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Supplementary Information

Isolation strategy to novel luminescent Eu^{3+}-pyridine-2, 6-dicarboxylic acid complex with high compatibility and stability for light conversion agricultural films

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Number of Tables:2

Preparation of light conversion films LCF-C, LDPF-4, and LDPF-6

Taking LCM-C as the representative example, the LCA-C with a loading amount of 0.4 wt% was evenly mixed with LDPE (100 AC) by the vertical mixer. The mixing speed and mixing time were set at 1200 r/min and 2 minutes, respectively. After that, the mixture was loaded on the twin-screw extruder for melt blending, the temperature of the first section was set at 180 °C, while the other three sections were at 190 °C, and the screw speed was 100 r/min. Then the extruder was cooled to room temperature by water, and the light conversion masterbatch LCM-C was obtained by granulating. Using LDPA-4 or LDPA-6 instead of LCA-C, masterbatch LDPM-4 or LDPM-6 can be obtained in the same procedure as LCM-C. To obtain the mixture for film blowing, a certain amount of light conversion masterbatch, 100AC, 2420D, 9047, and AA were mixed together (Table S1). The mixture was blown into a film by a film-blowing machine. The film-blowing machine was divided into three temperature zones, the temperature of zone 1, zone 2, and zone 3 was set at 180 °C, 190 °C, and 200 °C, respectively. At last, 100±10 μm thick light conversion films LDPF-4, LDPF-6, and LCF-C were obtained. Here, polyethylene (PE) film was selected as the reference sample.

Table S1. The formula of light conversion film.

Sample	Masterbatch (kg）	100AC（kg）	2420D（kg）	9047（kg）	AA（kg）
LDPF-4	15.0	0.0	10.0	5.0	3.0
LDPF-6	15.0	0.0	10.0	5.0	3.0
LCF-C	15.0	0.0	10.0	5.0	3.0
PE	0.0	15.0	10.0	5.0	3.0

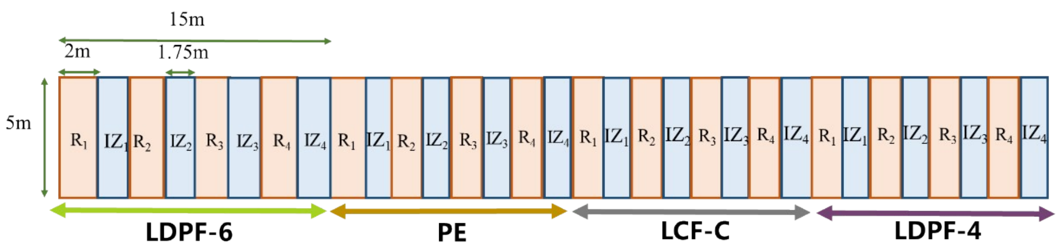
General Information of the Experimental Plot

The Sunshine Xinghong Orchards is selected as the experiment plot which is located in the Daxing district, Beijing (E 116 ° 43', N 39 ° 77', 45.3 m above sea level). The indoor shed area is 60×6 m=360 m^2. Before carrying out the experiments, the basic physical and chemical properties of the soil in the shed were studied and listed in Table S2. The experiment started in December 2021 and ended in February 2022.

Table S2. Physical and chemical properties of the experimental soil.

Depth (cm)	Soil texture	Organic matter (g kg^{-1})	Total nitrogen (g kg^{-1})	Available phosphorus (mg kg^{-1})	Available potassium (mg kg^{-1})	pH	Electronic conductivity (μ S cm^{-1})
0~20	Light Loam	15.40	1.46	103.0	218.0	8.3	553.0

In this experiment, rape was selected as the experimental crop and its seedlings were provided by Sunshine Xinghong orchards. The rape seedlings were planted on December 7, 2021, and covered with light conversion films in the second week. As is illustrated in Figure S1, the experimental shed was divided into four areas, each area (5×15 m) was separated by common PE film to ensure that there is no interference between them. Then these four areas were covered with films LDPF-6, PE, LCF-C, and LDPF-4 in turn by hot-melt connection (from left to right). In each area, four equal parts were further divided, rape plants were planted in a 5×2 m area, and the spacing between plants was set at 5 cm. Between each row of rape plants, a 5×1.75 m isolation zone was left.



Scheme S1. Schematic illustration of our experimental plots. R: repeat, IZ: isolation zone.

Analysis details of Biomass and Yield of the Film Treated Rape Sample

To get an insight into the difference in rape biomass distribution in four different film-treated rapes, the rape samples in each area were randomly sampled 3 different times after 34 days of film covering and calculated their net weight, then the average biomass weight of the collected rape samples will be available for comparison. In detail, the collected rape samples were washed with water and dipped with absorbent paper consequently to remove sediment and residual water, respectively. After that, the samples were put in a 105 ℃ oven for 30 min and then switched the temperature to 75 ℃ until the weight of the samples is constant. Finally, the aboveground and the belowground biomass of the collected samples were separately calculated.

To investigate the effect of light conversion film on the yield of rape, the rape samples were randomly collected 5 different times in each experimental area and their corresponding average weight was recorded. Then the rape yield could be estimated as follows:

Yield(%)= the average weight of five different sample weights (kg)/ha×100%.

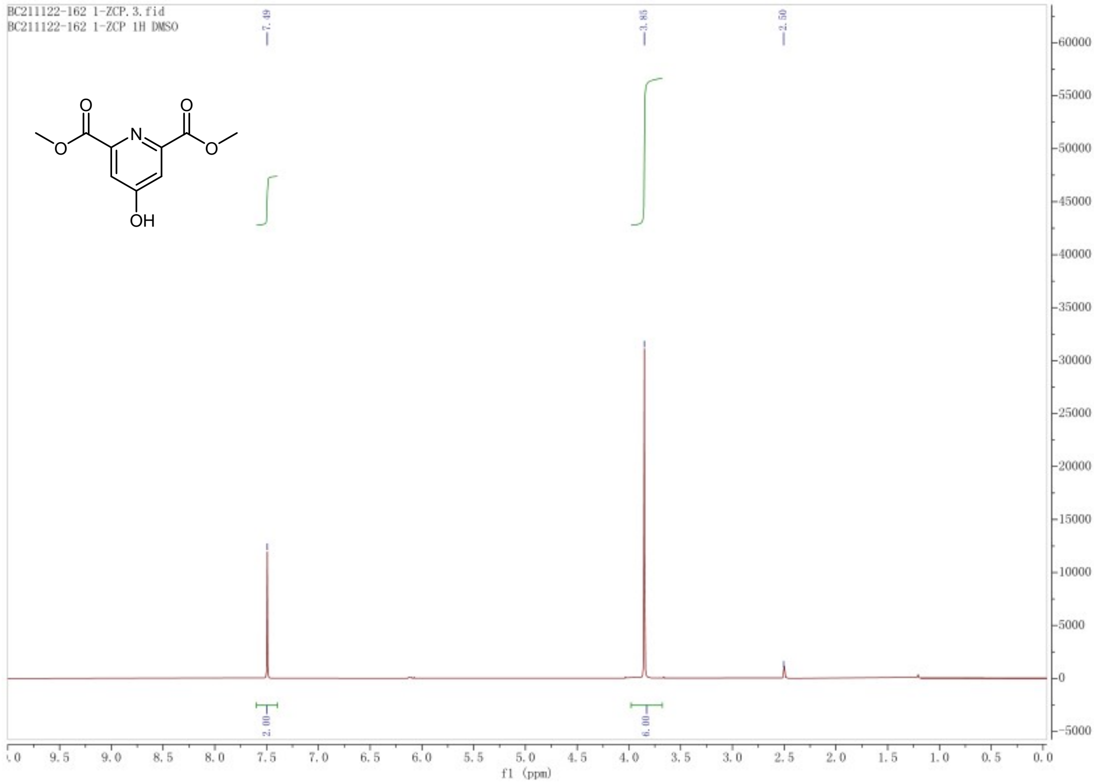


Figure S1. ^{1}H NMR spectrum of DPMe (DMSO-d_6, 400 MHz, 25 °C).

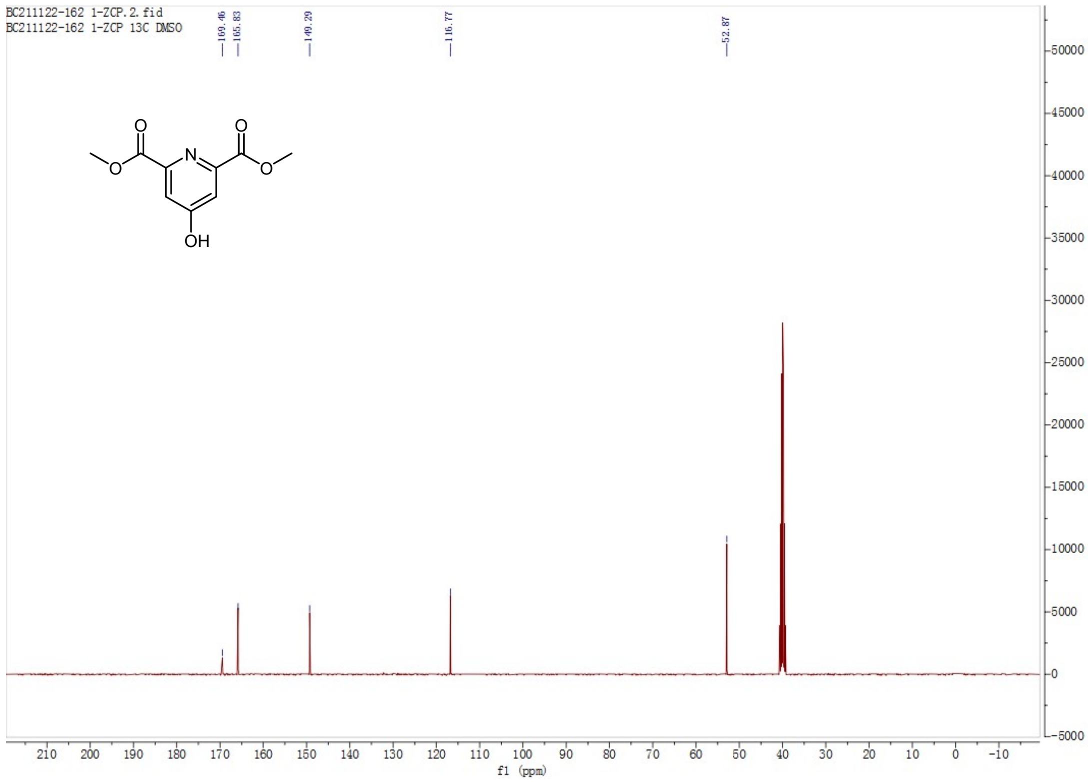


Figure S2. ^{13}C NMR spectrum of DPMe (DMSO-d_6, 100 MHz, 25 °C).

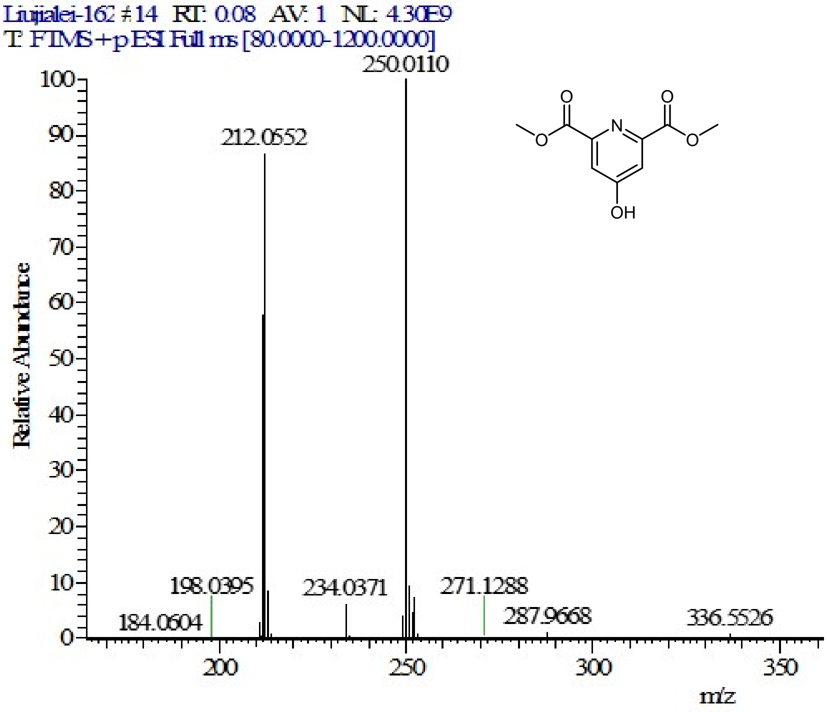


Figure S3. HRMS spectrum of DPMe.

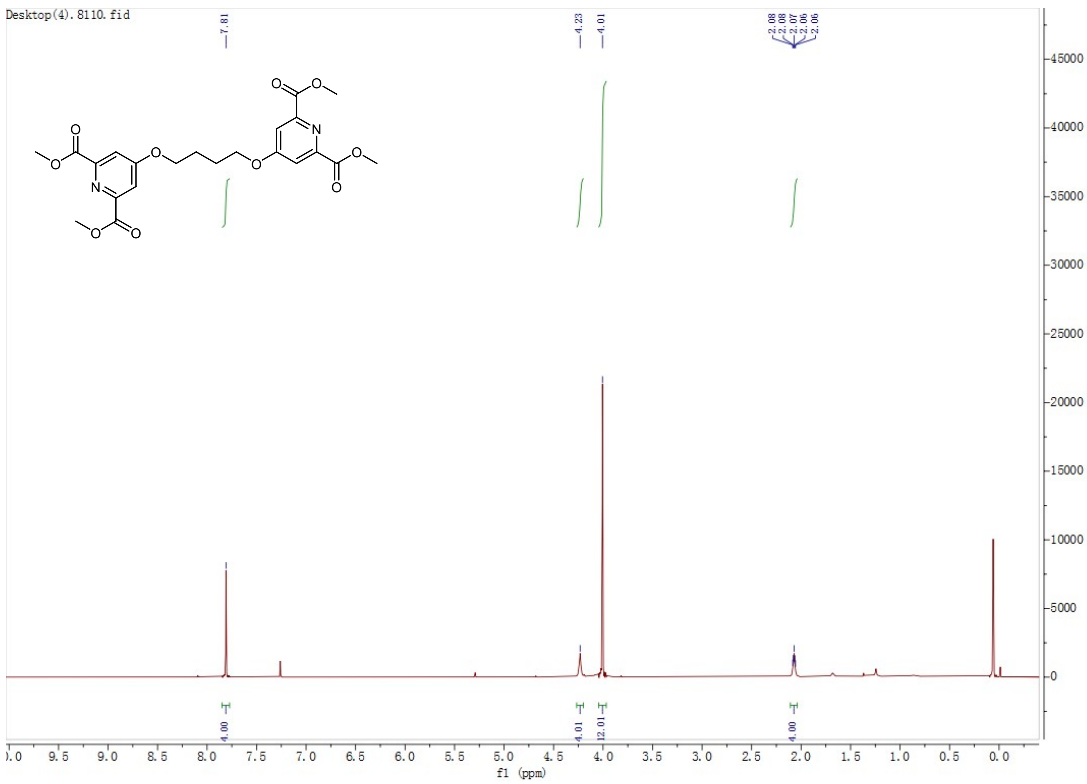


Figure S4. [1]H NMR spectrum of BDPMe-4 ($CDCl_3$, 400 MHz, 25 °C).

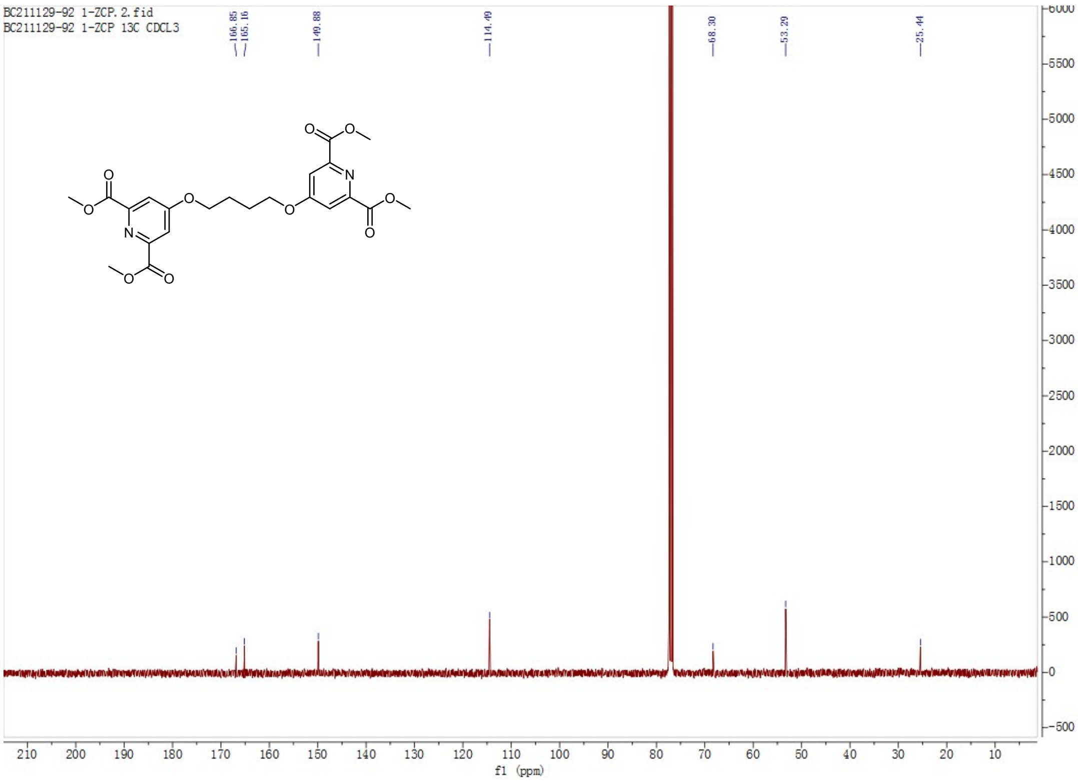


Figure S5. ^{13}C NMR spectrum of BDPMe-4 ($CDCl_3$, 100 MHz, 25 °C).

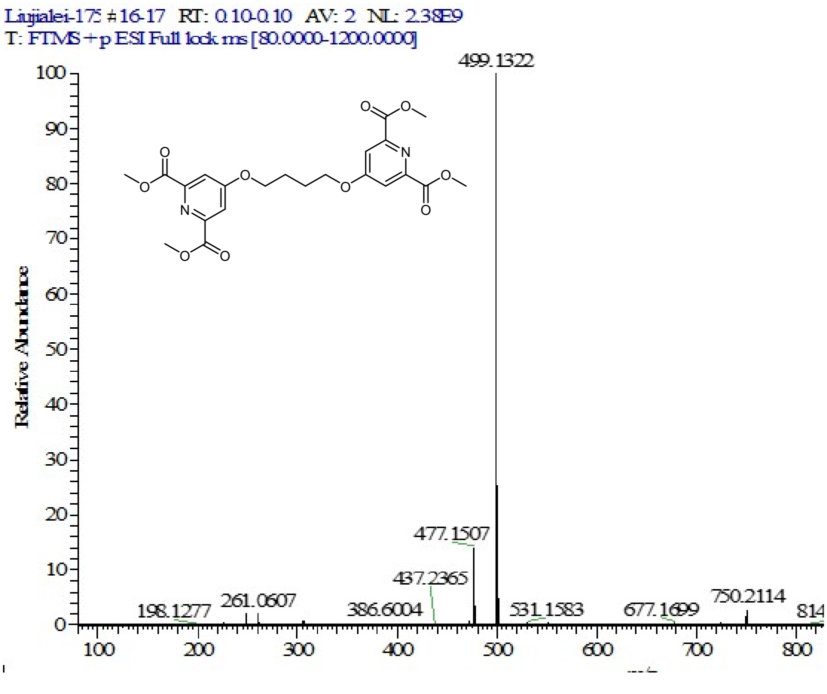


Figure S6. HRMS spectrum of BDPMe-4.

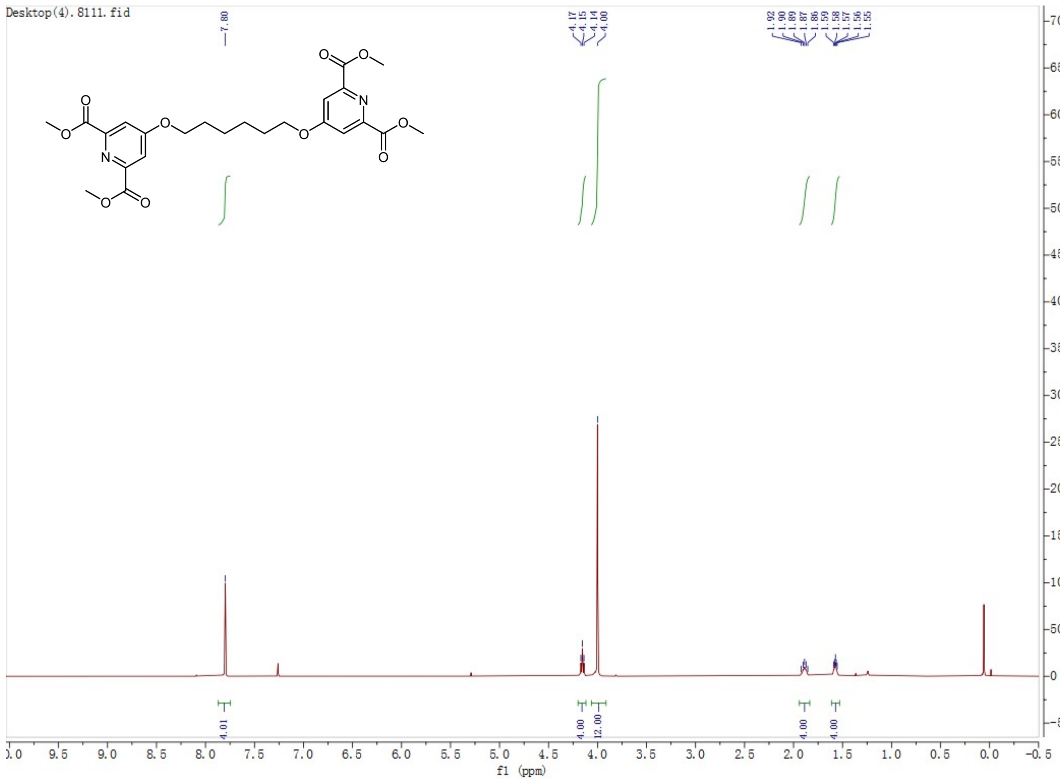


Figure S7. ^{1}H NMR spectrum of BDPMe-6 ($CDCl_3$, 400 MHz, 25 °C).

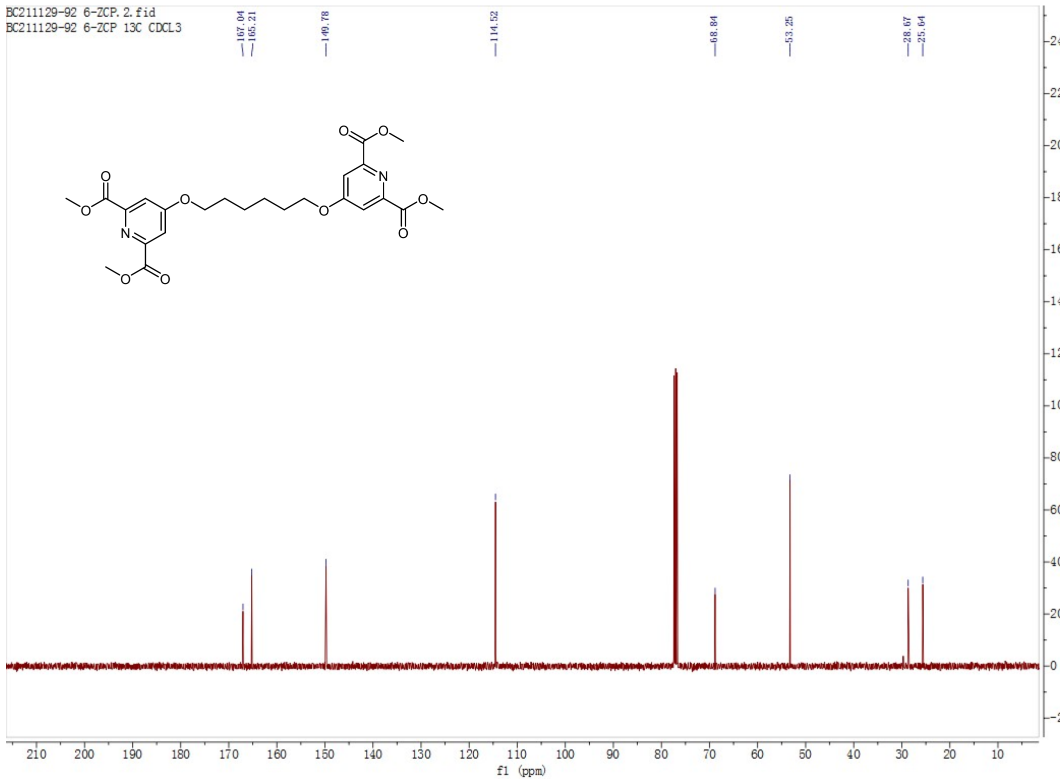


Figure S8. ^{13}C NMR spectrum of BDPMe-6 ($CDCl_3$, 100 MHz, 25 °C).

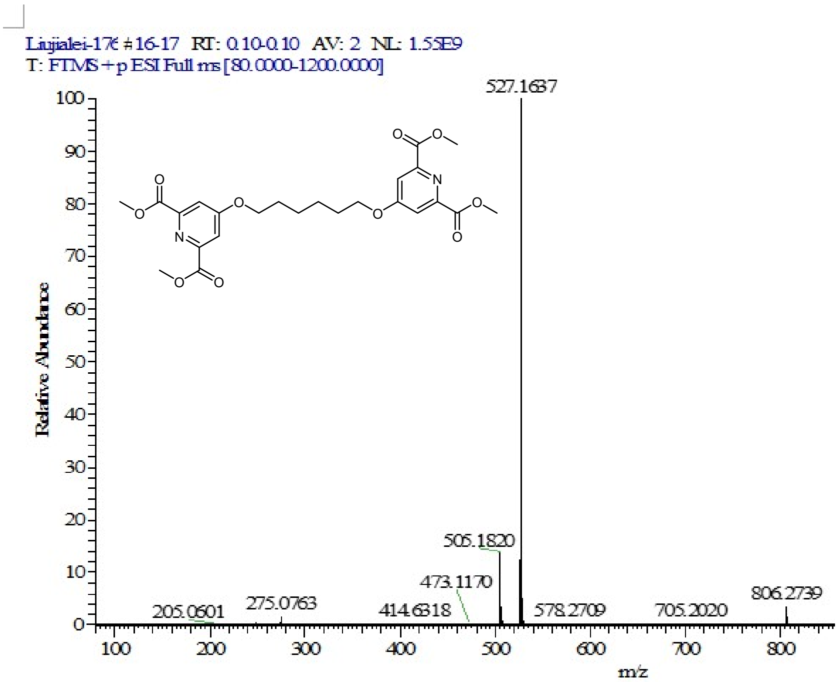


Figure S19. HRMS spectrum of BDPMe-6.

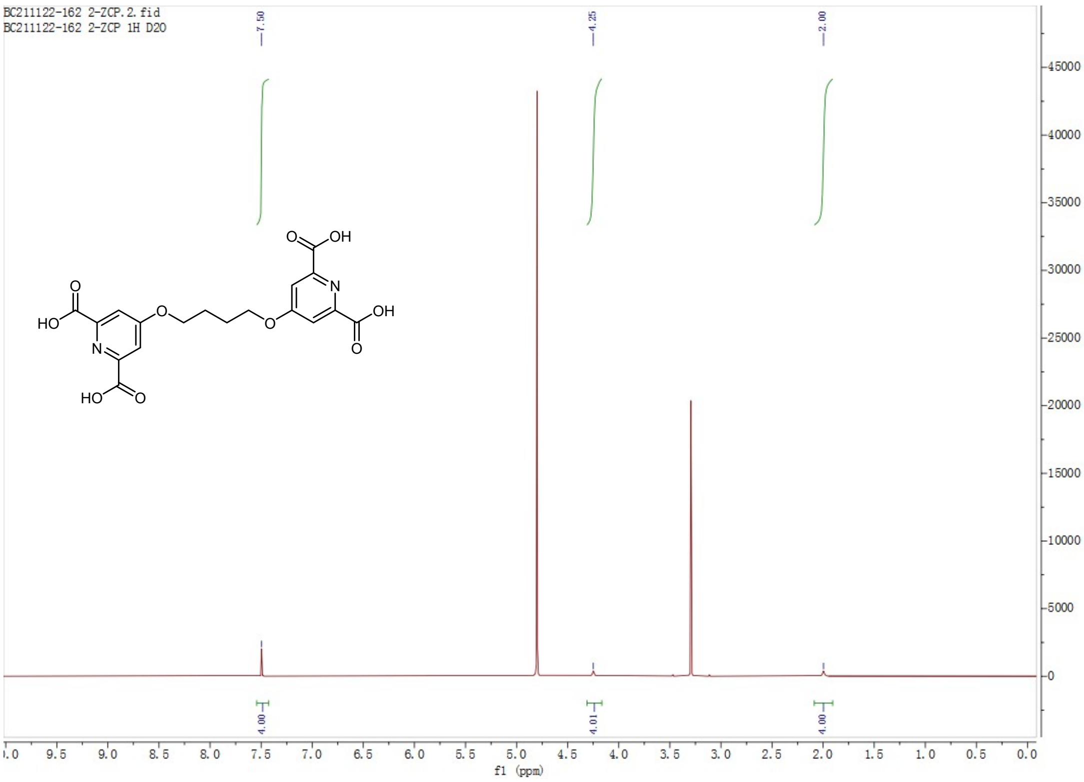


Figure S10.[1]H NMR spectrum of BDPA-4 (D_2O, 400 MHz, 25 °C).

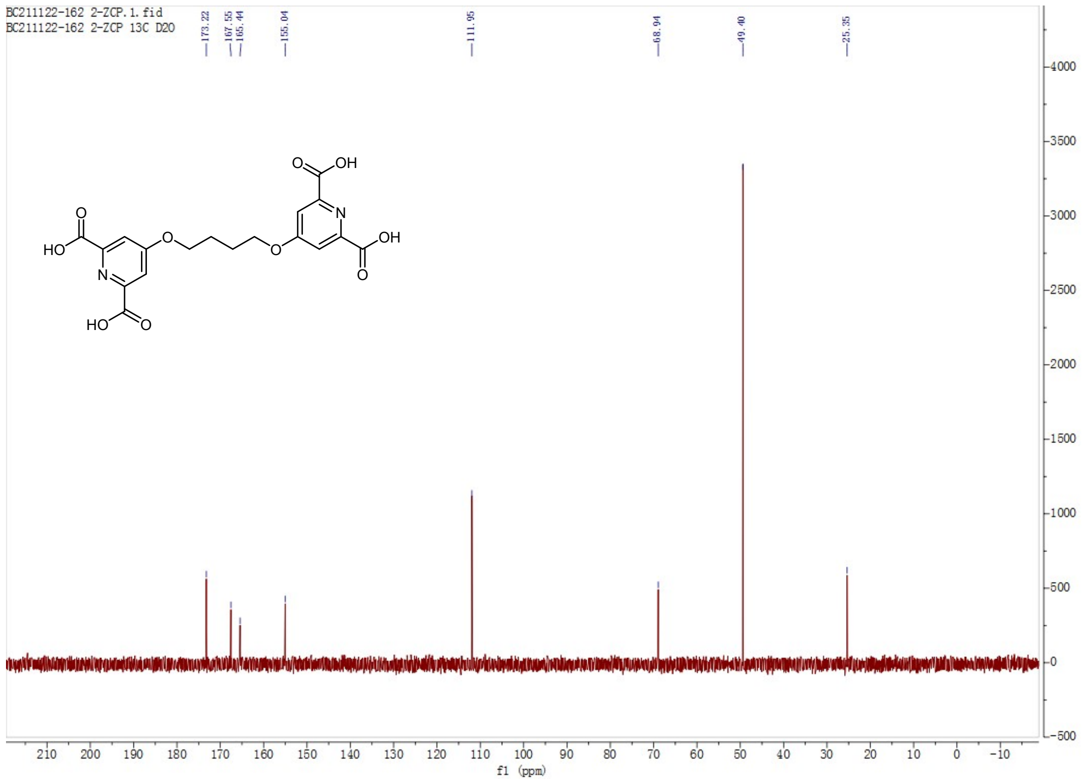


Figure S11. ^{13}C NMR spectrum of BDPA-4 (D_2O, 100 MHz, 25 °C).

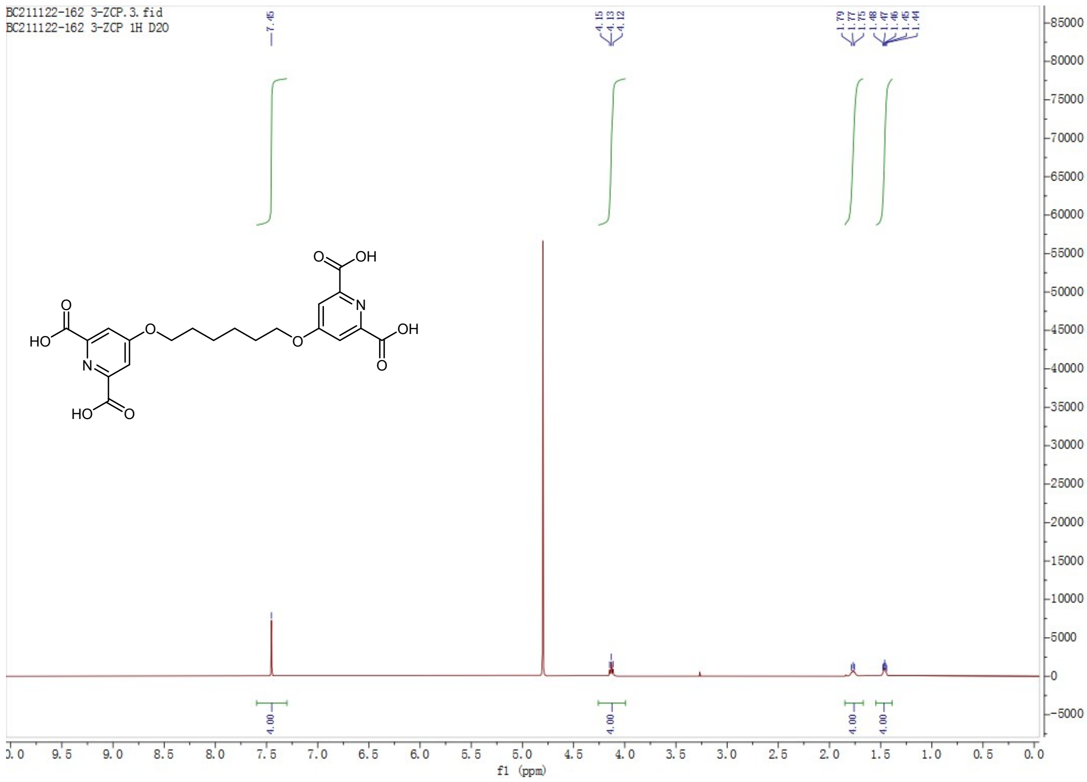


Figure S12. ^{1}H NMR spectrum of BDPA-6 (D_2O, 400 MHz, 25 °C).

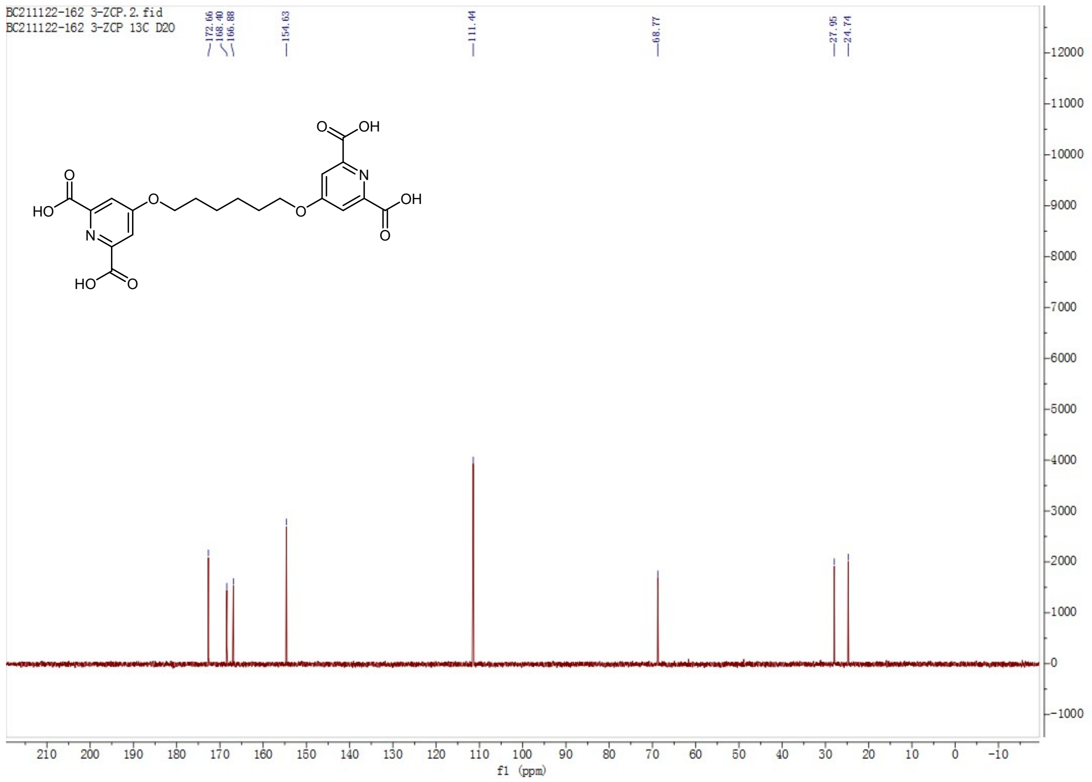


Figure S13.[13]C NMR spectrum of BDPA-6 (D_2O, 100 MHz, 25 °C).

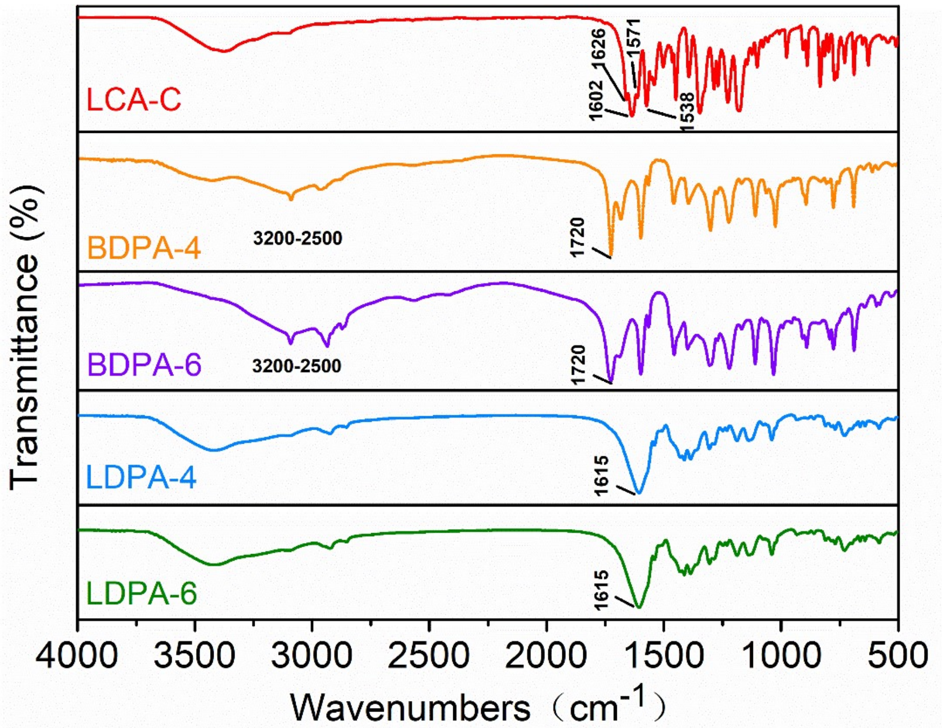


Figure S14. FTIR spectra of LCA-C, BDPA-4, BDPA-6, LDPA-4, and LDPA-6, respectively.