Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.
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# Supporting Information

# Monomeric and aggregation emissions of tetraphenylethene in a photo-switchable polymer controlled by cyclization of diarylethene and solvent conditions

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# List of contents:

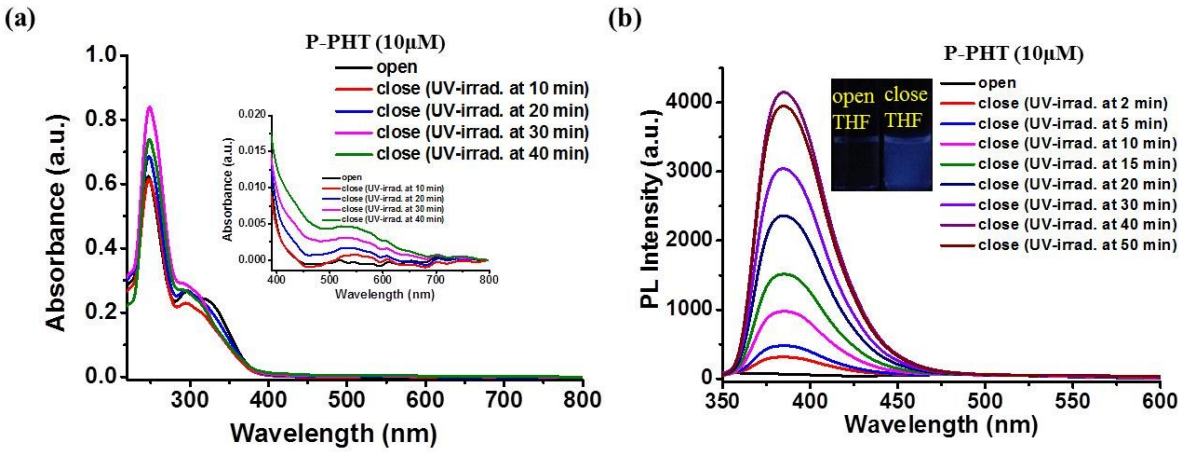



**Fig. S1 P-PHT** in THF before and after UV-irradiation, (a) UV-Vis spectral changes of **P-PHT** (open to close). (b) PL spectral changes of **P-PHT** (open to close). Inset: Photoimages of **P-PHT** 0 min and 40 min. (λex = 320 nm for PL exp.)

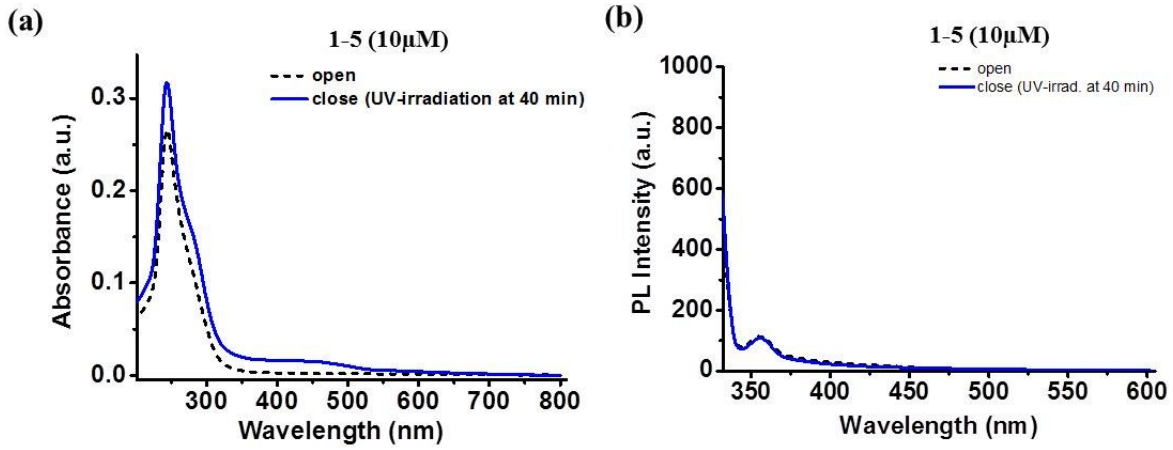



**Fig. S2** Compound **1-5** in THF before and after UV-irradiation, (a) UV-Vis spectral changes of compound **1-5** (open to close). (b) PL spectral changes of compound **1-5** (open to close). (λex = 320 nm for PL exp.)

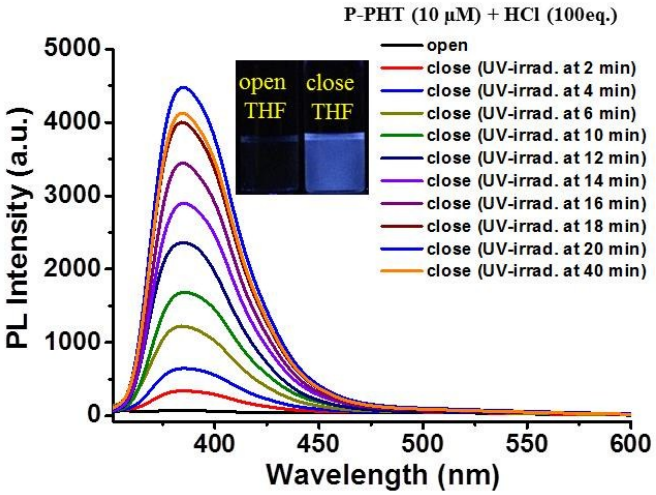



**Fig. S3** PL spectral changes of **P-PHT** (open to close form) with HCL (100 eq.) before and after UV-irradiation. Inset: Photoimages of **P-PHT** at 0 and 20 min with HCl (100eq.). (λex = 320 nm for PL exp.)

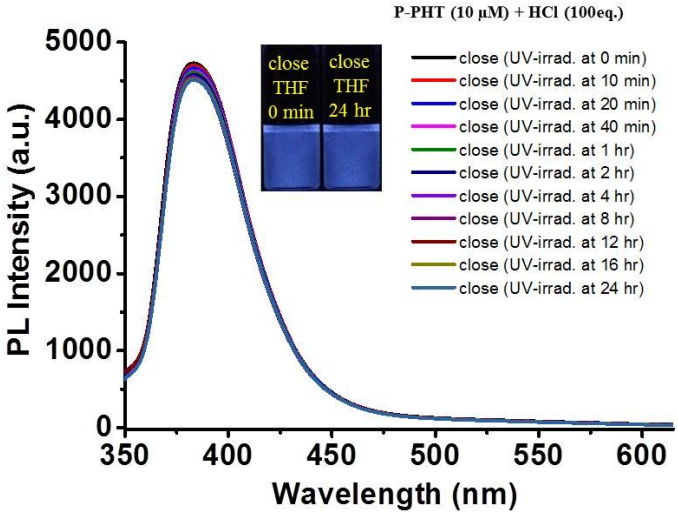



**Fig. S4** PL spectral changes of **P-PHT** (close) under acidic condition (HCl 100 eq. in THF) at different time intervals (from 0 to 24 hr). Inset: Photoimages of **P-PHT**(close) at 0 min and 24 hr. (λex = 320 nm for PL exp.)

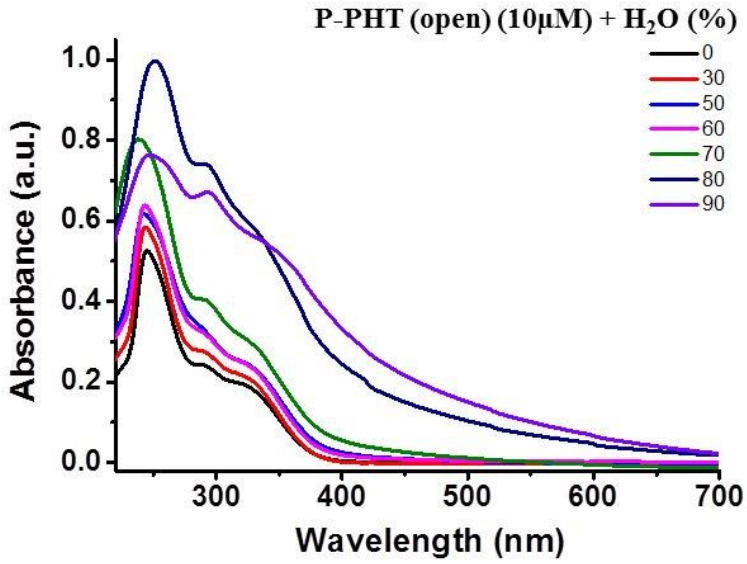



**Fig. S5** UV-Vis spectral changes of **P-PHT** (open) in THF by increasing water contents.

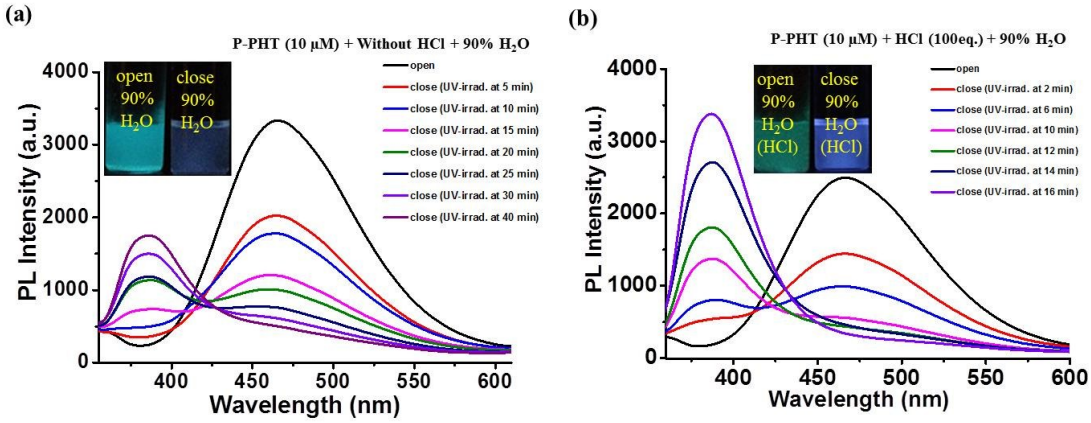



**Fig. S6 P-PHT** at 90% water content before and after UV-irradiation (at λ = 346 nm), (a) and (b) PL spectral changes of **P-PHT** (90% $H_2O$) from open to close form upon UV-irradiation without and with HCl (100eq.), respectively. Insets: Photoimages of **P-PHT** (90% $H_2O$) at 0, 40 min (UV-irradiation) without HCl, and at 0, 20 min (UV-irradiation) with HCl, respectively. (λex = 320 nm for PL exp.)

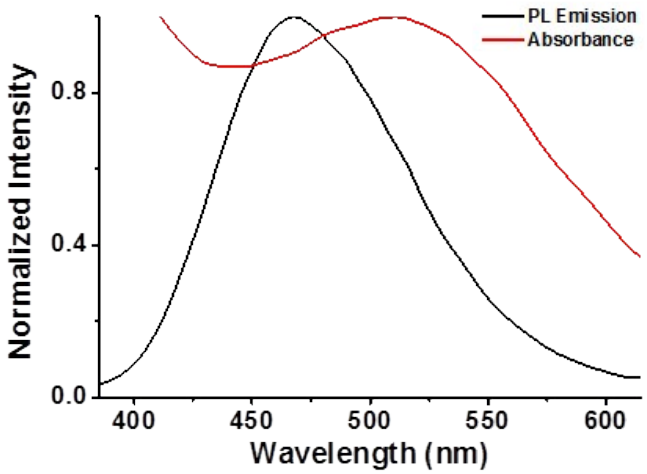



**Fig. S7** Spectral overlaps between AIE emission of TPE and absorption of cyclized DAE unit in **P-PHT**.

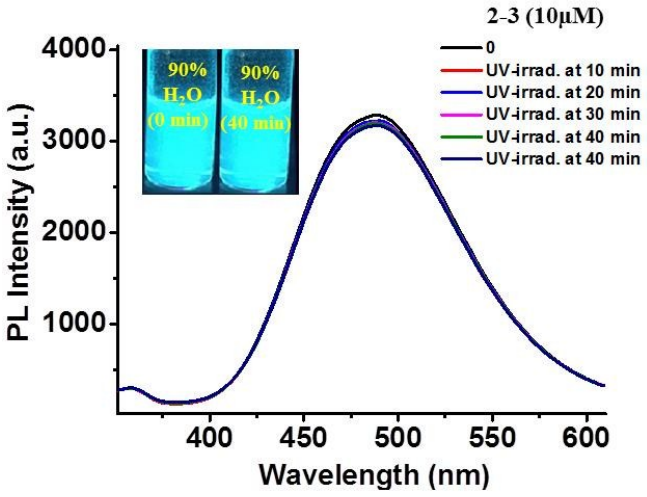



**Fig. S8** PL spectral changes of compound **2-3** at 90% water content after UV-irradiation (40 min and λ = 346 nm). Insets: Photoimages of compound **2-3** (90% $H_2O$) at 0 min and 40 min (UV-irradiation). (λex = 320 nm for PL exp.)

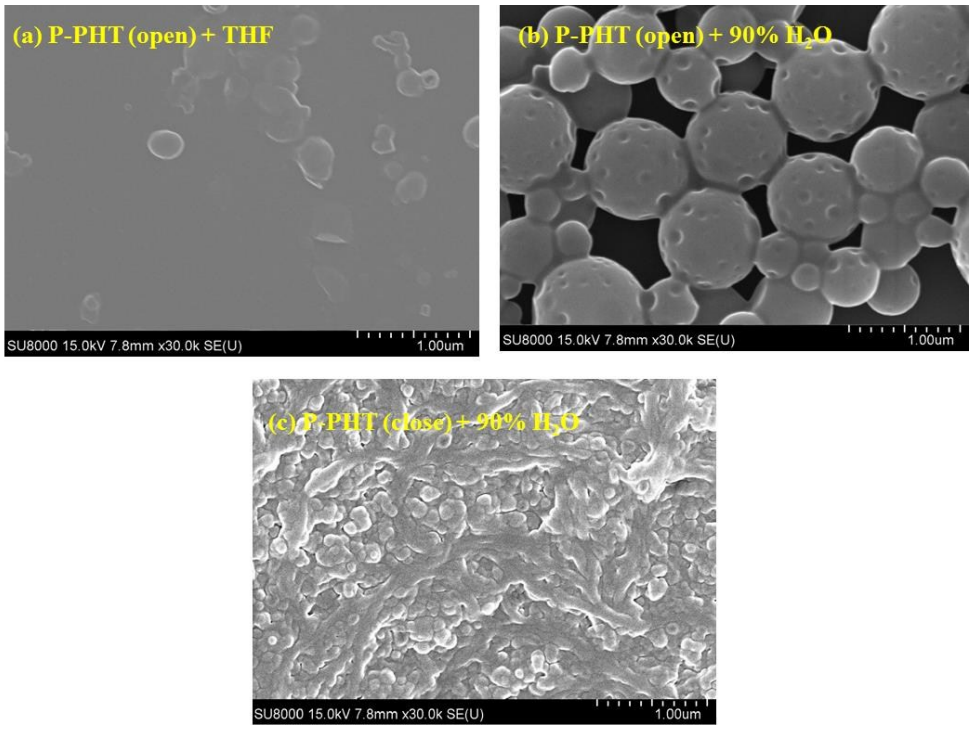



**Fig. S9** Morphological images of (a) **P-PHT** (open) in THF (b) **P-PHT** (open) at 90% water content. Upon the UV-Irradiation, (c) **P-PHT** (close) at 90% water content.

| P-PHT | Absorption data | | | | |
|---|---|---|---|---|---|
| | **Excited State** | **$\lambda_{abs,cal}$ (nm)** | **$f$[a]** | **Configuration[b]** | **Weight[c] (%)** |
| **open form** | S1 | 350.7 | 0.47 | H → L | 99.3 |
| | S4 | 286.5 | 0.12 | H-1 → L+1 | 96.7 |
| **close form** | S1 | 478.7 | 0.20 | H → L | 99.5 |
| | S4 | 350.2 | 0.48 | H-1 → L+1 | 96.7 |
| | S12 | 284.2 | 0.12 | H-1 → L+4 | 86.2 |

**Fig. (Table) S10** Absorption and Fluorescence maxima, Oscillator strengths, Contributing transitions of open and close forms of **P-PHT** are calculated by B3LYP/6-31G(d) method. ([a] Oscillator strength), **(**[b] H and L represent the calculated HOMO and LUMO, respectively; The second highest occupied and lowest unoccupied molecular orbitals denoted as H-1 and L+1, respectively), ([c] Only configurations with 5% or greater contribution are included.).

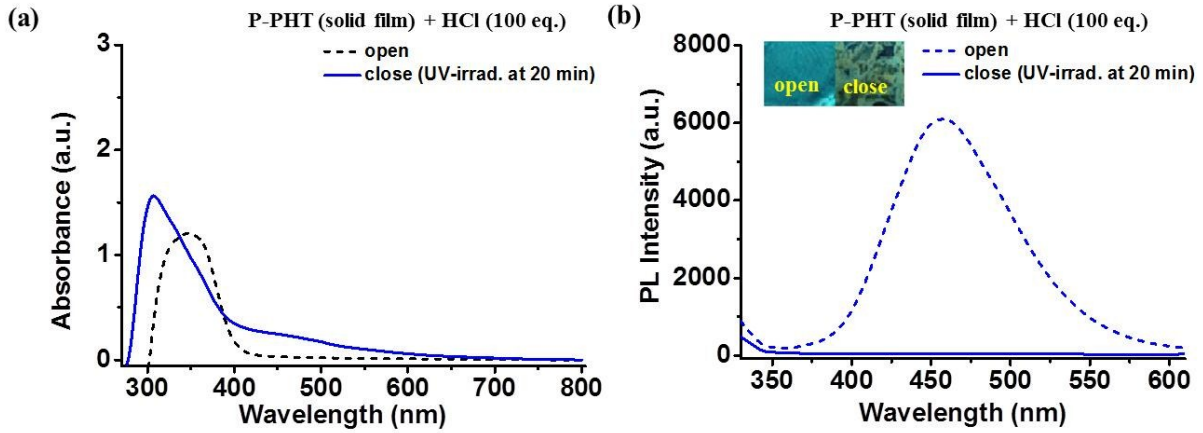



**Fig. S11 P-PHT** in solid films before and after UV-irradiation under HCL (100 eq.), (a) UV-Vis spectral changes of **P-PHT** (open to close). (b) PL spectral changes of **P-PHT** (open to close). Inset: Photoimages of **P-PHT** at 0 min and 20 min. (λex = 320 nm for PL exp.)

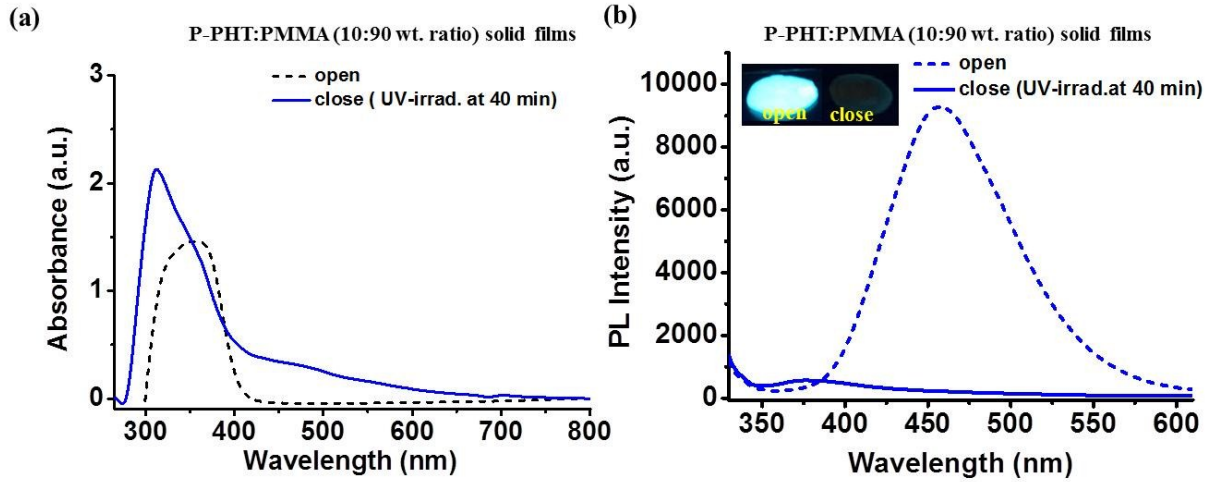


**Fig. S12 P-PHT**:PMMA (10:90 wt. ratio) in solid films before and after UV-irradiation, (a) UV-Vis spectral changes of **P-PHT**:PMMA (10:90 wt. ratio) (open to close). (b) PL spectral changes of **P-PHT**:PMMA (10:90 wt. ratio) (open to close). Inset: Photoimages of **P-PHT**:PMMA (10:90 wt. ratio) at 0 min and 40 min. (λex = 320 nm for PL exp.)

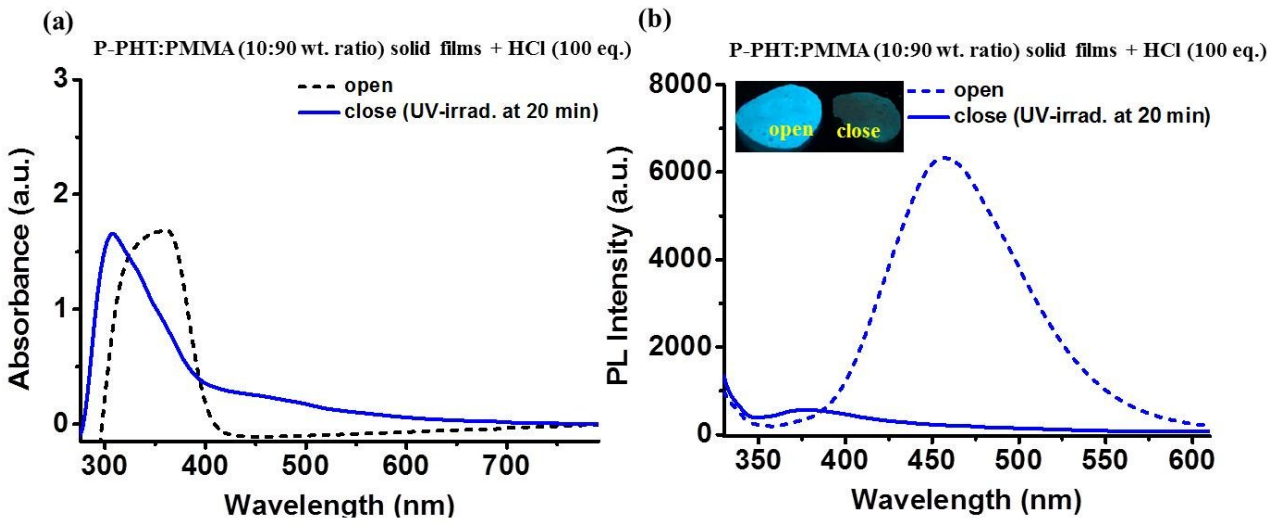



**Fig. S13 P-PHT**:PMMA (10:90 wt. ratio) in solid films before and after UV-irradiation with HCl (100 eq.), (a) UV-Vis spectral changes of **P-PHT**:PMMA (10:90 wt. ratio) (open to close). (b) PL spectral changes of **P-PHT**:PMMA (10:90 wt. ratio) (open to close). Inset: Photoimages of **P-PHT**:PMMA (10:90 wt. ratio) at 0 min and 20 min. (λex = 320 nm for PL exp.)

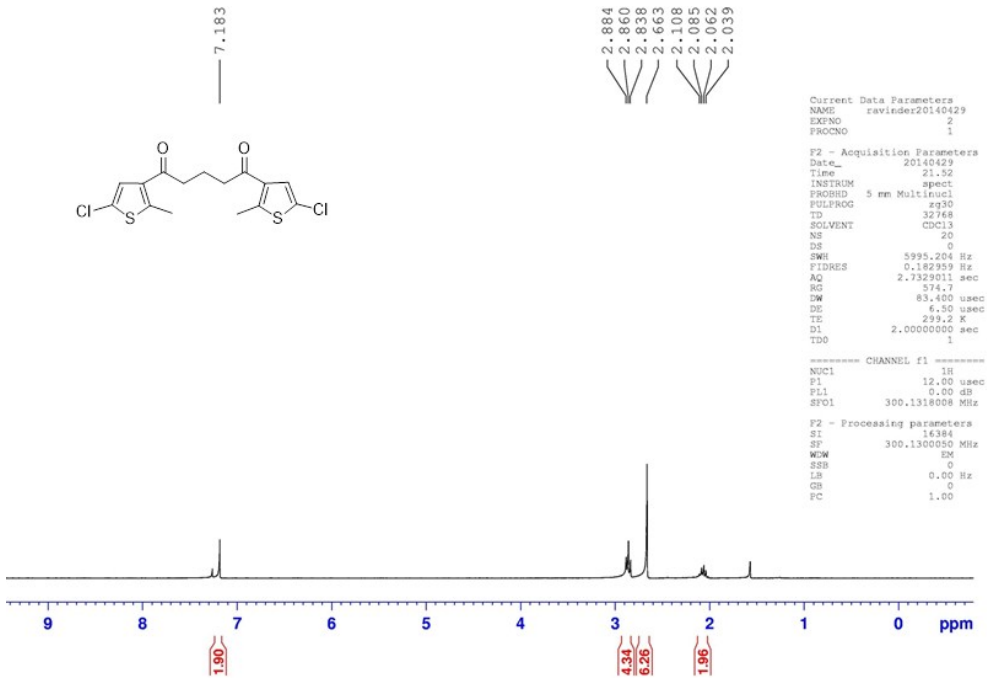



**Fig. S14** [1]H-NMR of intermediate **1-1**.

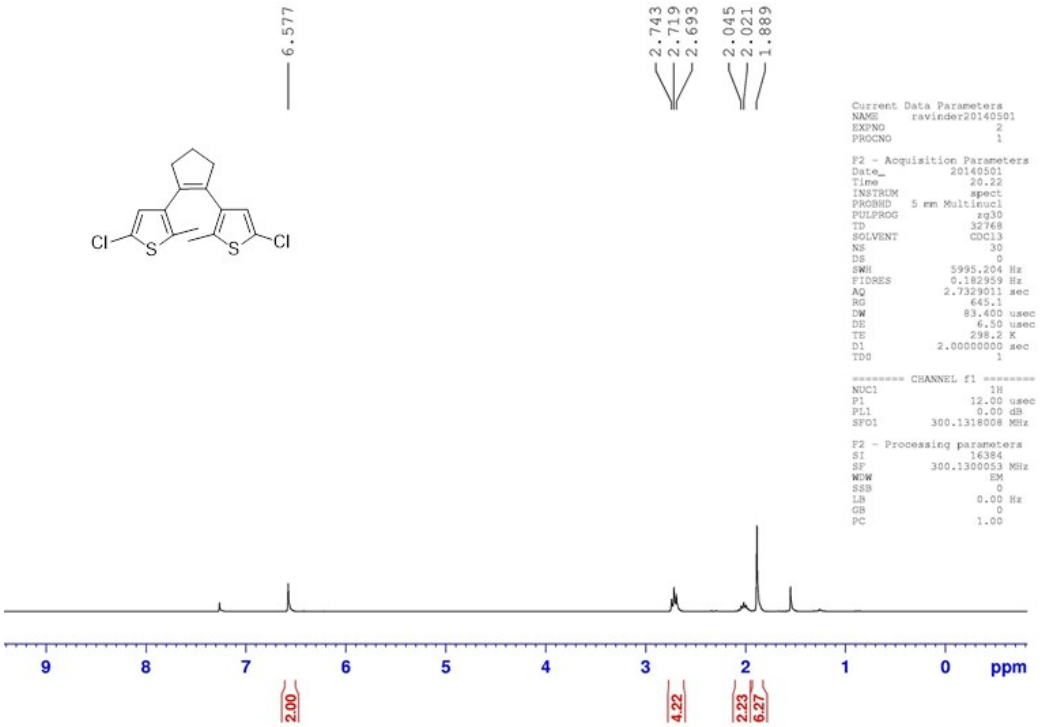



**Fig. S15** [1]H-NMR of intermediate **1-2**.

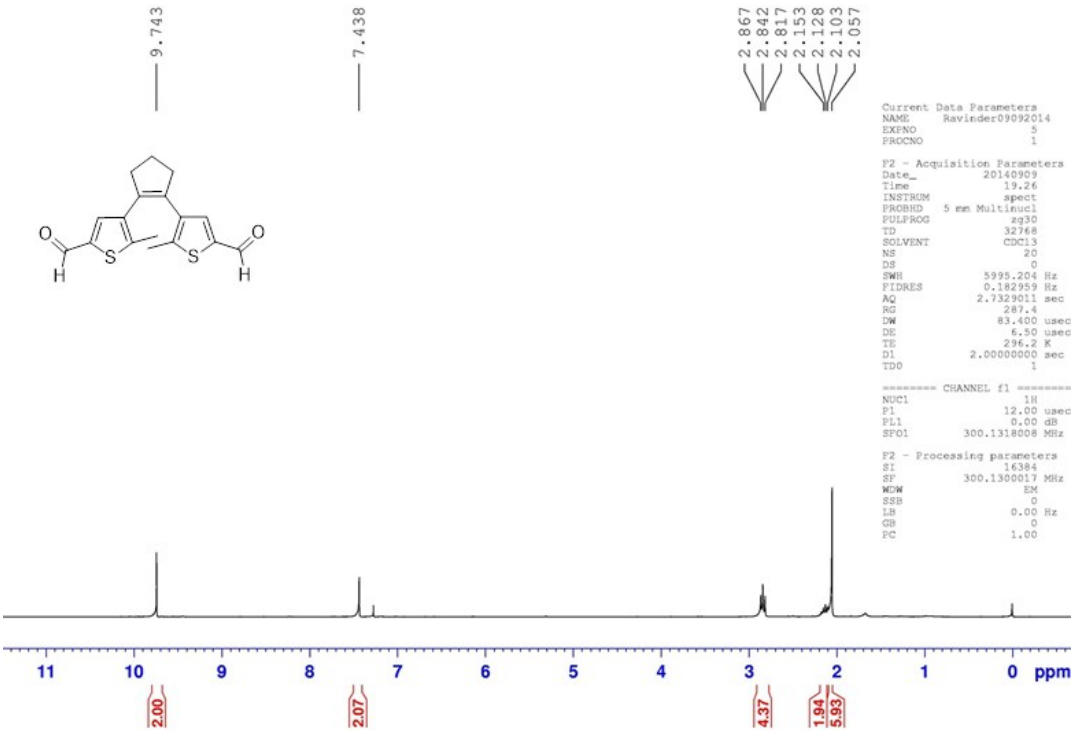



**Fig. S16.1** $^{1}$H-NMR of intermediate **1-3**.

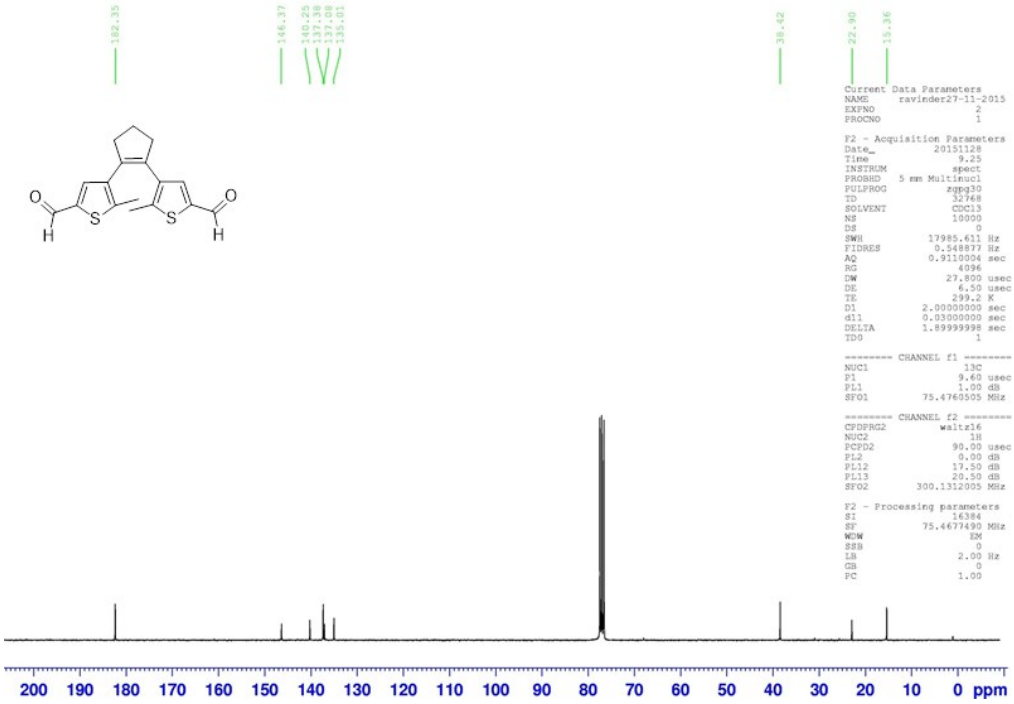



**Fig. S16.2** $^{13}$C-NMR of Intermediate **1-3**.

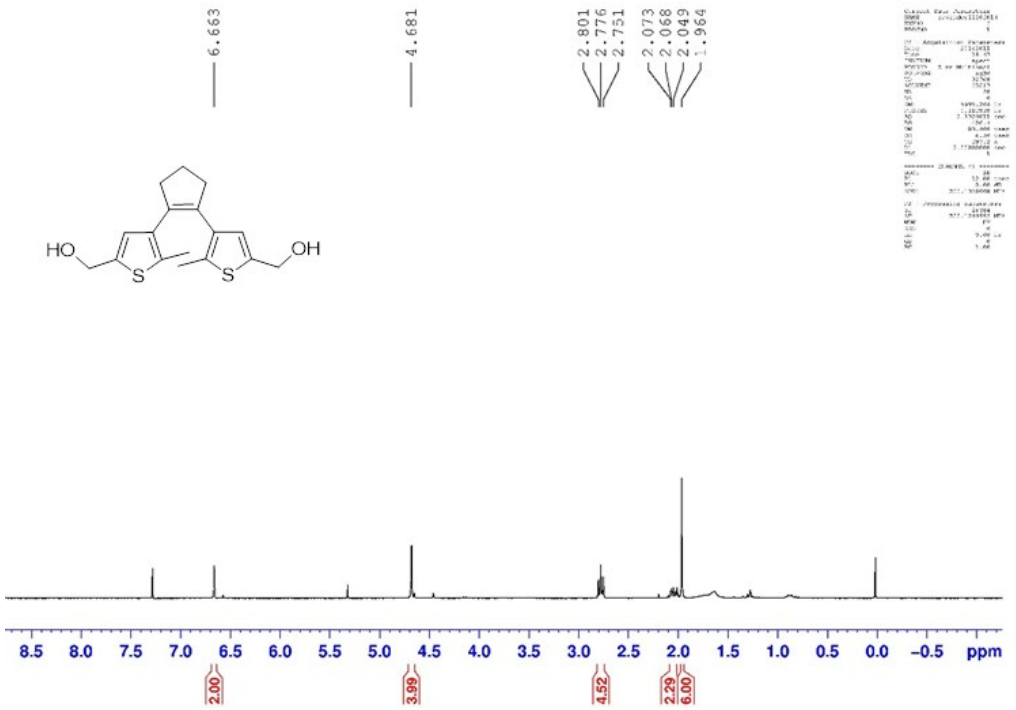



**Fig. S17.1** $^{1}$H-NMR of intermediate **1-4**.

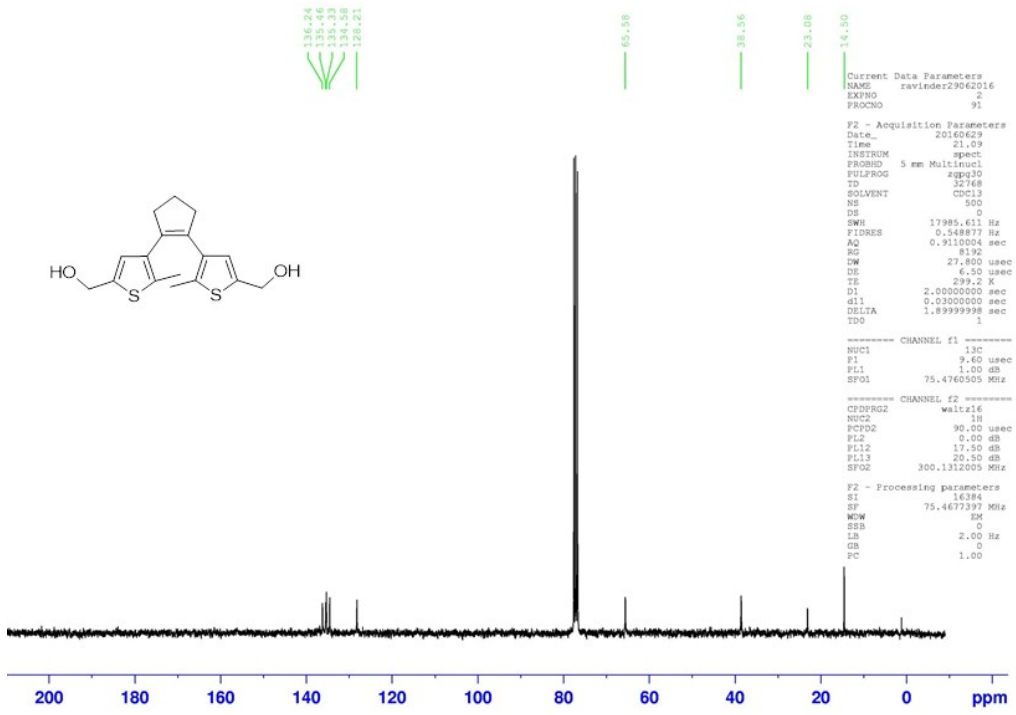



**Fig. S17.2** $^{13}$C-NMR of intermediate **1-4**.

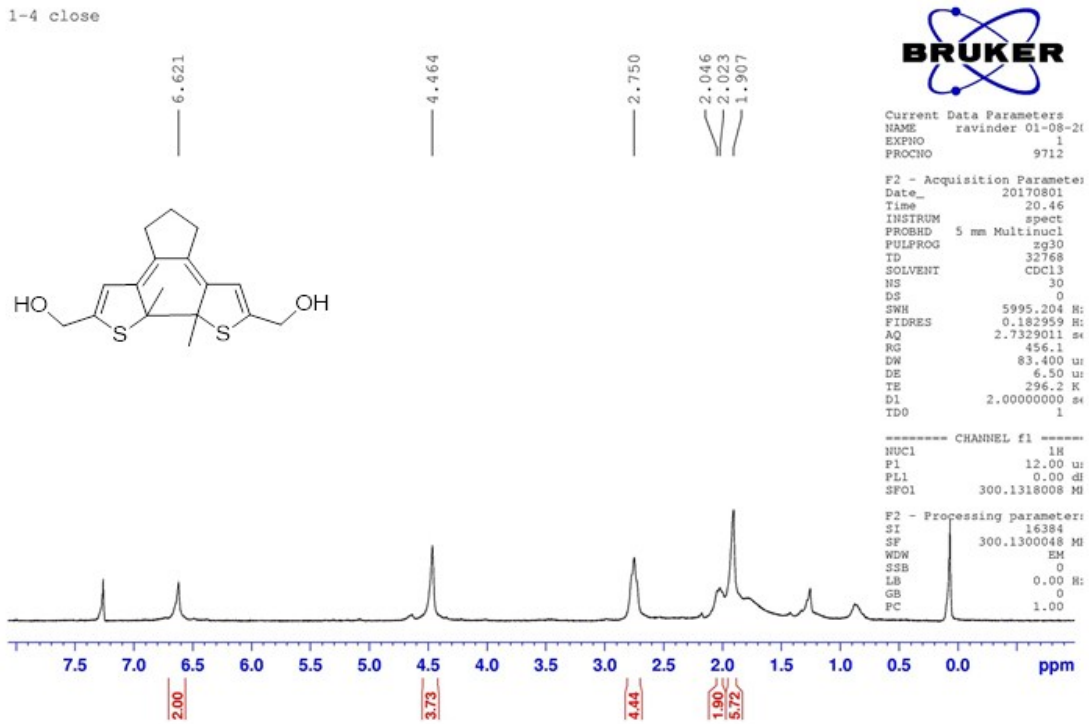



**Fig. S18** [1]H-NMR of intermediate **1-4** (close).

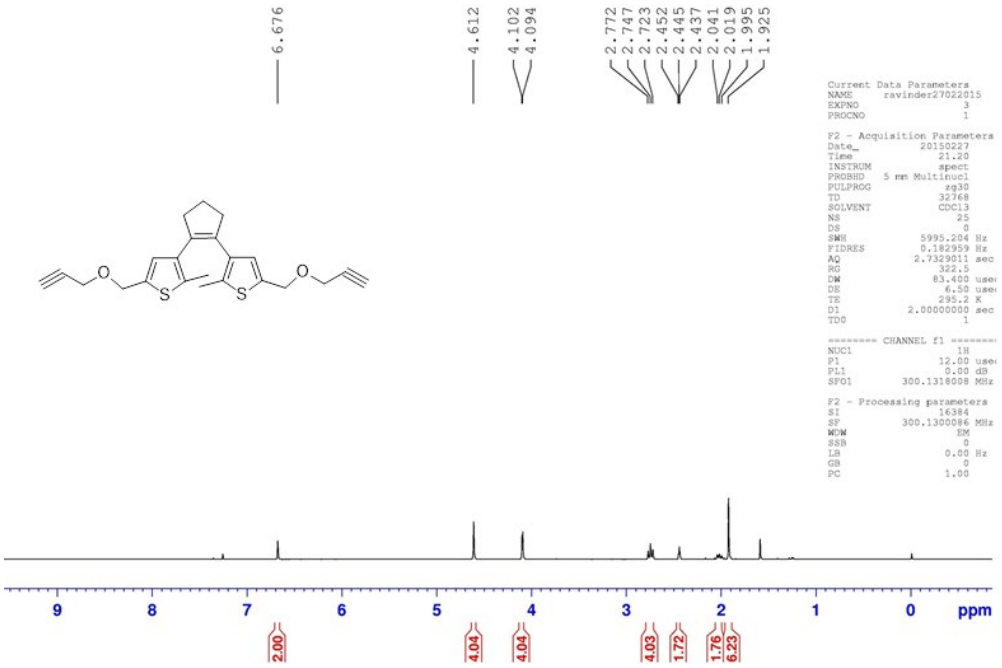



**Fig. S19.1** [1]H-NMR of intermediate **1-5**.

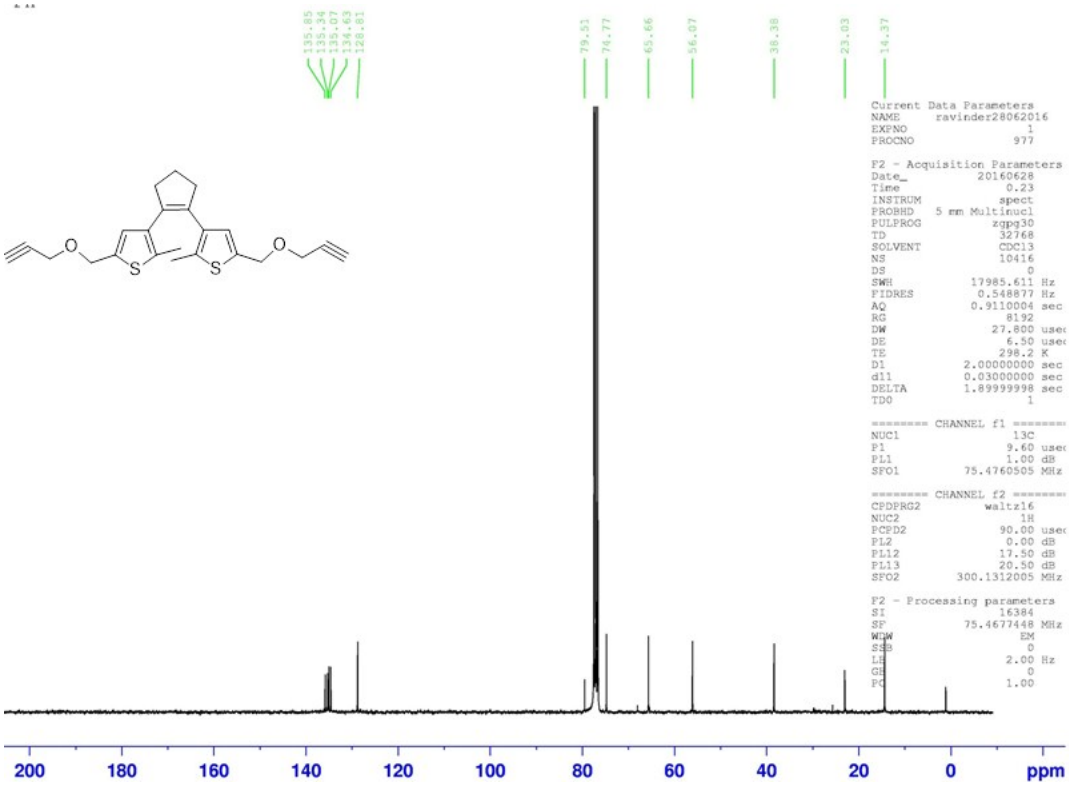


**Fig. S19.2** $^{13}$C-NMR of intermediate **1-5**.

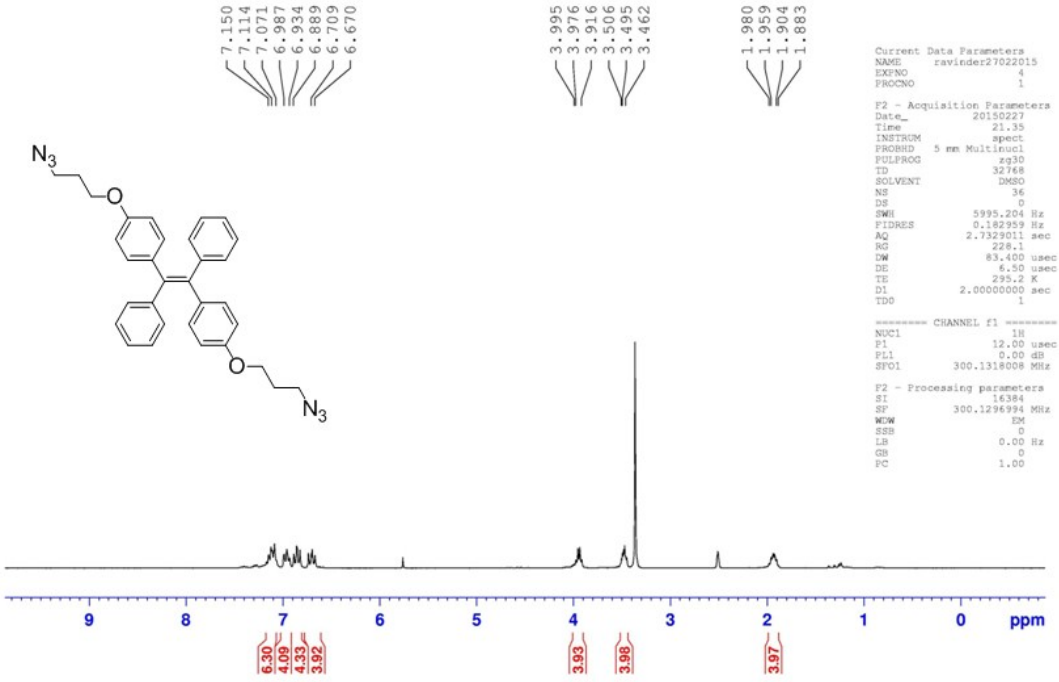


**Fig. S20.1** $^{1}$H-NMR of intermediate **2-3**.

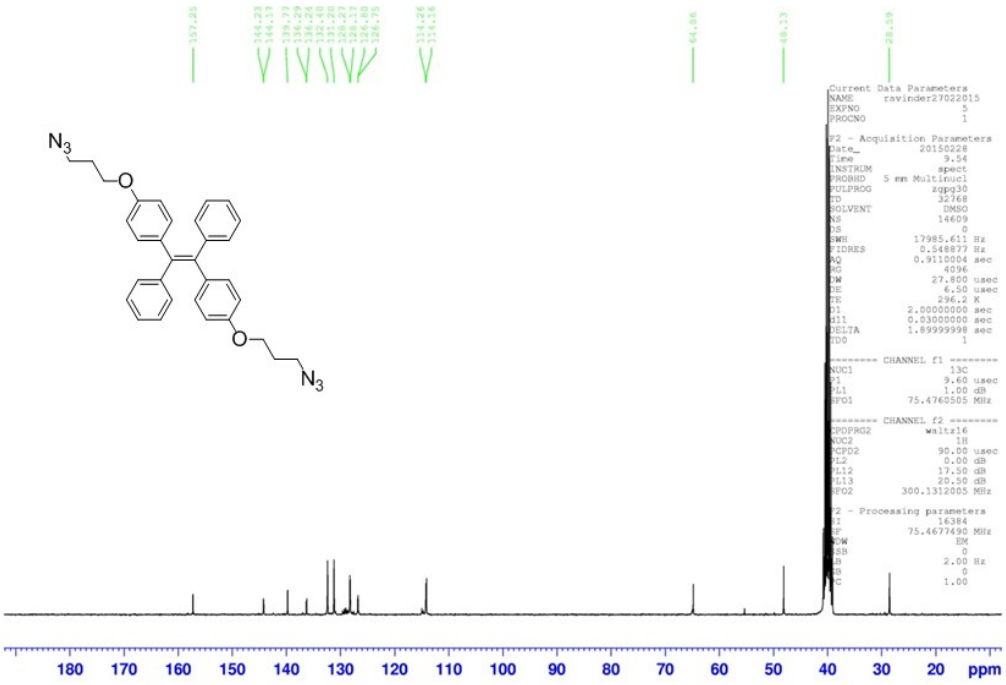


**Fig. S20.2** $^{13}$C-NMR of intermediate **2-3**.

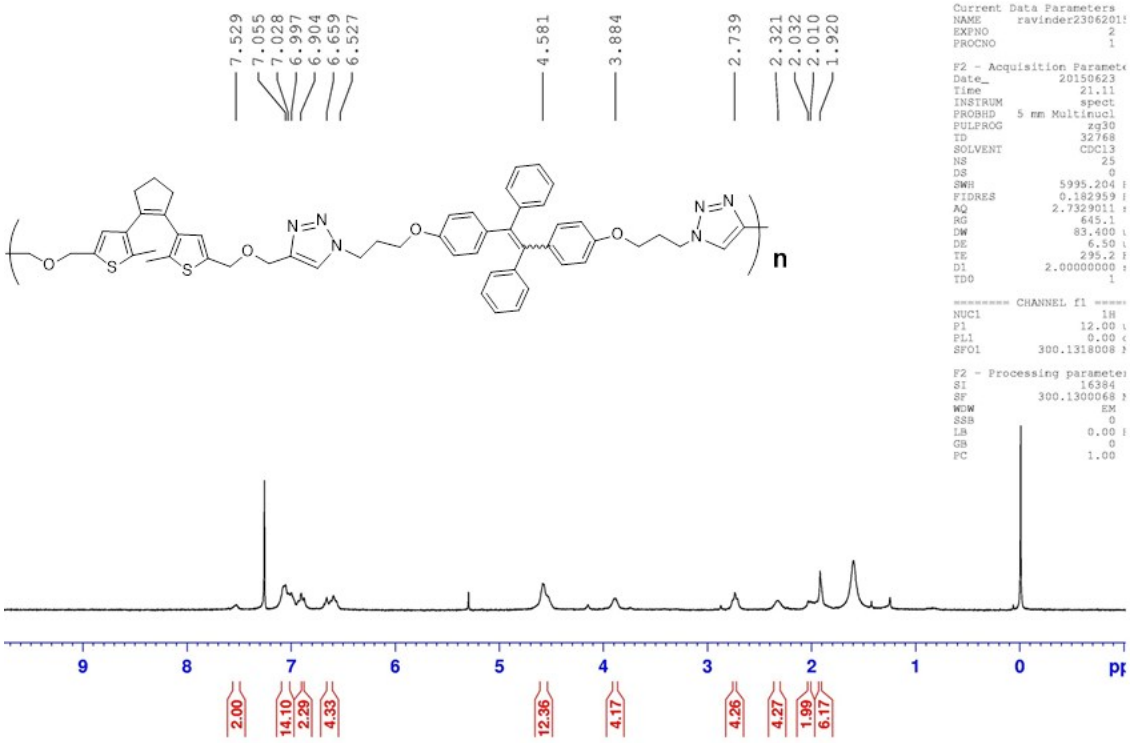


**Fig. S21.1** $^{1}$H-NMR of **P-PHT**.

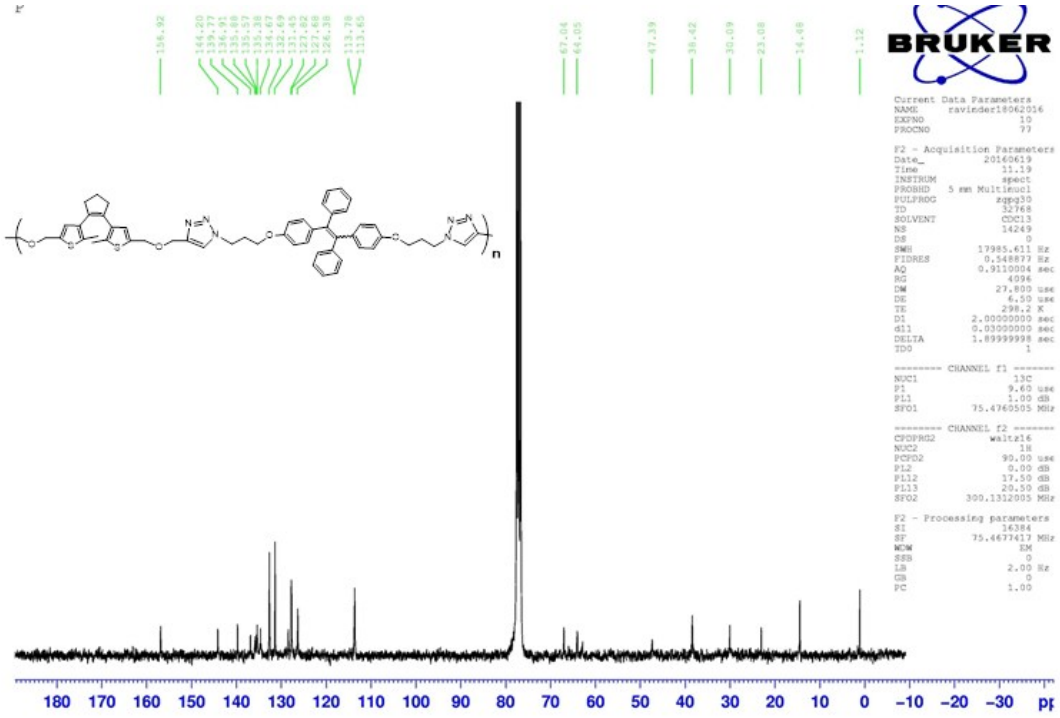



**Fig. S21.2** $^{13}$C-NMR of **P-PHT**.

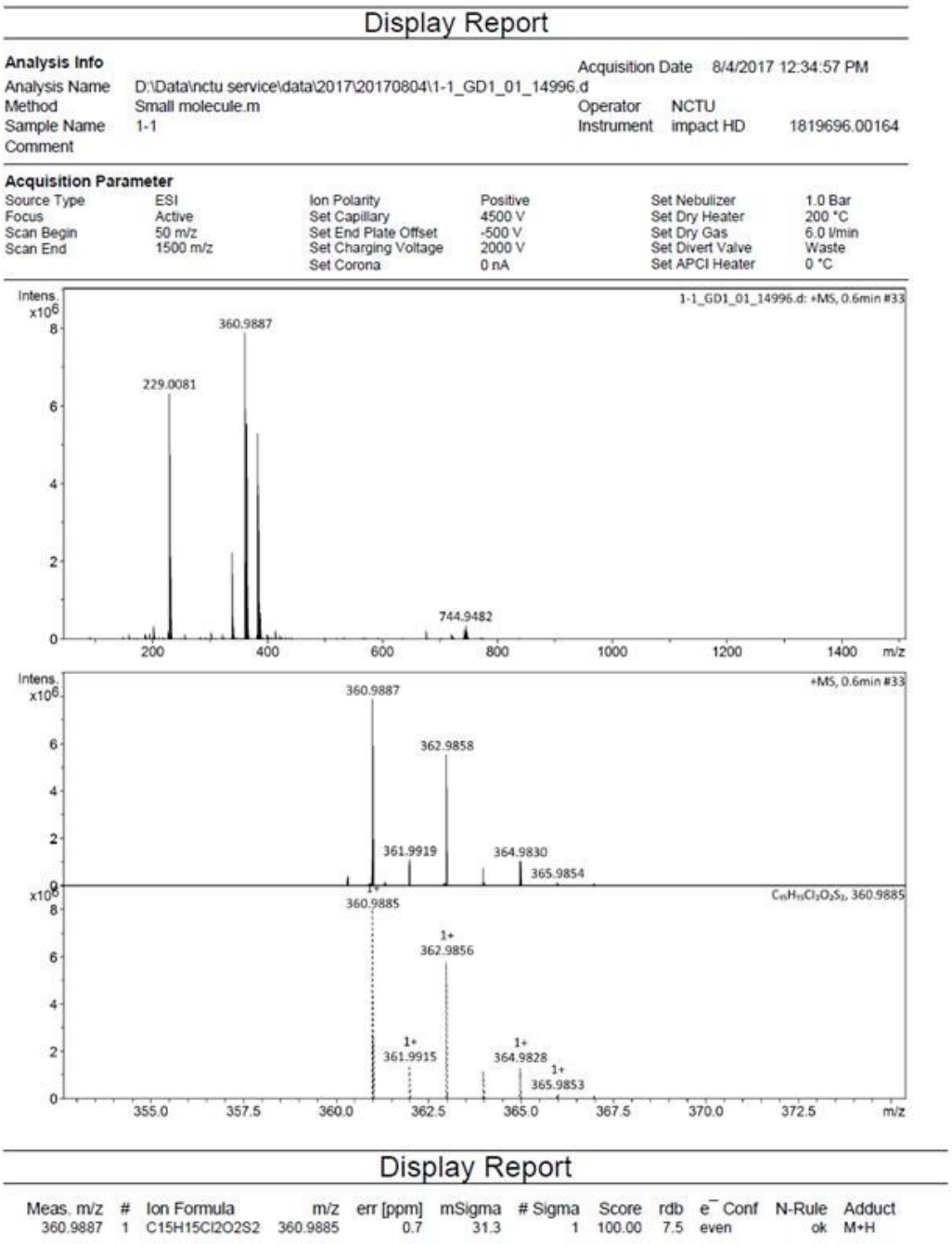



**Fig. S22** HRMS (ESI) data of intermediate **1-1**.

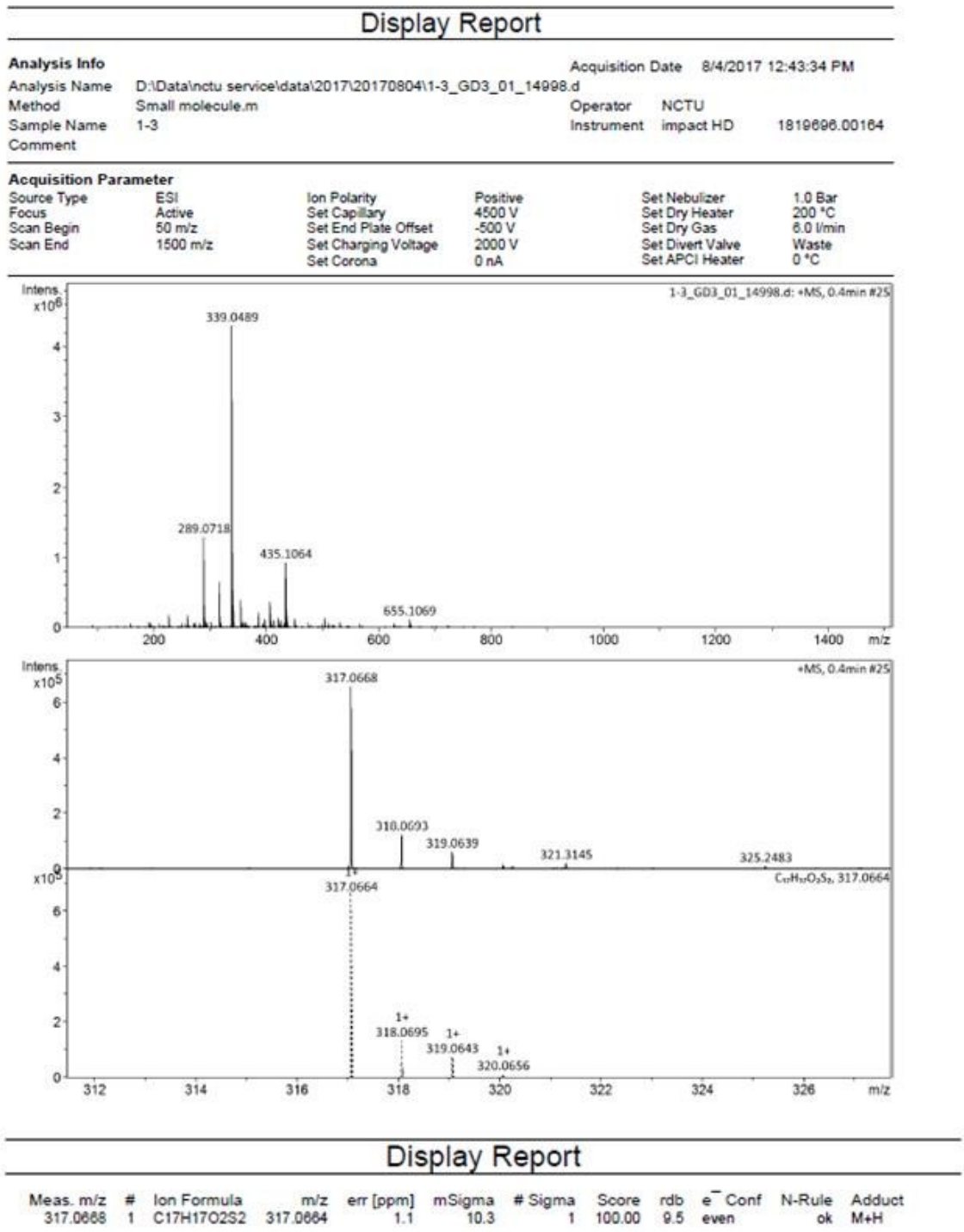



**Fig. S23** HRMS (ESI) data of intermediate **1-3**.

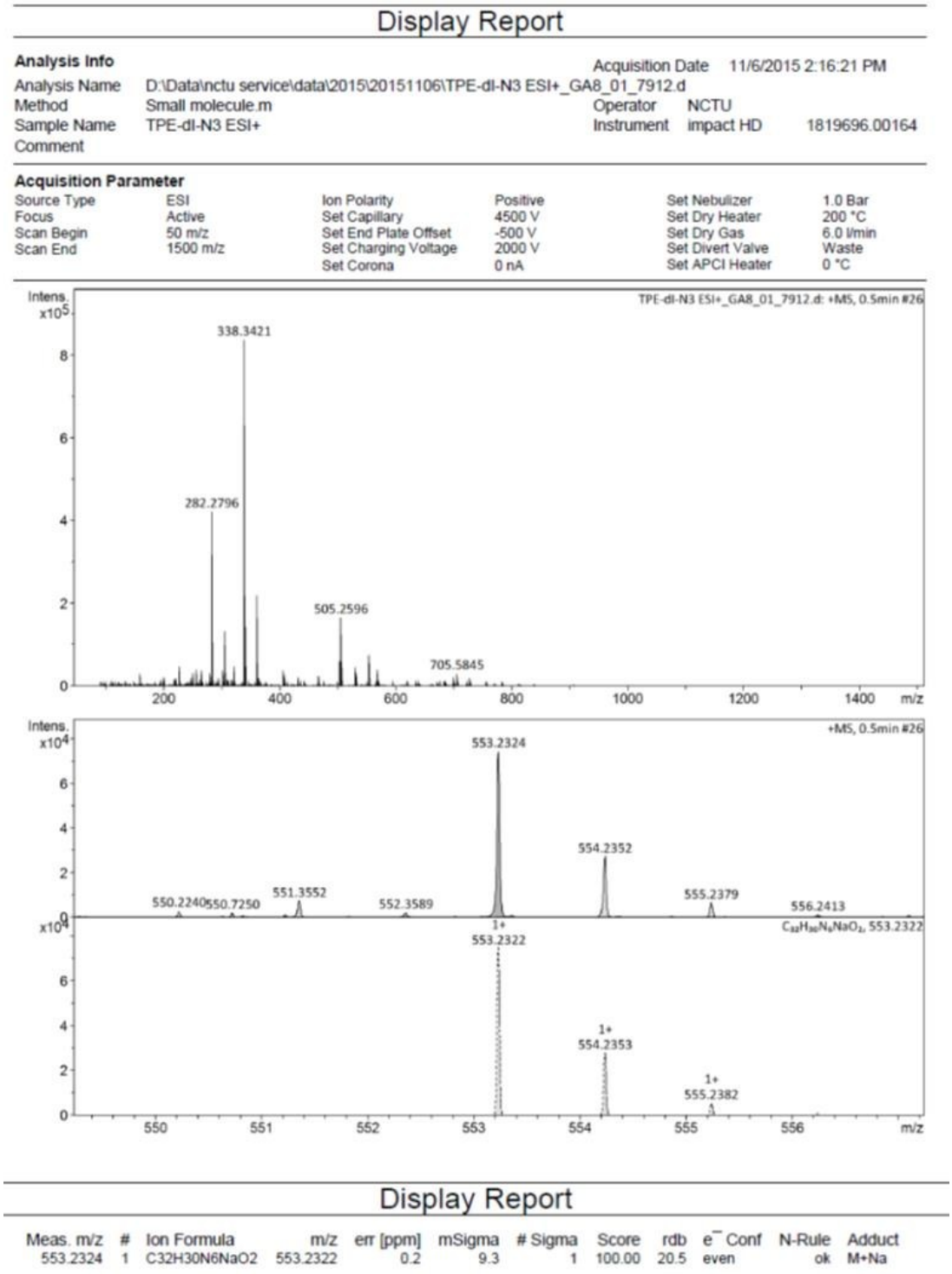



**Fig. S24** HRMS (ESI) data of intermediate **2-3**.

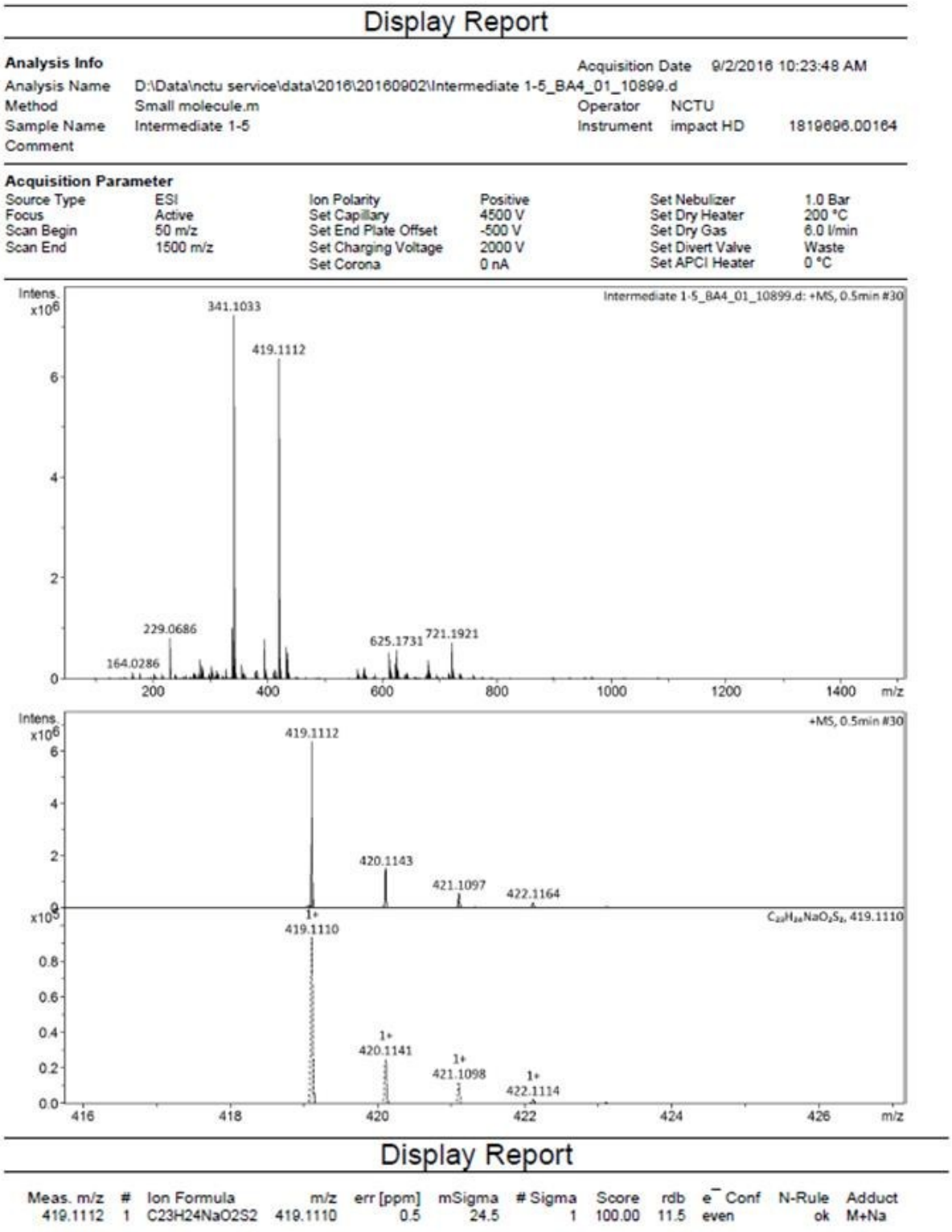



**Fig. S25** HRMS (ESI) data of intermediate **1-5**.

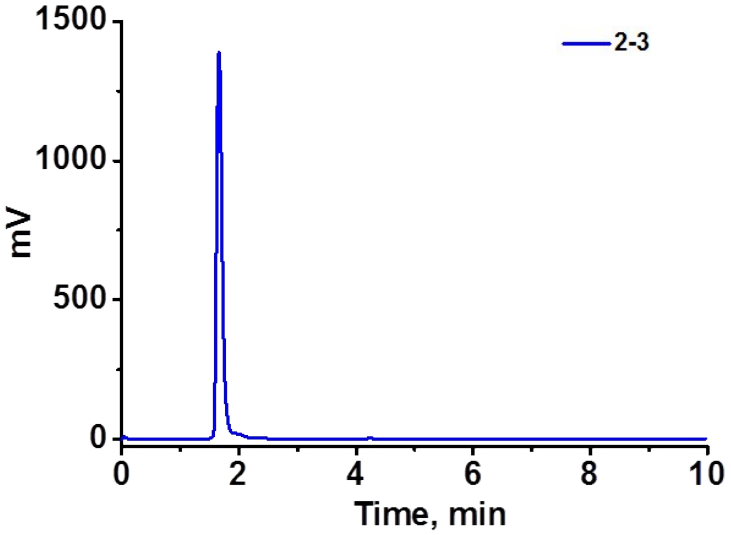



**Fig. S26** HPLC of intermediate **2-3** in ethyl acetate (EA) solvent. (Retention time of peak = 1.65 min).

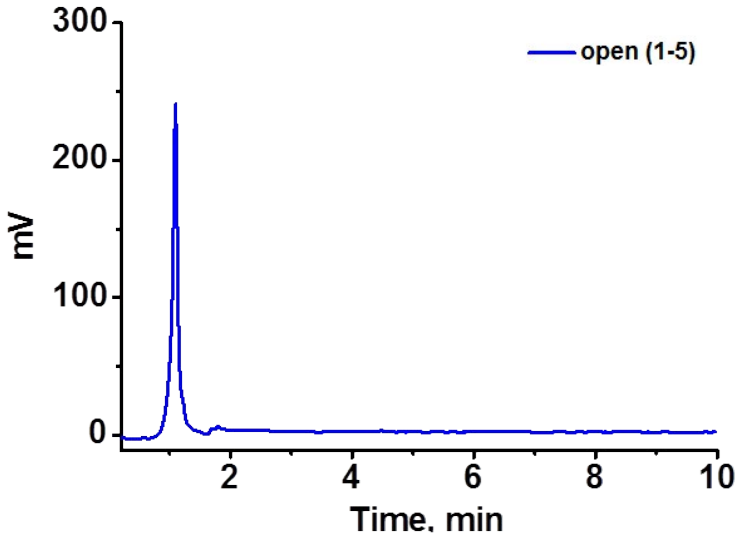



**Fig. S27** HPLC of intermediate **1-5** in ethyl acetate (EA) solvent. (Retention time of peak = 1.09 min).

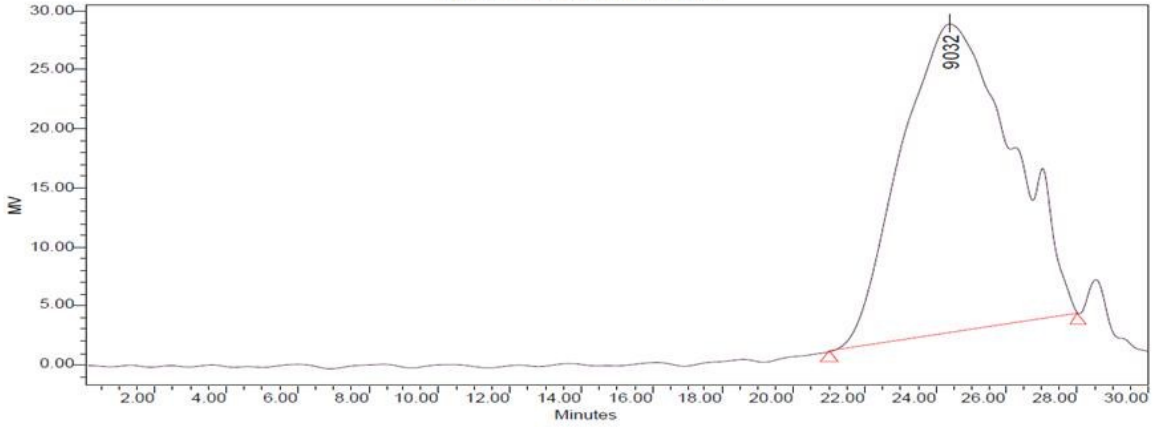
Waters
Project Name: HCLIN
Reported by User: System

Breeze

SAMPLE INFORMATION

| | | | | |
|---|---|---|---|---|
| Sample Name | Unk | Acquired By: | System | |
| Sample Type: | Broad Unknown | Date Acquired: | 2015/7/10 | 10:42:57 |
| Vial: | 1 | Acq. Method: | THF_40_1 | |
| Injection #: | 1 | Date Processed: | 2015/7/10 | 11:26:40 |
| Injection Volume: | 200.00 ul | Channel Name: | 410 | |
| Run Time: | 30.00 Minutes | Sample Set Name: | 20150710_min | |

Autoscaled Chromatogram




GPC Results

| | Dist Name | Elution Volume (ml) | Retention Time (min) | Adjusted RT (min) | Mn | Mw | MP | Mz | Mz+1 | Mz/Mw | Mz+1/Mw |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 24.373 | 24.373 | 24.373 | 7489 | 11634 | 9032 | 17858 | 24751 | 1.534973 | 2.127512 |

GPC Results

| | Area ( *sec) | % Area | Height ( ) | % Height | Integration Type | Peak Codes | Points Across Peak | Start Time (min) | End Time (min) | Baseline Start (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5688572 | 100.00 | 26213 | 100.00 | bb | | 420 | 21.000 | 28.000 | 21.000 |

GPC Results

| | Baseline End (min) | Slope ( /sec) | Offset ( ) |
|---|---|---|---|
| 1 | 28.000 | 4.613982e-001 | -8.495745e+000 |



**Fig. S28** GPC data of **P-PHT**.