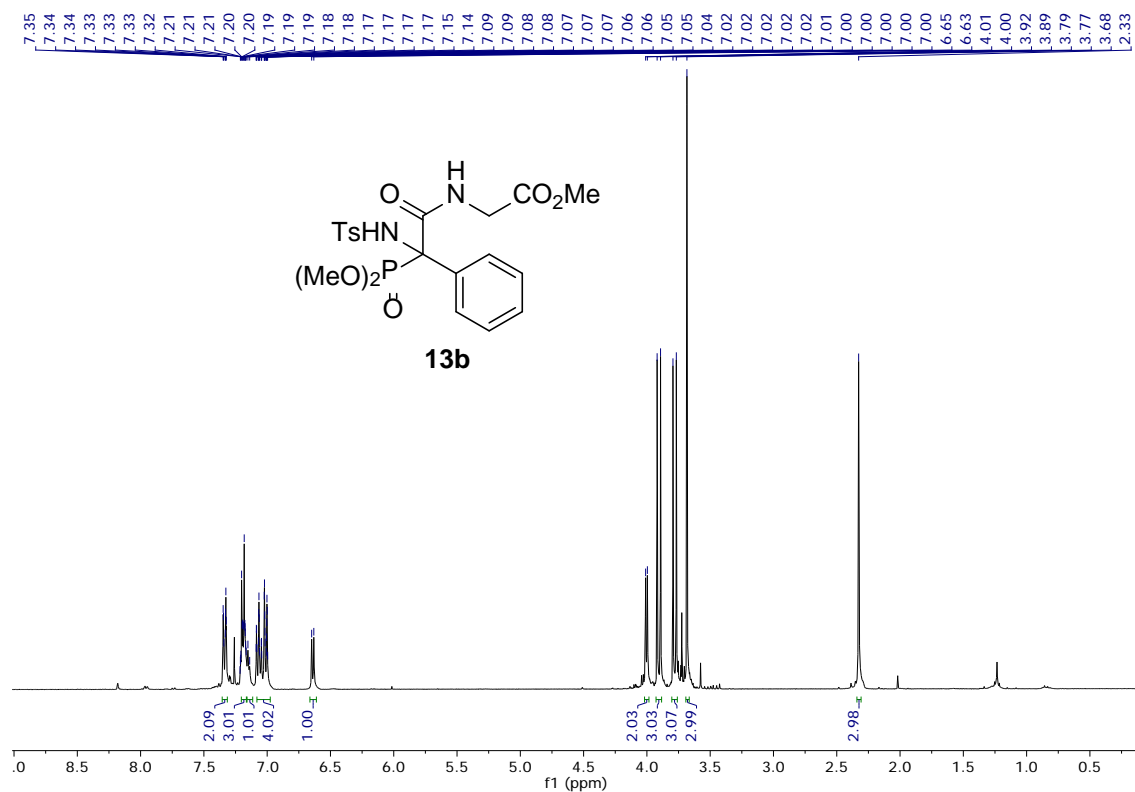


^{31}P NMR (121 MHz, CDCl_3)

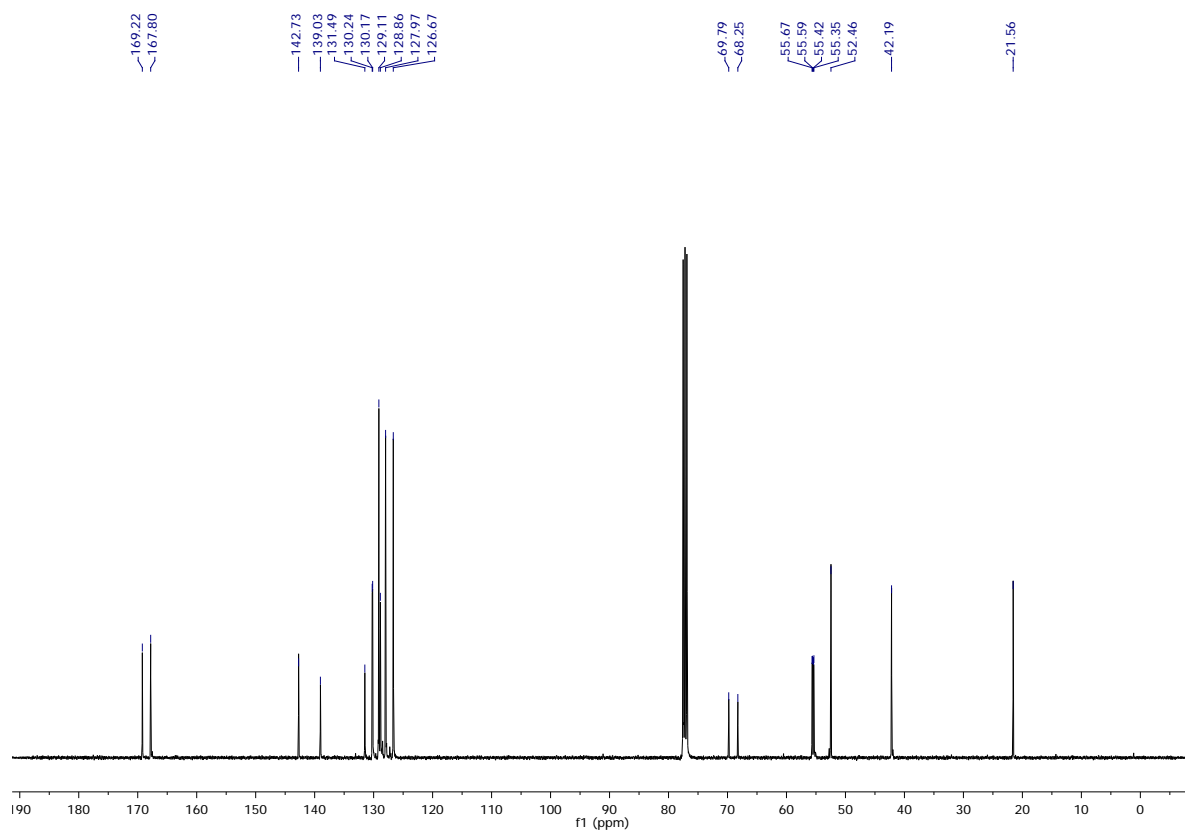


Methyl (2-(dimethoxyphosphoryl)-2-((4-methylphenyl)sulfonamido)-2-phenylacetyl)glycinate (**13b**)

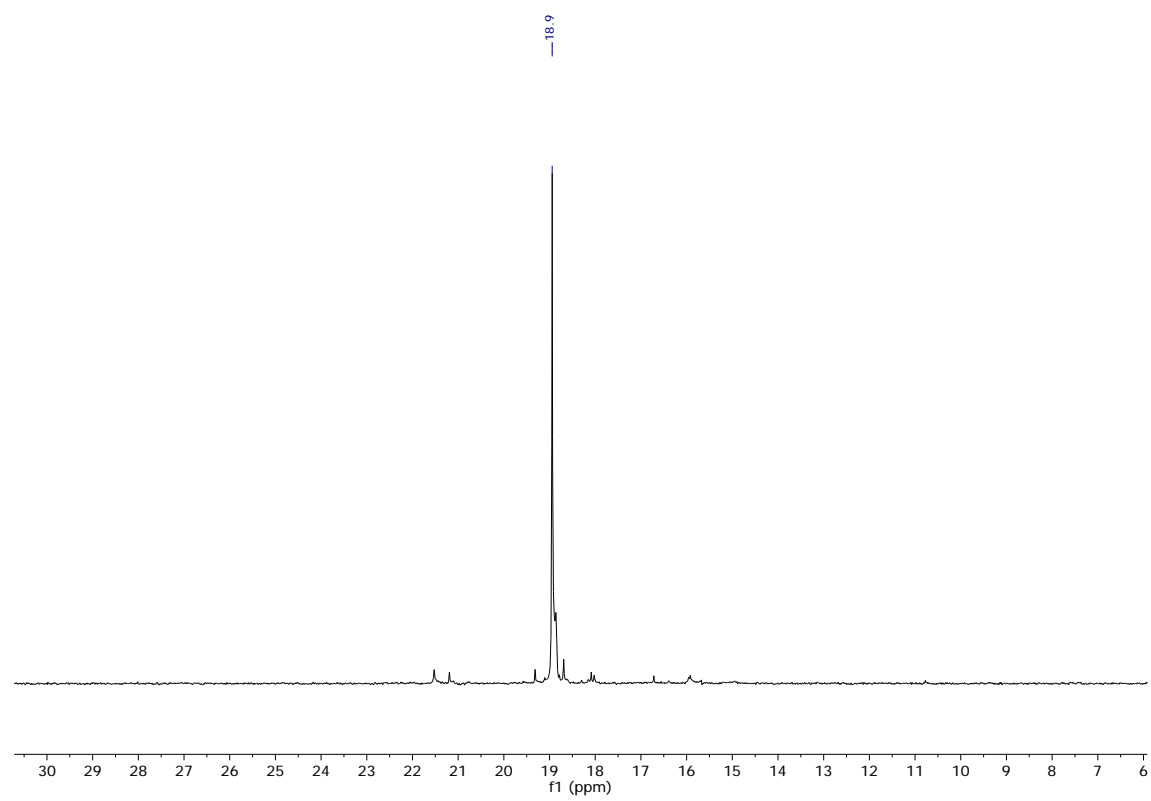
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR [^1H] (101 MHz, CDCl_3)

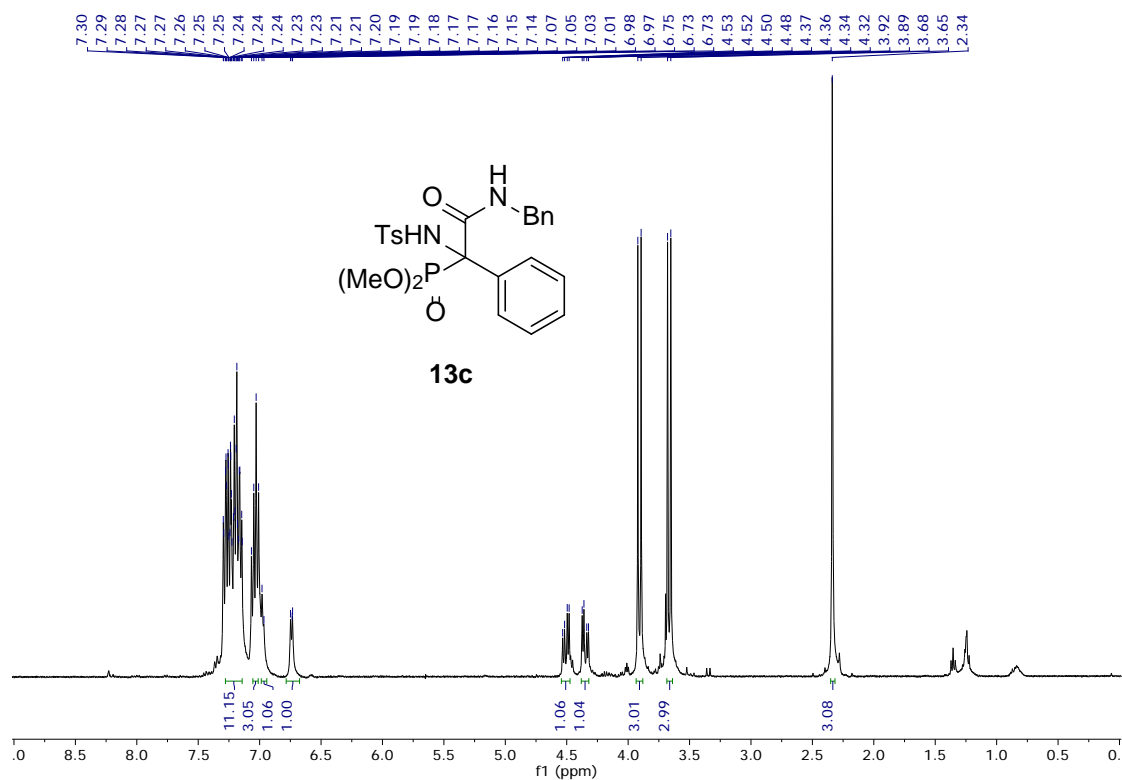


^{31}P NMR (121 MHz, CDCl_3)

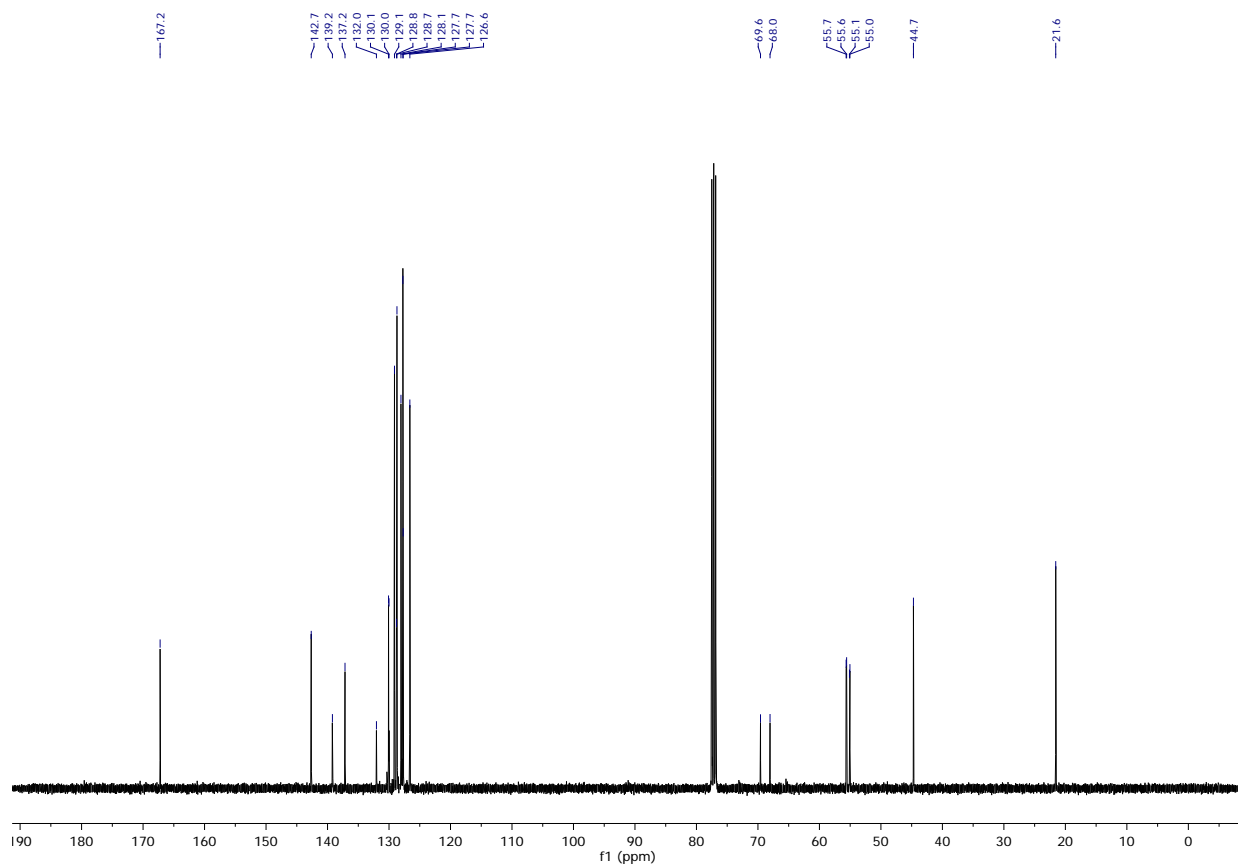


Dimethyl (2-(benzylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (**13c**)

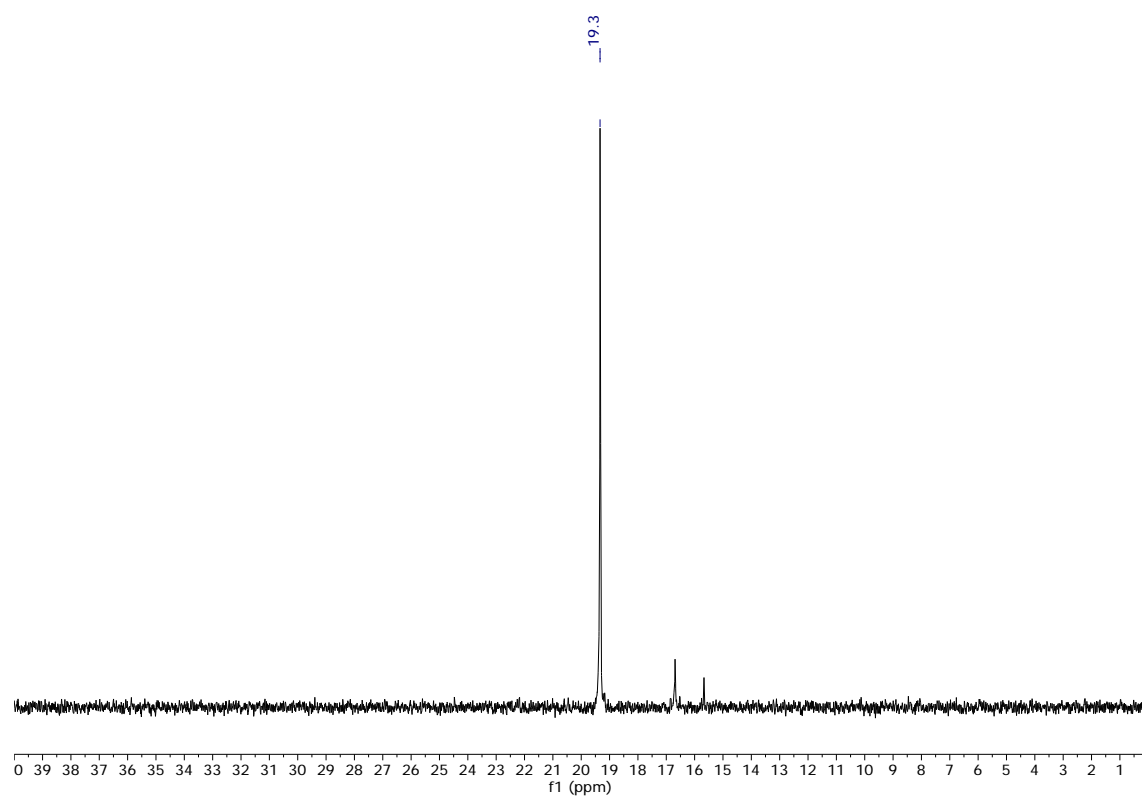
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

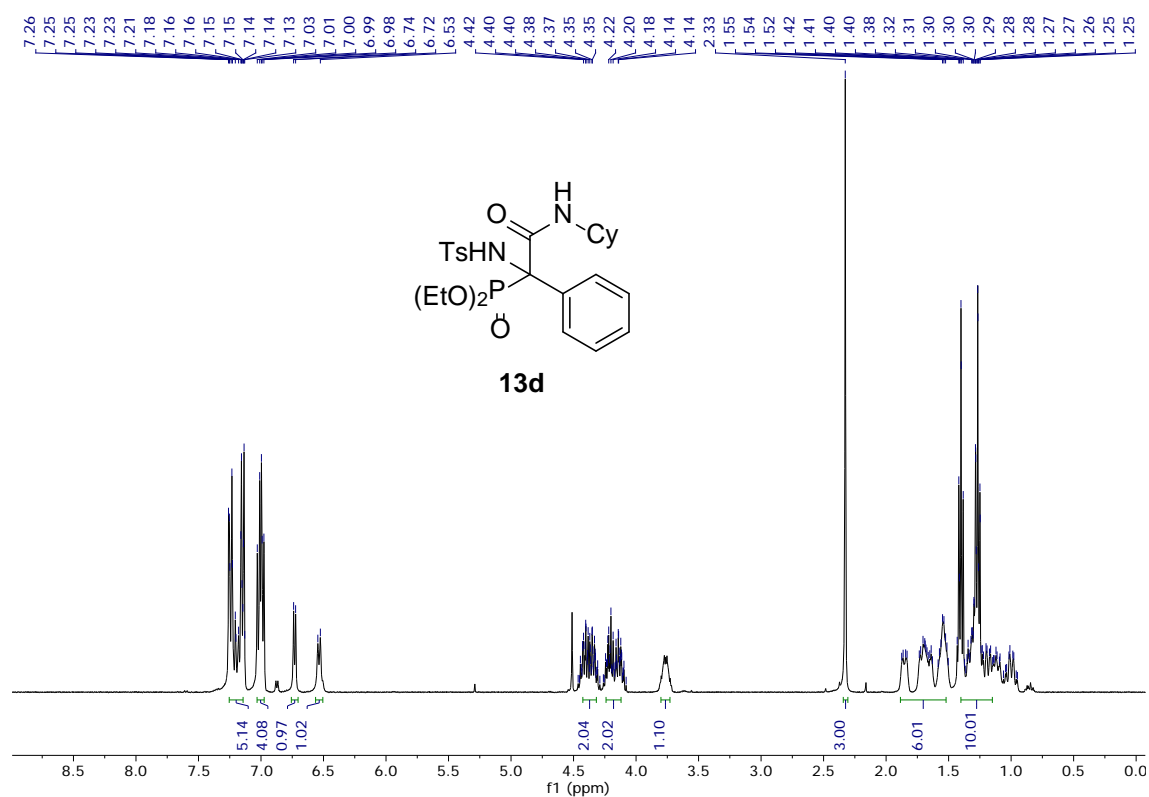


^{31}P NMR (121 MHz, CDCl_3)

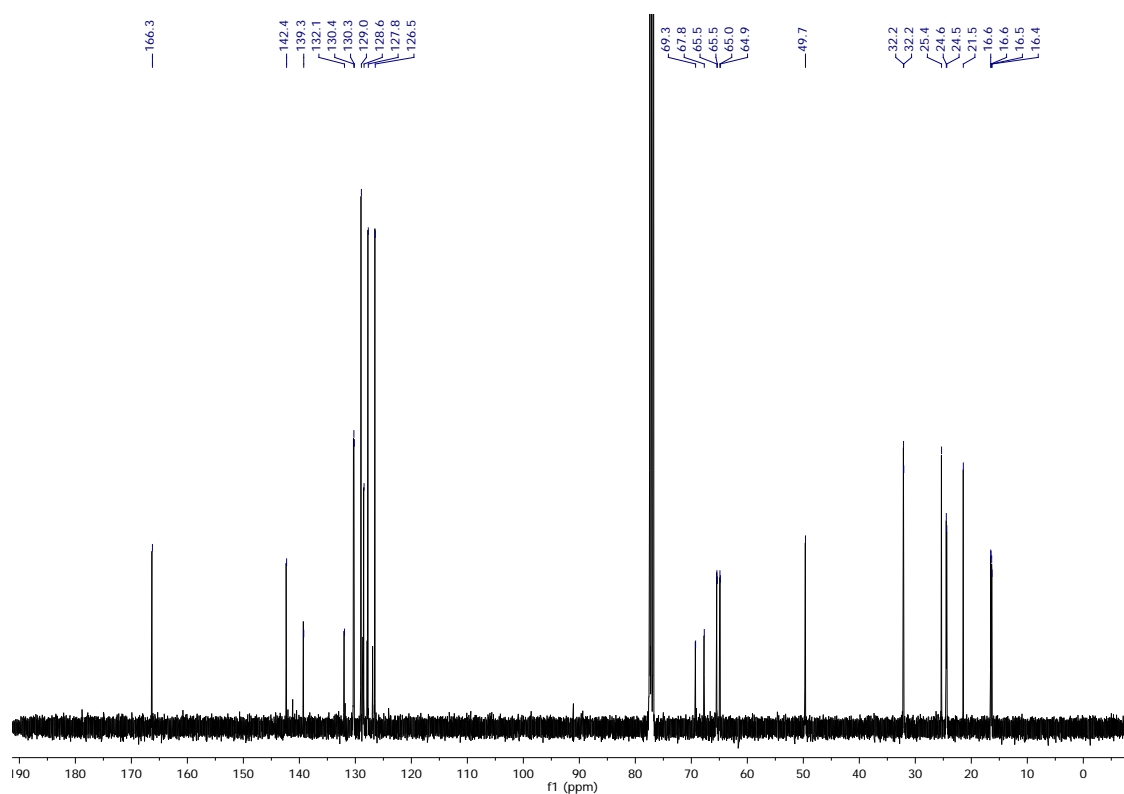


Diethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (**13d**)

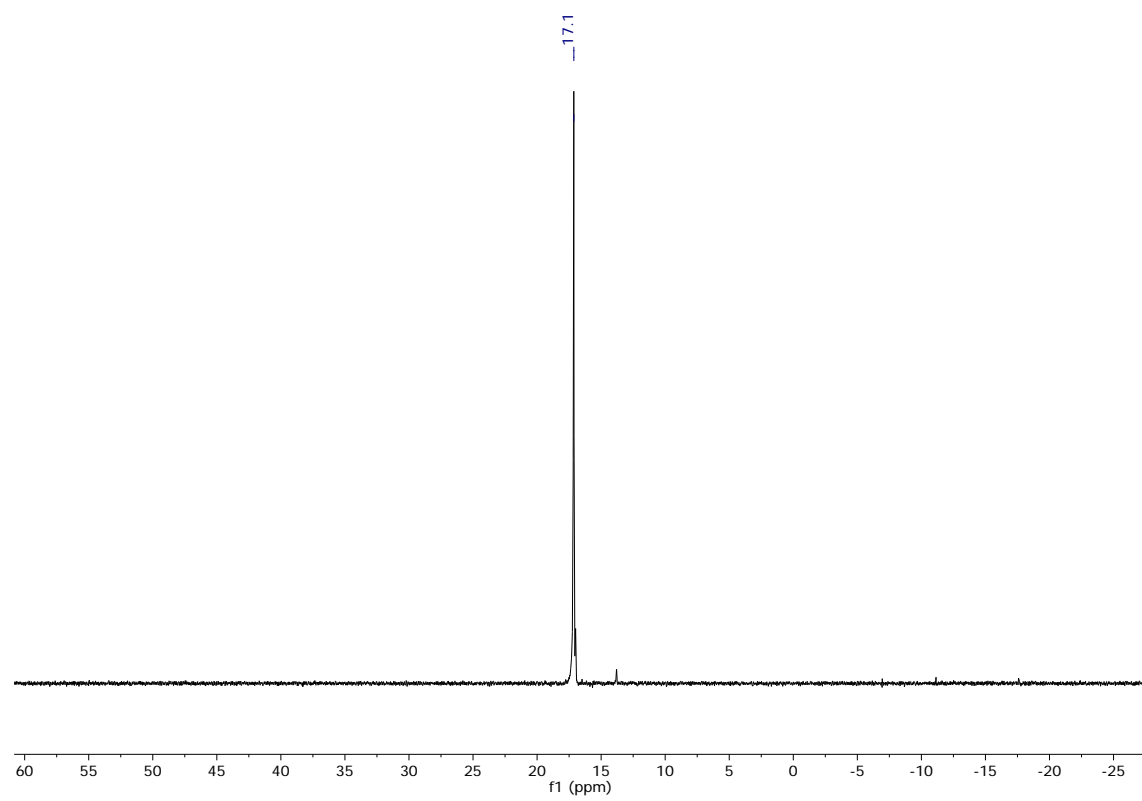
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

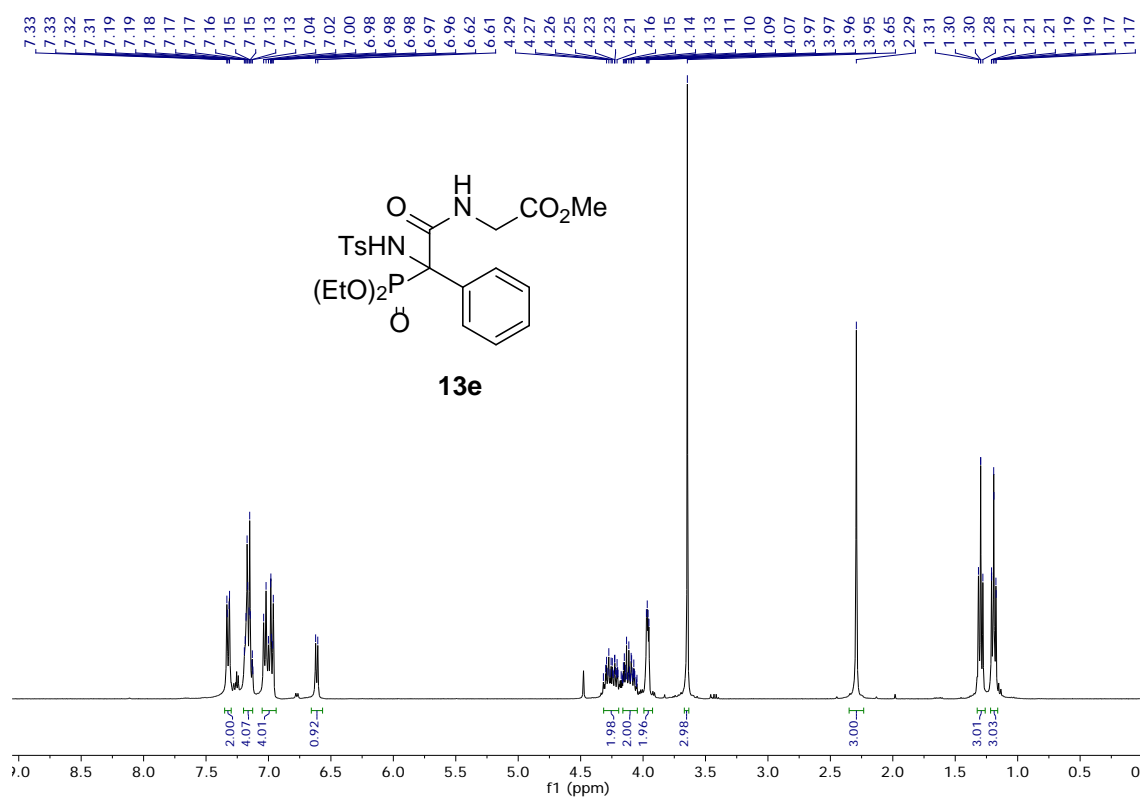


^{31}P NMR (121 MHz, CDCl_3)

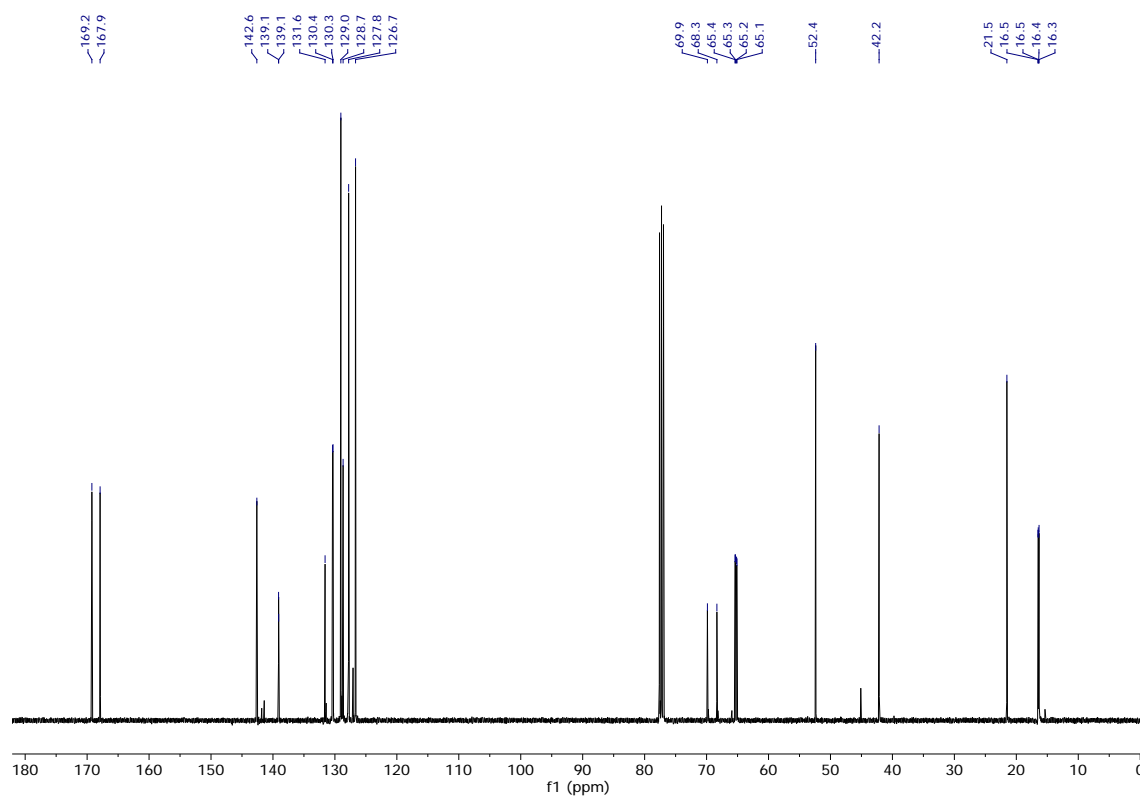


**Methyl (2-(diethoxyphosphoryl)-2-((4-methylphenyl)sulfonamido)-2-phenylacetyl)glycinate
(13e)**

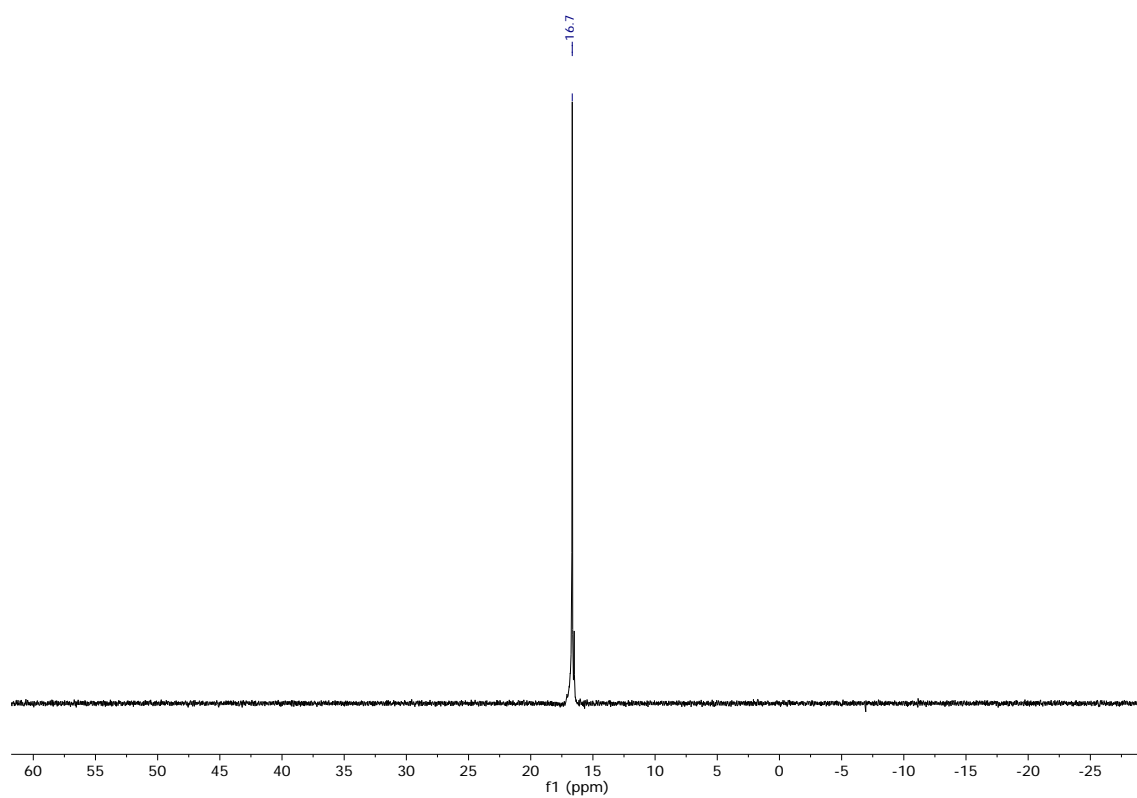
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

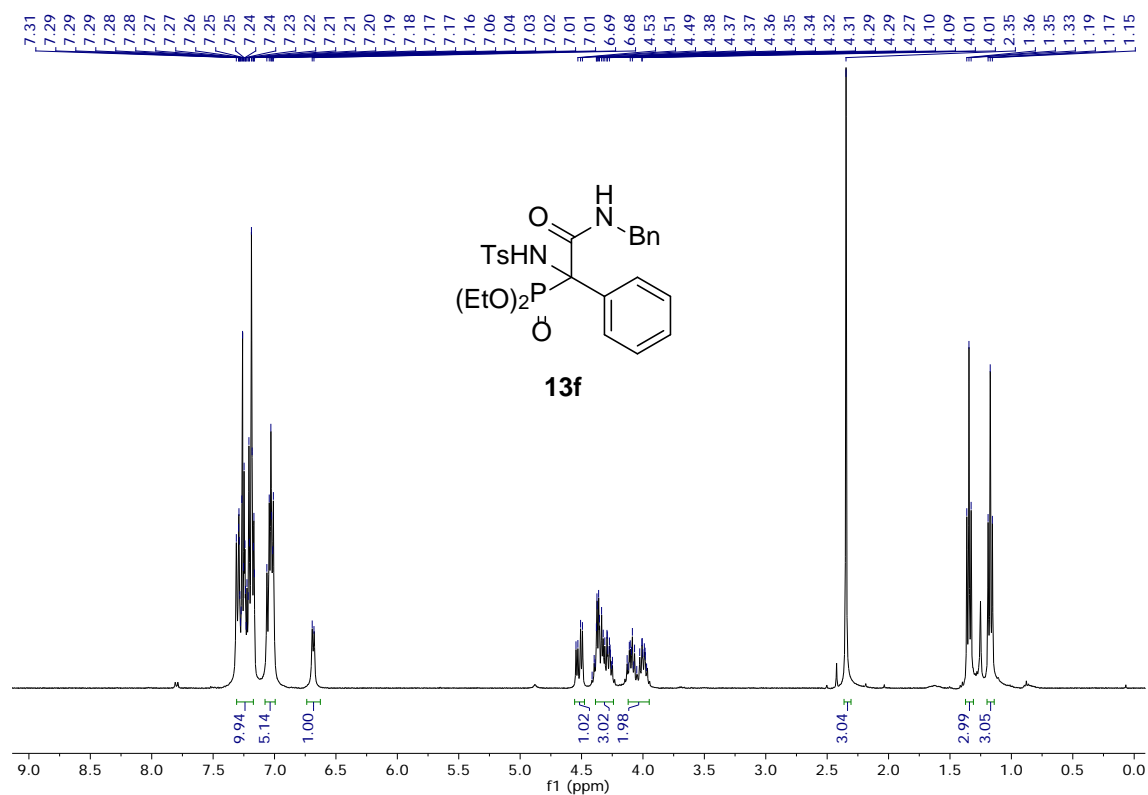


^{31}P -NMR (121 MHz, CDCl_3)

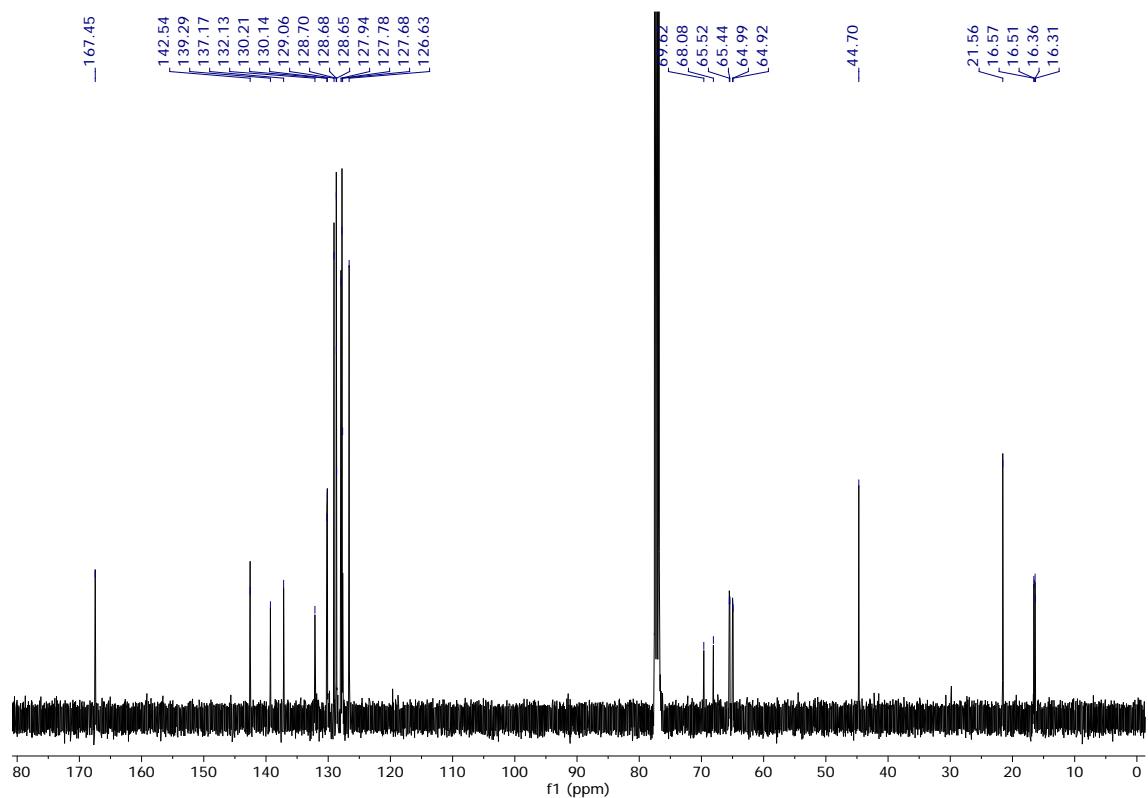


Diethyl (2-(benzylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (13f)

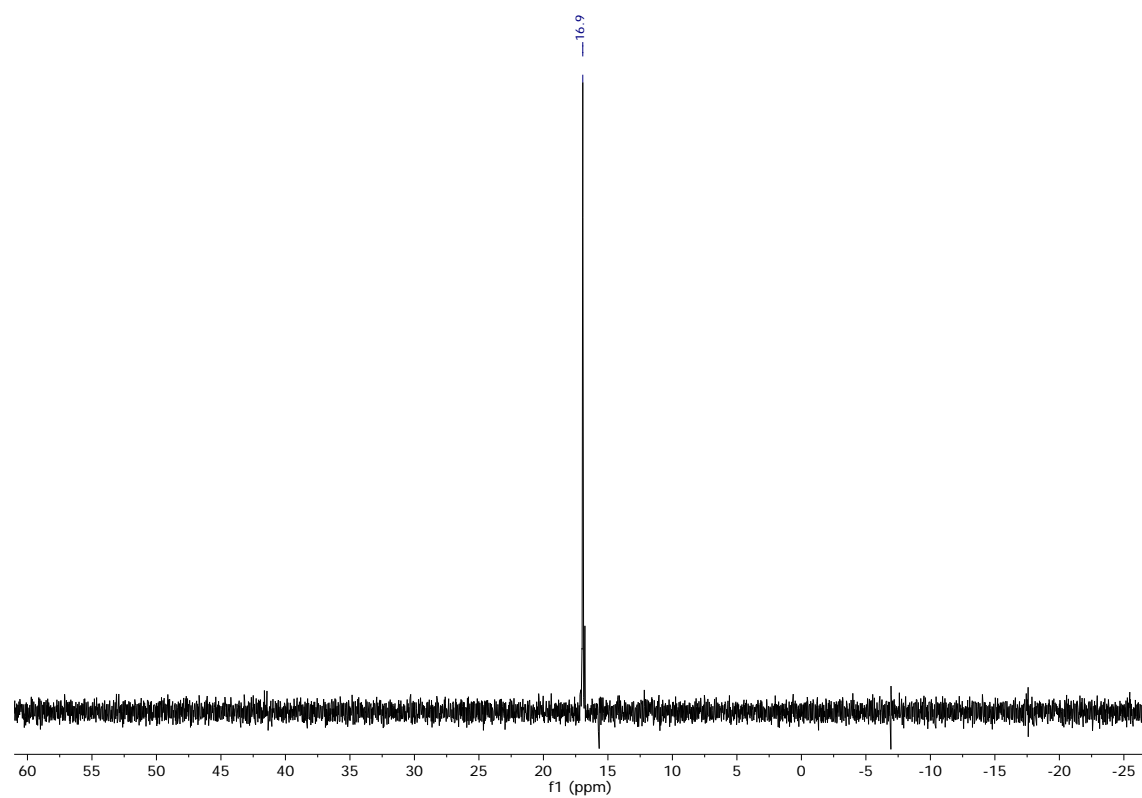
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

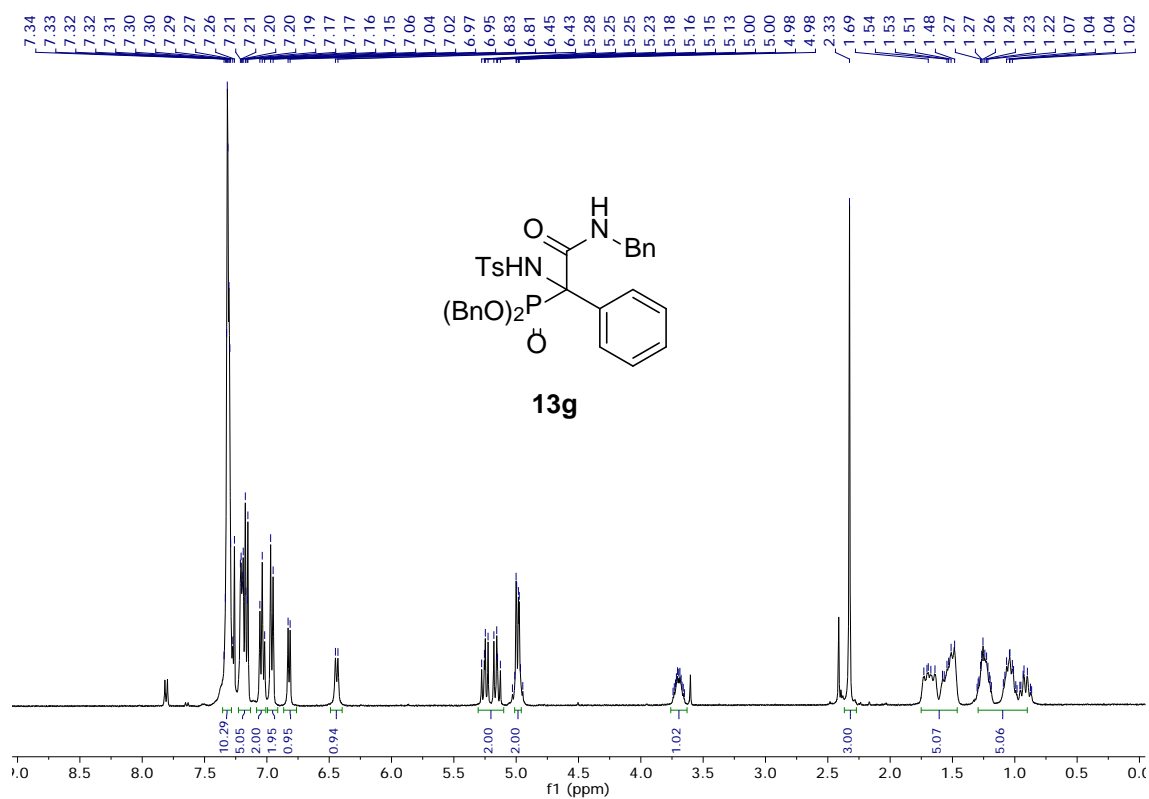


^{31}P -NMR (121 MHz, CDCl_3)

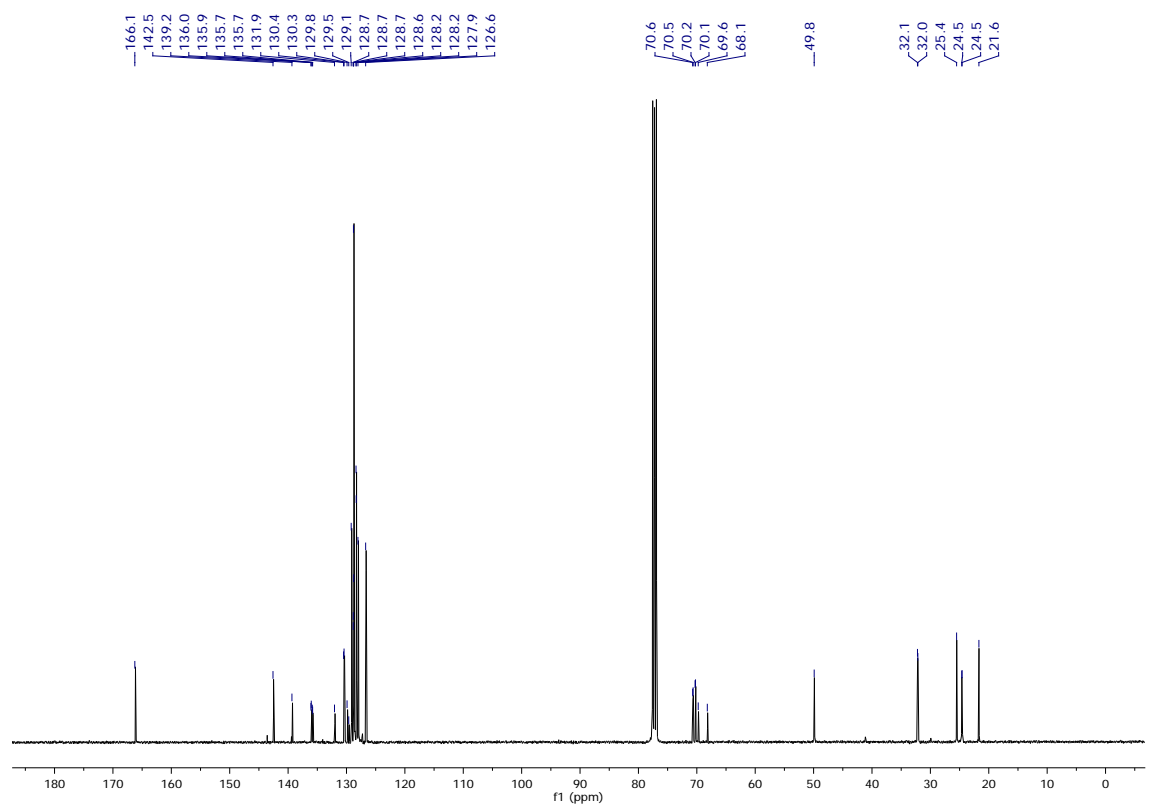


Dibenzyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (13g)

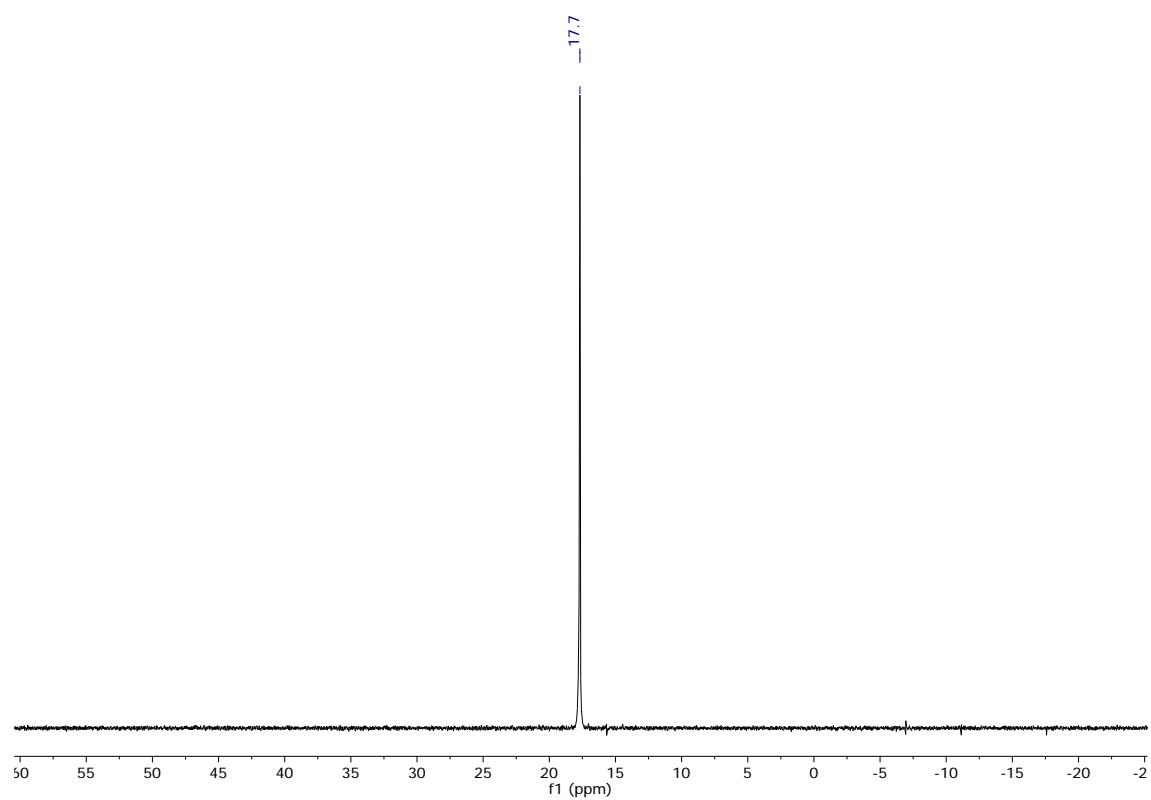
^1H NMR (400 MHz, CDCl_3)

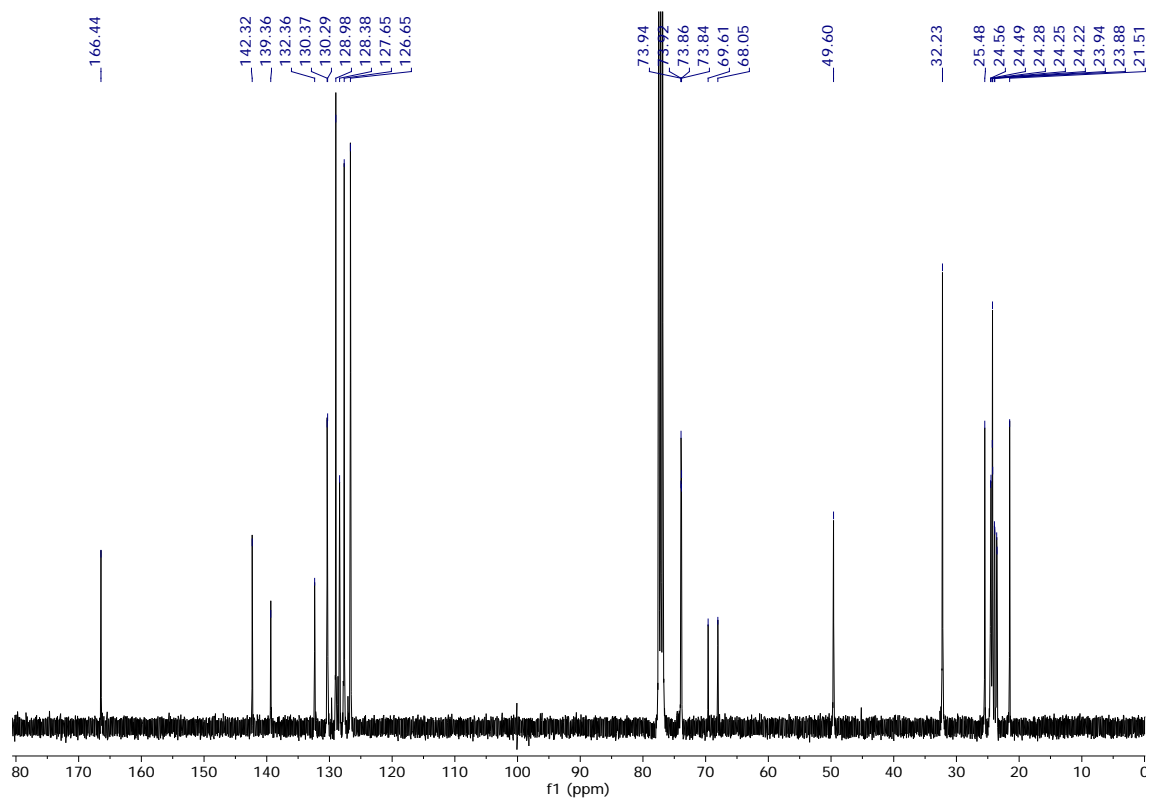


^{13}C NMR { ^1H } (101 MHz, CDCl_3)

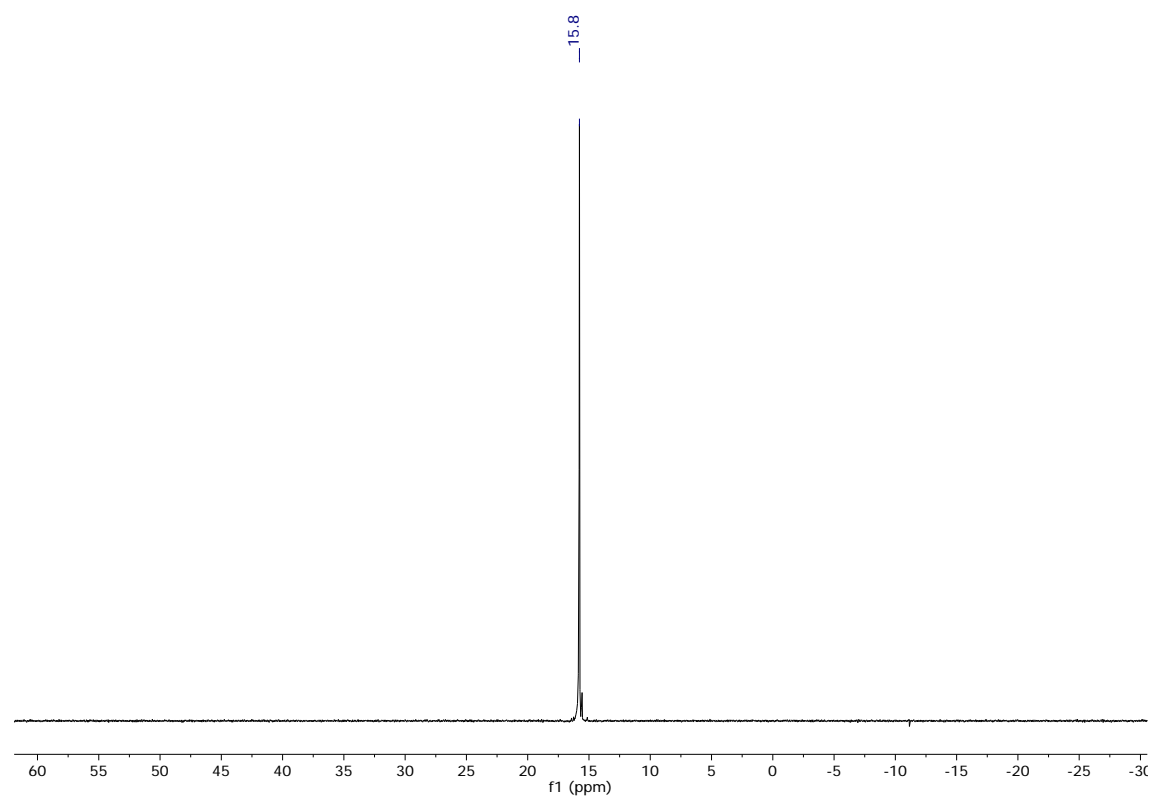


^{31}P -NMR (121 MHz, CDCl_3)



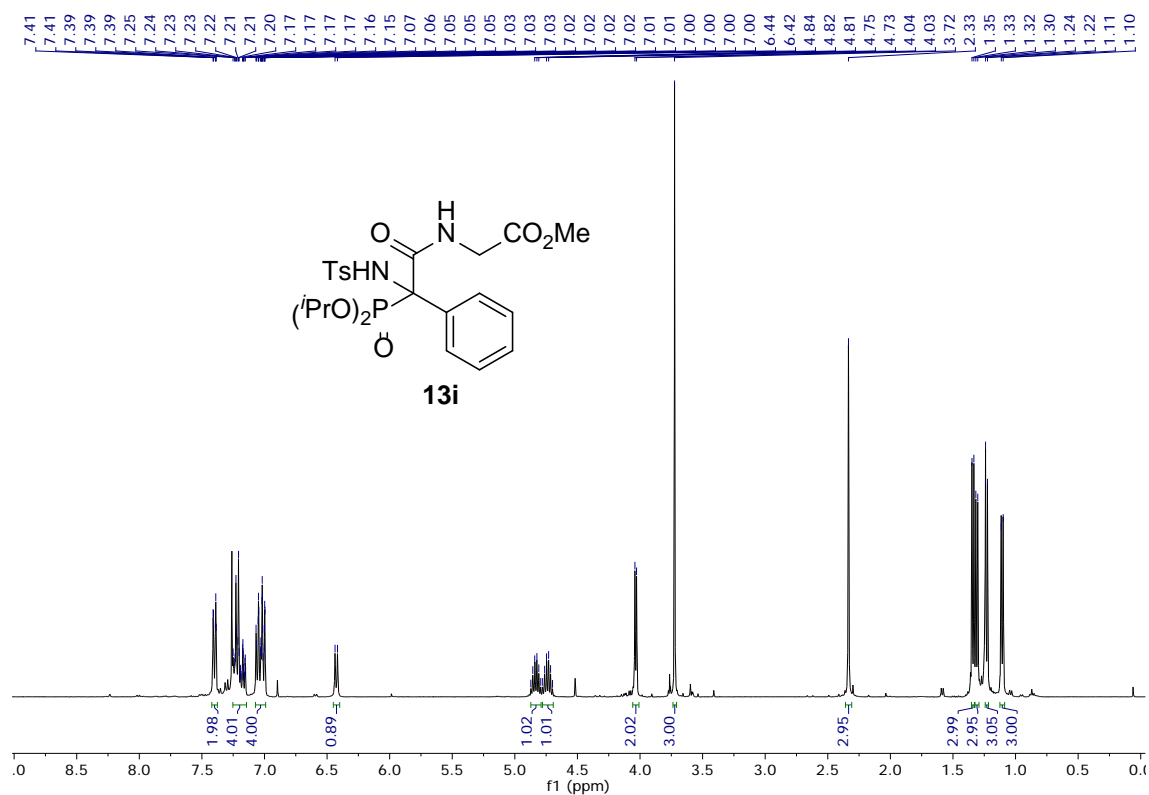


^{31}P NMR (121 MHz, CDCl_3)

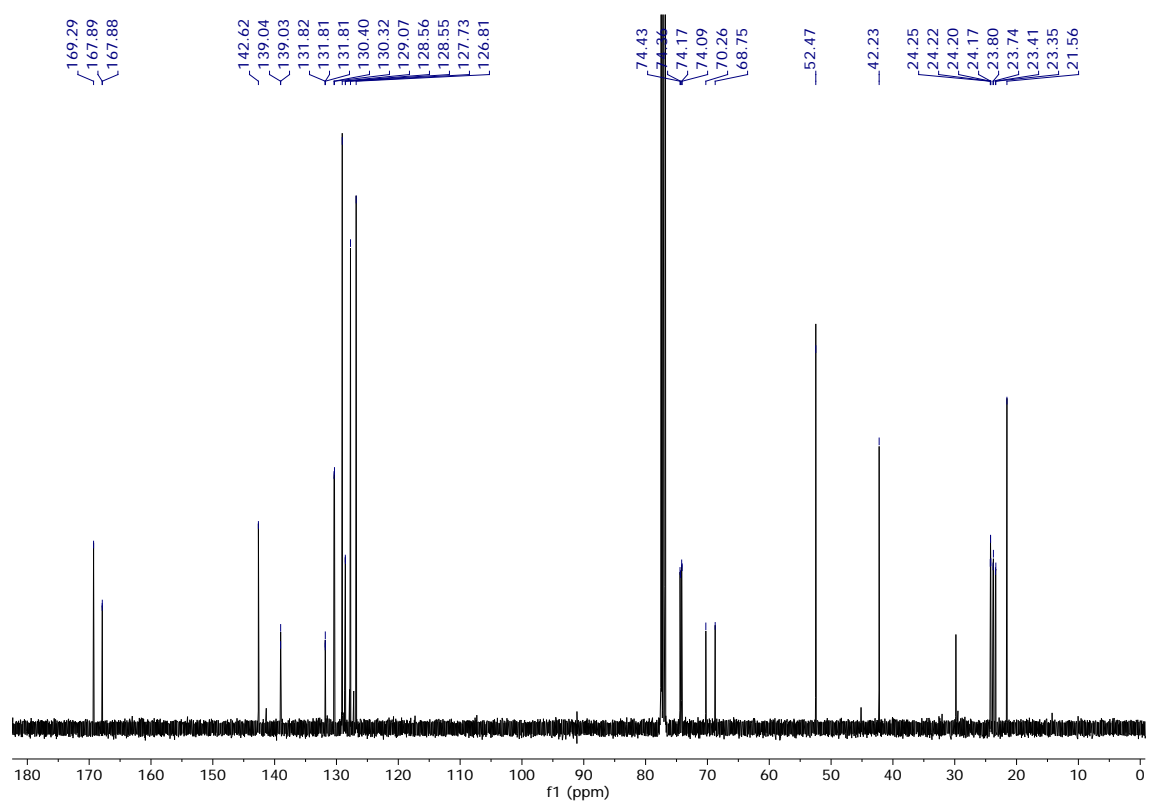


Methyl (2-(diisopropoxyphosphoryl)-2-((4-methylphenyl)sulfonamido)-2-phenylacetyl)glycinate (**13i**)

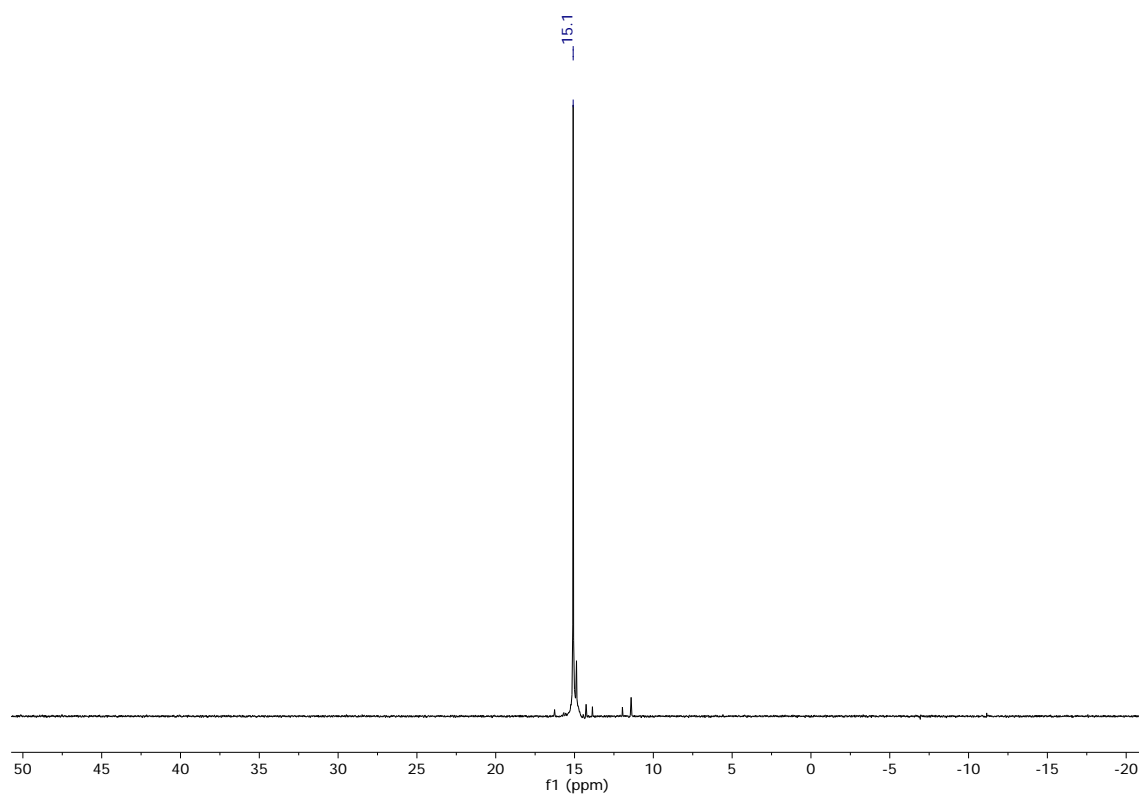
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

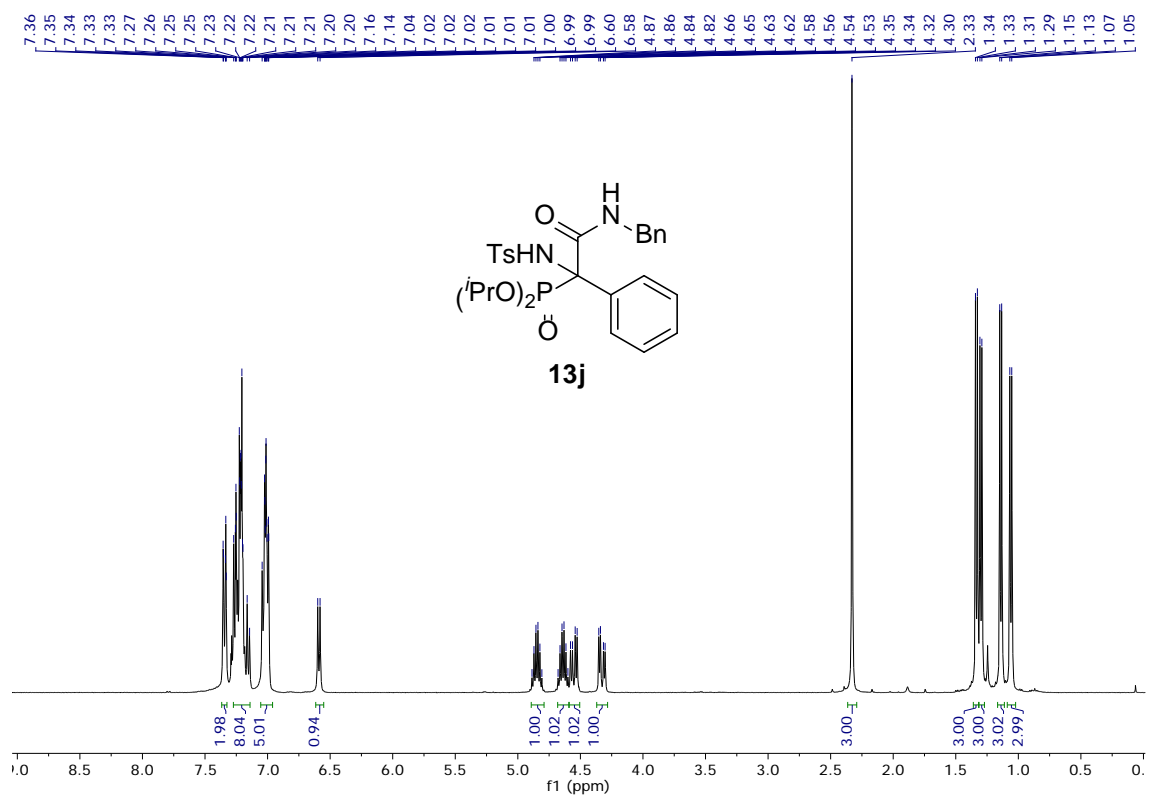


^{31}P NMR (121 MHz, CDCl_3)

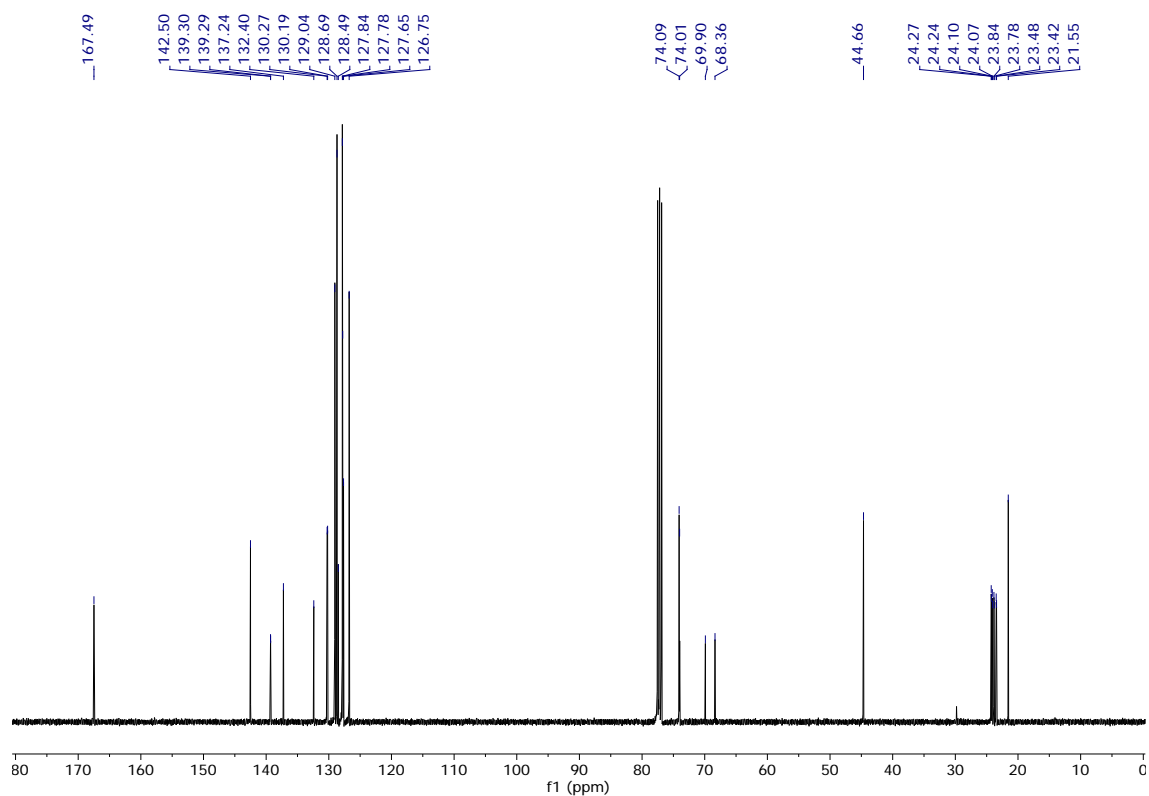


Diisopropyl (2-(benzylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonate (**13j**)

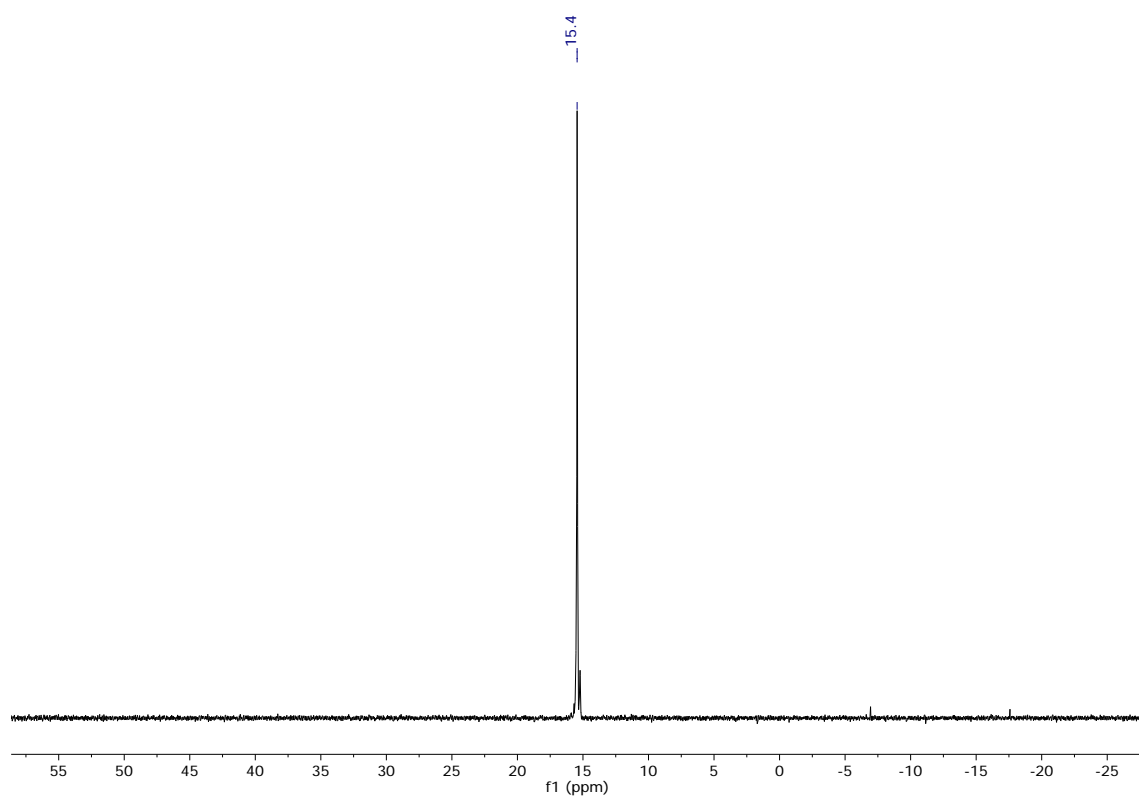
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CDCl_3)

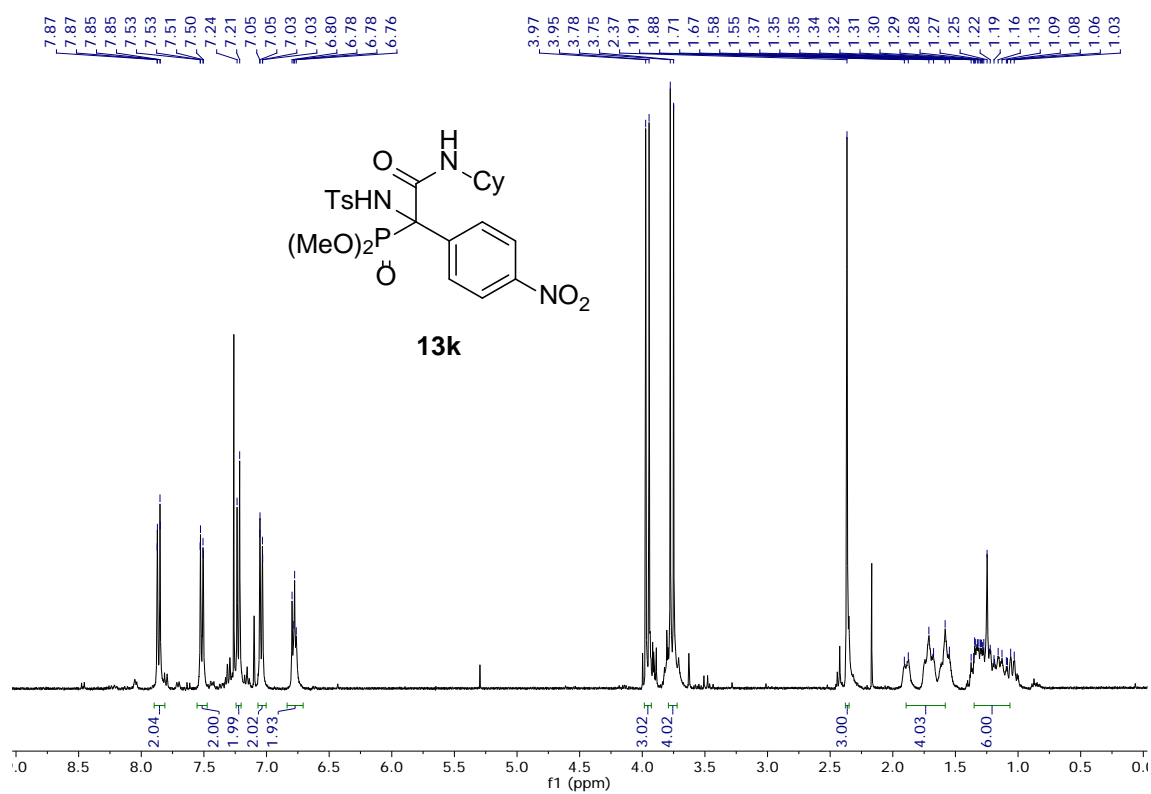


^{31}P NMR (121 MHz, CDCl_3)

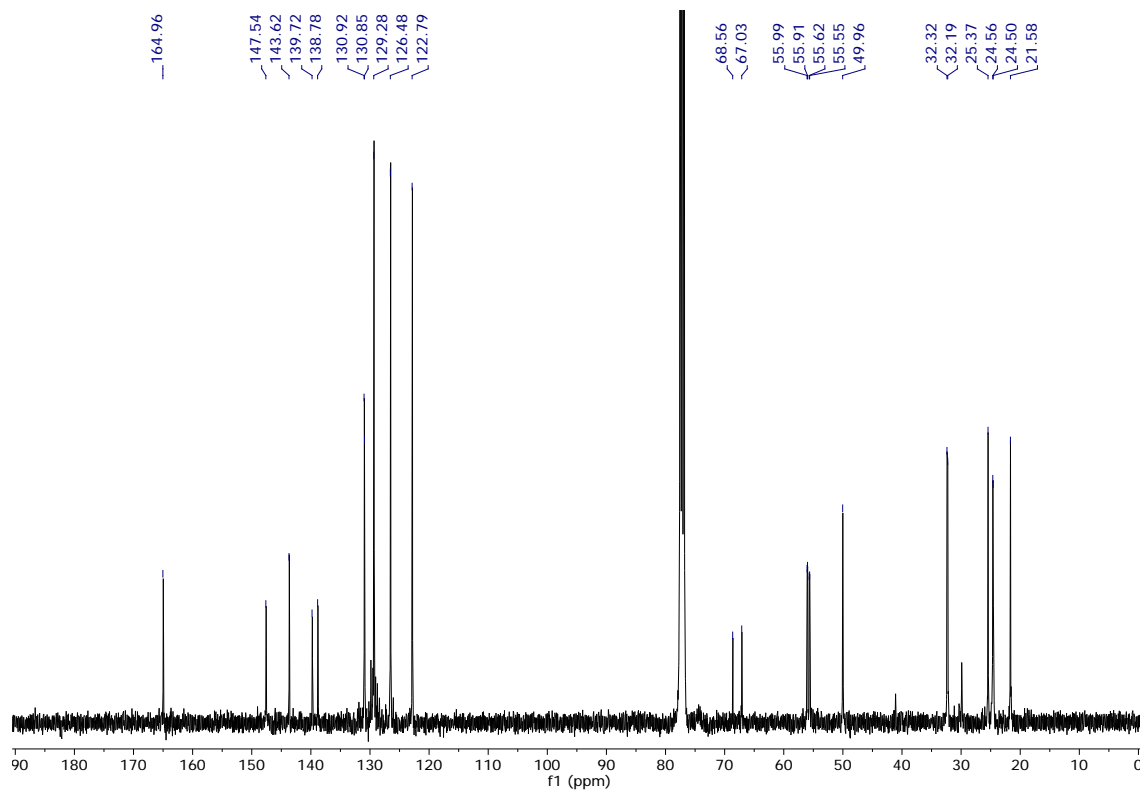


Dimethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-1-(4-nitrophenyl)-2-oxoethyl)phosphonate (13k)

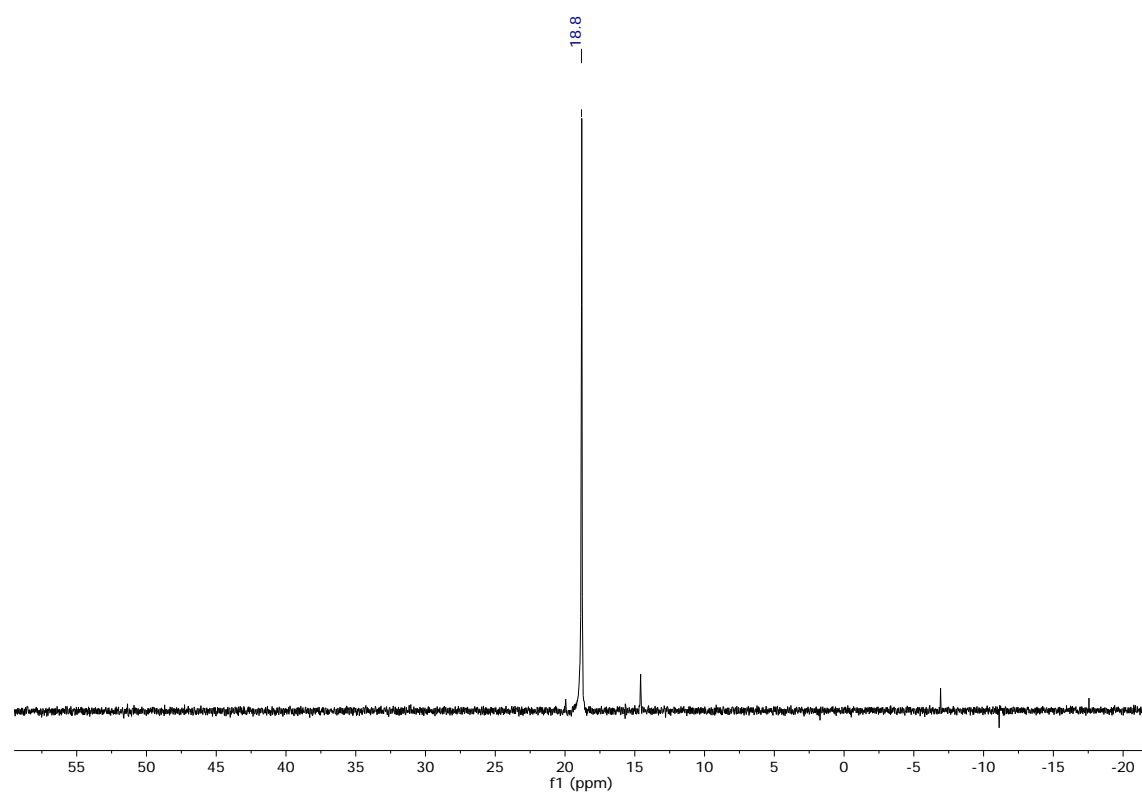
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR { ^1H } (101 MHz, CDCl_3)

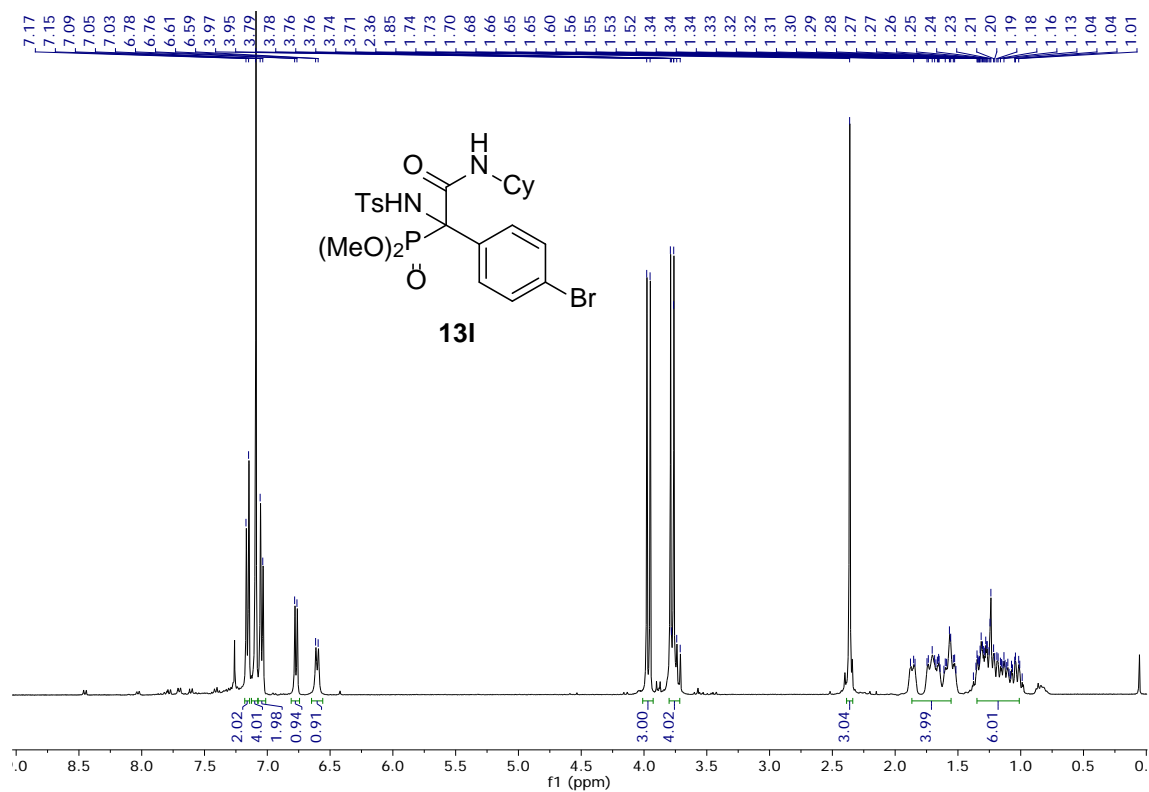


^{31}P NMR (121 MHz, CDCl_3)

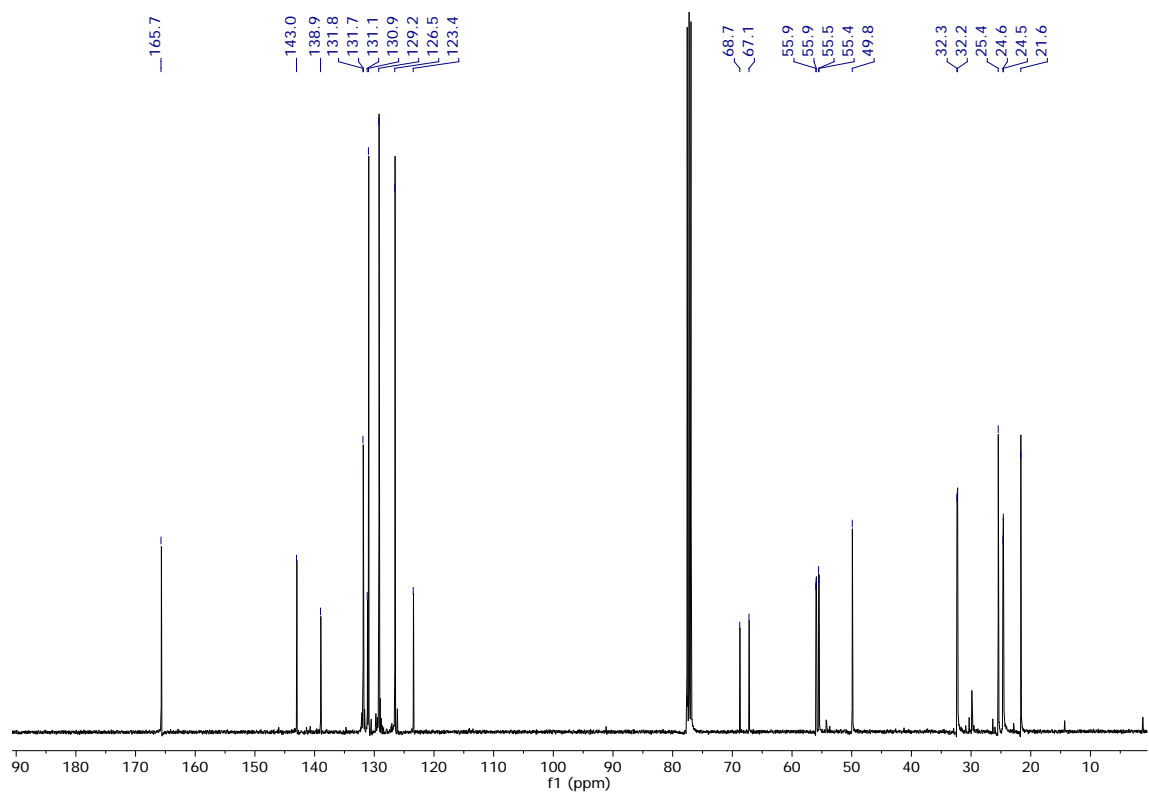


Dimethyl (1-(4-bromophenyl)-2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxoethyl)phosphonate (**13I**)

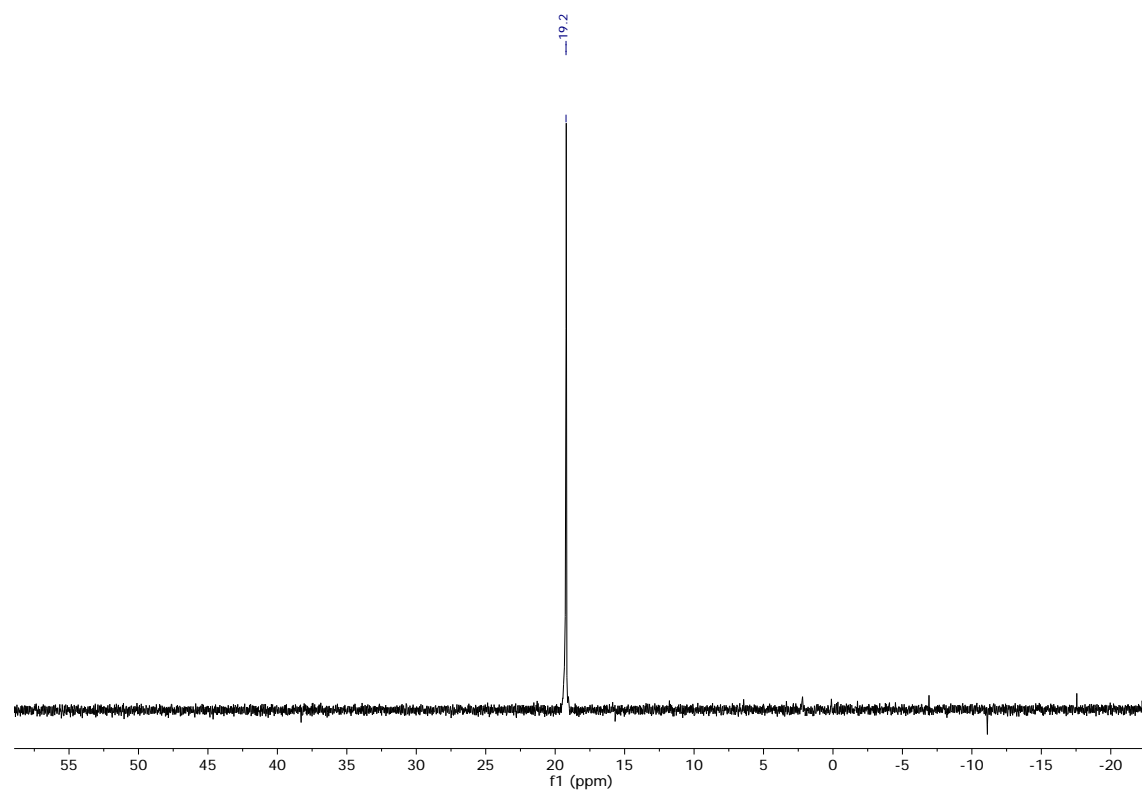
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR { ^1H } (101 MHz, CDCl_3)

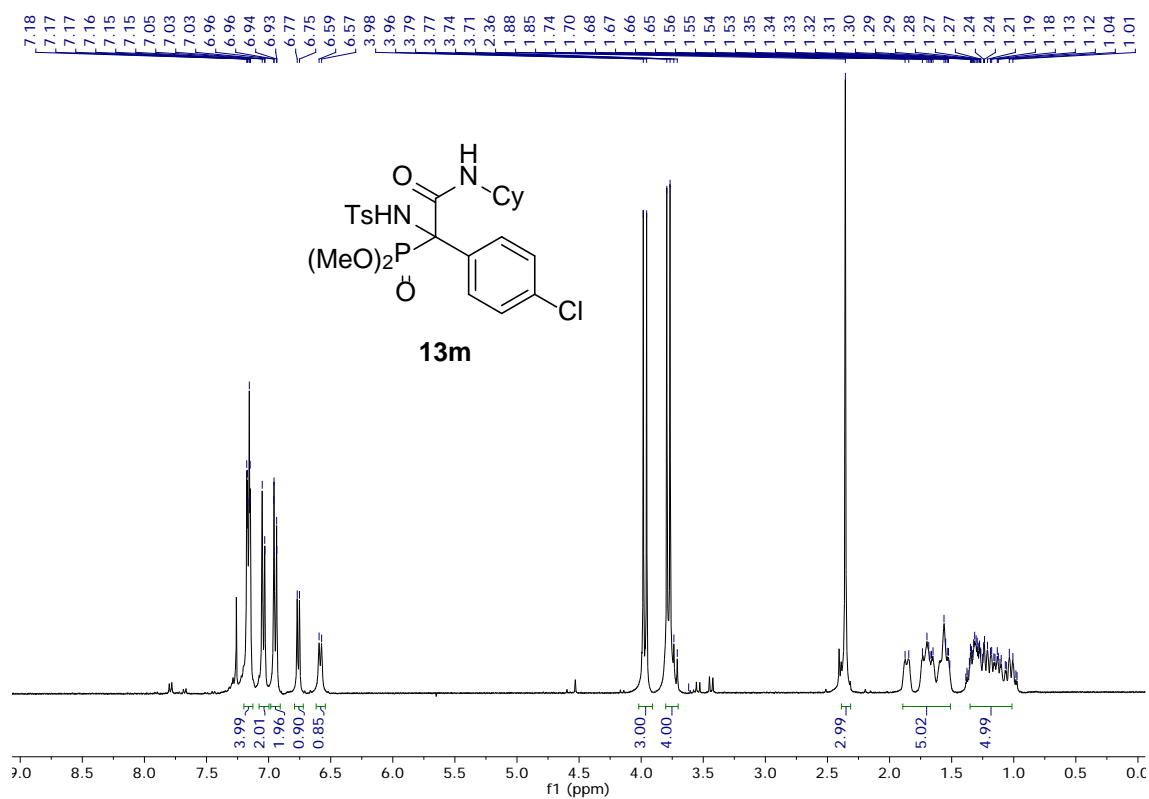


^{31}P NMR (121 MHz, CDCl_3)

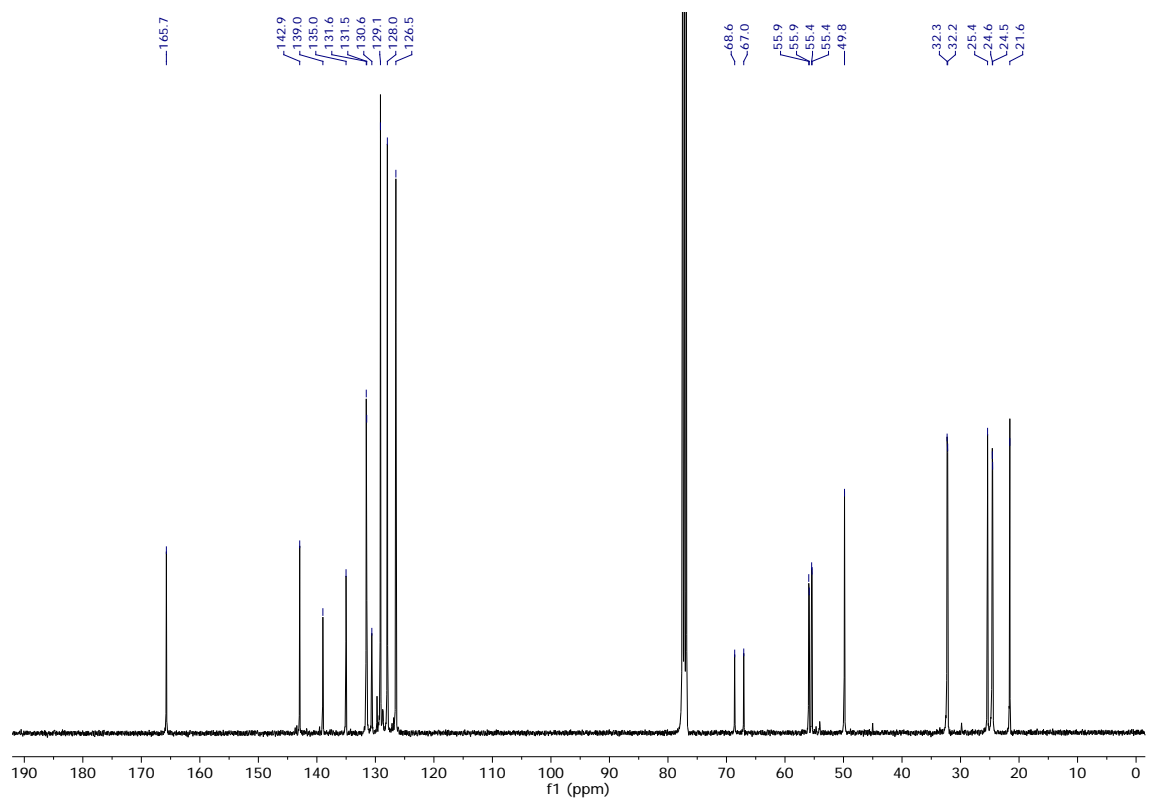


Dimethyl (1-(4-chlorophenyl)-2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxoethyl)phosphonate (13m)

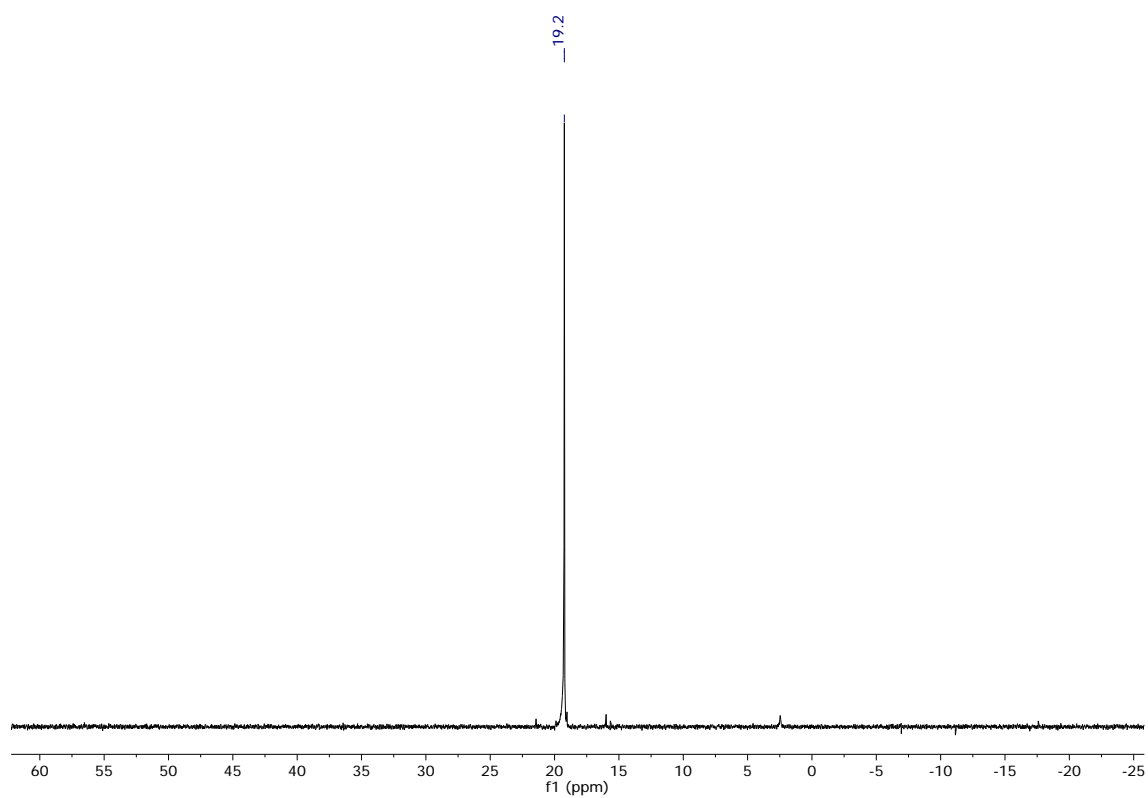
¹H NMR (400 MHz, CDCl₃)



¹³C NMR {¹H} (101 MHz, CDCl₃)

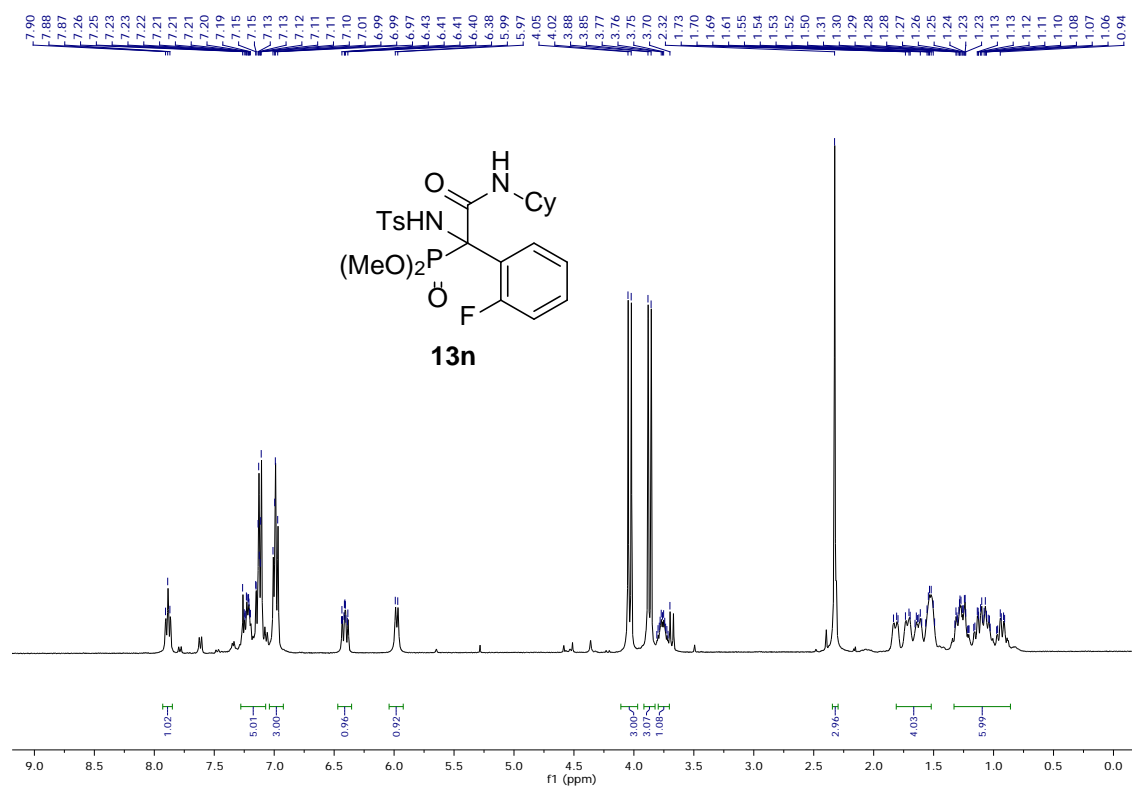


^{31}P NMR (121 MHz, CDCl_3)

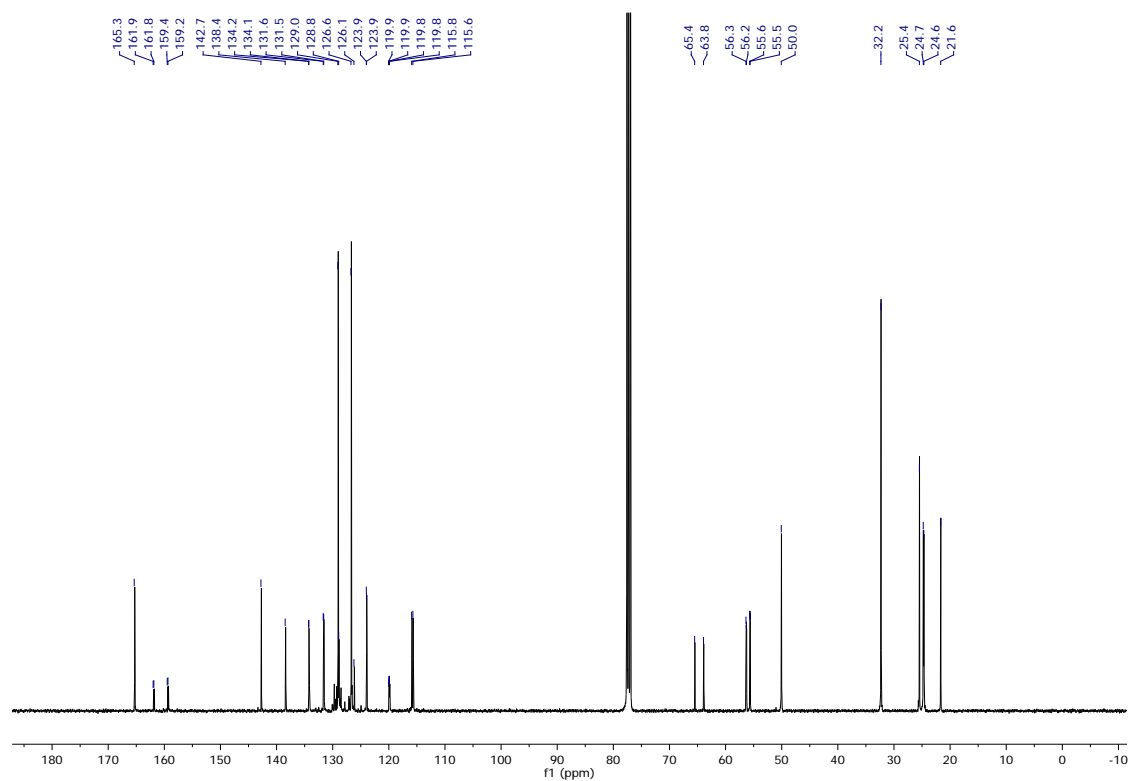


Dimethyl (2-(cyclohexylamino)-1-(2-fluorophenyl)-1-((4-methylphenyl)sulfonamido)-2-oxoethyl)phosphonate (13n)

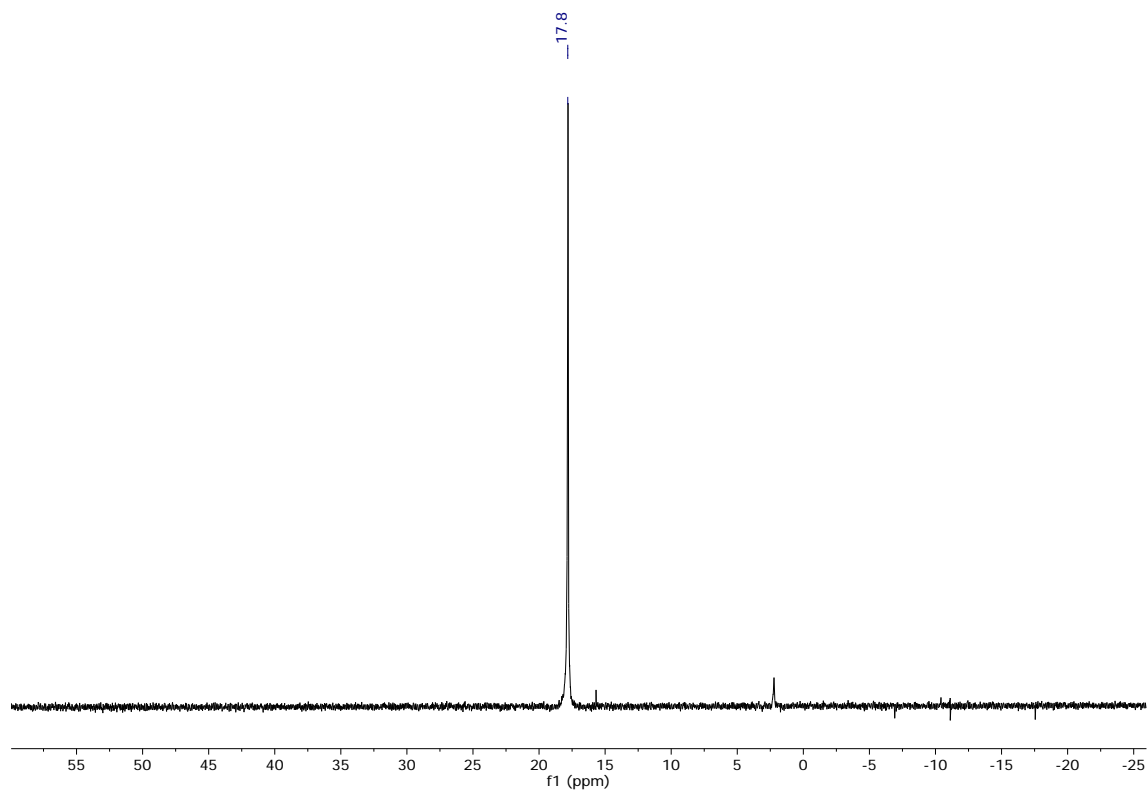
¹H NMR (400 MHz, CDCl₃)



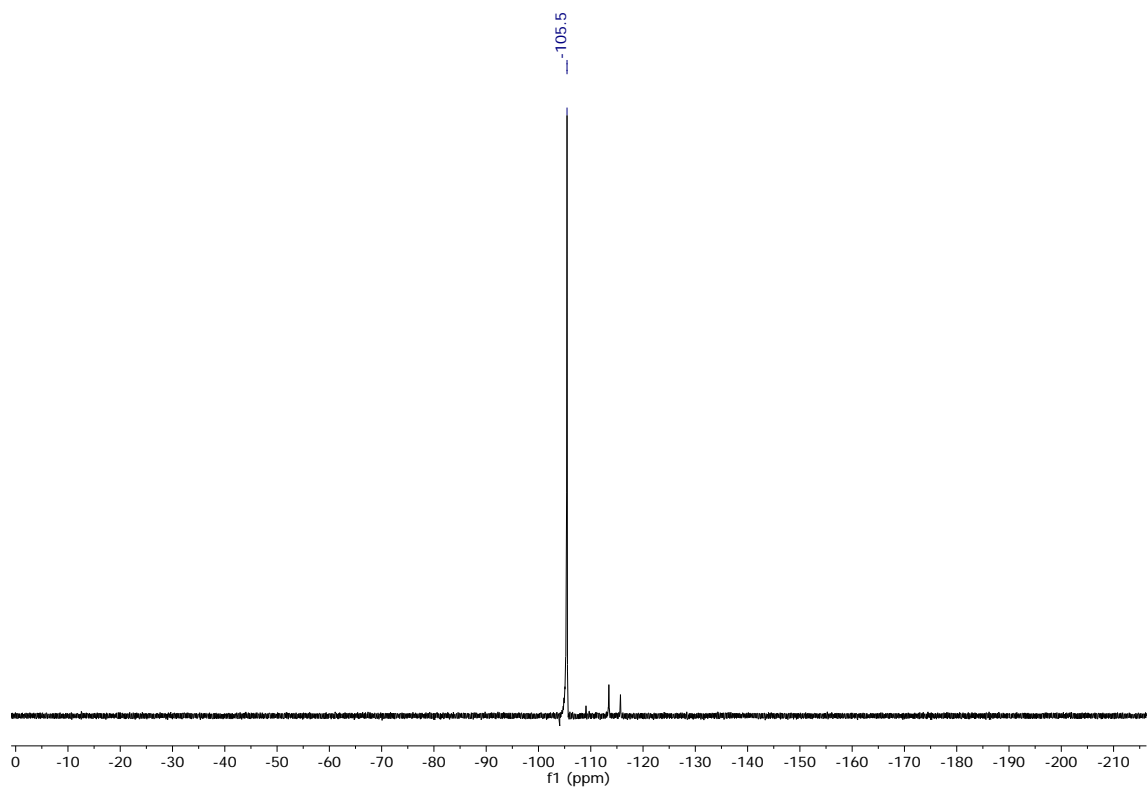
¹³C NMR {¹H} (101 MHz, CDCl₃)



³¹P NMR (121 MHz, CDCl₃)

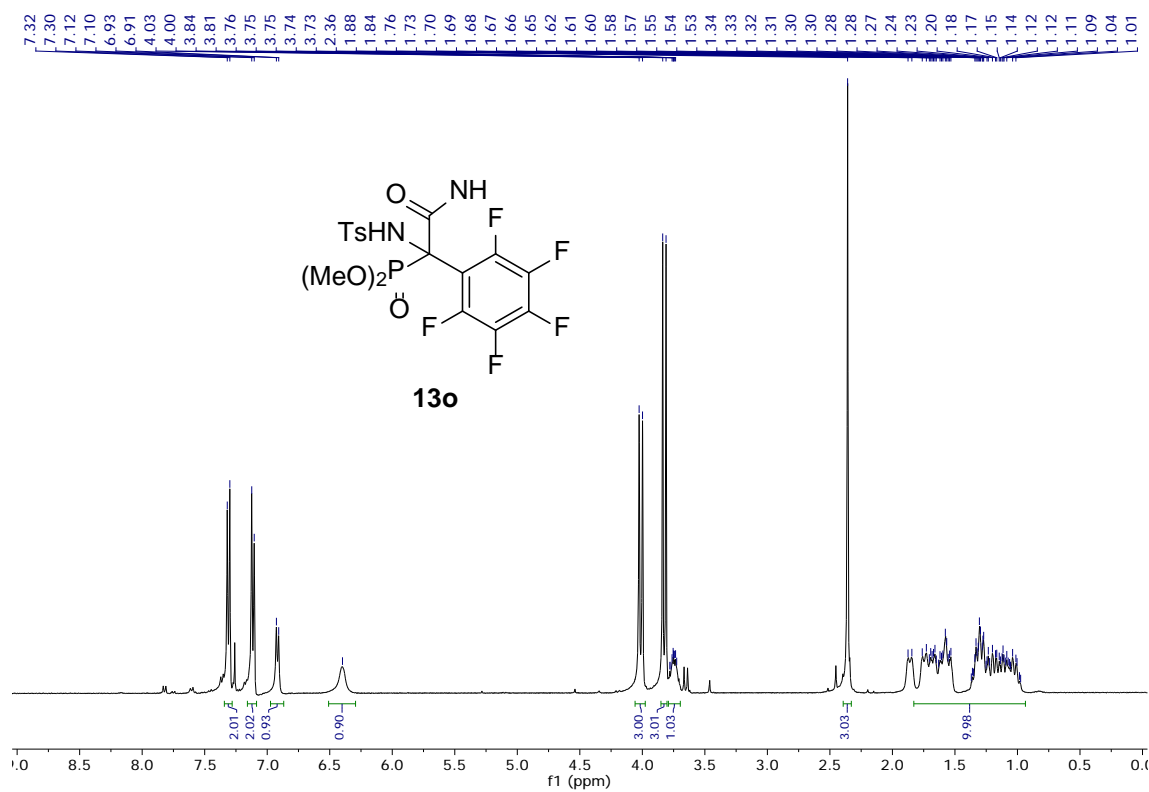


^{19}F NMR (282 MHz, CDCl_3)

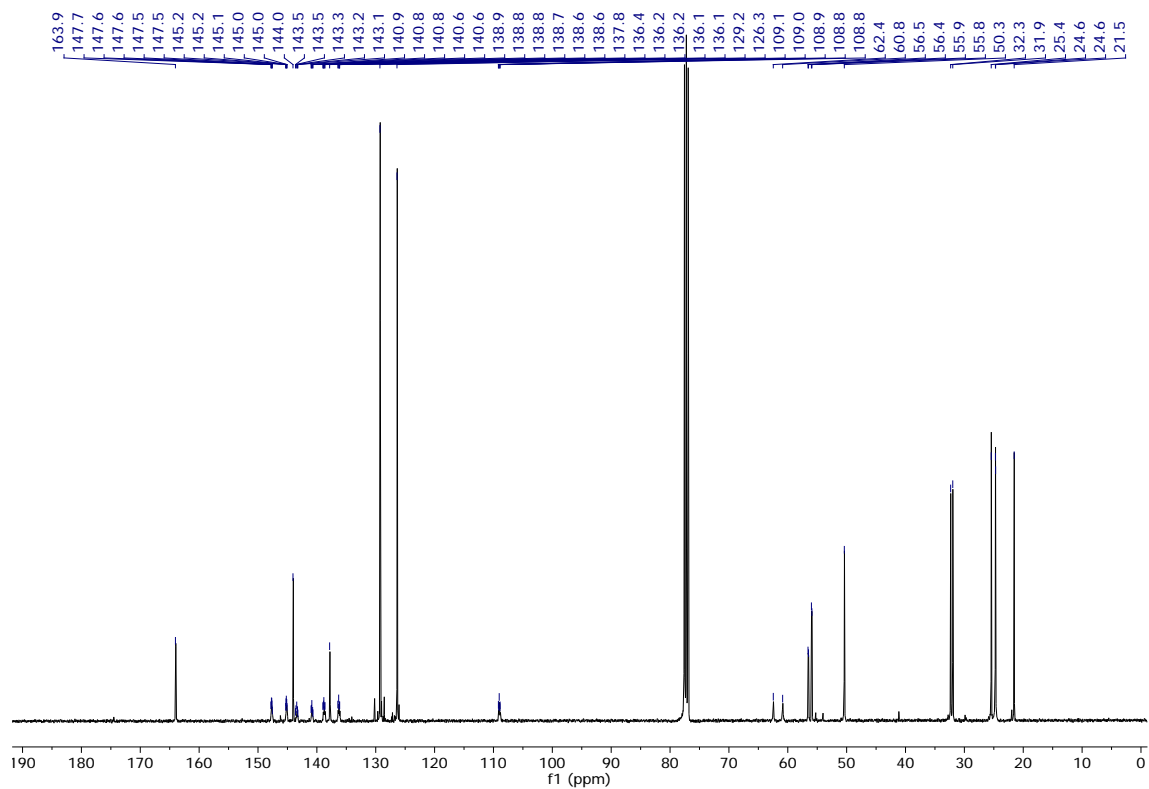


Dimethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-(perfluorophenyl)ethyl)phosphonate (13o)

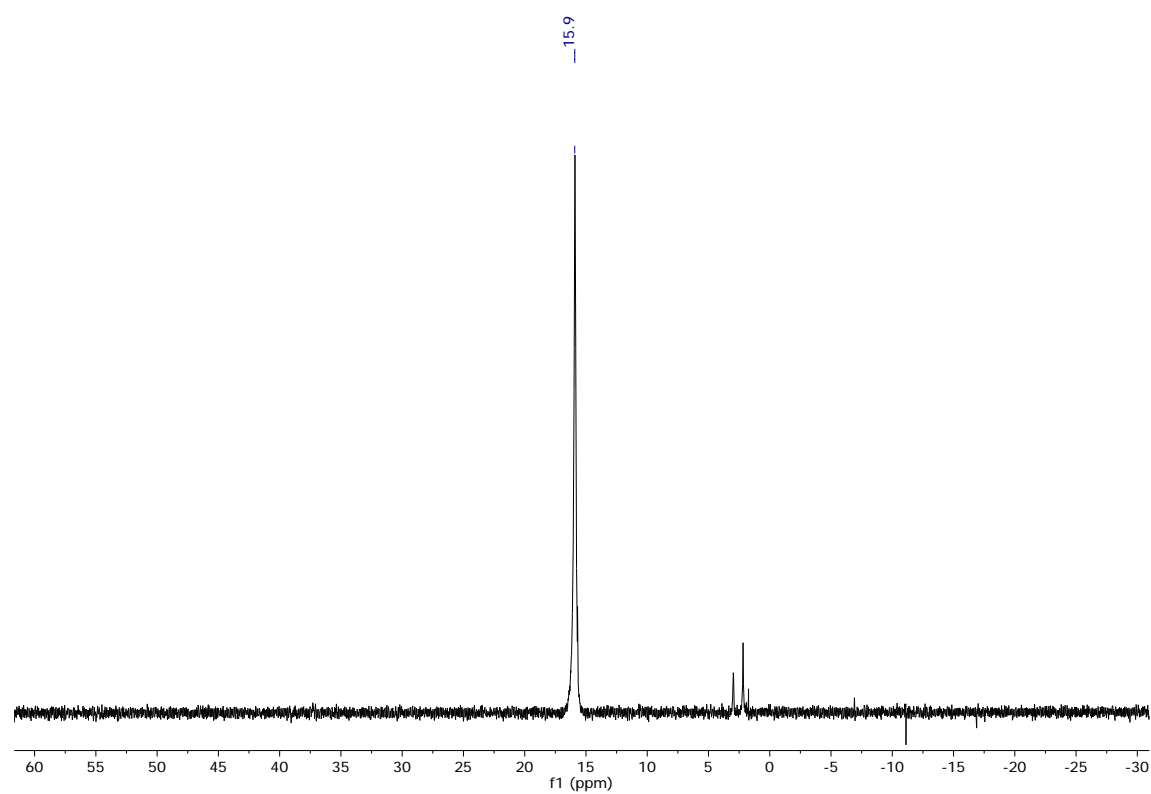
^1H NMR (400 MHz, CDCl_3)



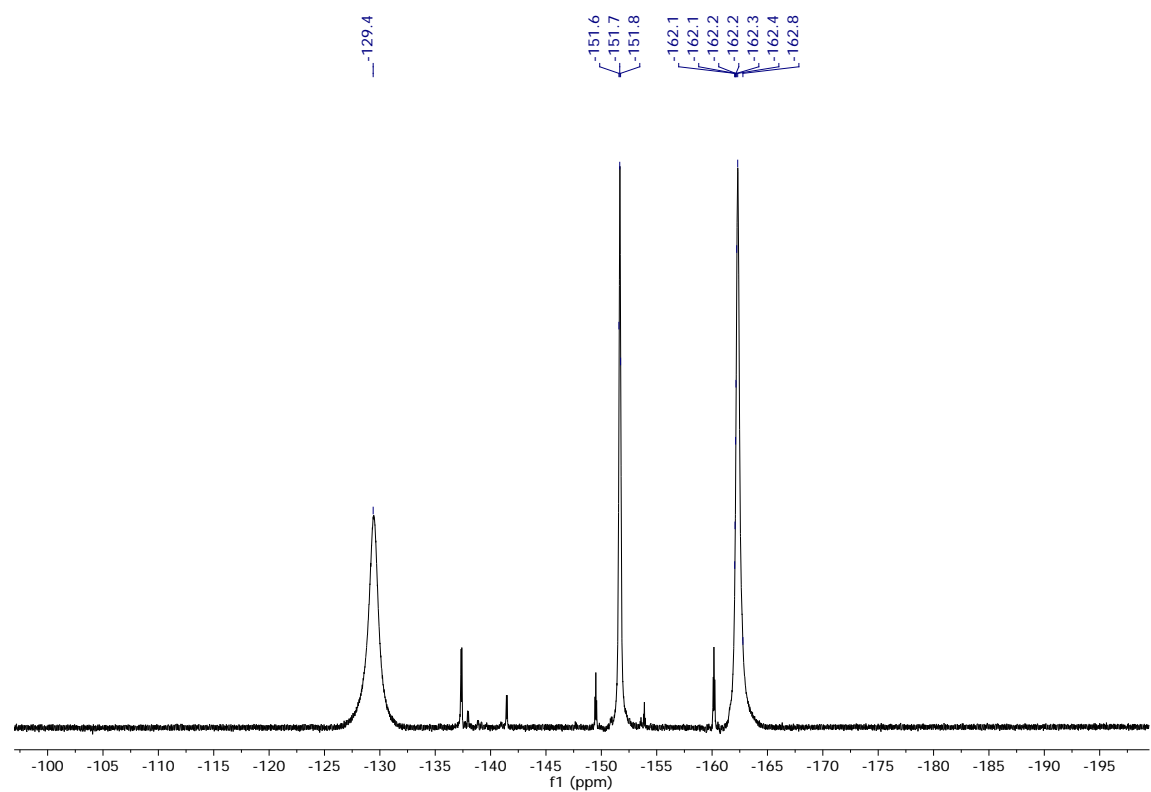
^{13}C NMR { ^1H } (101 MHz, CDCl_3)



^{31}P NMR (121 MHz, CDCl_3)

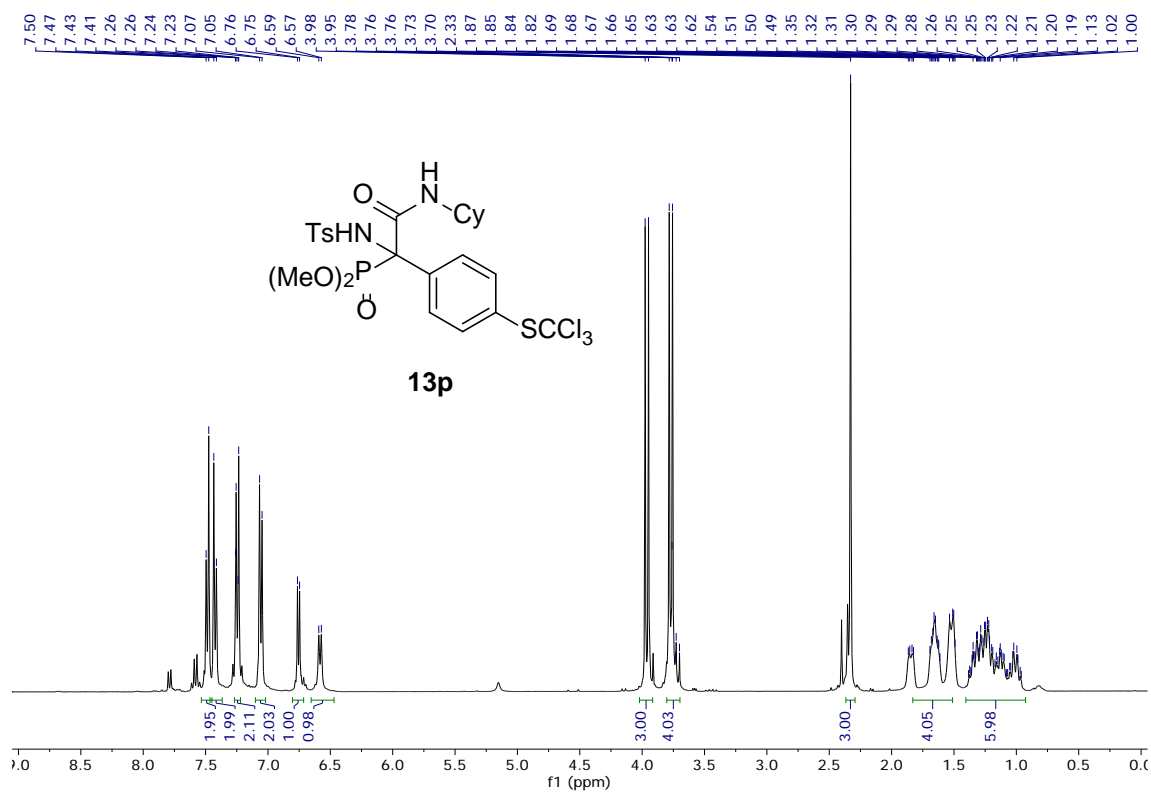


^{19}F NMR (282 MHz, CDCl_3)

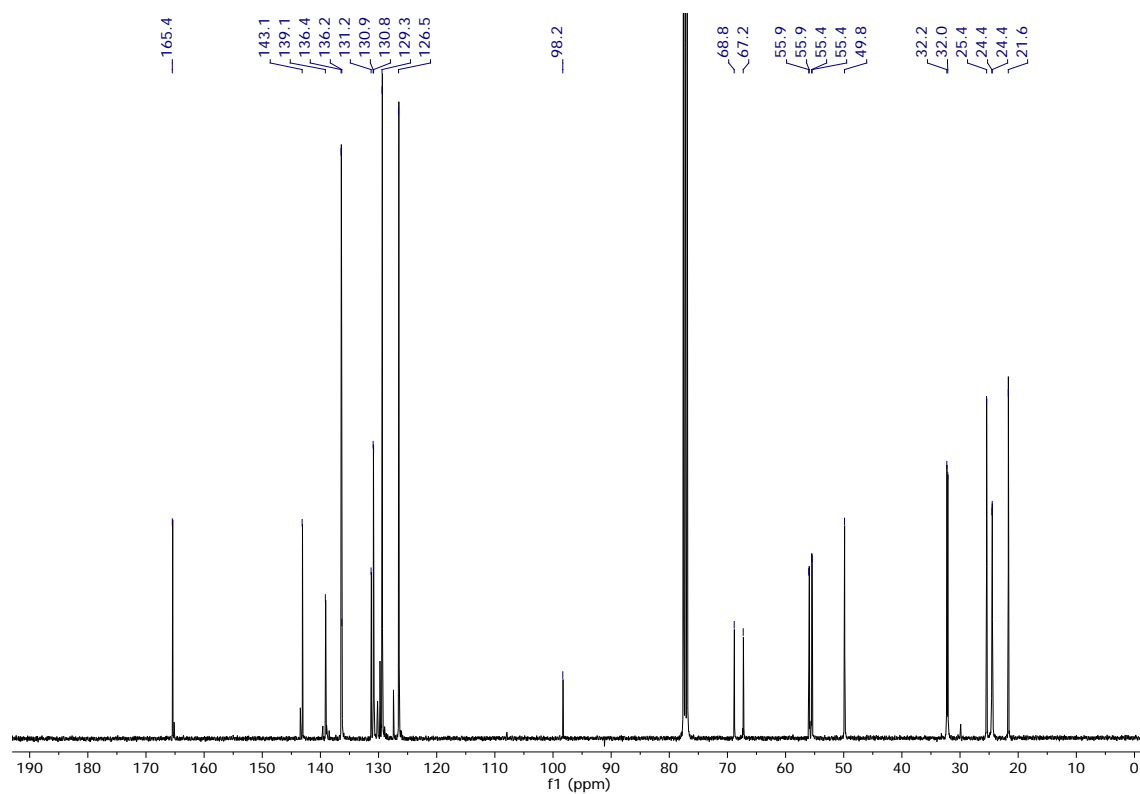


Dimethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-(4-((trichloromethyl)thio)phenyl)ethyl)phosphonate (13p)

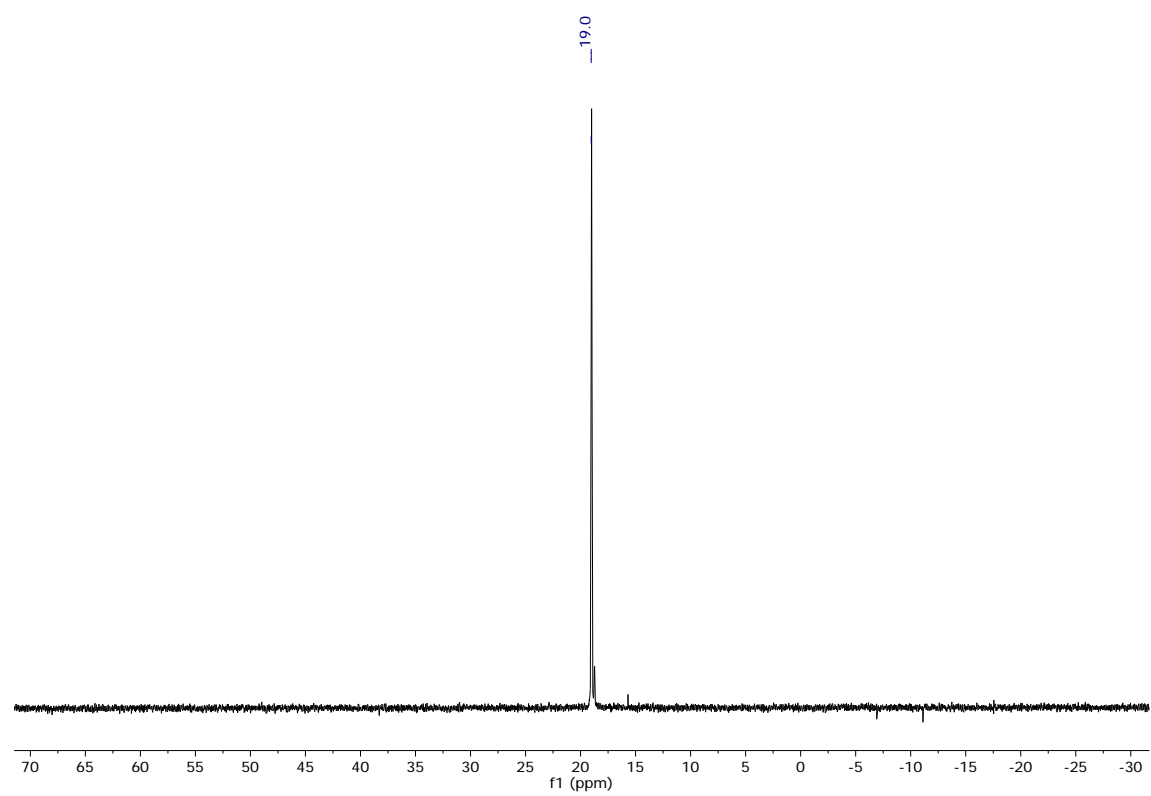
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR { ^1H } (101 MHz, CDCl_3)

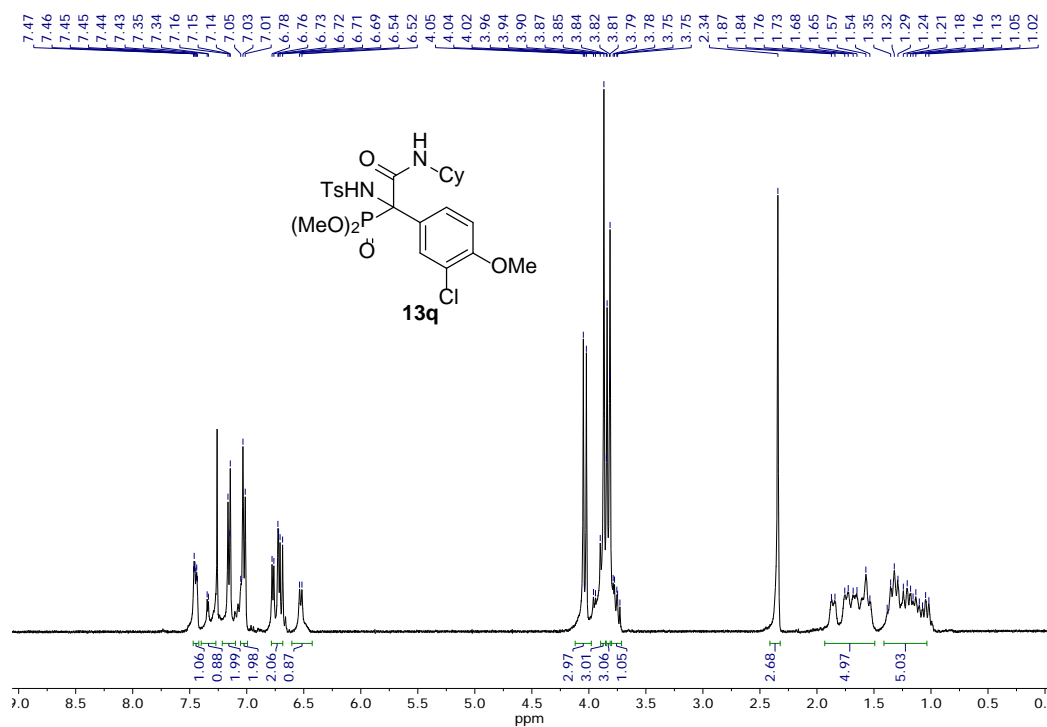


^{31}P NMR (121 MHz, CDCl_3)

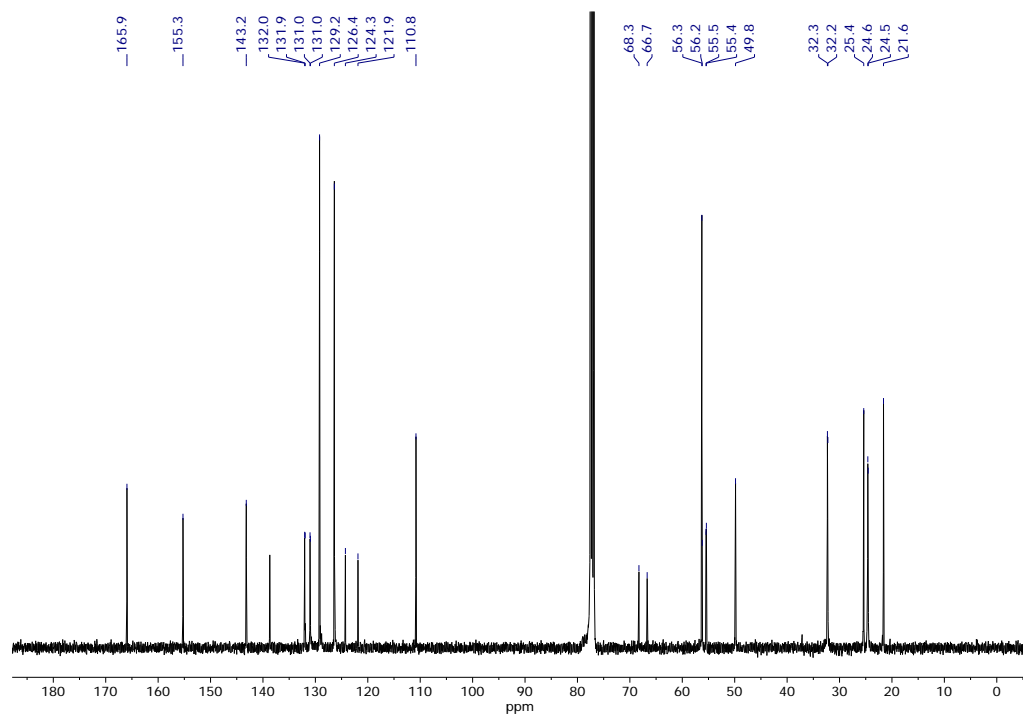


Dimethyl (1-(3-chloro-4-methoxyphenyl)-2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxoethyl)phosphonate (13q).

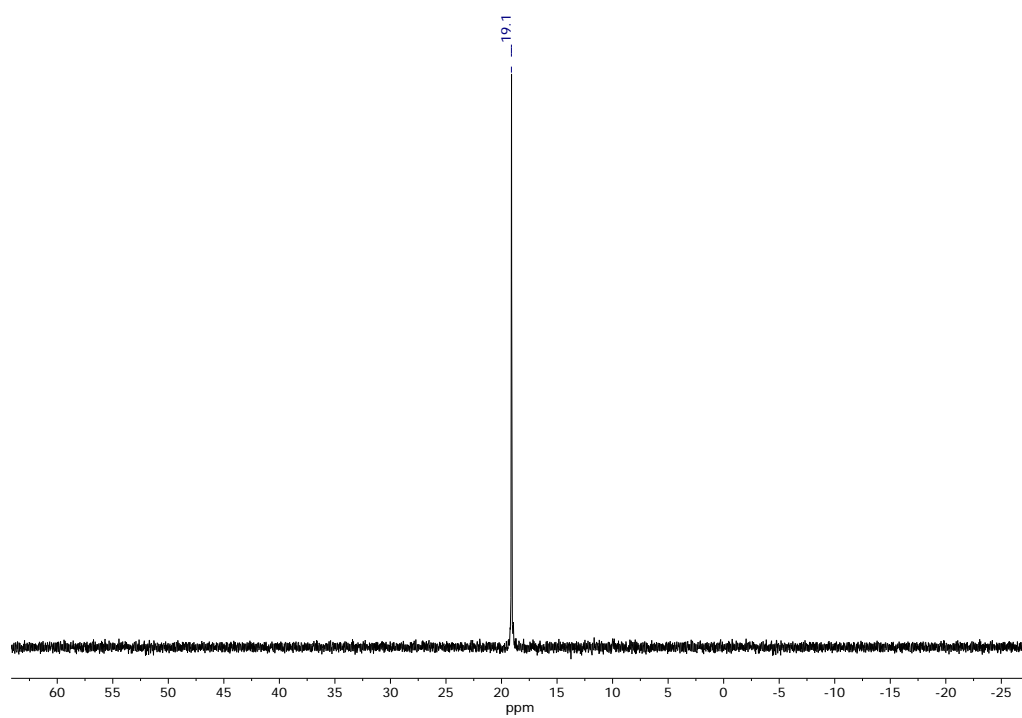
^1H NMR (400 MHz, CDCl_3)



^{13}C NMR [^1H] (101 MHz, CDCl_3)

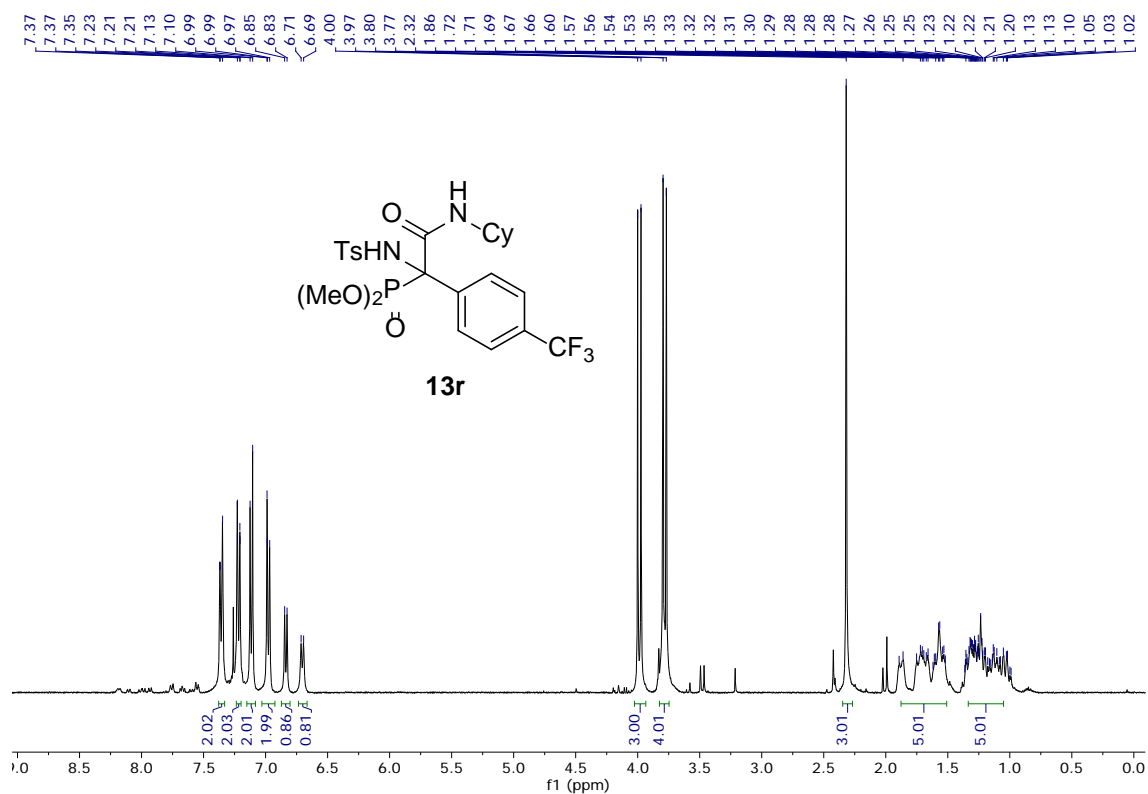


^{31}P NMR (121 MHz, CDCl_3)

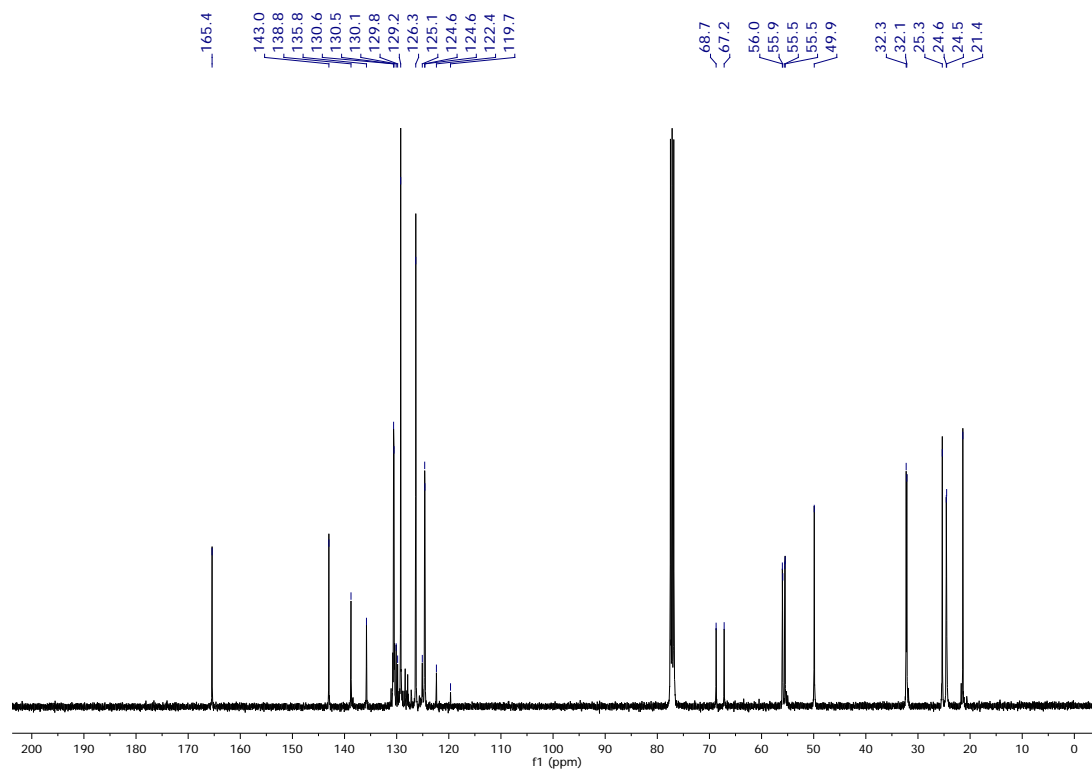


Dimethyl (2-(cyclohexylamino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-(4-(trifluoromethyl)phenyl)ethyl)phosphonate (13r)

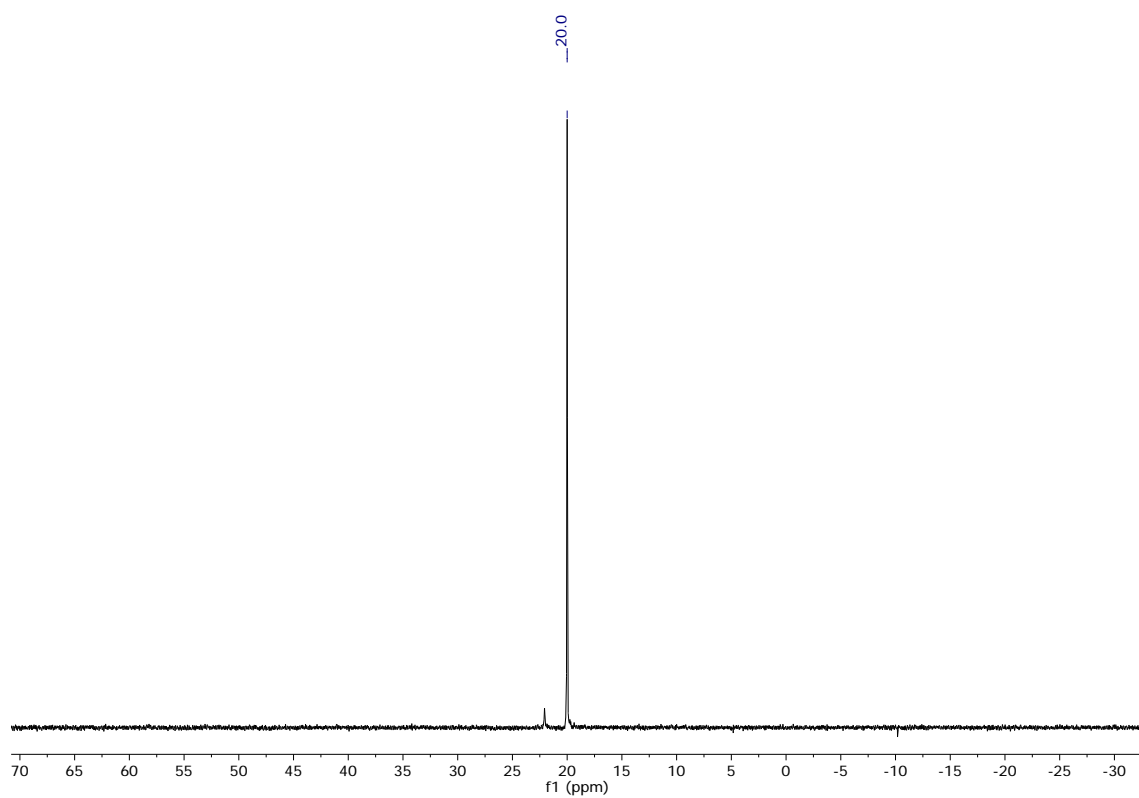
^1H NMR (400 MHz, CDCl_3)



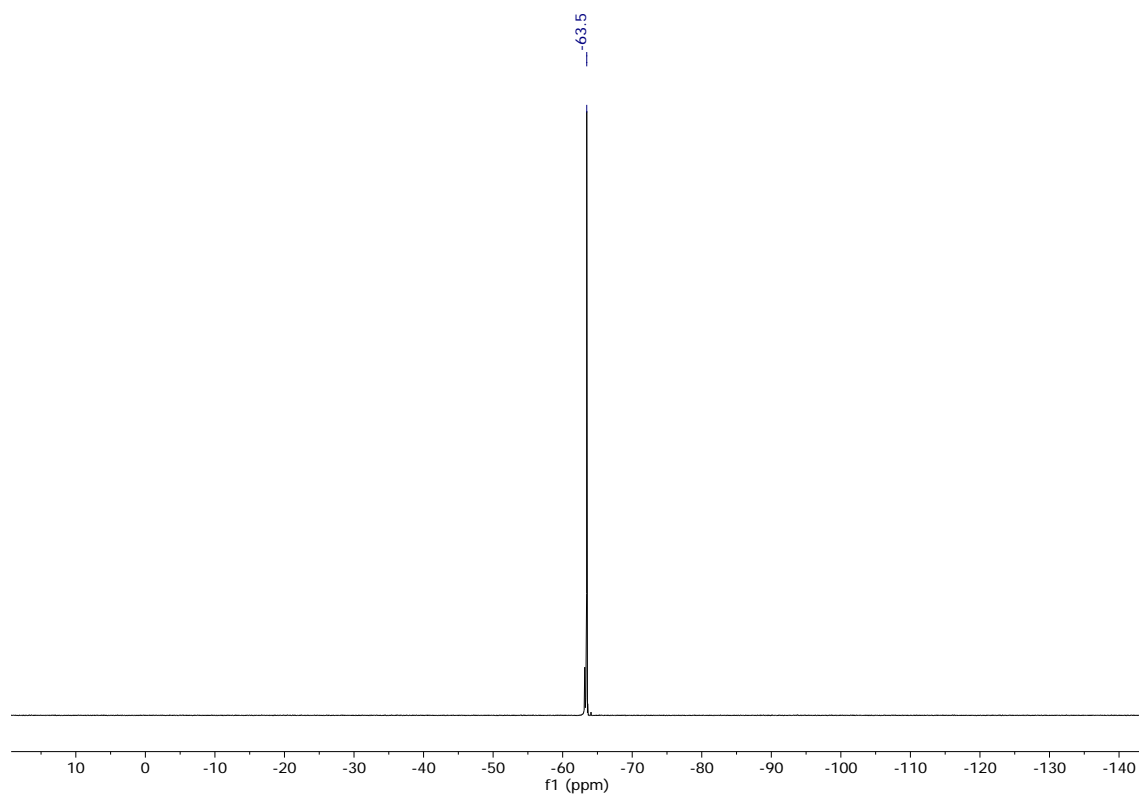
^{13}C NMR { ^1H } (101 MHz, CDCl_3)



^{31}P NMR (121 MHz, CDCl_3)

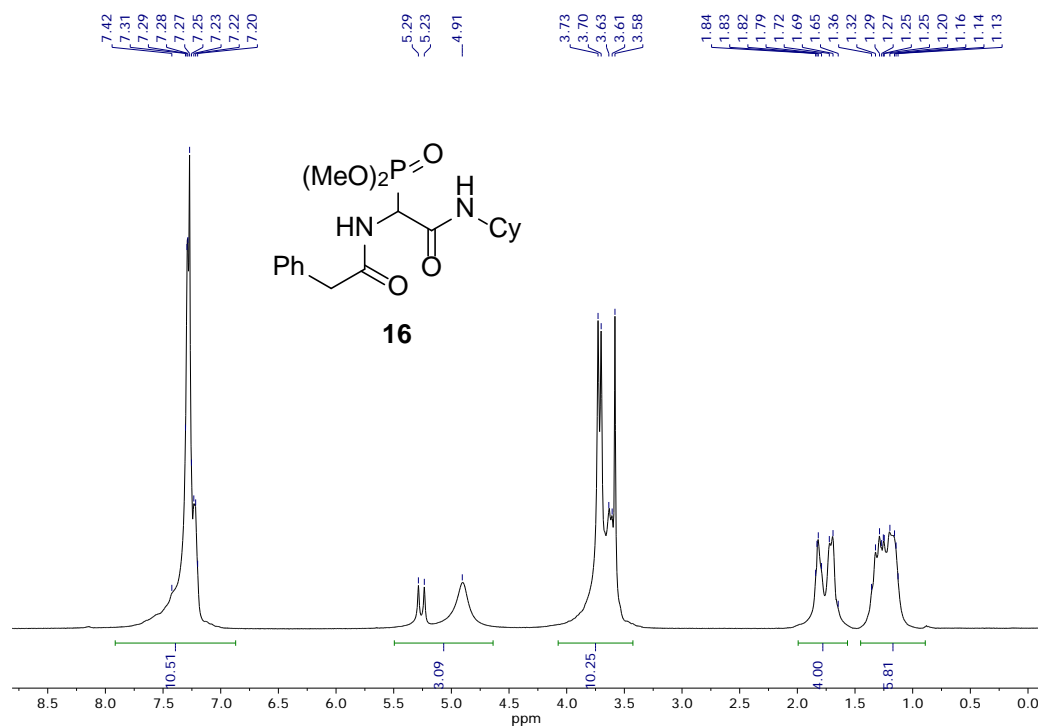


^{19}F NMR (282 MHz, CDCl_3)

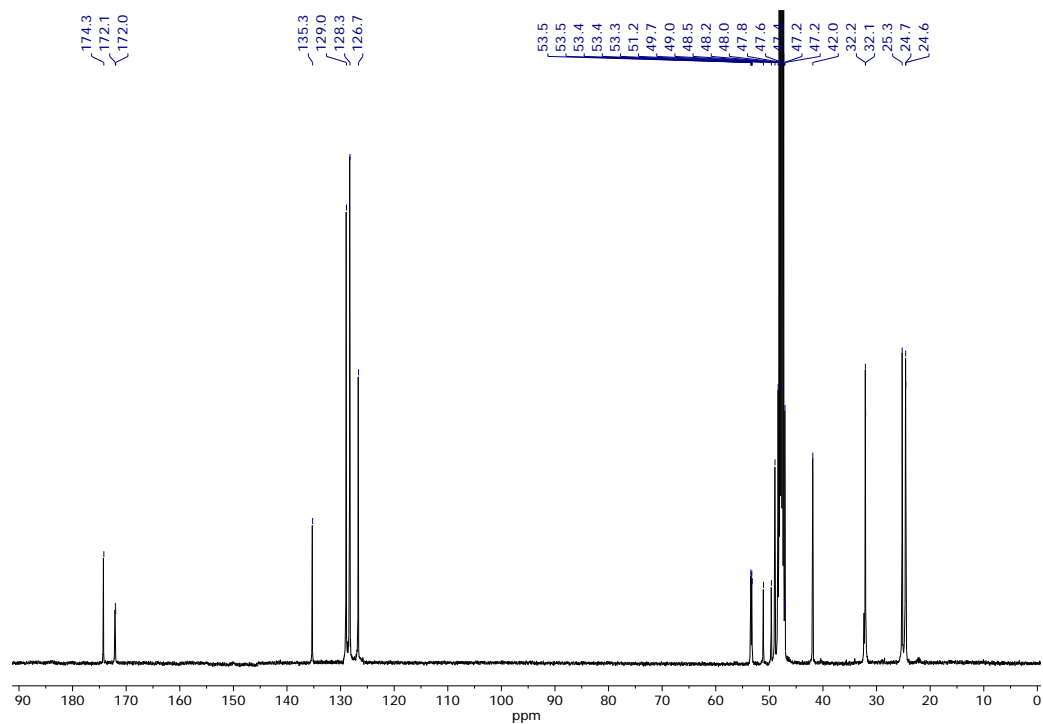


Dimethyl (2-(cyclohexylamino)-2-oxo-1-(2-phenylacetamido)ethyl)phosphonate (16).

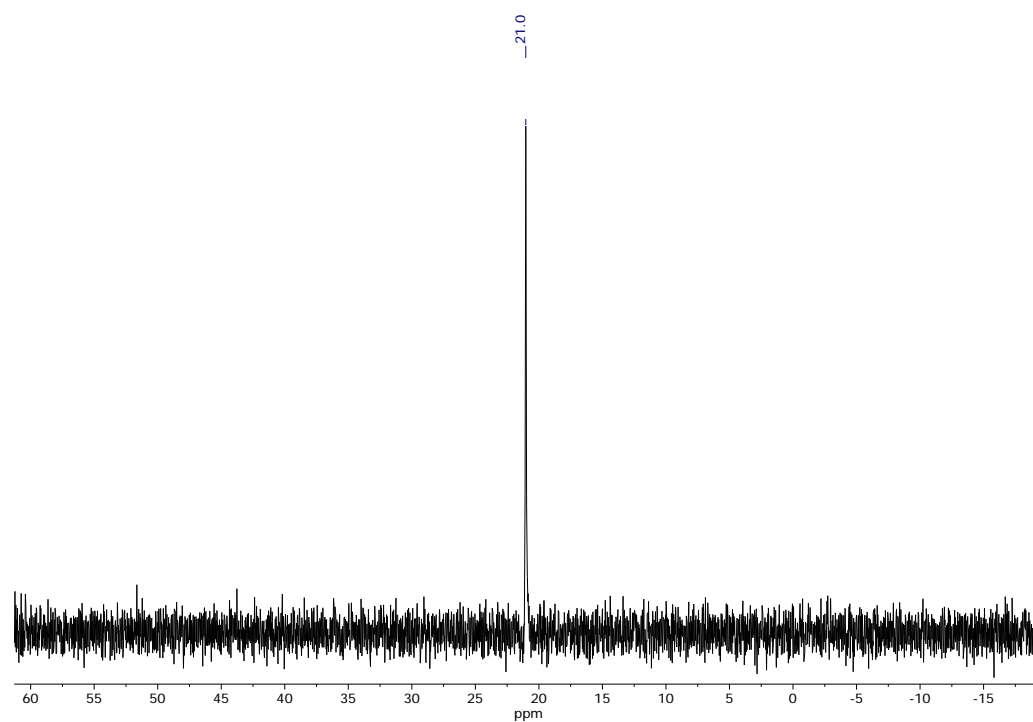
^1H NMR (300 MHz, CDCl_3)

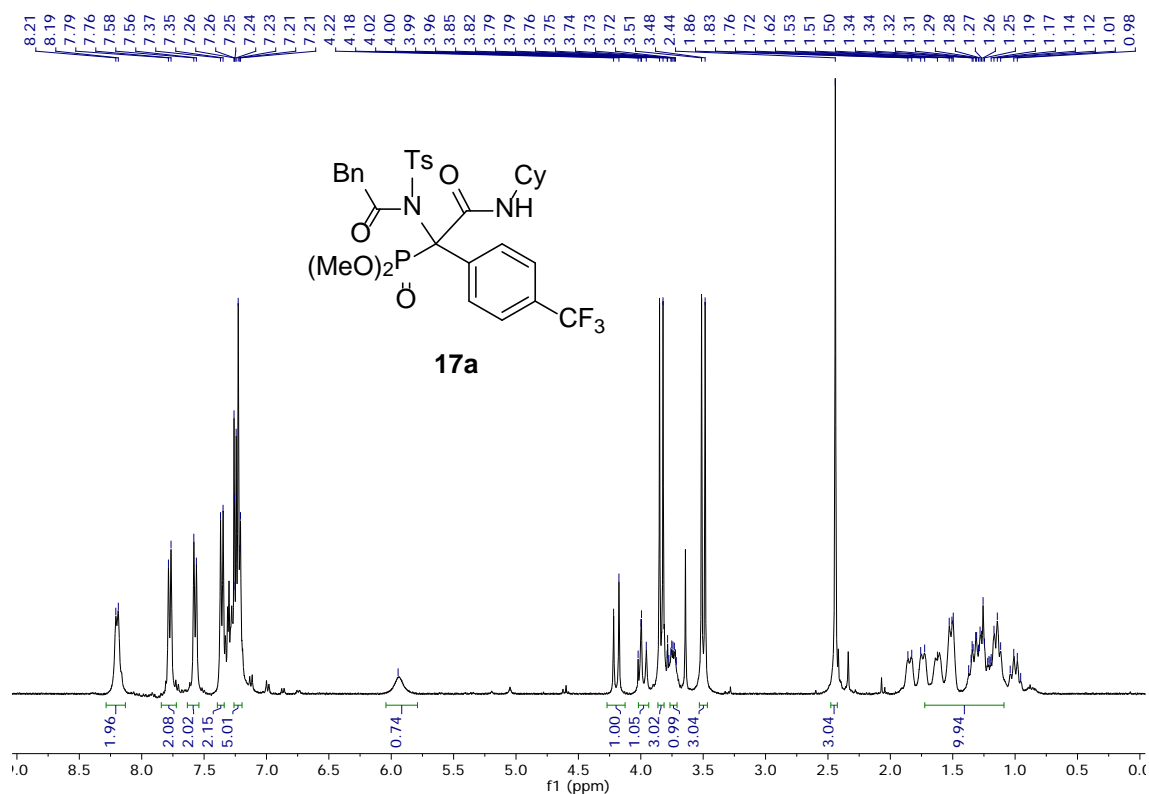
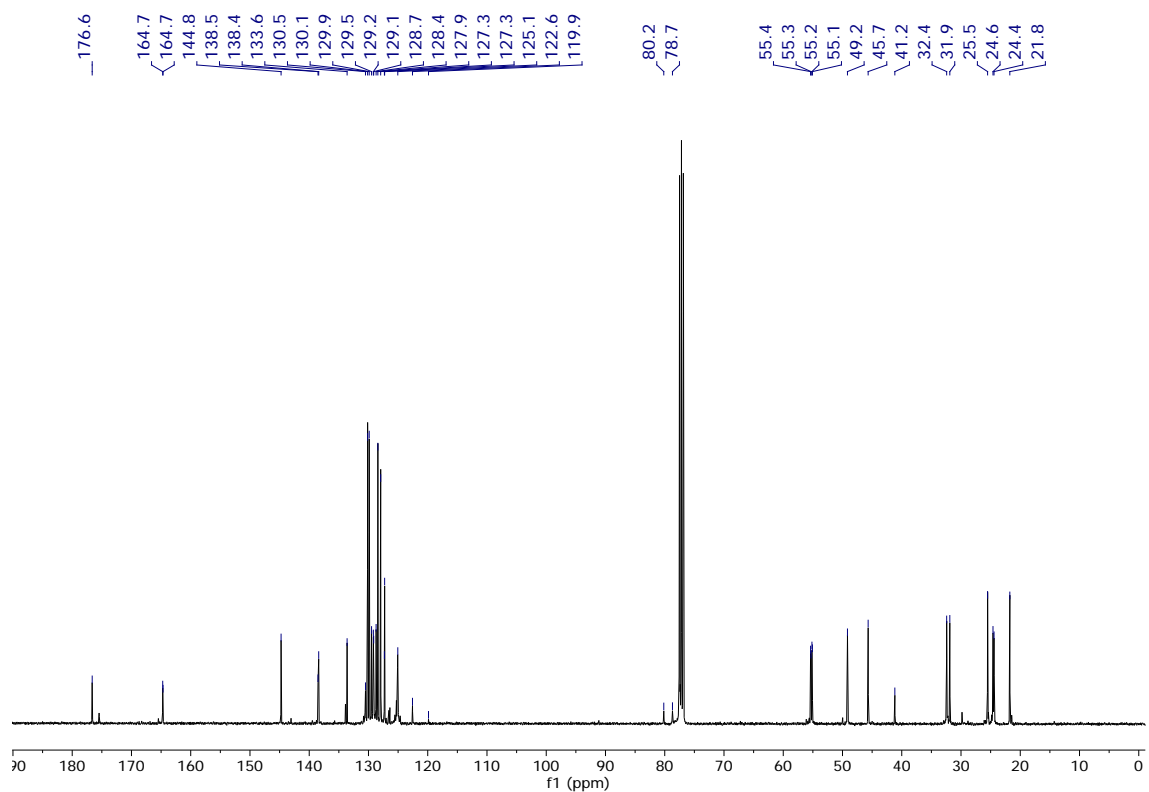


^{13}C NMR $\{^1\text{H}\}$ (101 MHz, CD_3OD)

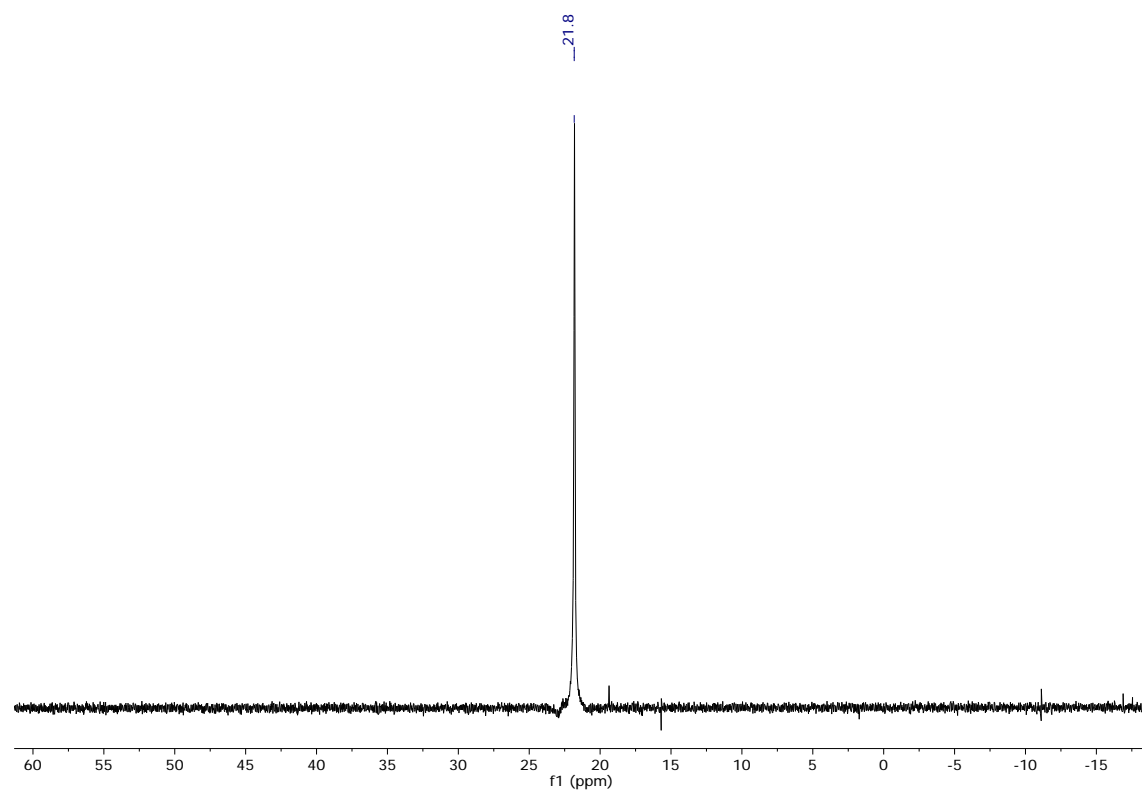


^{31}P NMR (121 MHz, CDCl_3)

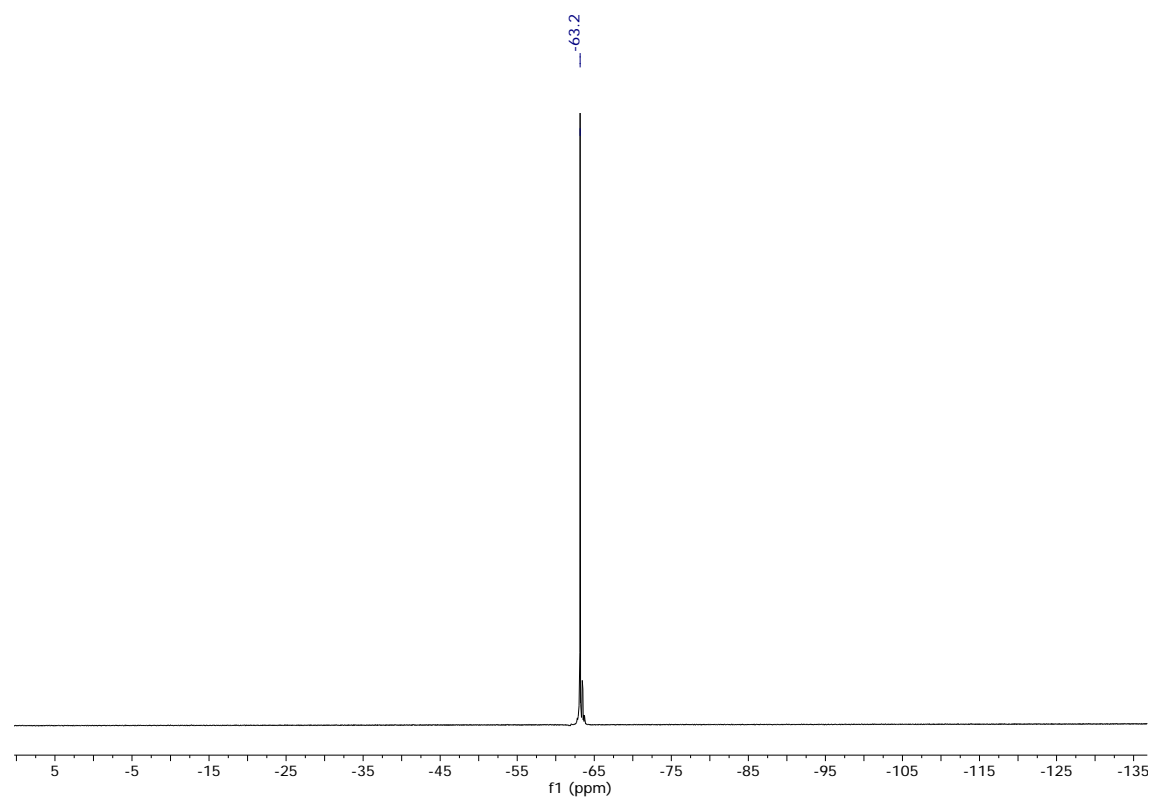


¹H NMR (400 MHz, CDCl₃) ^{13}C NMR { ^1H } (101 MHz, CDCl_3)

^{31}P NMR (121 MHz, CDCl_3)

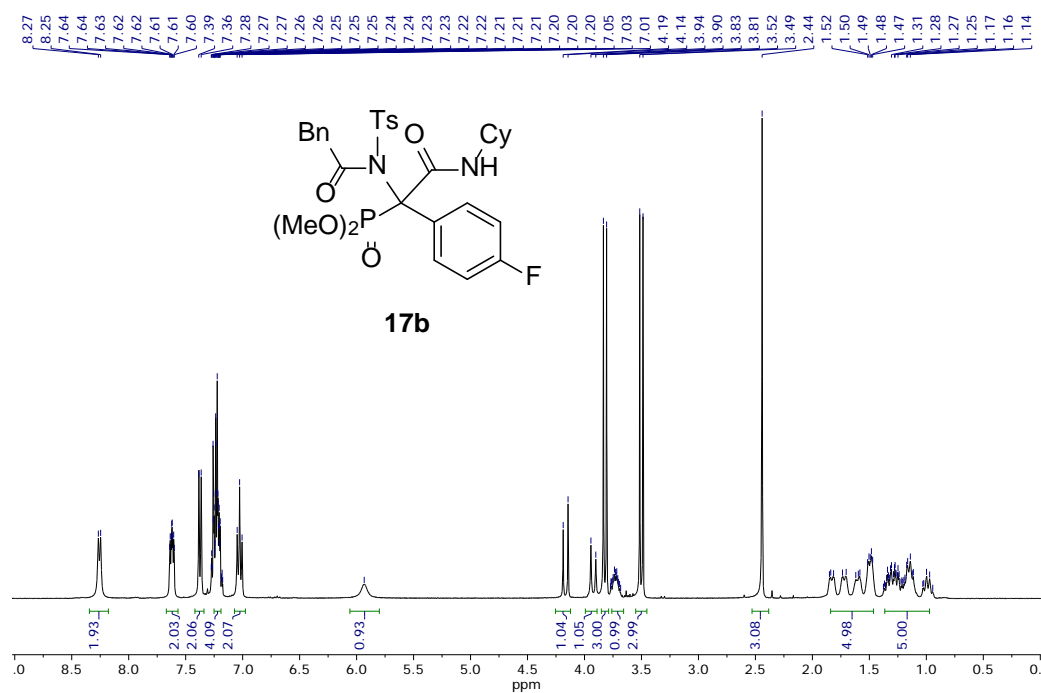


^{19}F NMR (282 MHz, CDCl_3)

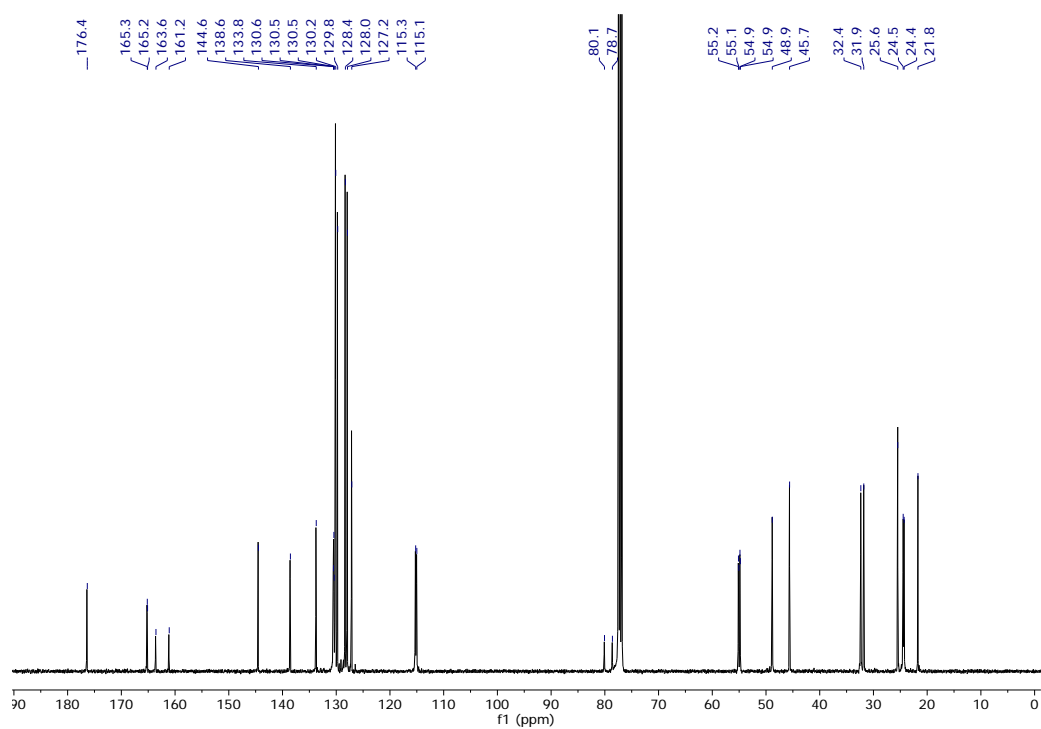


Dimethyl (2-(cyclohexylamino)-1-(4-fluorophenyl)-1-((4-methylphenyl)sulfonamido)-2-oxoethyl)phosphonate (17b).

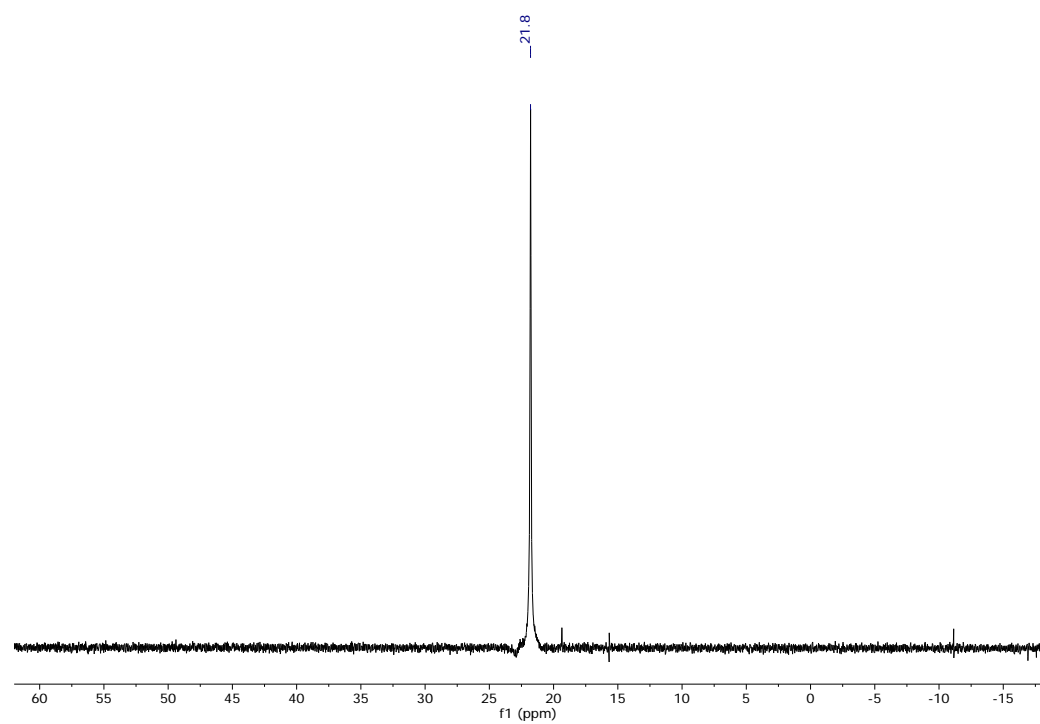
^1H NMR (400 MHz, CDCl_3)



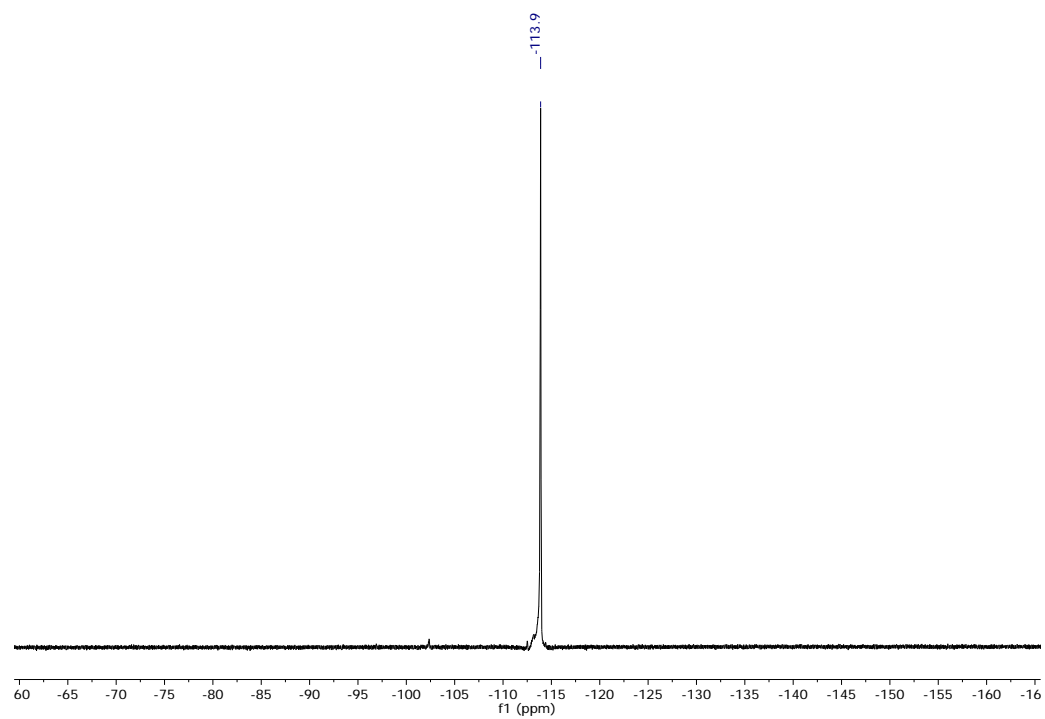
^{13}C $\{^1\text{H}\}$ NMR (101 MHz, CDCl_3)



^{31}P NMR (121 MHz, CDCl_3)

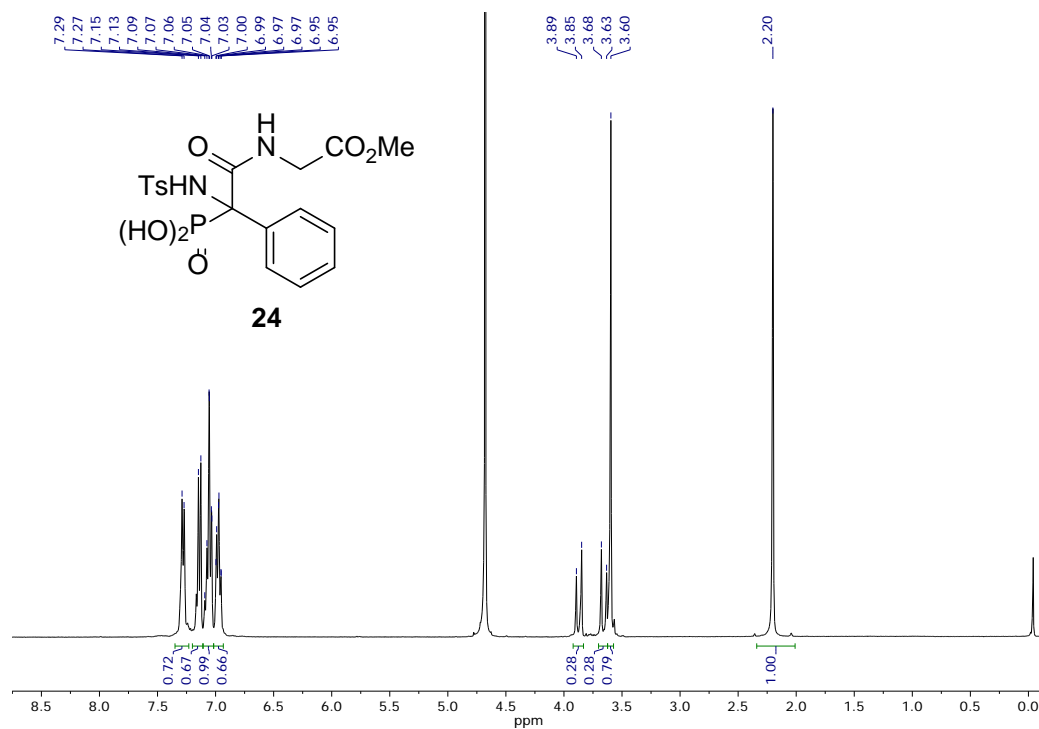


^{19}F NMR (282 MHz, CDCl_3)

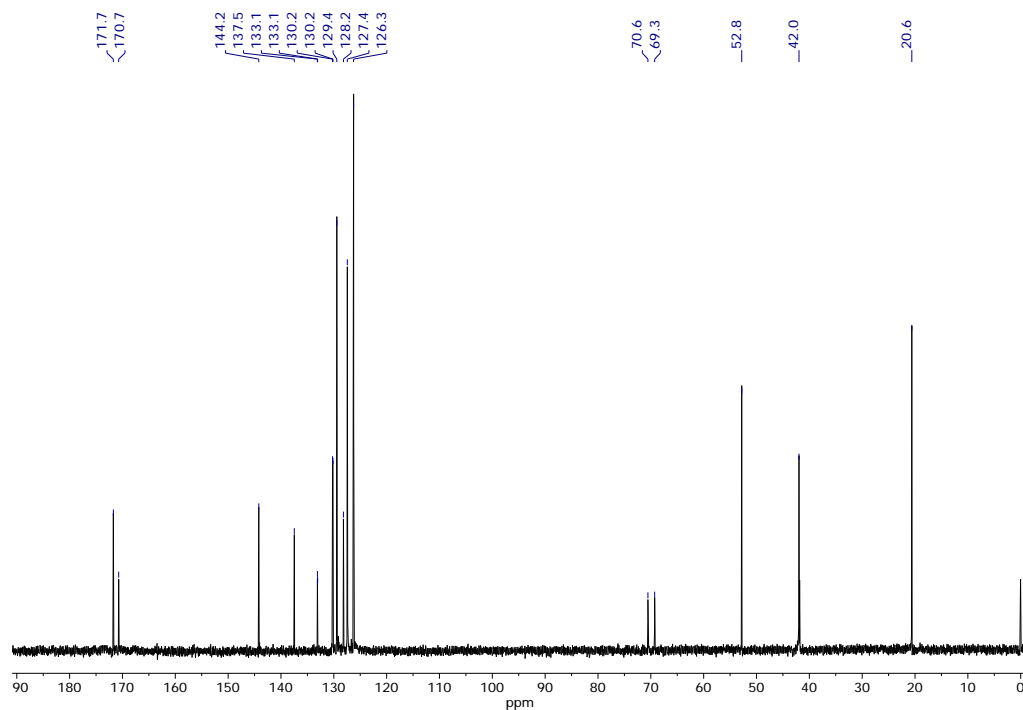


(2-((2-Methoxy-2-oxoethyl)amino)-1-((4-methylphenyl)sulfonamido)-2-oxo-1-phenylethyl)phosphonic acid (24)..

¹H NMR (400 MHz, D₂O)



¹³C NMR {¹H} (101 MHz, D₂O)



^{31}P NMR (121 MHz, D_2O)

