

Metal-free synthesis of 1,3,5-trisubstituted benzenes by the cyclotrimerization of enamines or alkynes in water

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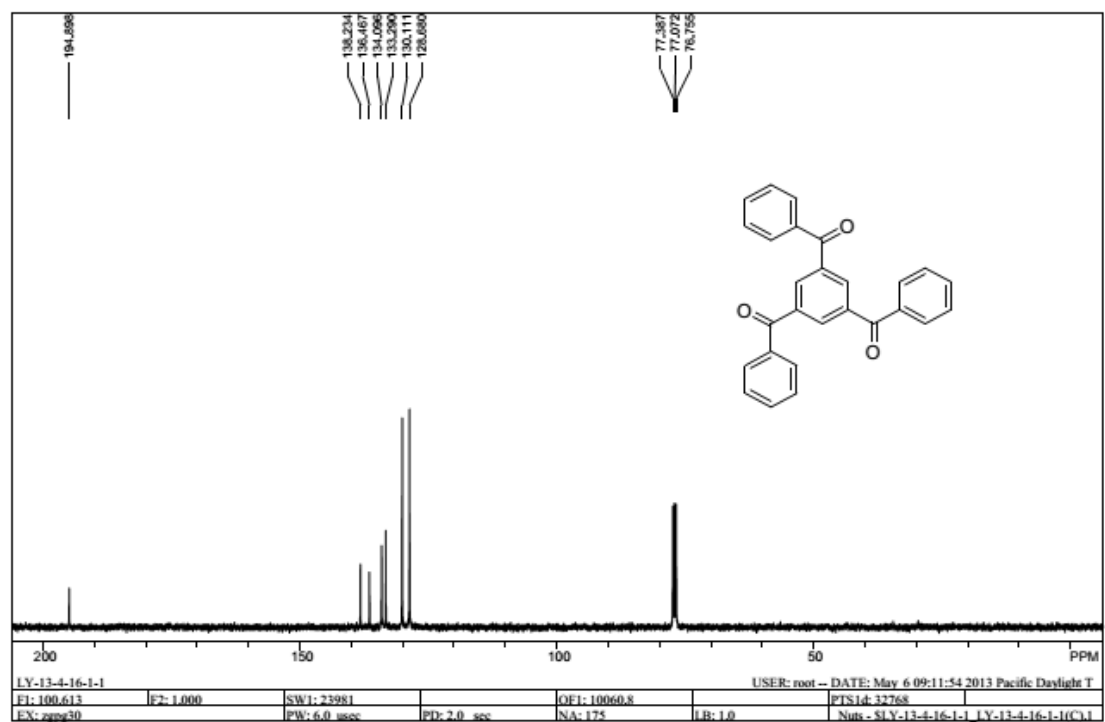
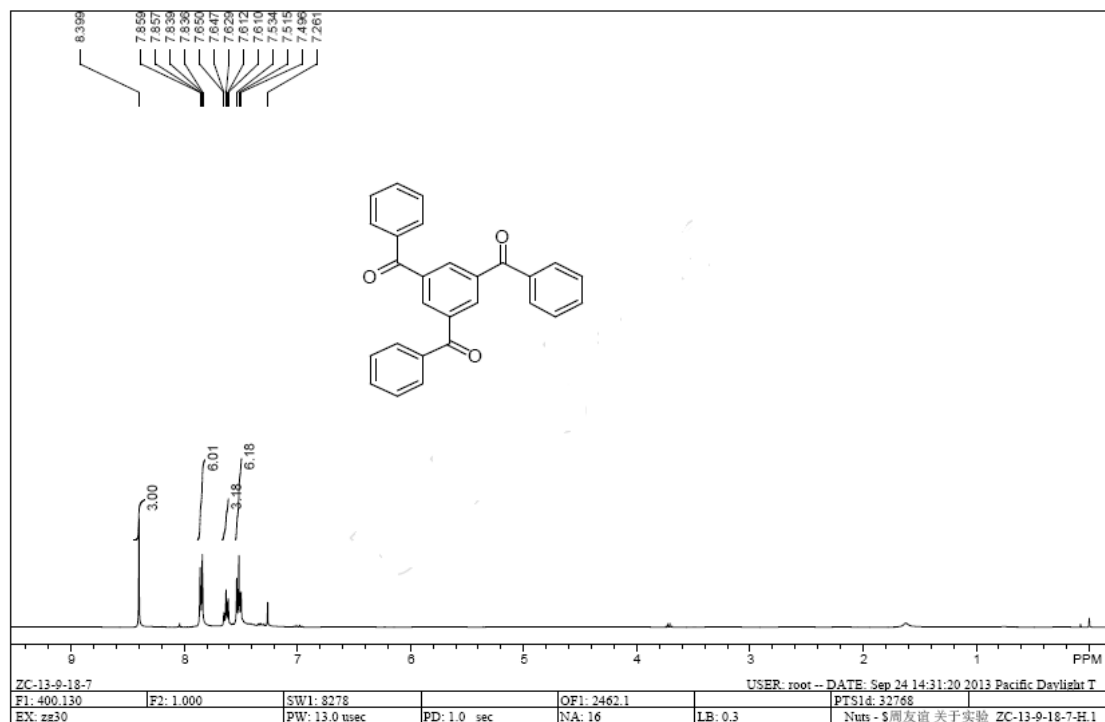
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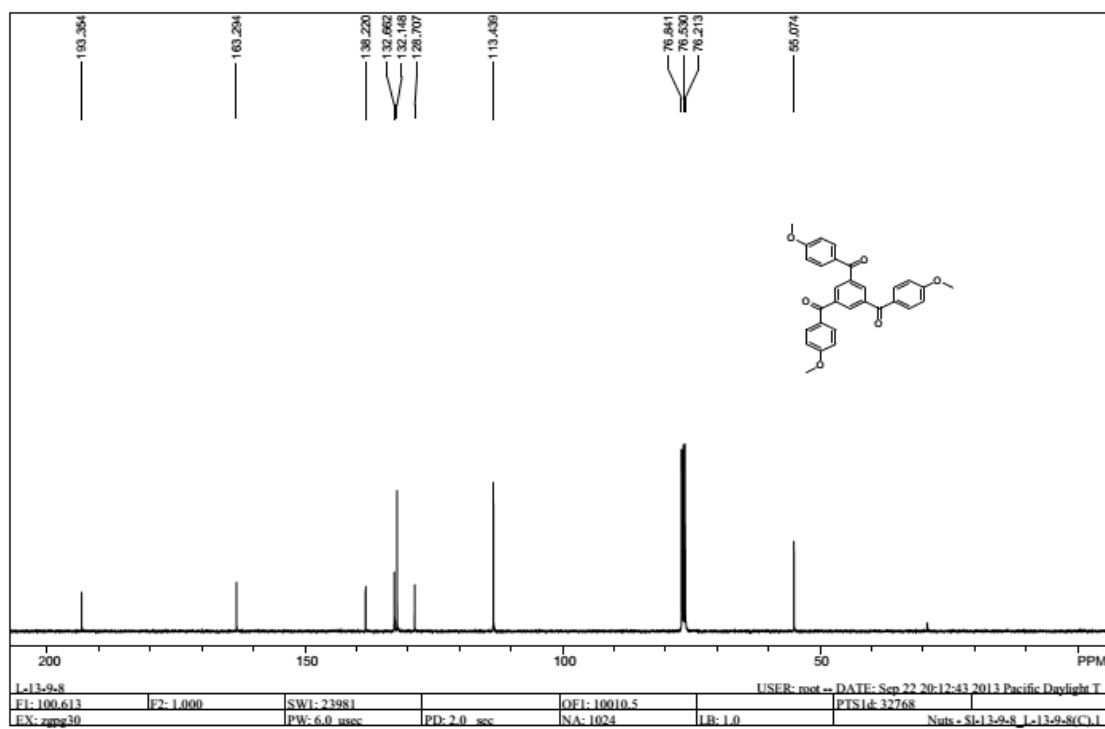
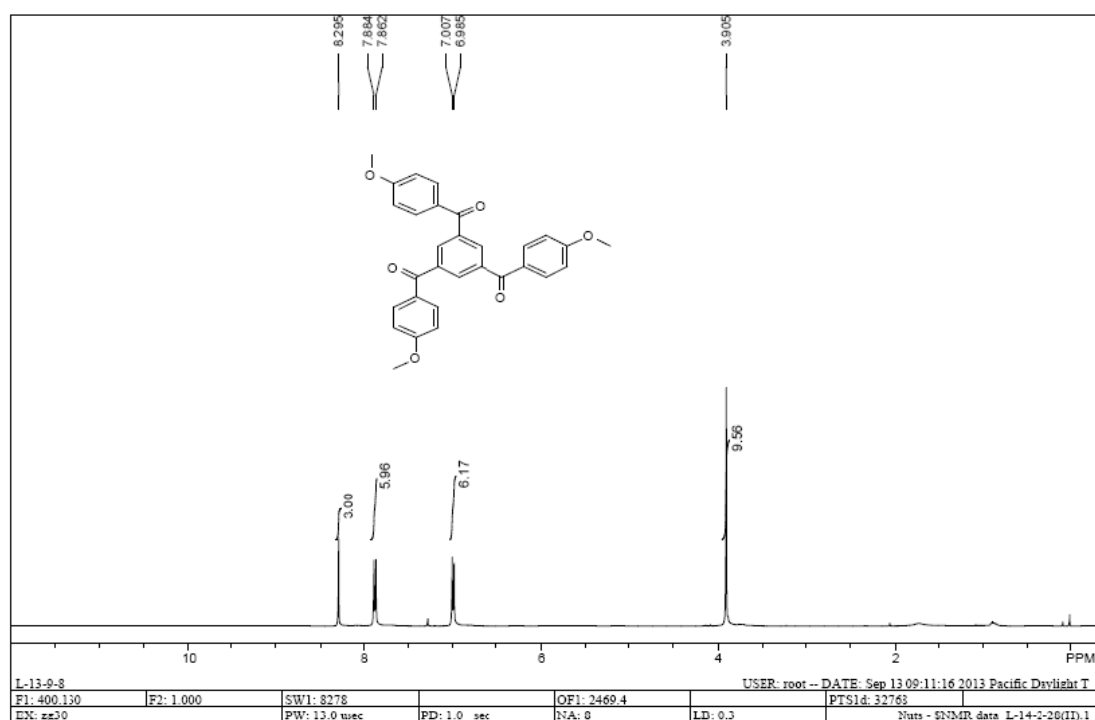
General experimental information

All experiments were carried out at open atmosphere, enamines used in the experiment were prepared following literature method,¹ and all other chemicals were obtained from commercial resource and used without further purification. Deionized water was used for reactions involving water as solvent. ¹H and ¹³C NMR were recorded in 400 MHz apparatus (AVANCE 400, Bruker) or 600 MHz apparatus (600MHz DD2, Agilent). The chemical shifts were reported in ppm using TMS as internal standard. Melting points were tested in X-4A instrument without correcting temperature, IR were measured in KBr method and the HRMS were obtained under ESI model.

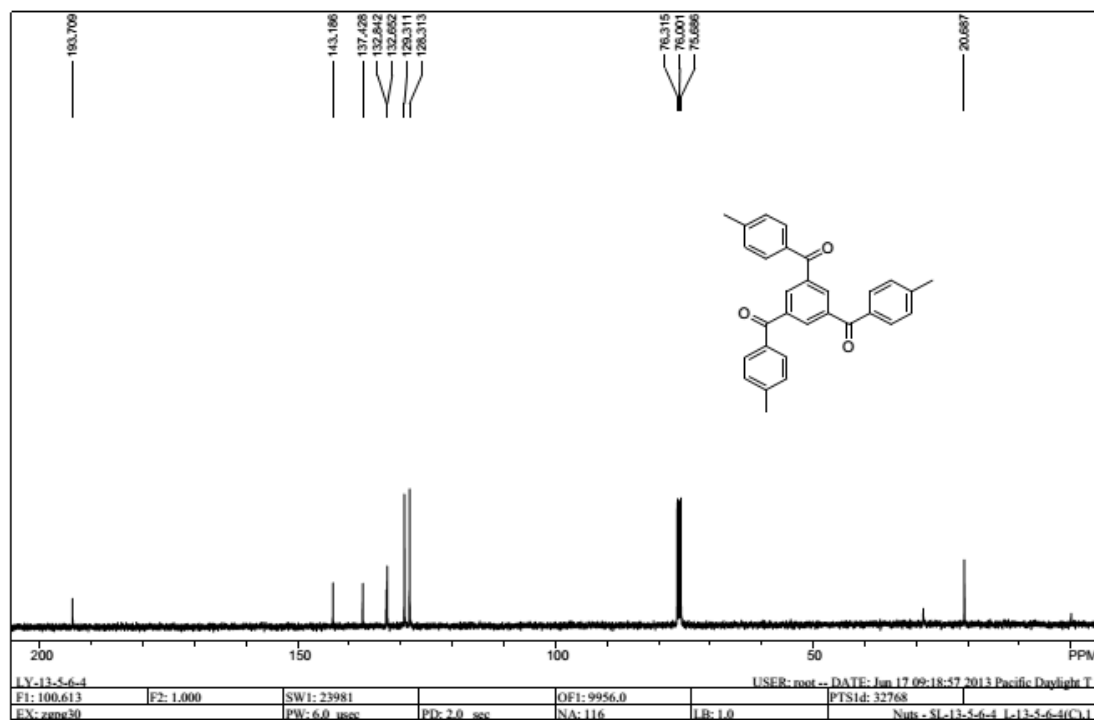
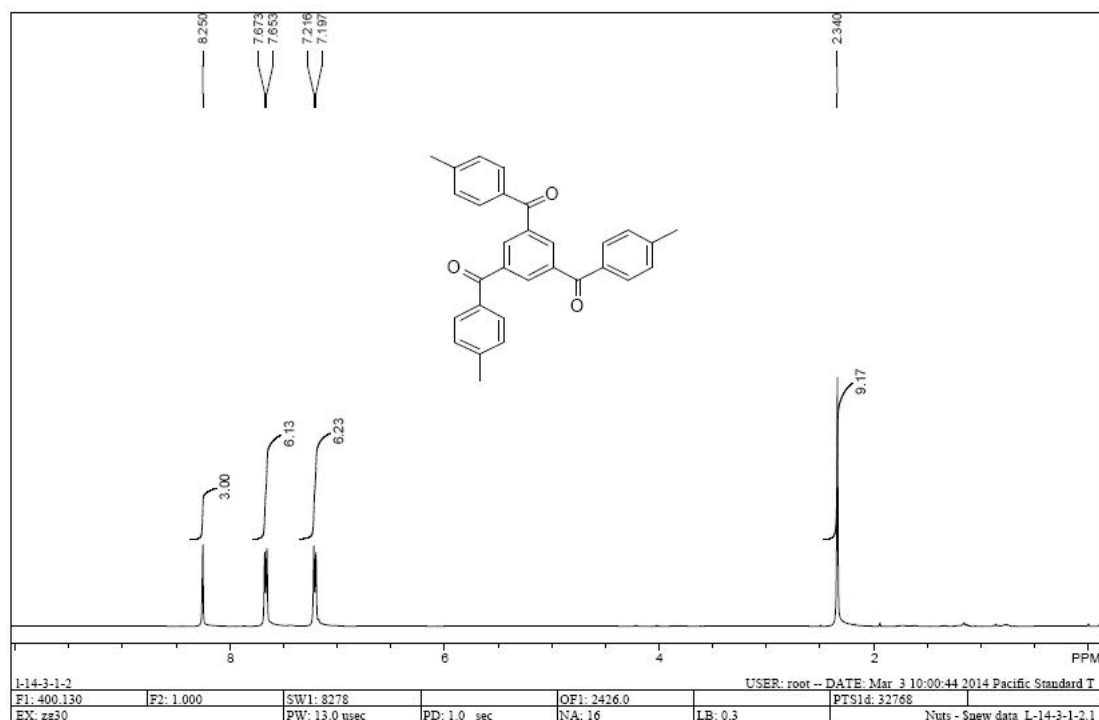
^1H and ^{13}C NMR spectra of **3a**



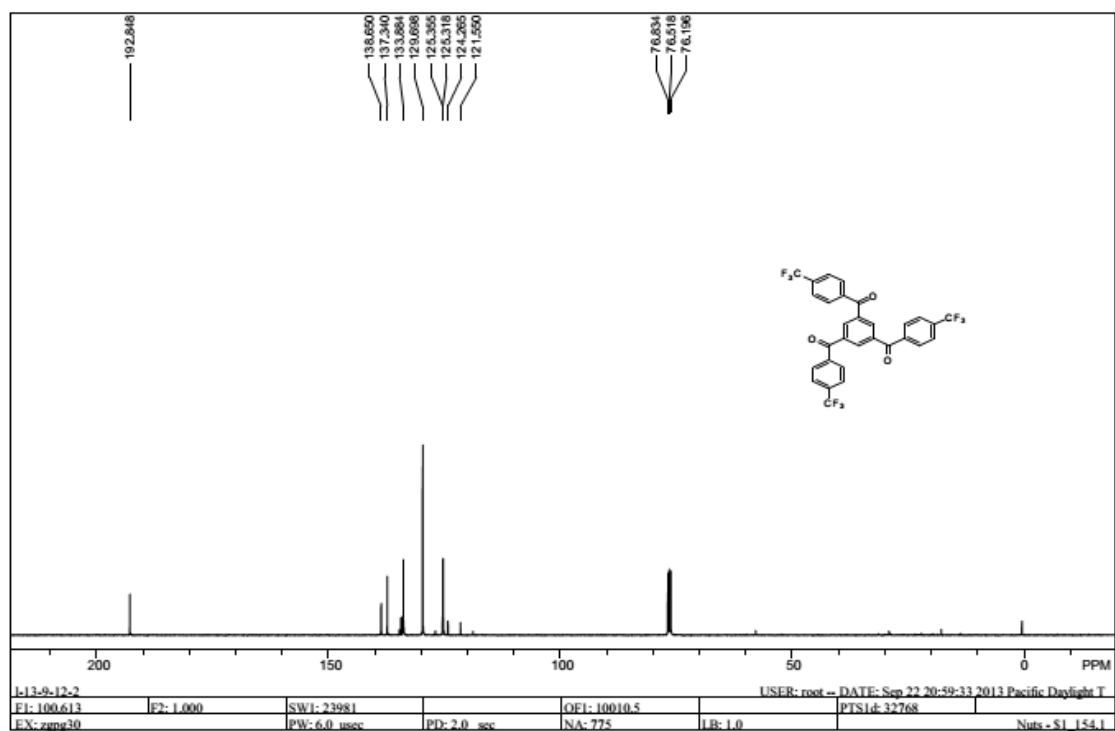
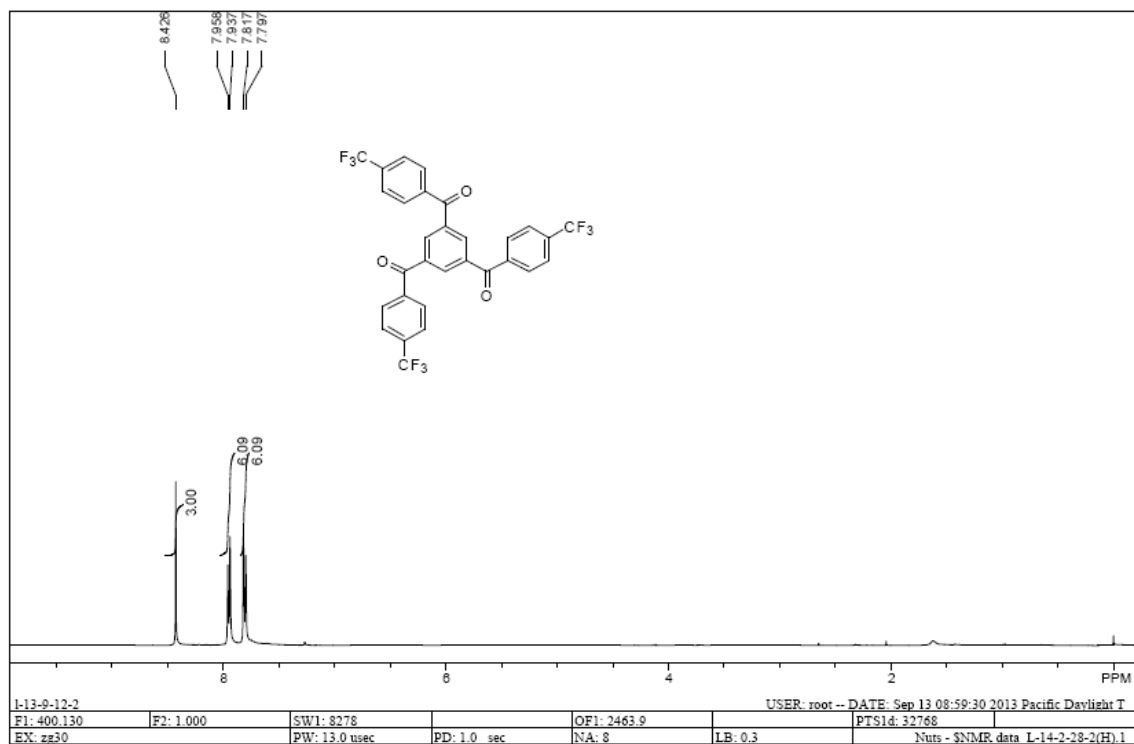
^1H and ^{13}C NMR spectra of **3b**



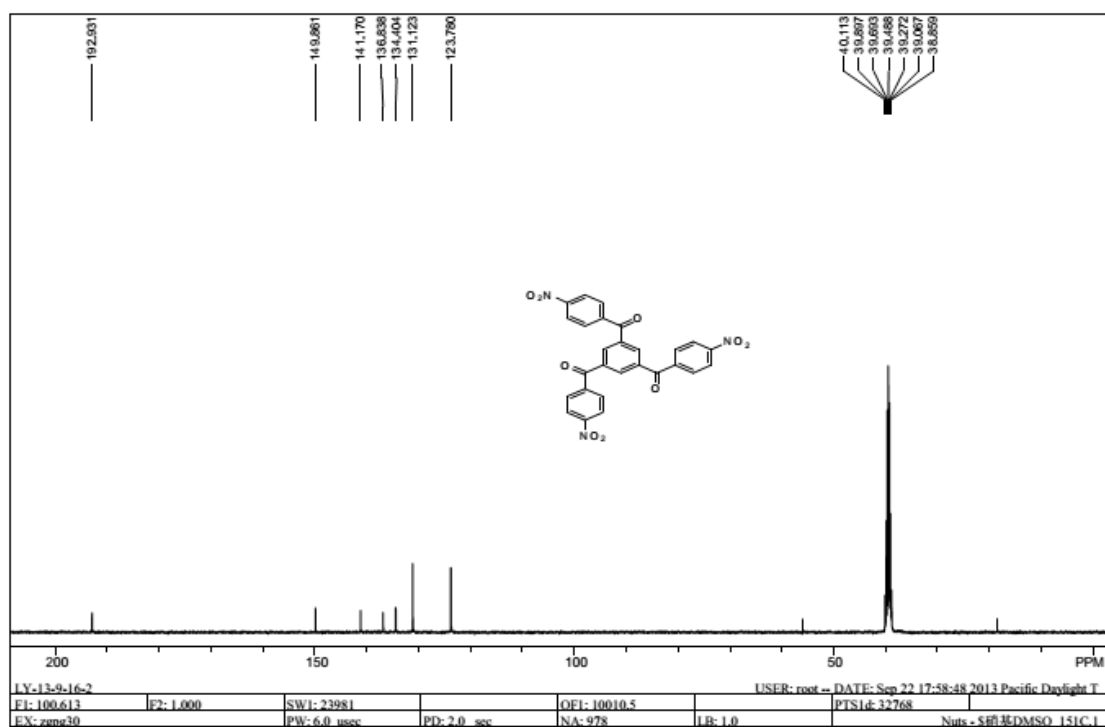
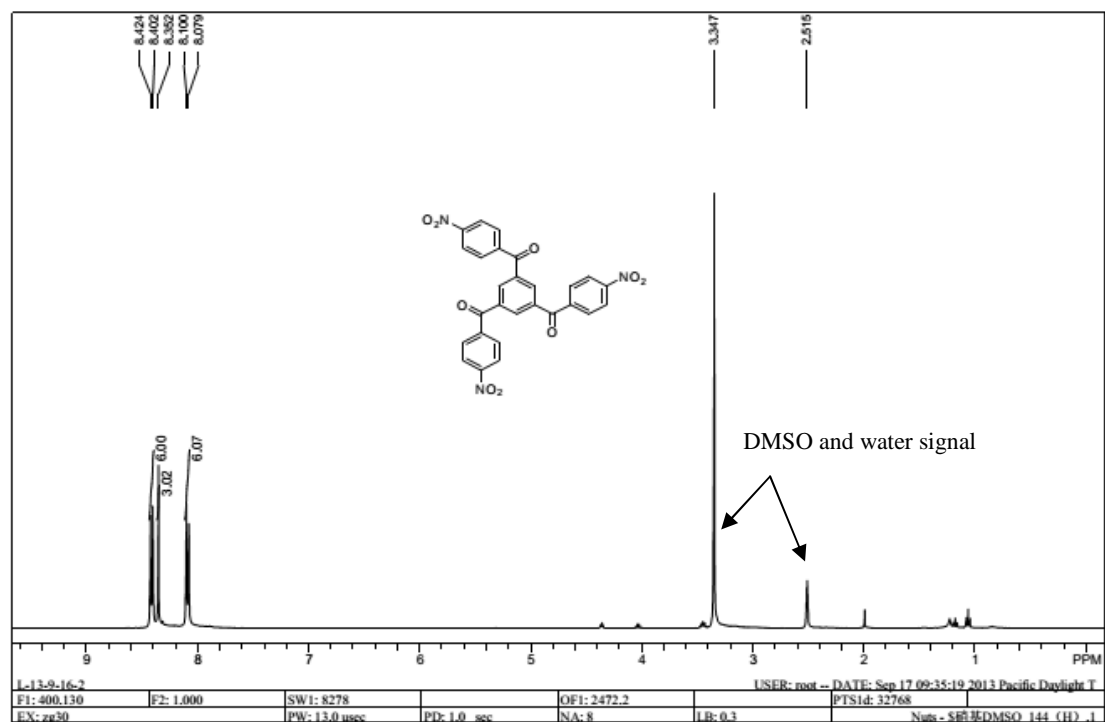
^1H and ^{13}C NMR spectra of **3c**



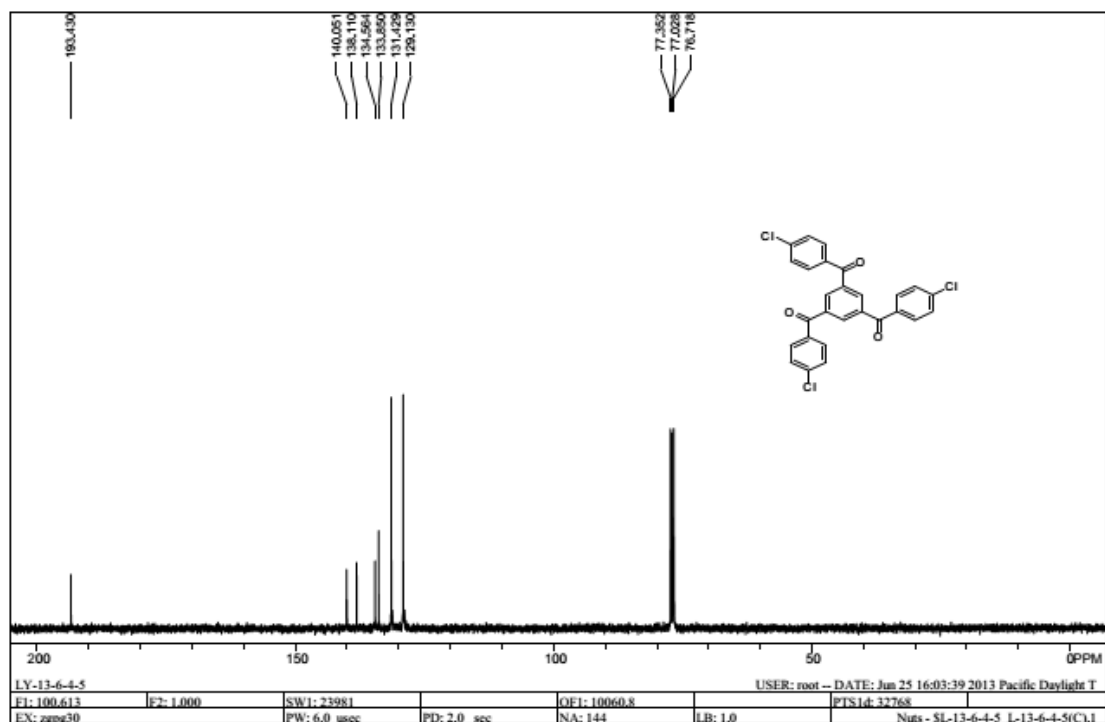
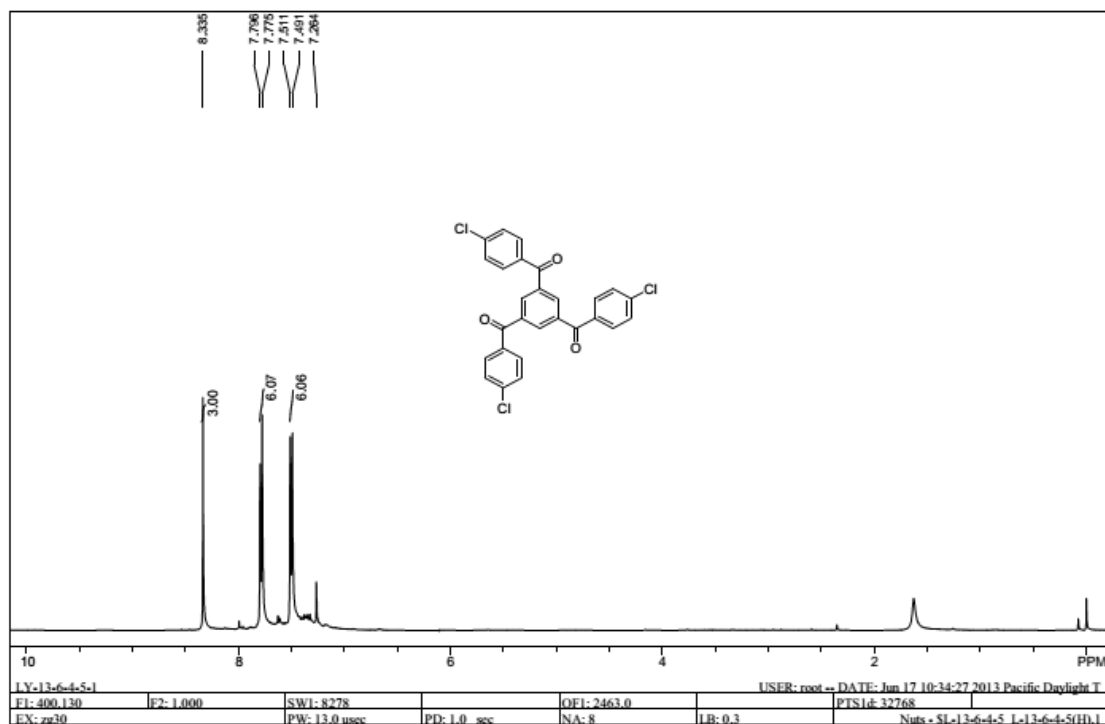
^1H and ^{13}C NMR spectra of **3d**



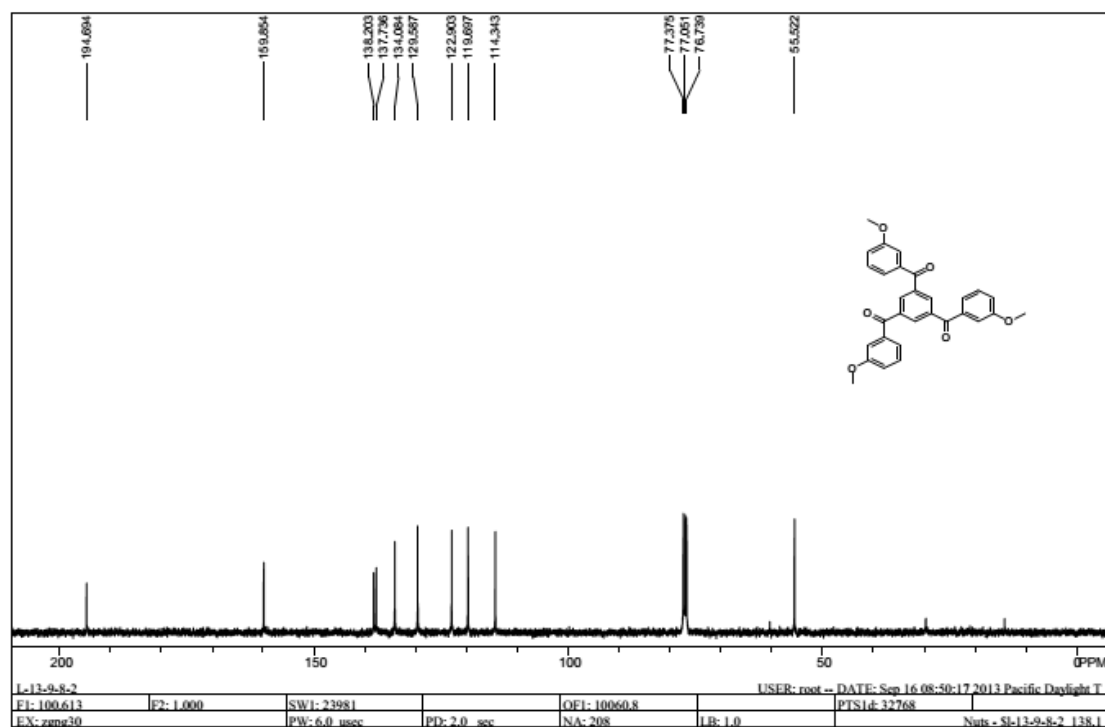
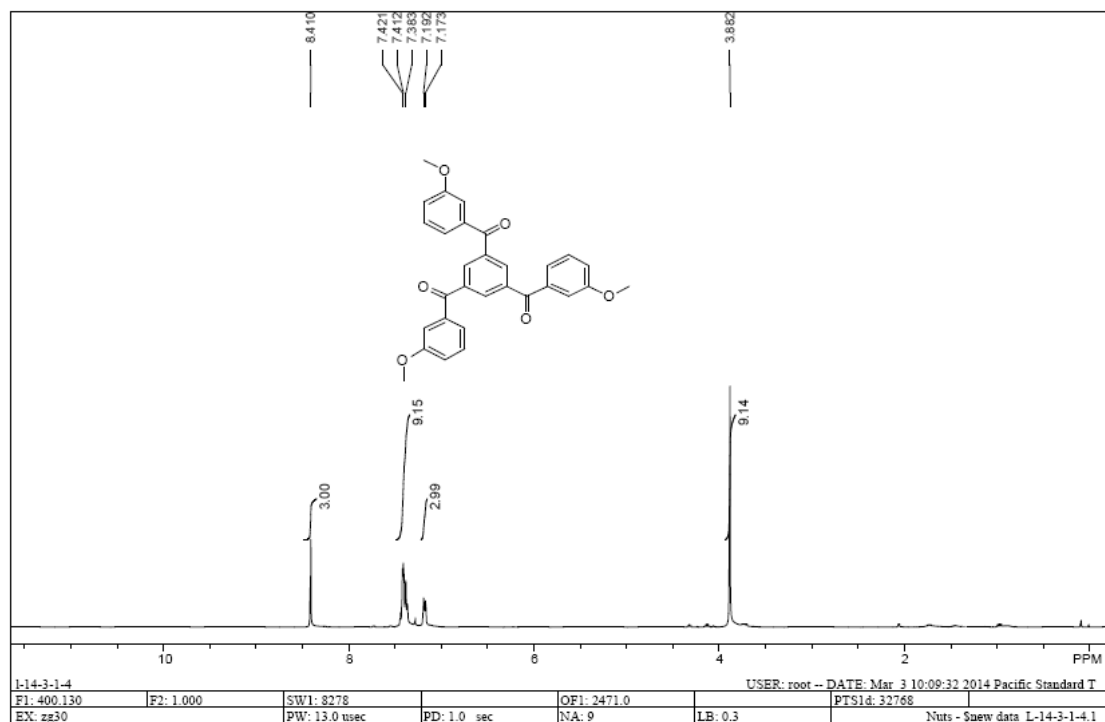
^1H and ^{13}C NMR spectra of **3e** (Measured in $\text{DMSO-}d_6$)



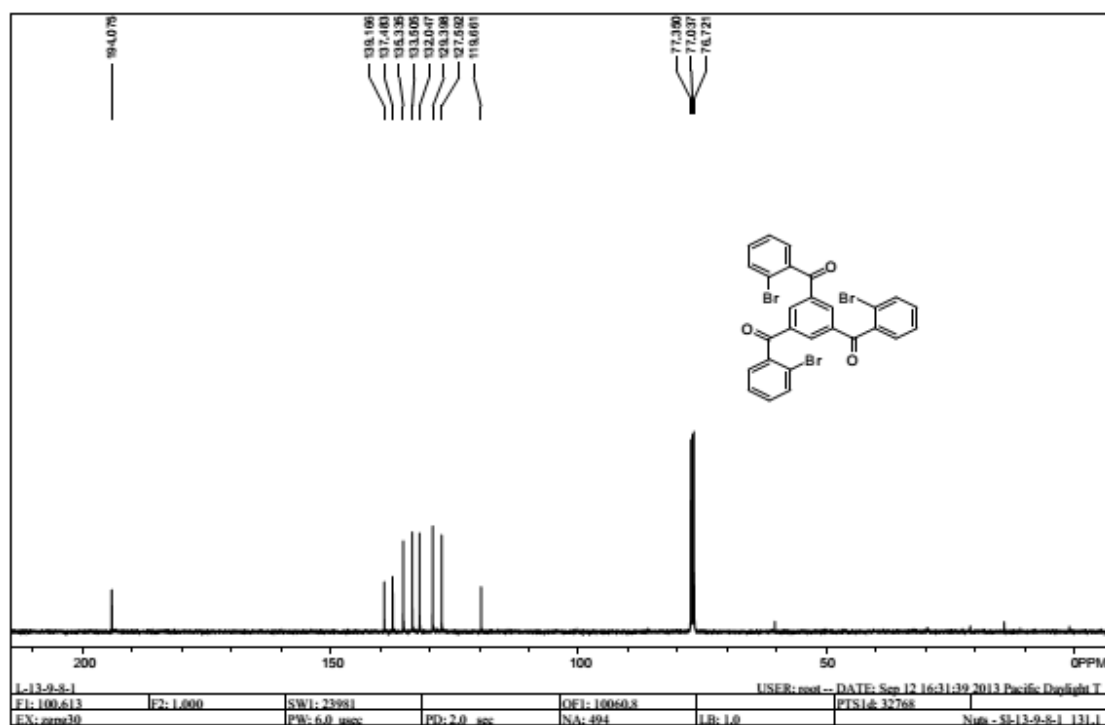
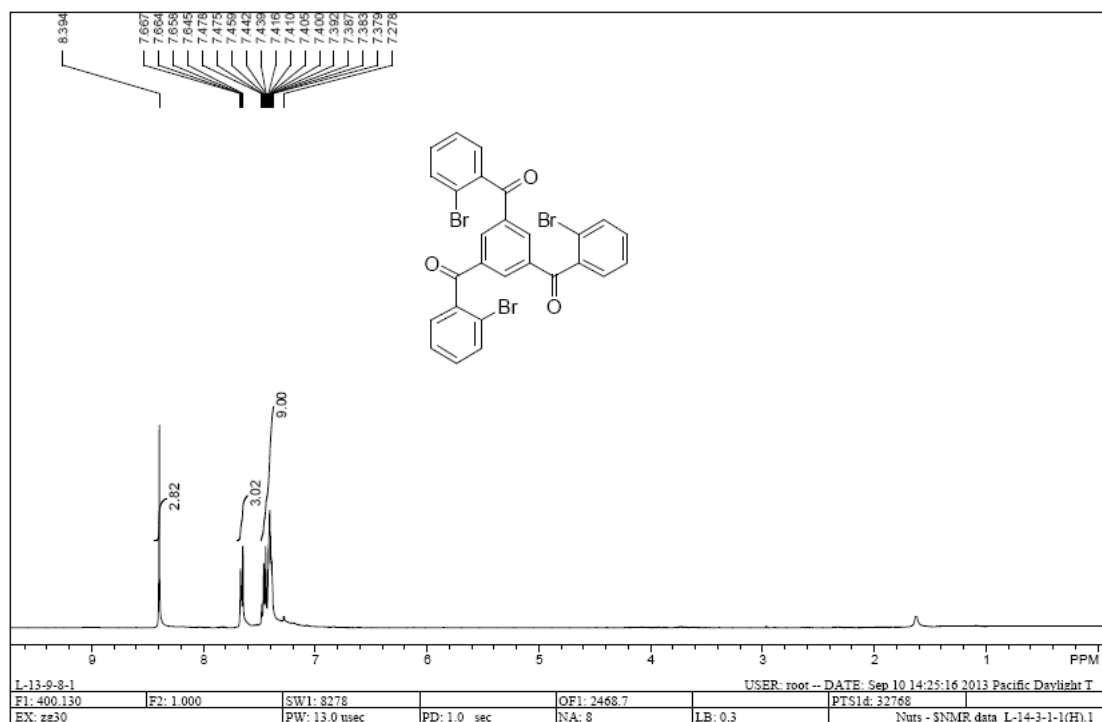
^1H and ^{13}C NMR spectra of **3f**



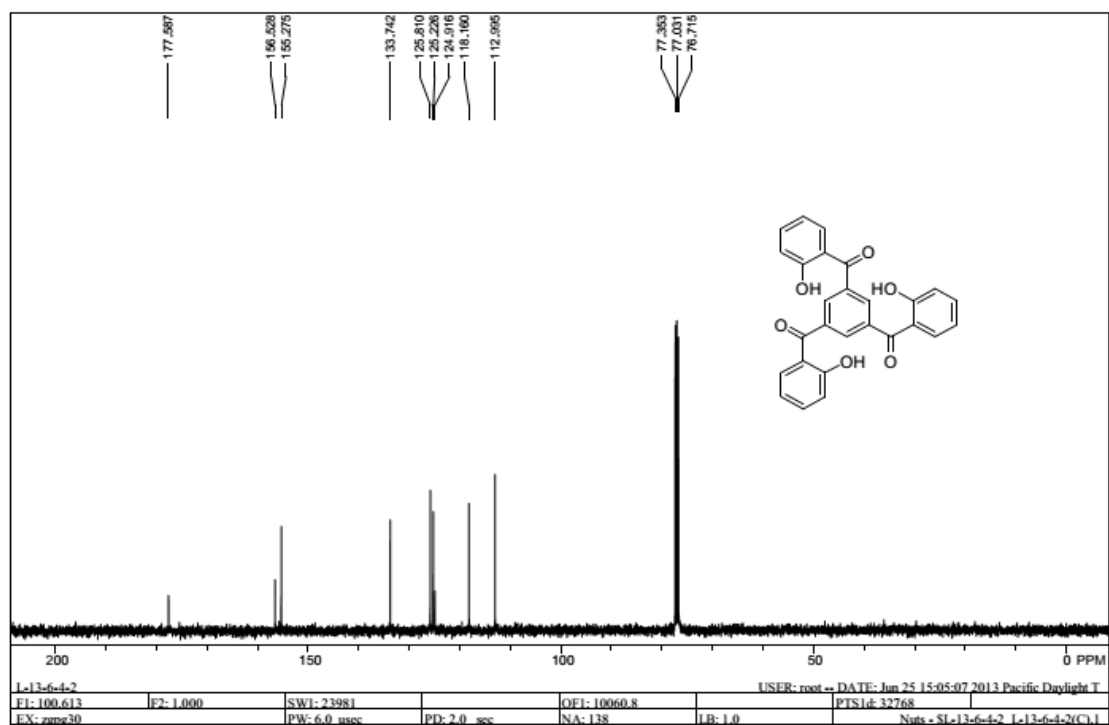
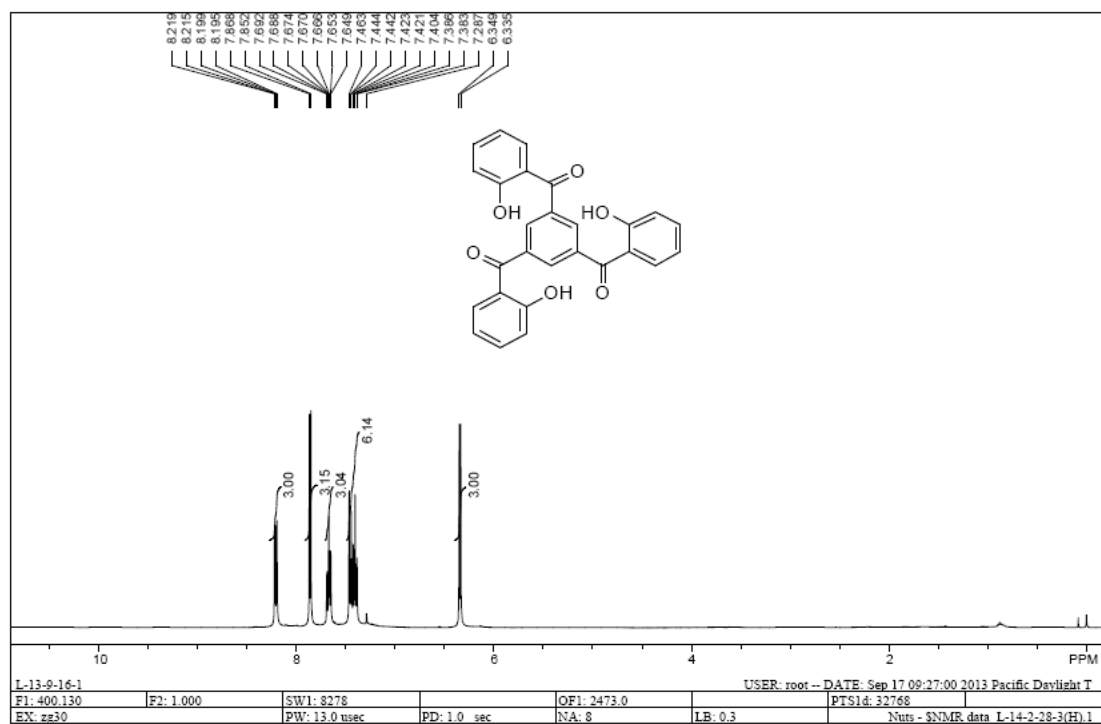
^1H and ^{13}C NMR spectra of **3g**



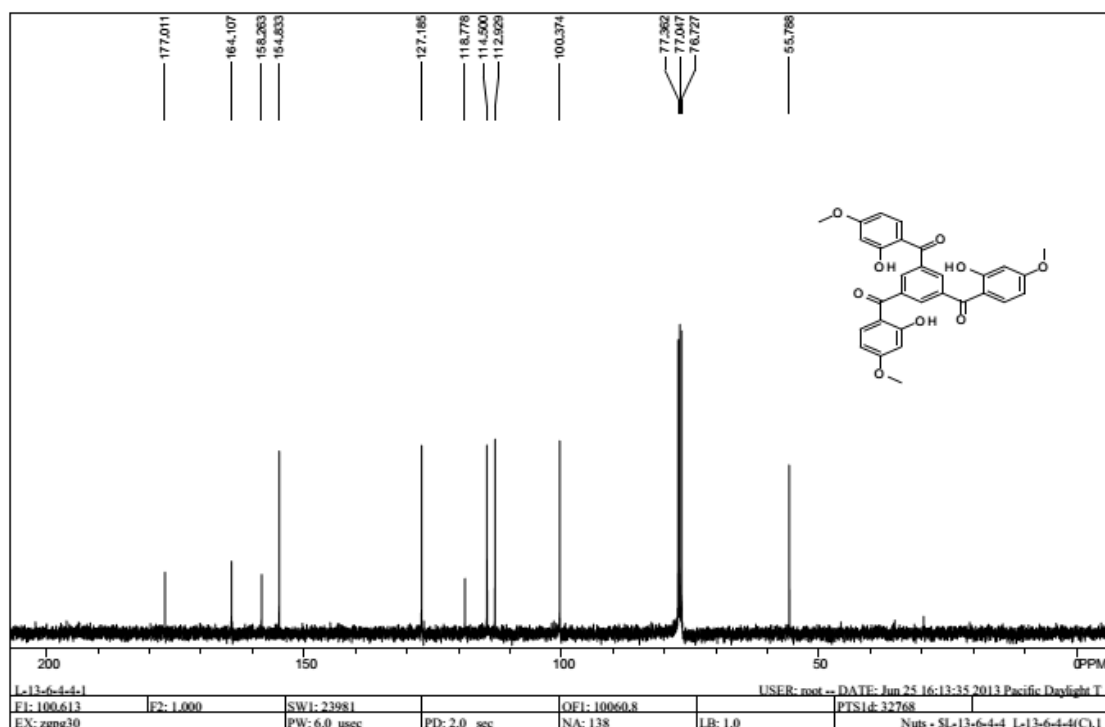
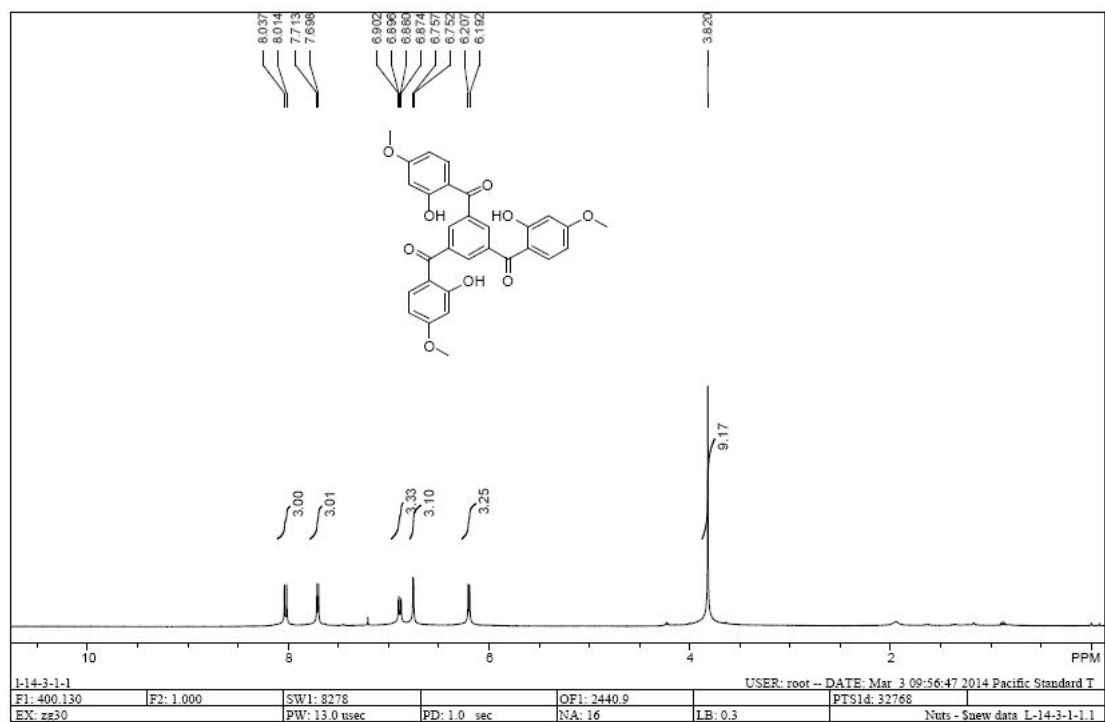
^1H and ^{13}C NMR spectra of **3h**



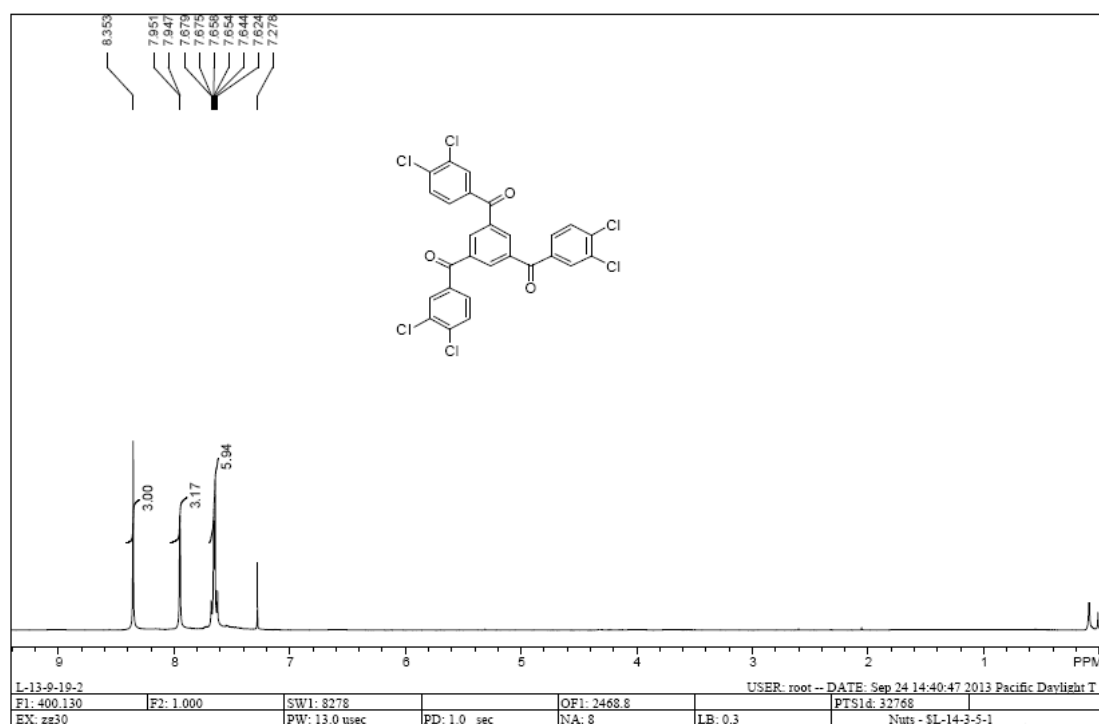
^1H and ^{13}C NMR spectra of **3i**



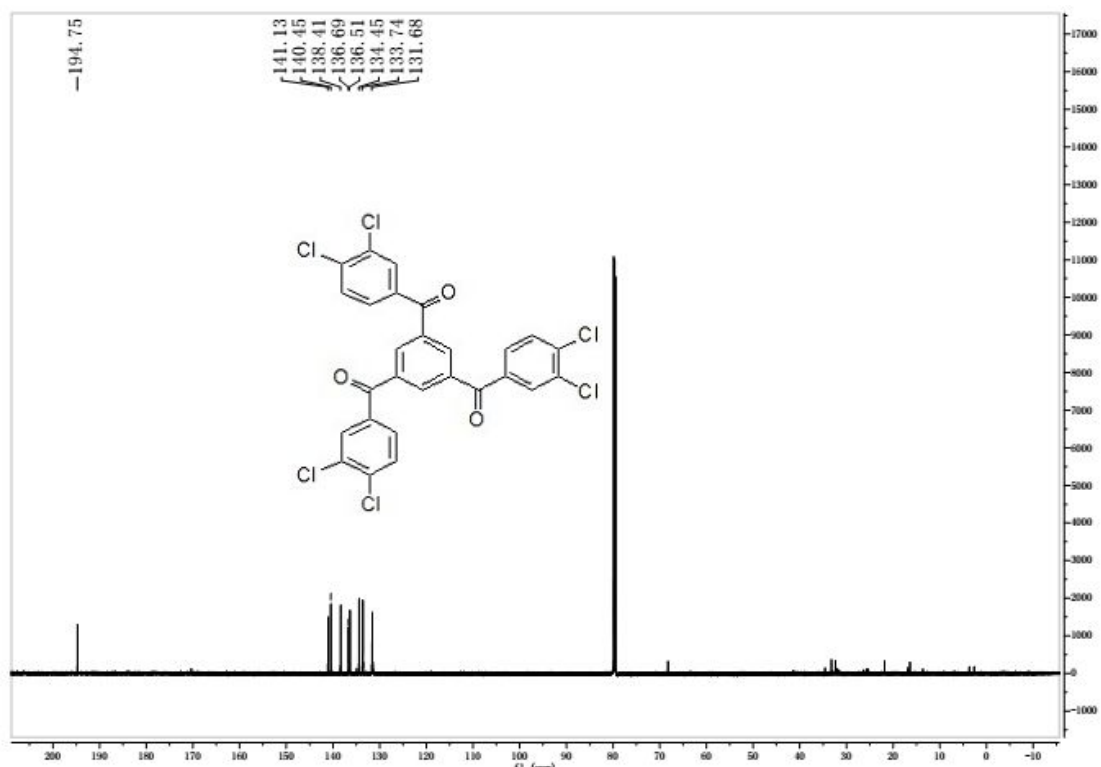
^1H and ^{13}C NMR spectra of **3j**



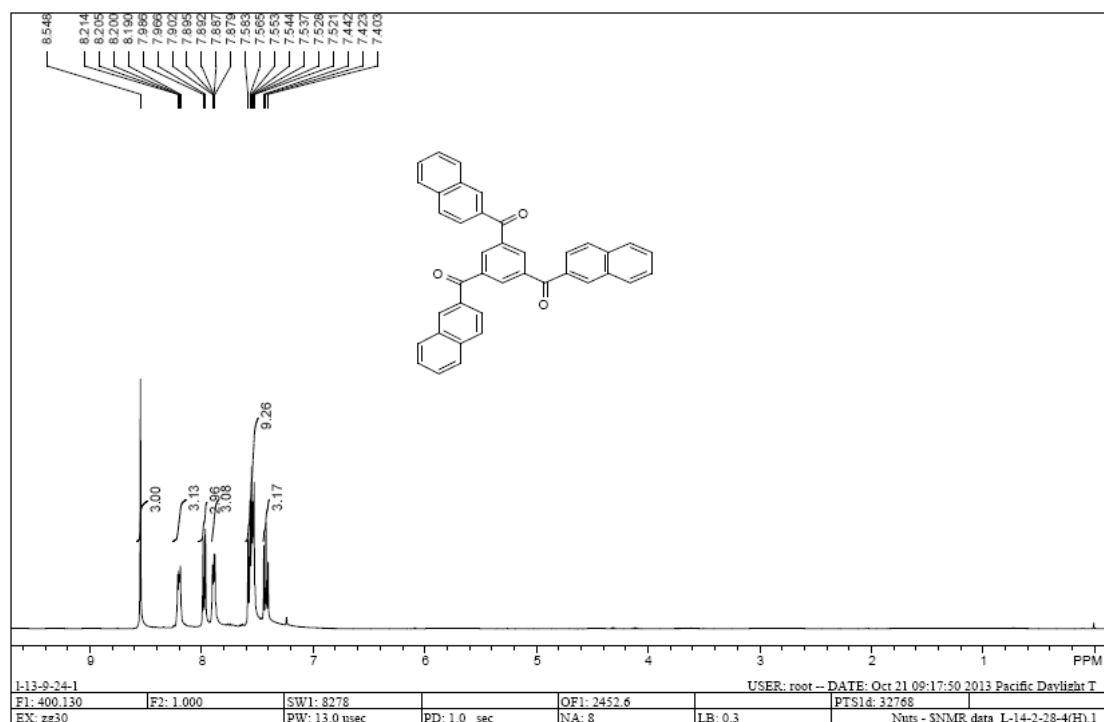
^1H and ^{13}C NMR spectra of **3k**



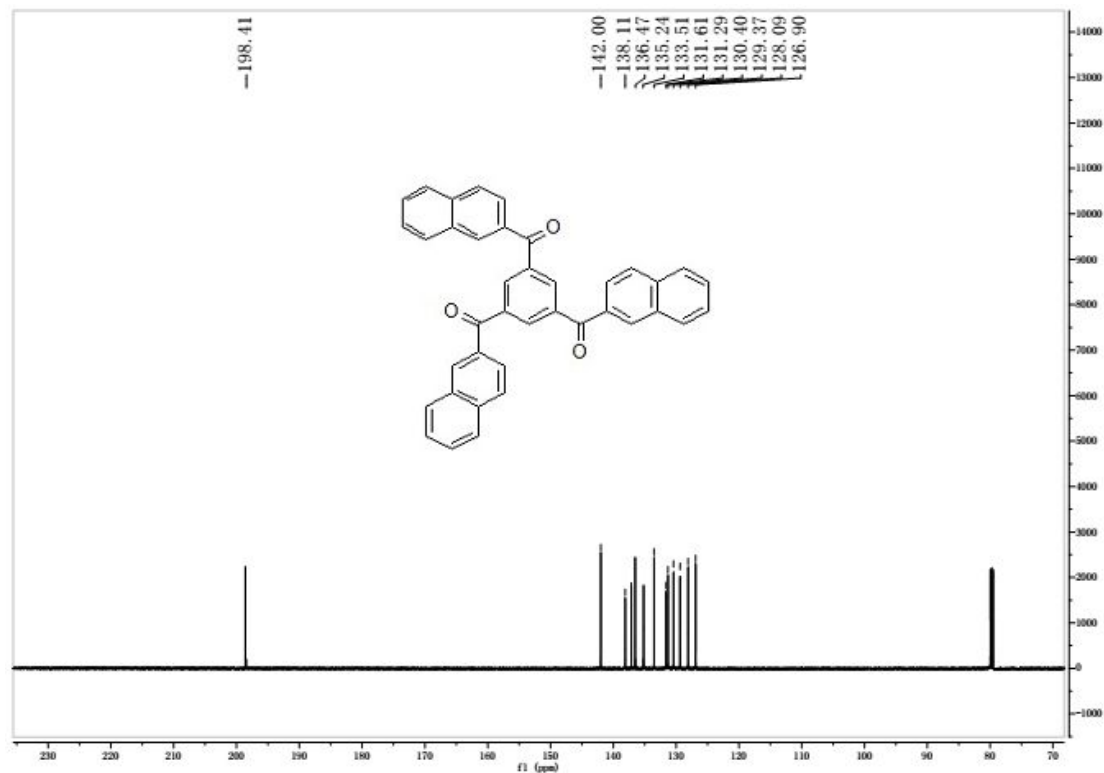
^{13}C NMR was recorded in 600 MHz apparatus



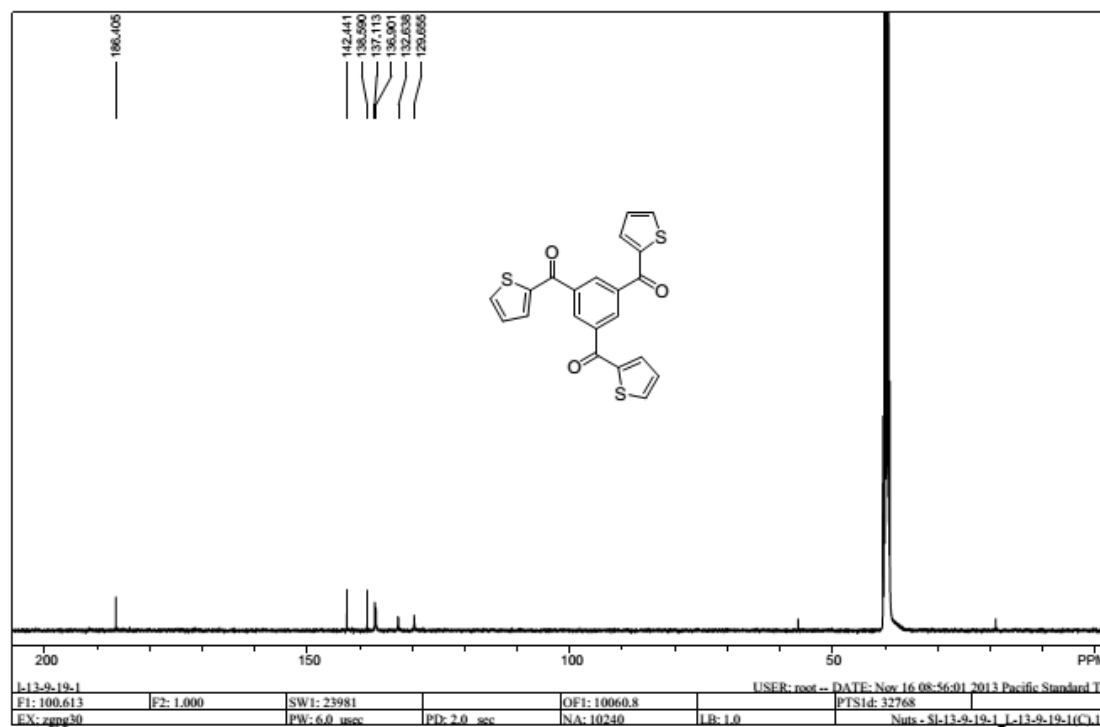
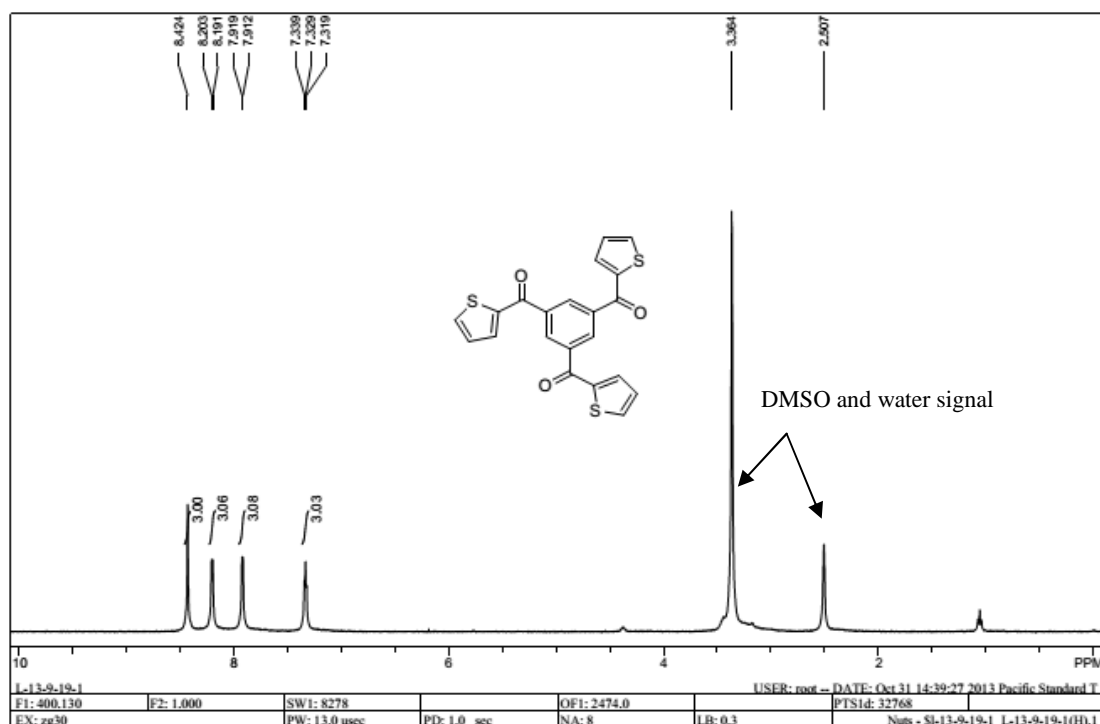
^1H and ^{13}C NMR spectra of **31**



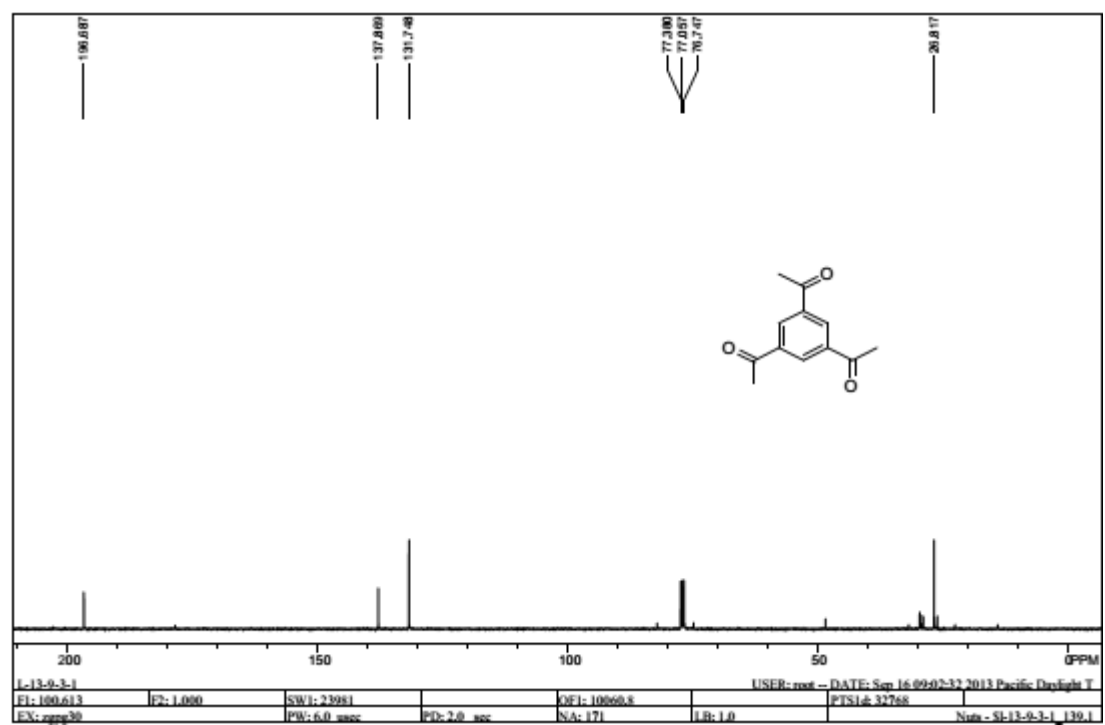
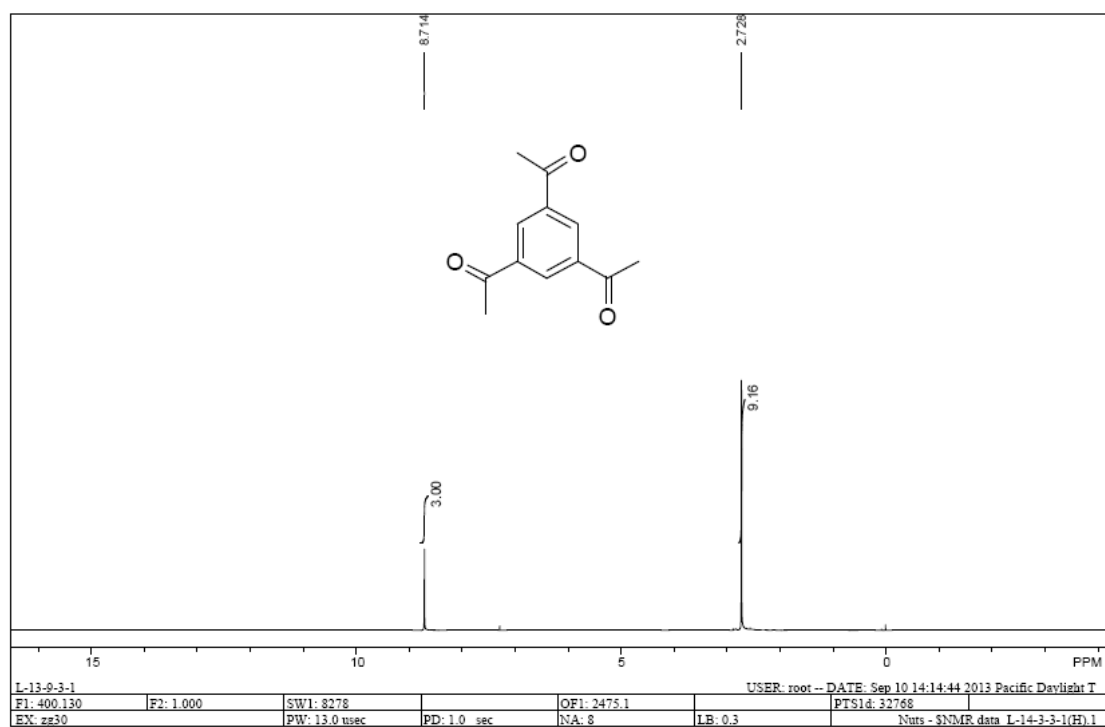
^{13}C NMR was recorded in 600 MHz apparatus



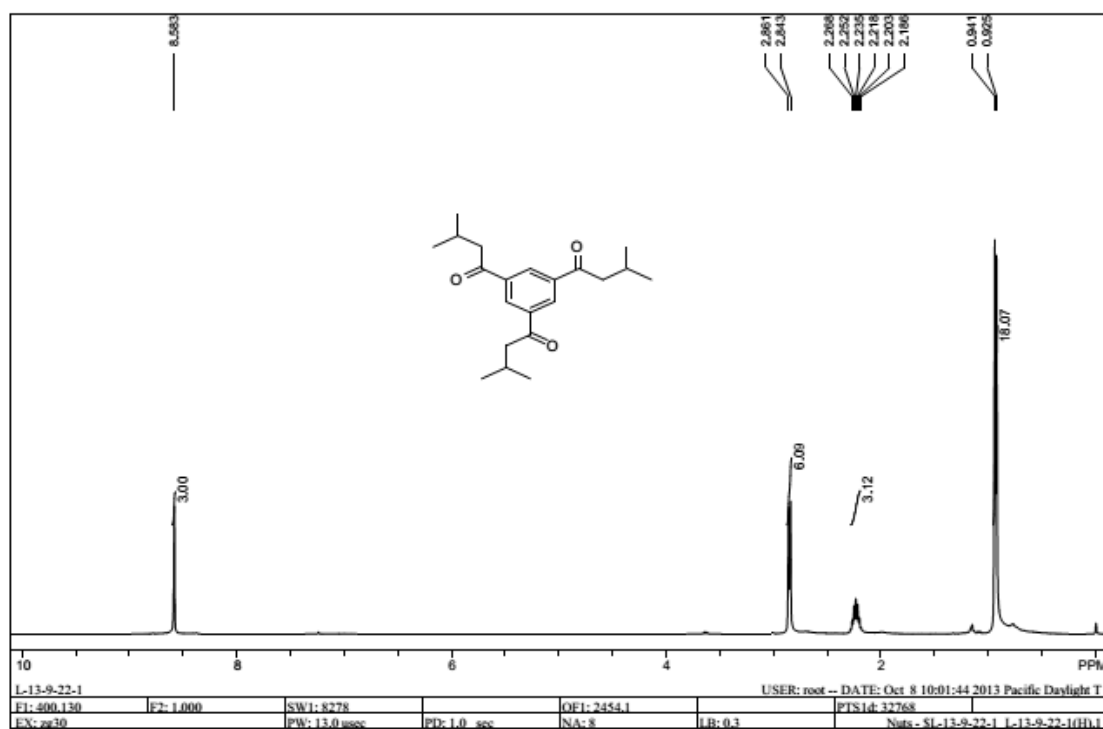
^1H and ^{13}C NMR spectra of **3m** (tested in $\text{DMSO-}d_6$)



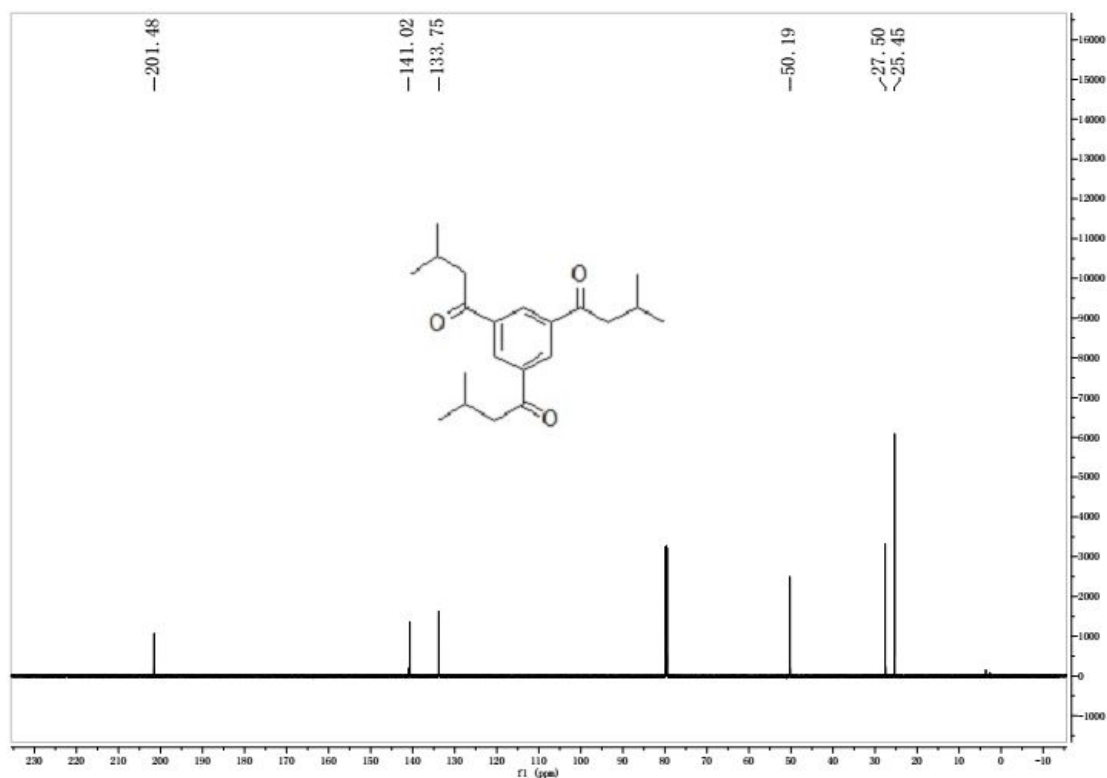
^1H and ^{13}C NMR spectra of **3n**



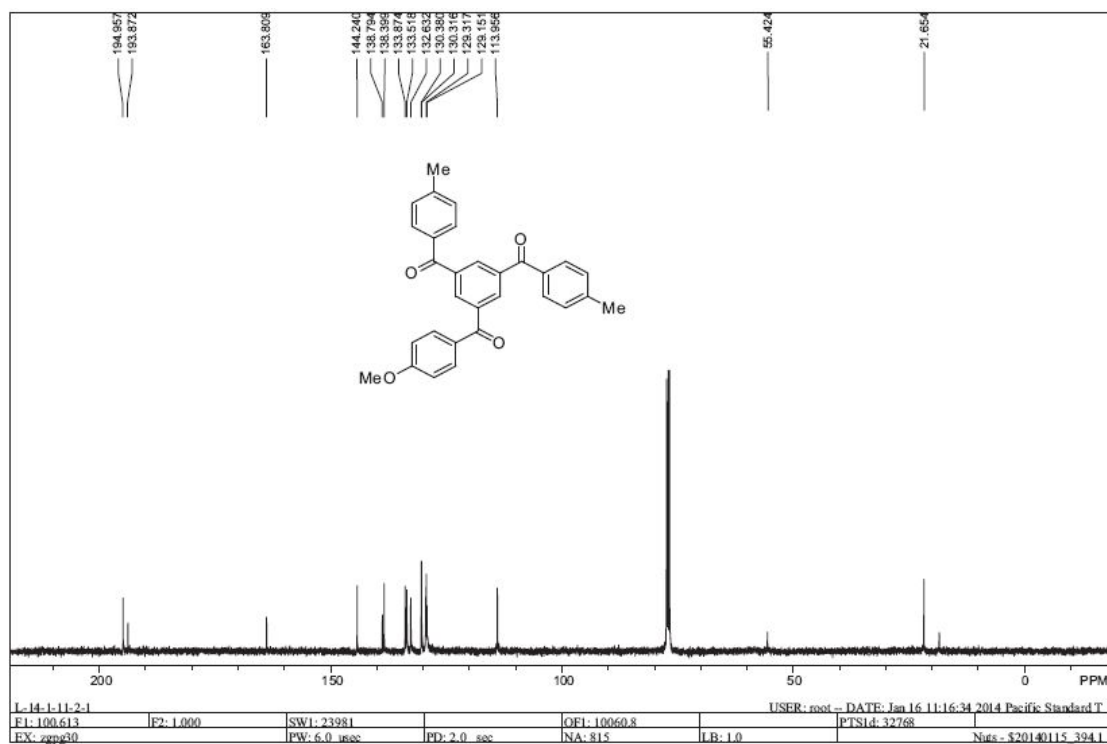
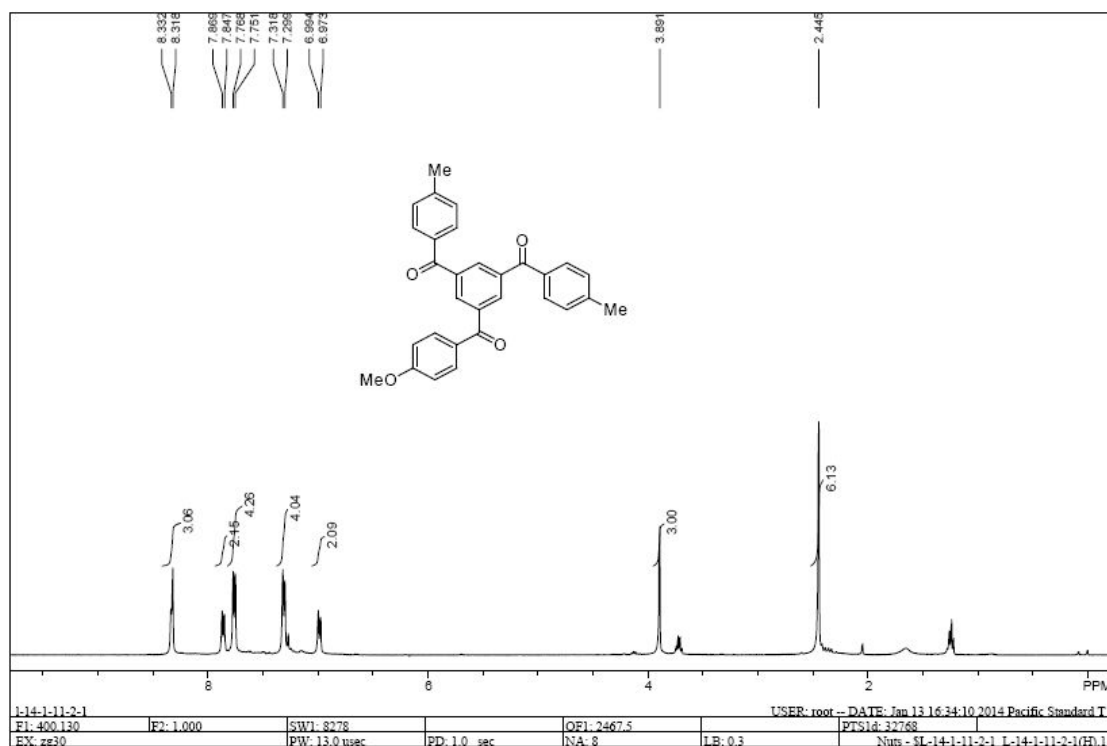
^1H and ^{13}C NMR spectra of **3o**



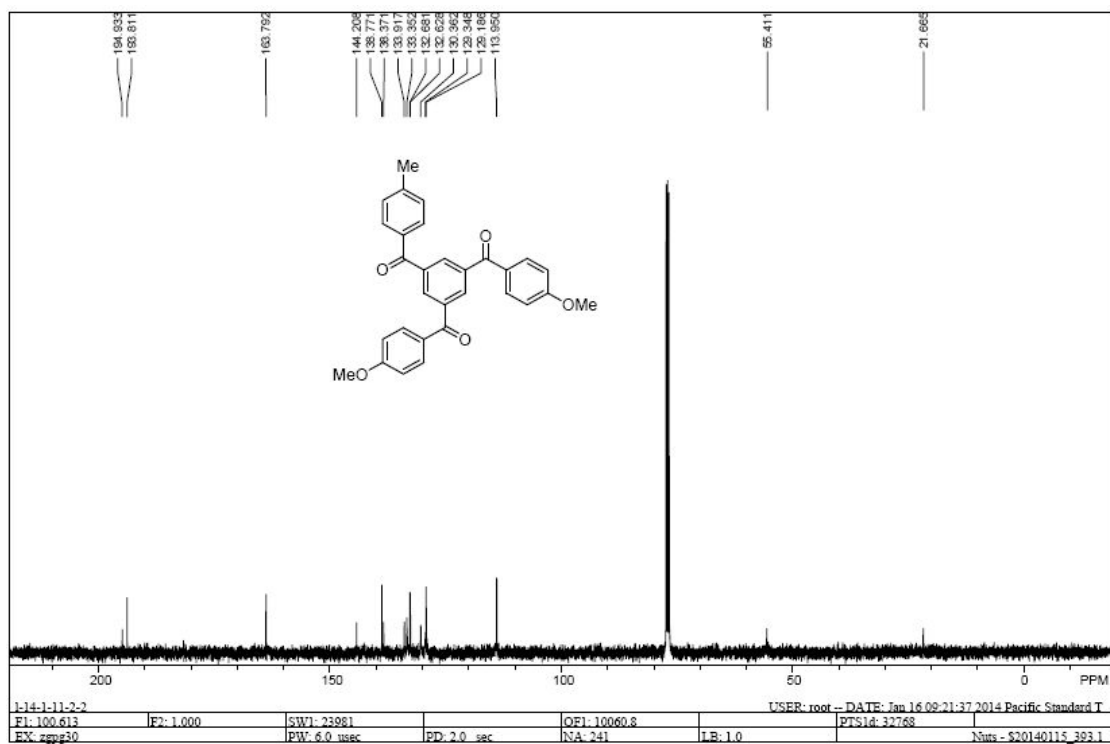
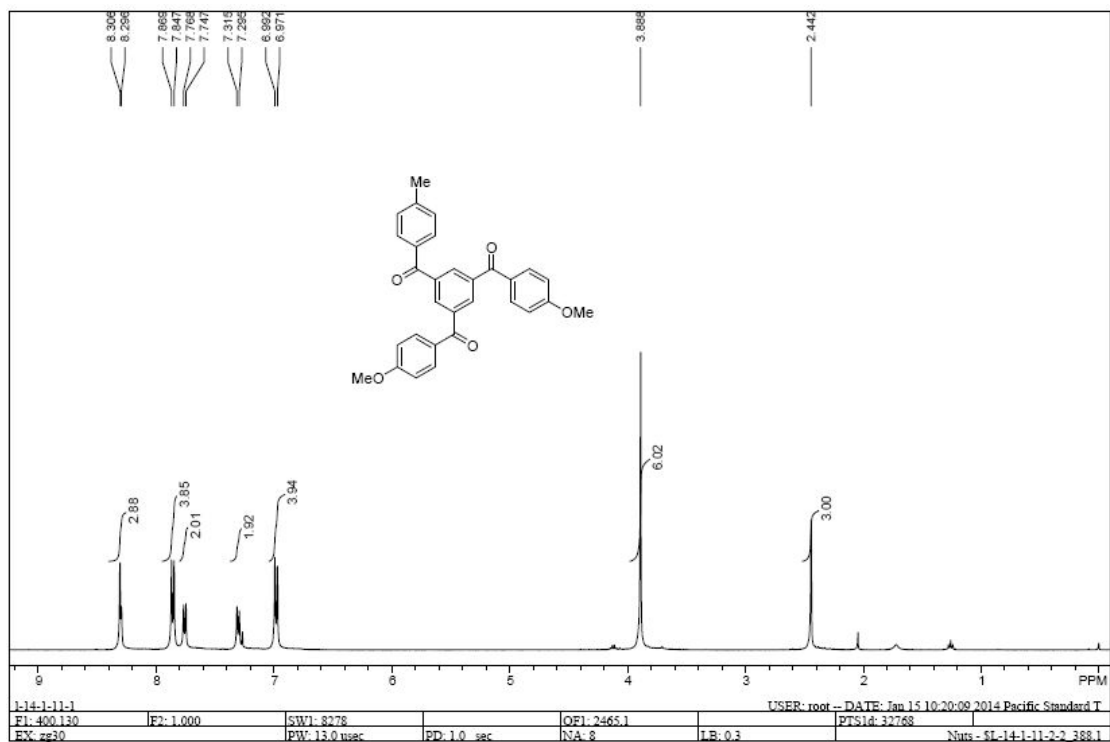
^{13}C NMR was recorded in 600 MHz apparatus



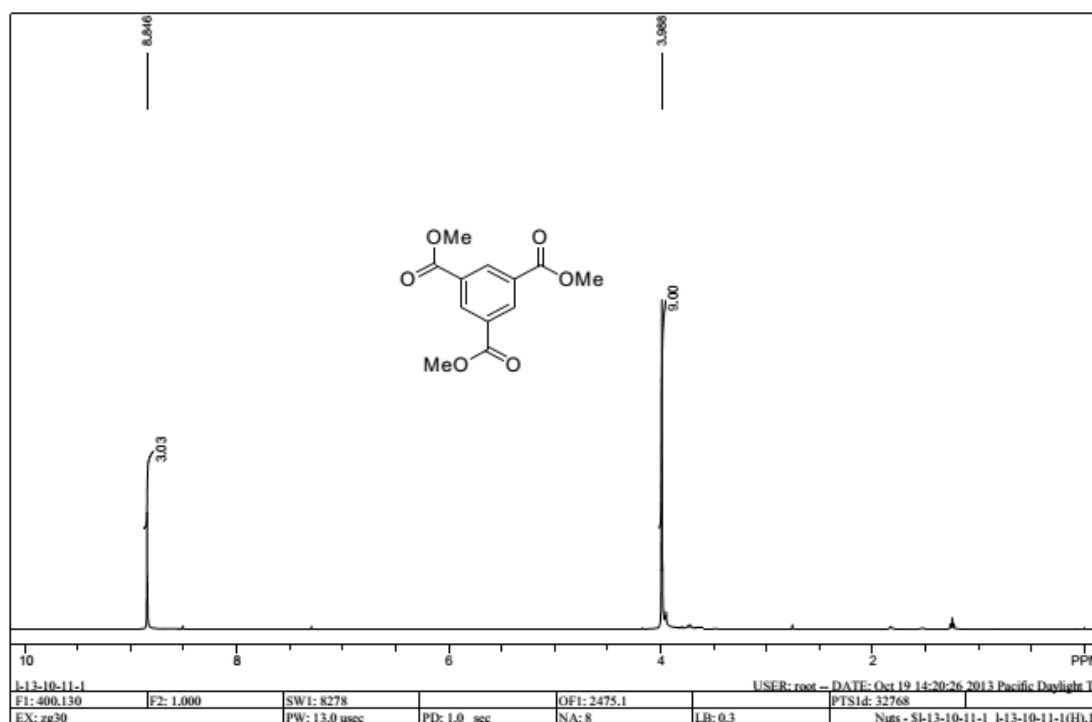
^1H and ^{13}C NMR spectra of **3cb**



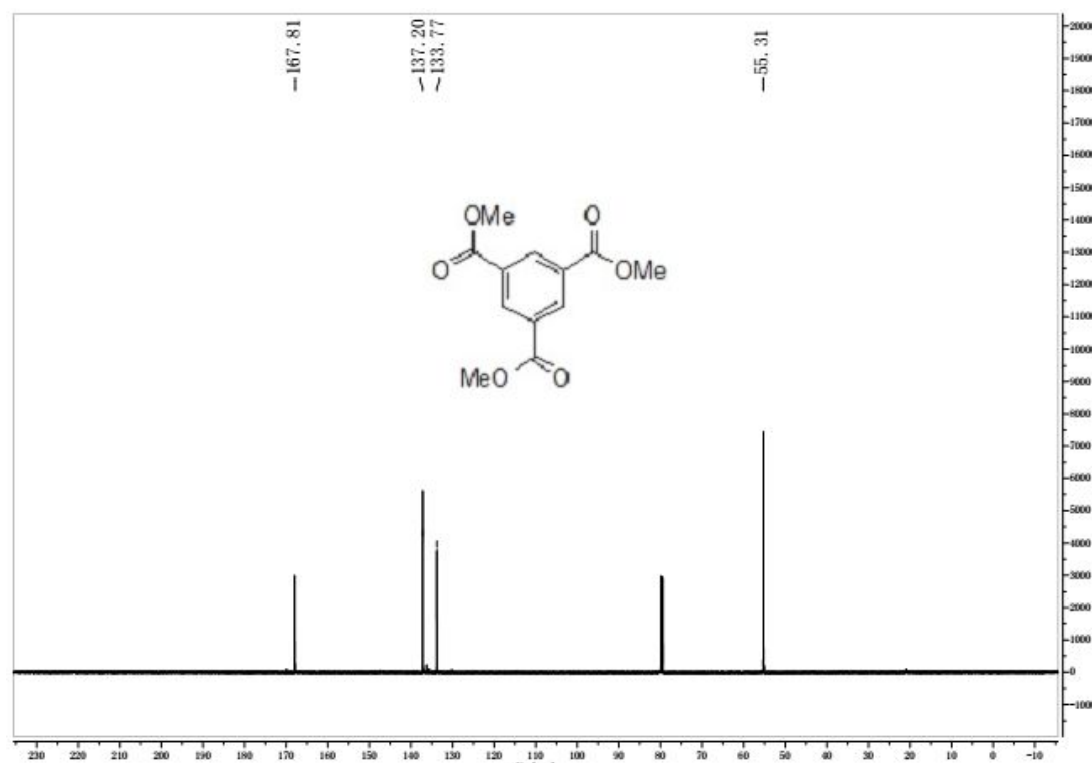
^1H and ^{13}C NMR spectra of **3bc**



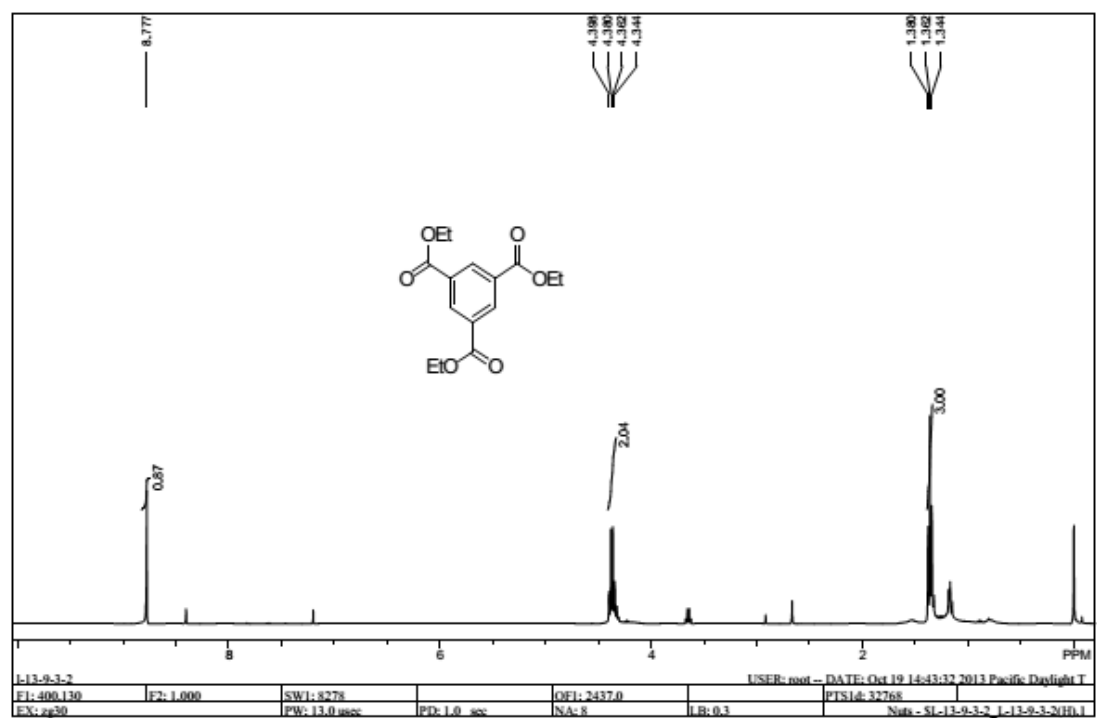
^1H and ^{13}C NMR spectra of **7a**



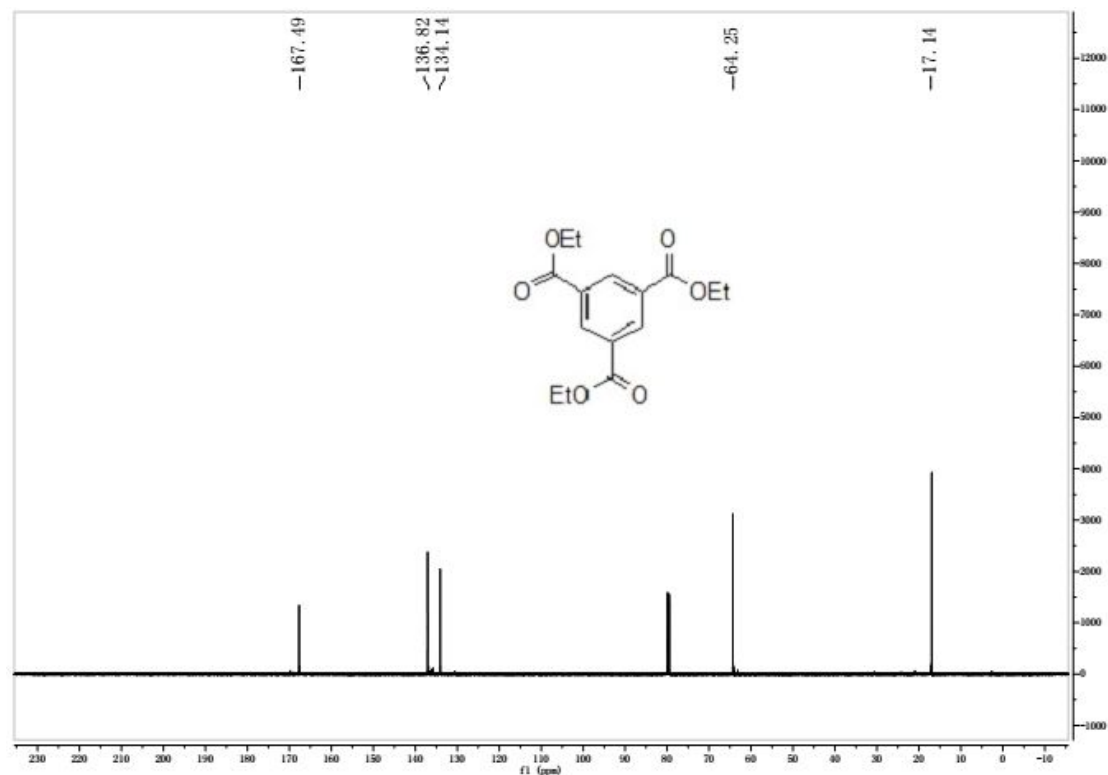
^{13}C NMR was recorded in 600 MHz apparatus



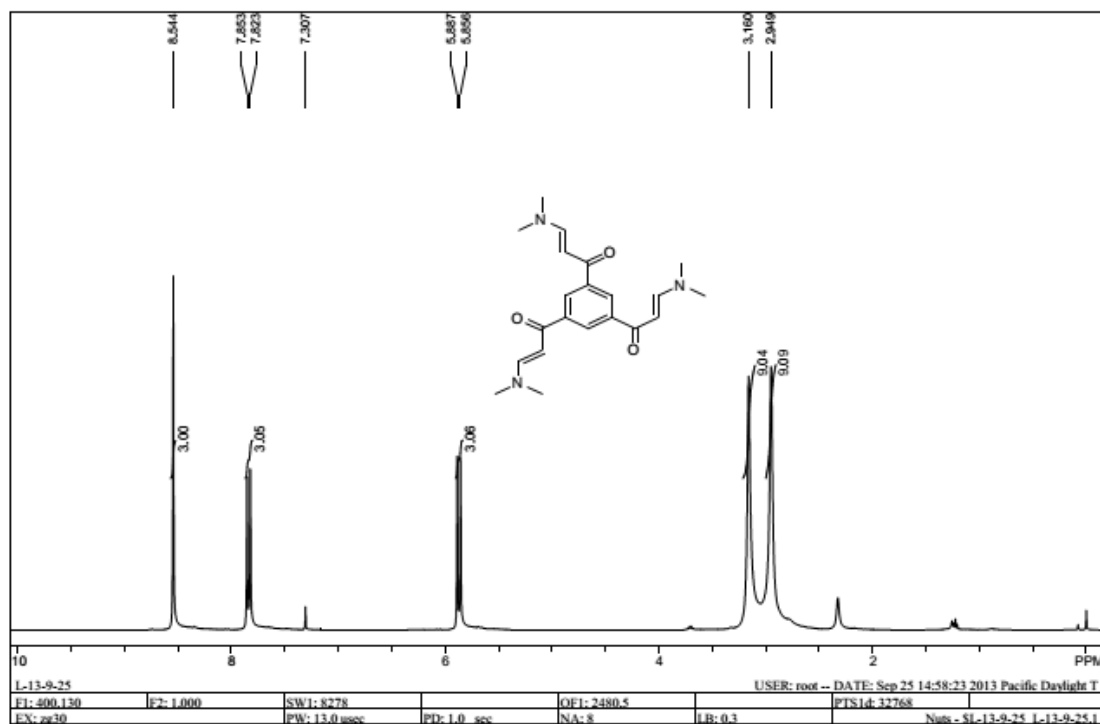
^1H and ^{13}C NMR spectra of **7b**



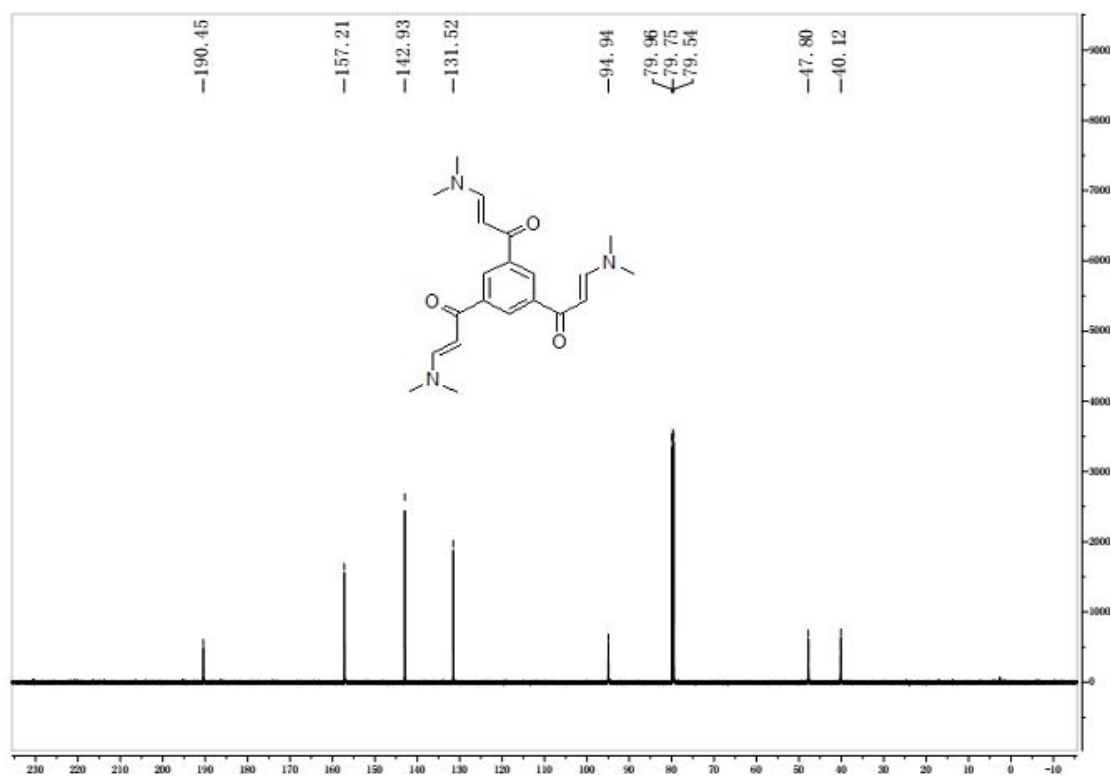
^{13}C NMR was recorded in 600 MHz apparatus



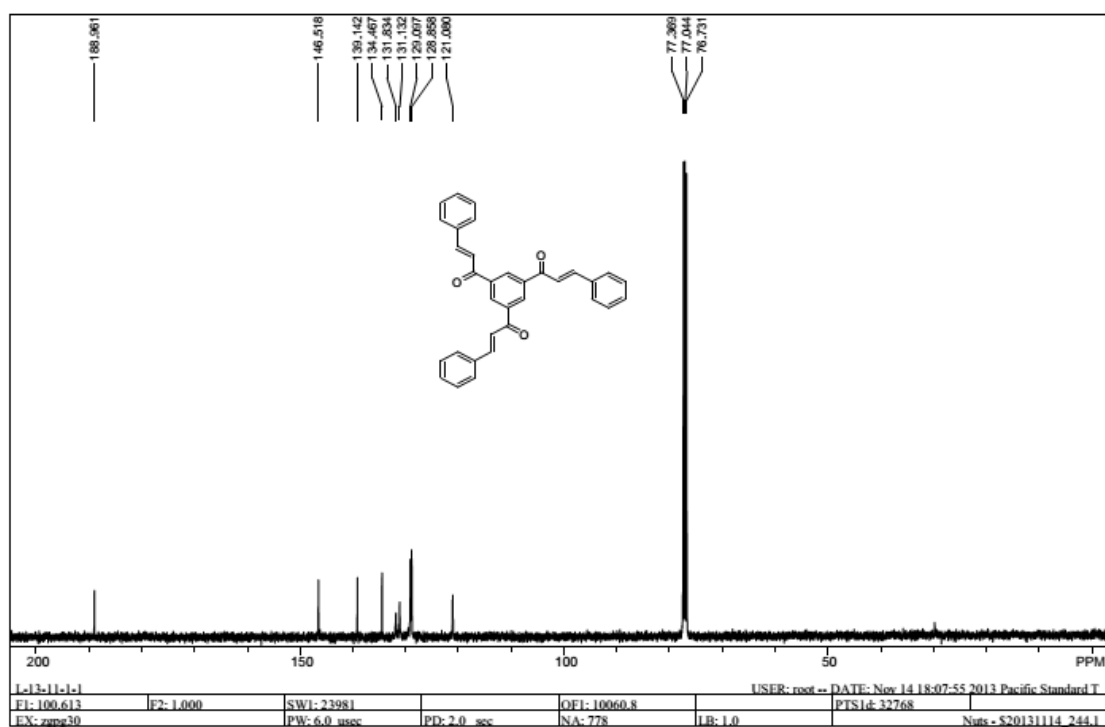
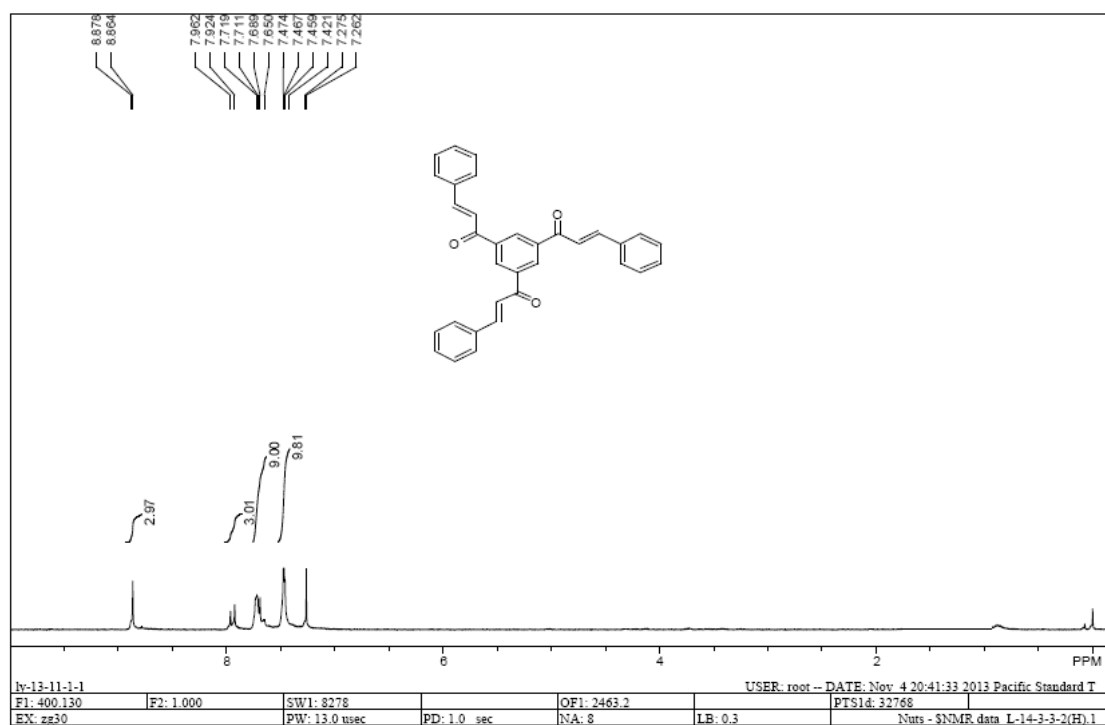
^1H and ^{13}C NMR spectra of **9**



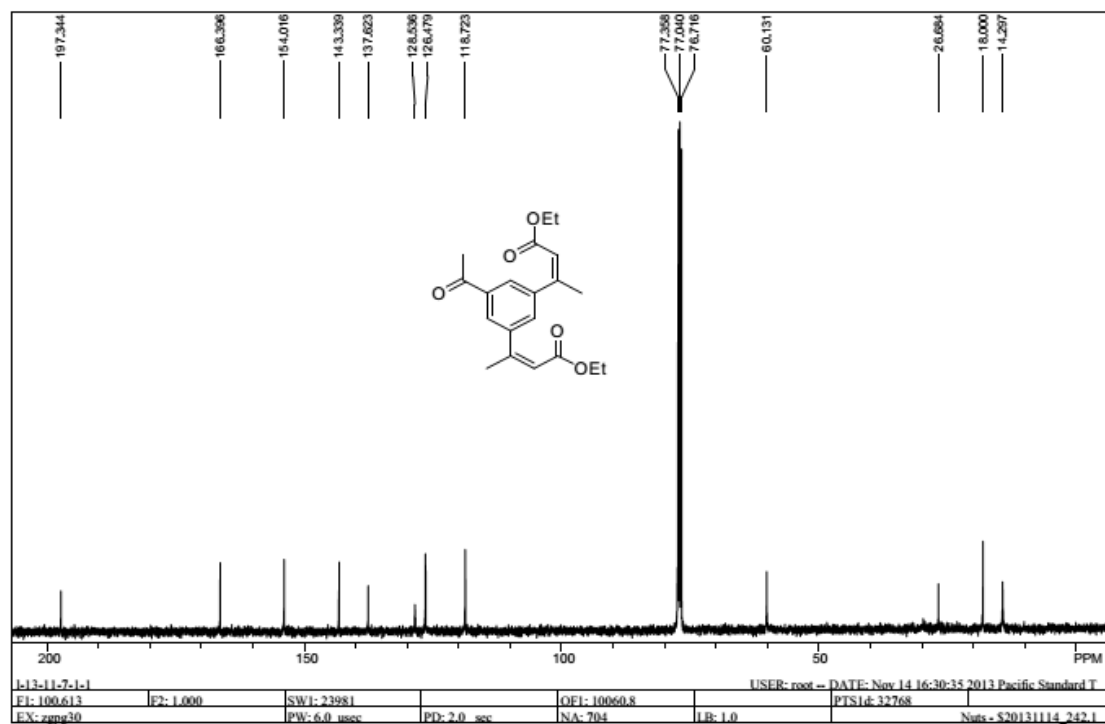
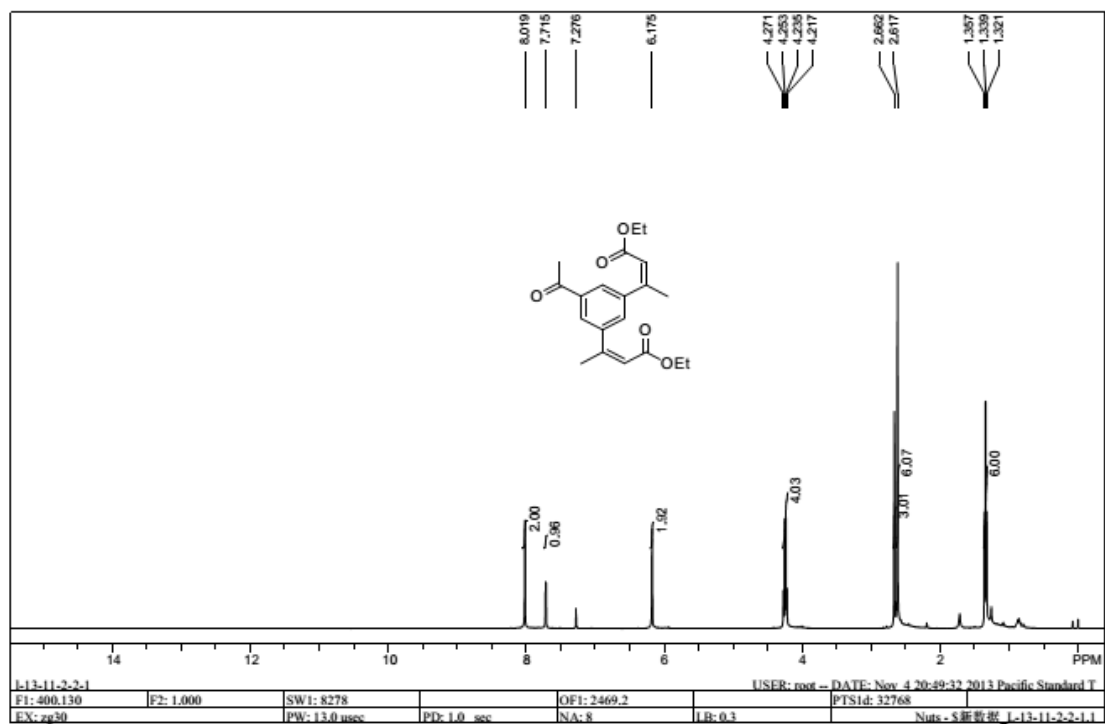
^{13}C NMR was recorded in 600 MHz apparatus



^1H and ^{13}C NMR spectra of **10**



^1H and ^{13}C NMR spectra of **12a**



^1H and ^{13}C NMR spectra of **12b**

