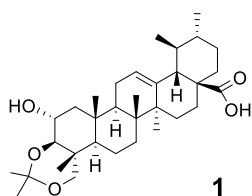
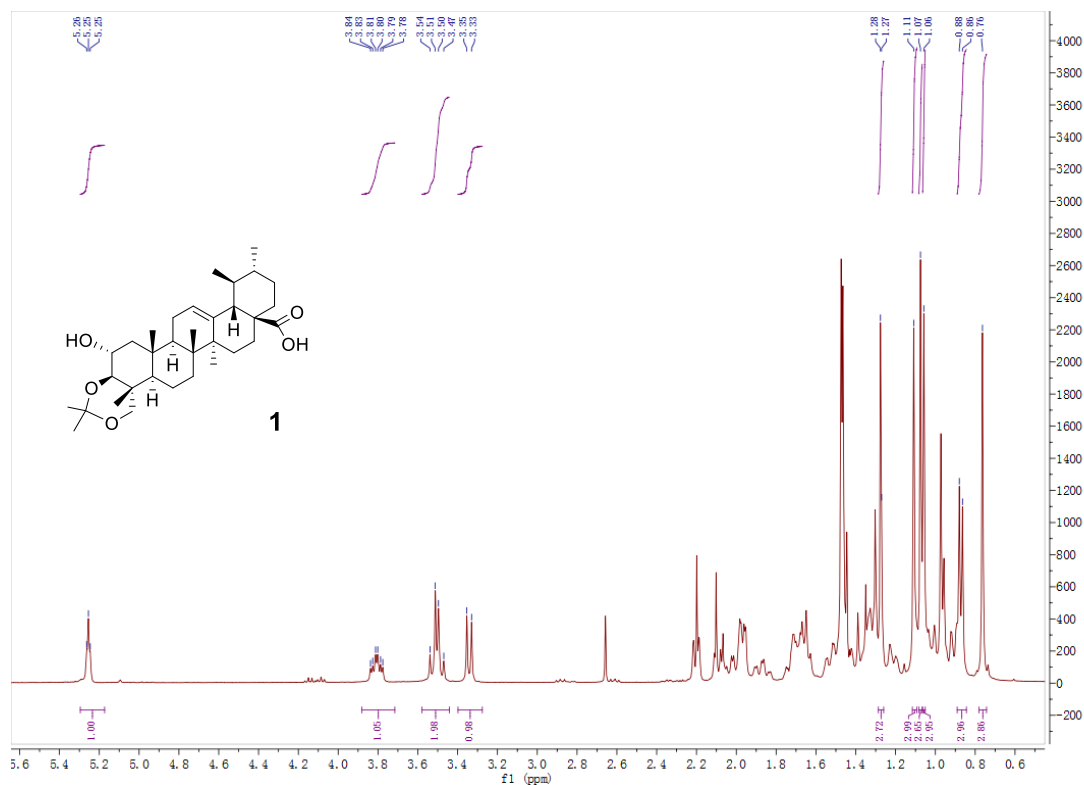


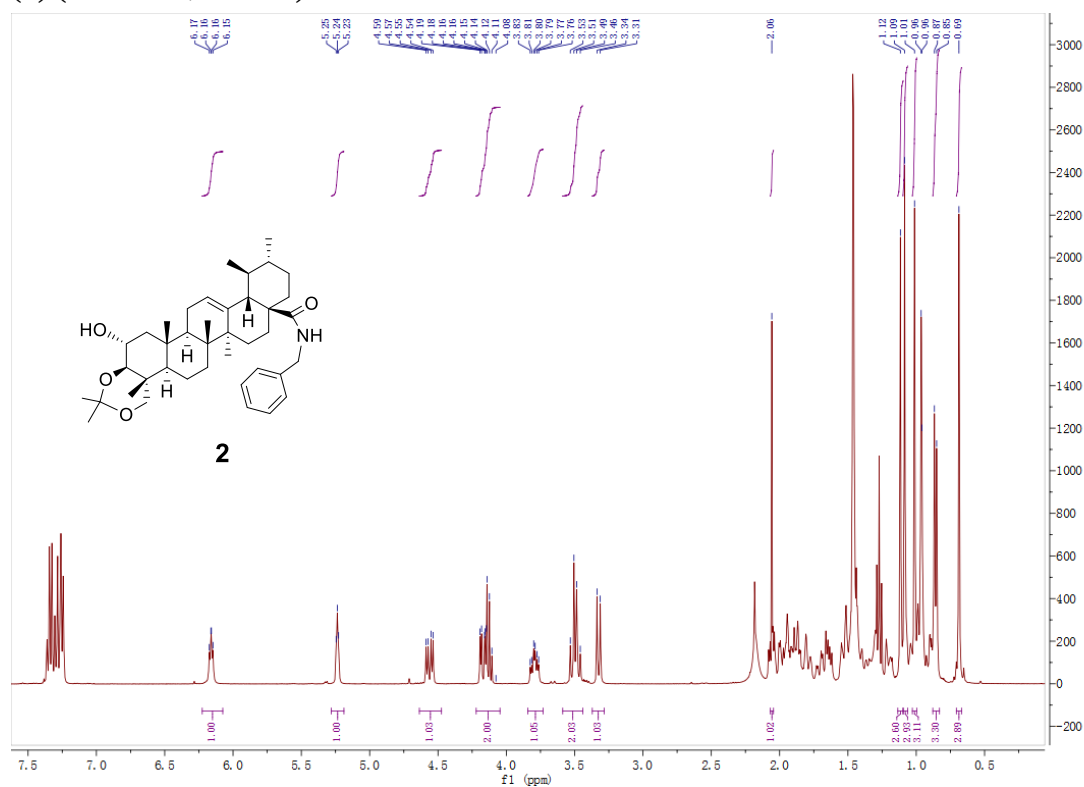
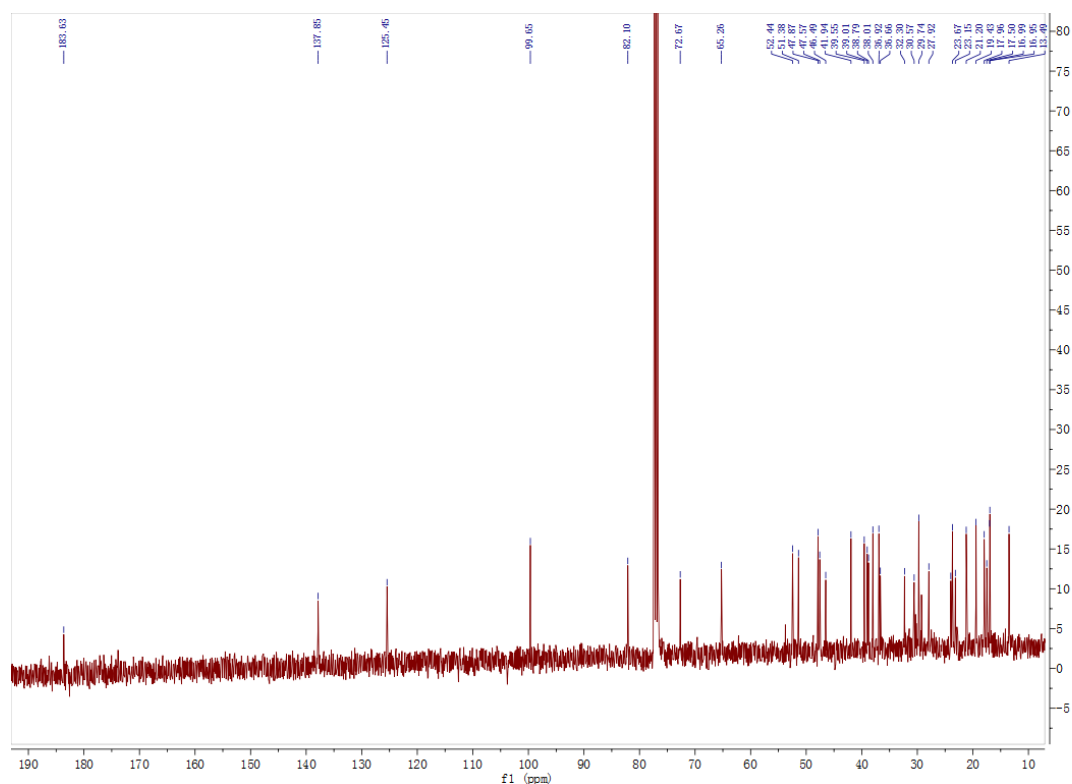
Supplementary information

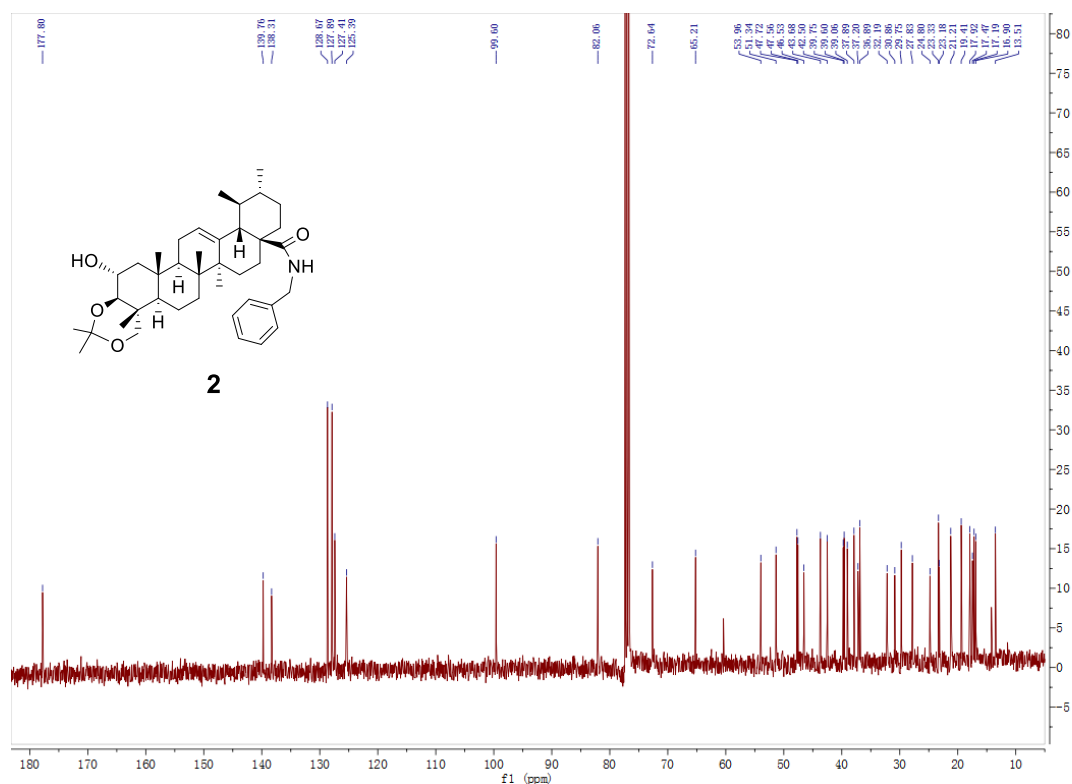
Synthesis and cytotoxic activity of novel C-23-modified asiatic acid derivatives

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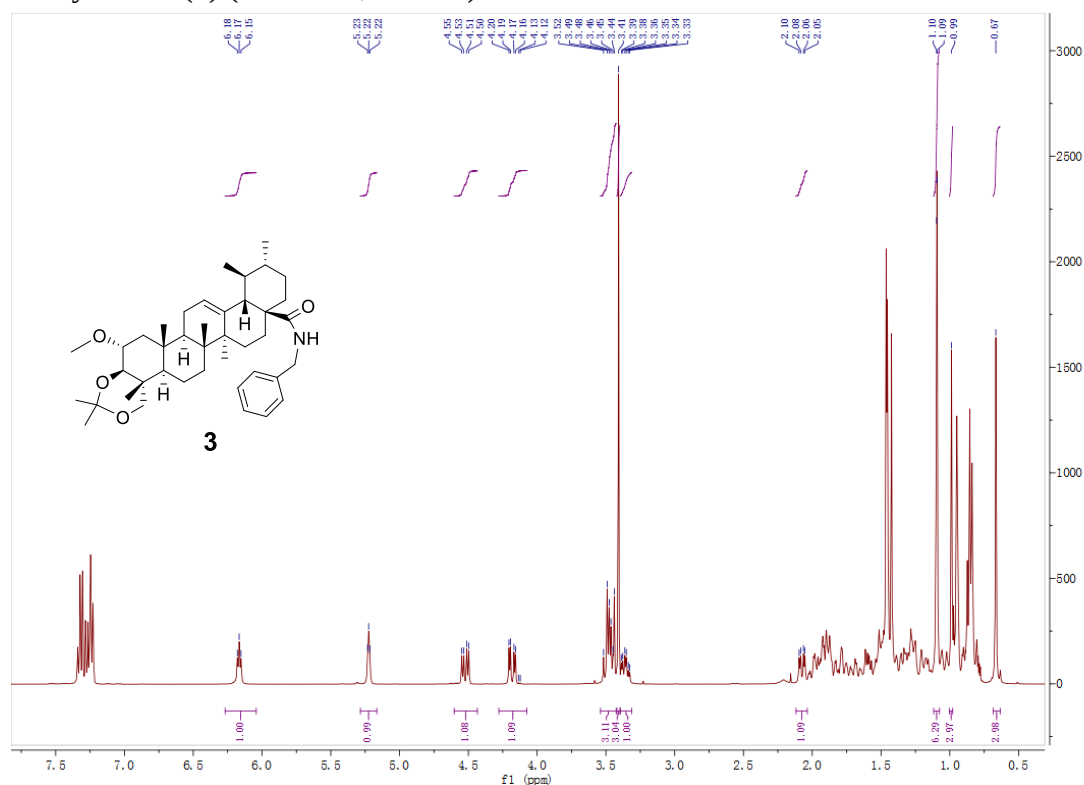
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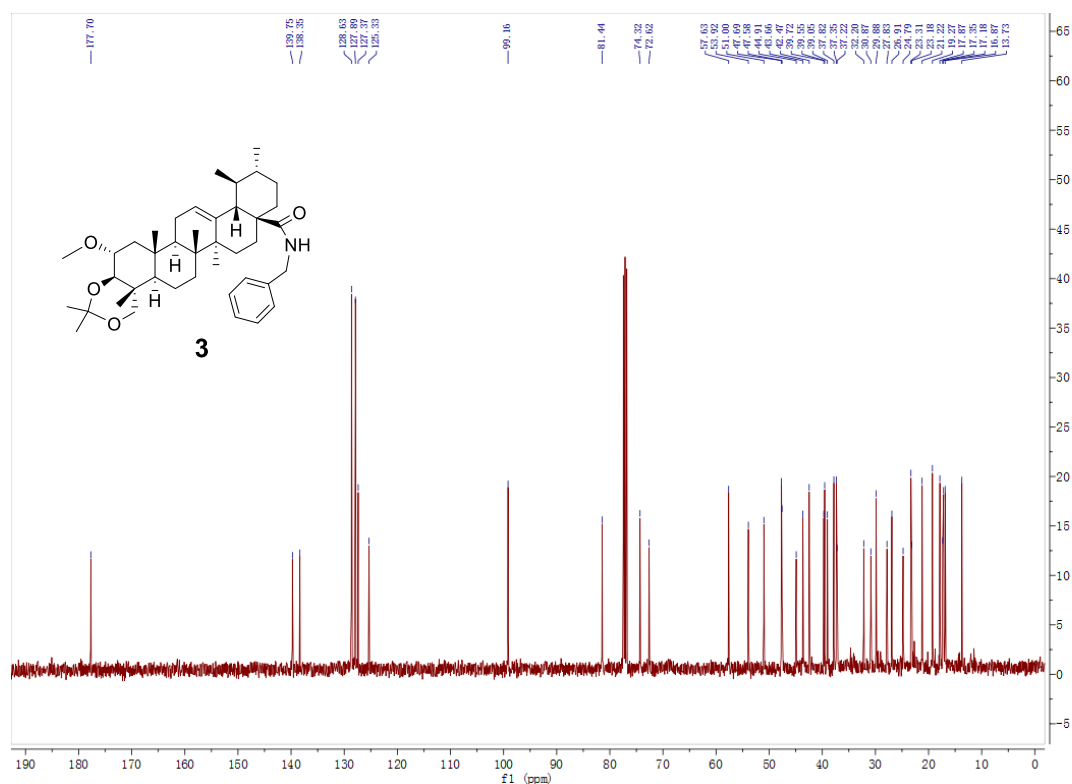




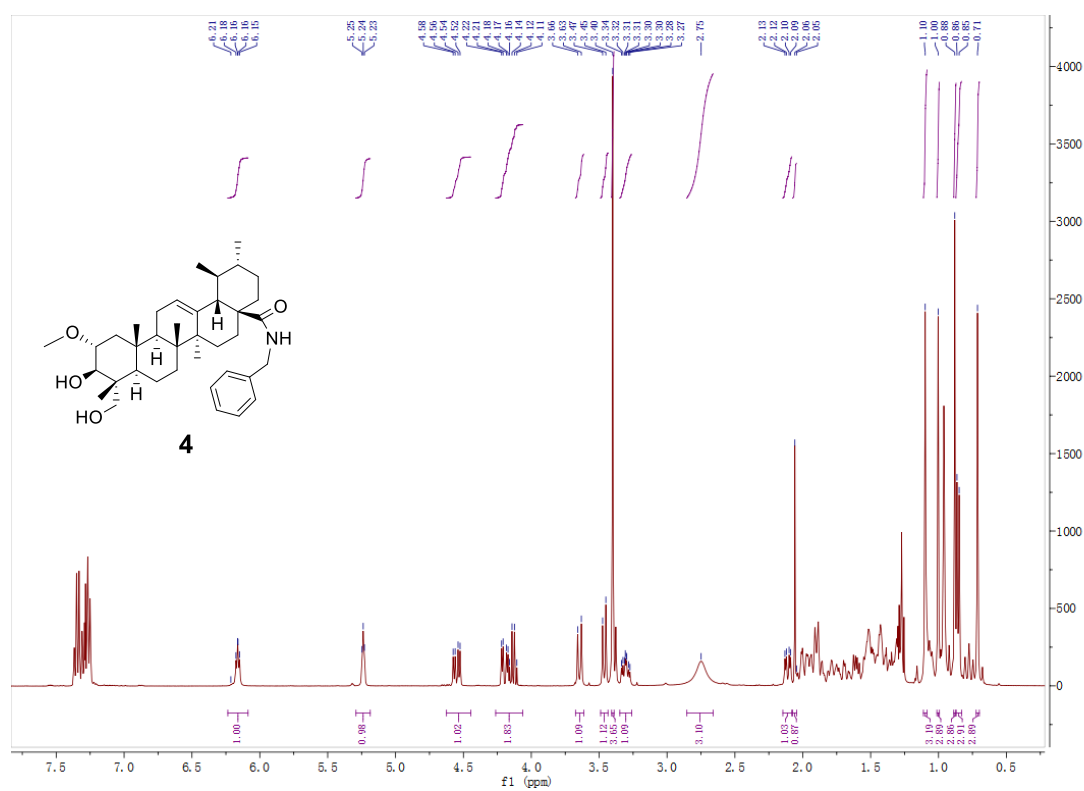
¹³C NMR Spectrum of α-hydroxy-3β,23-isopropylidenedioxy-urs-12-ene-28-benzylamide (2) (101 MHz, CDCl₃)



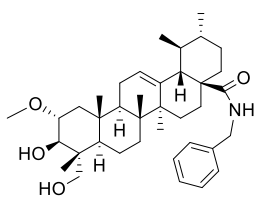
¹H NMR Spectrum of α-methoxy-3β,23-isopropylidenedioxy-urs-12-ene-28-benzylamide (3) (400 MHz, CDCl₃)

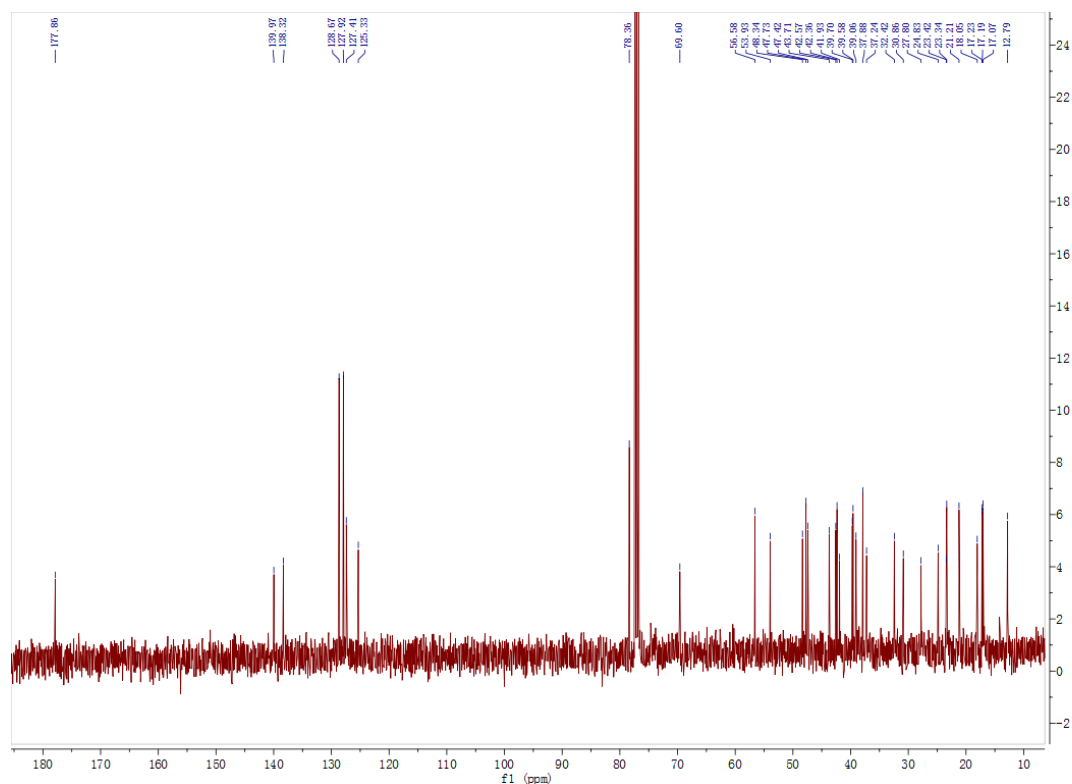


¹³C NMR Spectrum of α -methoxy-3 β ,23-isopropylidenedioxy-urs-12-ene-28-benzylamide (**3**) (101 MHz, CDCl₃)

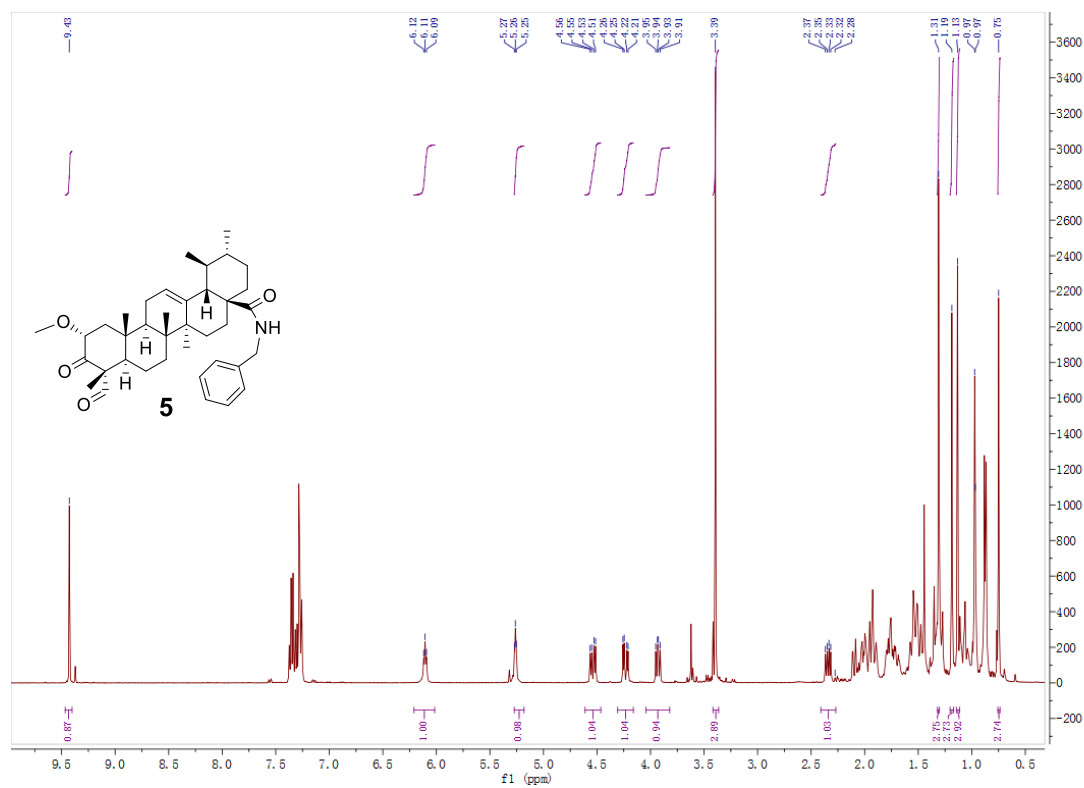


¹H NMR Spectrum of 2 α -methoxy-3 β ,23-dihydroxy-urs-12-ene-28-benzylamide (**4**) (400 MHz, CDCl₃)

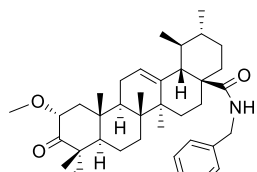


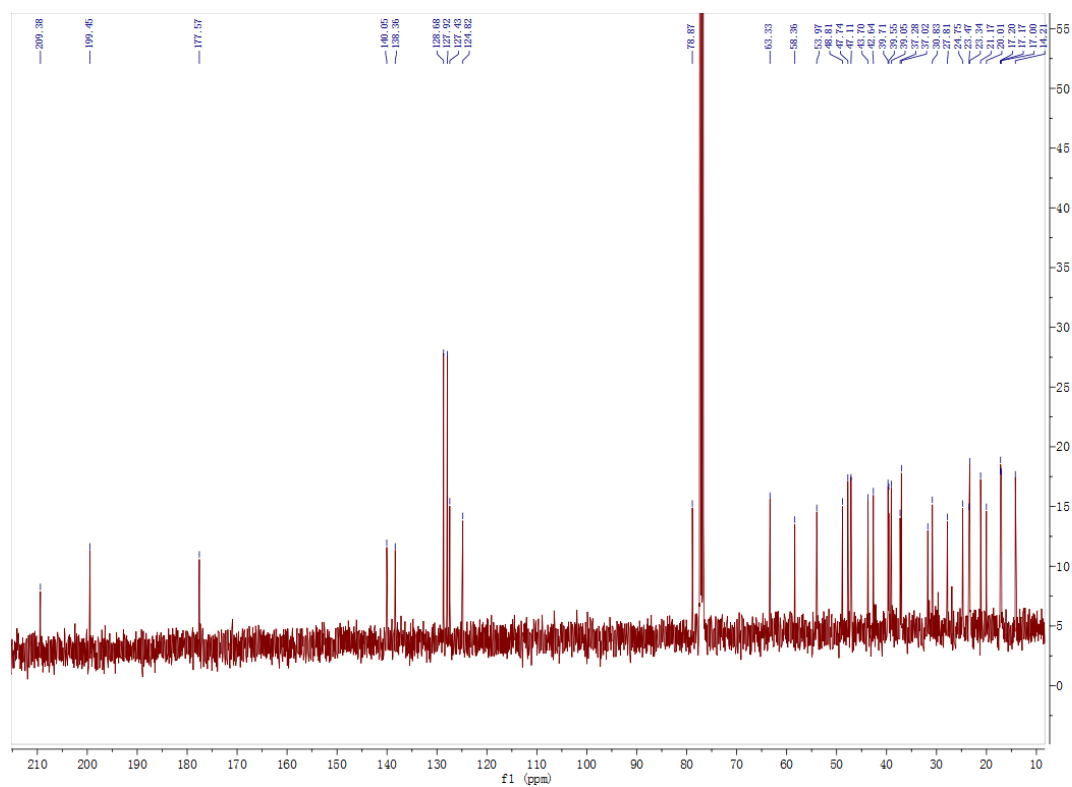


¹³C NMR Spectrum of 2 α -methoxy-3 β ,23-dihydroxy-urs-12-ene-28-benzylamide (**4**) (101 MHz, CDCl₃)

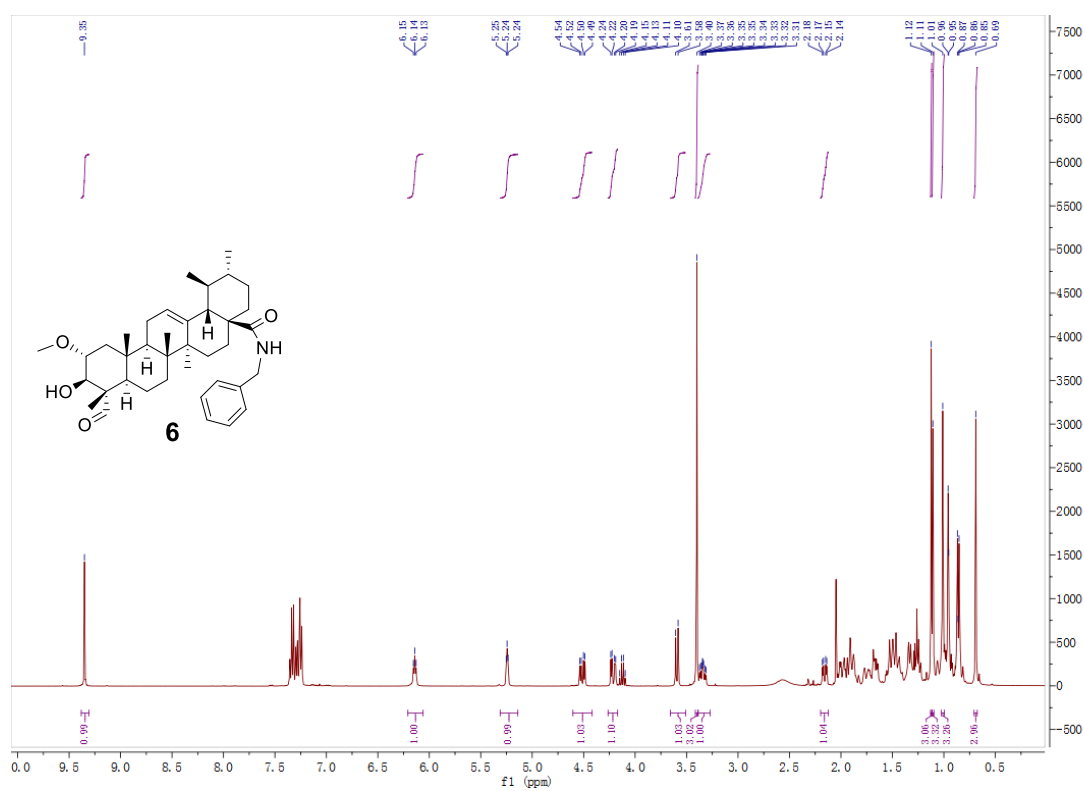


¹H NMR Spectrum of 2 α -methoxy-3,23-dioxo-urs-12-ene-28-benzylamide (**5**) (400 MHz, CDCl₃)

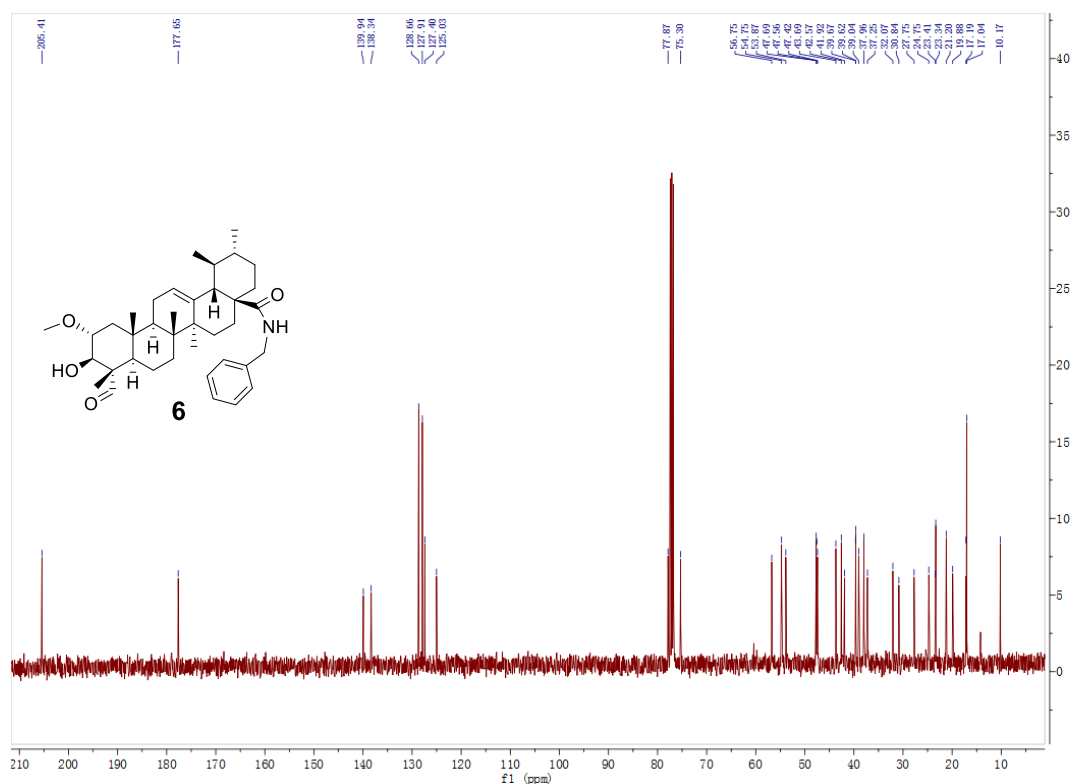




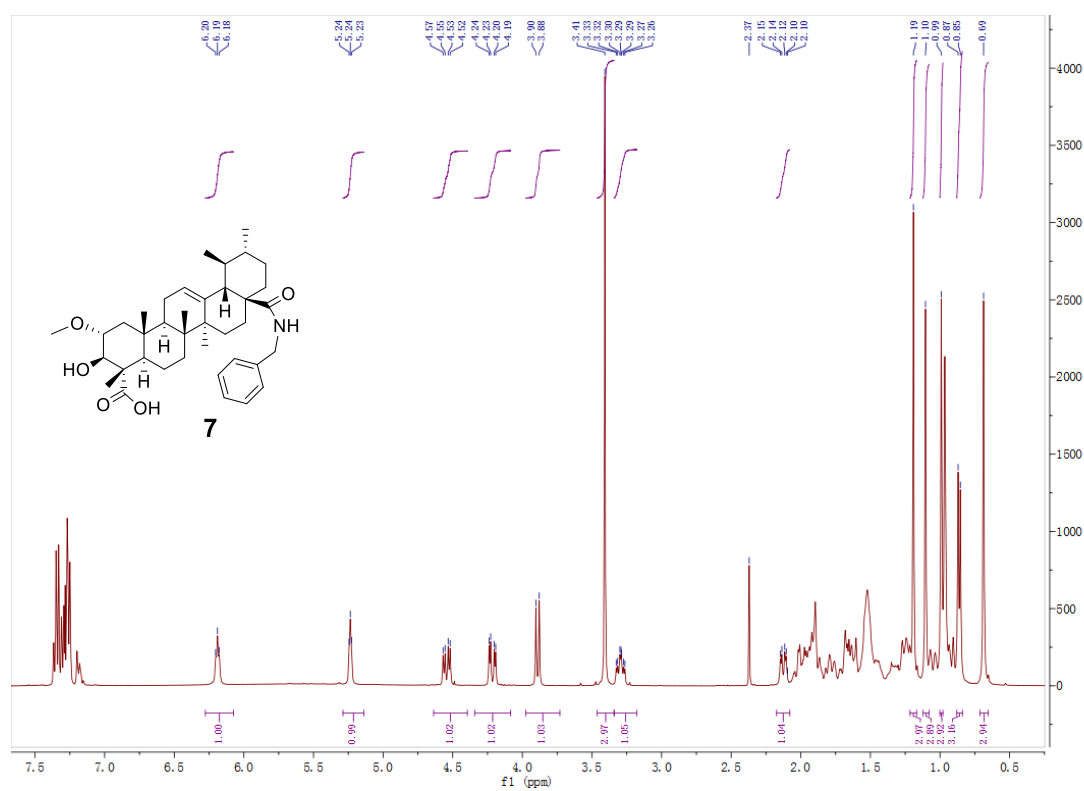
¹³C NMR Spectrum of 2 α -methoxy-3,23-dioxo-urs-12-ene-28-benzylamide (**5**) (101 MHz, CDCl₃)



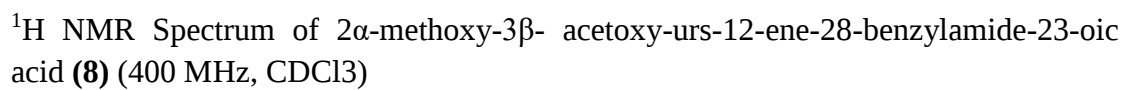
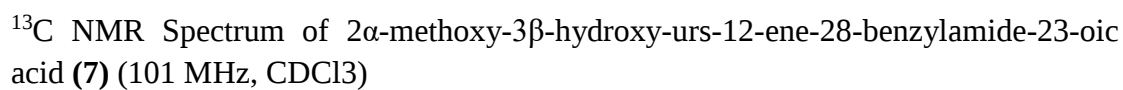
¹H NMR Spectrum of 2 α -methoxy-3 β -hydroxy-23-oxo-urs-12-ene-28-benzylamide (**6**) (400 MHz, CDCl₃)

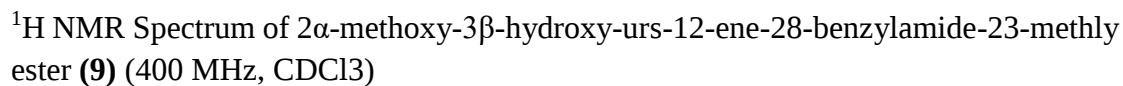
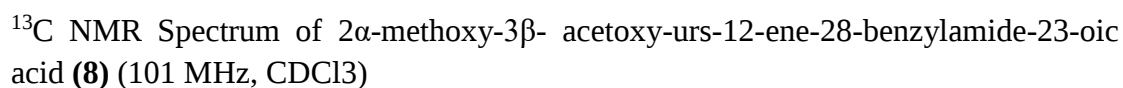


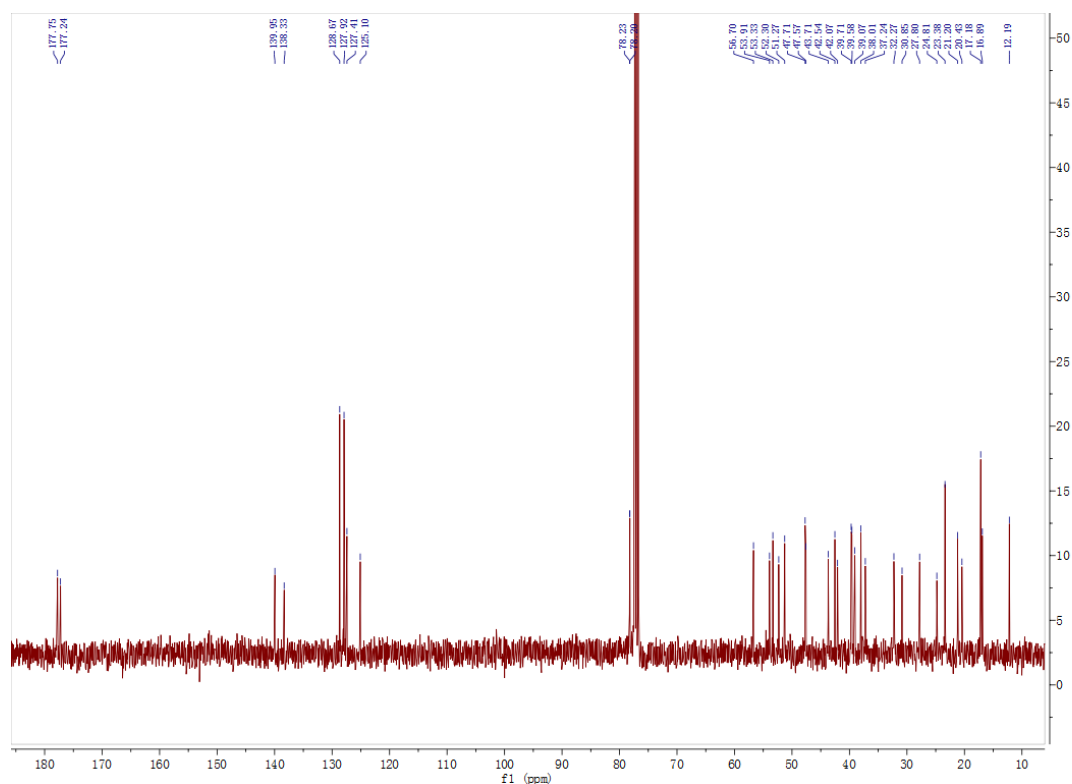
¹³C NMR Spectrum of 2α-methoxy-3β-hydroxy-23-oxo-urs-12-ene-28-benzylamide (**6**) (101 MHz, CDCl₃)



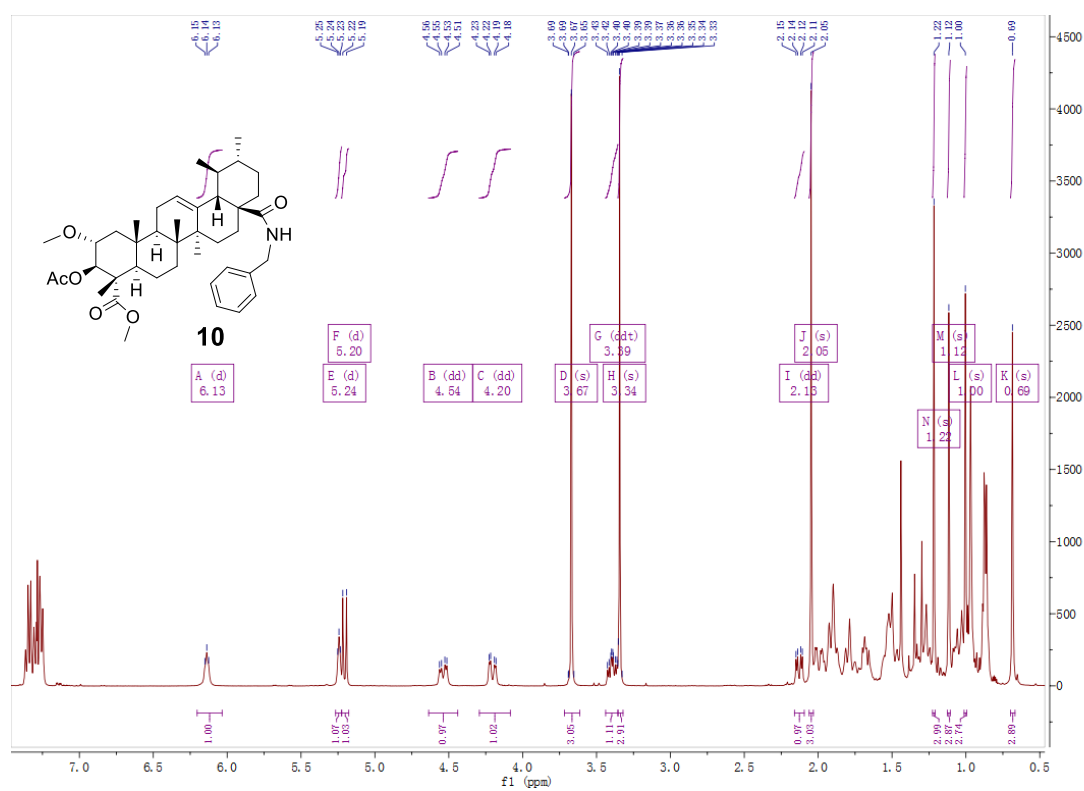
¹H NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oic acid (**7**) (400 MHz, CDCl₃)



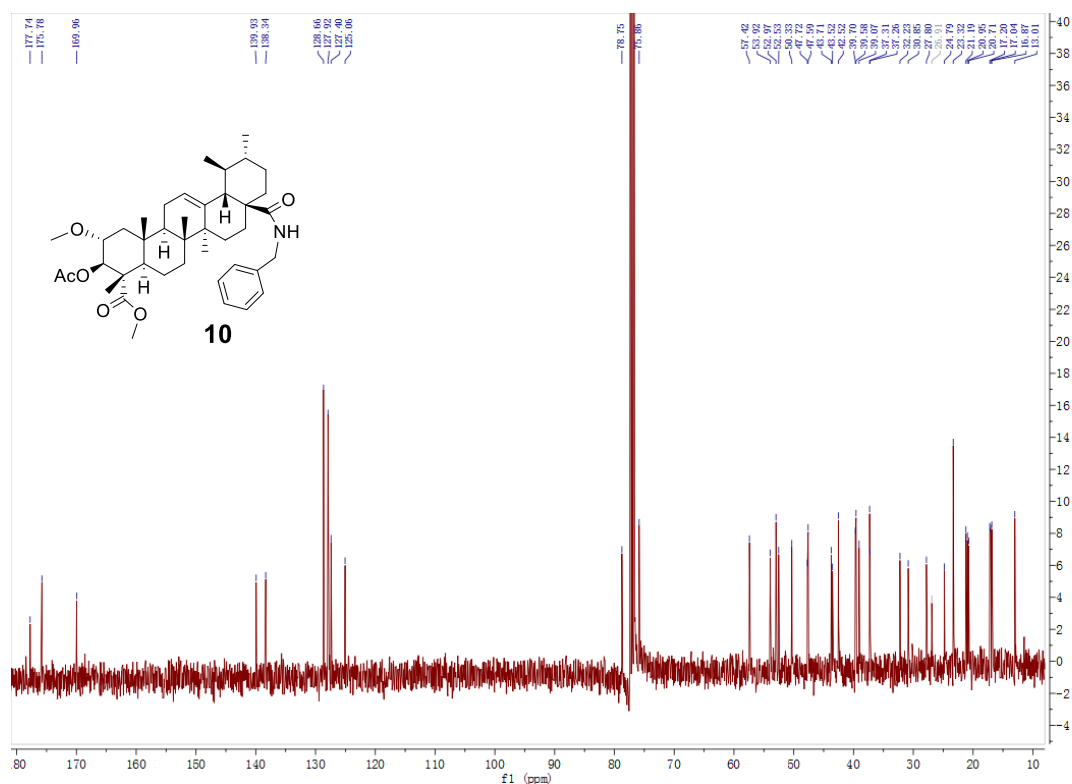




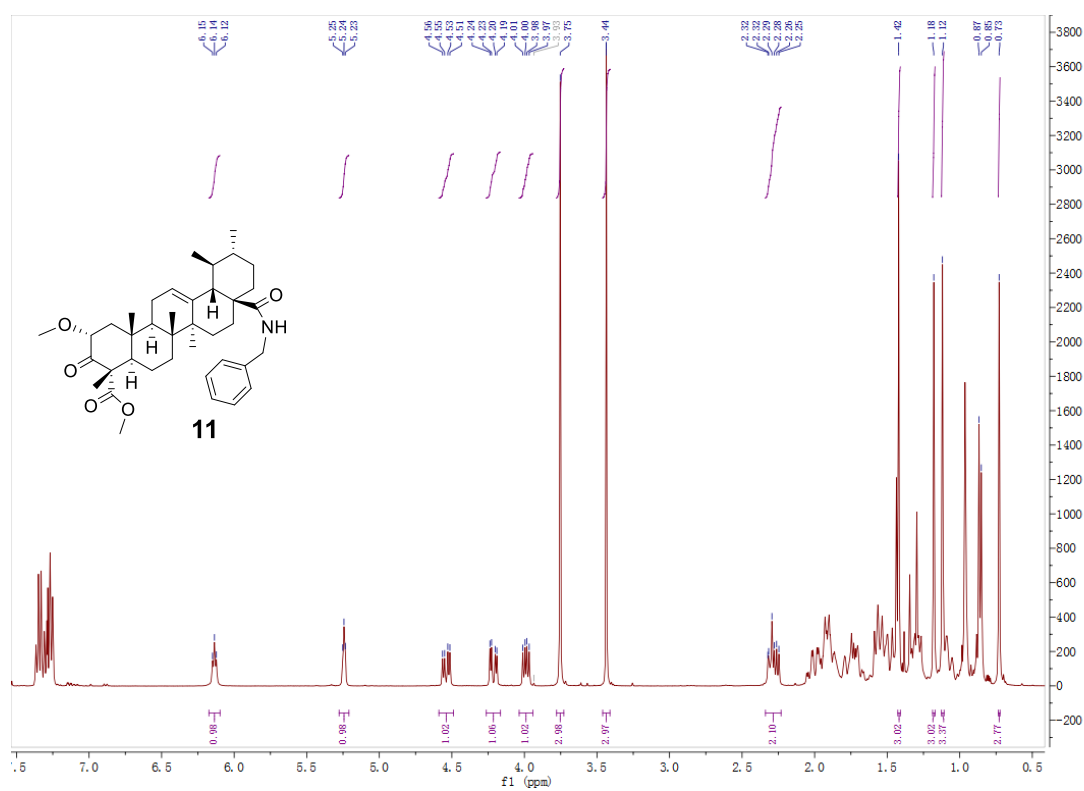
^{13}C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzylamide-23-methyl ester (**9**) (101 MHz, CDCl_3)



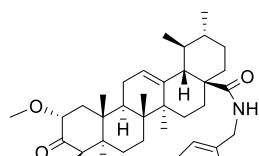
^1H NMR Spectrum of 2 α -methoxy-3 β - acetoxy-urs-12-ene-28-benzylamide-23-methyl ester (**10**) (400 MHz, CDCl_3)

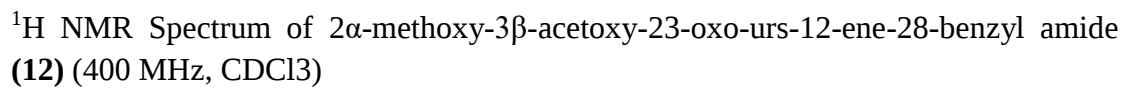
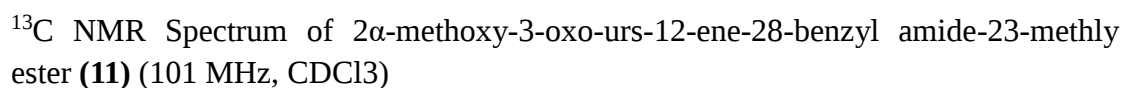


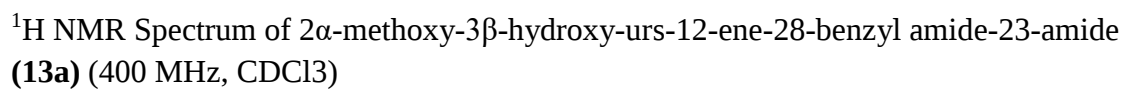
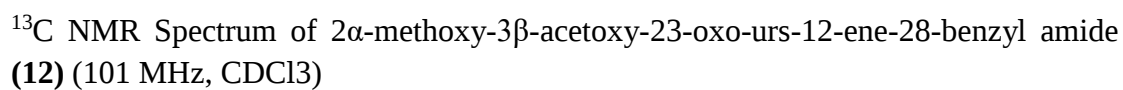
¹³C NMR Spectrum of 2α -methoxy- 3β -acetoxy-urs-12-ene-28-benzylamide-23-methyl ester (**10**) (101 MHz, CDCl₃)

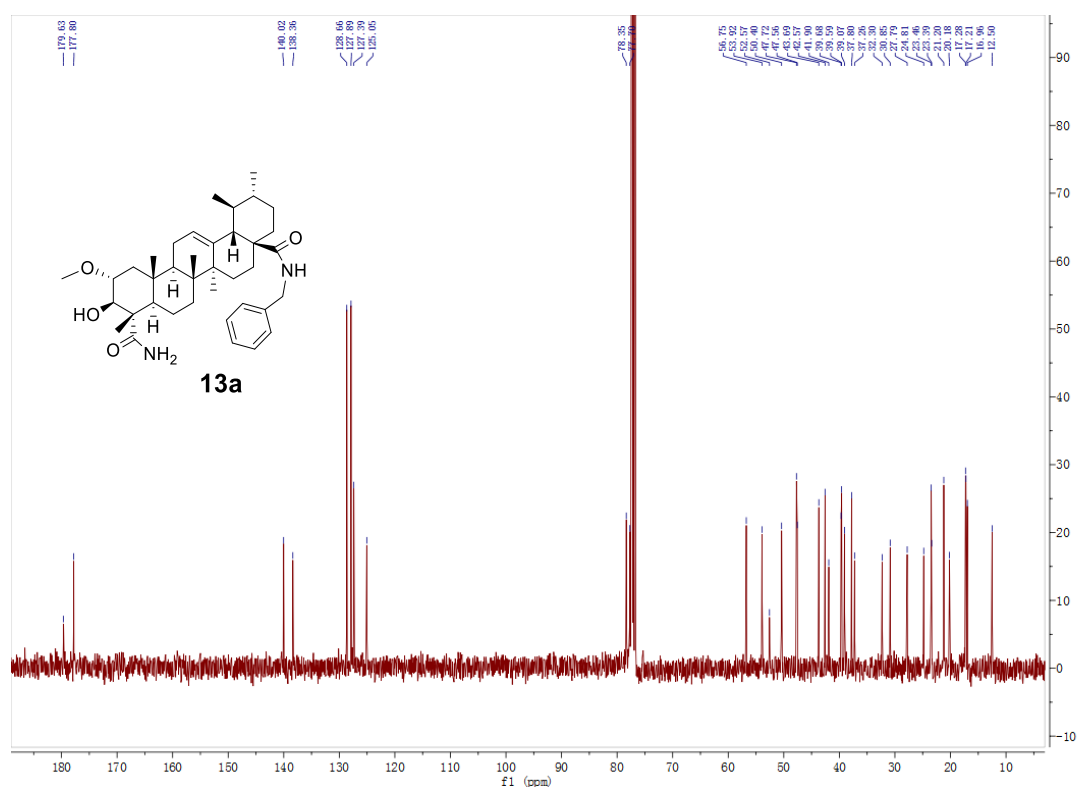


¹H NMR Spectrum of 2α -methoxy-3-oxo-urs-12-ene-28-benzylamide-23-methyl ester (**11**) (400 MHz, CDCl₃)

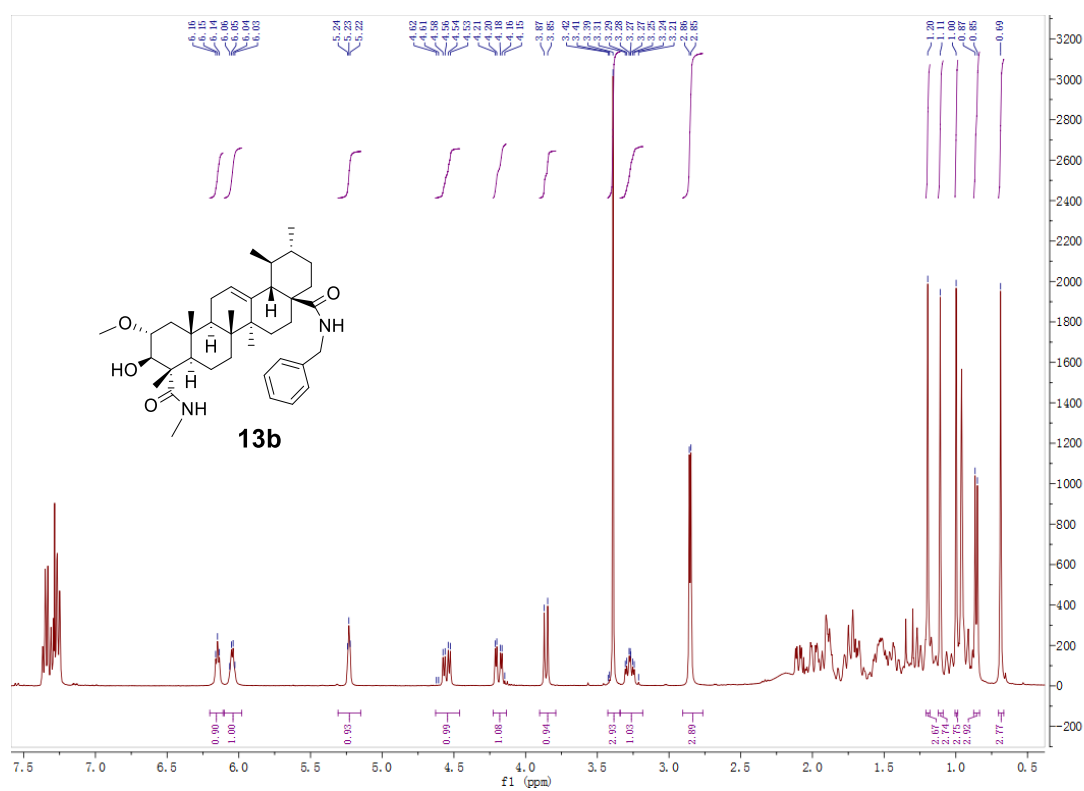




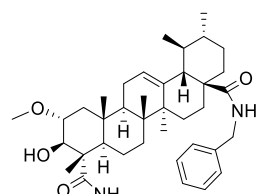


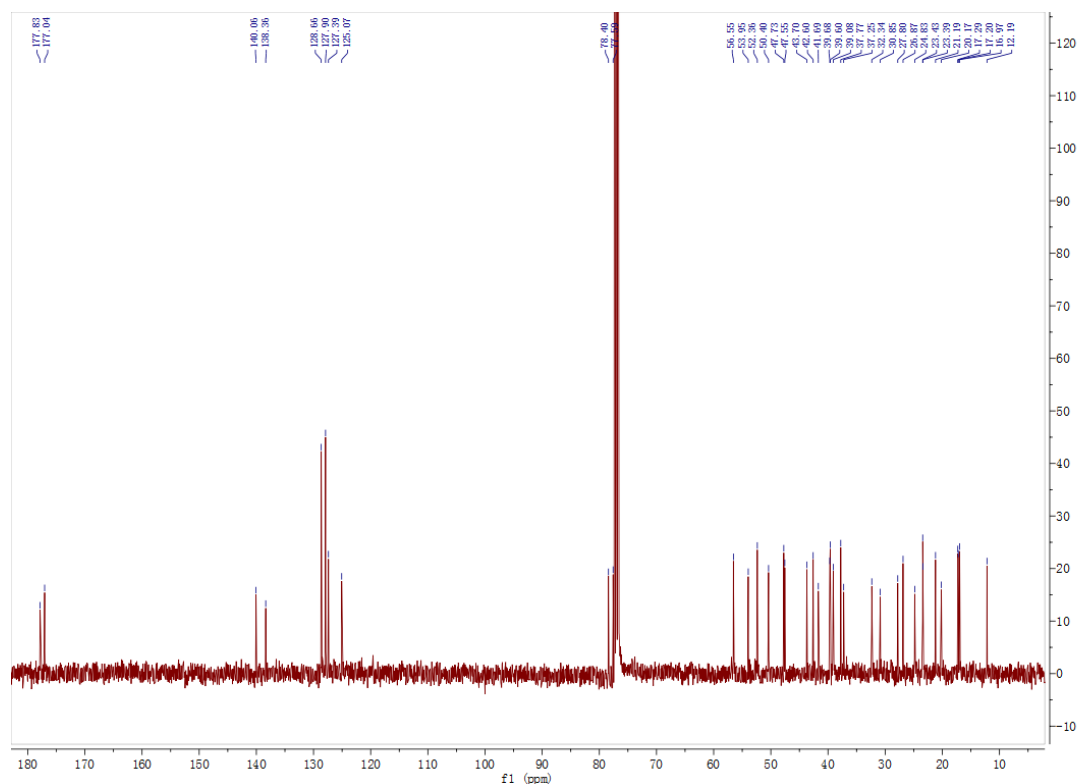


¹³C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-amide (**13a**) (101 MHz, CDCl₃)

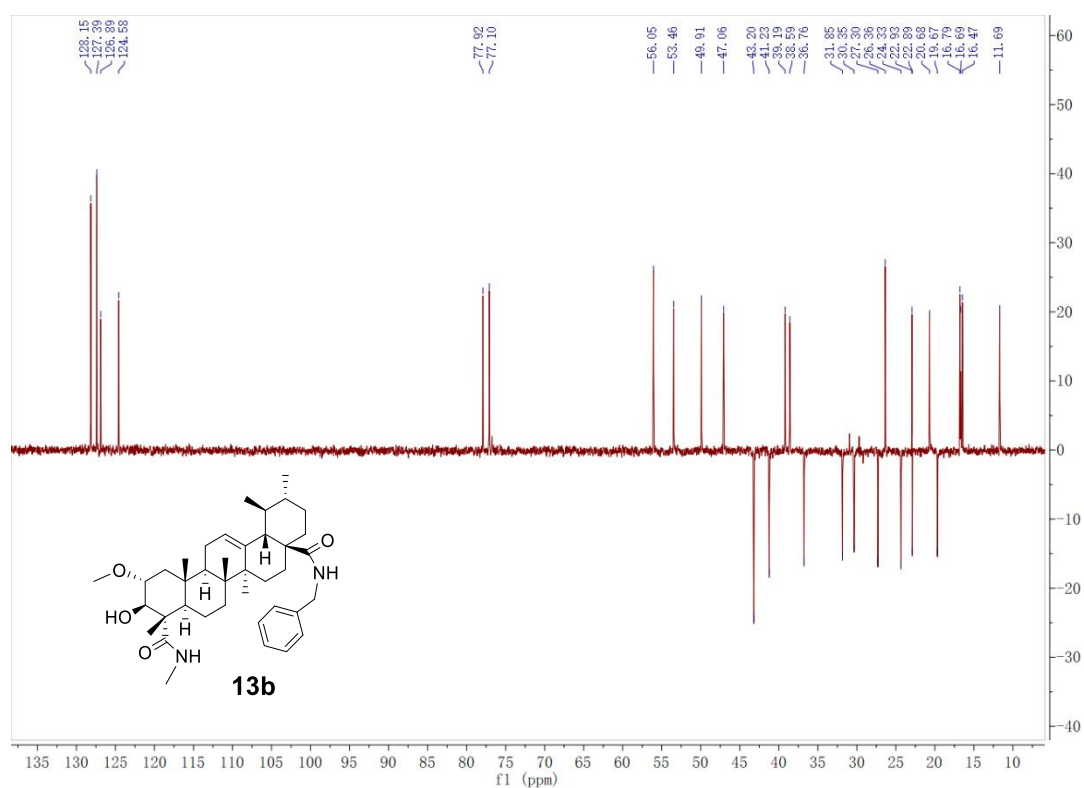


¹H NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-methylamide (**13b**) (400 MHz, CDCl₃)

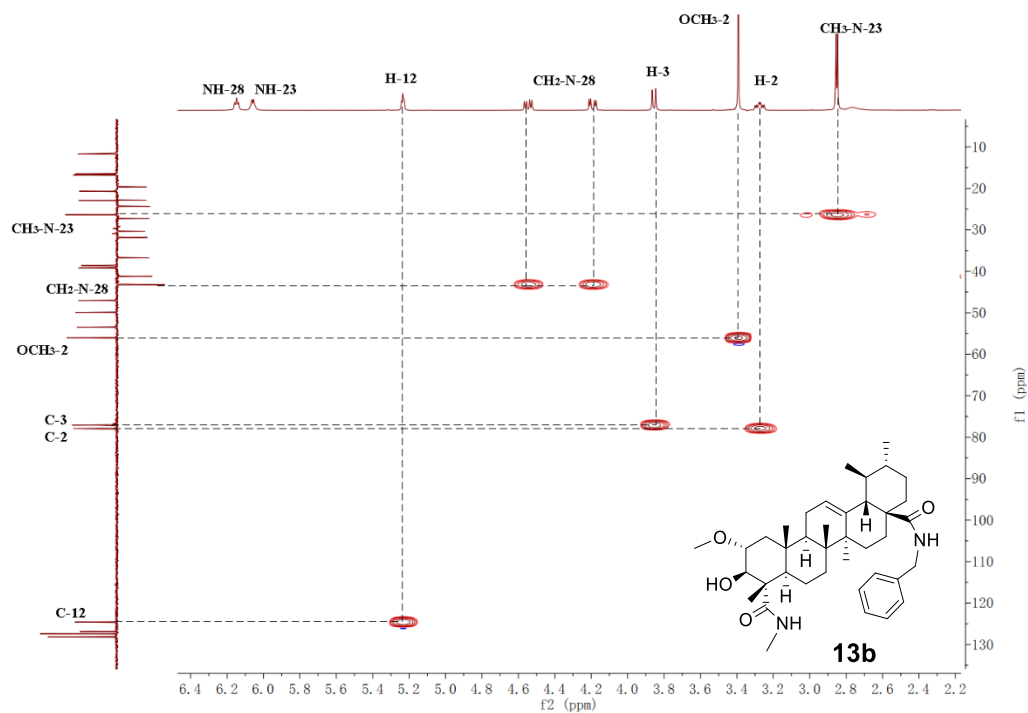




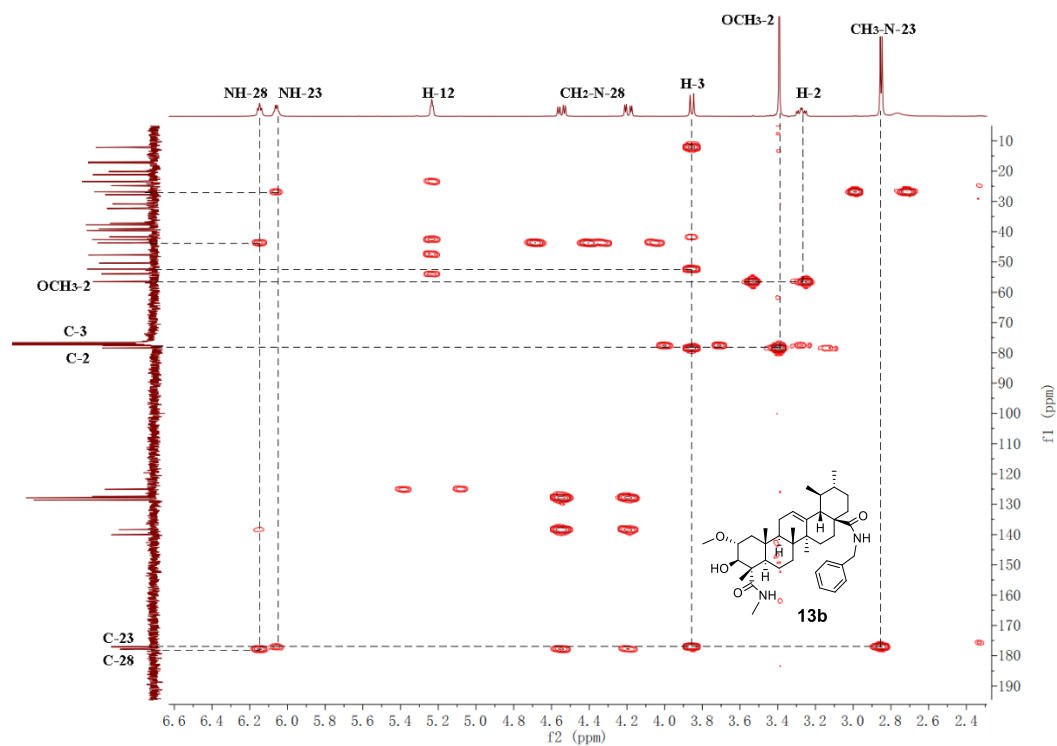
¹³C NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzyl amide-23-methylamide (**13b**) (101 MHz, CDCl₃)



DEPT135 NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzyl amide-23-methylamide (**13b**) (126 MHz, CDCl₃)

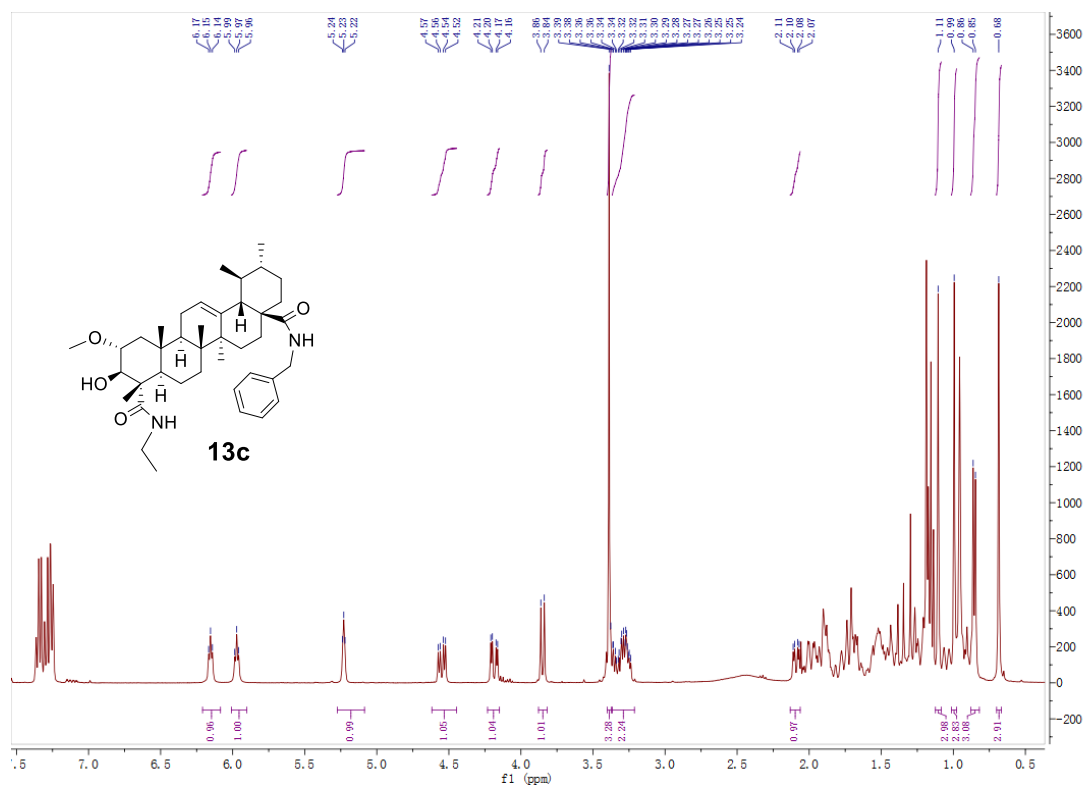


2-D ^1H - ^{13}C HSQC NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-methylamide (**13b**) (^1H NMR 500 MHz, CDCl_3 , ^{13}C NMR 126 MHz, CDCl_3)

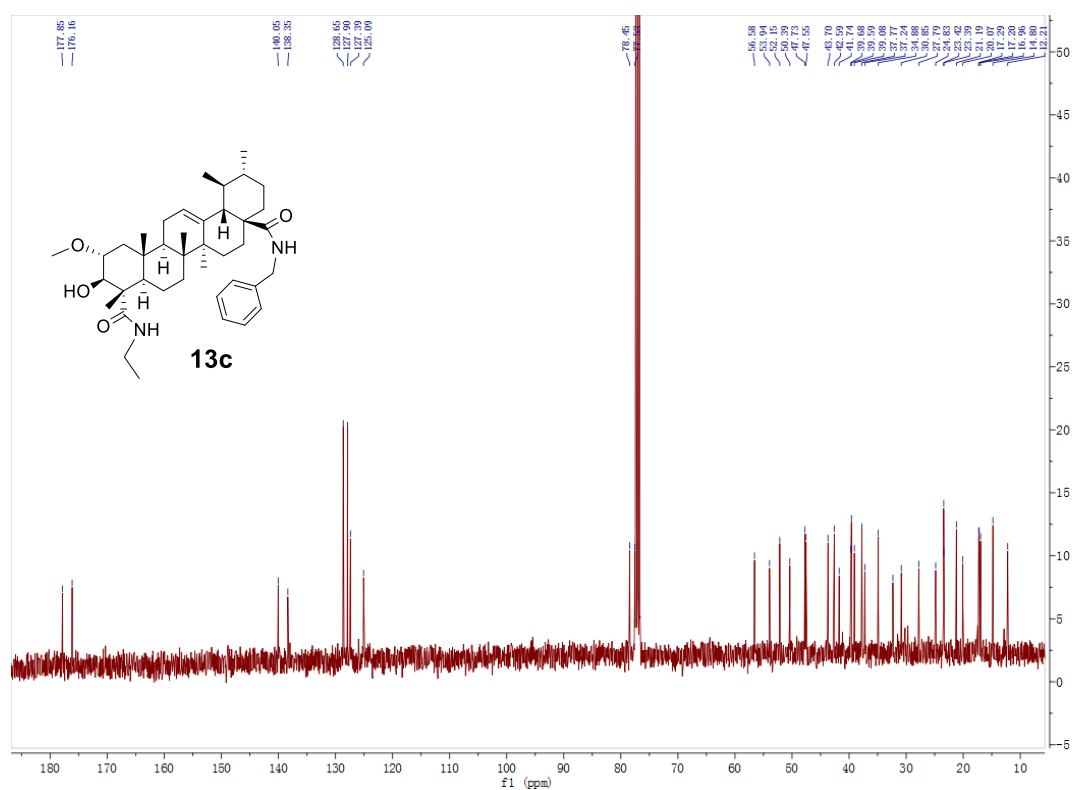


2-D ^1H - ^{13}C HMBC NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl

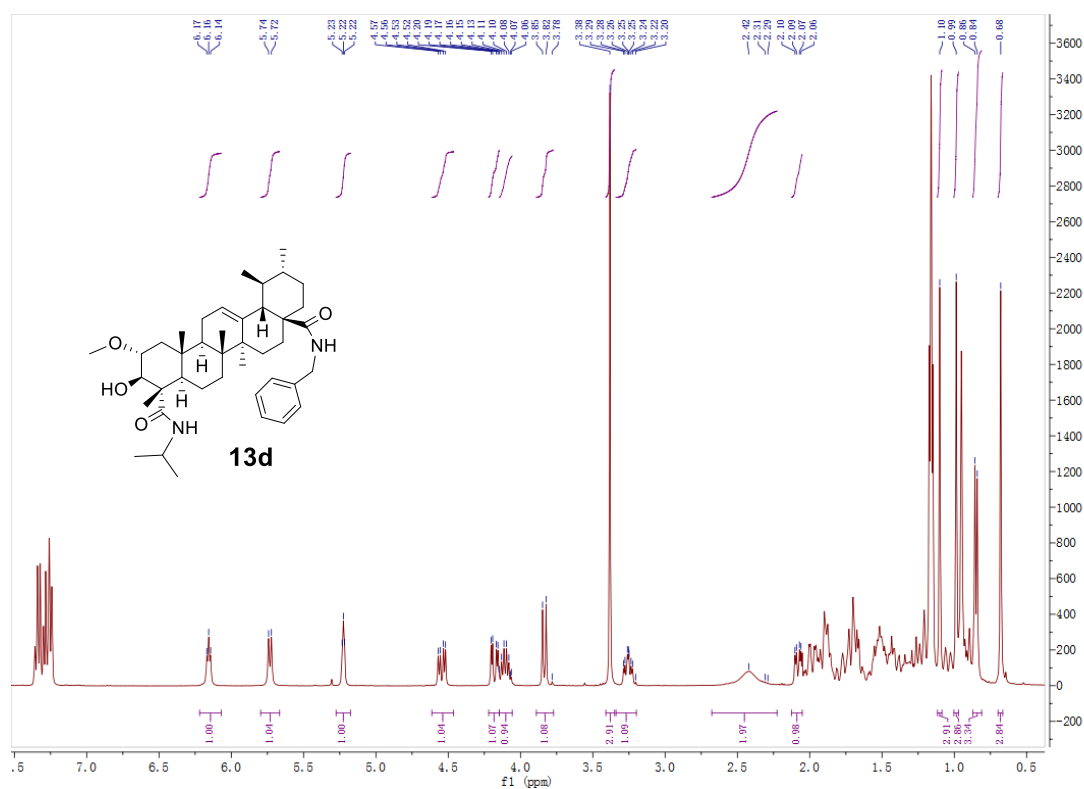
amide-23-methylamide (**13b**) (^1H NMR 500 MHz, CDCl_3 , ^{13}C NMR 126 MHz, CDCl_3)



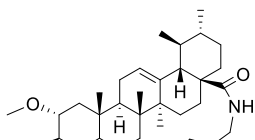
^1H NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-ethylamide (**13c**) (400 MHz, CDCl_3)

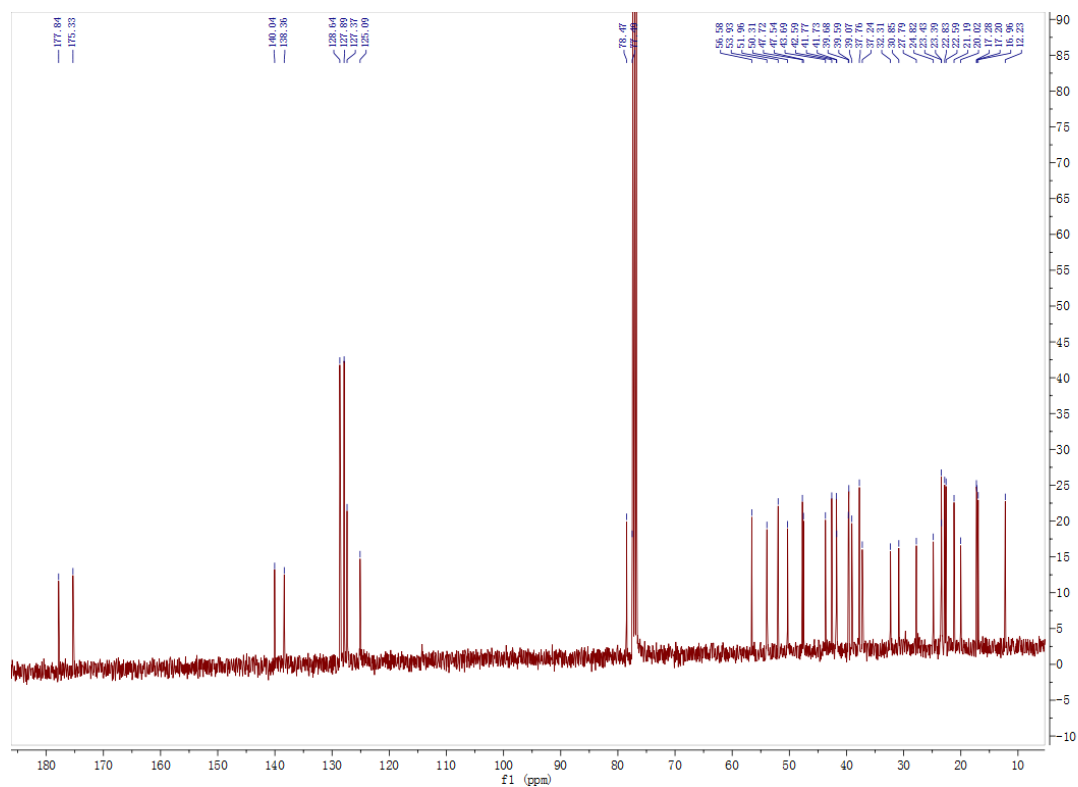


¹³C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-ethylamide (**13c**) (101 MHz, CDCl₃)

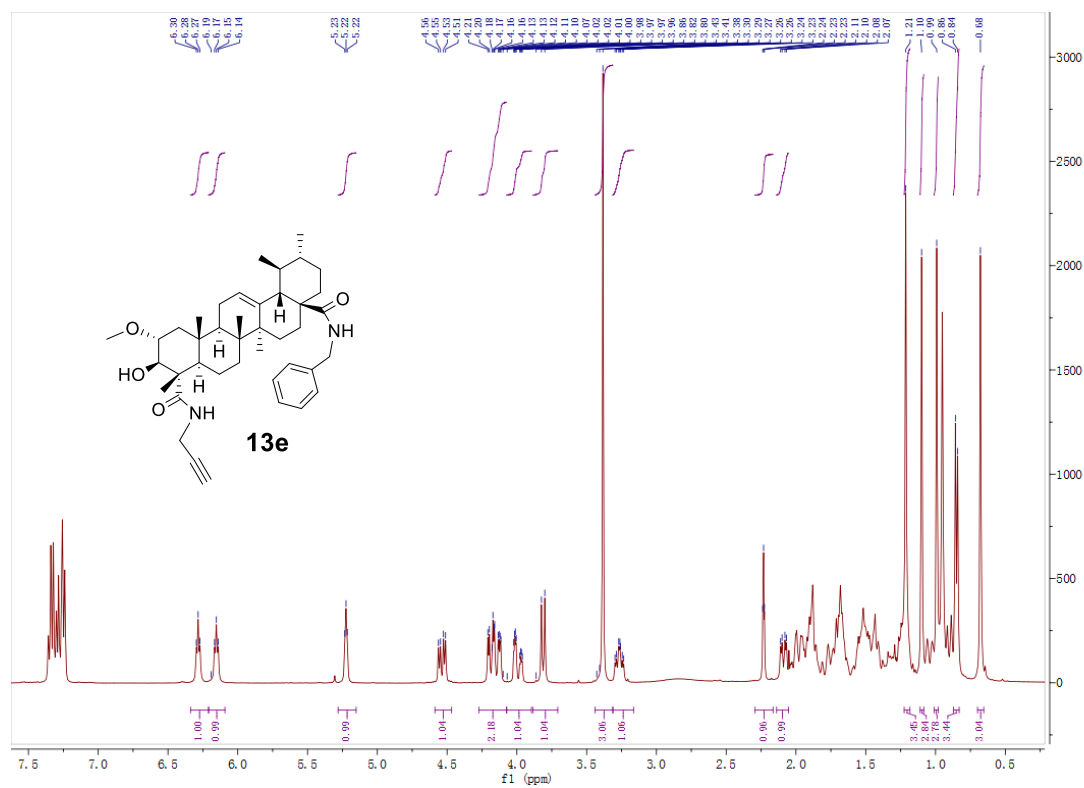


¹H NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-isopropylamide (**13d**) (400 MHz, CDCl₃)

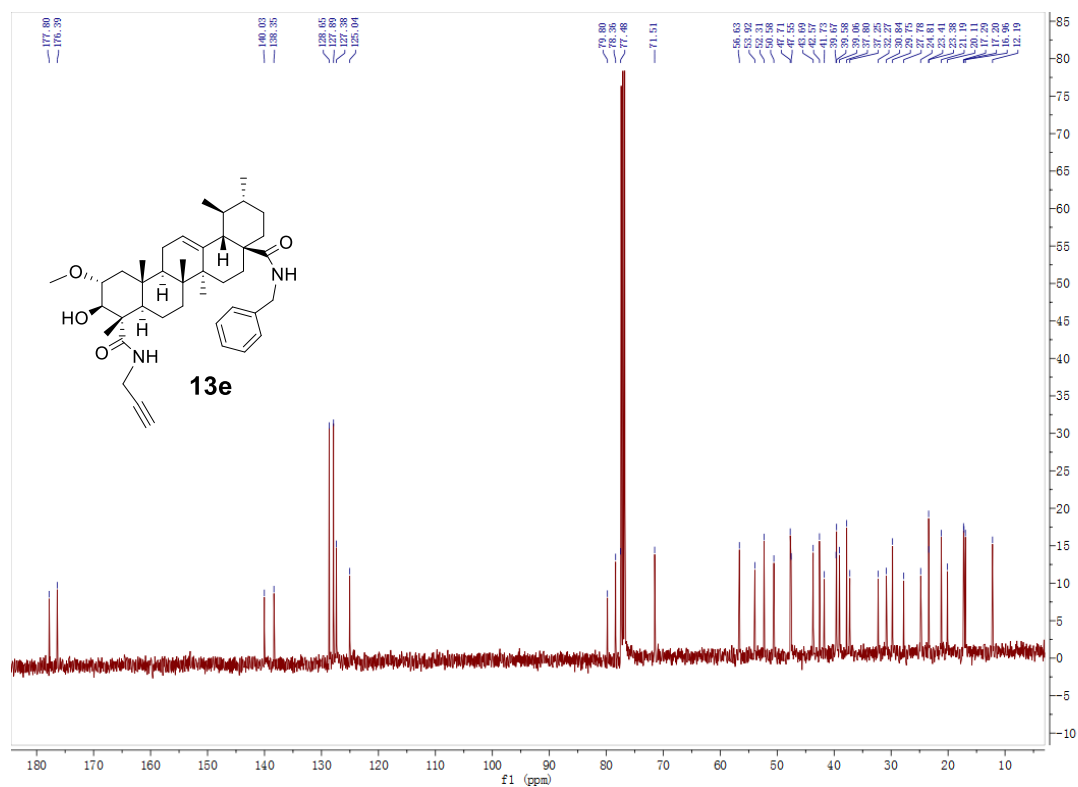




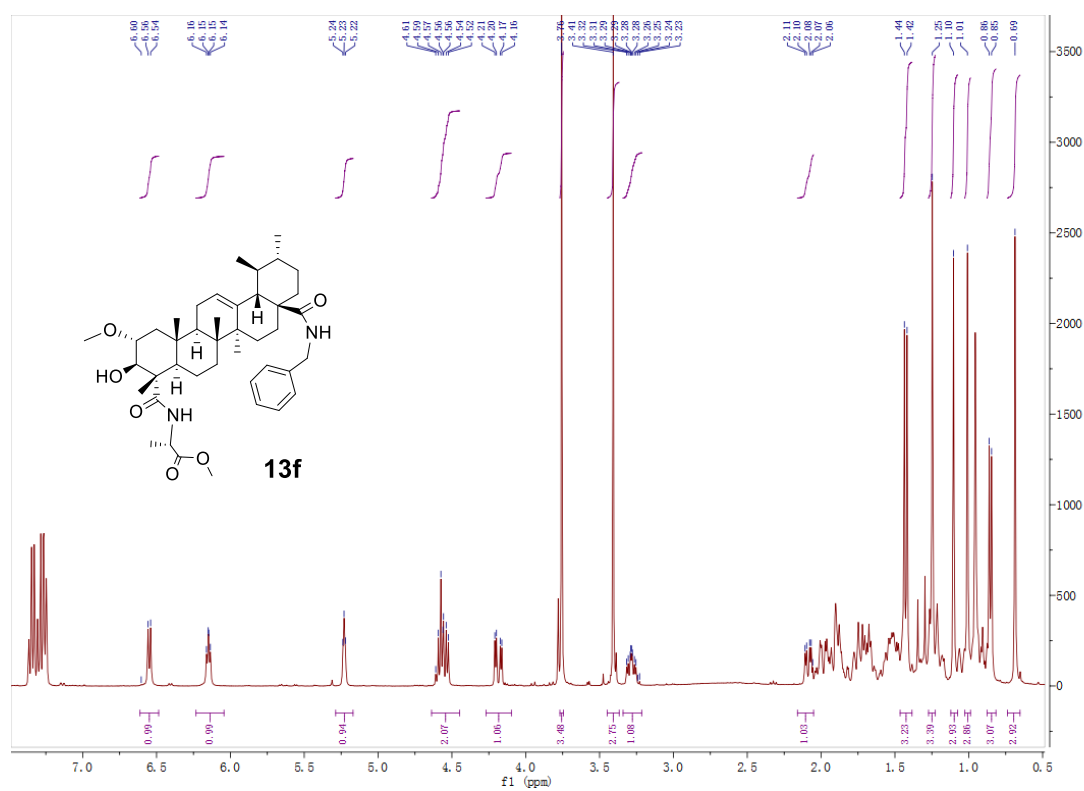
¹³C NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzyl amide-23-isopropylamide (**13d**) (101 MHz, CDCl₃)



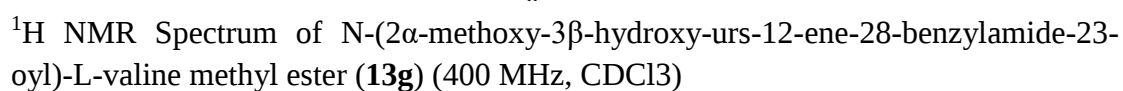
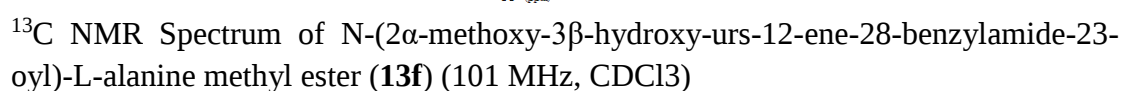
¹H NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzyl amide-23-propargylamide (**13e**) (400 MHz, CDCl₃)

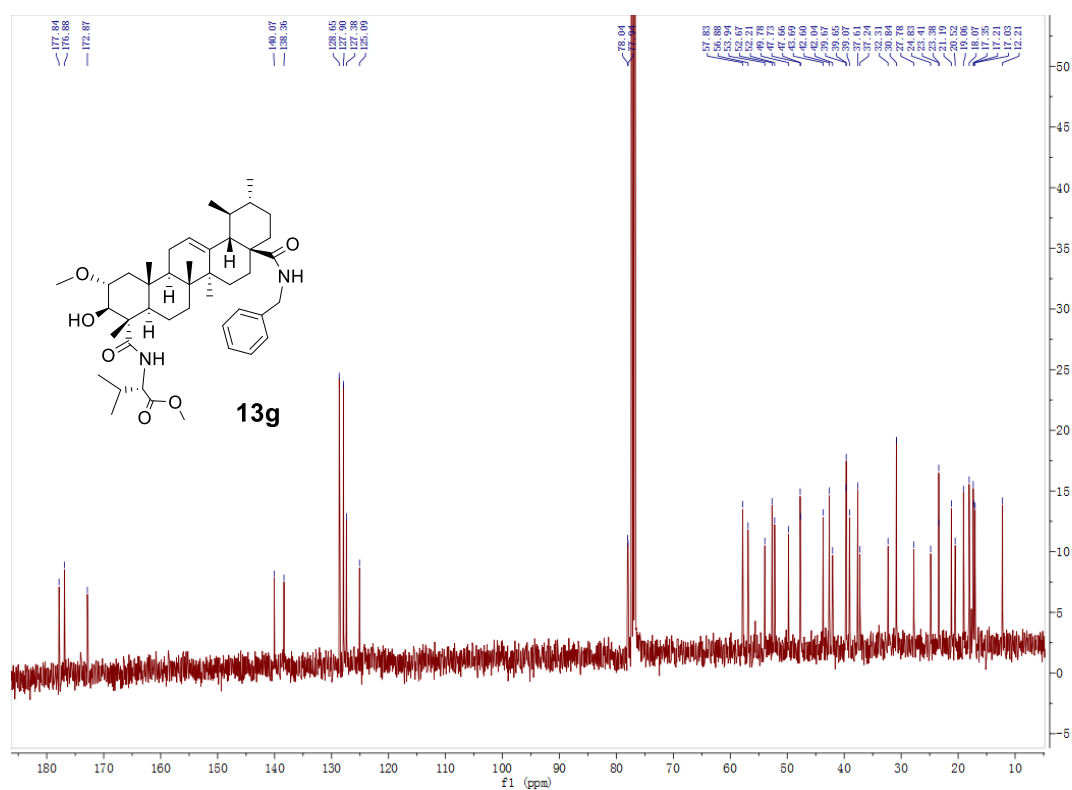


¹³C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-propargylamide (13e) (101 MHz, CDCl₃)

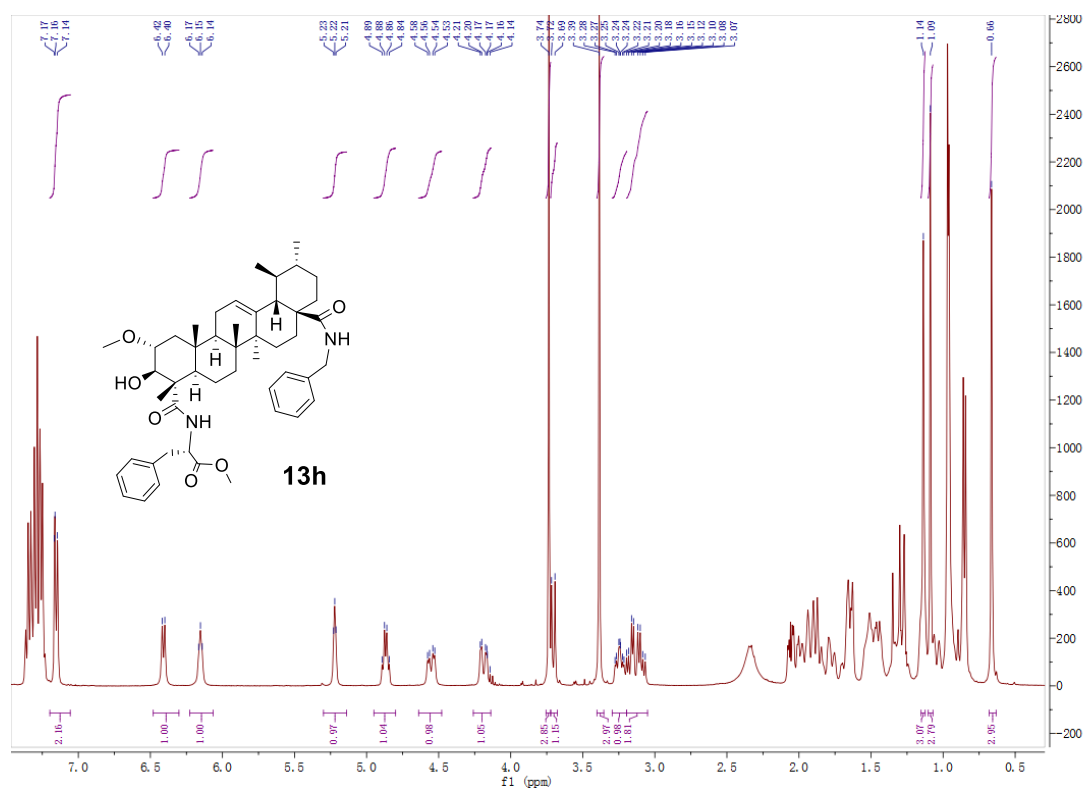


¹H NMR Spectrum of N-(2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzylamide-23-oyl)-L-alanine methyl ester (13f) (400 MHz, CDCl₃)

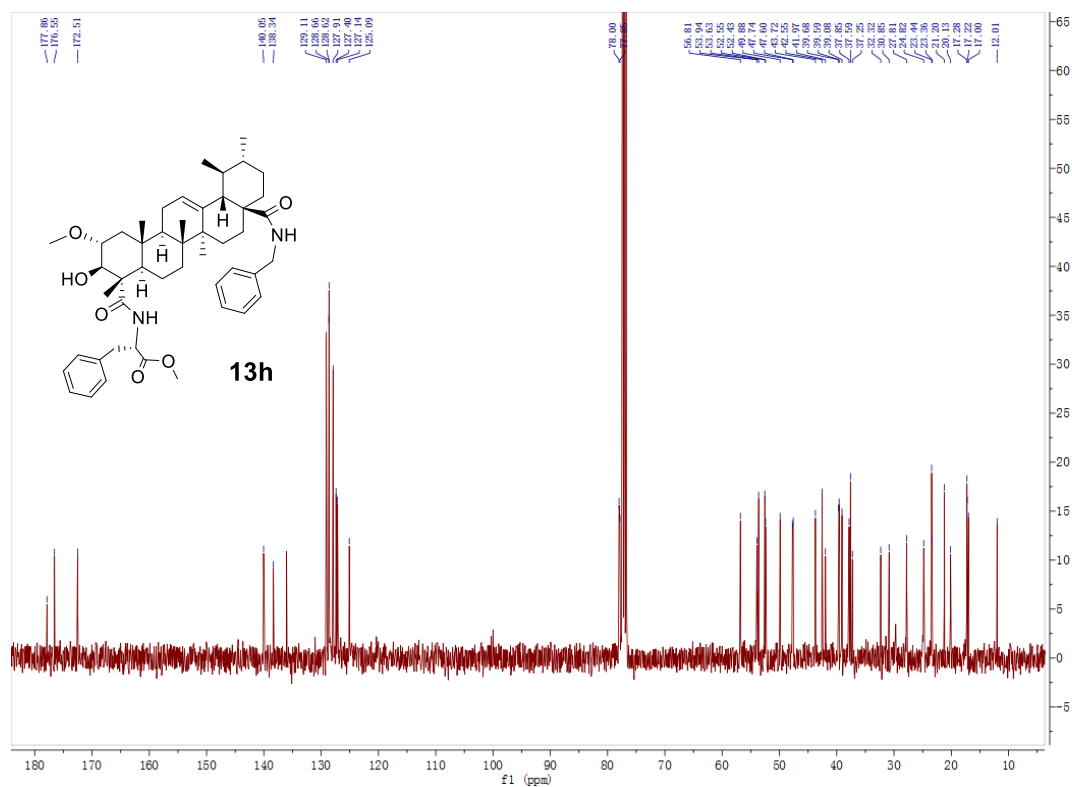




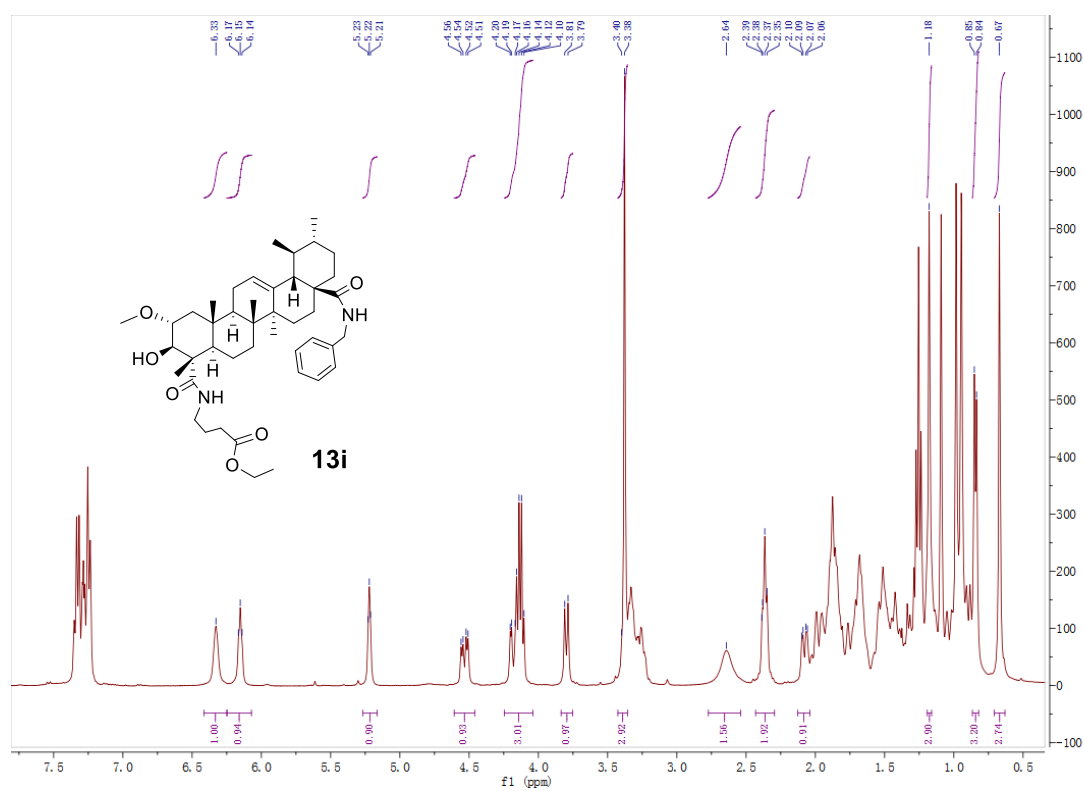
¹³C NMR Spectrum of N-(2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oyl)-L-valine methyl ester (**13g**) (101 MHz, CDCl₃)



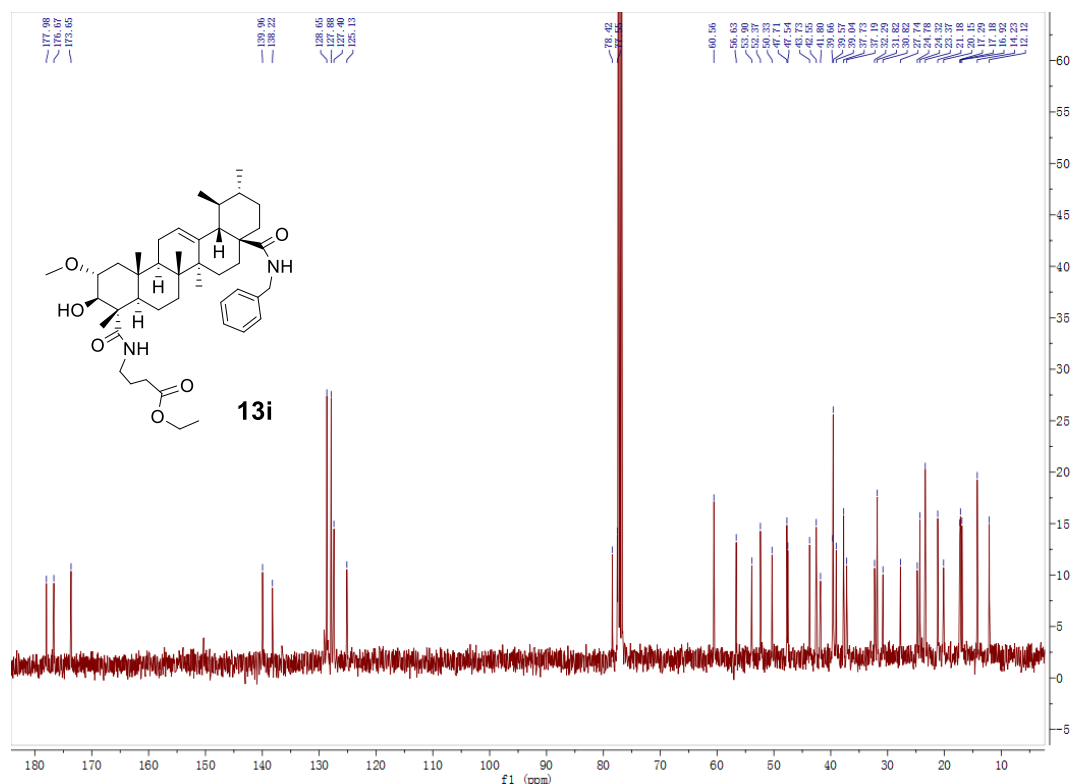
¹H NMR Spectrum of N-(2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oyl)-L-phenylalanine methyl ester (**13h**) (400 MHz, CDCl₃)



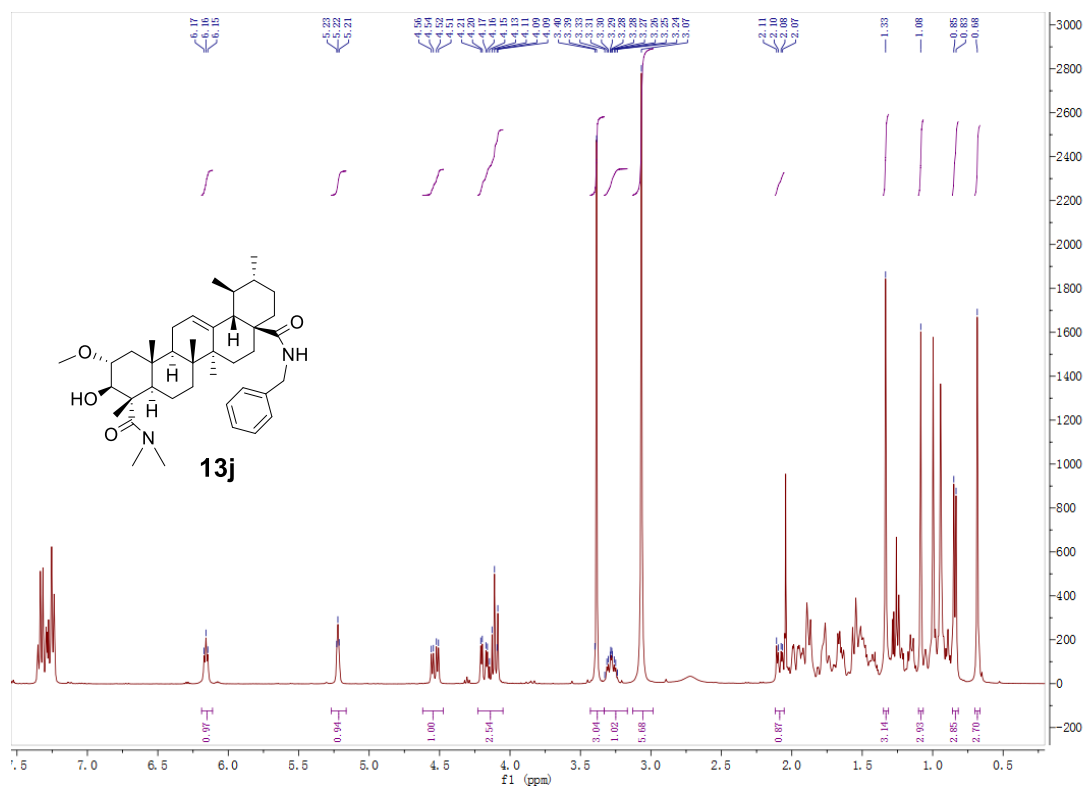
¹³C NMR Spectrum of N-(2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oyl)- L-phenylalanine methyl ester (13h) (101 MHz, CDCl₃)



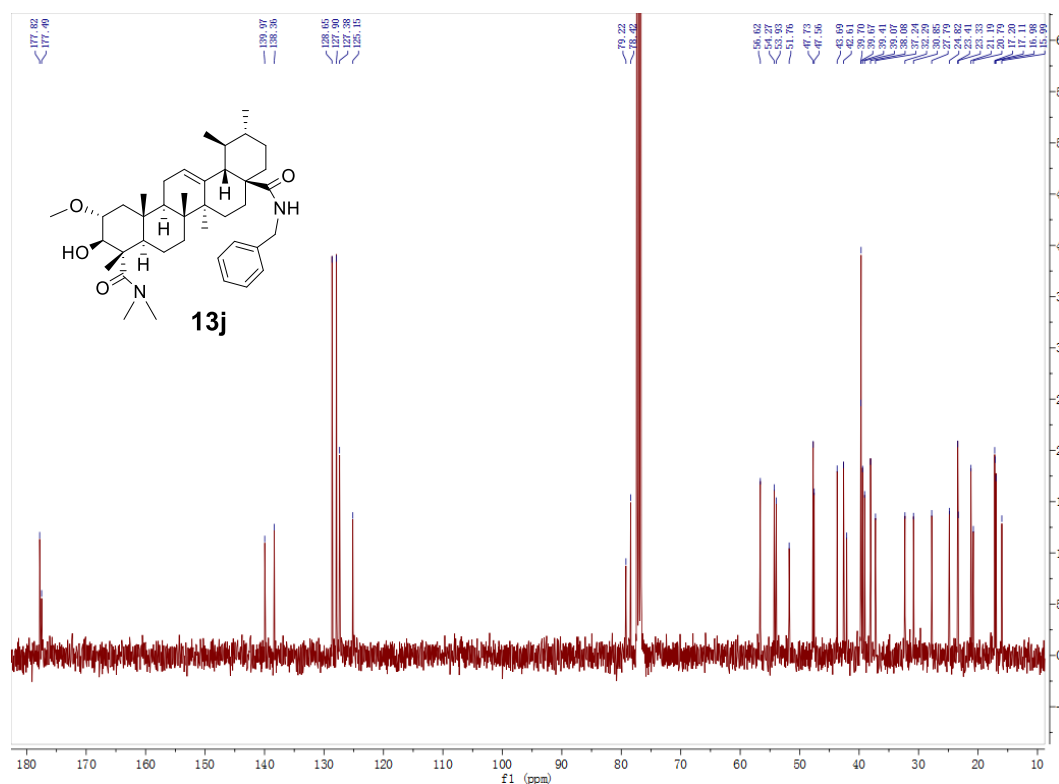
¹H NMR Spectrum of N-(2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oyl)- 4-aminobutyric ethyl ester (13i) (400 MHz, CDCl₃)



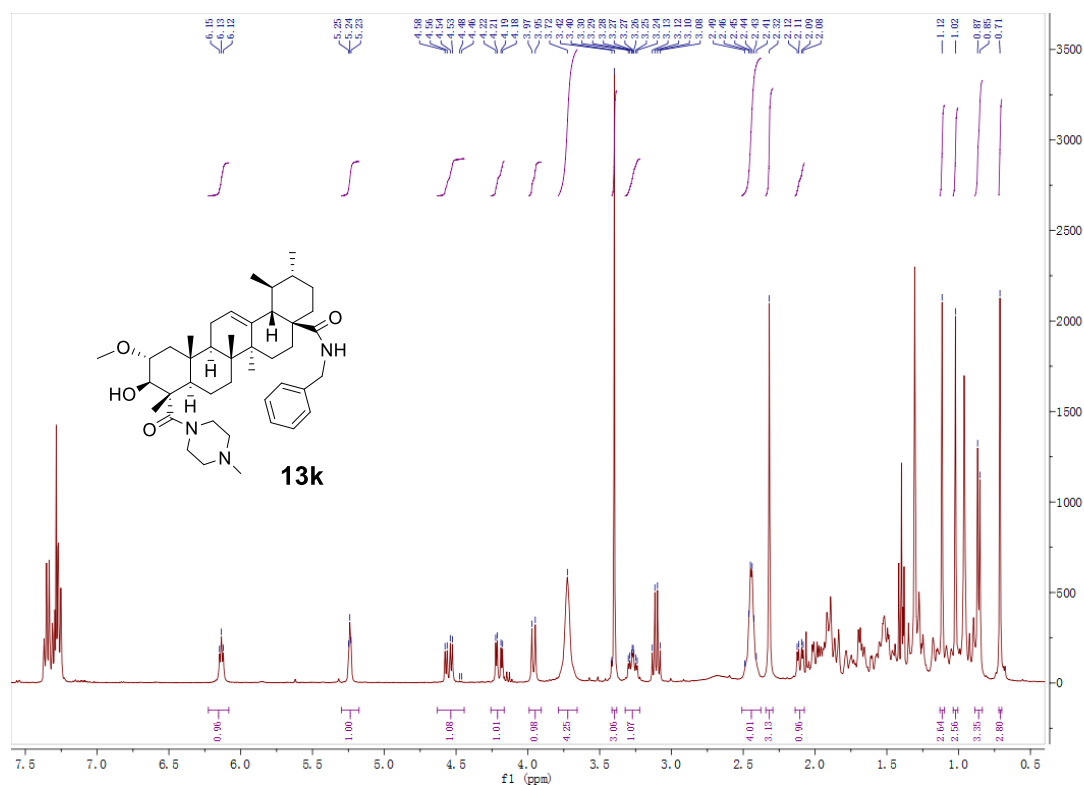
¹³C NMR Spectrum of N-(2α-methoxy-3β-hydroxy-urs-12-ene-28-benzylamide-23-oyl)-4-aminobutyric ethyl ester (**13i**) (101 MHz, CDCl₃)



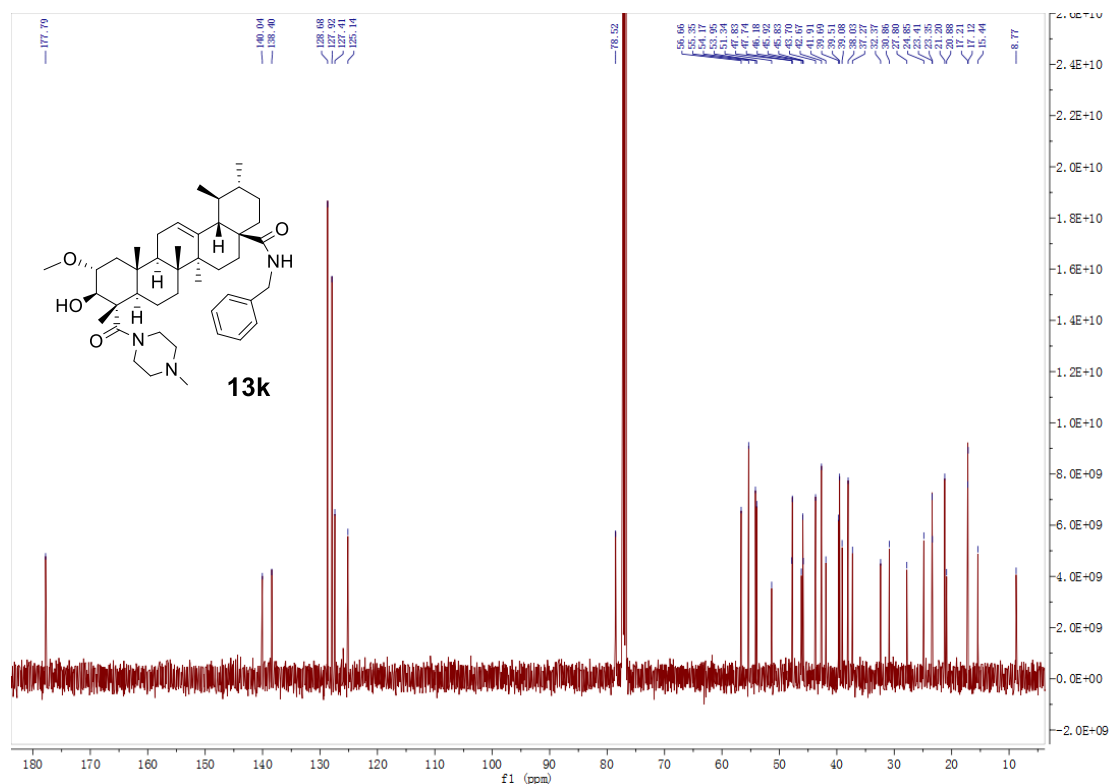
¹H NMR Spectrum of 2α-methoxy-3β-hydroxy-urs-12-ene-28-benzyl amide-23-dimethylamide (**13j**) (400 MHz, CDCl₃)



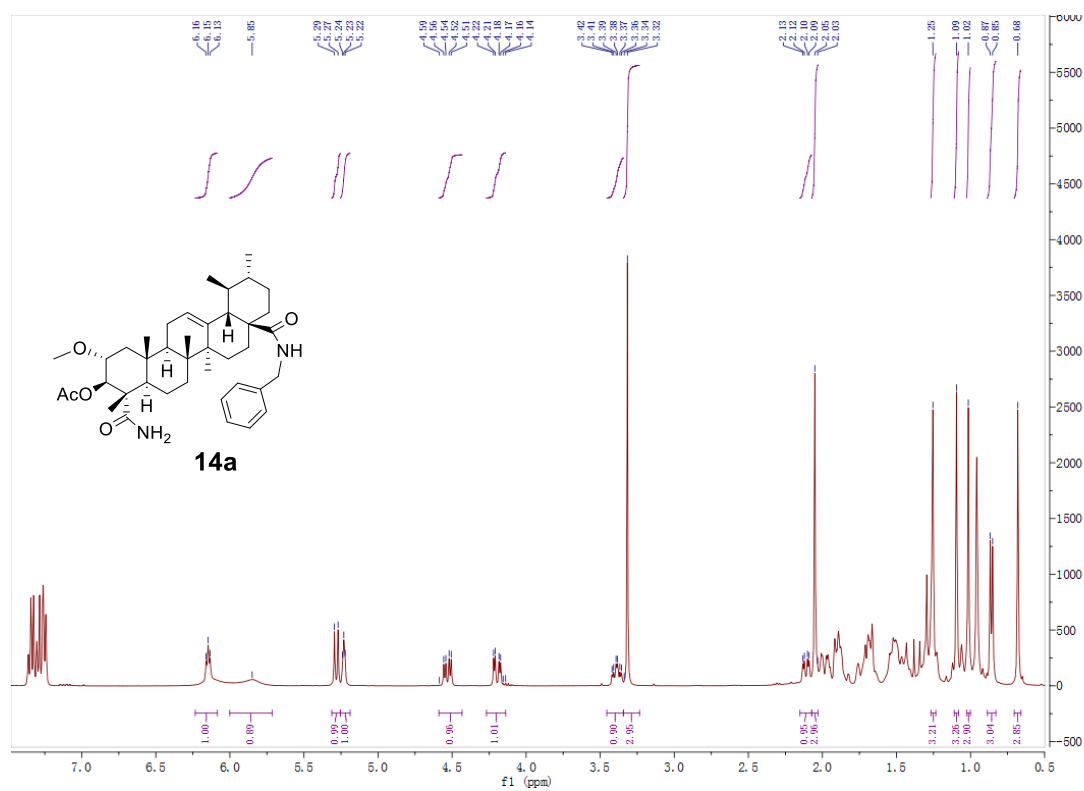
¹³C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzyl amide-23-dimethylamide (**13j**) (101 MHz, CDCl₃)



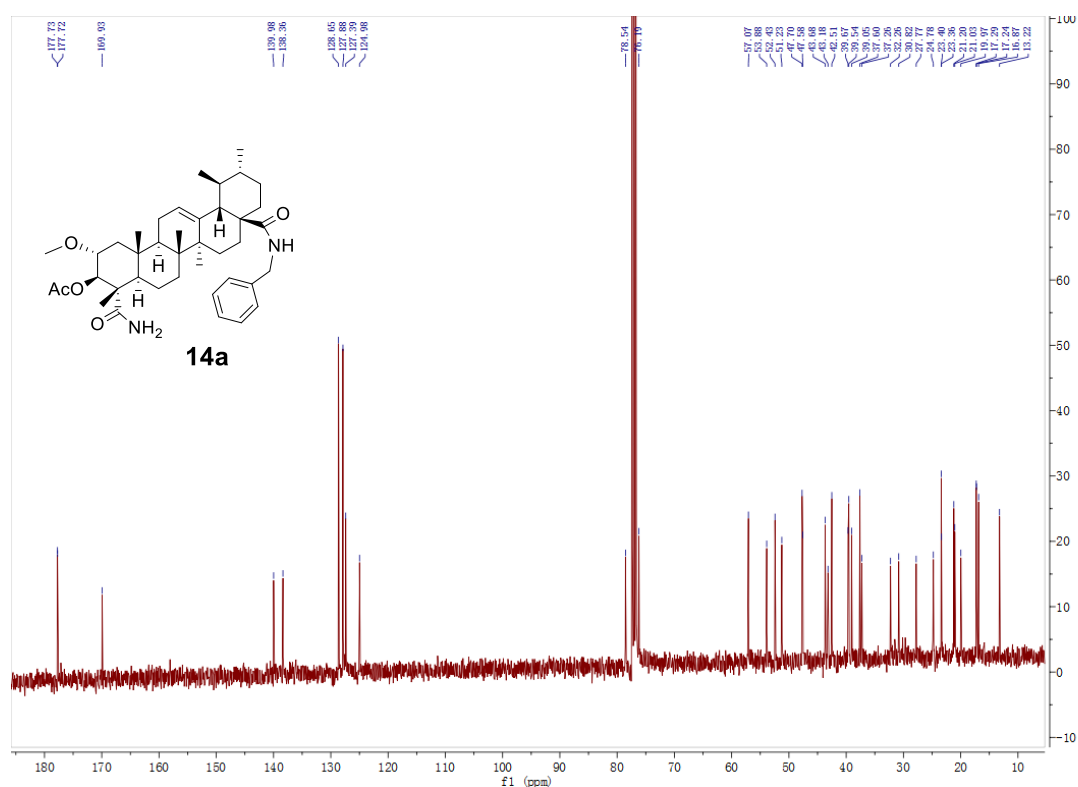
¹H NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzylamide-23-(4-methyl-1-piperazinyl)-amide (**13k**) (400 MHz, CDCl₃)



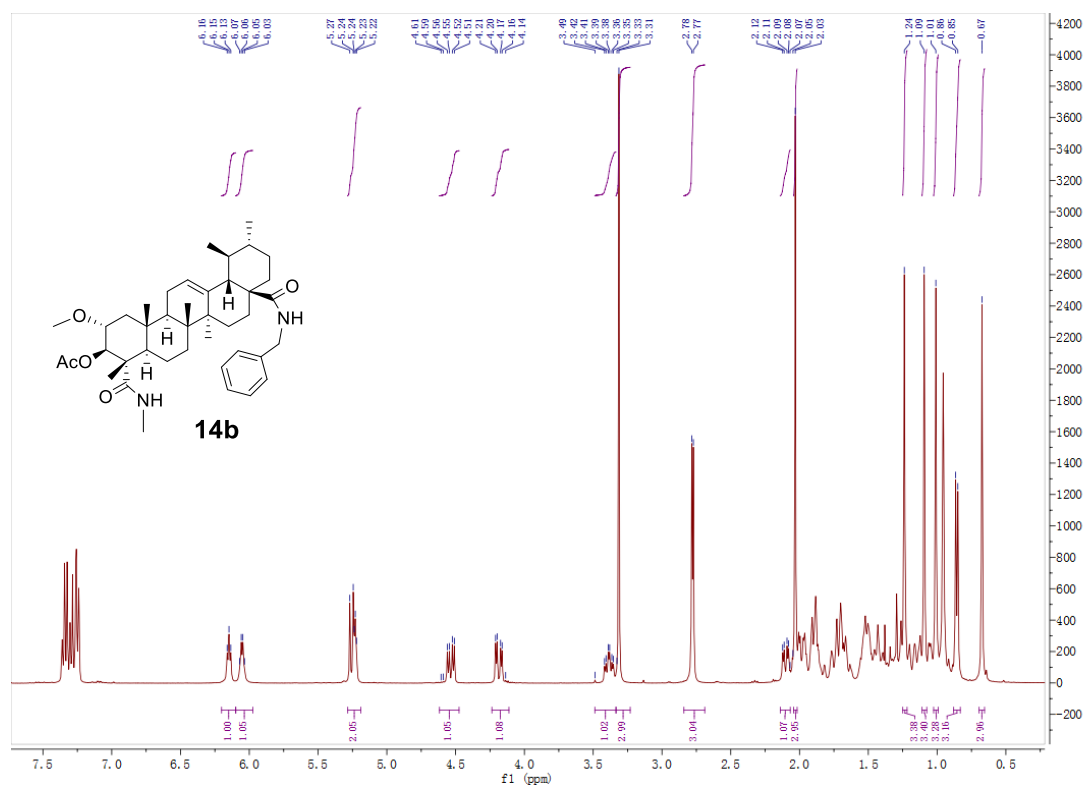
¹³C NMR Spectrum of 2 α -methoxy-3 β -hydroxy-urs-12-ene-28-benzylamide-23-(4-methyl-1-piperazinyl)-amide (**13k**) (126 MHz, CDCl₃)



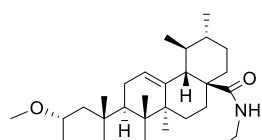
¹H NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-amide (**14a**) (400 MHz, CDCl₃)

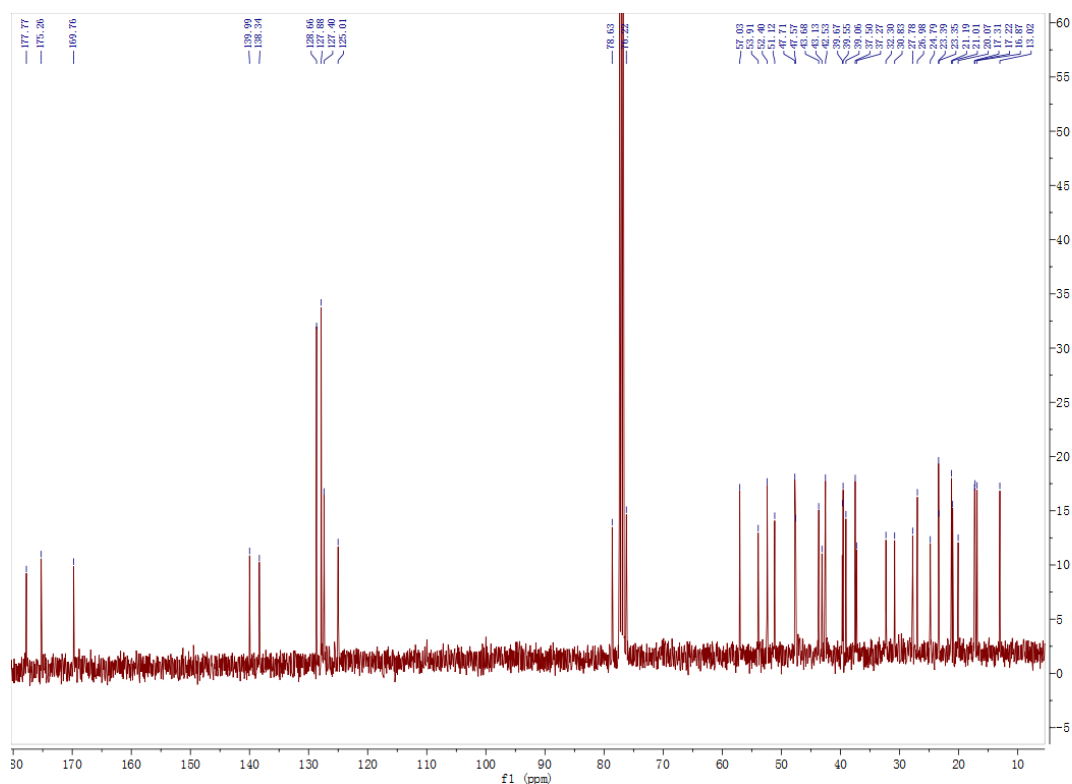


¹³C NMR Spectrum of α -methoxy- β -acetoxy-urs-12-ene-28-benzyl amide-23-amide (**14a**) (101 MHz, CDCl₃)

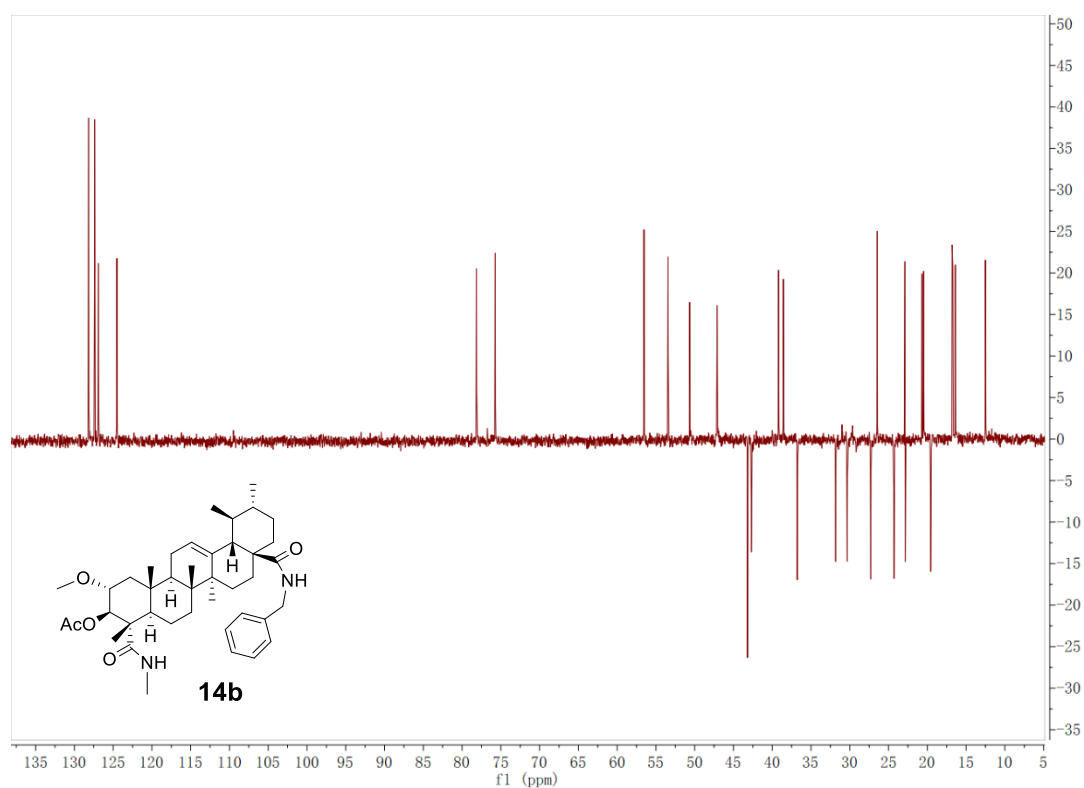


¹H NMR Spectrum of 2 α -methoxy- β -acetoxy-urs-12-ene-28-benzyl amide-23-methylamide (**14b**) (400 MHz, CDCl₃)

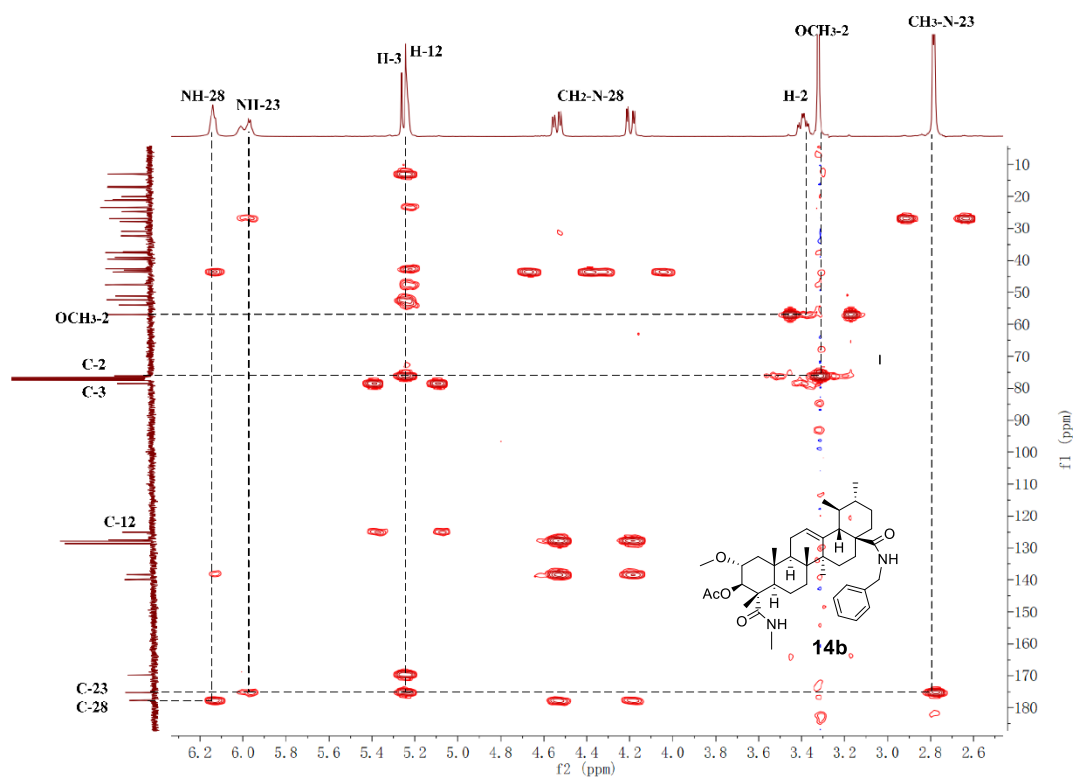
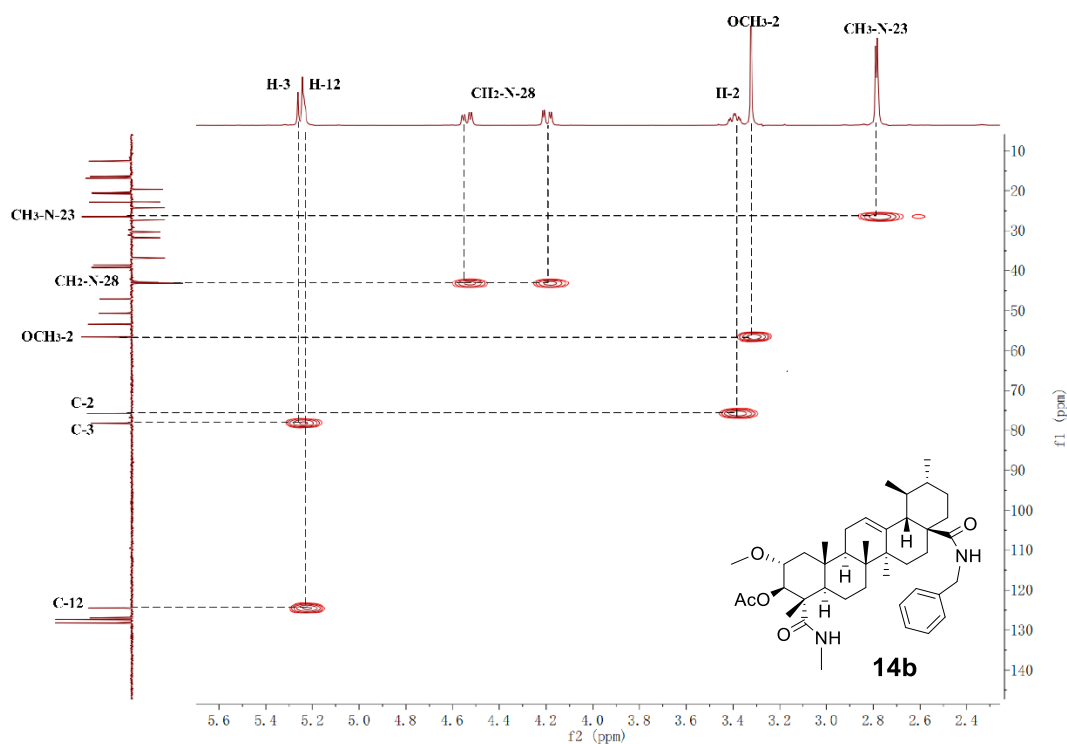




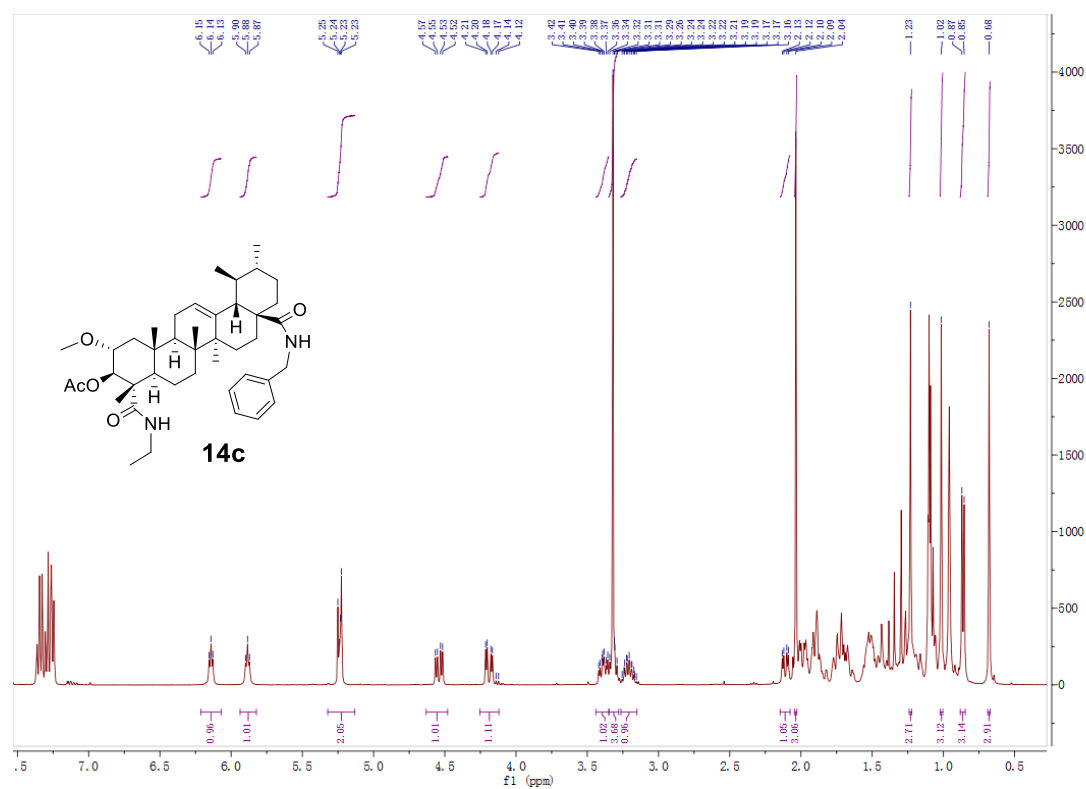
^{13}C NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-methylamide (**14b**) (101 MHz, CDCl_3)



DEPT135 NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-methylamide (**14b**) (^{13}C NMR 126 MHz)

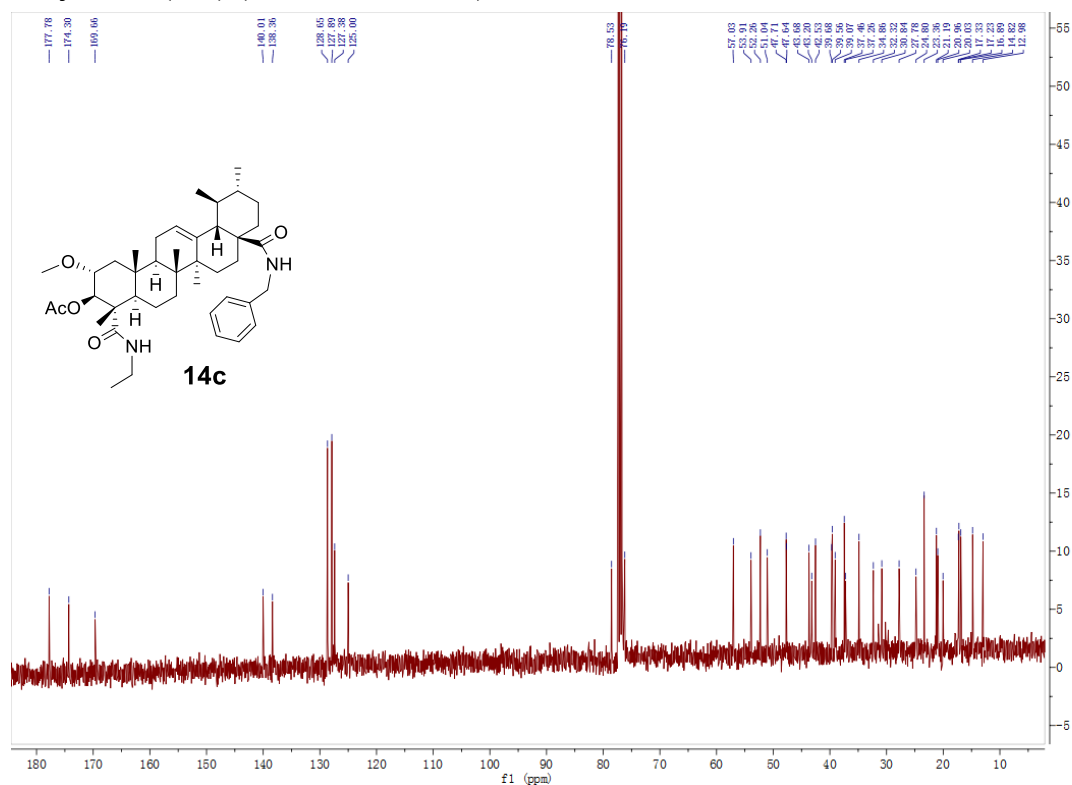


amide-23-methylamide (**14b**) (^1H NMR 500 MHz, CDCl_3 , ^{13}C NMR 126 MHz, CDCl_3)

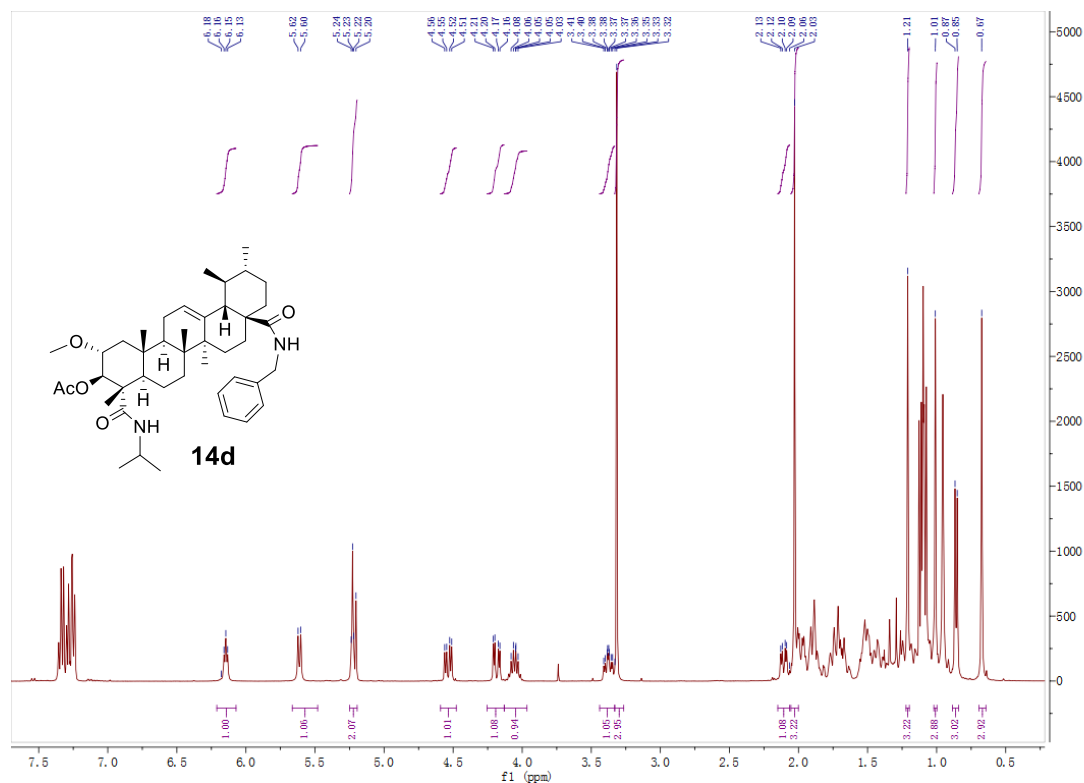


^1H NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-

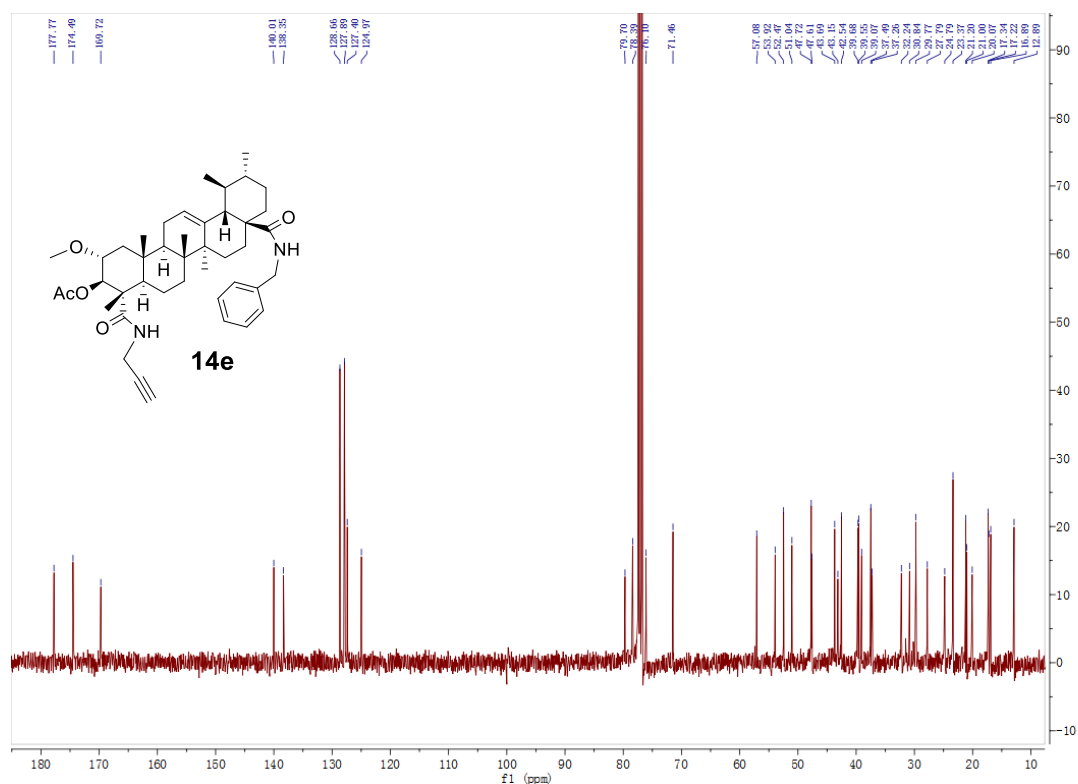
ethlyamide (**14c**) (400 MHz, CDCl₃)



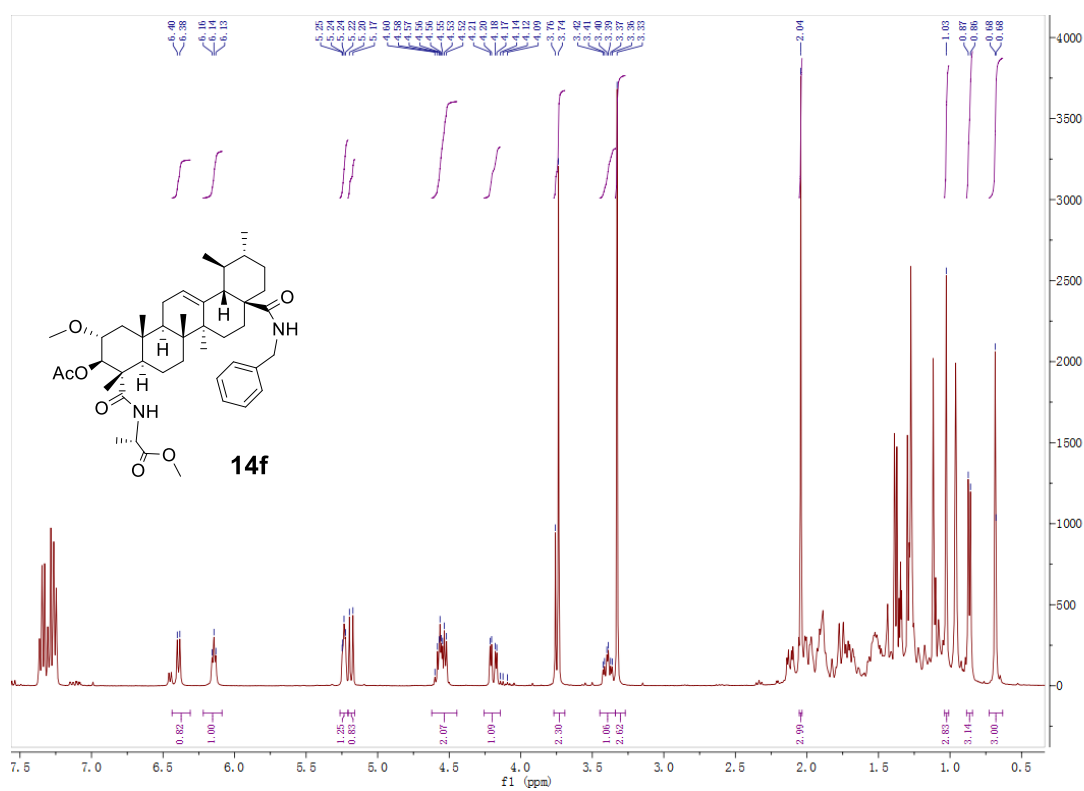
¹³C NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-ethlyamide (**14c**) (101 MHz, CDCl₃)



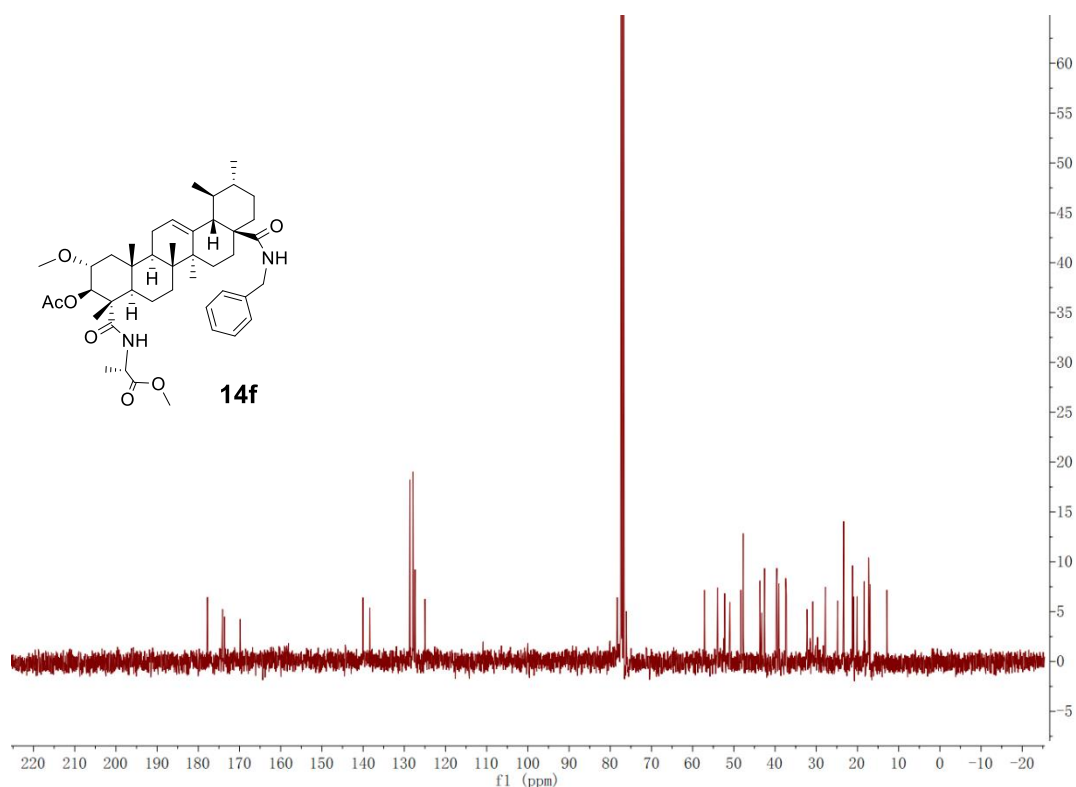
¹H NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-isopropylamide (**14d**) (400 MHz, CDCl₃)



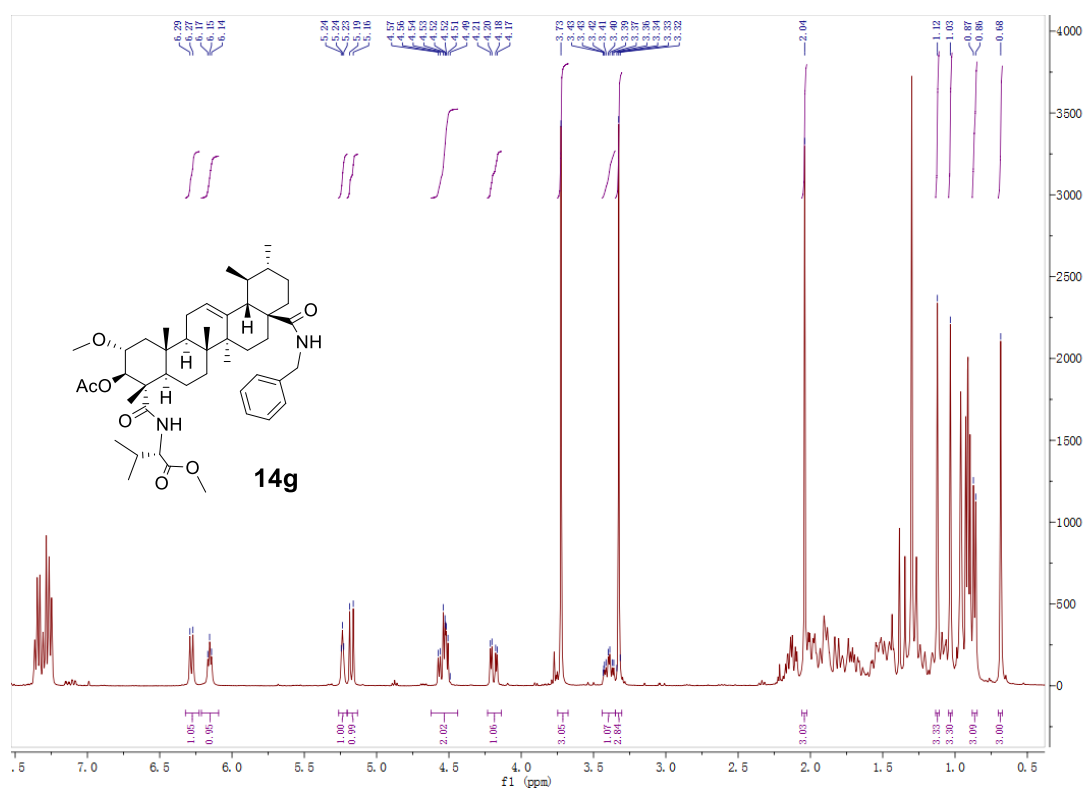
¹³C NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-propargylamide (**14e**) (101 MHz, CDCl₃)



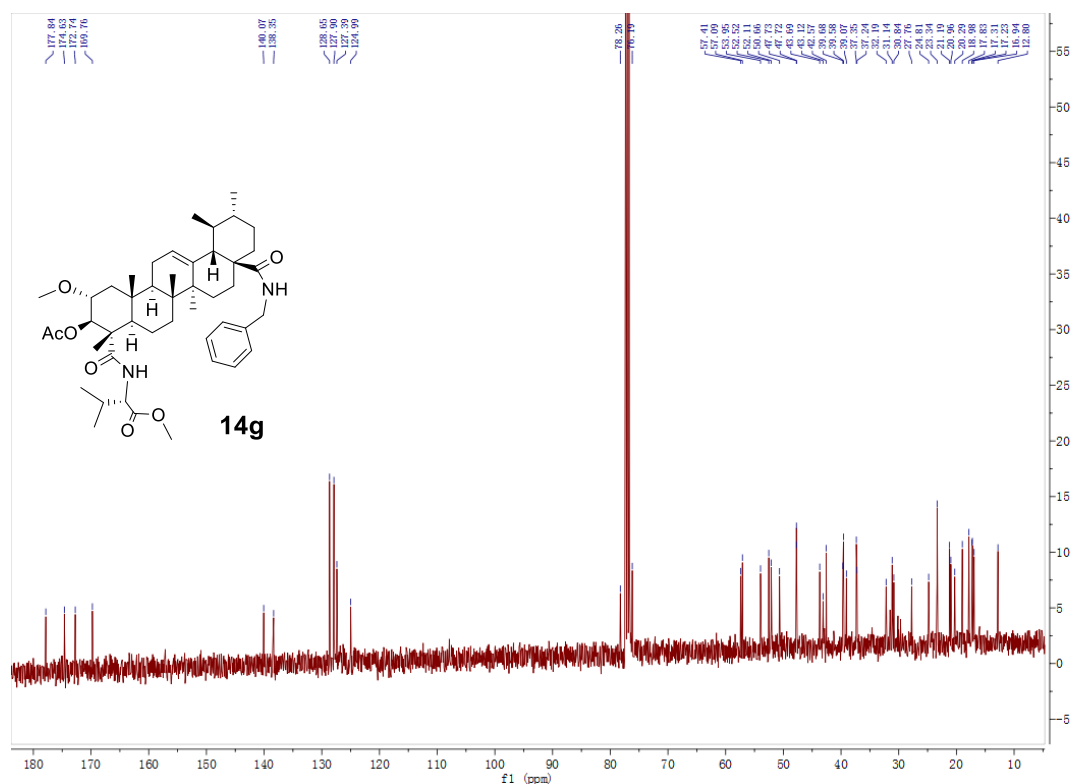
¹H NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-L-alanine methyl ester (**14f**) (400 MHz, CDCl₃)



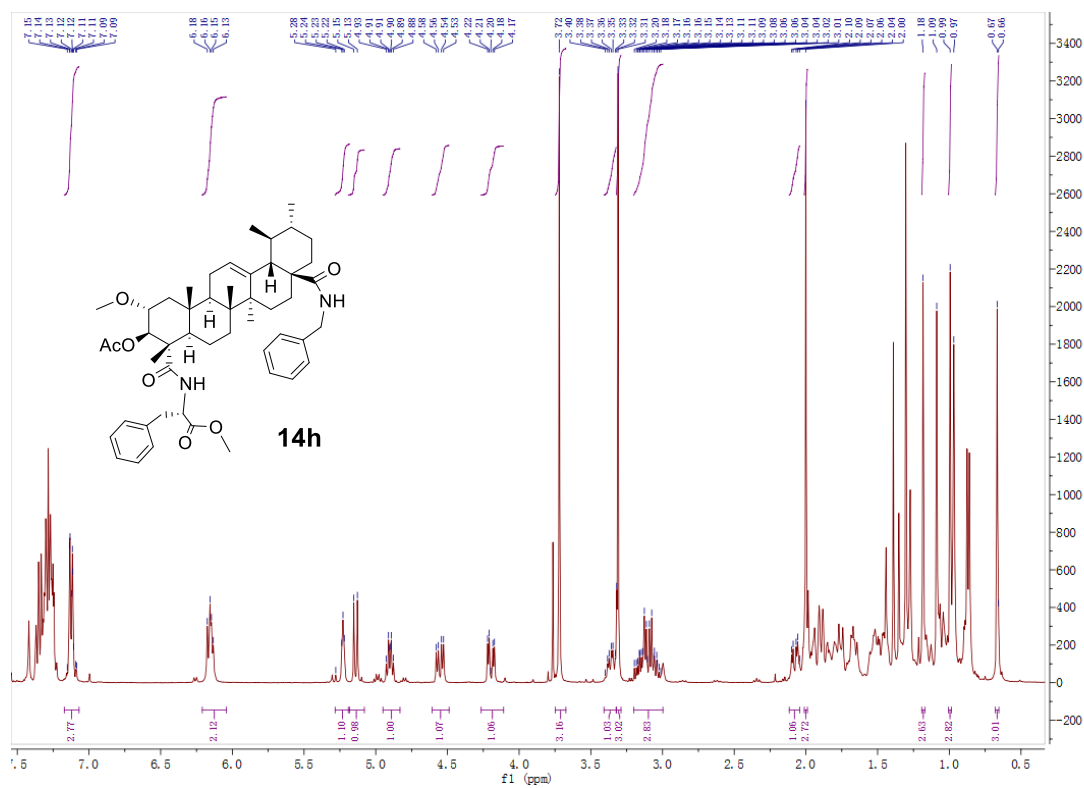
¹³C NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-L-alanine methyl ester (**14f**) (101 MHz, CDCl₃)



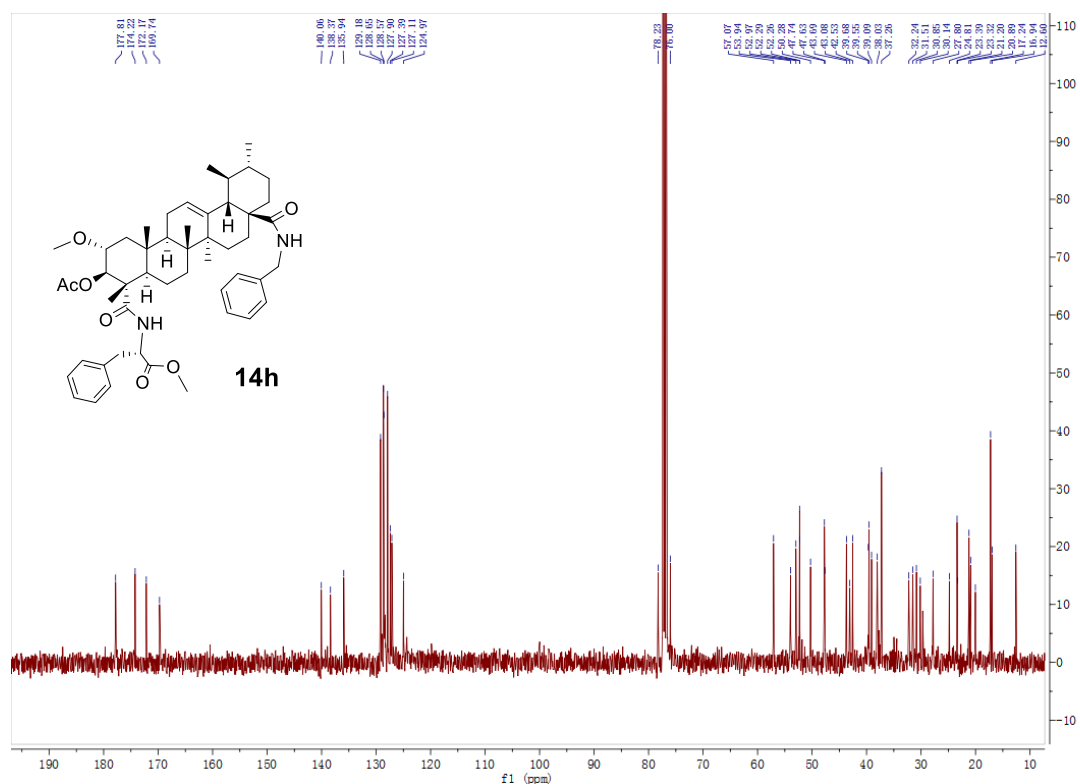
¹H NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-L-valine methyl ester (**14g**) (400 MHz, CDCl₃)



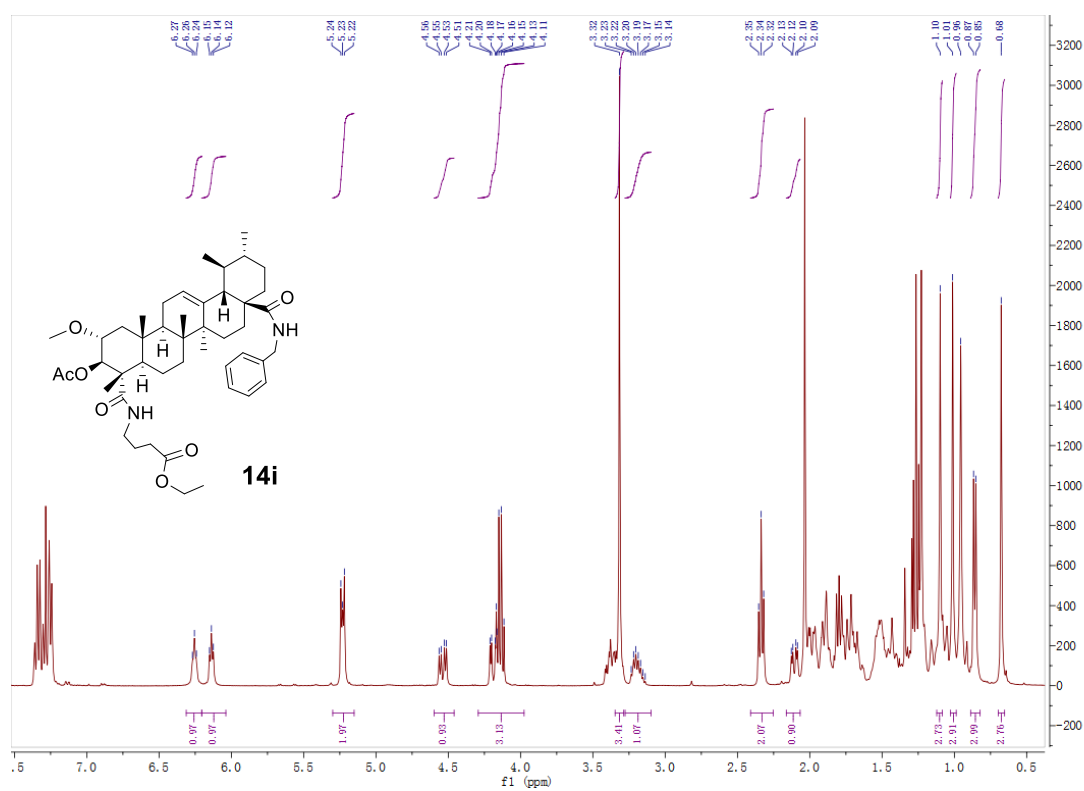
¹³C NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-L-valine methyl ester (**14g**) (101 MHz, CDCl₃)



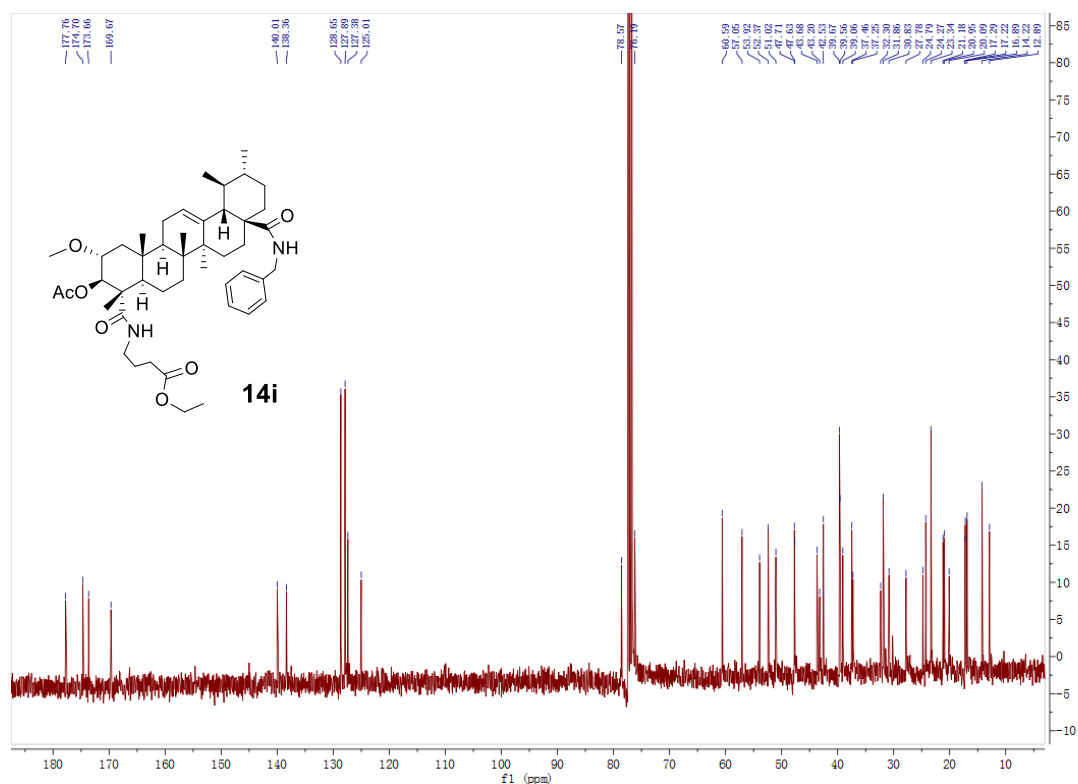
¹H NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-L-phenylalanine methyl ester (**14h**) (400 MHz, CDCl₃)



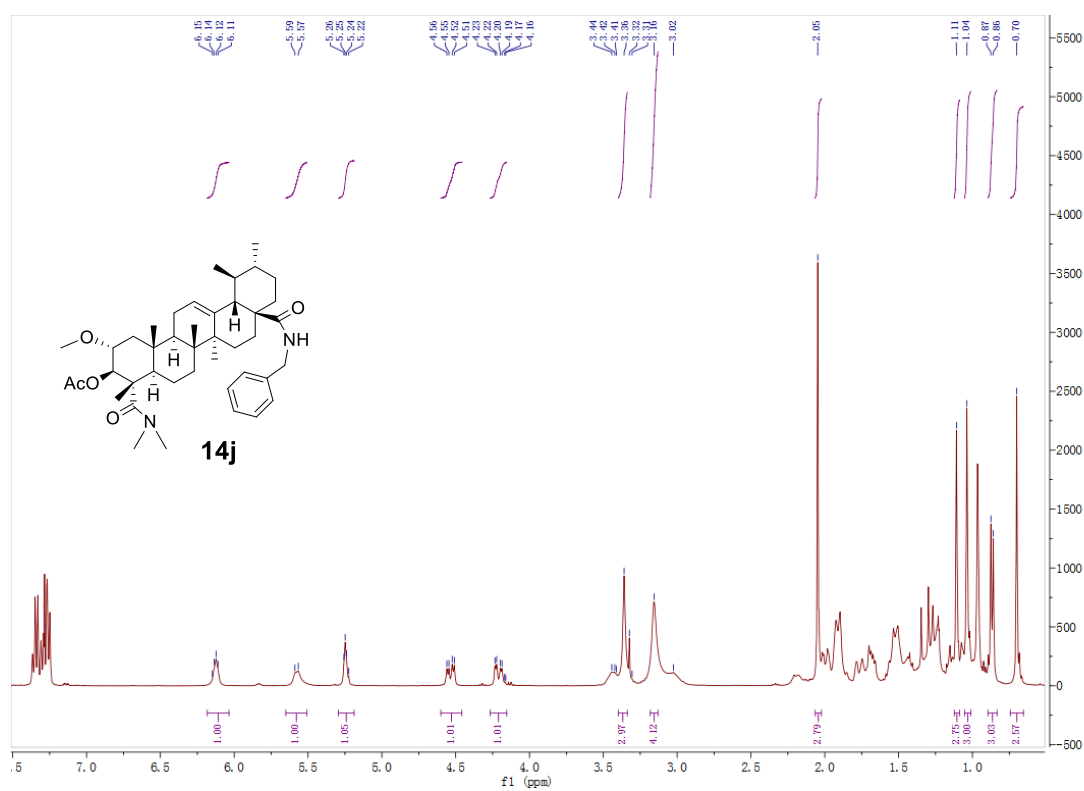
¹³C NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)- L-phenylalanine methyl ester (**14h**) (101 MHz, CDCl₃)



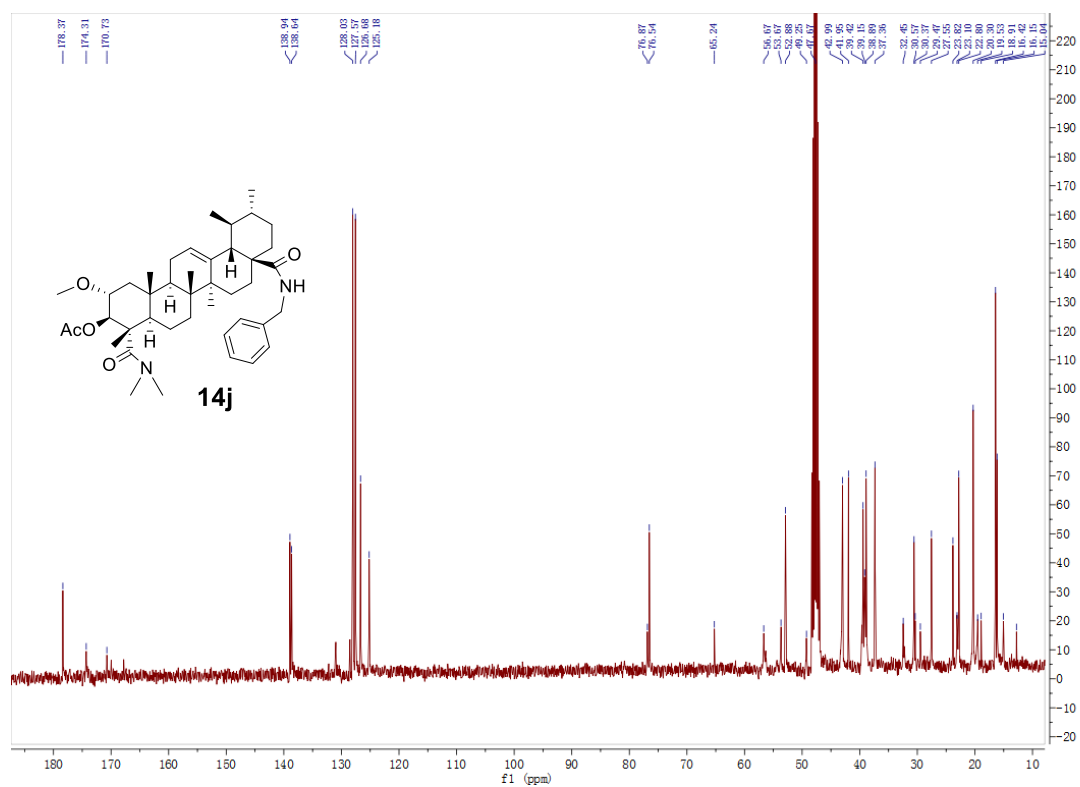
¹H NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-4-aminobutyric ethyl ester (**14i**) (400 MHz, CDCl₃)



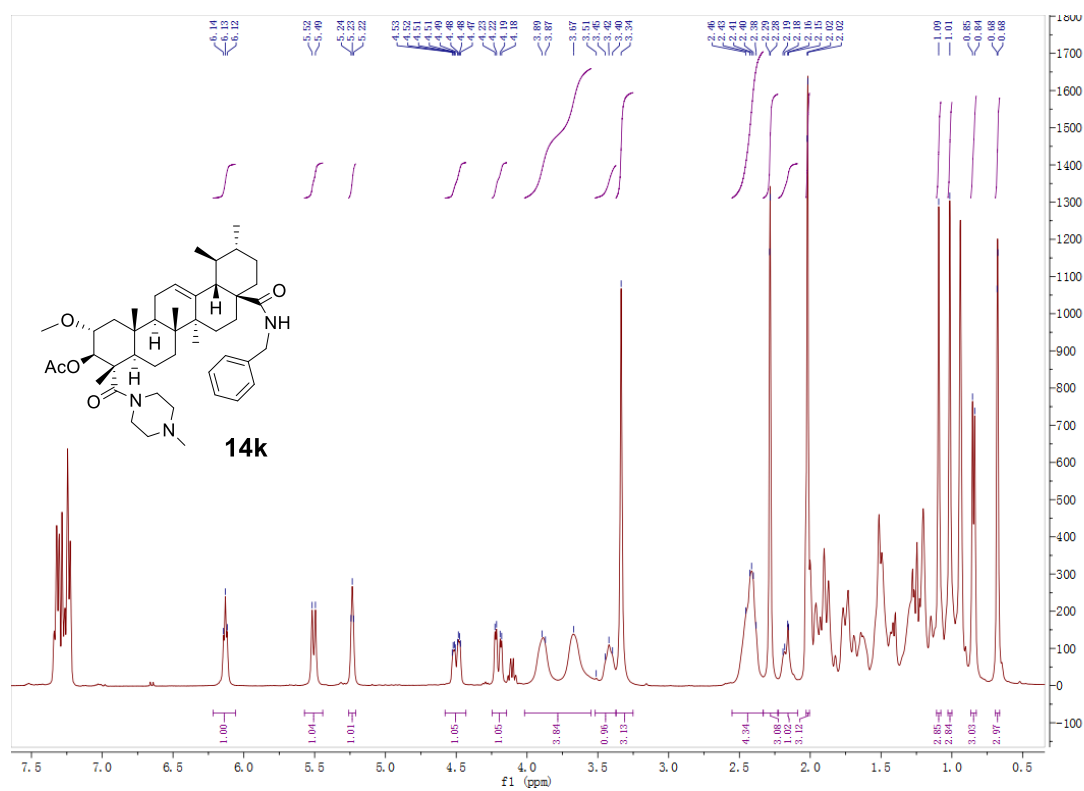
¹³C NMR Spectrum of N-(2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-oyl)-4-aminobutyric ethyl ester (**14i**) (101 MHz, CDCl₃)



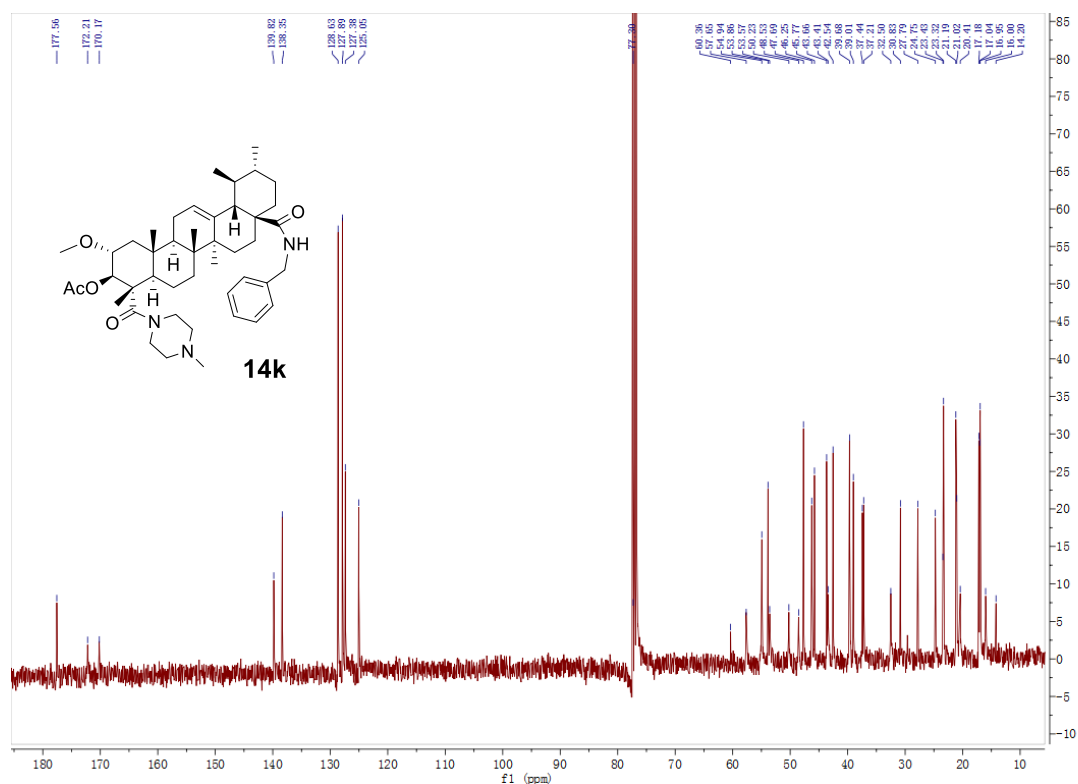
¹H NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzyl amide-23-dimethylamide (**14j**) (400 MHz, CDCl₃)



¹³C NMR Spectrum of 2 α -methoxy-3 β - acetoxy-urs-12-ene-28-benzyl amide-23-dimethylamide (**14j**) (101 MHz, MeOD)



¹H NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-(4-methyl-1-piperazinyl)-amide (**14k**) (400 MHz, CDCl₃)



¹³C NMR Spectrum of 2 α -methoxy-3 β -acetoxy-urs-12-ene-28-benzylamide-23-(4-methyl-1-piperazinyl)-amide (**14k**) (101 MHz, CDCl₃)

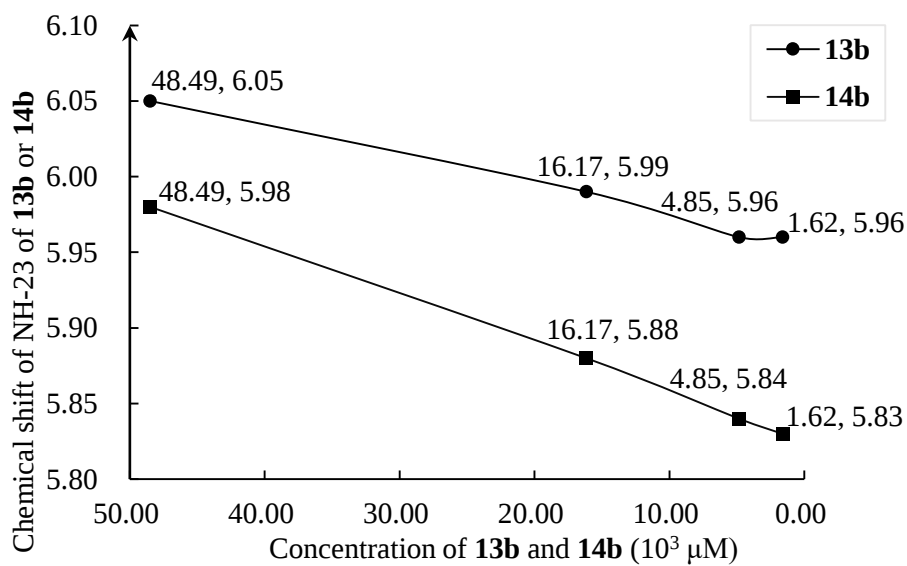


Fig. 1. NMR titration curves for compounds **13b** and **14b**.

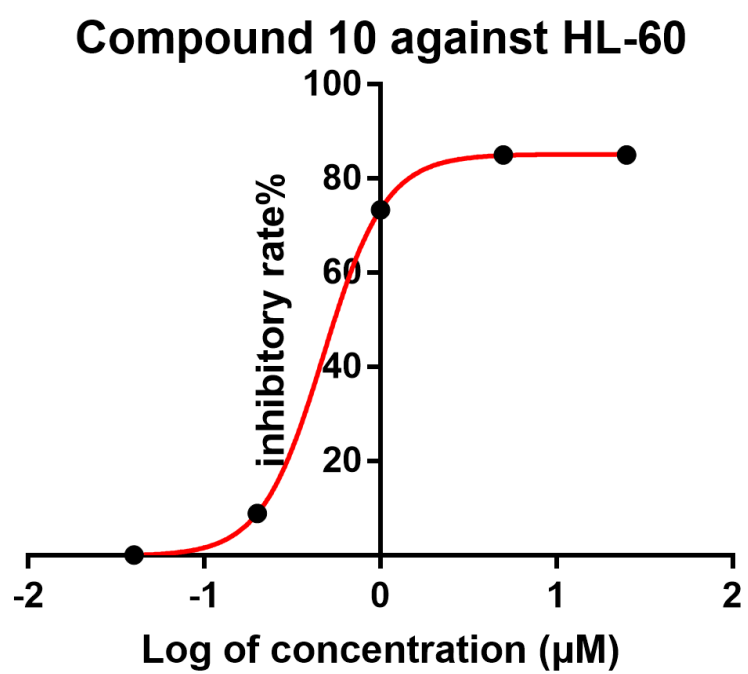


Fig. 2. IC₅₀ curve of compound **10** against HL-60.

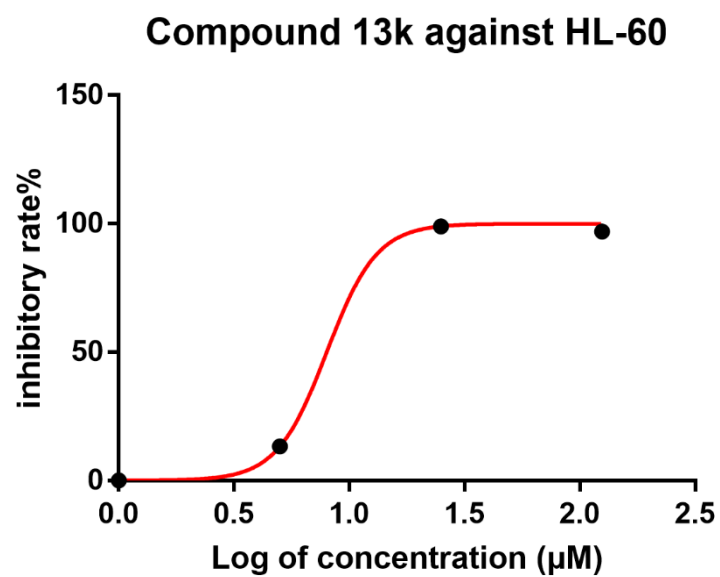


Fig. 3. IC₅₀ curve of compound **13k** against HL-60.

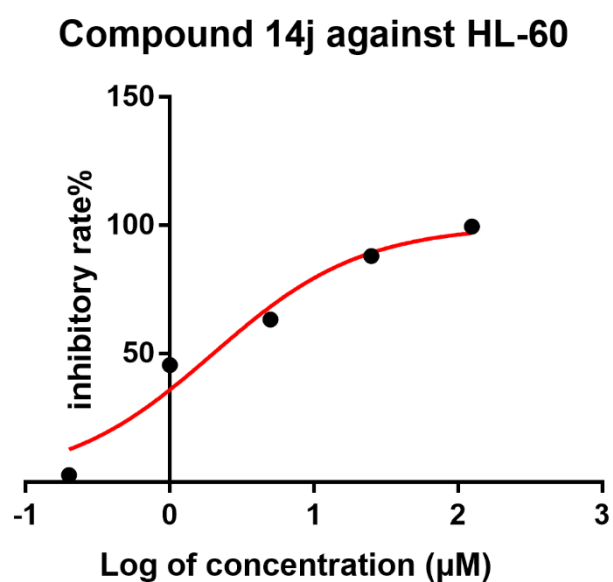


Fig. 4. IC₅₀ curve of compound **14j** against HL-60.

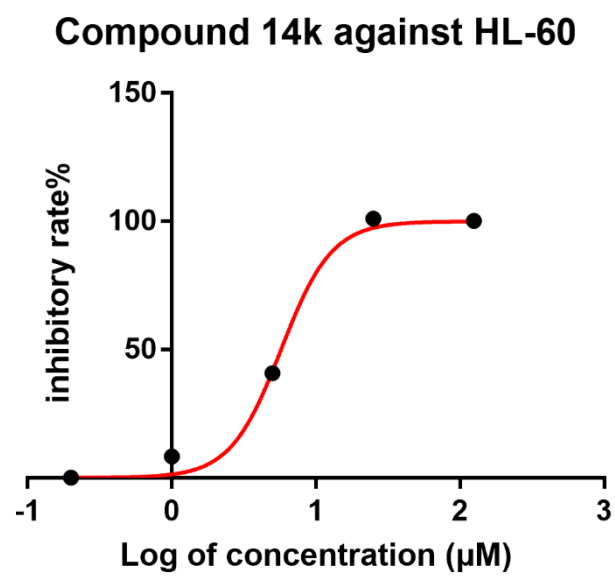


Fig. 5. IC₅₀ curve of compound **14k** against HL-60.