Electronic Supplementary Information (ESI) for:

CAL-B catalyzed Regioselective Bulk Polymerization of L-Aspartic acid Diethyl Ester

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1. Materials and Methods

The L-Aspartic acid diethyl ester hydrochloride salt (99.62% purity by HPLC) was purchased from Chem-Impex Int'l Inc. and used without further purification. CAL-B from *Candida antarctica* immobilized on acrylic resin (Novozym-435) was obtained from Novozymes and dried under vacuum at 40 ^{o}C for 24 h before use. Other reagents and solvents were of analytical grade and were used without further purification.

Dehydrochlorination of L-Asp(OEt)-OEt.HCl. 10 g of L-Aspartic acid diethyl ester hydrochloride salt were dissolved in 100 mL of a mixture of saturated $NaHCO_3$aq/Dichloromethane (1:1). After stirring for 1h at room temperature, the resulting biphasic mixture was transferred in a separator funnel and the organic phase was separated. The aqueous phase was extracted two more times with dichloromethane and the combined organic phase was dried using sodium sulfate. Evaporation of the solvent leads to the desired product as colorless oil (yield = 91%).

CAL-B catalyzed polymerization. To 500 mg (2.64 mmol) of desalted L-Aspartic acid diethyl ester in a round flask, was added the immobilized CAL-B (100 mg, 20 wt%). The resulting mixture was stirred under vacuum at 80 ^{o}C for 2-24 h. After the specific time, the reaction was quenched by adding 20 mL of chloroform. The enzyme was filtered off and the chloroform was removed by rotoevaporation. The crude product was dissolved in chloroform (2 mL) and precipitated using diethyl ether or methanol (10 mL). The precipitate was collected by centrifugation and washed with ether or methanol (10 mLx3). After drying under vacuum for 24 h, the pure product was obtained as a white powder. Control reactions (without enzyme) were carried out in the same conditions.

NMR experiments. 1D and 2D NMR spectra were recorded at 25 ^{o}C on a Bruker 600 MHz Spectrometer, equipped with 4 RF channels, an ultra-sensitive HCND cryoprobe with a z-axis gradient, and a room temperature HCND probe with triple-axis gradients.

Sample concentrations were 1-3 wt% in chloroform-d. NMR data were processed using TopSpin3.5pl5 or MestReNova 9.0.

CD measurements. CD spectra were measured at 20 ^{o}C using a JASCO model J-815 Spectrometer. Spectra were recorded using a 1 mm pathlength cell from 260 nm to 225 nm (in chloroform) or from 260 nm to 210 nm (in methanol). Scans were collected 4 times with a speed of 100 nm/min and averaged. Samples concentrations were 0.3 wt% and 0.1 wt% in chloroform and in methanol, respectively.

Thermal analysis. Thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) were performed under nitrogen on a TGA Q50 and DSC Q2000, respectively. The data were processed using a Universal V4.5A TA analysis software. TGA and DSC scans were collected at a heating rate of 10 ^{o}C/min

2. Supporting Figures

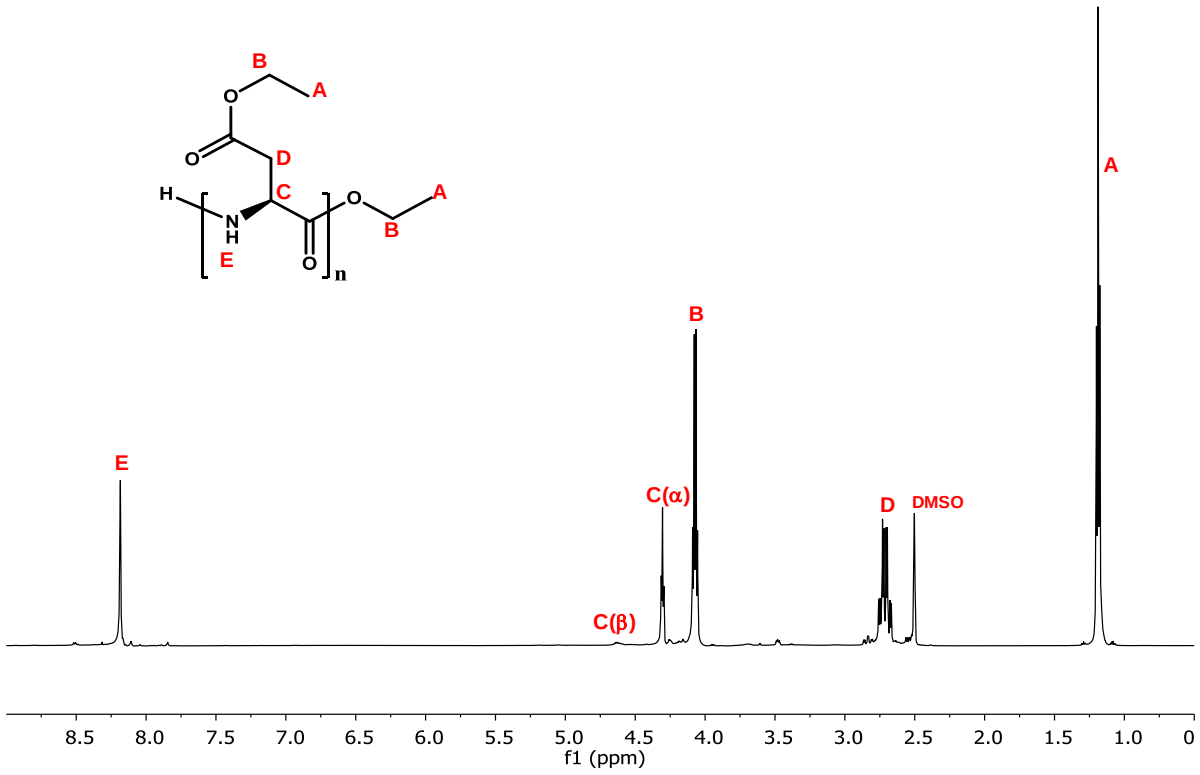

Figure SI-1. ^{1}H NMR spectrum (600 MHz) of poly(β-Et-α-Aspartate) in DMSO-d_6. The NH amide signal appears at 8.18 ppm.

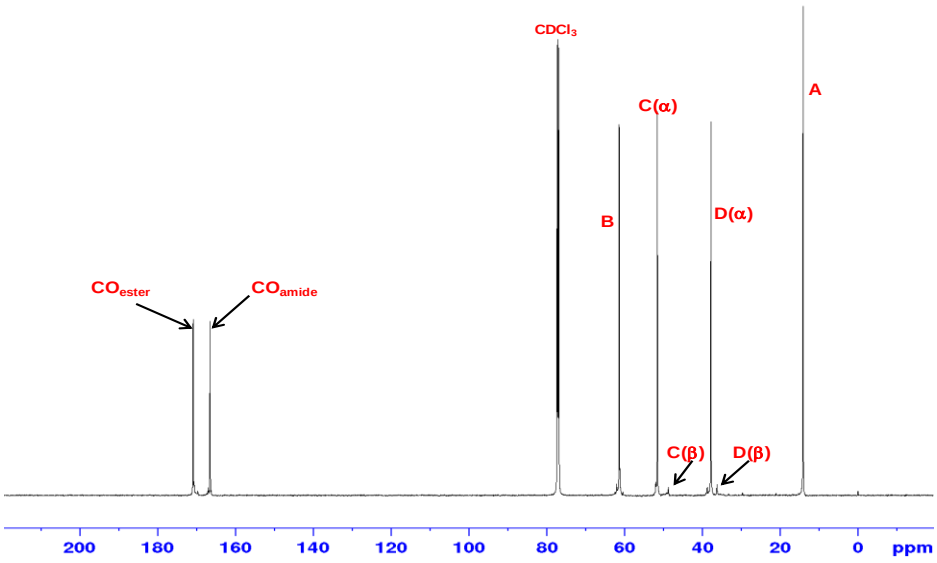

Figure SI-2. ^{13}C NMR spectrum (150 MHz) of poly(β-Et-α-Aspartate) in $CDCl_3$. The two carbonyl signals were assigned from HMBC experiment.

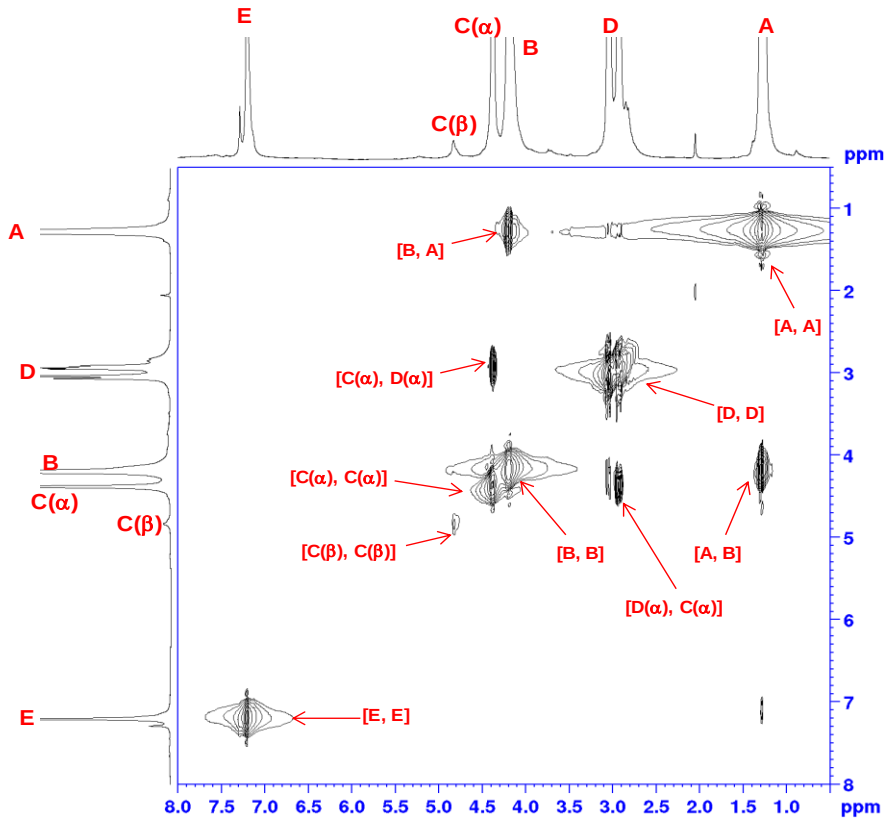

Figure SI-3. ^{1}H-^{1}H COSY spectrum (600 MHz) of poly(β-Et-α-Aspartate) in $CDCl_3$.

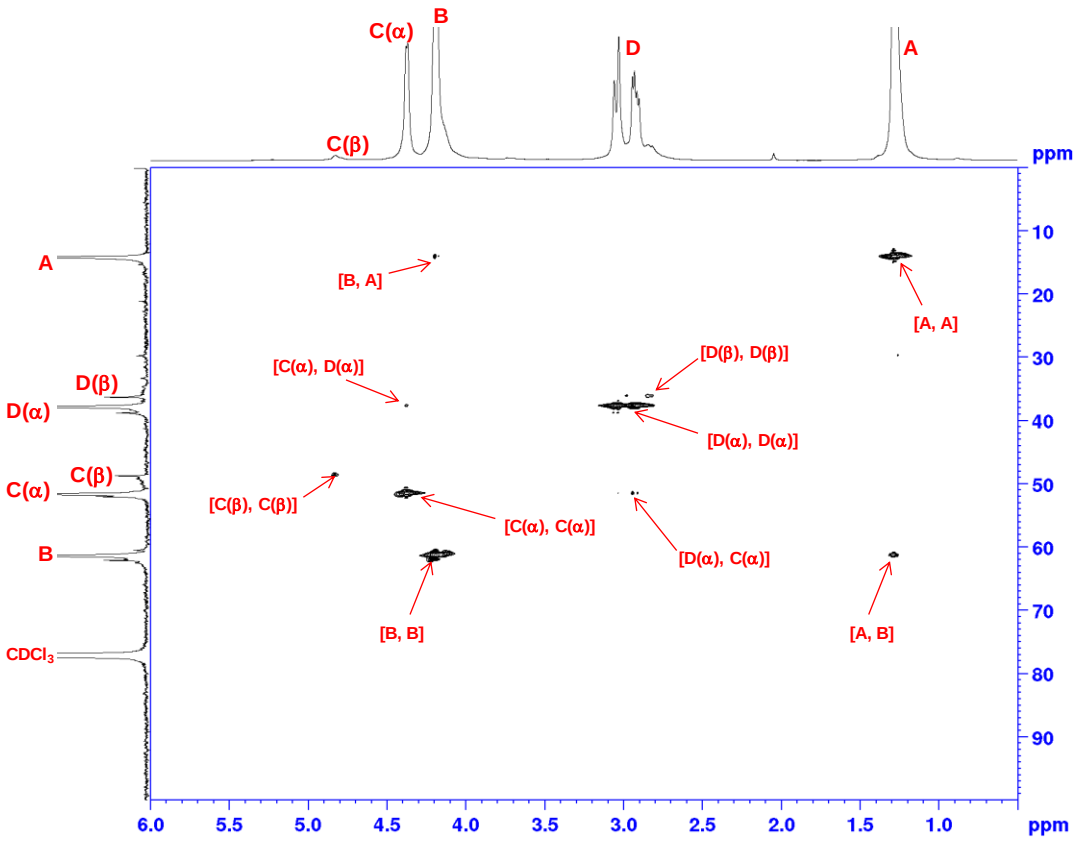

Figure SI-4. ^{1}H-^{13}C HSQC spectrum (600 MHz) of poly(β-Et-α-Aspartate) in $CDCl_3$.

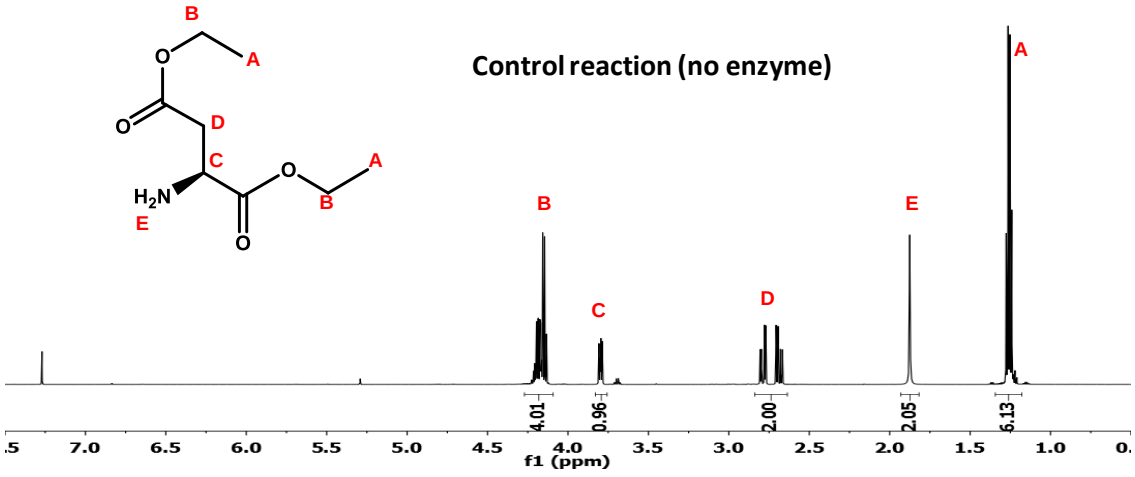

Figure SI-5. ^{1}H NMR spectrum (600 MHz) in $CDCl_3$ of the control reaction carried out at 80 ^{o}C for 24 h in the absence of CAL-B. The resulting ^{1}H NMR spectrum is identical to that of the monomer.

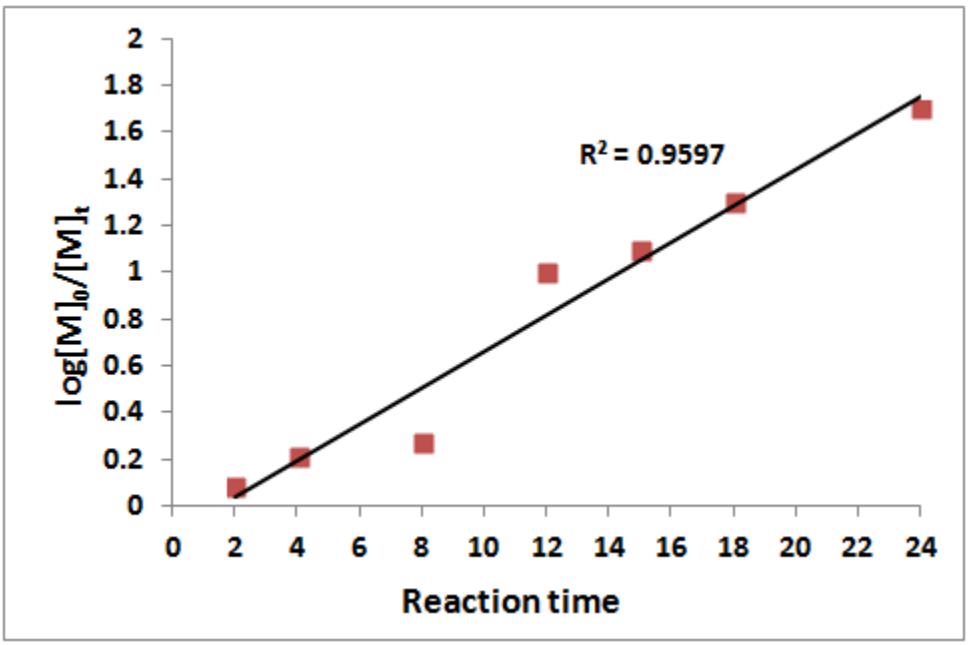

Figure SI-6. Plot of $\log[M]_0/[M]_t$ versus reaction time for CAL-B (20 wt.%) catalyzed bulk polymerization of L-Asp(OEt)$_2$ at 80 ^{o}C. $[M]_0$ and $[M]_t$ refer to initial and remaining monomer concentration, respectively.

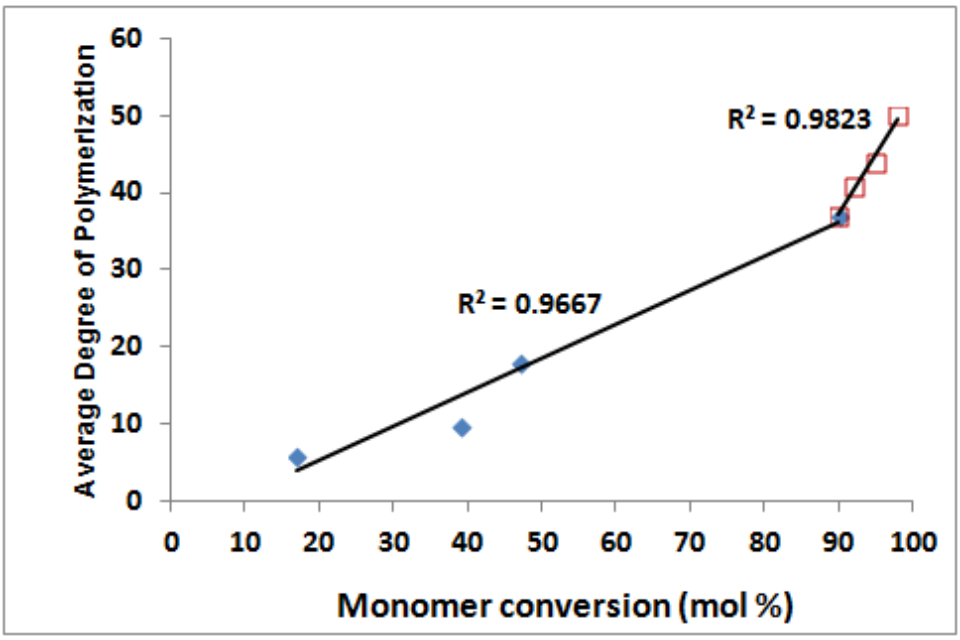

Figure SI-7. Plot of DP_{avg} versus monomer conversion for CAL-B (20 wt.%) catalyzed bulk polymerization of L-Asp(OEt)$_2$ at 80 ^{o}C for 2-24 h.

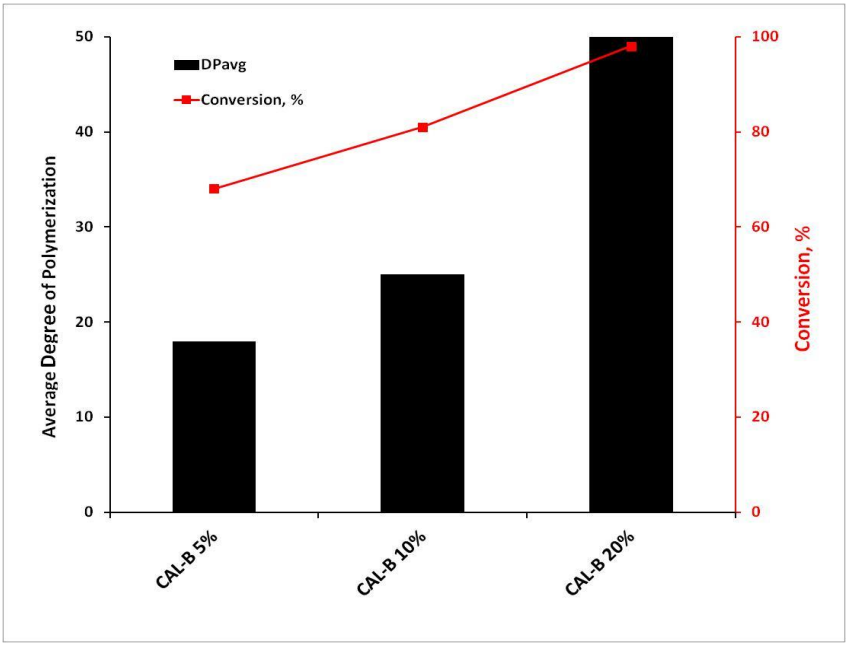

Figure SI-8. Effect of enzyme loading (5, 10 and 20%) on monomer **c**onversion and DP_{avg}. The reactions were performed at 80 ^{o}C, under vacuum for 24 h.

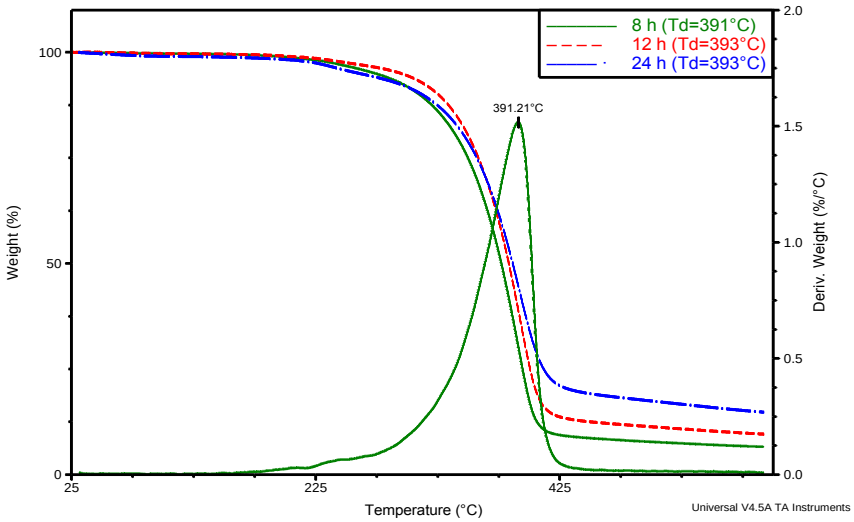

Figure SI-9. Thermogravimetric analysis (TGA) performed under nitrogen at a heating rate of 10 ^{o}C/min of three poly(β-Et-α-Asp)s with DP_{avg} = 18, 37, 50 obtained after 8, 12 and 24 h, respectively. The decomposition temperature (T_d) was determined at the inflection point of the first derivative curve.

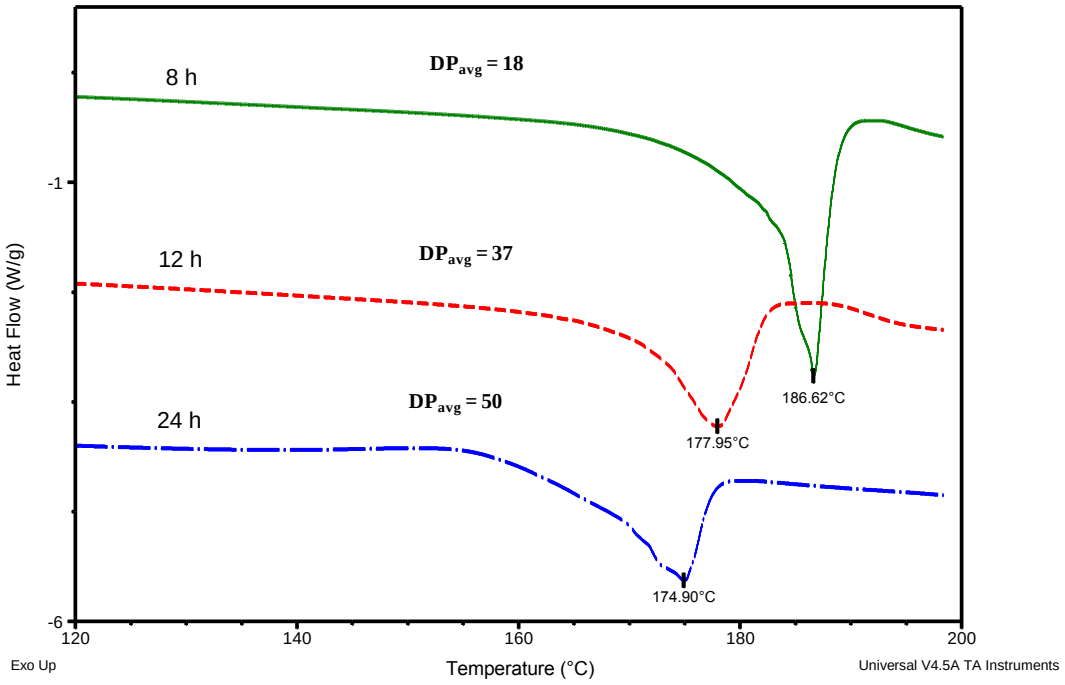

Figure SI-10. First scan differential scanning calorimetry (DSC) analysis performed under nitrogen at a heating rate of 10 ^{o}C/min of three poly(β-Et-α-Asp)s with DP_{avg} = 18, 37, 50 obtained from 8, 12 and 24 h polymerizations, respectively. The three samples exhibited an endotherm at 187, 178 and 175 ^{o}C, respectively.