Electronic Supplementary Information (ESI)

Tetraphenylethene-Decorated Carbazoles: Synthesis, Aggregation-Induced Emission, Photo-Oxidation and Electroluminescence

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Content

1. **Experimental methods**

All commercially available starting materials, reagents and solvents were used as supplied, unless otherwise stated, and were purchased from Aladdin, Acros Organics and PuyangHuicheng Chemical Co. Ltd. All reactions were carried out under a dry nitrogen atmosphere unless water was used as a solvent or reagent and the temperatures were measured externally. Benzene was dried over CaH_2 with stirring overnight followed by distillation under reduced pressure. Reported yields are isolated yields. Purification of most intermediates and all final products was accomplished in most cases by gravity column chromatography, using silica gel. For qualitative purity tests of all intermediates and final products, a single spot (visualised using UV-light at 254 nm and 365 nm) was obtained. Elemental analysis was used for quantitative purity checks of all final products. ^{1}H NMR spectra are reported in parts per million (ppm) relative to tetramethylsilane as an internal standard.

UV-VIS: Shimadzu UV-VIS-NIR Spectrophotometer (UV-3600)

PL: Edinburgh instruments (FLS 920 spectrometers)

^{1}HNMR: (Bruker AV600).

Mass Spectrometry: Agilent (1100 LC/MSD Trap),

Elemental Analysis: Elementar (Vario Micro-cube).

Stylus profiler: Bruker Dektakxt

2. Optical properties

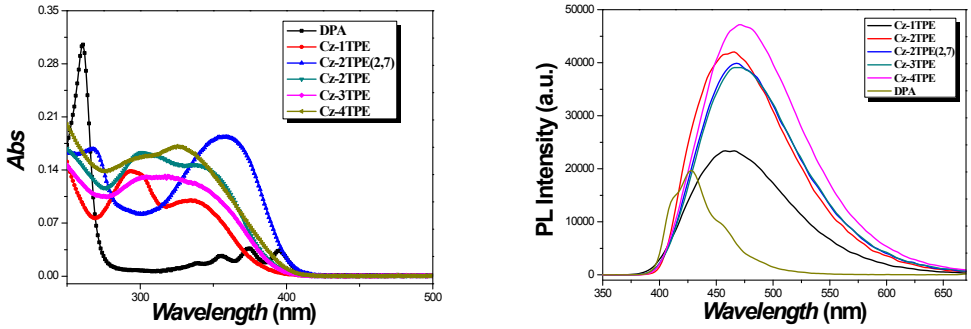


Figure S1 UV-vis absorption spectra and PL spectra of Cz-TPEs and DPA in PMMA thin films.

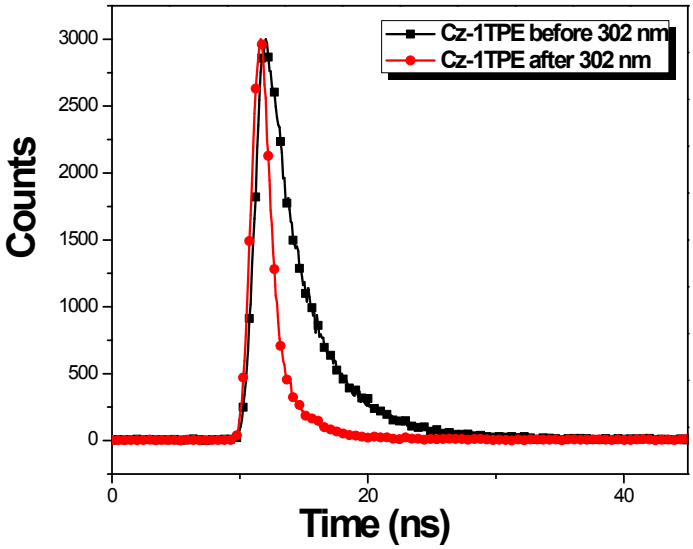


Figure S2 Fluorescence lifetime of Cz-TPEs in pure thin films.

3. Measurements of the film thickness

The thickness of the films used for photo-oxidation and electroluminescence devices are calculated by a stylus profiler (Bruker Dektakxt).

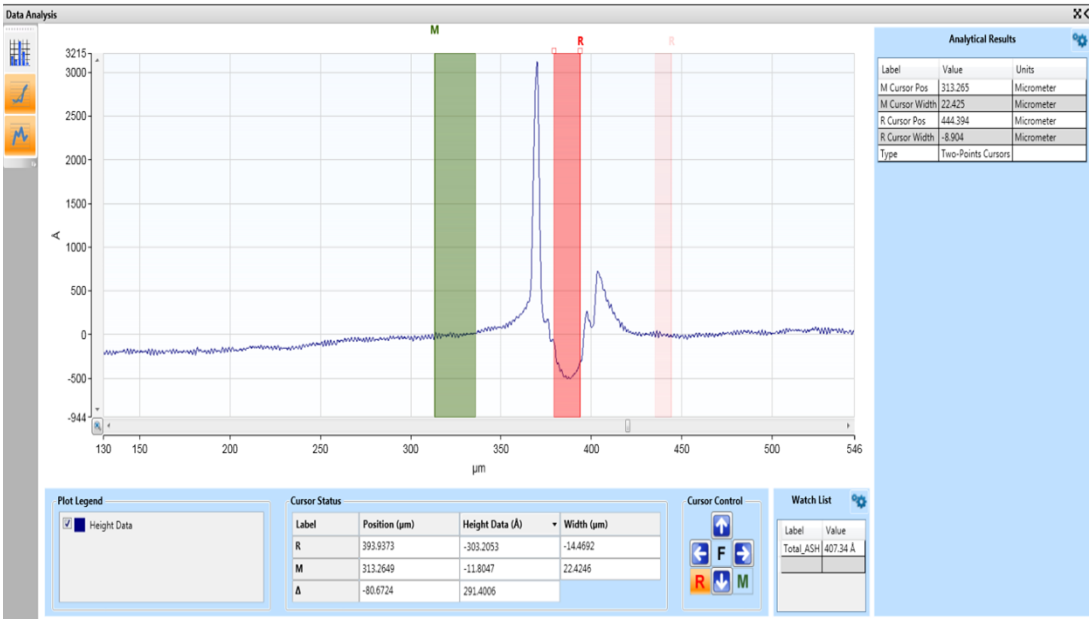
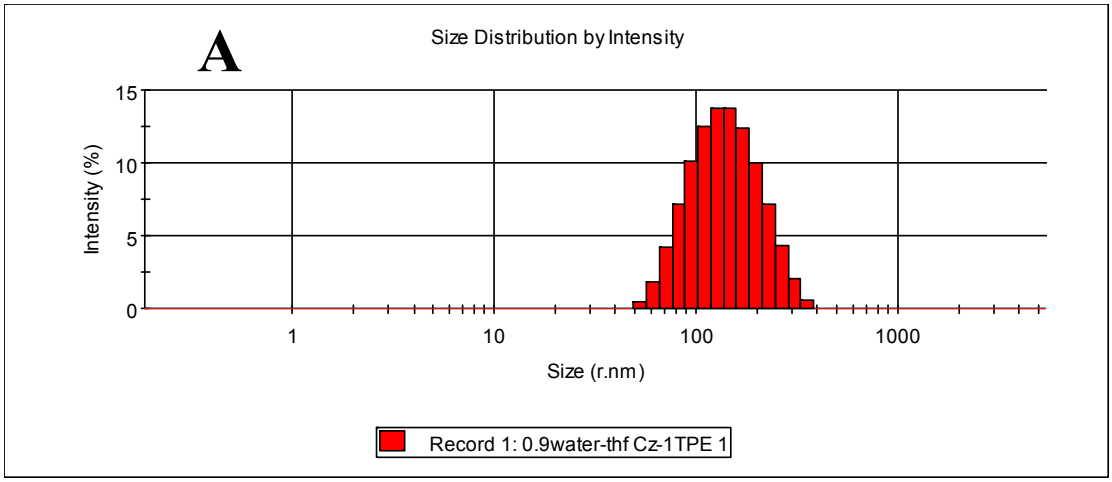
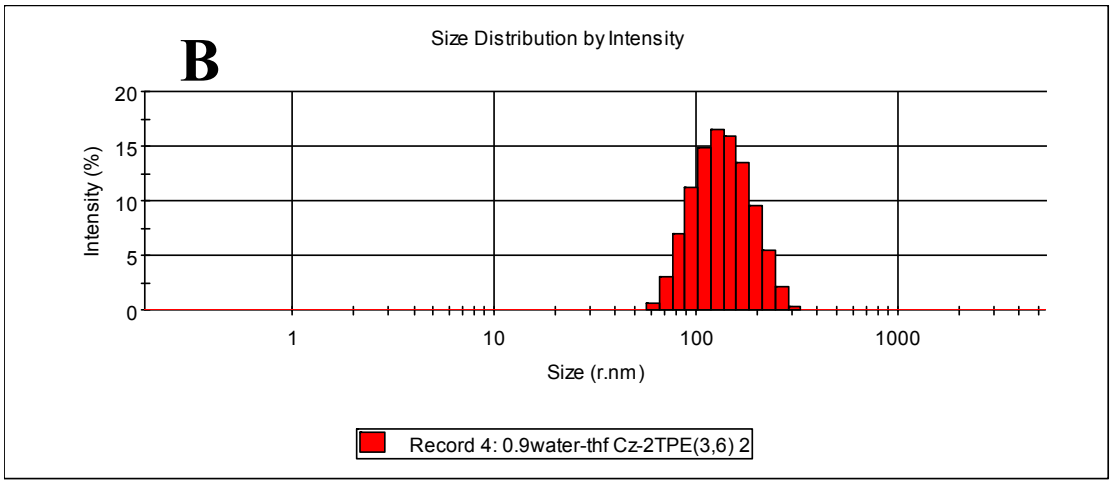


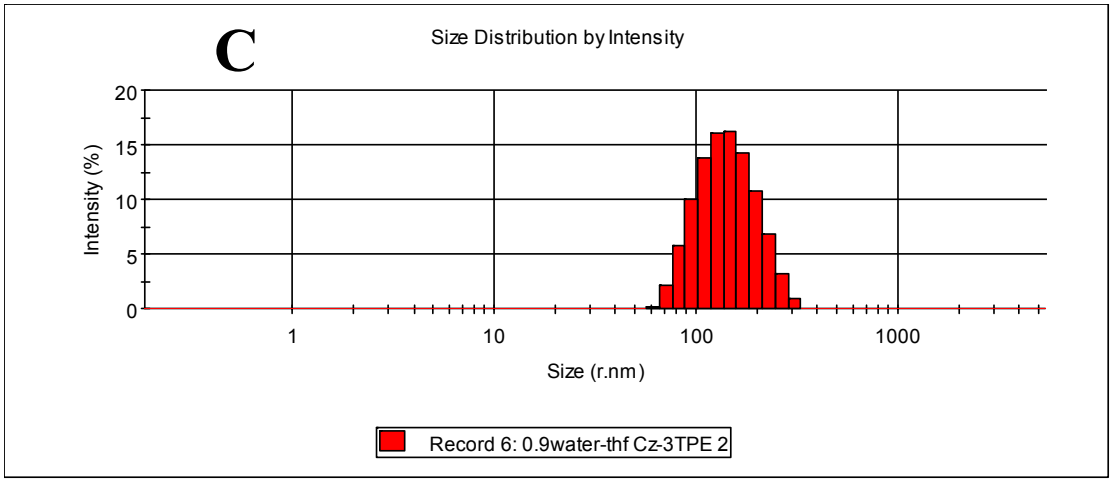
Figure S3 The screen shot picture of film (Cz-1TPE) used in photo-oxidation experiments, the value is 407.34A, which is about 40nm thickness

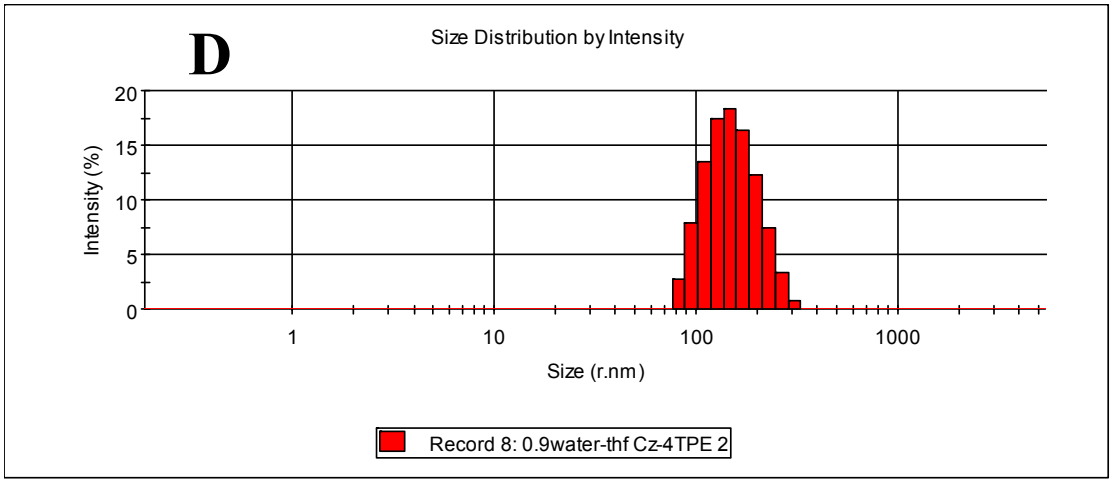
Figure S4 The screen shot picture of film used in OLED devices, the value is 473.96A, which is about 47nm thickness

4. DLS measurement









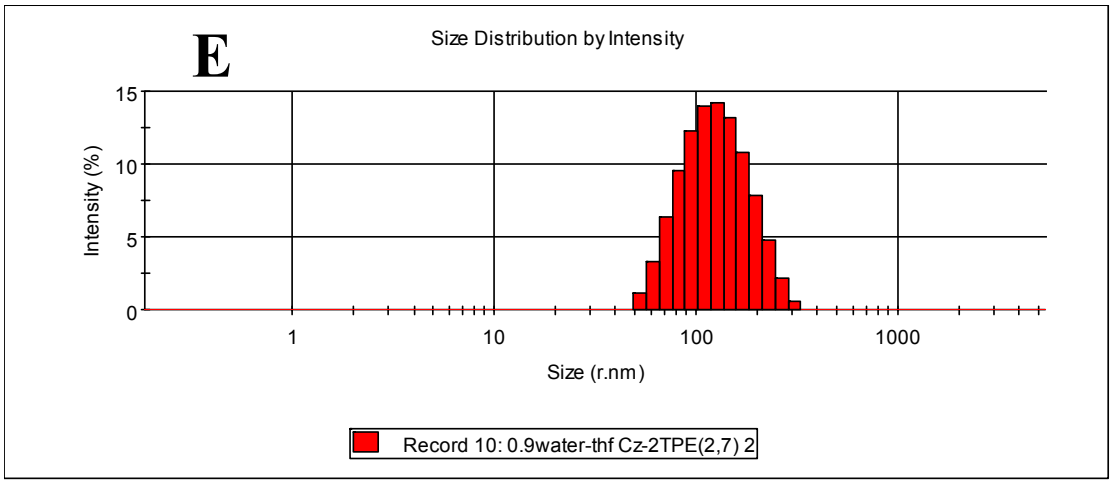


Figure S5 DLS data of Cz-TPEs in $\mathbf{f_w}$= 90%, concentration equals 10-5mol/L**(A)** Cz-1TPE, **(B)** Cz-2TPE,**(C)** Cz-3TPE,**(D)** Cz-4TPE and **(E)** Cz-2TPE (2, 7); DLS calculated Nanoparticle size of Cz-TPEs in $\mathbf{f_w}$= 90% with concentration [M] = 10^{-5}mol L^{-1}

Sample name	Cz-1TPE	Cz-2TPE(3,6)	Cz-2TPE(2,7)	Cz-3TPE	Cz-4TPE
Size(nm)	125.4	127.5	115	136.6	144.1

5. ^{1}H and ^{13}C NMR

^{1}H-NMR spectra of Cz-TPEs in $CDCl_3$

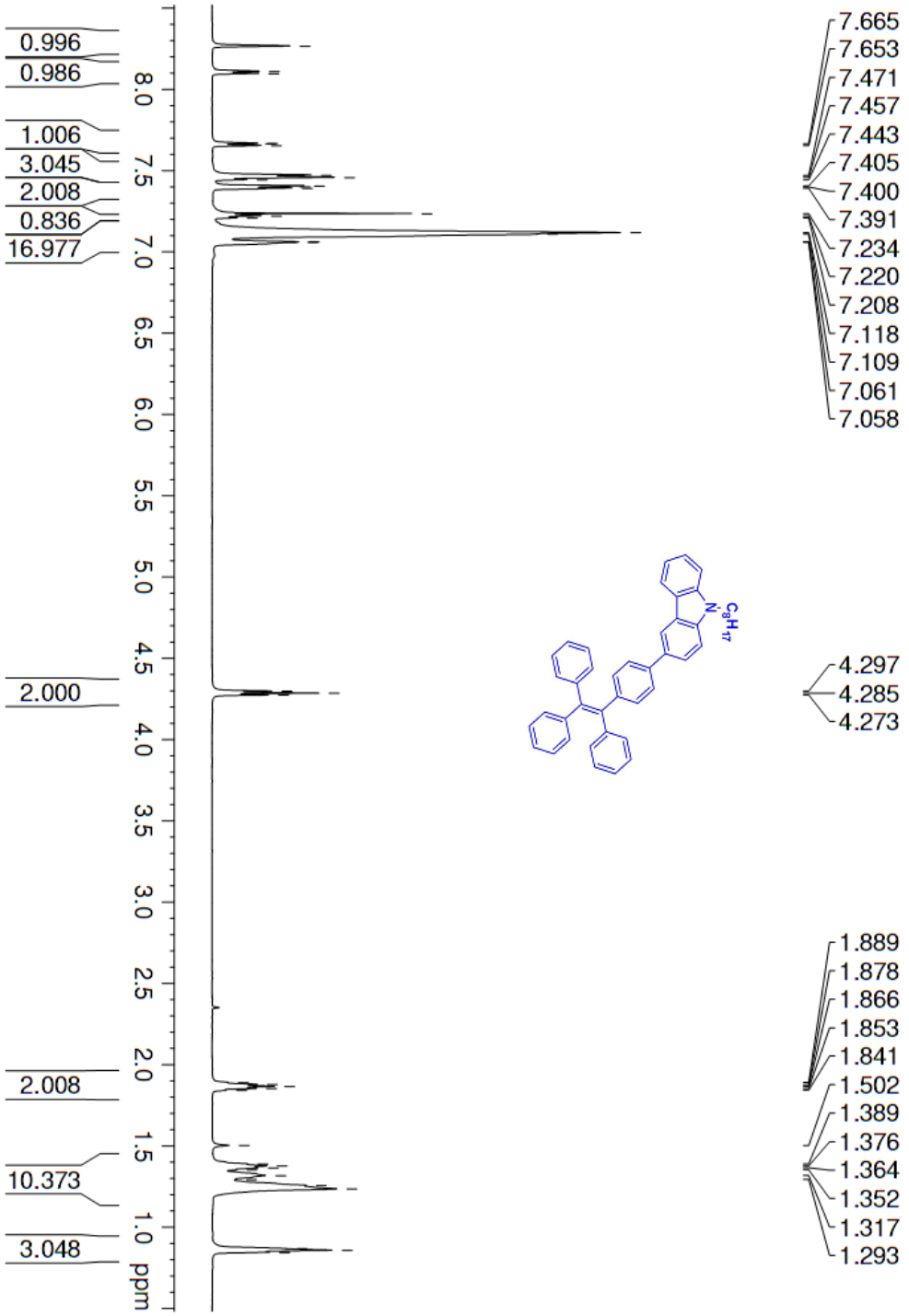


Figure S6 ^{1}-H-NMR Spectra of Cz-1TPE in $CDCl_3$

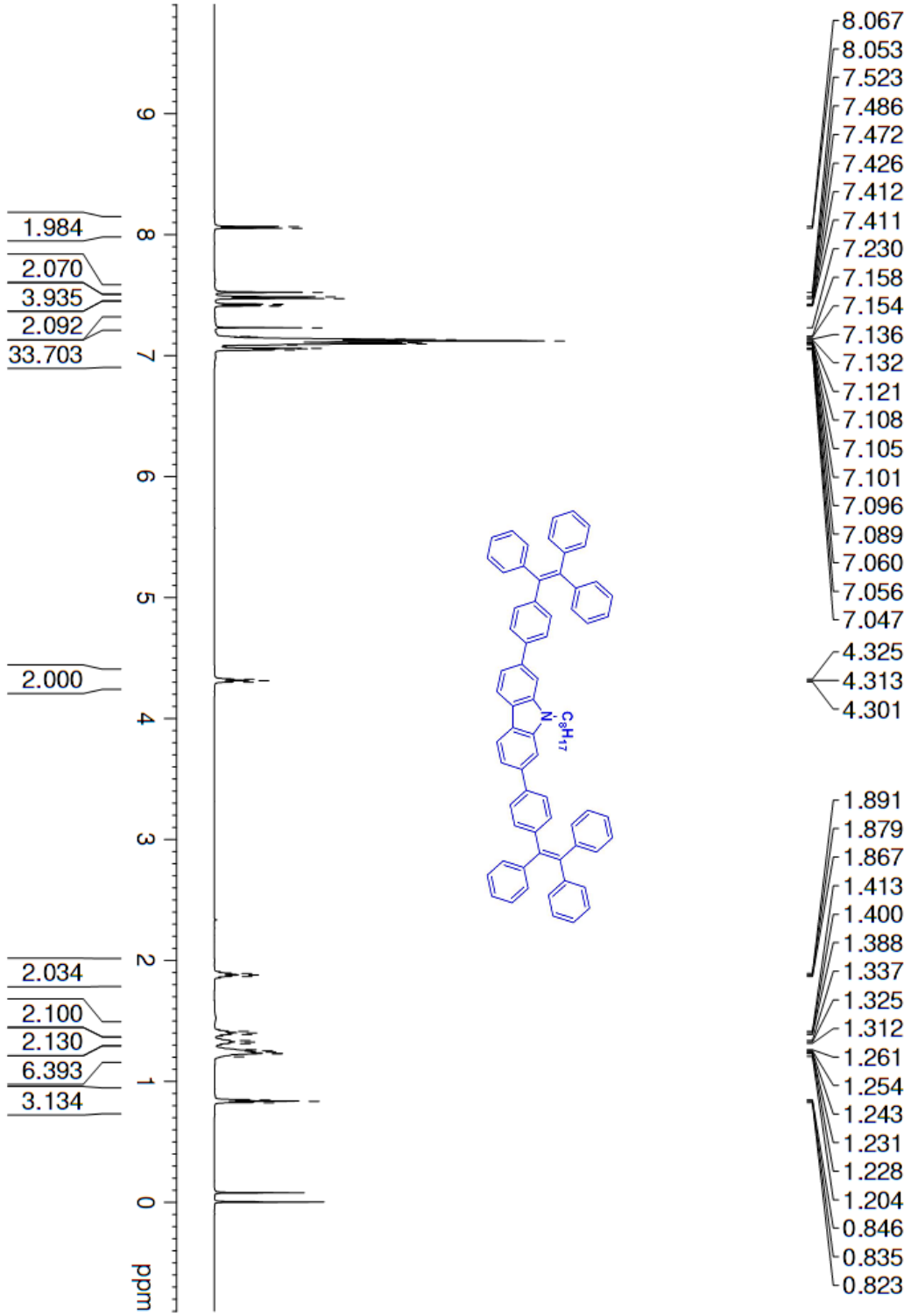


Figure S7 ^{1}-H-NMR Spectra of Cz-2TPE (2, 7) in $CDCl_3$

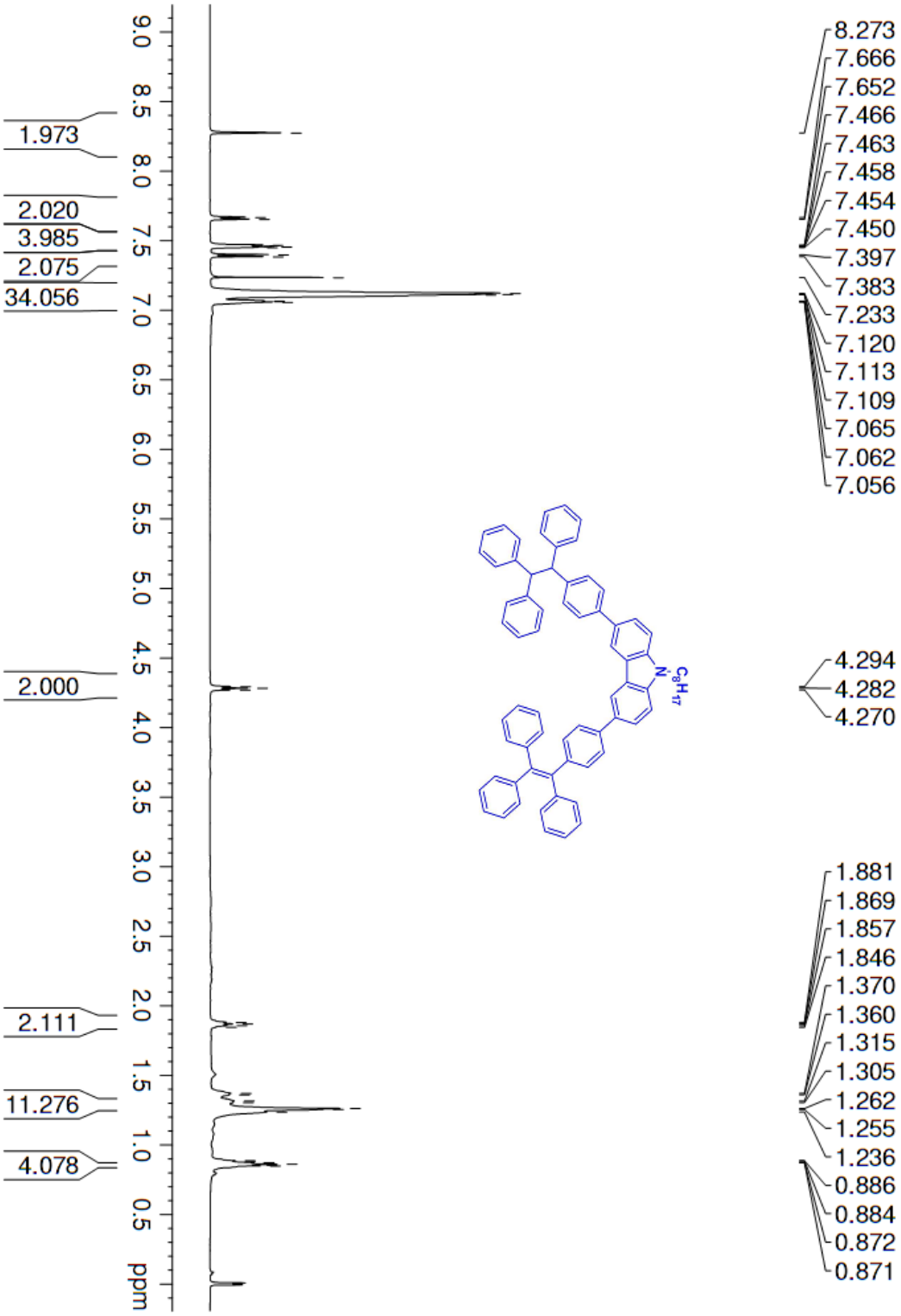


Figure S8 ^{1}H-NMR Spectra of Cz-2TPE (3, 6) in $CDCl_3$

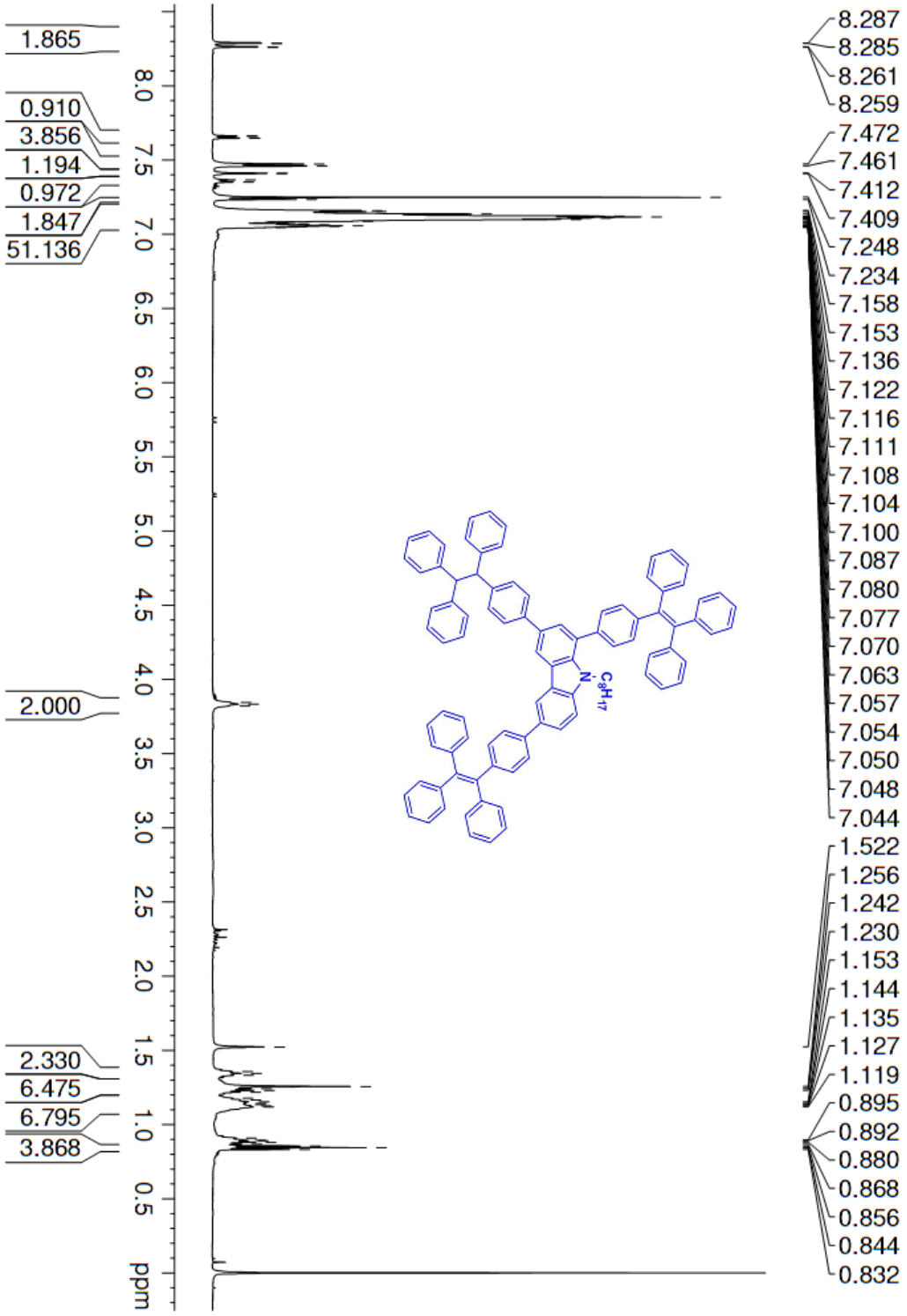


Figure S9 ^{1}H-NMR Spectra of Cz-3TPE in $CDCl_3$

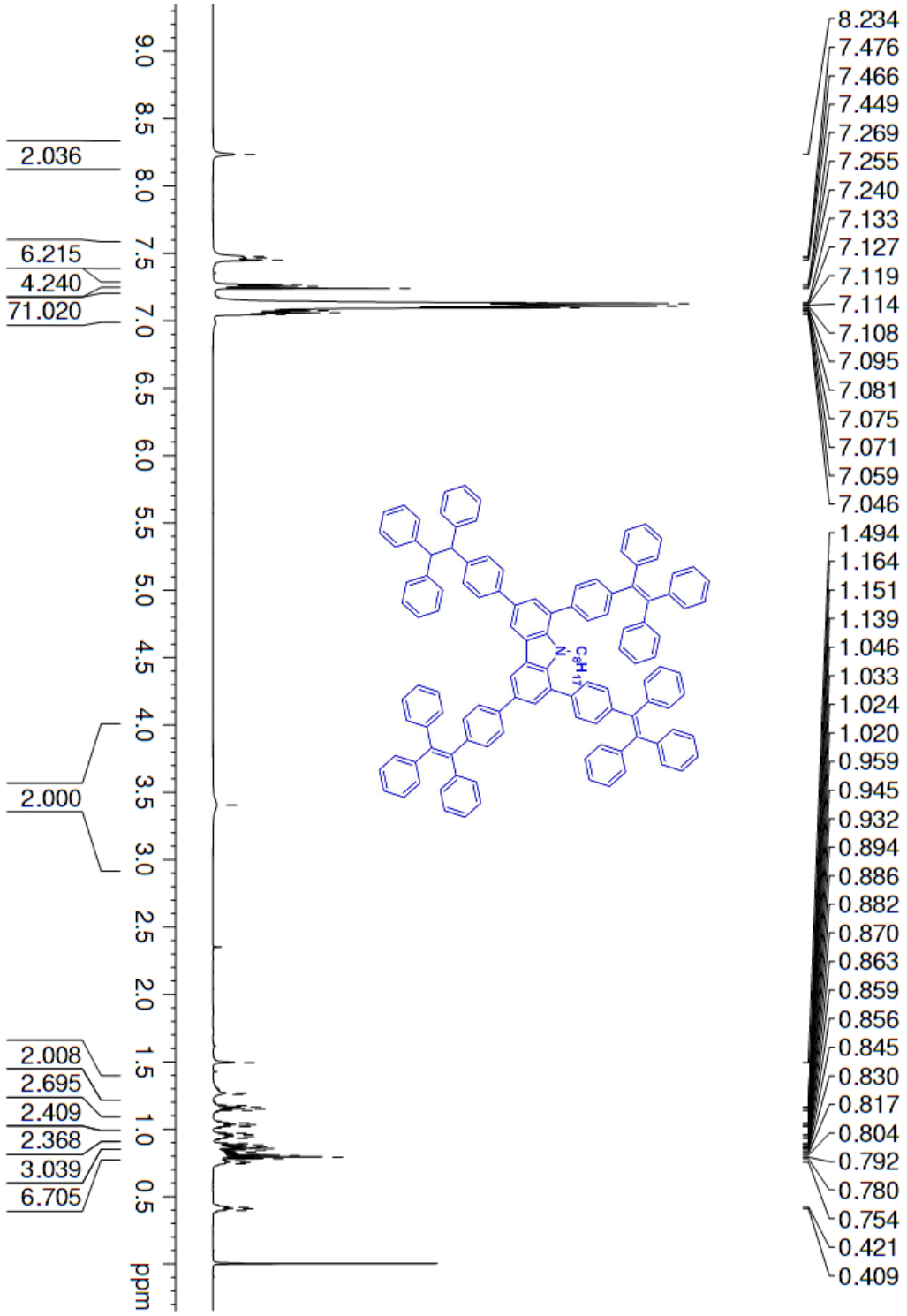


Figure S10 ^{1}-H-NMR Spectra of Cz-4TPE in $CDCl_3$

^{13}C-NMR of Cz-TPEs in $CDCl_3$

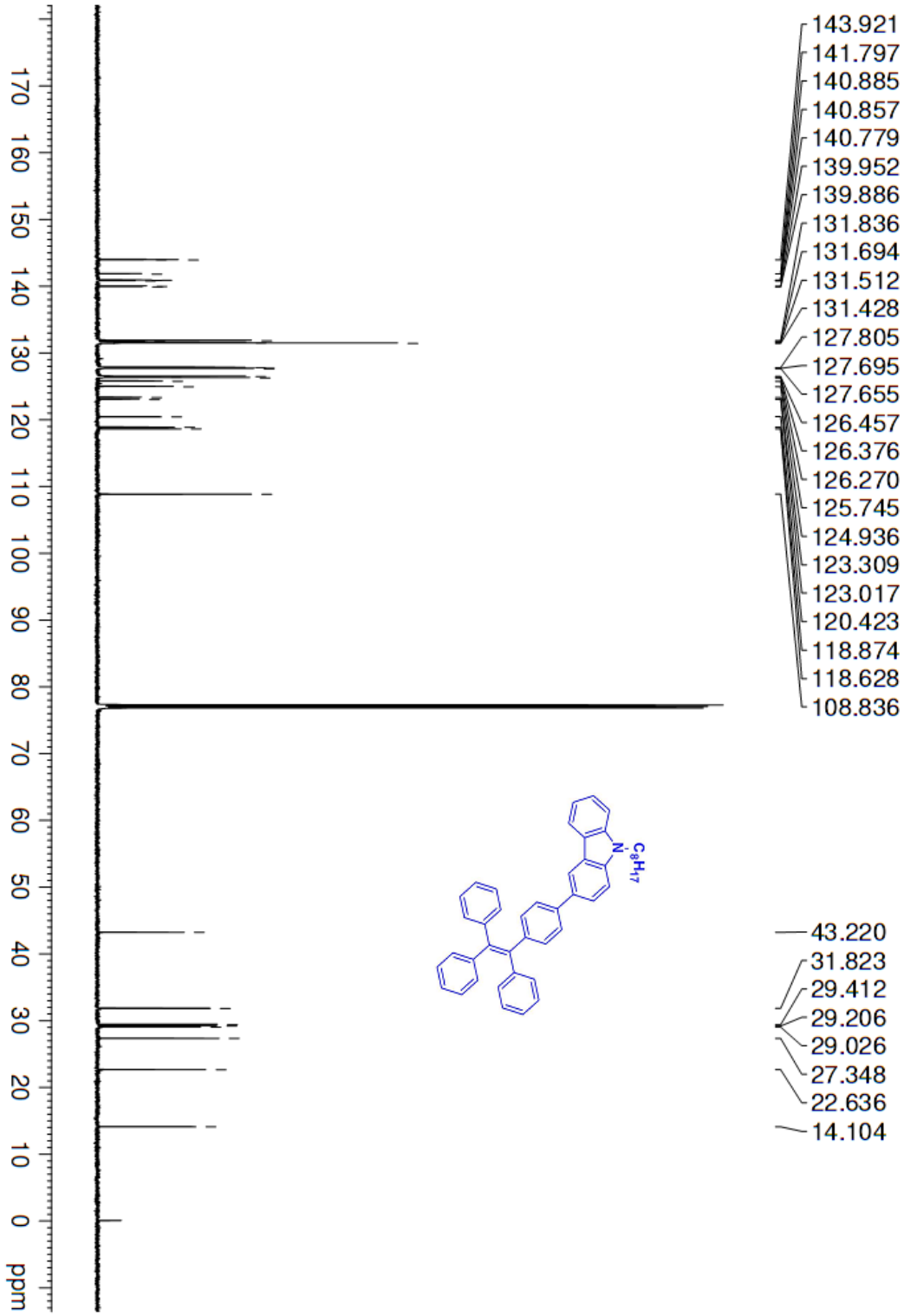


Figure S11 ^{13}-C-NMR Spectra of Cz-1TPE in $CDCl_3$

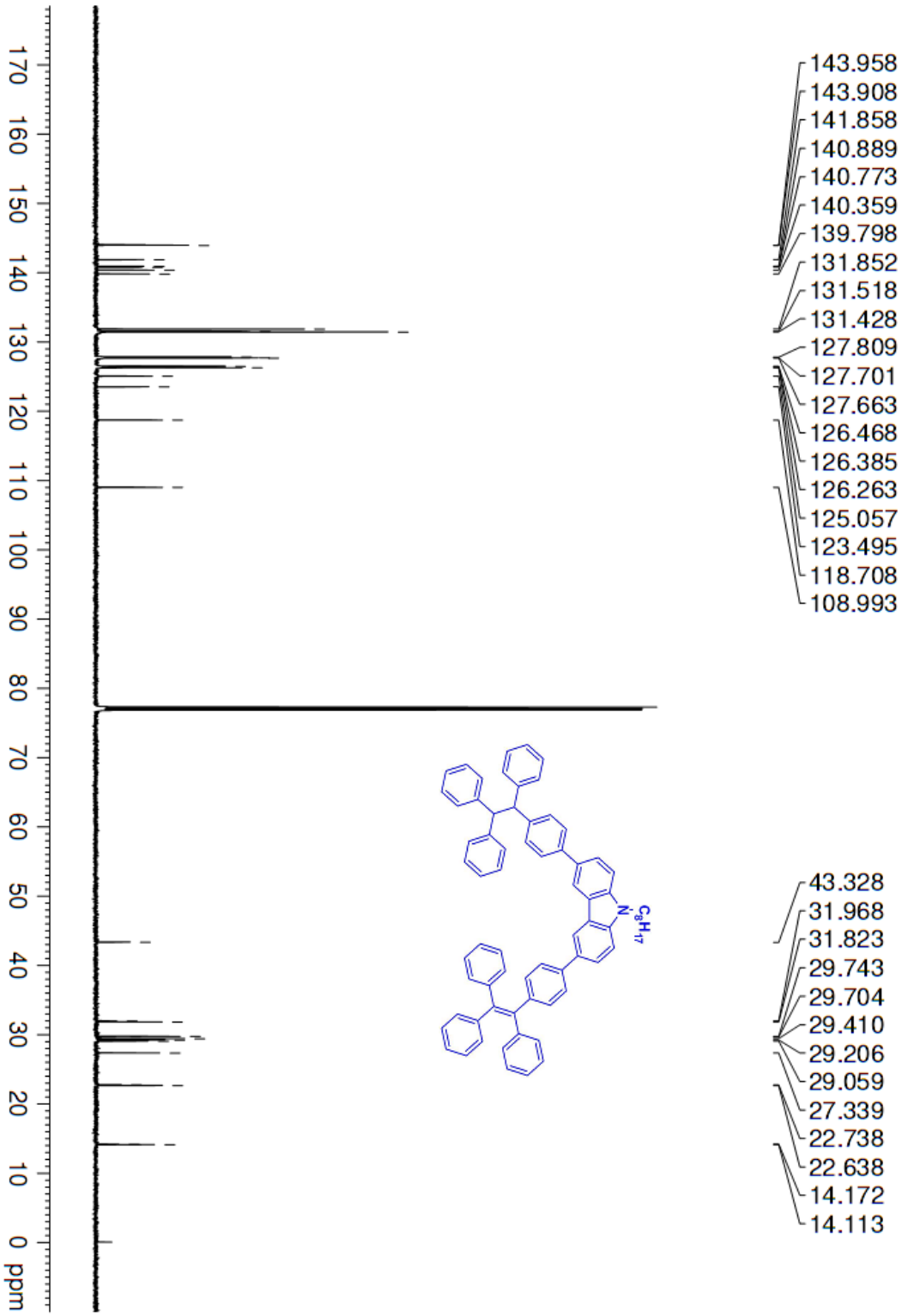


Figure S12 ^{13}-C-NMR Spectra of Cz-2TPE in $CDCl_3$

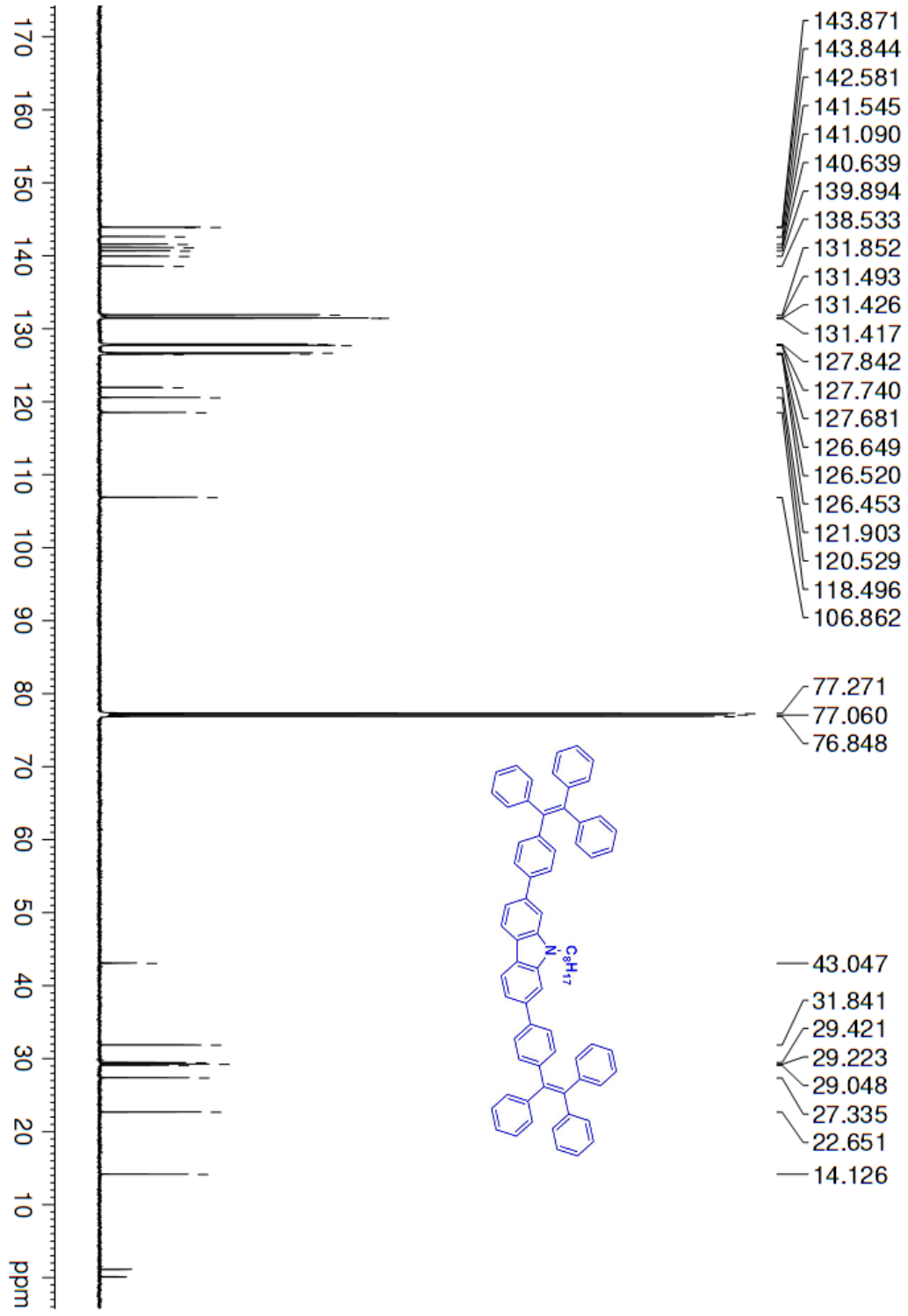


Figure S13 ^{13}C-NMR Spectra of Cz-2TPE (2, 7) in $CDCl_3$

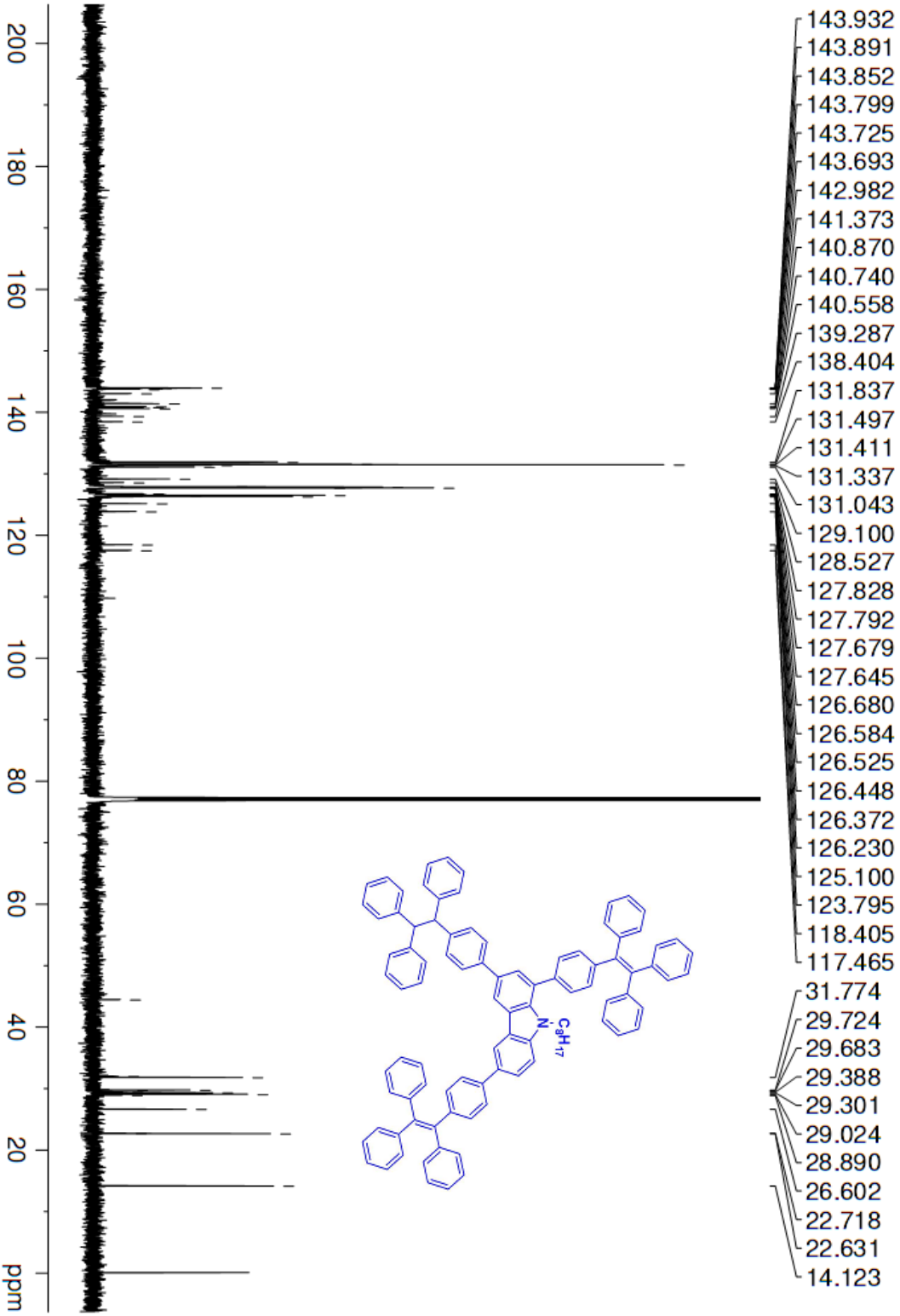


Figure S14 ^{13}-C-NMR Spectra of Cz-3TPE in $CDCl_3$

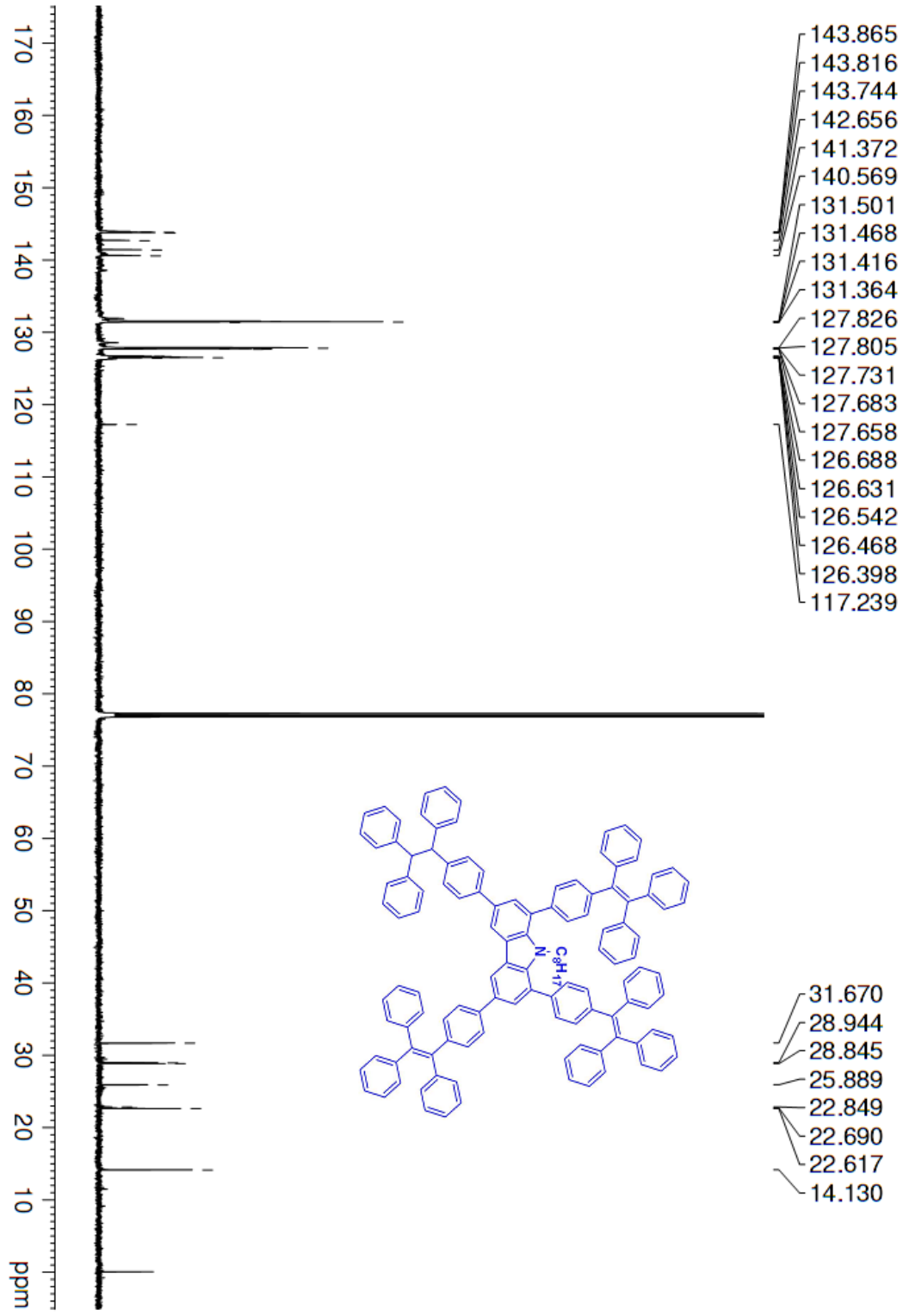


Figure S15 ^{13}-C-NMR Spectra of Cz-4TPE in $CDCl_3$

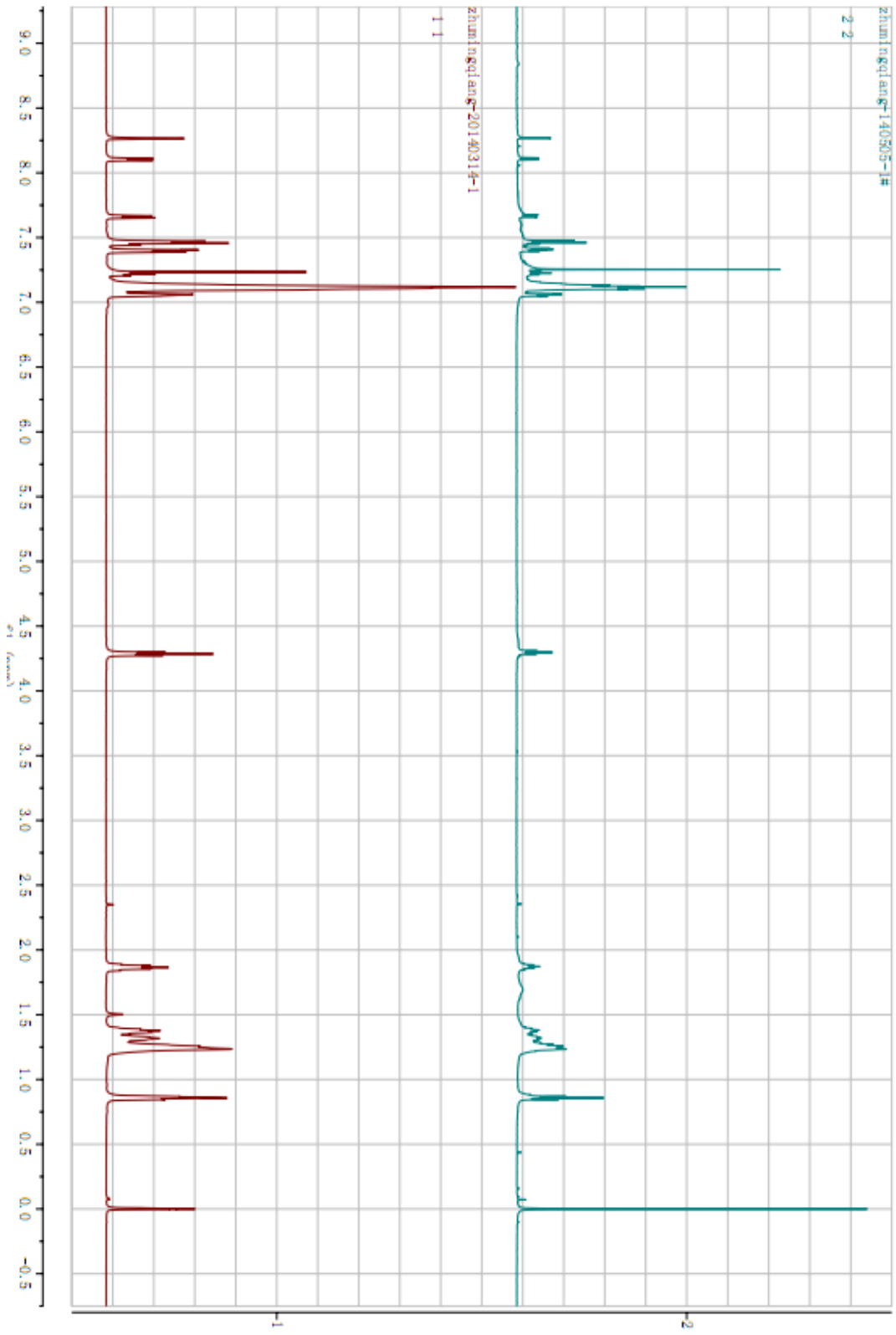


Figure S16 Overlap ^{1}-H NMR Spectra of Cz-1TPE in $CDCl_3$ before (red line) and after (blue line) UV light irradiation

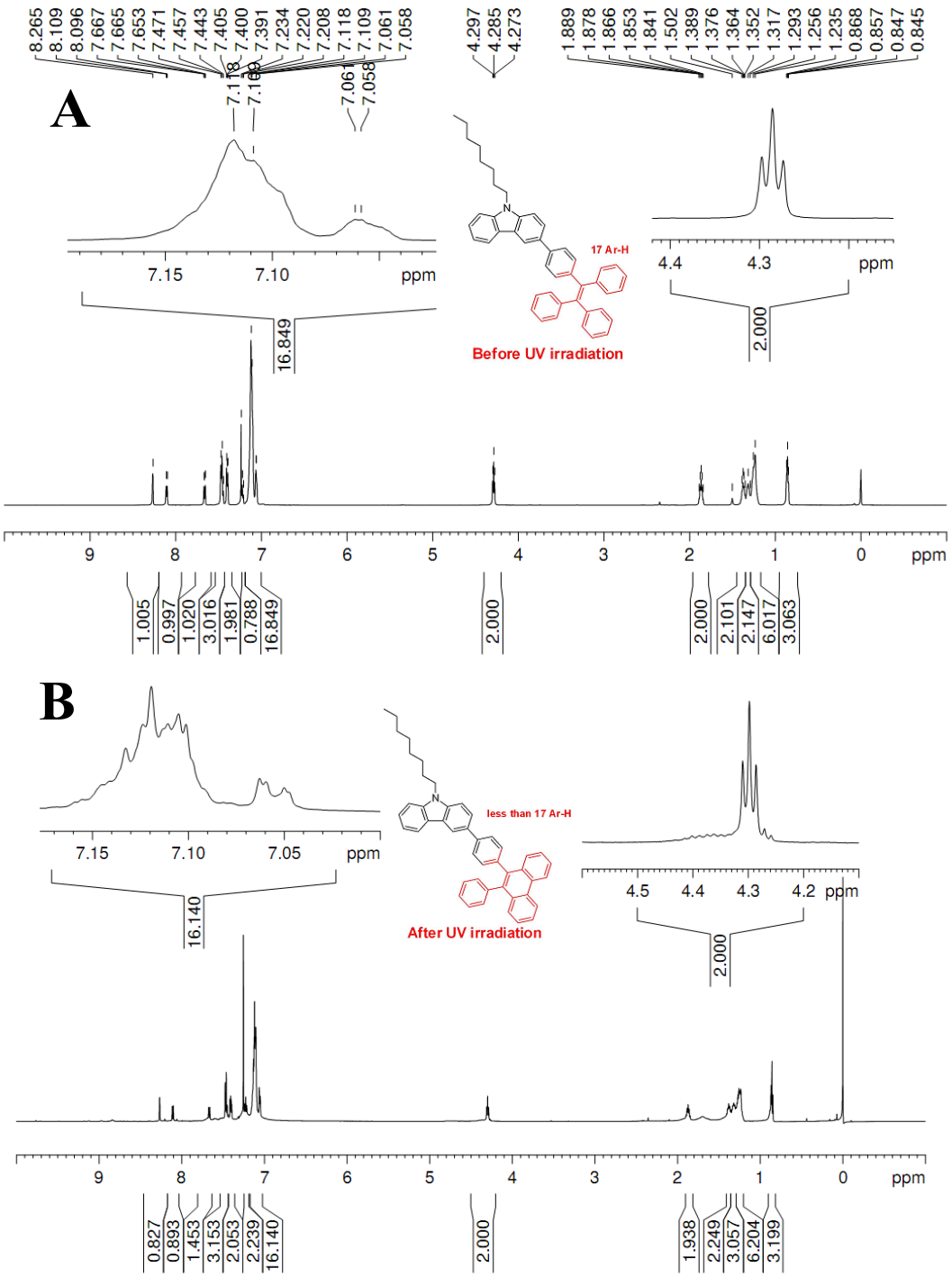


Figure S17 ^{1}H NMR Spectra of Cz-1TPE in $CDCl_3$ before (**A**) and after (**B**) UV light irradiation.

6. Mass spectra

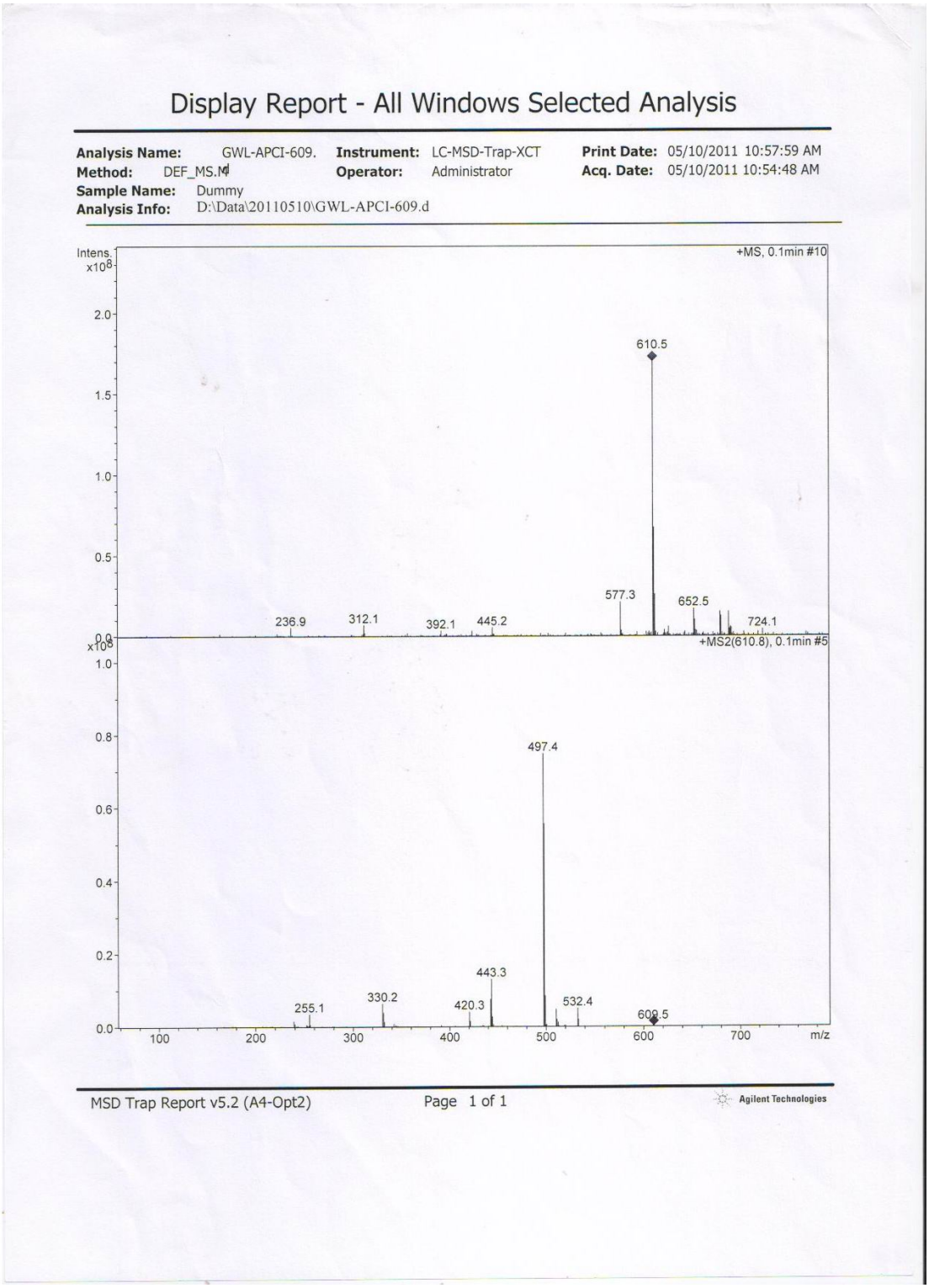


Figure S18 Mass spectra of Cz-1TPE

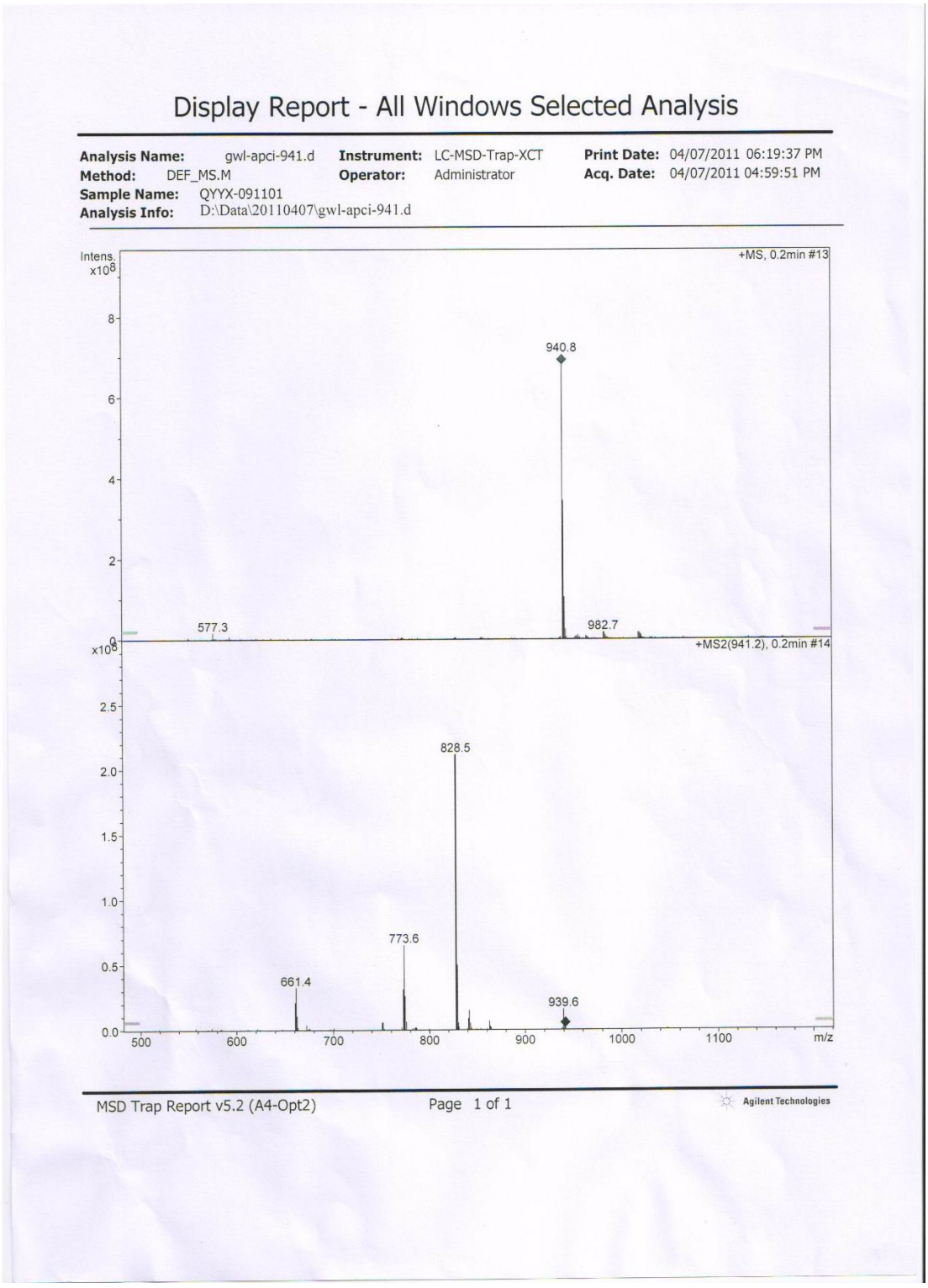


Figure S19 Mass spectrum of Cz-2TPE (3, 6)

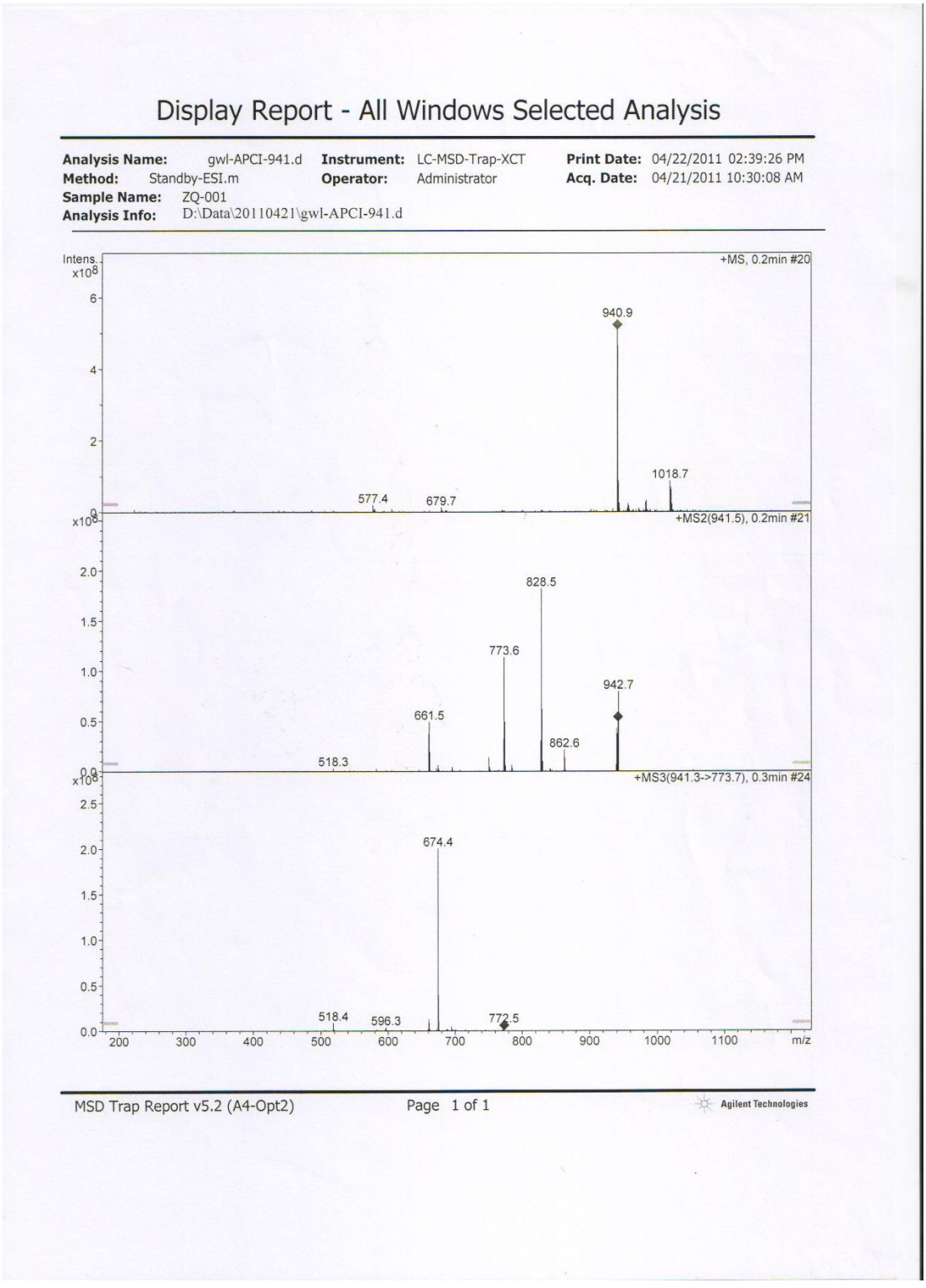


Figure S20 Mass spectrum of Cz-2TPE (2, 7)

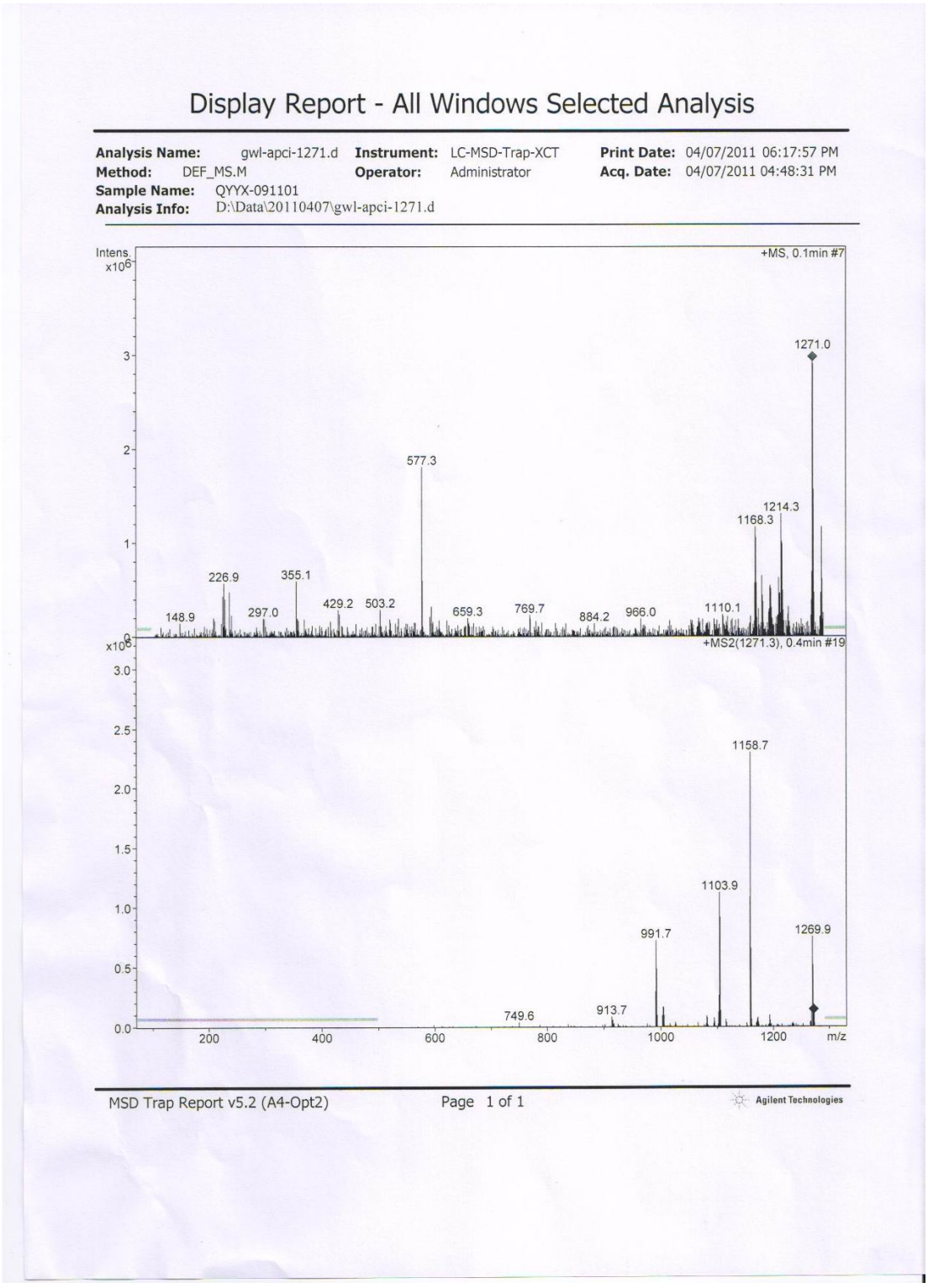


Figure S21 Mass spectrum of Cz-3TPE

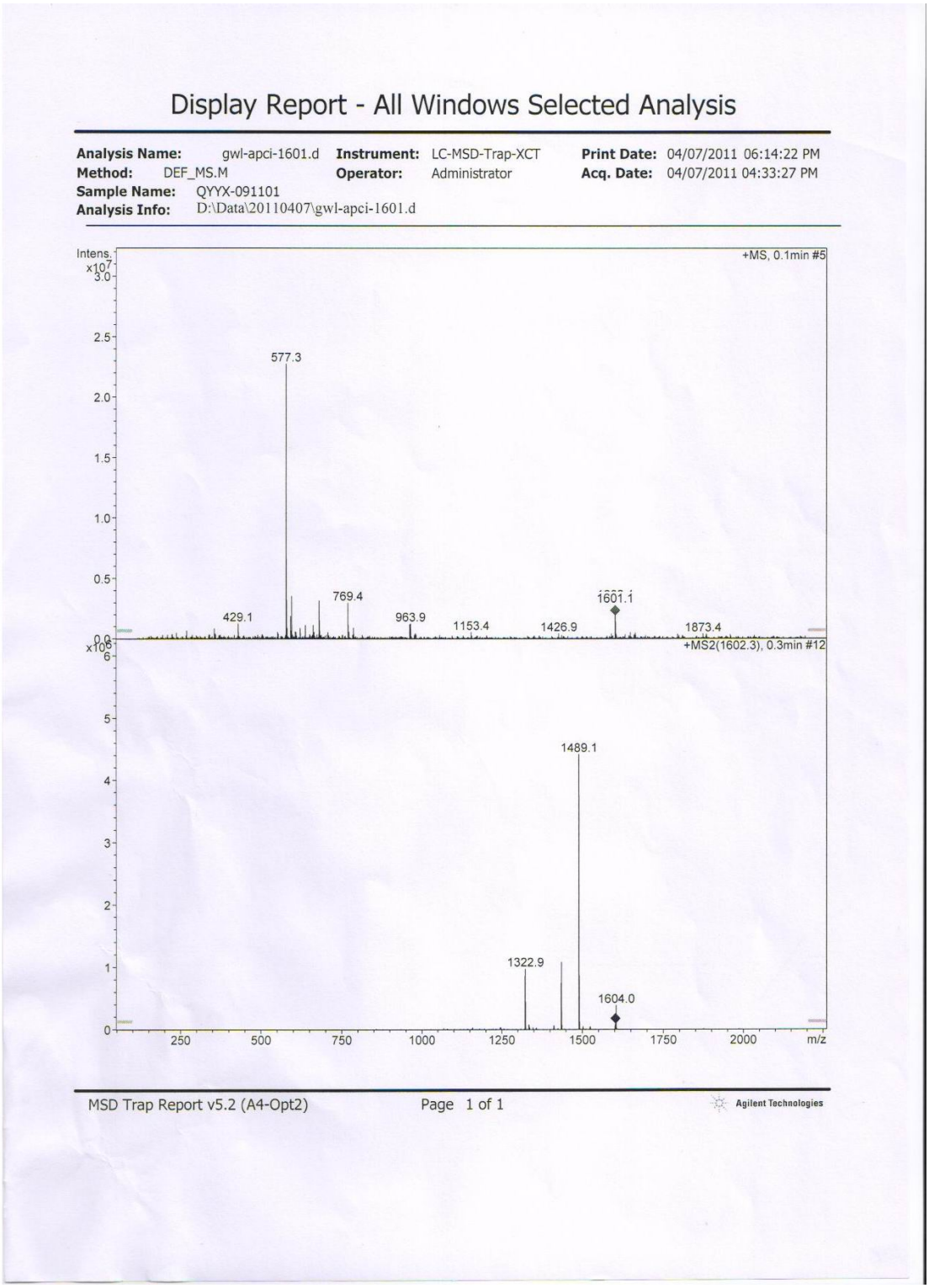


Figure S22 Mass spectrum of Cz-4TPE