Supporting Information for

Aminolysis of poly(ethylene terephthalate) to bis(2-hydroxy ethylene)terephthalamide with ethanolamine catalyzed by $La(OAc)_3$

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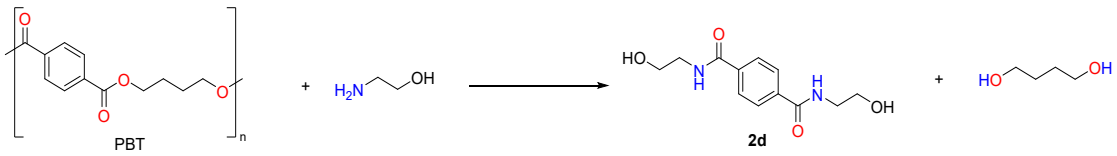
1 Experimental Section

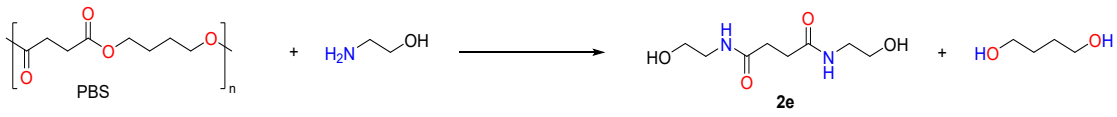
Procedures for polyester and polycarbonate depolymerization with ethanolamine

1.1 Procedure for PBT depolymerization



The depolymerization of PBT was carried out in a Schlenk tube at 160 °C. PBT (1 g, 4.54 mmol) was added first. Ethanolamine (2.5 g, 9 equiv), and $La(OAc)_3$ (5 mg, 0.5 wt %). After 1 hour, the unreacted PBT was separated by hot filtration. Washed with deionized water, dried in an oven at 80 °C, and weighed (0.21 g), Dichloromethane was added to the filtrate, then filtered, the filtered solid was vacuum dried to remove residual dichloromethane to obtain a pure white solid product **2d** (0.72 g, 63 %). ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.55 (t, J = 5.6 Hz, 2H), 7.92 (s, 4H), 4.76 (t, J = 5.6 Hz, 2H), 3.52 (q, J = 5.9 Hz, 4H), 3.34 (d, J = 6.3 Hz, 4H).

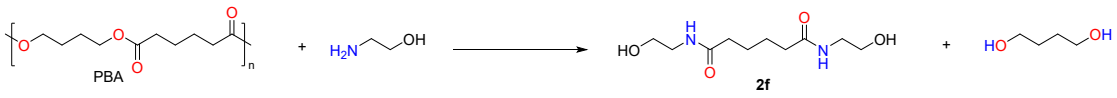
1.2 Procedure for PBS depolymerization



The depolymerization of PBS was carried out in a Schlenk tube at 160 °C. PBS (1 g, 4.8 mmol) was added first. Ethanolamine (2.64 g, 9 equiv) and $La(OAc)_3$ (5 mg, 0.5 wt%) were then added. The reaction was monitored by ^{1}H NMR spectrum, aliquot was taken for ^{1}H NMR spectroscopic analysis. After 1 h, we calculated that the conversion was 100%. Dichloromethane was added to the reaction system, then filtered, the filtered solid was vacuum dried to remove residual dichloromethane to obtain a pure white solid

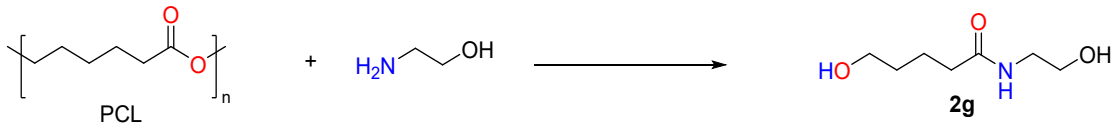
powder **2e** (0.98 g, 99 %). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.80 (t, J = 5.6 Hz, 2H), 4.62 (t, J = 5.4 Hz, 2H), 3.38-3.35 (q, 4H), 3.08 (q, J = 6.0 Hz, 4H), 2.29 (s, 4H).

1.3 Procedure for PBA depolymerization



The depolymerization of PBA was carried out in a Schlenk tube at 160 °C. PBA (1 g, 4.23mmol) was added first. Ethanolamine (2.33g, 9 equiv) and $La(OAc)_3$ (5 mg, 0.5 wt%) were then added. The reaction was monitored by ^{1}H NMR spectrum, aliquot was taken for ^{1}H NMR spectroscopic analysis. After 1 h, we calculated that the conversion was 100%. Dichloromethane was added to the reaction system, then filtered, the filtered solid was vacuum dried to remove residual dichloromethane to obtain a pure yellow-brown solid powder **2f** (0.91g, 93 %). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.74 (t, J = 5.6 Hz, 2H), 4.62 (t, J = 5.4 Hz, 2H), 3.37-3.33 (q, 4H), 3.09-3.05 (q, 4H), 2.03 (t, J = 5.4 Hz, 4H), 1.42 (t, J = 5.4 Hz, 4H).

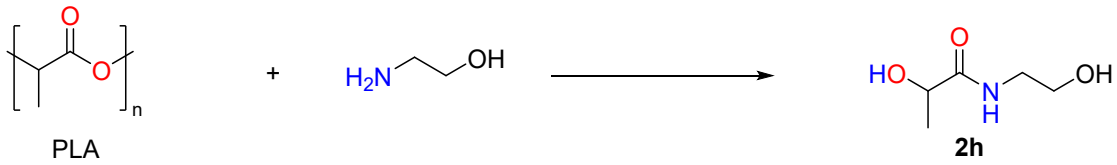
1.4 Procedure for PCL depolymerization



The depolymerization of PCL was carried out in a Schlenk tube at 160°C. PCL (1 g,8.77 mmol) was added first. Ethanolamine (4.82g,9 equiv) and $La(OAc)_3$ (5 mg, 0.5 wt%) were then added. The reaction was monitored by ^{1}H NMR spectrum, aliquot was taken for ^{1}H NMR spectroscopic analysis. After 0.5 h, we calculated that the conversion was 100 %. The solvent was removed under vacuum. Removed excess ethanolamine by vacuum distillation to obtain brown crystals product **2g** (1.41 g, 99%). ^{1}H NMR (400

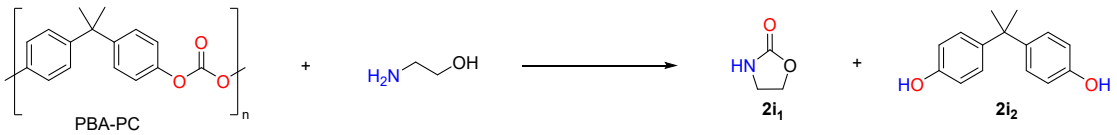
MHz, DMSO-d_6) δ 7.75 (t, J = 5.8 Hz, 1H), 4.65 (s, 1H), 4.36 (s, 1H), 3.38-3.34 (q, J = 6.8 Hz, 4H), 3.1.-3.06 (t, J = 6.0 Hz, 2H), 2.05-2.02 (t, J = 6.0, 2.5 Hz, 2H), 1.49-1.43 (t, J = 5.4 Hz, 2H), 1.41-1.35 (t, J = 5.4 Hz, 2H), 1.25-1.19 (t, J = 5.4 Hz, 2H).

1.5 Procedure for PLA depolymerization



The depolymerization of PLA was carried out in a Schlenk tube at 160°C. PLA (1 g 13.87 mmol) was added first. Ethanolamine (7.62g, 9 equiv) and $La(OAc)_3$ (5 mg, 0.5 wt%) were then added. The reaction was monitored by ^{1}H NMR spectrum, aliquot was taken for ^{1}H NMR spectroscopic analysis. After 0.5 h, we calculated that the conversion was 100 %. The solvent was removed under vacuum. Removed excess ethanolamine by vacuum distillation to obtain brown oily liquid product **2h** (1.84 g, 99 %). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.61 (t, J = 5.8 Hz, 1H), 5.51 (s, 1H), 4.72 (s, 1H), 3.95 (q, J = 6.8 Hz, 1H), 3.41 (t, J = 6.0 Hz, 2H), 3.14 (qd, J = 6.0, 2.5 Hz, 2H), 1.19 (d, J = 6.8 Hz, 3H)

1.6 Procedure for BPA-PC depolymerization



The depolymerization of BPA-PC was carried out in a Schlenk tube at 160 °C. BPA-PC (1 g, 3.9 mmol) was added first. Ethanolamine (2.14 g, 9 equiv) and $La(OAc)_3$ (5 mg, 0.5 wt%) were then added. The reaction was monitored by ^{1}H NMR spectrum, aliquot was taken for ^{1}H NMR spectroscopic analysis. After 1 h, we calculated that the

conversion was 100 %. The reaction system was cooled to room temperature. After that, a certain amount of water was introduced to the reaction, stirring uniformly. The suspension was filtered to collect the precipitate and filtrate. After evaporative concentration and column chromatography (chloroform as eluent), 0.29 g of **2i$_1$** was obtained in 86 % yield. The precipitate was vacuum dried, 0.82 g of **2i$_2$** with a yield of 92 % was obtained. **2i$_1$**: ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.40 (s, 1H), 4.24-4.21 (m, 2H), 3.40-3.37 (m, 2H). **2i$_2$**: ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.12 (s, 2H), 6.98-6.96 (m, 4H), 6.64-6.62 (m, 4H), 1.52 (s, 6H).

2 NMR spectra of aminolysis products

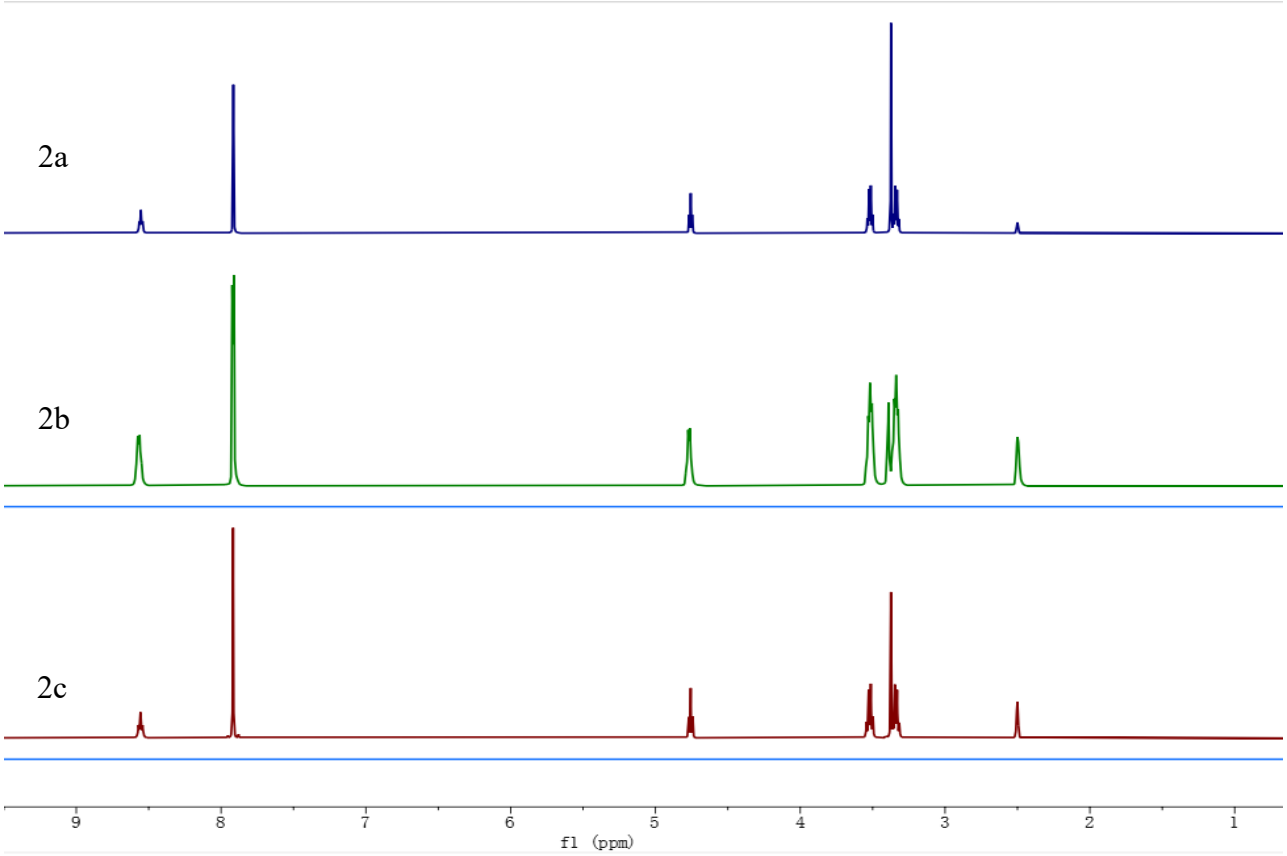


Fig. S1 ^{1}H NMR spectra (400 MHz, DMSO-d_6) of **2a, 2b, 2c**.

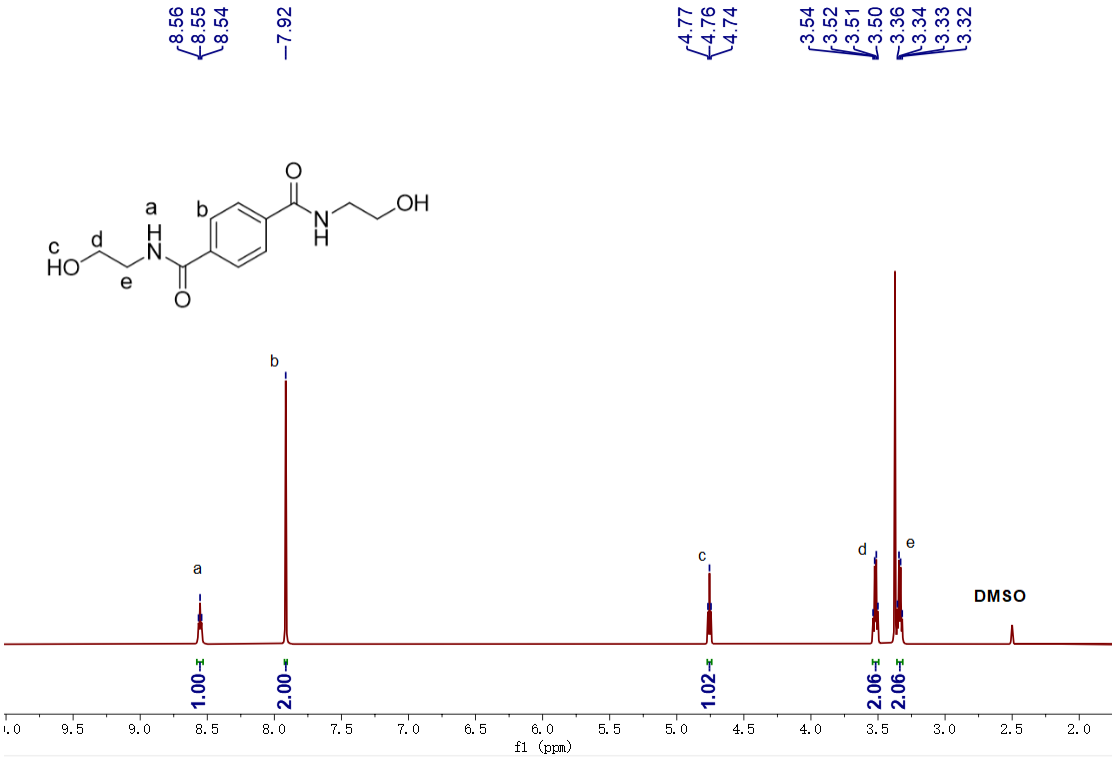


Fig. S2 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of PBT **2d**.

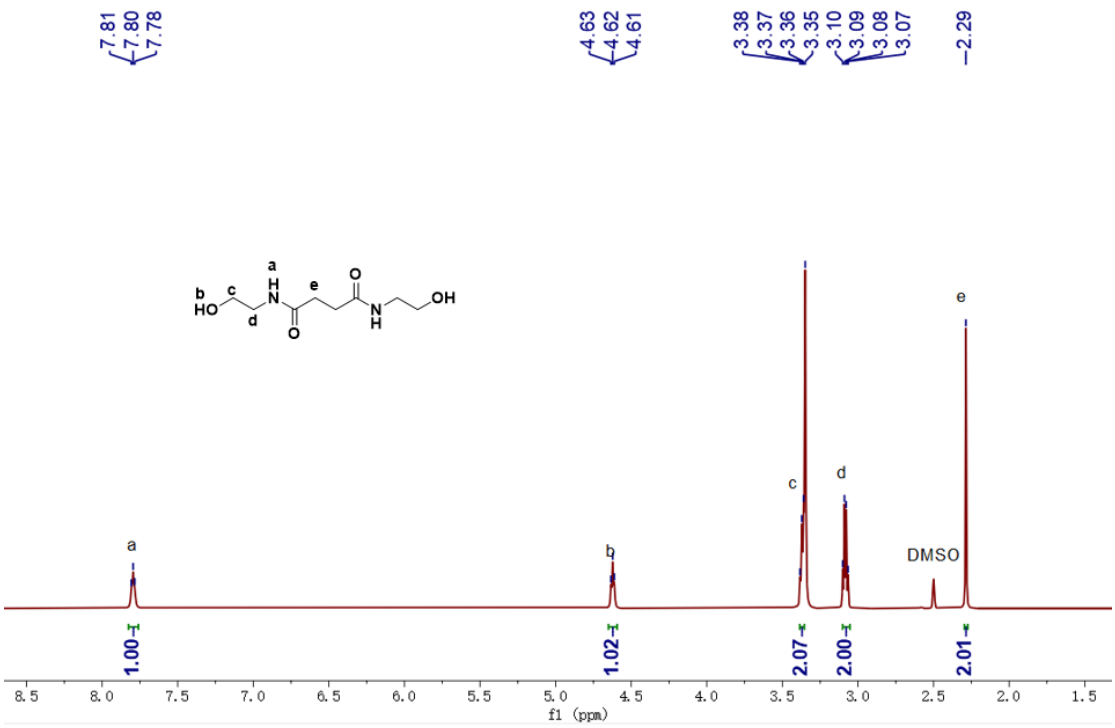


Fig. S3 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of PBS **2e**.

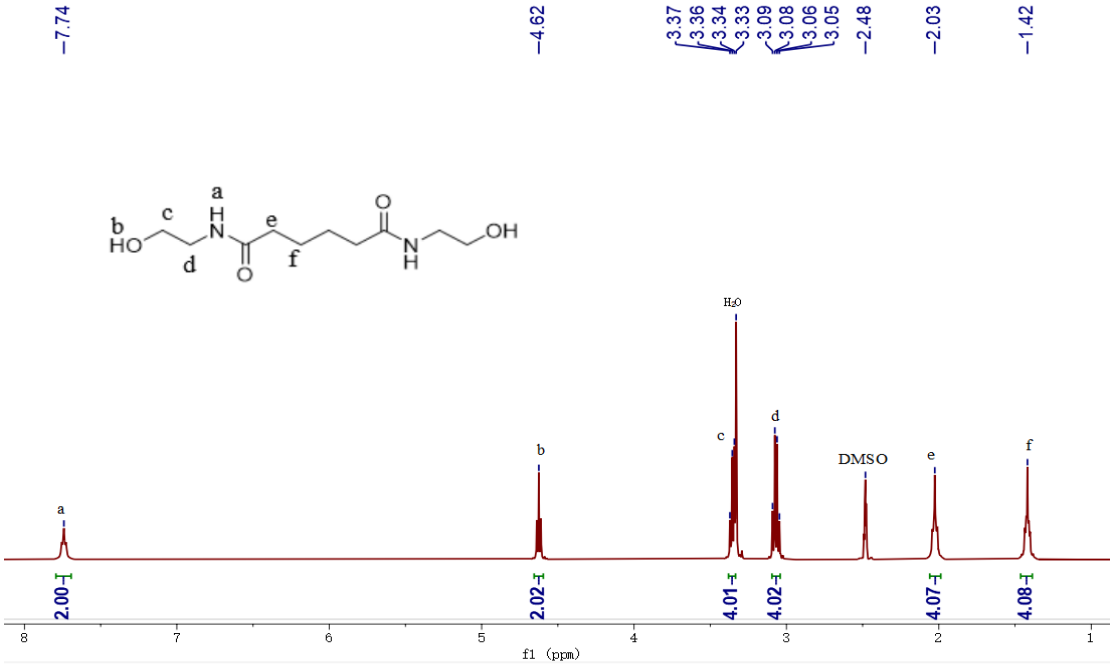


Fig. S4 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of PBA **2f**.

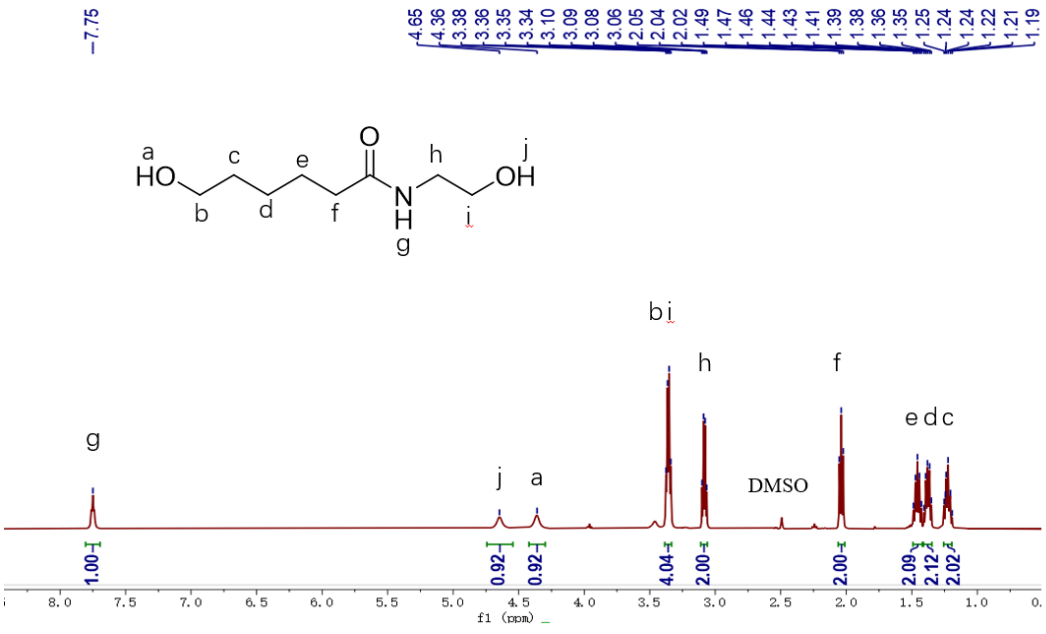


Fig. S5 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of PCL **2g**.

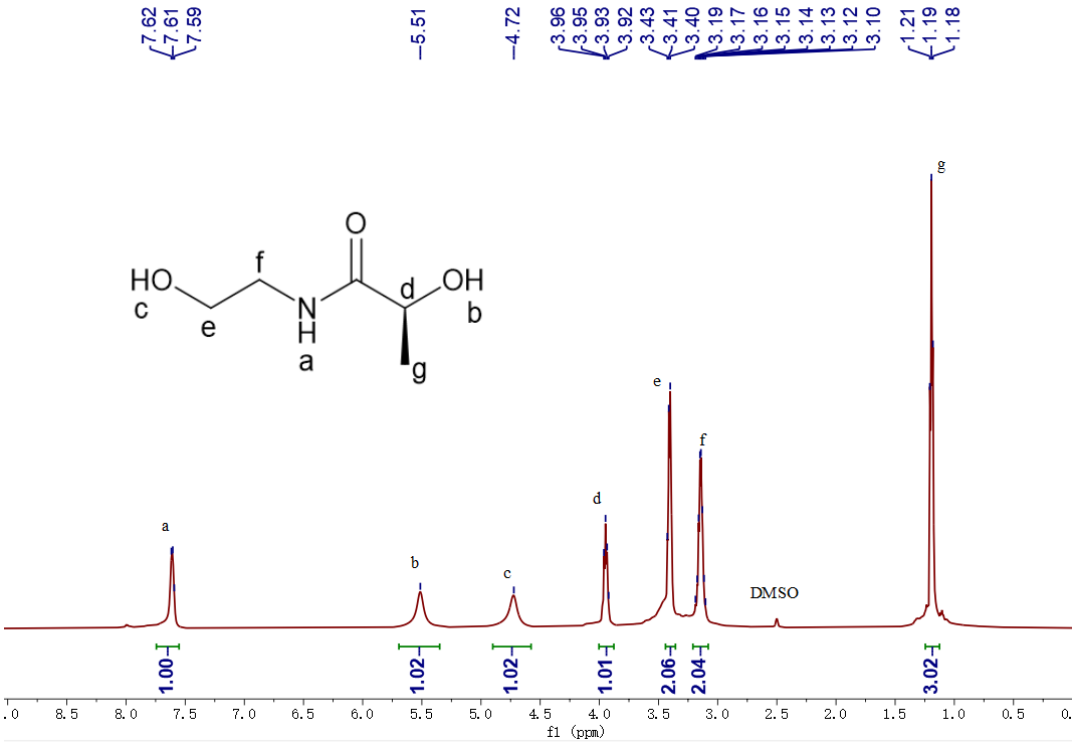


Fig. S6 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of PLA **2h**.

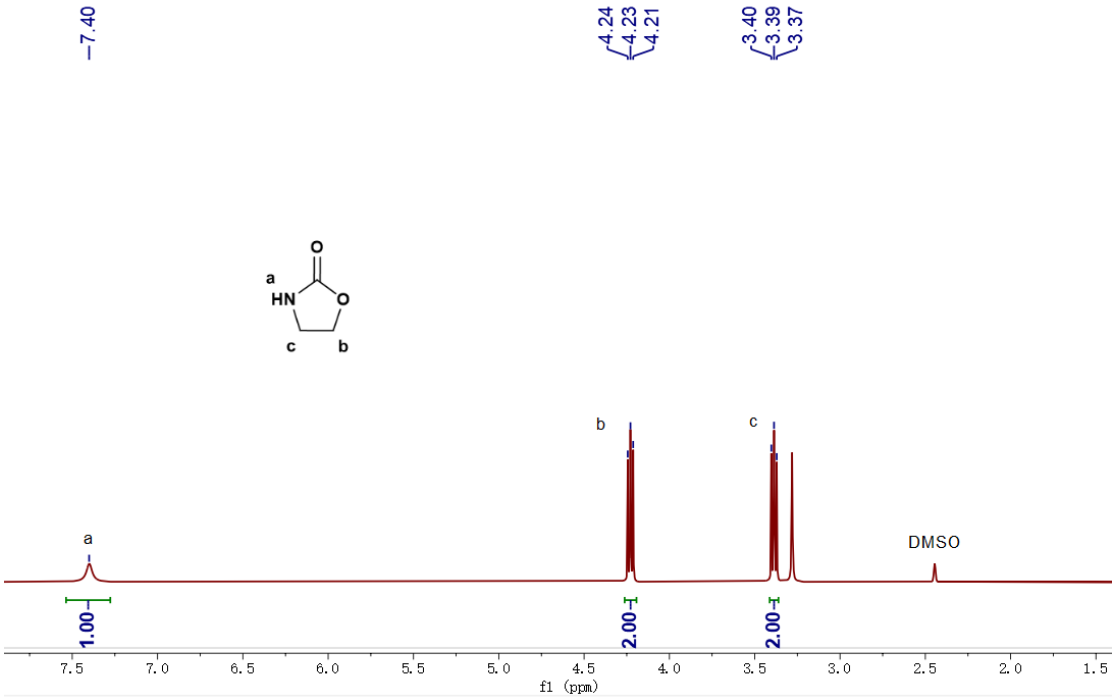


Fig. S7 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of BPA **2i$_1$**.

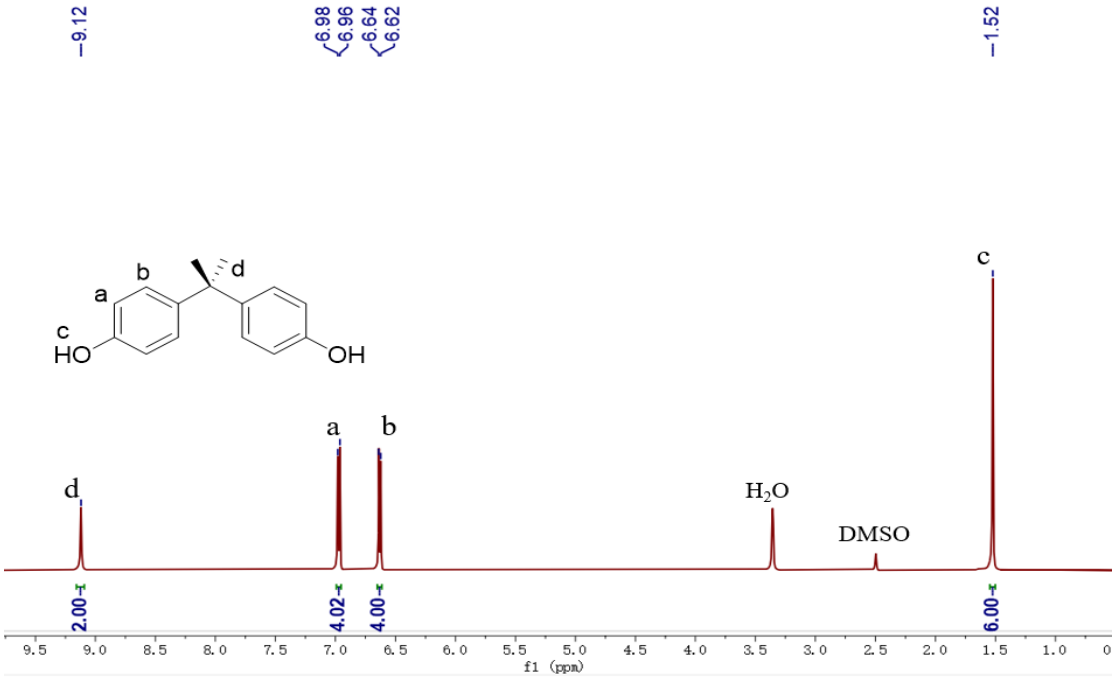


Fig. S8 ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of aminolysis product of BPA **2i$_2$**.

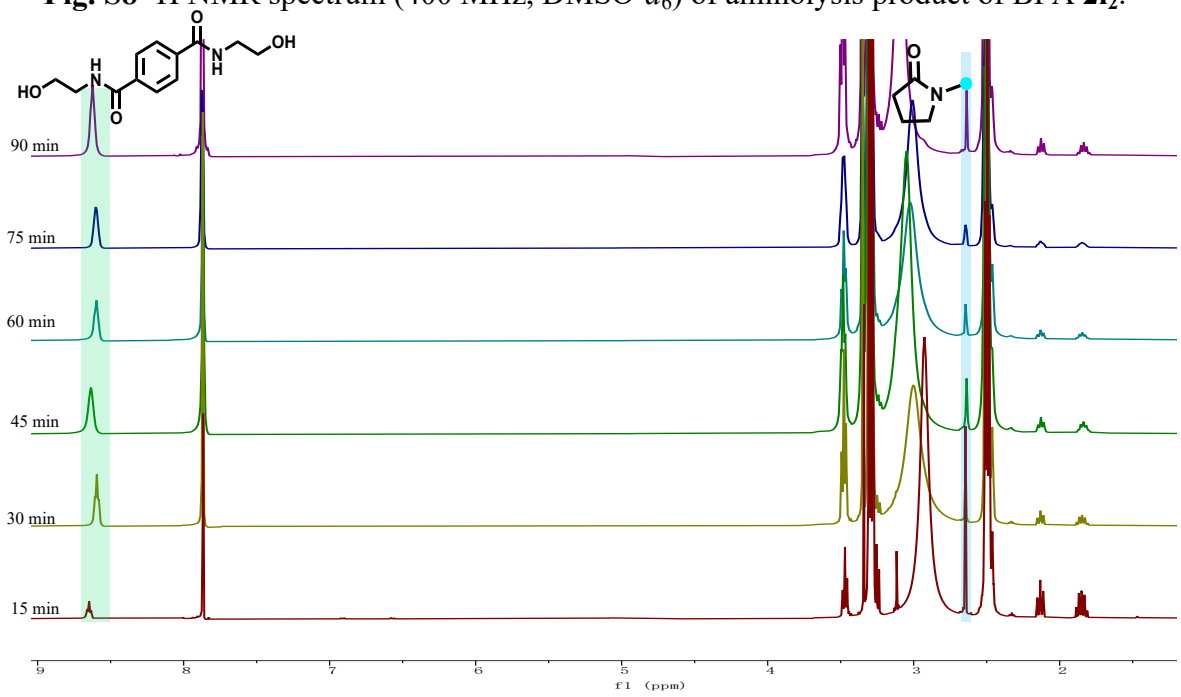


Fig. S9 Stacked ^{1}H-NMR spectra PET aminolysis at 160 °C for 1.5 h under catalyst-La(OAc)$_3$ conditions (400 MHz, DMSO-d_6, 298 K). The blue and green areas show the peaks used to calculate the yield of BHETA monomer (δH = 8.56 (t, 2H)) with N-Methyl-2-pyrrolidone NMP solvent as an internal standard (δH = 2.70, s, 3H).

Table S1 The effect of different colored PET on depolymerization.

Run[a]	Color	Conversion (%)	BHETA Yield[b] (%)
1	yellow	100	92.5
2	green	100	93
3	blue	100	90
4	pink	100	92
5	brown	100	90
6	white	100	90

[a] Depolymerization conditions: 5 mg of catalyst (0.5 wt% with respect to PET weight), 1.0 g (5.2 mmol) of PET, 2.86 g (46.8 mmol) of ethanolamine, 160 °C, 1.5 h. [b] Separation yield.