**Supporting Information for**

# Inducting Effects of Ionic Liquid Crystals Modified-PEDOT:PSS on the Performance of Bulk Heterojunction Polymer Solar Cells

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## Materials

4′-hydroxybiphenyl-4-carbonitrile, 1,6-dibromohexadecane, $K_2CO_3$, trimethylamine ($NMe_3$), LiF(99.99%), Al(99.998%), poly(3-hexylthiophene) (P3HT, $M_w$ = 20000, PDI = 2.3), [6,6]-phenyl-C61-butyric acid methyl ester ($PC_{61}BM$, 99.9%) and other materials are purchased from Alfa, or Aldrich. Actone and tetrahydrofuran (THF) was dried over sodium. Indium-tin oxide (ITO) glass was purchased from Delta Technologies Limited while PEDOT: PSS (Baytron PAl4083) was obtained from Bayer Inc.

## Synthesis of ionic liquid crystals 4′-(N, N, N-trimethyl ammonium bromide hexyloxy)-4-cyanobiphenyl (6CNBP-N)

The synthesis of ionic liquid crystals 4′-(N, N, N-trimethyl ammonium bromide hexyloxy)-4-cyanobiphenyl (**6CNBP-N**) is outlined in **Scheme 1**. 4′-(n-bromoalky) biphenyl-4-carbonitrile was prepared according to our previously reported method. The second step was carried out according to a reference method. Condensed trimethylamine (5 mL) was added dropwise to a solution of 4′-(n-bromoalky) biphenyl-4-carbonitrile (200mg) in THF (20 mL) at -78 °C. The mixture was allowed to warm to room temperature. The precipitate was re-dissolved by the addition of water (10 mL). After the mixture was cooled to -78 °C, extra trimethylamine (2 mL) was added and the mixture was stirred for 24 h at room temperature. After removing

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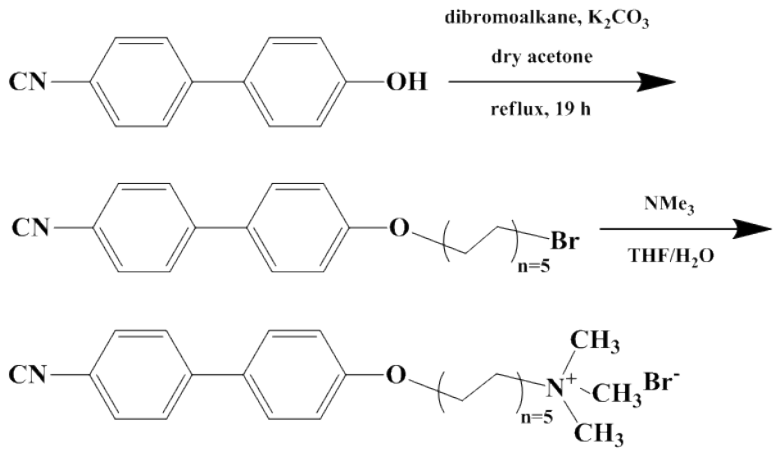
most of the solvent, n-hexane was added to precipitate to give the aqueous phase. And then excessive $NMe_3$ was removed by reduced pressure. The residue was purified by freeze-drying of the desired material (white power).




**Scheme S1** Synthesis of 6CNBP-N

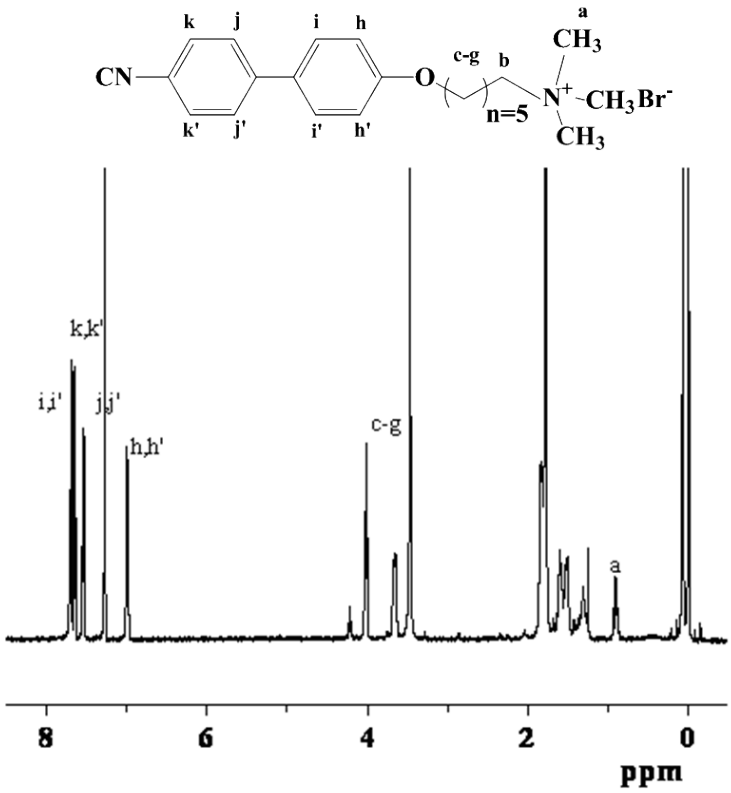



**Figure S1**. $^{1}$H NMR spectra of **6CNBP-N**.

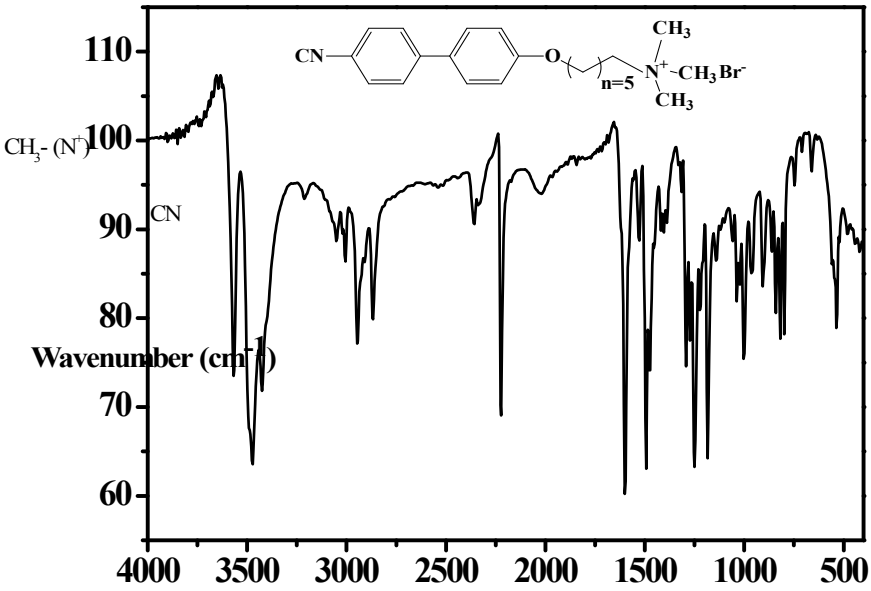



**Figure S2**. FT-IR of **6CNBP-N**.

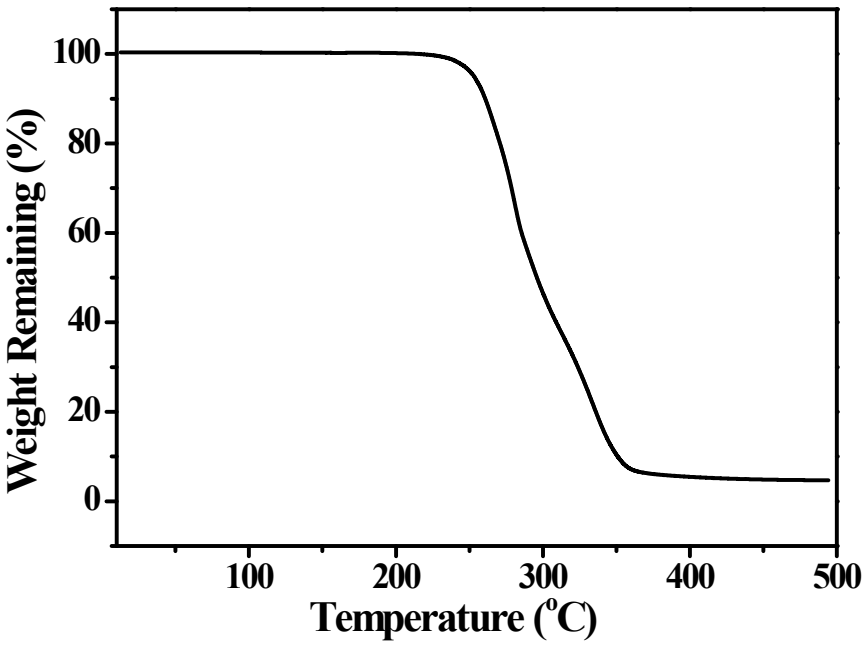



**Figure S3**. TGA thermograms of **6CNBP-N**.

**Figure S4**. Solubilty of **6CNBP-N** in mixed methanol and isopropanol (left) and dichlorobenzene (right). The concentration are both 2.14 mg/ml.