Electronic Supplementary Information for Visible Light-induced Alkylpyridylation of Styrenes via a Reductive Radical Three-component Coupling

Jing-miao Yu,[a] Li-wen Zhu,[b] Xiao-yuan Hong,[b] Huan Gao,[b] Ting-ting Chen*[b]

[a] School of Pharmaceutical and Materials Engineering & Institute for Advanced Studies, Taizhou University, 1139 Shifu Avenue, Taizhou 318000, People's Republic of China

[b]School of Pharmaceutical and Materials Engineering, Taizhou University, 1139 Shifu Avenue, Taizhou 318000, People's Republic of China

* Corresponding Author e-mail: chentt@tzc.edu.cn.

1. General information
2. General Procedure
3. NMR spectra

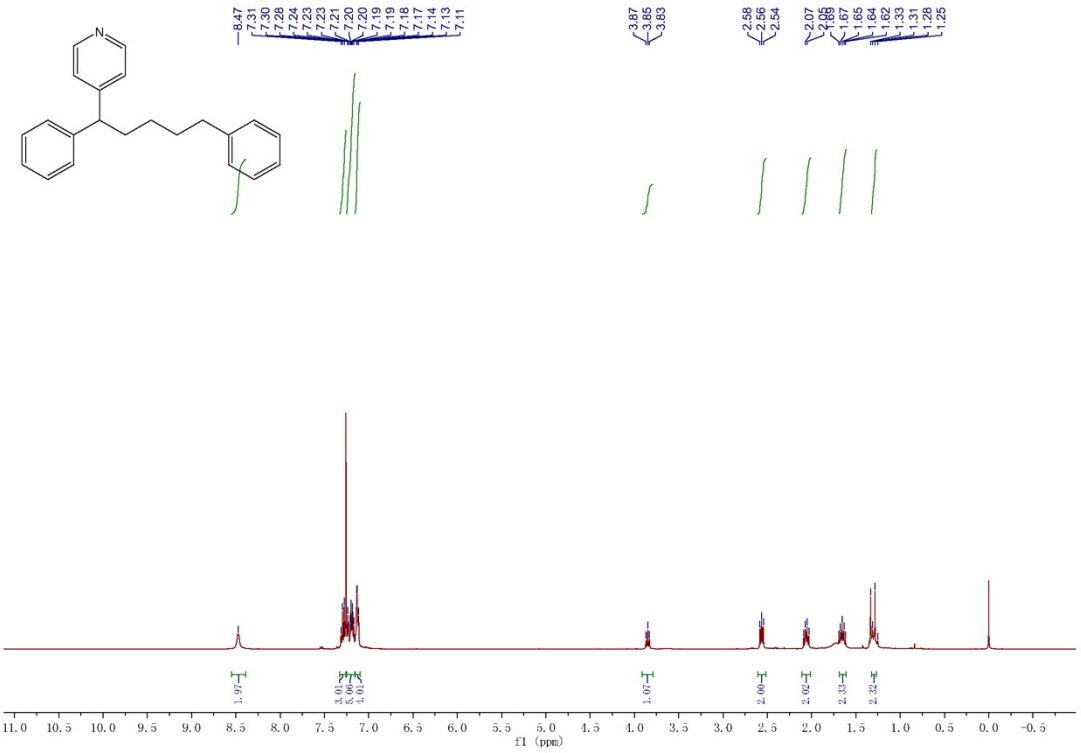
1. General Information

All chemical reagents are obtained from commercial suppliers and used without further purification. All unknown compounds are characterized by ^{1}H NMR, ^{13}C NMR, MS, HRMS. Irradiation of visible light was performed with a 90W Kessil A360W Blue LED lamp. Analytical thin-layer chromatography are performed on glass plates precoated with silica gel impregnated with a fluorescent indicator (254 nm), and the plates are visualized by exposure to ultraviolet light.^{1}H NMR and ^{13}C NMR spectra are recorded on an AVANCE 400 Bruker spectrometer operating at 400 MHz and 100 MHz in $CDCl_3$, respectively, and chemical shifts are reported in ppm. Multiplicities are indicated by s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), and br (broad). High-resolution mass spectra are taken on a Waters SYNAPT G2-Si instrument in the electrospray ionization (ESI) mode.

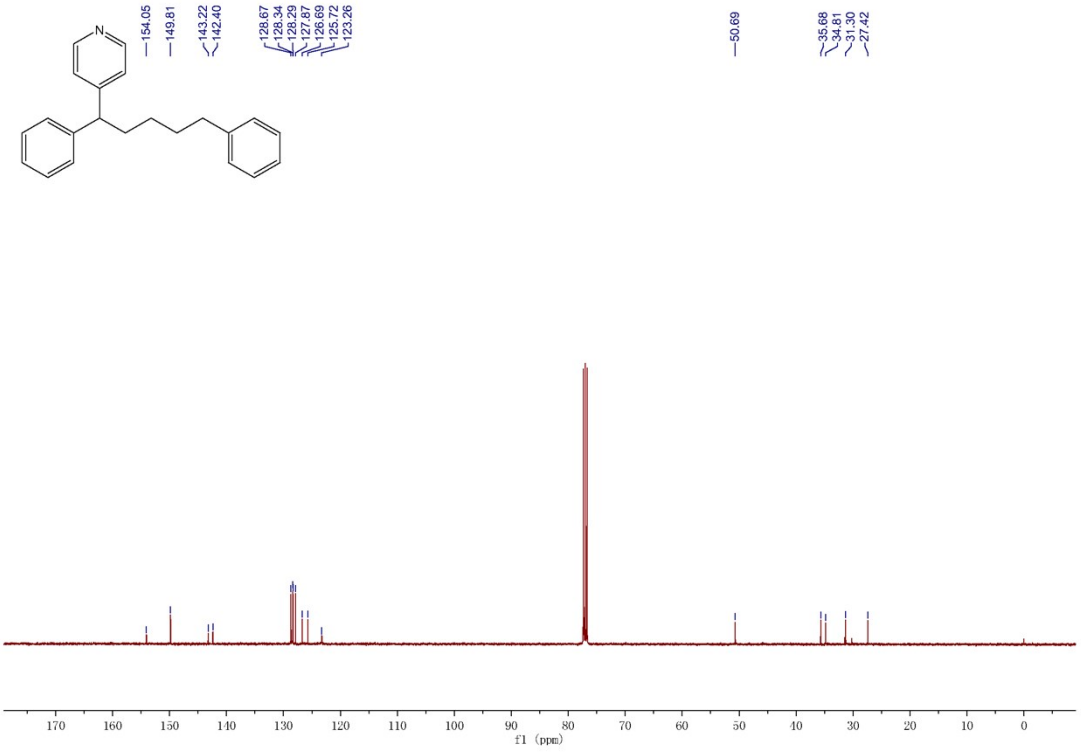
2. General Procedure

General procedure for visible light-induced alkylpyridylation of styrenes via a reductive radical three-component coupling: A 10 mL reaction vessel with a magnetic stirring bar was equipped with alkenes (0.2 mmol), 4-cyano pyridine (0.3 mmol), NHPI esters (0.3 mmol), HE (0.3 mmol) and MTBE (2 mL). The mixture was irradiated with a 90 W blue LED lamp (1 cm away with cooling from a fan), and stirred under Ar atmosphere at r.t. overnight. After the solvent had been removed under reduced pressure, the residue was purified by flash chromatography using PE-AcOEt (10:1-8:1, v/v) as the eluent to 1,1-diarylalkane derivatives.

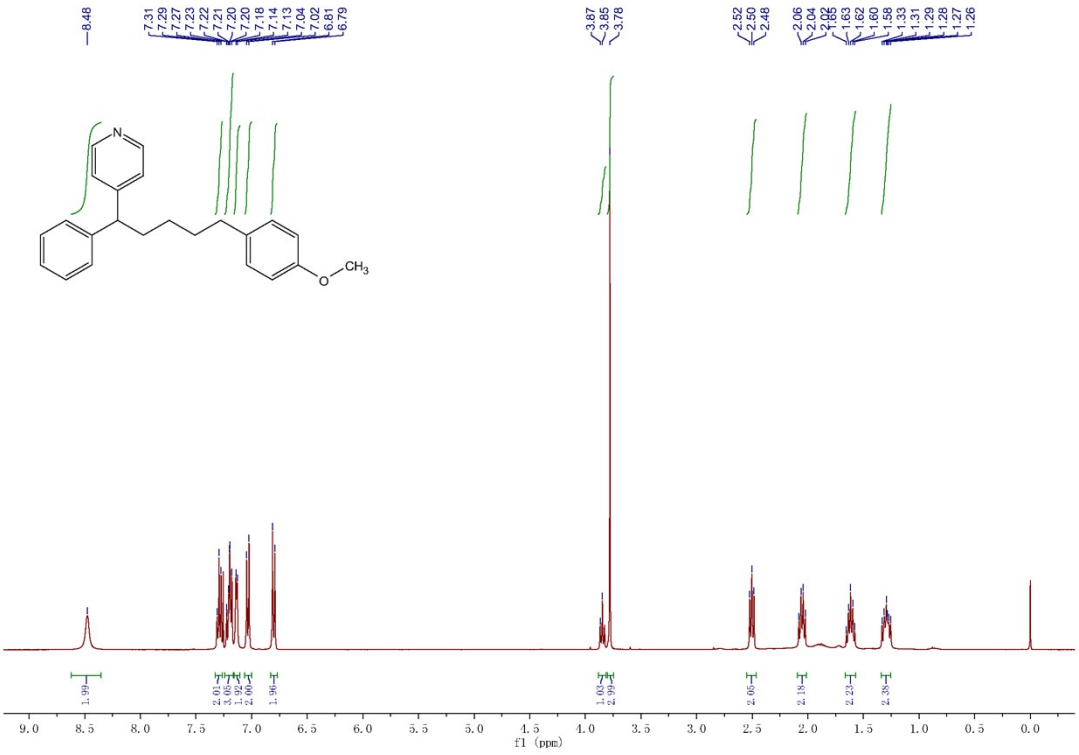
3. NMR Spectra of All Products



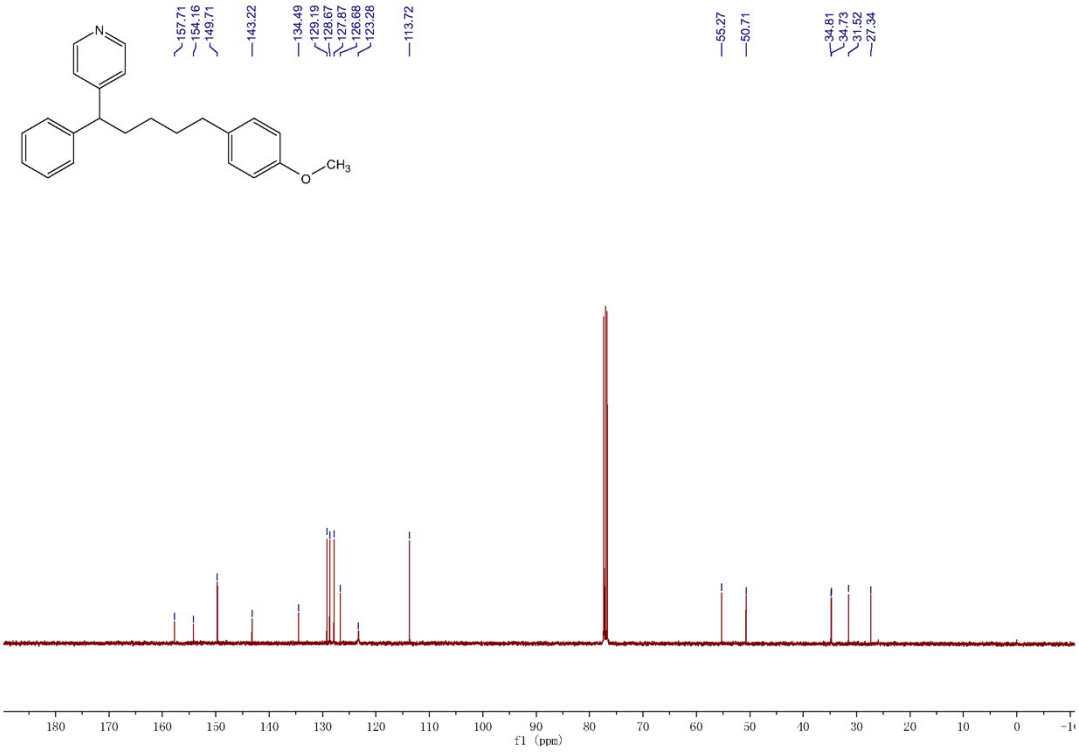
^{1}H NMR Spectrum of Compound **1** (400MHz, $CDCl_3$)



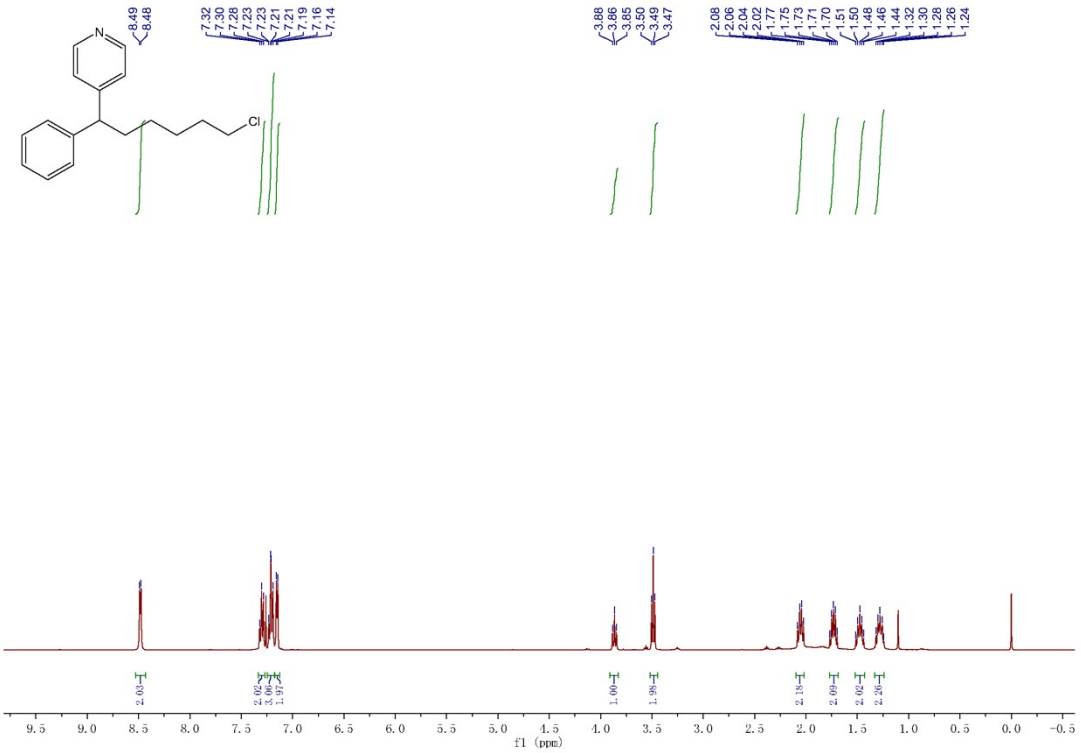
^{13}C NMR Spectrum of Compound **1** (100MHz, $CDCl_3$)



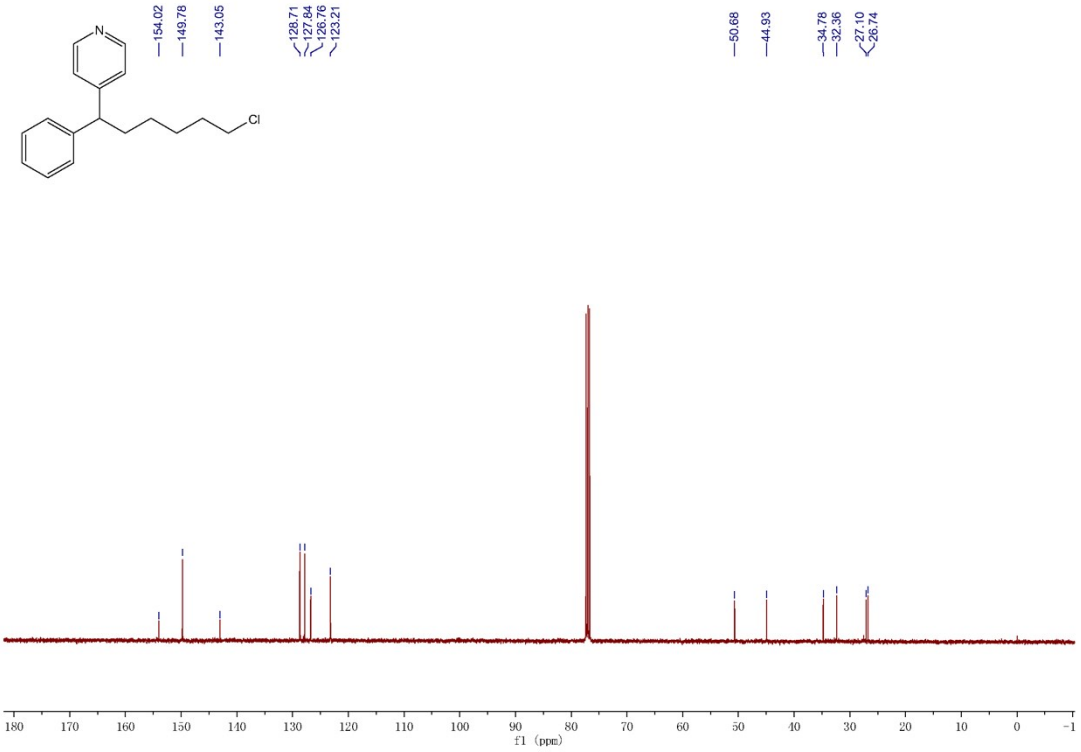
^{1}H NMR Spectrum of Compound **2** (400MHz, $CDCl_3$)



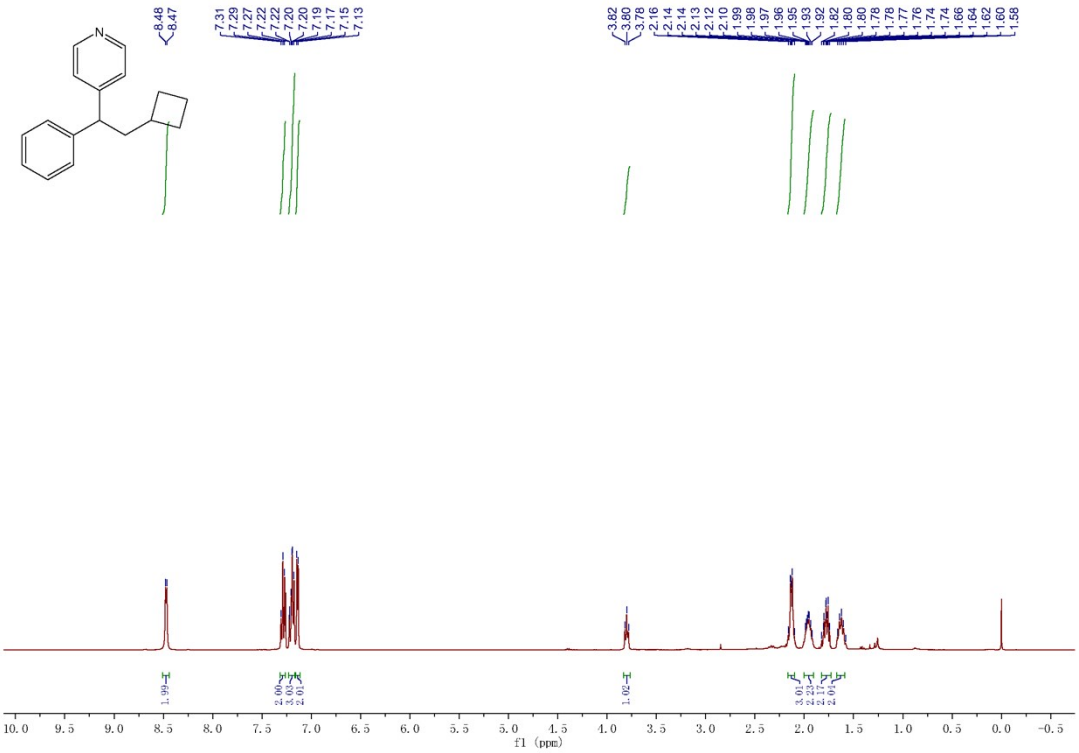
^{13}C NMR Spectrum of Compound **2** (100MHz, $CDCl_3$)



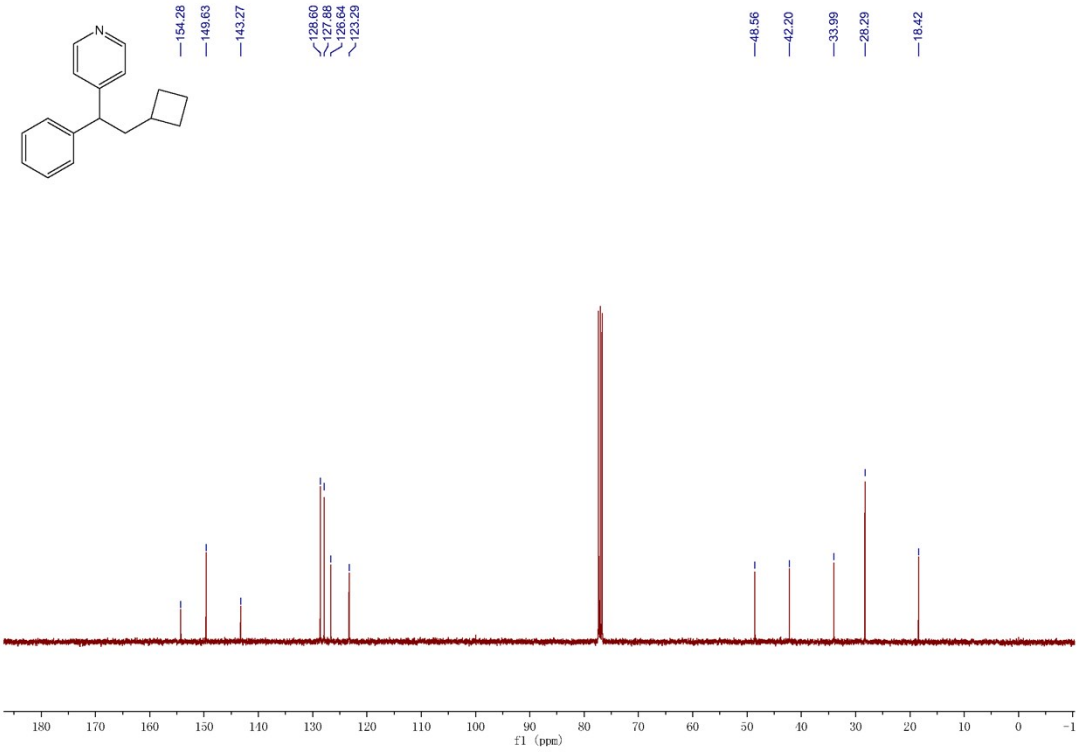
^{1}H NMR Spectrum of Compound **3** (400MHz, $CDCl_3$)



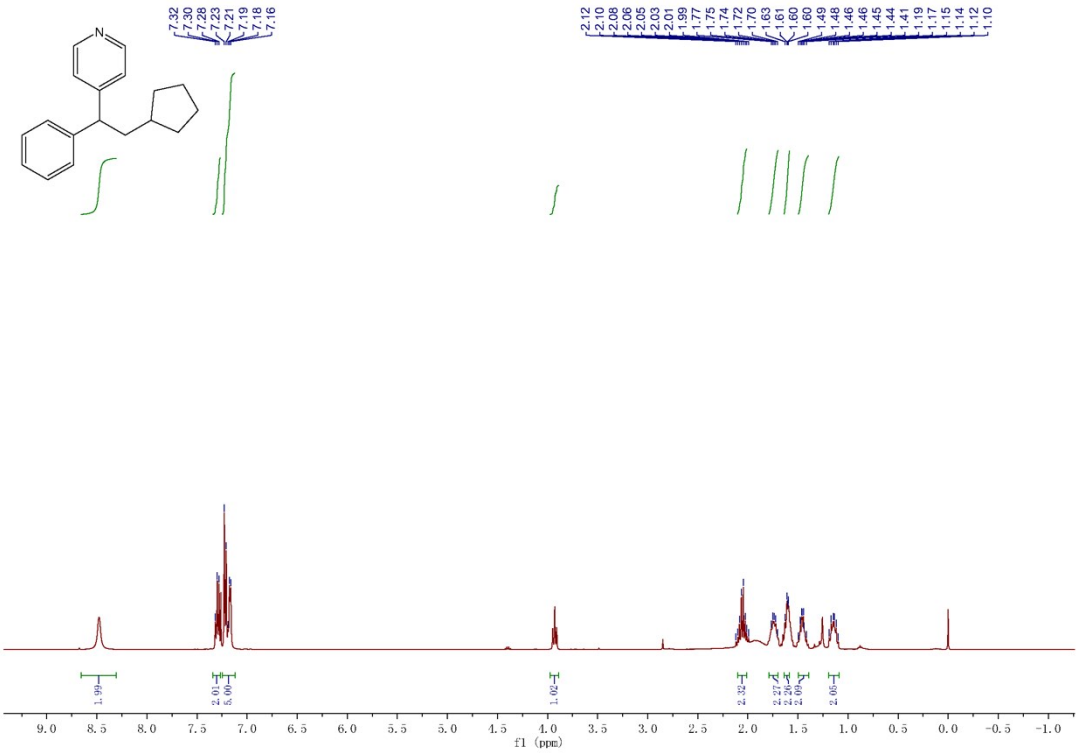
^{13}C NMR Spectrum of Compound **3** (100MHz, $CDCl_3$)



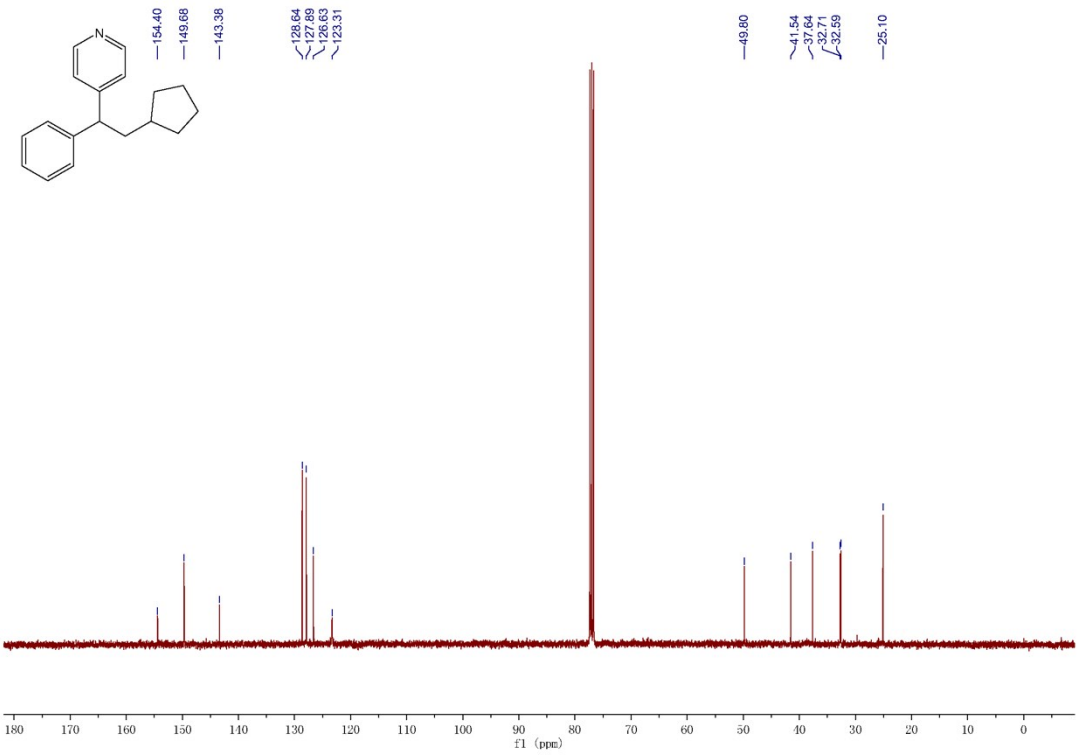
^{1}H NMR Spectrum of Compound **4** (400MHz, $CDCl_3$)



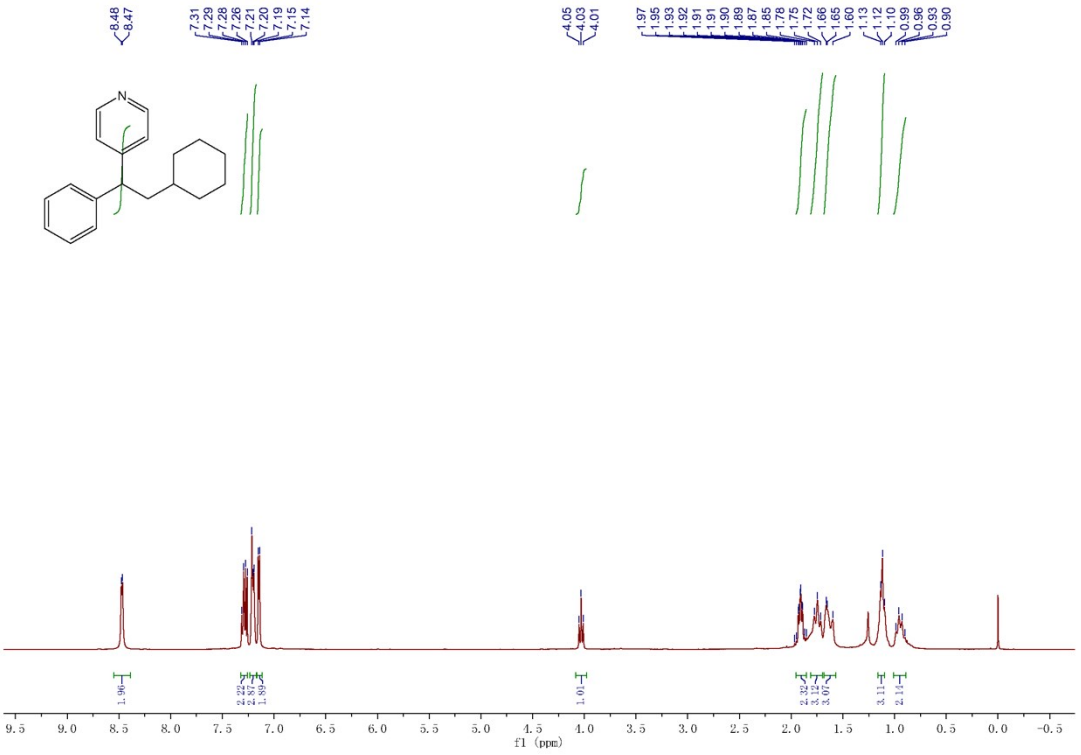
^{13}C NMR Spectrum of Compound **4** (100MHz, $CDCl_3$)



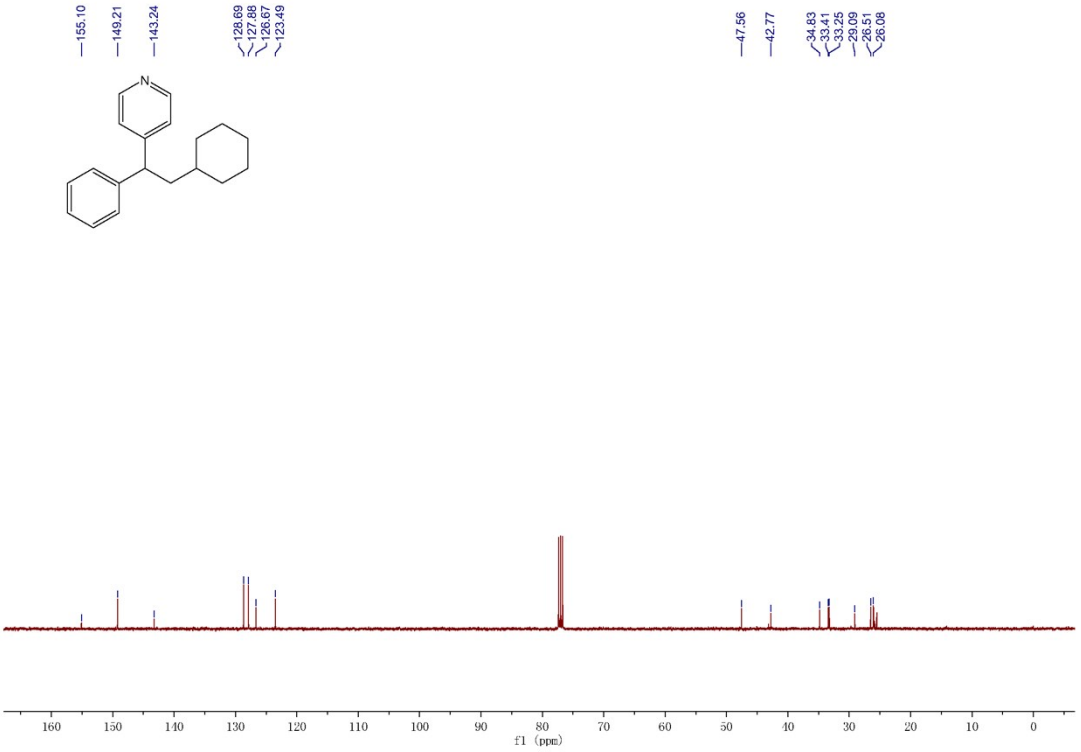
^{1}H NMR Spectrum of Compound **5** (400MHz, $CDCl_3$)



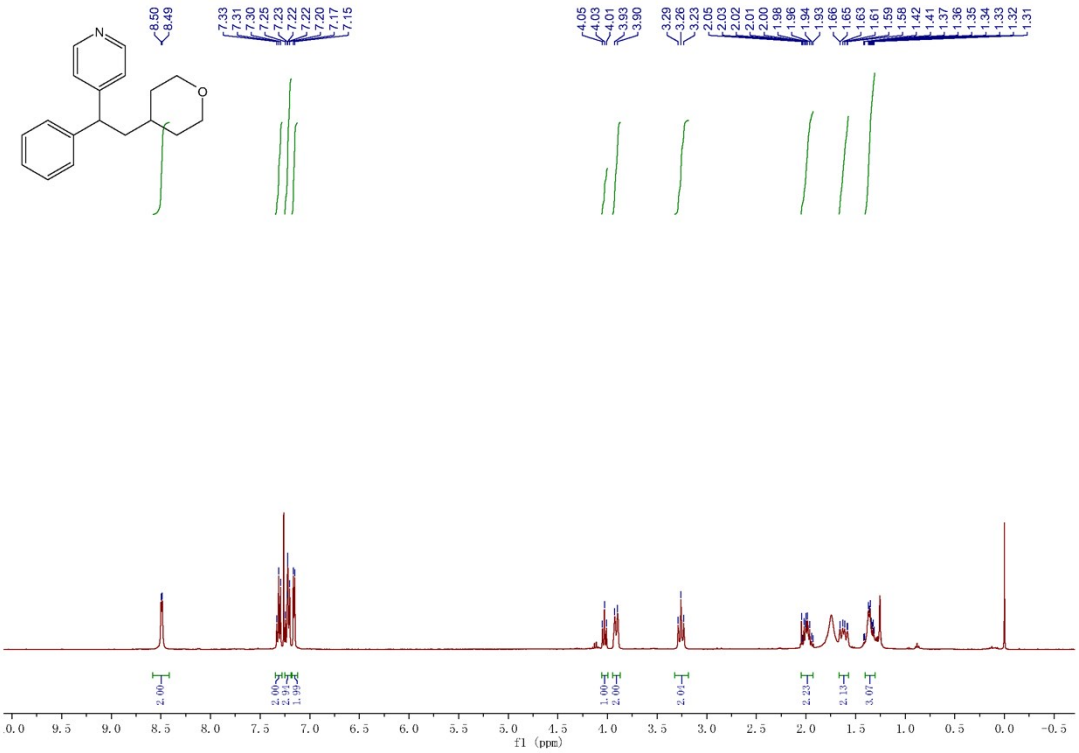
^{13}C NMR Spectrum of Compound **5** (100MHz, $CDCl_3$)



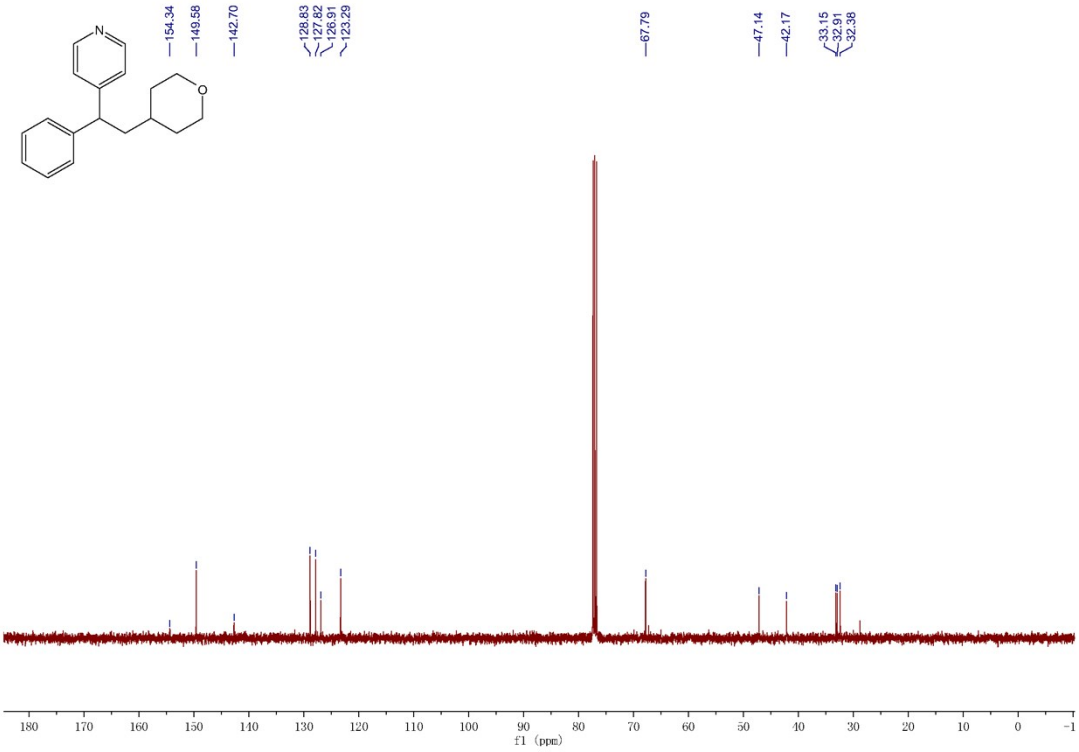
^{1}H NMR Spectrum of Compound **6** (400MHz, $CDCl_3$)



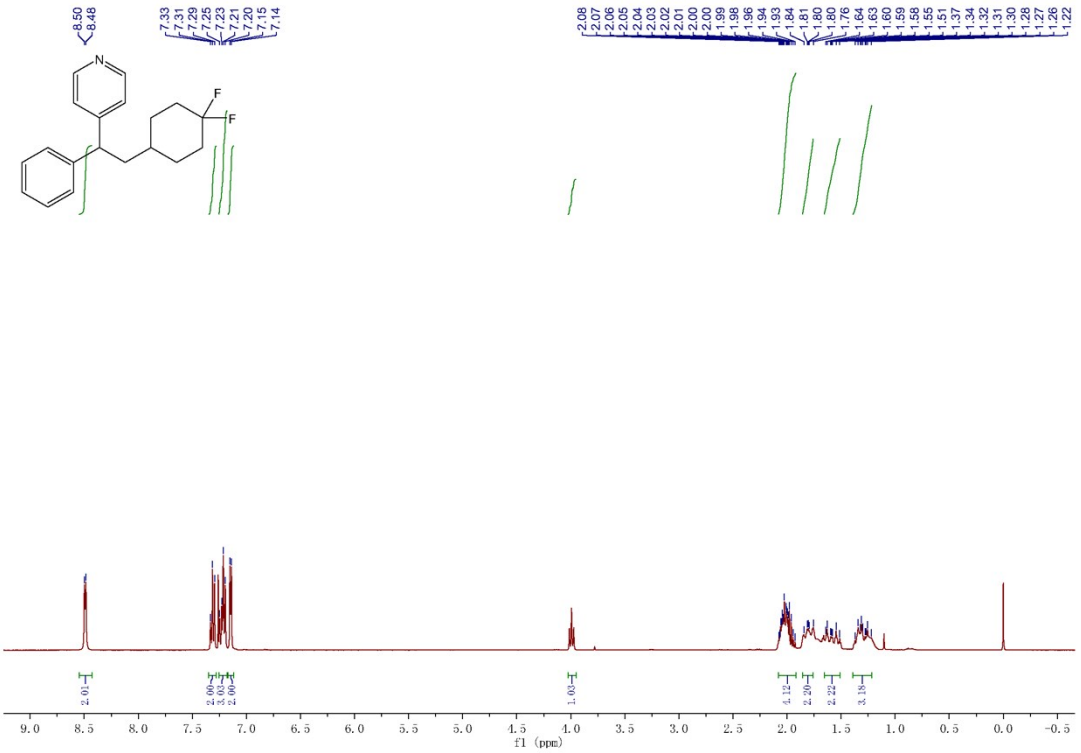
^{13}C NMR Spectrum of Compound **6** (100MHz, $CDCl_3$)



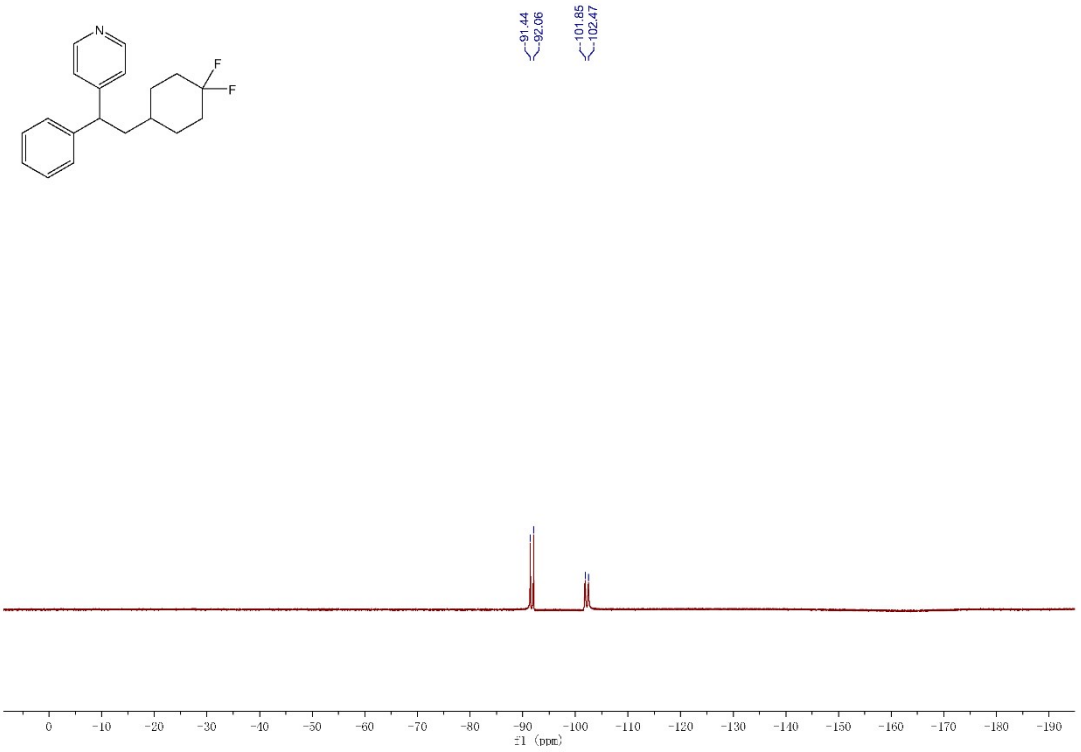
^{1}H NMR Spectrum of Compound **7** (400MHz, $CDCl_3$)



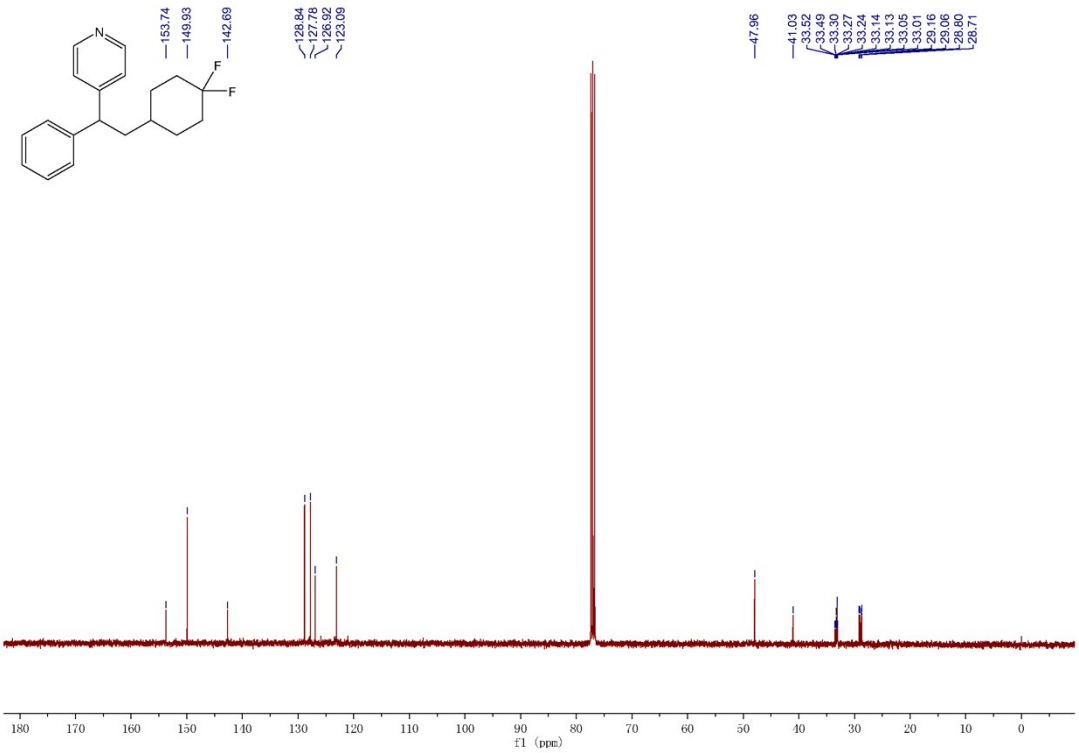
^{13}C NMR Spectrum of Compound **7** (100MHz, $CDCl_3$)



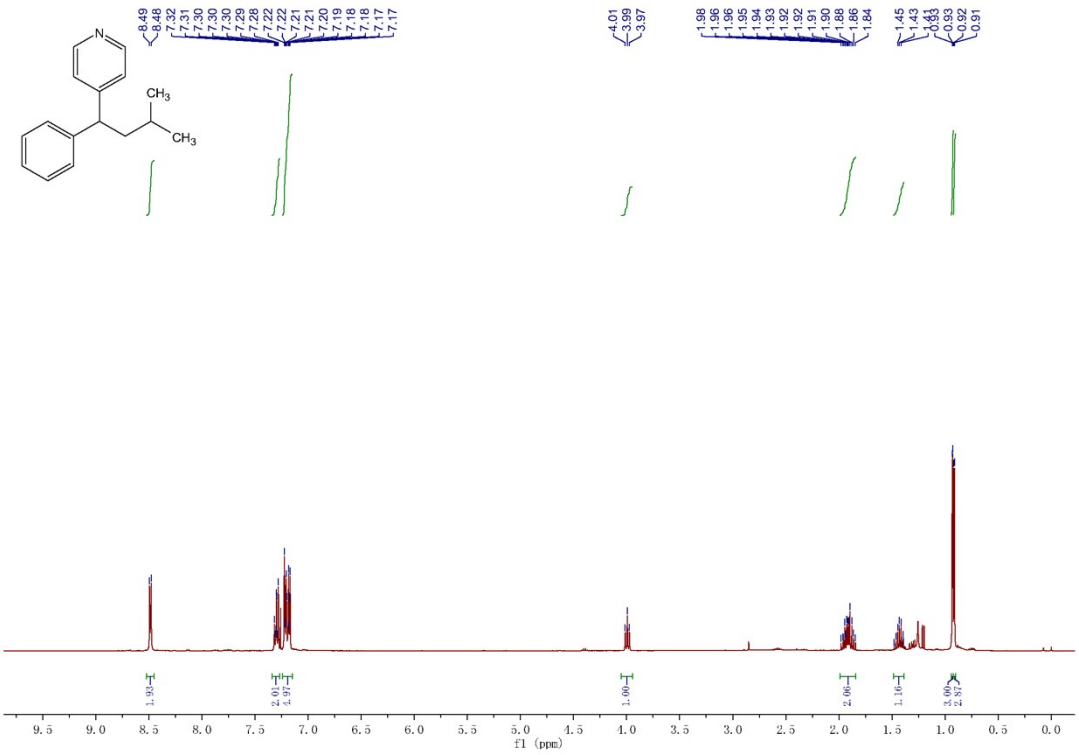
^{1}H NMR Spectrum of Compound **8** (400MHz, $CDCl_3$)



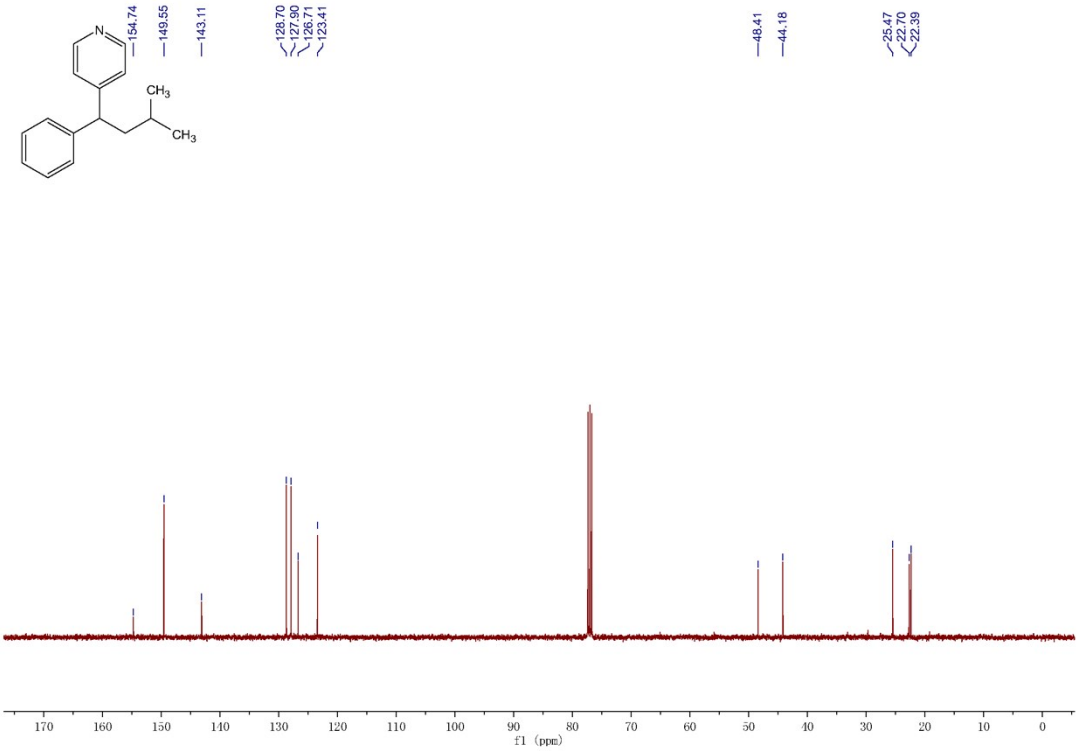
^{19}F NMR Spectrum of Compound **8** (377MHz, $CDCl_3$)



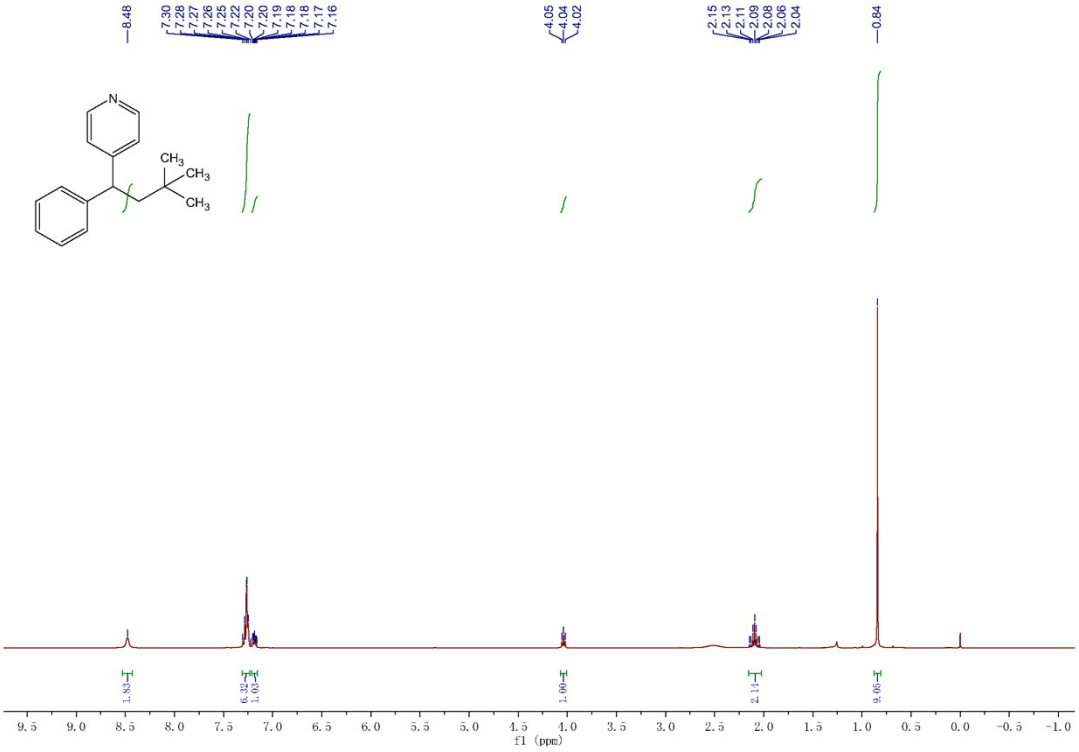
^{13}C NMR Spectrum of Compound **8** (100MHz, $CDCl_3$)



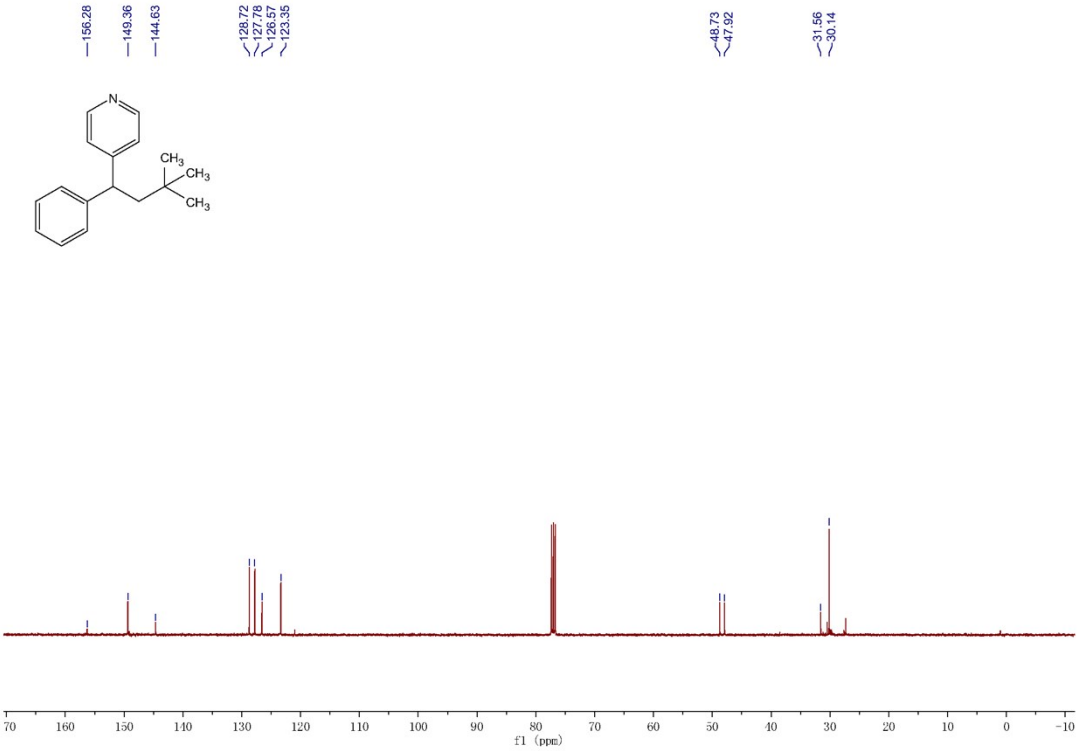
^{1}H NMR Spectrum of Compound **9** (400MHz, $CDCl_3$)



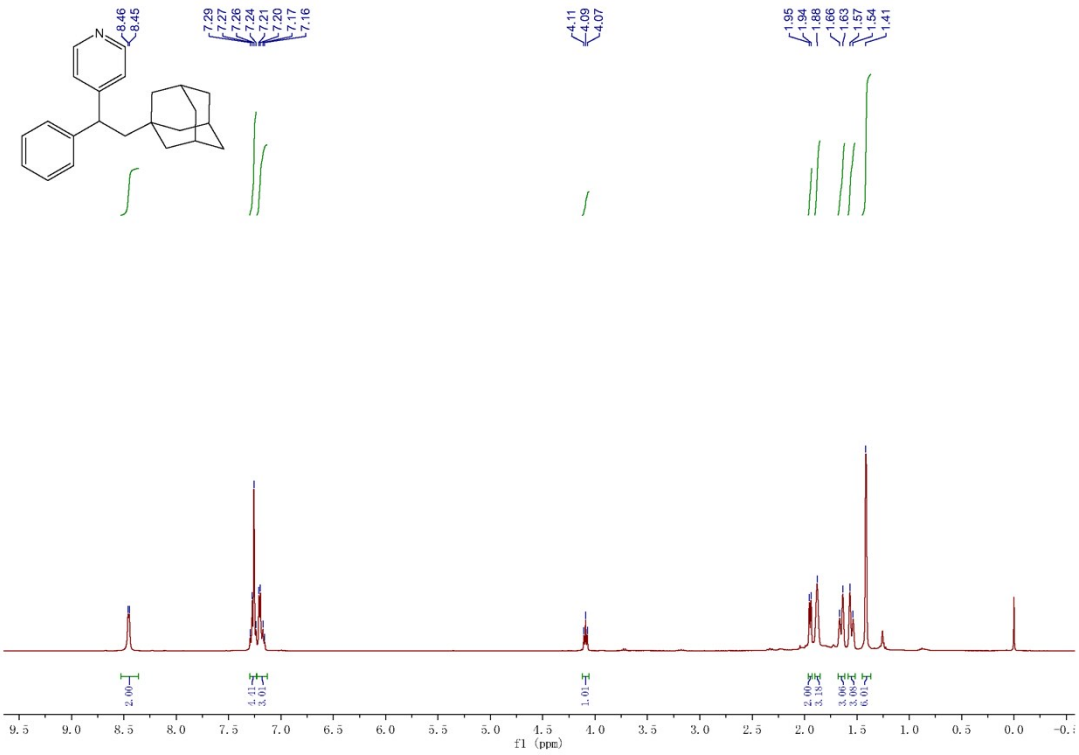
^{13}C NMR Spectrum of Compound **9** (100MHz, $CDCl_3$)



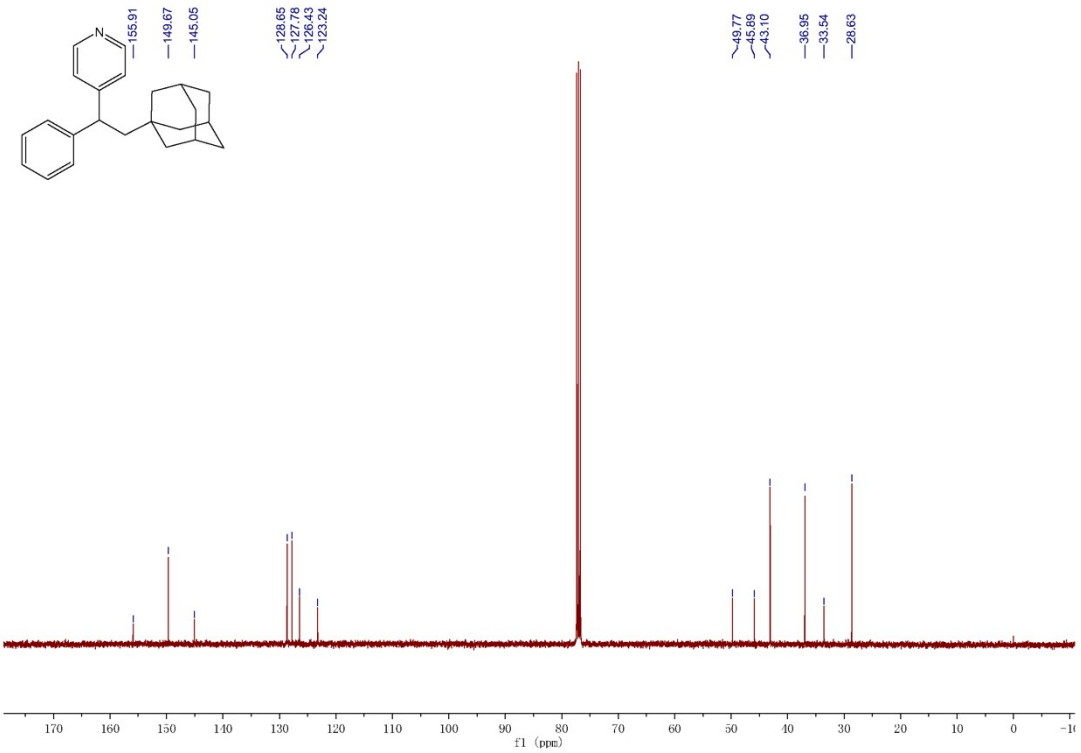
^{1}H NMR Spectrum of Compound **10** (400MHz, $CDCl_3$)



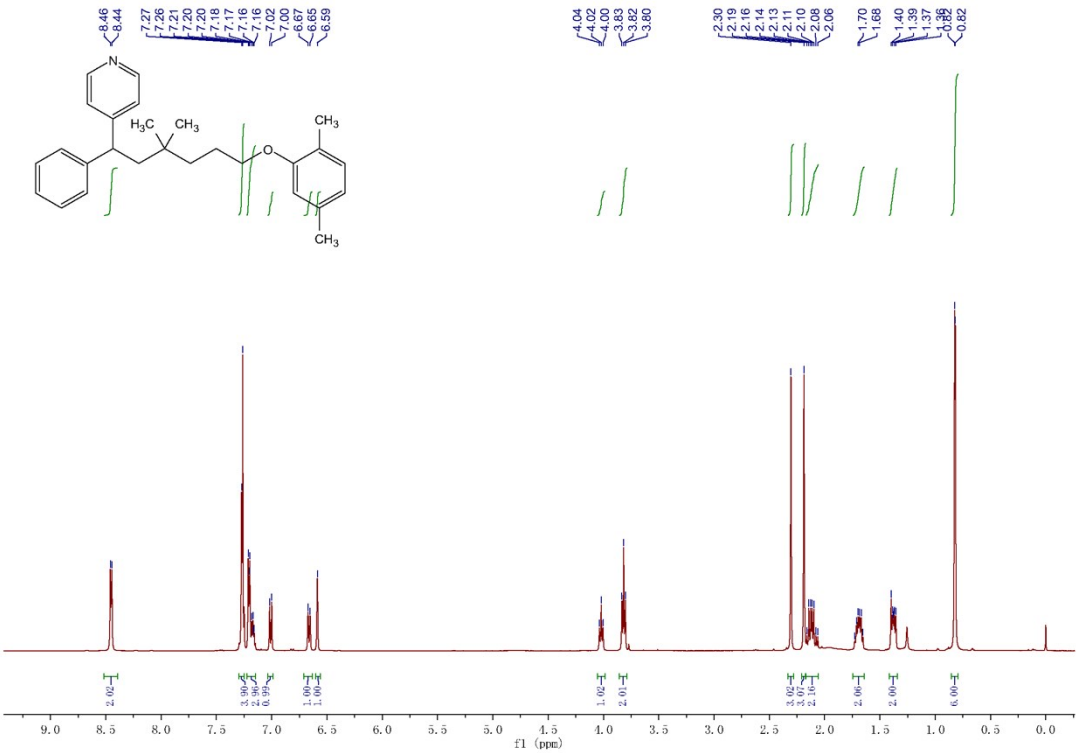
^{13}C NMR Spectrum of Compound **10** (100MHz, $CDCl_3$)



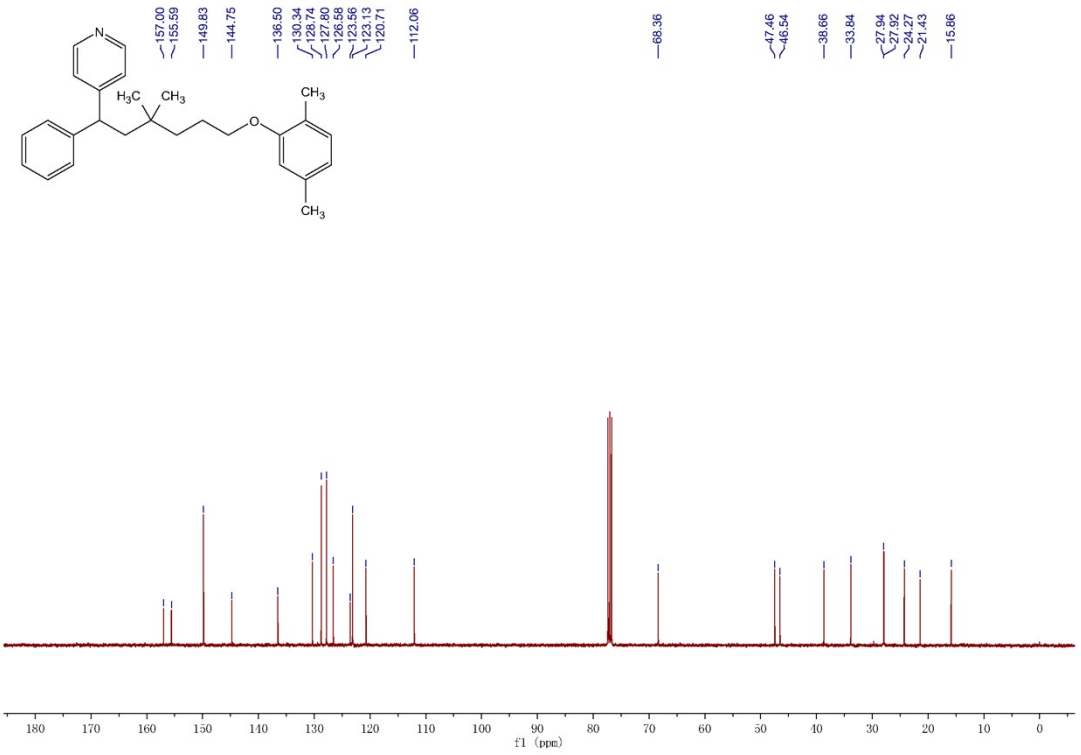
^{1}H NMR Spectrum of Compound **11** (400MHz, $CDCl_3$)



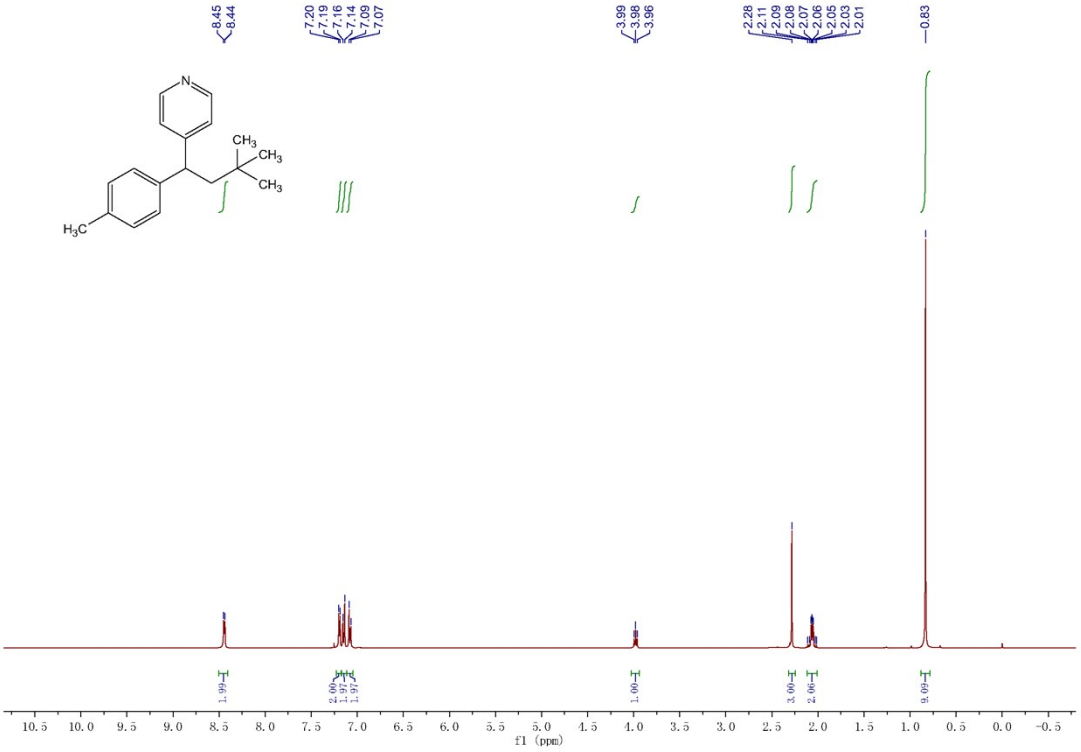
^{13}C NMR Spectrum of Compound **11** (100MHz, $CDCl_3$)



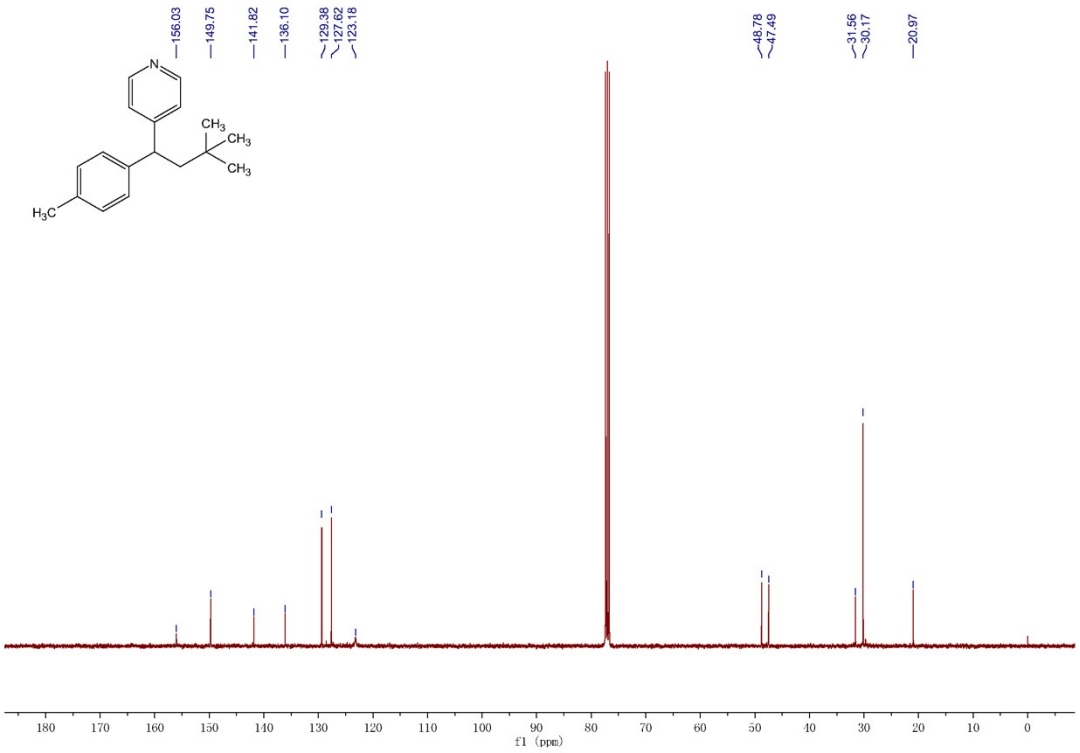
^{1}H NMR Spectrum of Compound **12** (400MHz, $CDCl_3$)



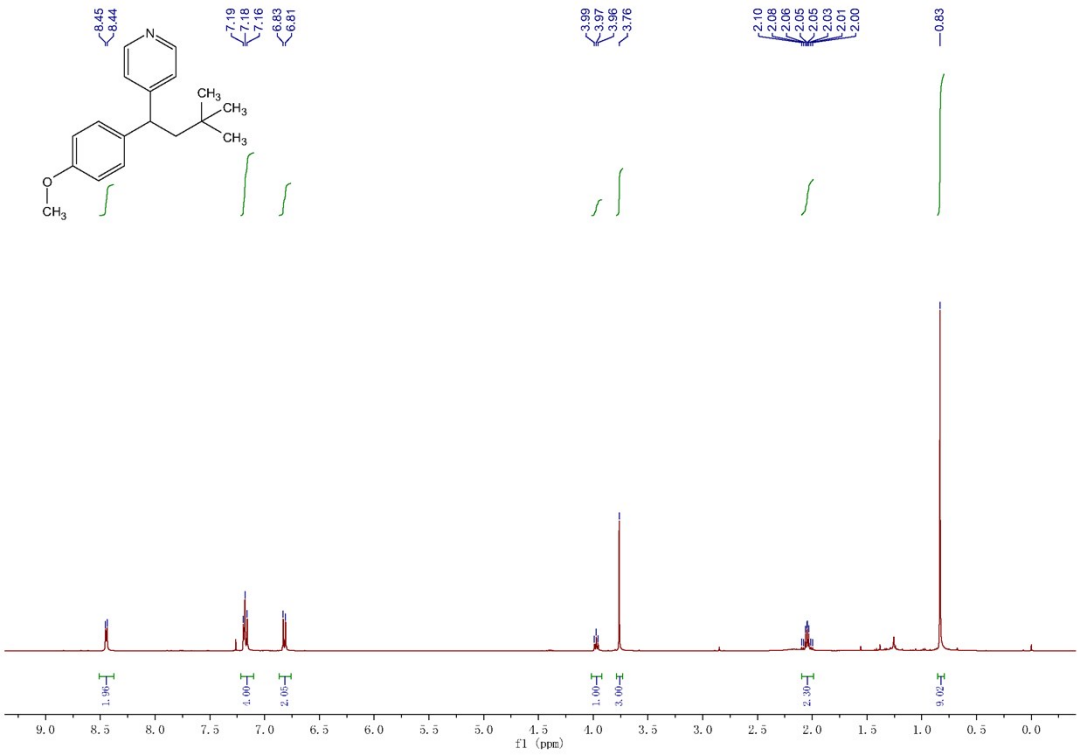
^{13}C NMR Spectrum of Compound **12** (100MHz, $CDCl_3$)



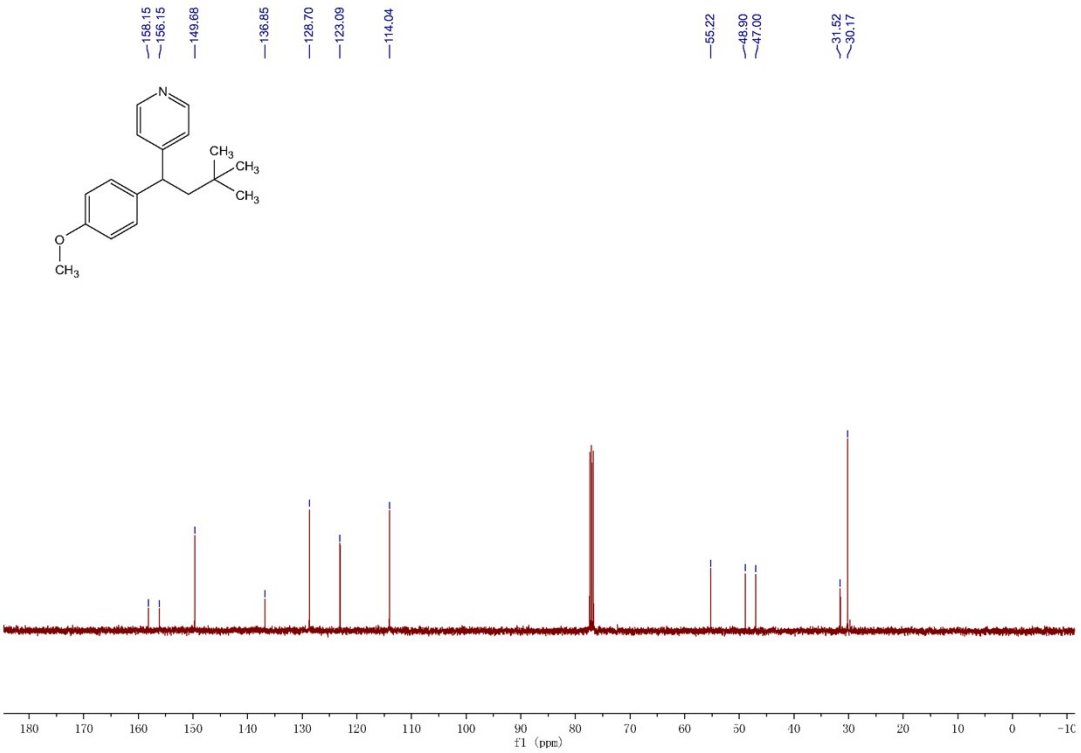
^{1}H NMR Spectrum of Compound **13** (400MHz, $CDCl_3$)



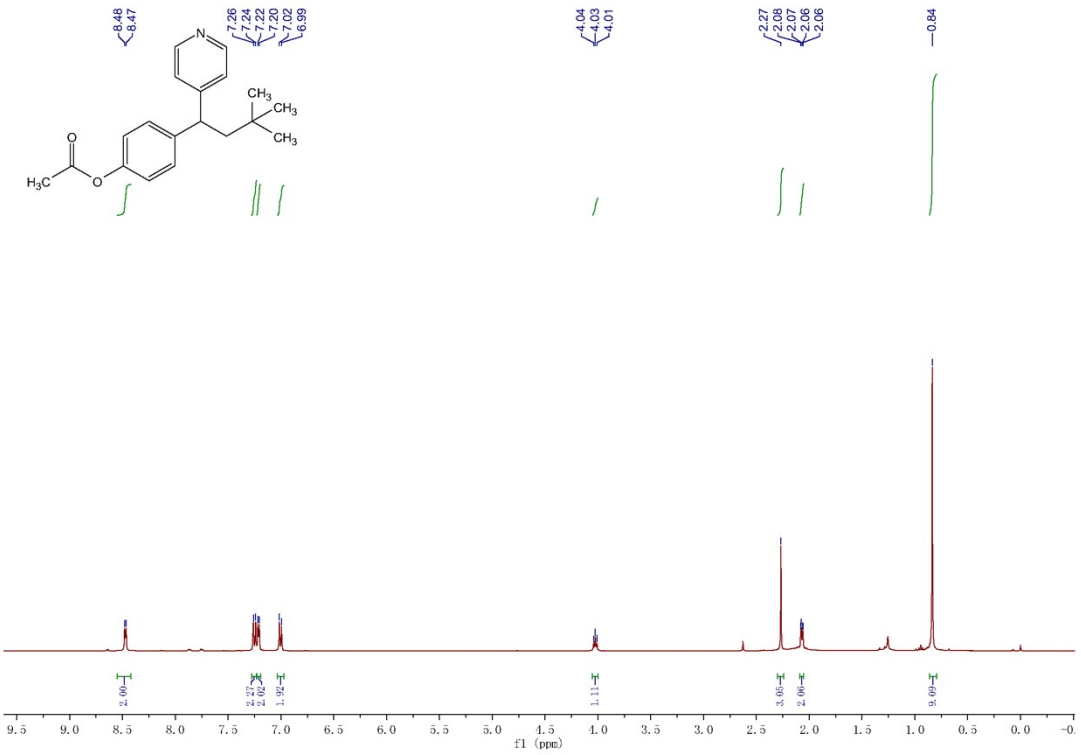
^{13}C NMR Spectrum of Compound **13** (100MHz, $CDCl_3$)



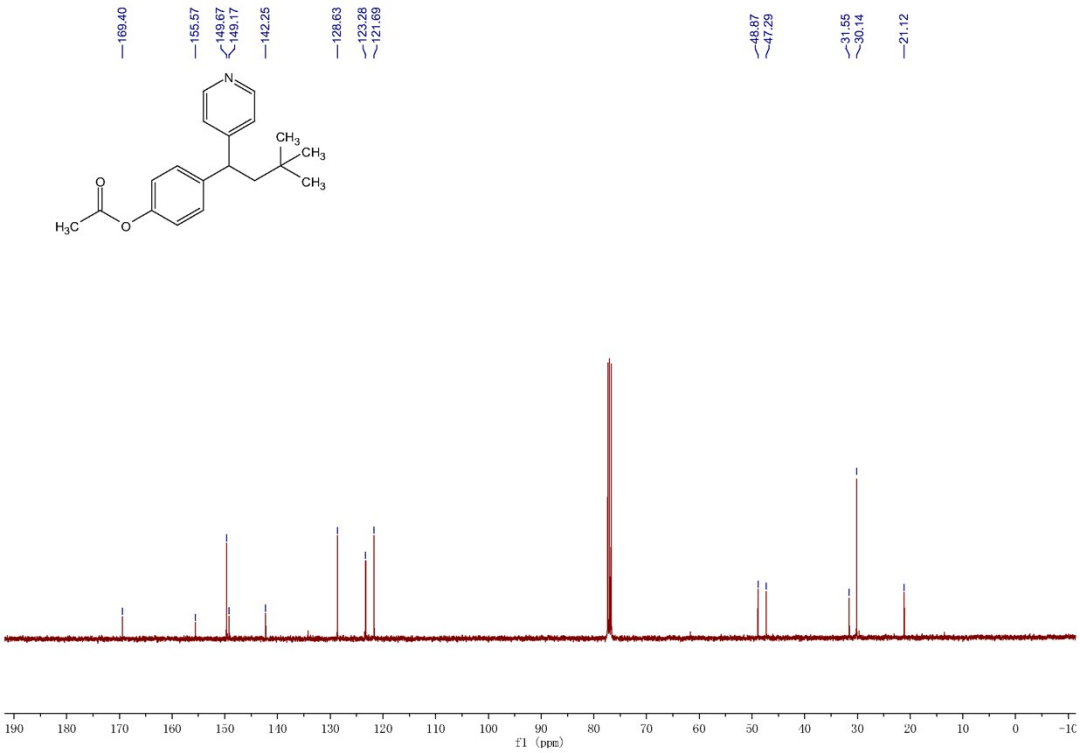
^{1}H NMR Spectrum of Compound **14** (400MHz, $CDCl_3$)



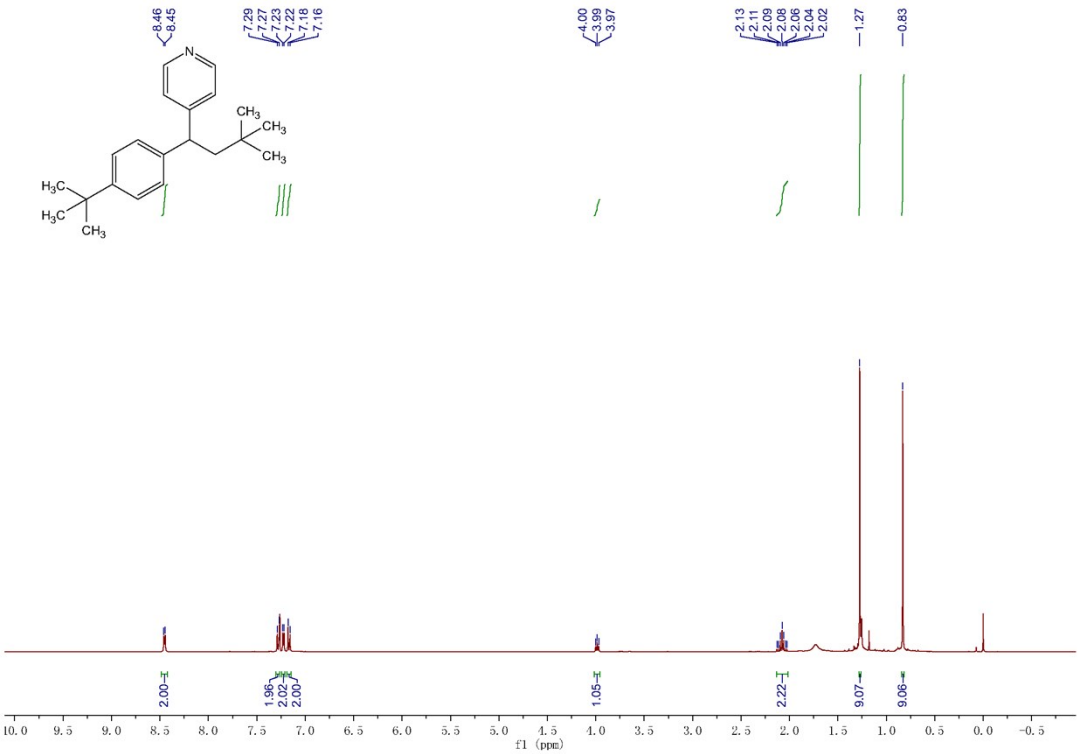
^{13}C NMR Spectrum of Compound **14** (100MHz, $CDCl_3$)



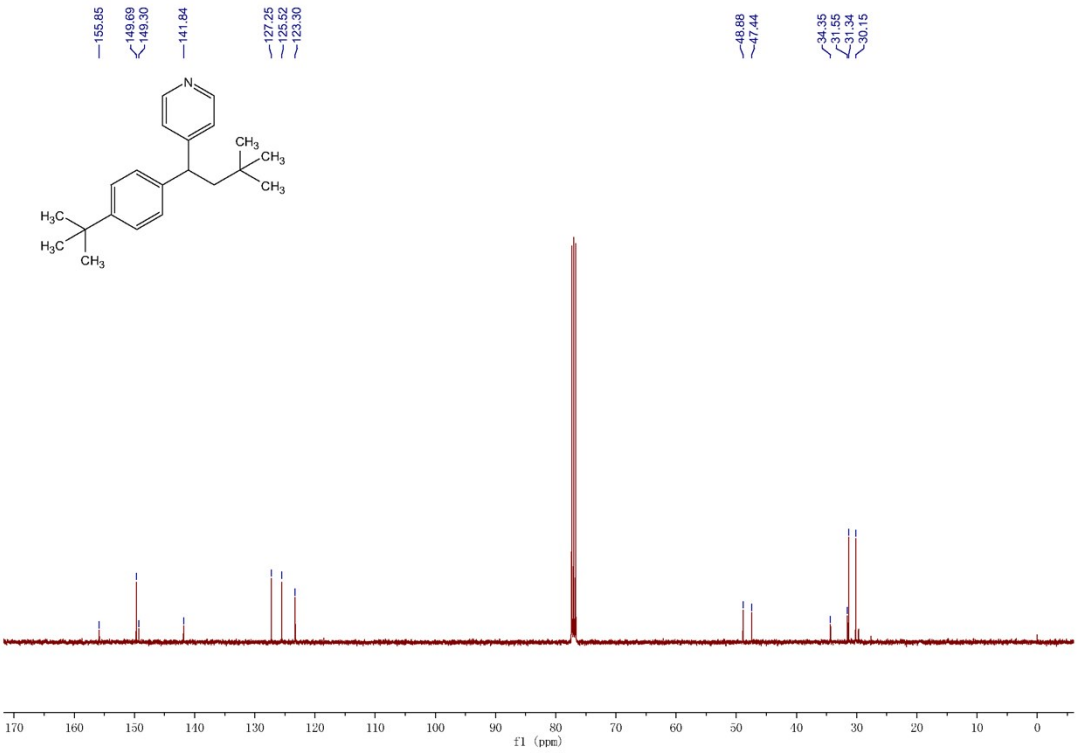
^{1}H NMR Spectrum of Compound **15** (400MHz, $CDCl_3$)



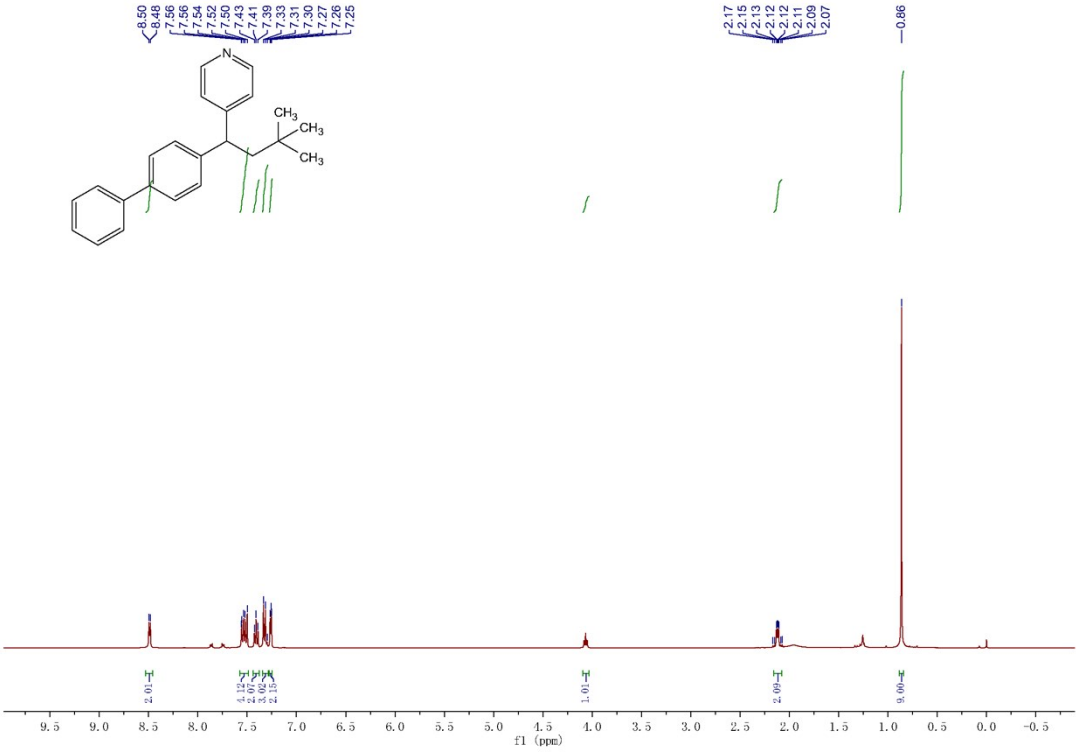
^{13}C NMR Spectrum of Compound **15** (100MHz, $CDCl_3$)



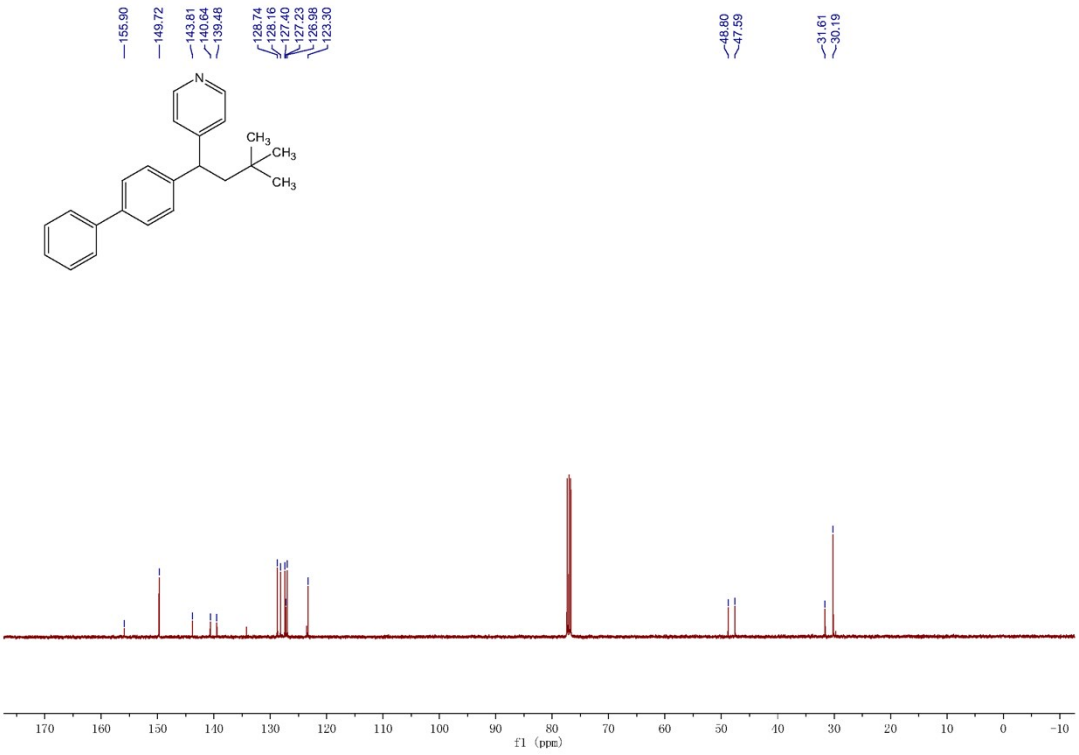
^{1}H NMR Spectrum of Compound **16** (400MHz, $CDCl_3$)



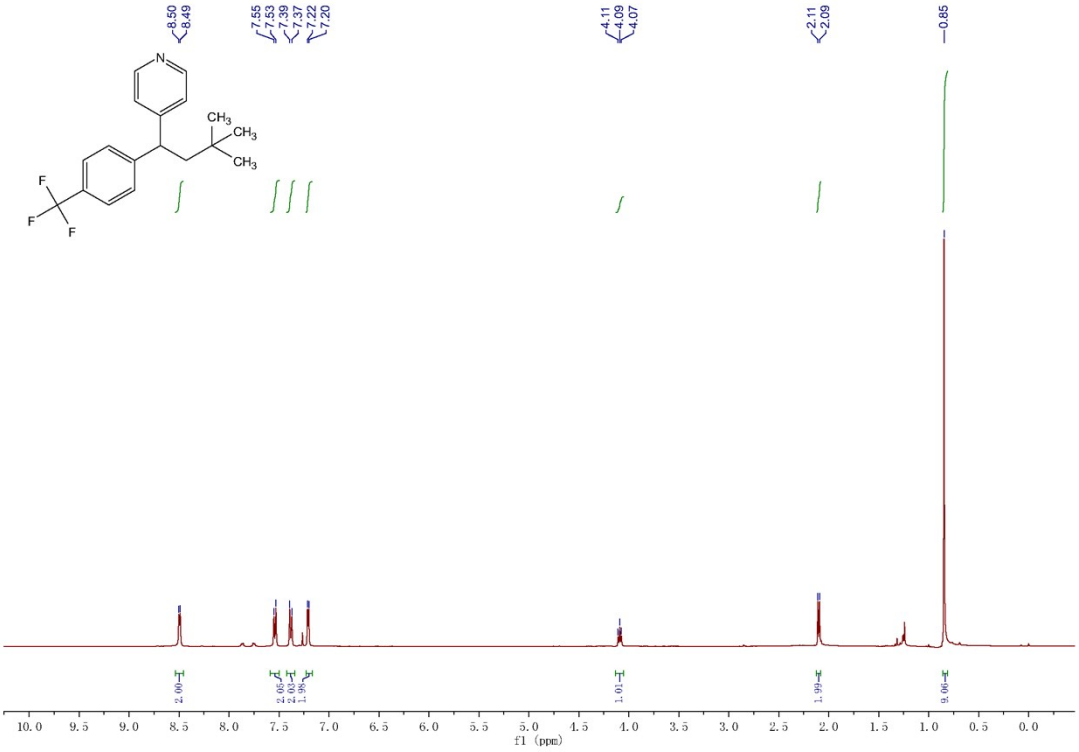
^{13}C NMR Spectrum of Compound **16** (100MHz, $CDCl_3$)



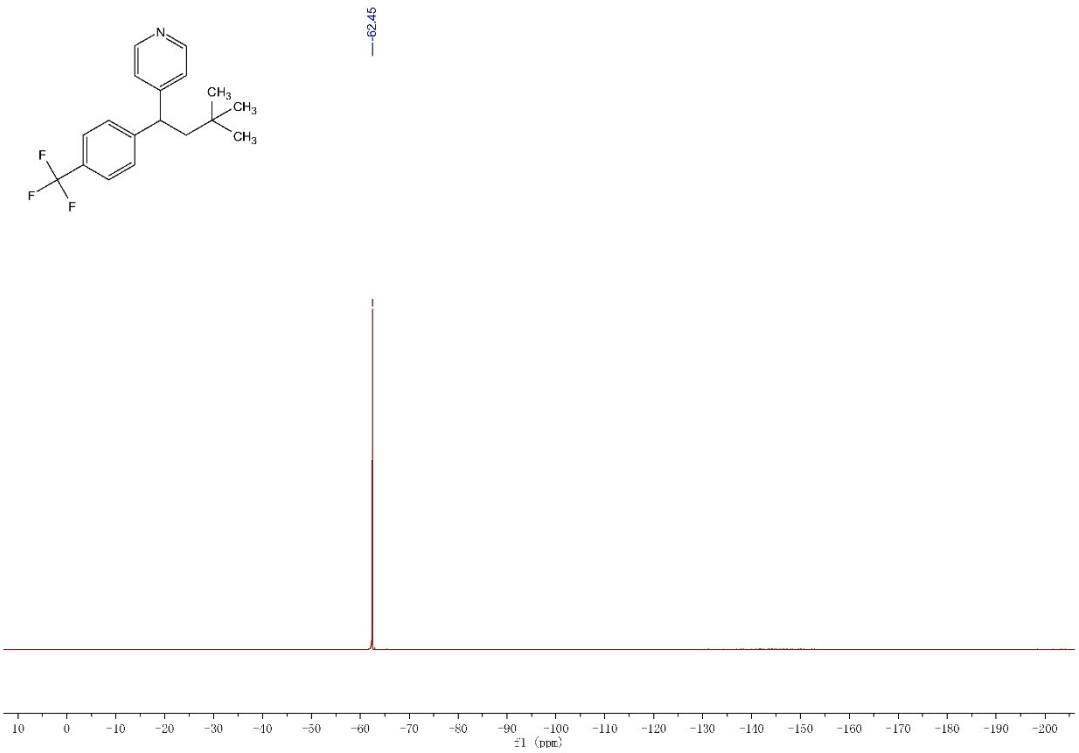
^{1}H NMR Spectrum of Compound **17** (400MHz, $CDCl_3$)



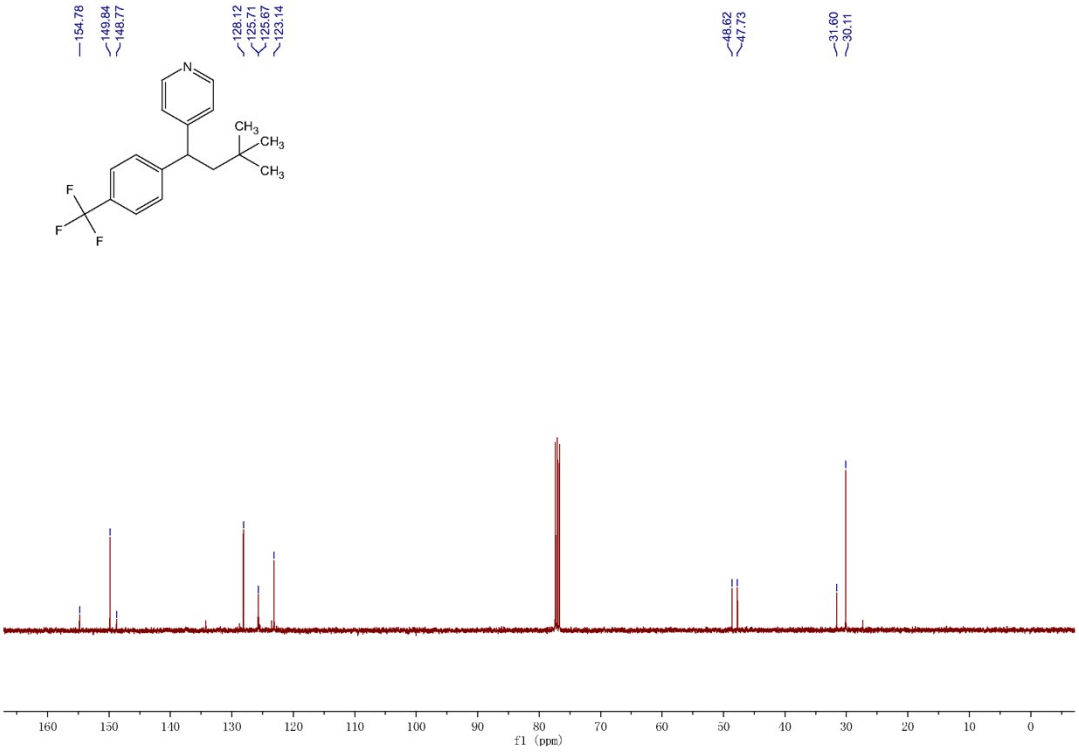
^{13}C NMR Spectrum of Compound **17** (100MHz, $CDCl_3$)



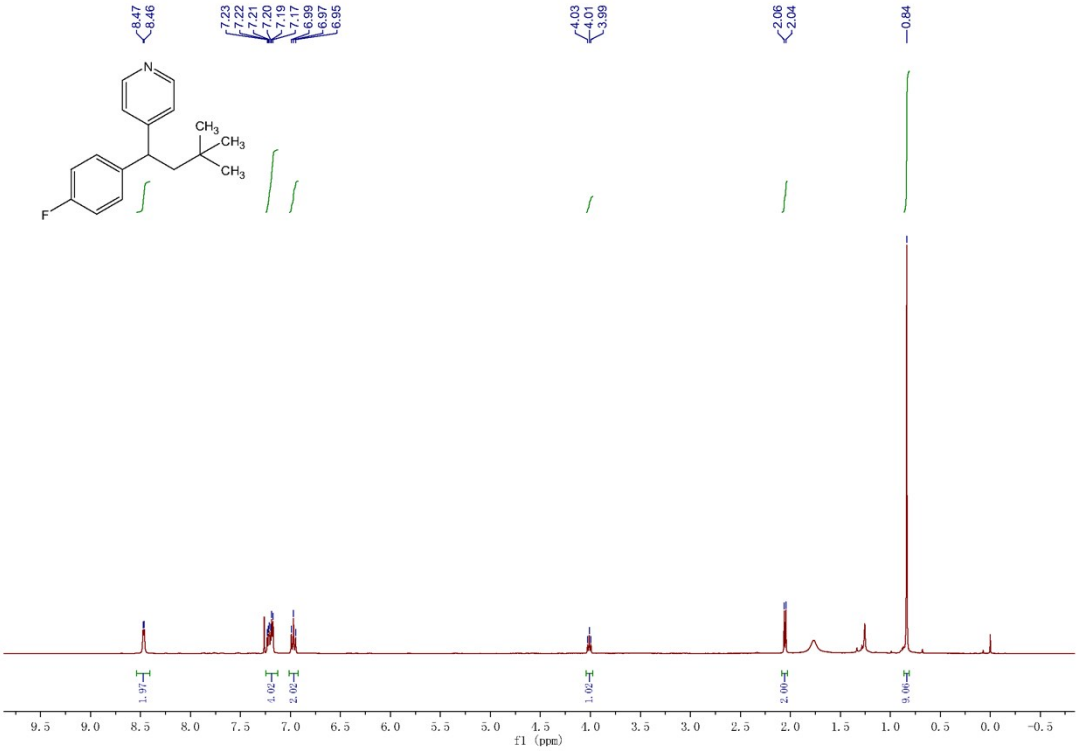
^{1}H NMR Spectrum of Compound **18** (400MHz, $CDCl_3$)



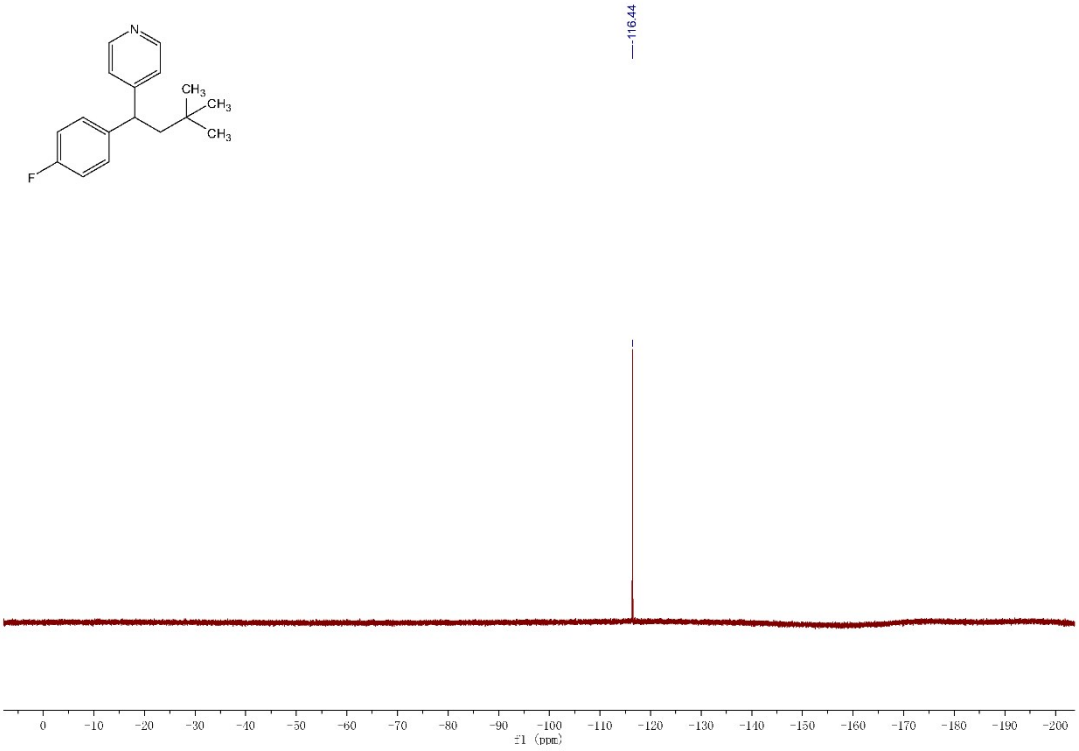
^{19}F NMR Spectrum of Compound **18** (377MHz, $CDCl_3$)



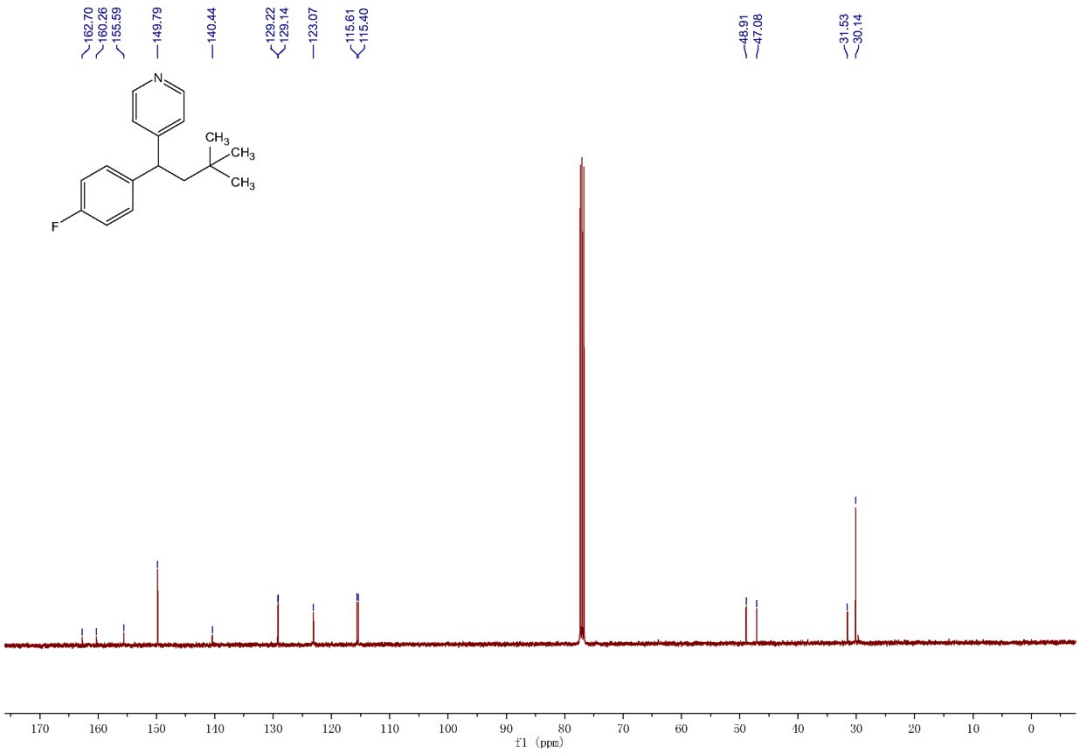
^{13}C NMR Spectrum of Compound **18** (100MHz, $CDCl_3$)



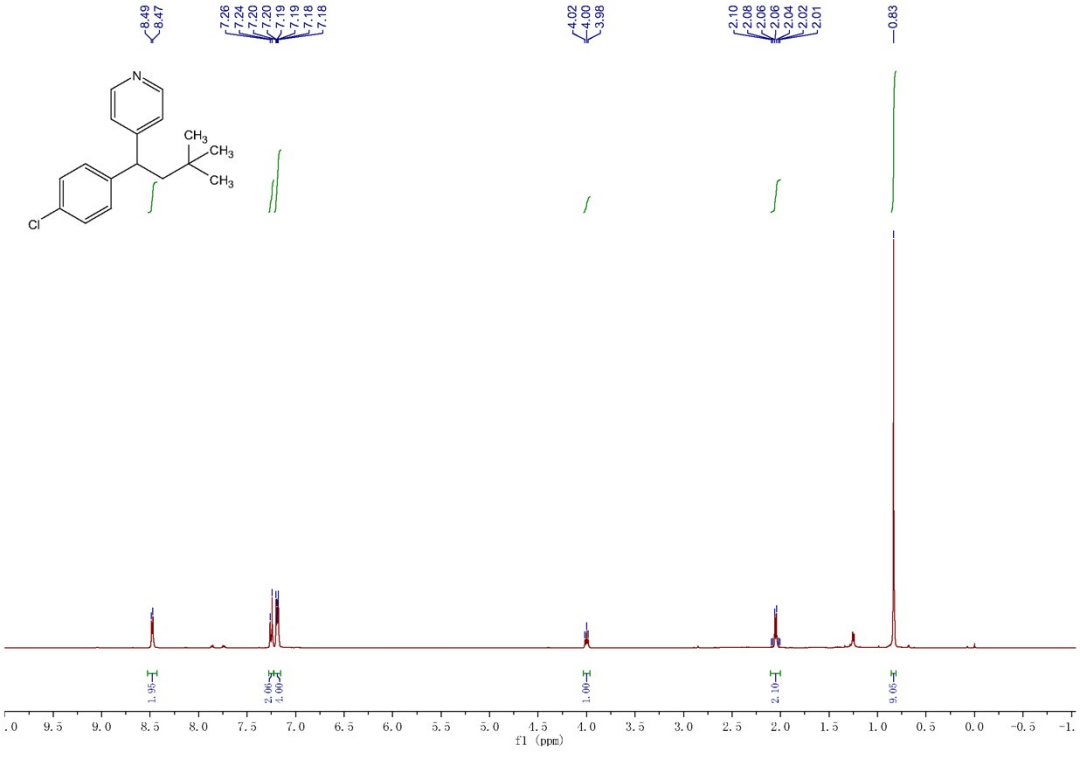
^{1}H NMR Spectrum of Compound **19** (400MHz, $CDCl_3$)



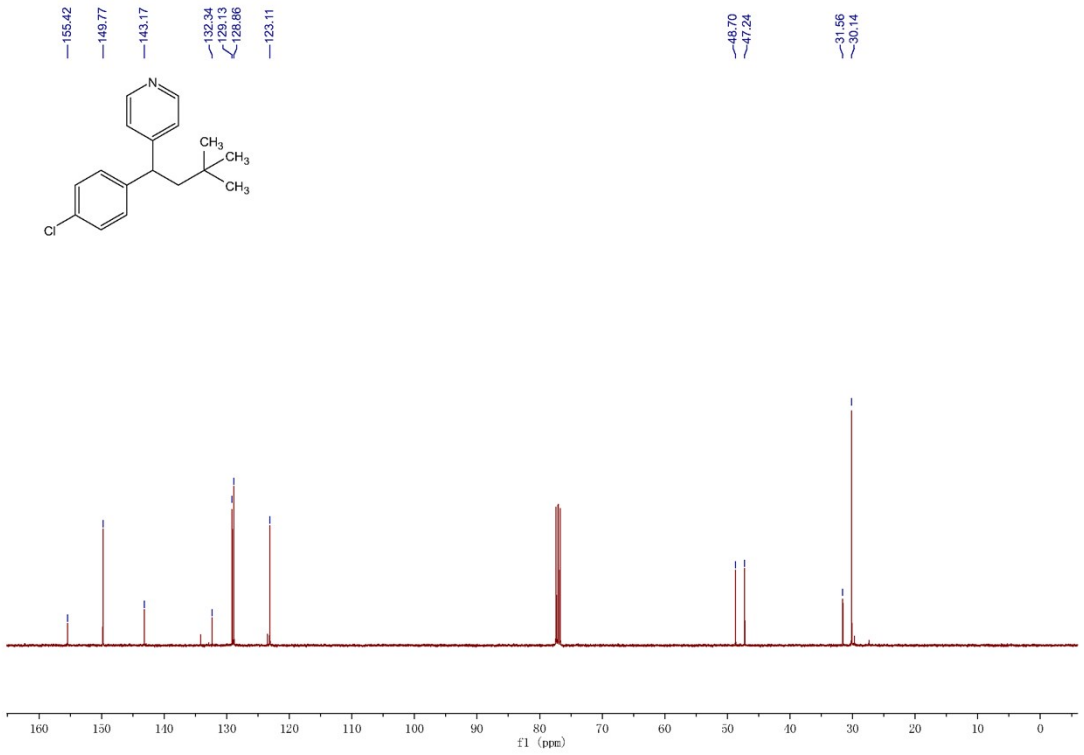
^{19}F NMR Spectrum of Compound **19** (377MHz, $CDCl_3$)



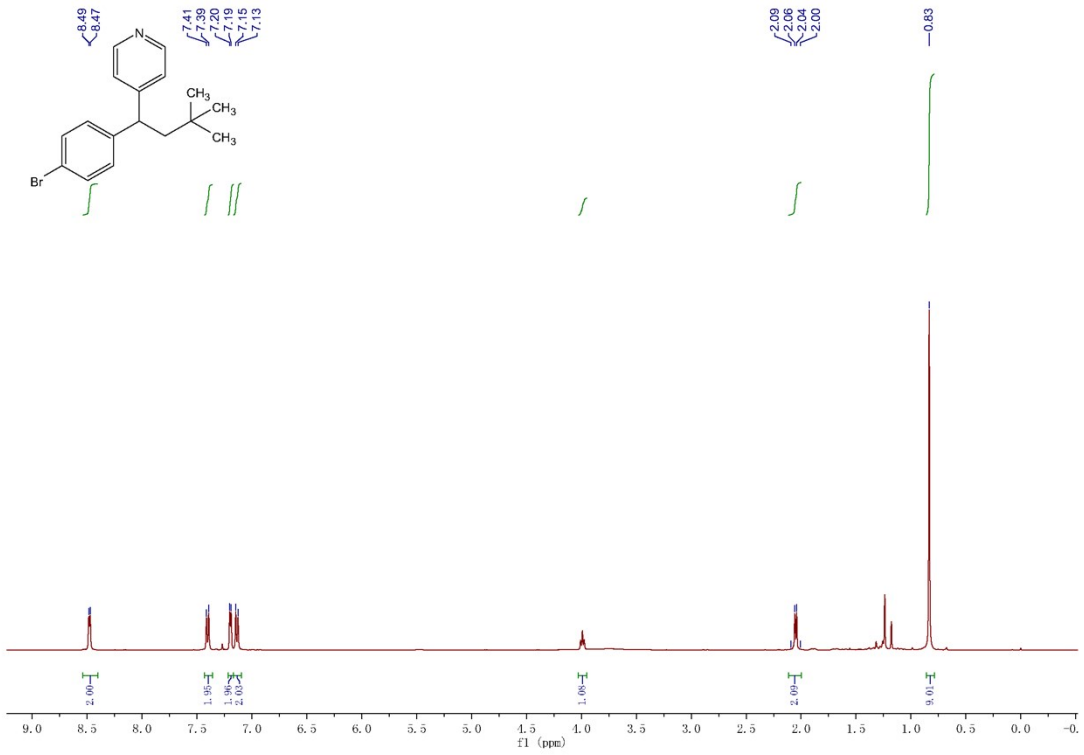
^{13}C NMR Spectrum of Compound **19** (100MHz, $CDCl_3$)



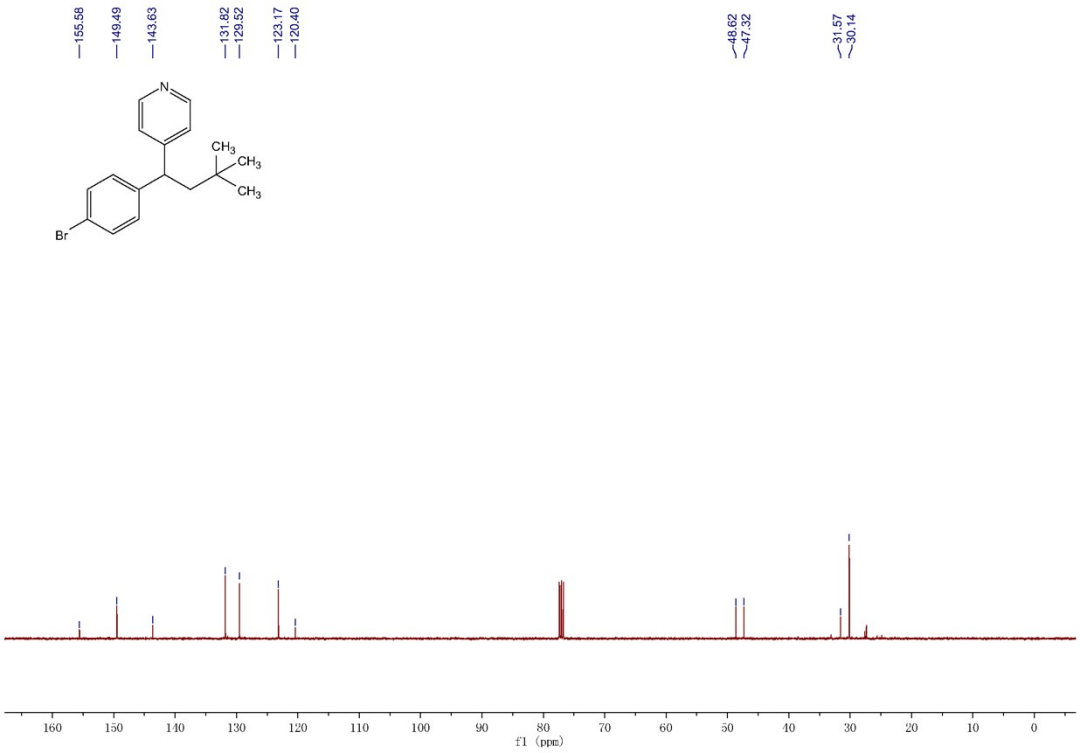
^{1}H NMR Spectrum of Compound **20** (400MHz, $CDCl_3$)



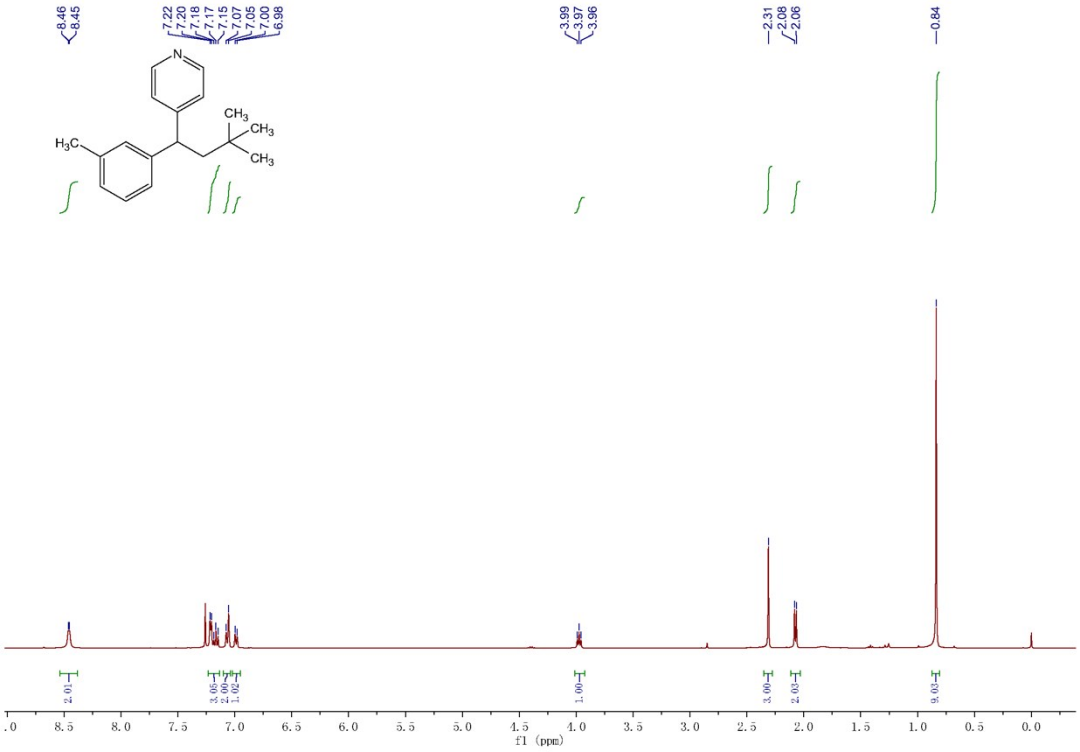
^{13}C NMR Spectrum of Compound **20** (100MHz, $CDCl_3$)



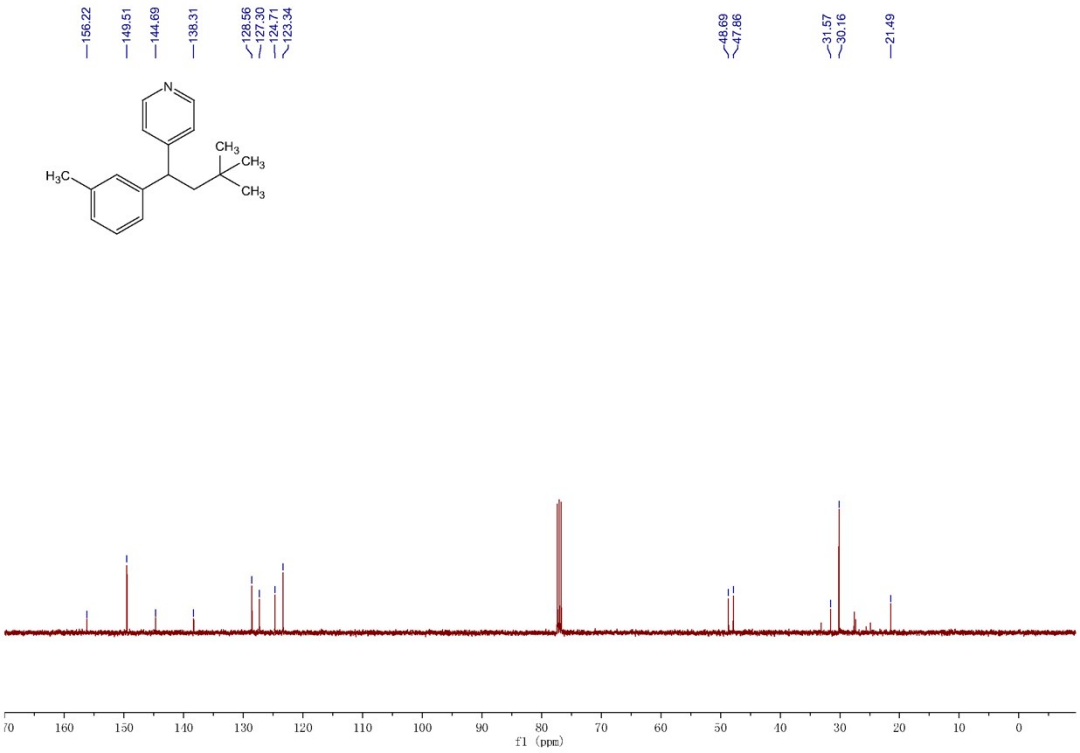
^{1}H NMR Spectrum of Compound **21** (400MHz, $CDCl_3$)



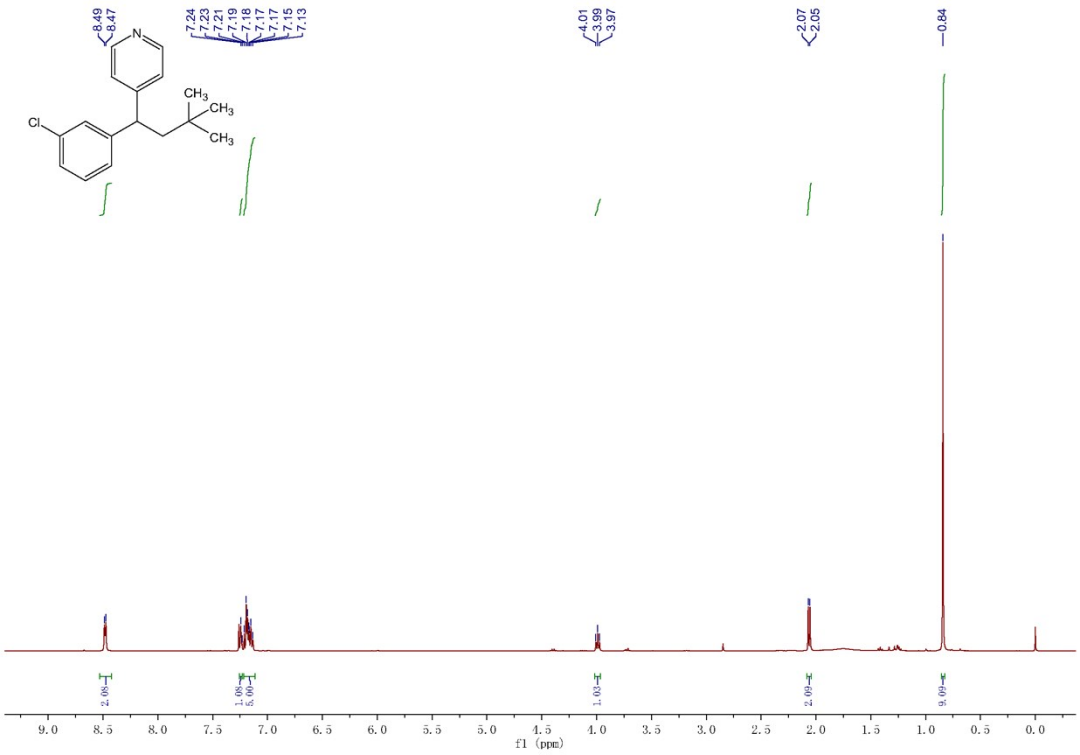
^{13}C NMR Spectrum of Compound **21** (100MHz, $CDCl_3$)



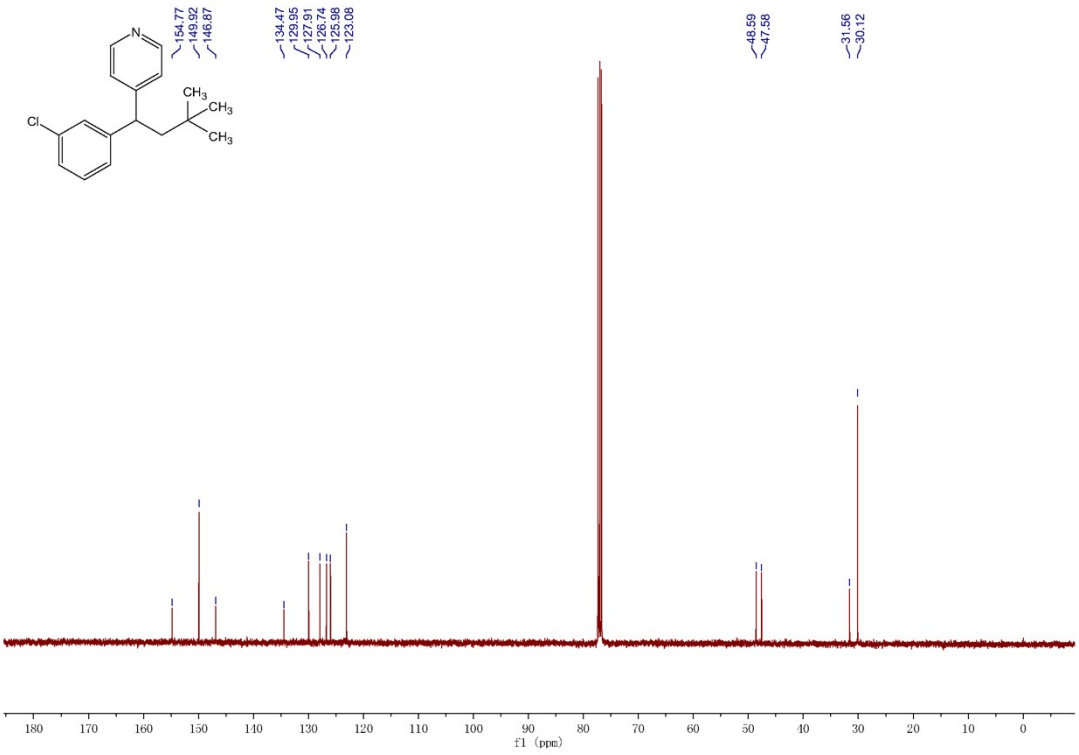
^{1}H NMR Spectrum of Compound **22** (400MHz, $CDCl_3$)



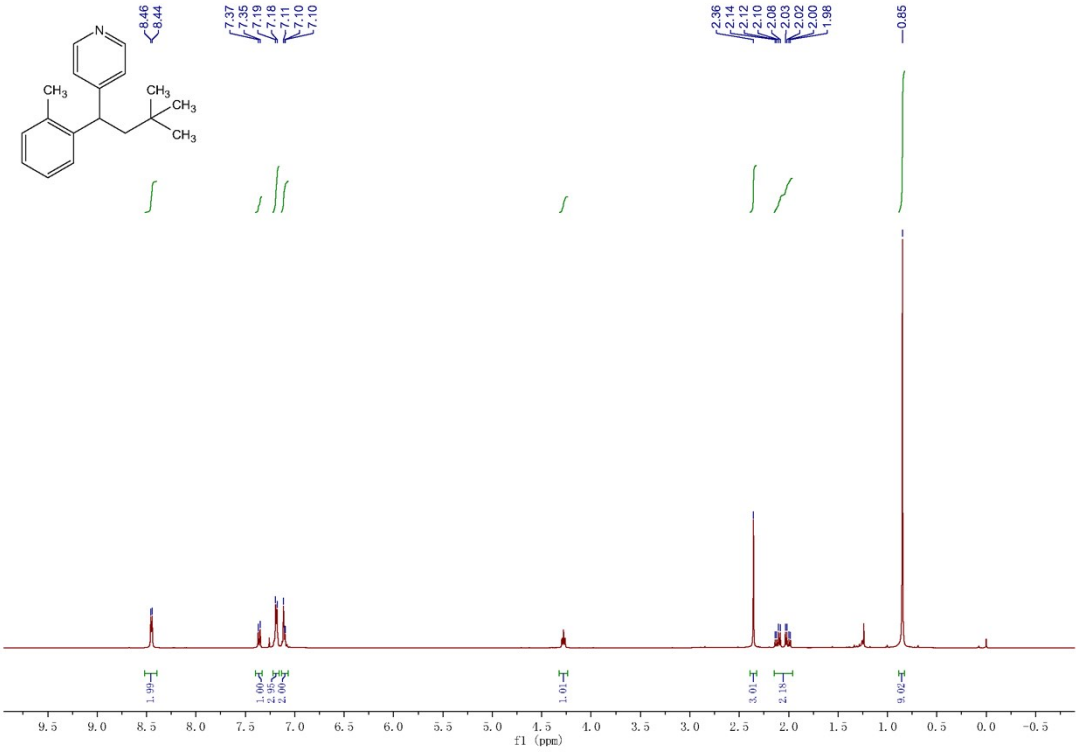
^{13}C NMR Spectrum of Compound **22** (100MHz, $CDCl_3$)



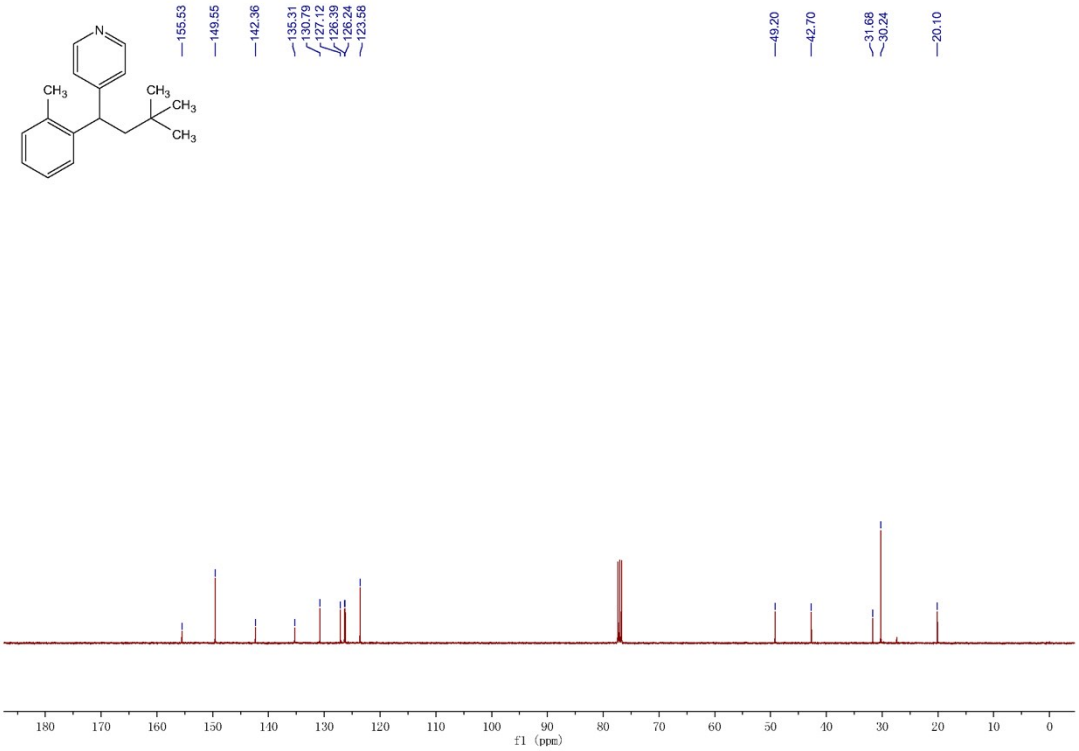
^{1}H NMR Spectrum of Compound **23** (400MHz, $CDCl_3$)



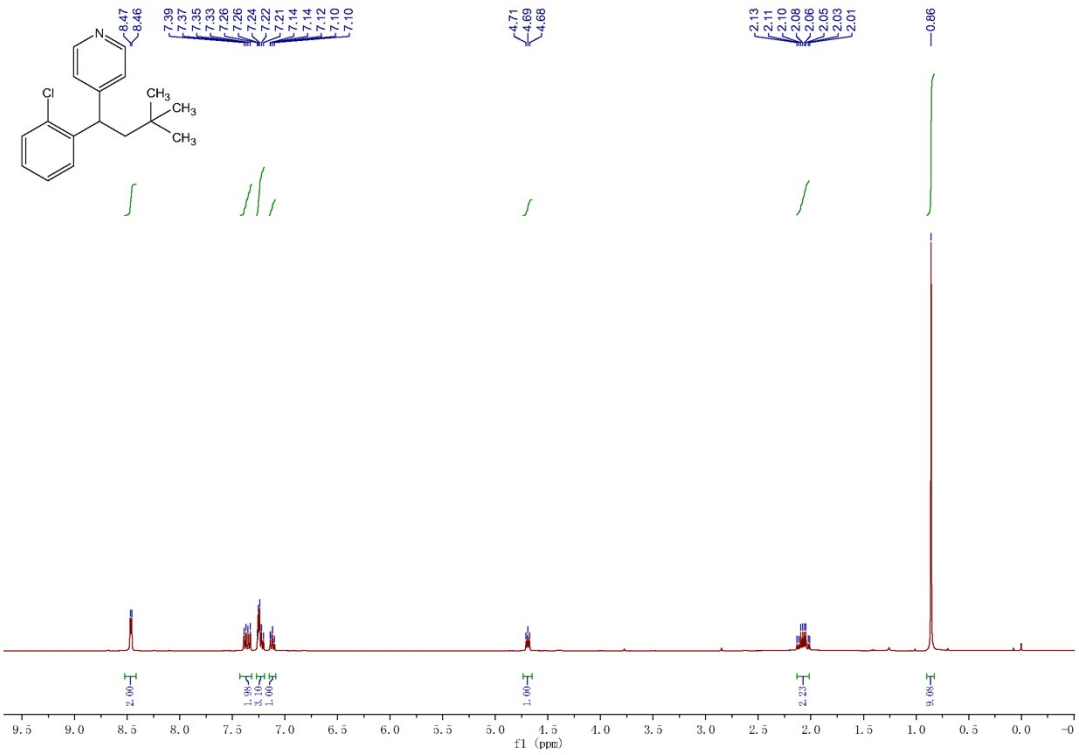
^{13}C NMR Spectrum of Compound **23** (100MHz, $CDCl_3$)



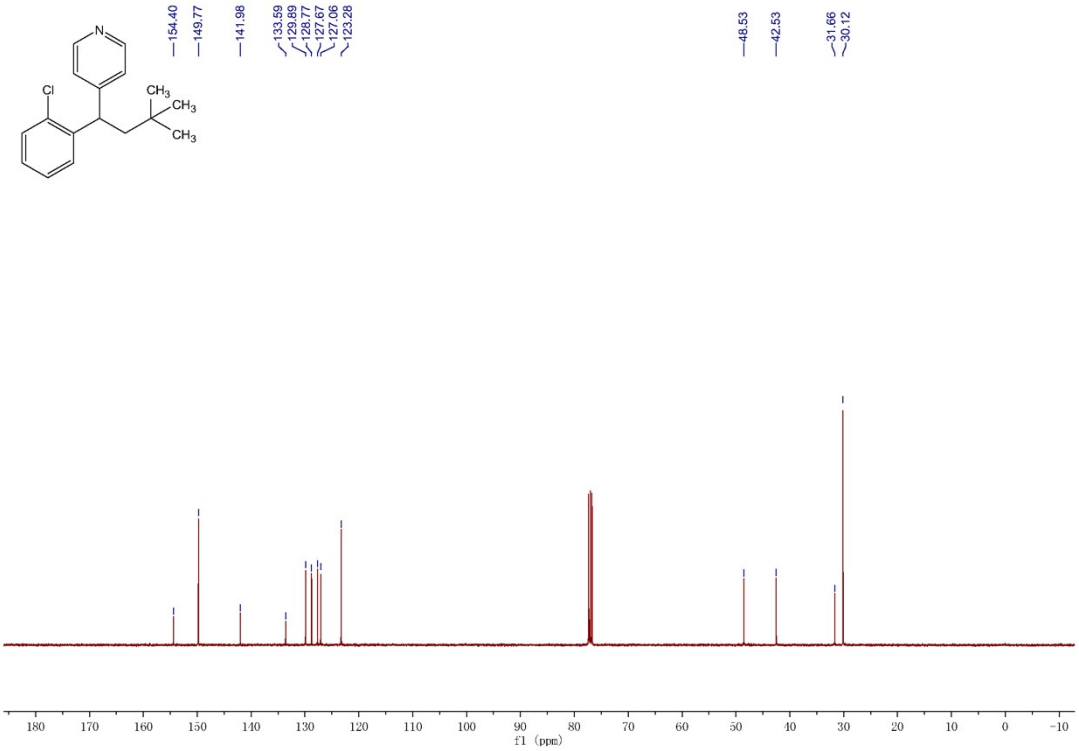
^{1}H NMR Spectrum of Compound **24** (400MHz, $CDCl_3$)



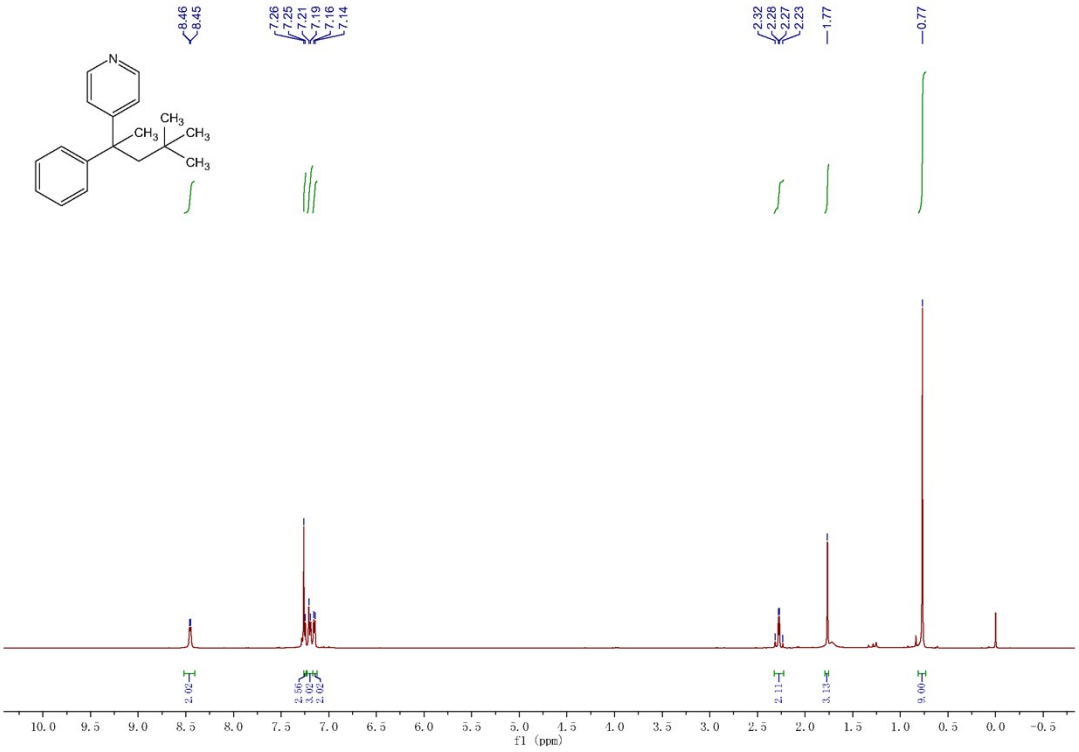
^{13}C NMR Spectrum of Compound **24** (100MHz, $CDCl_3$)



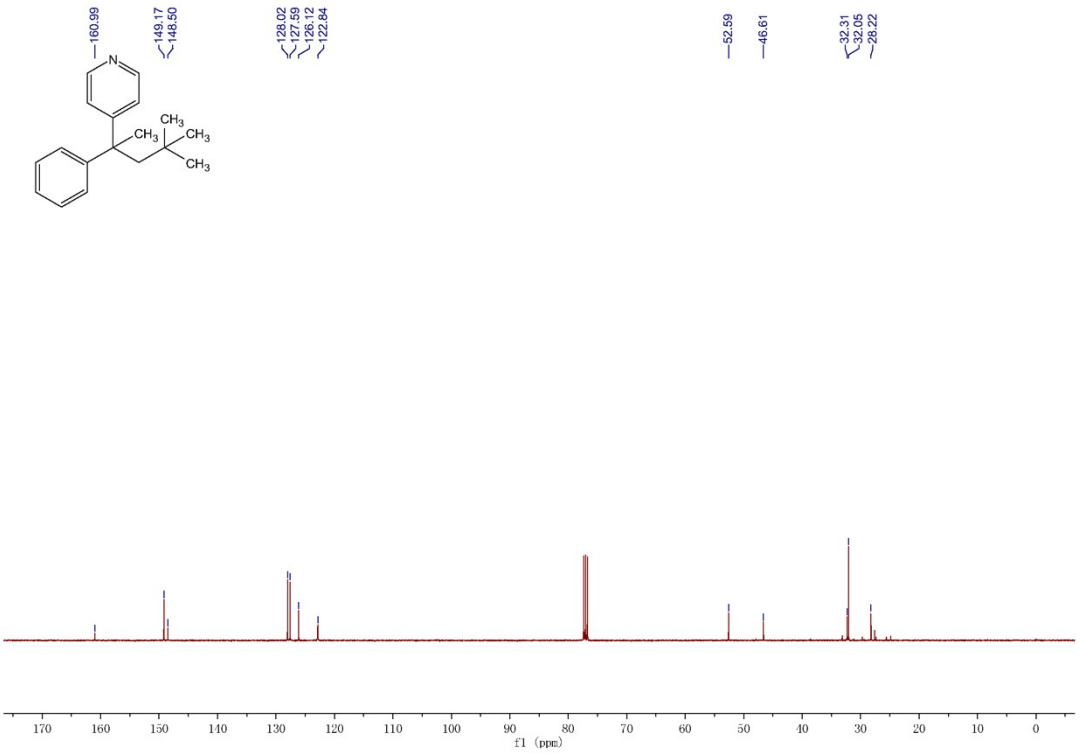
^{1}H NMR Spectrum of Compound **25** (400MHz, $CDCl_3$)



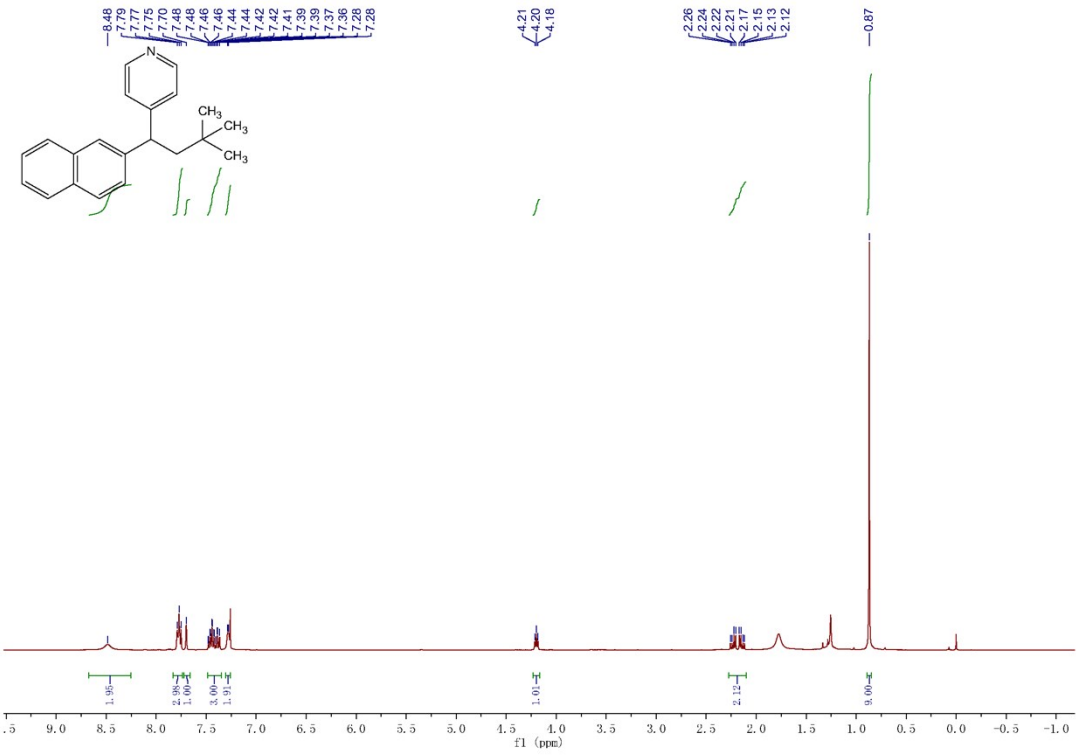
^{13}C NMR Spectrum of Compound **25** (100MHz, $CDCl_3$)



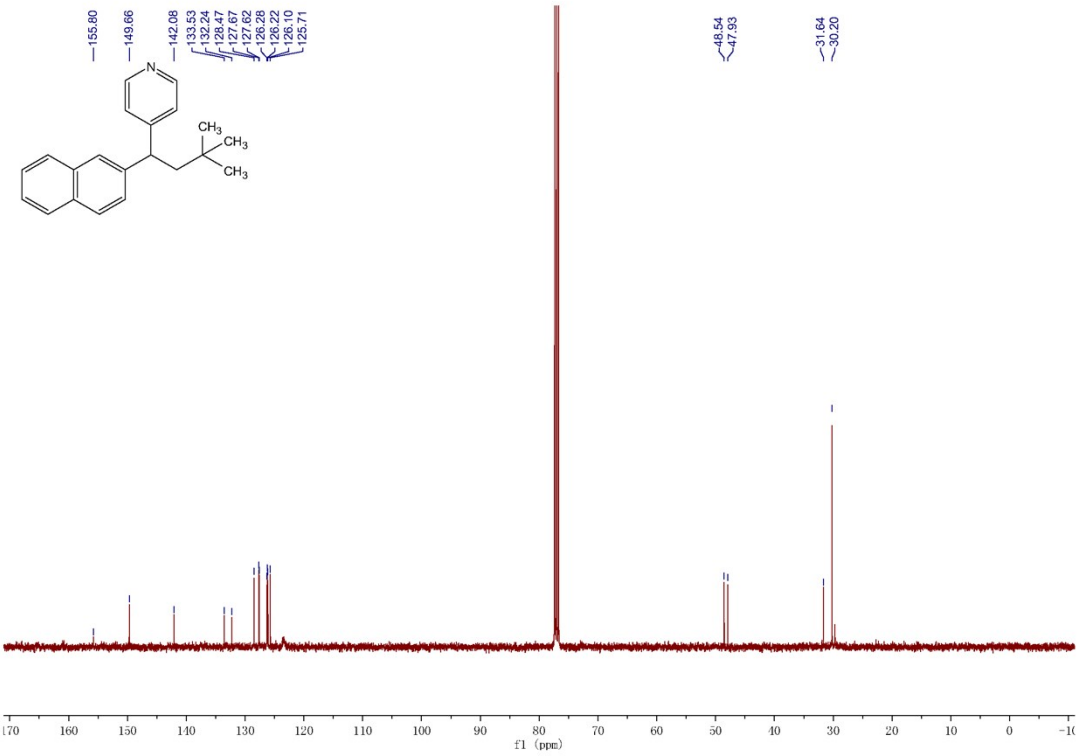
^{1}H NMR Spectrum of Compound **26** (400MHz, $CDCl_3$)



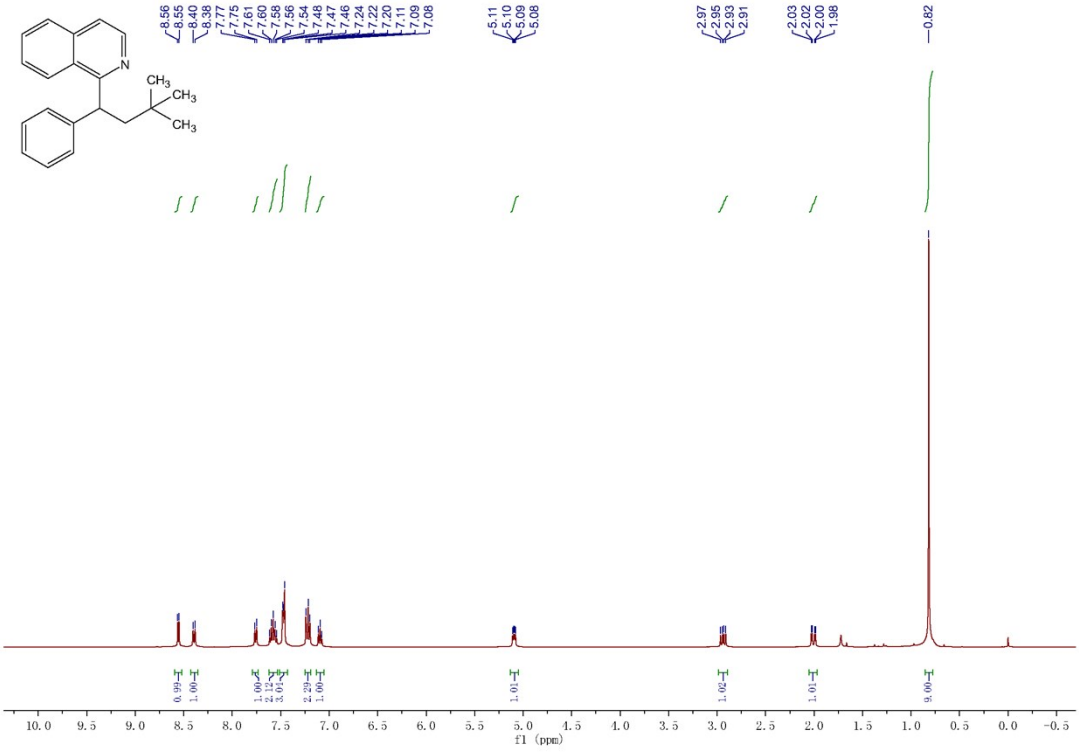
^{13}C NMR Spectrum of Compound **26** (100MHz, $CDCl_3$)



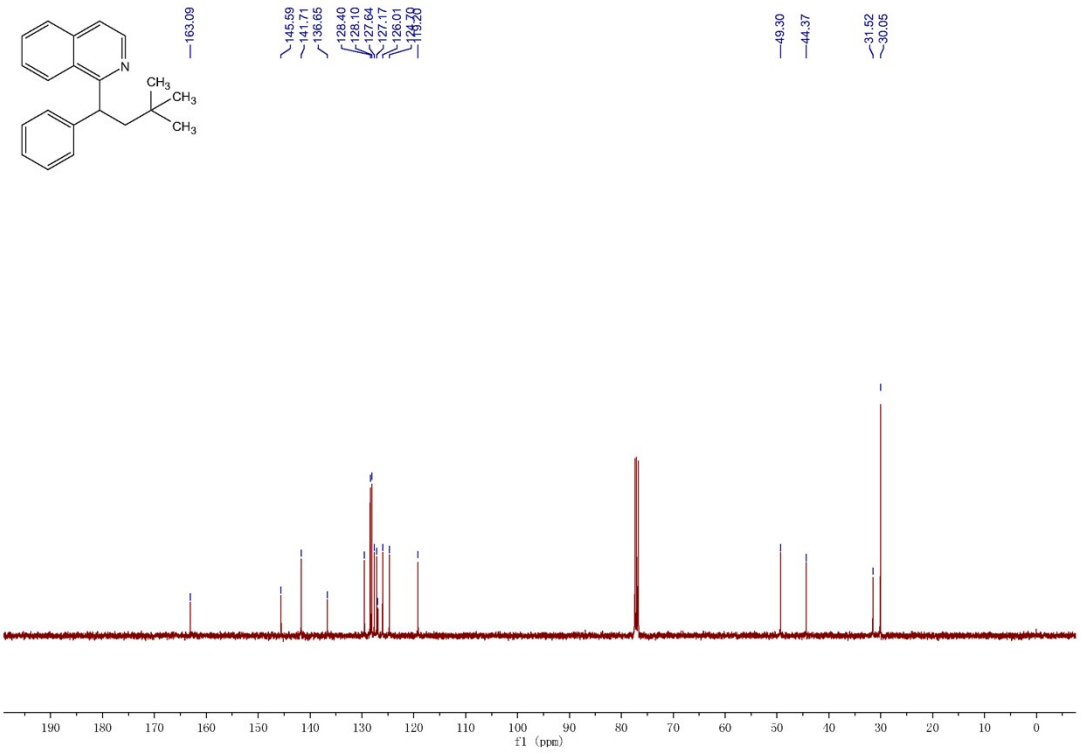
^{1}H NMR Spectrum of Compound **27** (400MHz, $CDCl_3$)



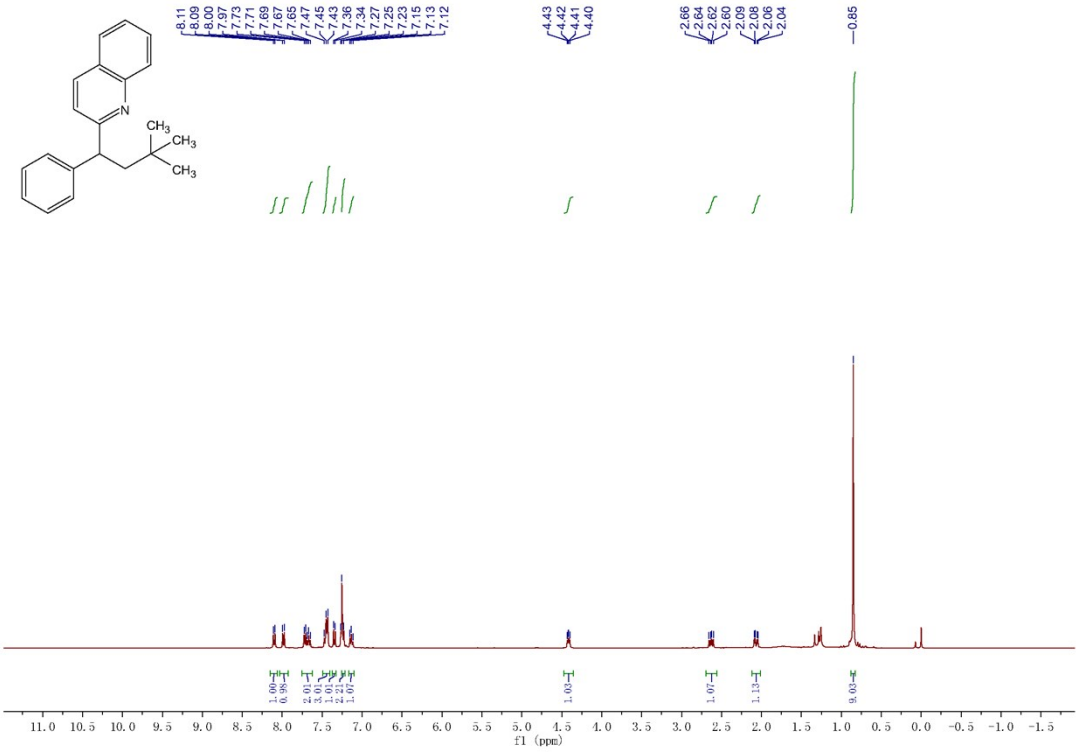
^{13}C NMR Spectrum of Compound **27** (100MHz, $CDCl_3$)



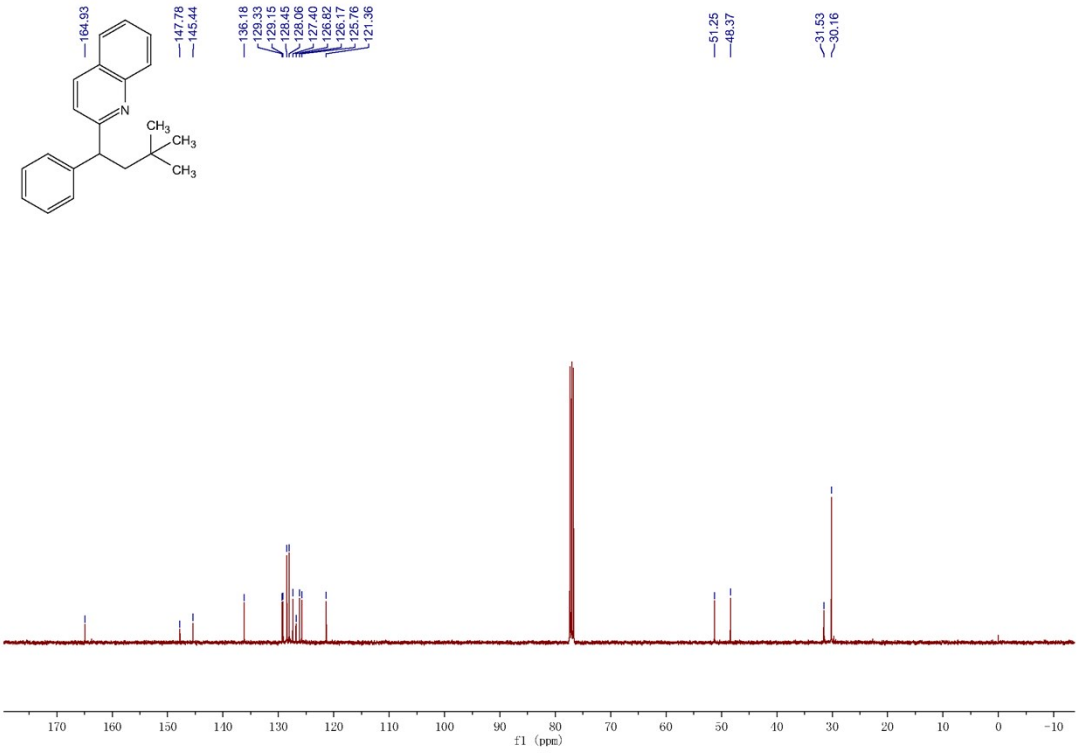
^{1}H NMR Spectrum of Compound **28** (400MHz, $CDCl_3$)



^{13}C NMR Spectrum of Compound **28** (100MHz, $CDCl_3$)



^{1}H NMR Spectrum of Compound **29** (400MHz, $CDCl_3$)



^{13}C NMR Spectrum of Compound **29** (100MHz, $CDCl_3$)