Supporting Information

Polymer Synthesis by Mimicking Nature's Strategy: combination of ultra-fast RAFT and the Biginelli reaction

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EXPERIMENTAL SECTION

1. Materials

2-[2-(2-Chloroethoxy)ethoxy]ethanol (96%, TCI), 4-hydroxybenzaldehyde (99%, Aladdin Reagents), 4-iodobenzaldehyde (96%, J&K chemical), 4-formylphenylboronic (96%, Aladdin Reagents), vanillin (98%, HEOWNS®), 5-iodo-vanillin (99%, J&K chemical), carbon disulfide (98%, HEOWNS®), ethyl mercaptan (97%, TCI), 2-bromopropionic acid (96%, J&K chemical), urea (99%, J&K chemical), thiourea (99%, Aladdin Reagents), *N*-methylurea (98%, HEOWNS®), *N*-methylthiourea (98%, HEOWNS®), glycine (99%, Aladdin Reagents), magnesium chloride ($MgCl_2$, 99%, J&K chemical), ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC HCl, 99%,

J&K chemical), 4-dimethylaminopyridine (DMAP, 98%, J&K chemical), triethylamine (Et_3N, 99%, Aladdin Reagents), dimedone (Heowns, 98%), ammonium acetate (J&K, 98%), *N,N*-dimethylacrylamide (DMAm, 98%, HEOWNS), 4-acryloylmorpholine (AMPL, 98%, HEOWNS), *N*-(2-hydroxyethyl) acrylamide (96%, Energy Chemical), 2,2'-azobis[2-(2-imidazolin-2-yl) propane] dihydrochloride (VA-044, 97%, J&K chemical) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical were used directly as received. Diketen (95%, Ouhe) was vacuum distillation before use. 2-(((Ethylthio)carbonothioyl) thio) propanoic acid[1] and 4-(2-(2-(2-hydroxyethoxy) ethoxy) ethoxy)benzaldehyde[2] were synthesis according to the references.

2. Instruments

Gel permeation chromatography (GPC) analyses of polymers were performed using *N, N*-dimethylformamide (DMF) as the eluent with a flow rate of 1.0 mL/min. The GPC system was a Shimadzu LC-20AD pump system comprising an auto injector, a MZ-Gel SDplus 10.0 μm guard column (50 × 8.0 mm, 10^2 Å) followed by two PLgel 5 μm MIXED-D columns (300 × 7.5 mm). The system was calibrated using narrow molecular weight distribution polystyrene standards ranging from 200 to 10^6 g mol^{-1}. The reverse phase high performance liquid chromatography (RP-HPLC) system had two Shimadzu LC-6AD pumps, an auto injector, an Agilent Zorbax 300SB-C18 column and a Shimadzu SPD-M20A diode array detector. The mobile phases (1 mL/min) were phase A (99.9% H_2O, 0.1% TFA) and phase B (99.9% acetonitrile, 0.1% TFA), respectively. The gradient of the mobile phase B is 30% - 90% (30 min), 50°C.

^1H NMR and ^{13}C NMR spectra were obtained using a JEOL JNM-ECA400 (400 MHz) spectrometer for all samples. Fourier Transform Infrared (FT-IR) spectra were

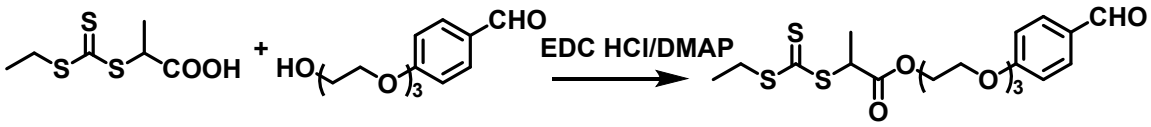
record on PerkinElmer Spectrum 100 FT-IR spectrometer. The fluorescence measurements were carried out on a Perkin-Elmer LS-55 spectrometer equipped with quartz cuvettes of 1 cm path length.

ESI-MS data were collected using a Micro TOF-QII Bruker. Matrix-assisted laser desorption ionization time-of-flight mass (MALDI-TOF MS) spectra were recorded on an AXIMA-Performance MA in a linear mode.

CT imaging data were obtained from a LightSpeed VCT (GE, USA). Scanning parameters: 120 kV, 500 mA, helical thickness: 2.5 mm, rotation time: 0.8 sec. The images were reconstructed into 2.5 mm/slice.

3. Methods

3.1 2-(2-(2-(4-Formylphenoxy)ethoxy)ethoxy) ethyl 2-(((ethylthio) carbonothioyl)thio) propanoate



4-(2-(2-(2-Hydroxyethoxy)ethoxy)ethoxy)-benzaldehyde[2] (2.54 g, 10 mmol) and 2-(((ethylthio)carbonothioyl)thio) propanoic acid[1] (2.10 g, 10 mmol) were dissolved in dichloromethane (50 mL). Ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC HCl, 2.20 g, 11 mmol) and 4-dimethylaminopyridine (DMAP, 0.06 g, 0.5 mmol) were added. The mixture was stirred at 20°C for 10 h, and 50 mL of deionized water was added. The organic phase was collected, dried by $MgSO_4$ and concentrated under reduced pressure. The residue was purified by silica chromatography (ethyl acetate/petroleum ether = 1/2) to get the product as a yellow oil (4.1 g, 92% yield).

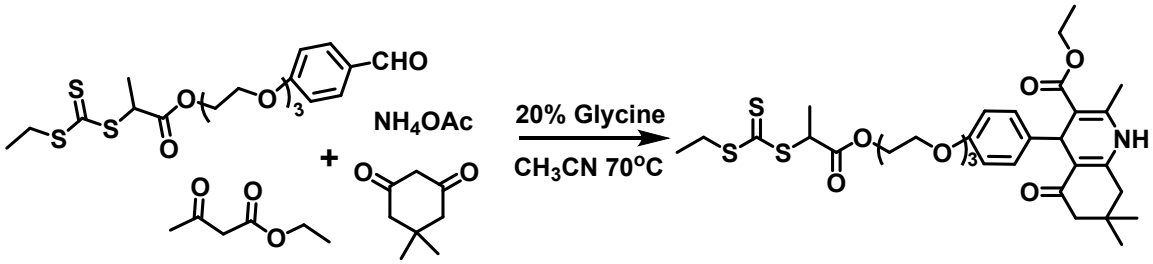
^{1}H NMR (400 MHz, DMSO-d_6, δ/ppm): 9.82 (s, 1H, CHO), 7.82 (d, *J* = 8.7 Hz, 2H, C<u>H</u>CCHO), 7.13 (d, *J* = 8.7 Hz, 2H, OCCH), 4.70 (q, *J* = 7.3 Hz, 1H, SCH), 4.17 (m, 4H, CO_2CH_2, $COCH_2$), 3.74 (m, 2H, $COCH_2C\underline{H}_2$), 3.60 (m, 6H, $COCH_2CH_2OC\underline{H}_2C\underline{H}_2OC\underline{H}_2$), 3.36 (q, *J* = 7.4 Hz, 2H, $CH_3C\underline{H}_2S$), 1.51 (d, *J* = 7.3 Hz, 3H, $C\underline{H}_3CH$), 1.26 (t, *J* = 7.4 Hz, 3H, $C\underline{H}_3CH_2S$).

^{13}C NMR (101 MHz, DMSO-d_6, δ/ppm): 221.91, 191.29, 170.20, 163.47, 131.79, 129.65, 114.94, 69.92, 69.83, 68.73, 68.10, 67.89, 64.77, 47.63, 31.10, 16.43, 12.93.

FT-IR (ν/cm^{-1}): 2882, 1736, 1692, 1596, 1572, 1514, 1446, 1308, 1257, 1216, 1158, 1079, 943, 826.

ESI-MS: observed (expected): 469.0794 (469.0799) [M+Na^{+}].

3.2 Synthesis of the CTA



2-(2-(2-(4-Formylphenoxy) ethoxy)ethoxy)ethyl 2-(((ethylthio) carbonothioyl)thio) propanoate (0.9 g, 2 mmol), ethyl acetoacetate (0.26 g, 2 mmol), dimedone (0.28 g, 2 mmol), ammonium acetate (0.23 g, 3 mmol) and glycine (0.03 g, 0.4 mmol) were dissolved in acetonitrile (2 mL). The mixture was stirred at 70°C for 2 h, then ethyl acetate (30 mL) was added. The organic layer was washed by brine thrice, dried over $MgSO_4$ and concentrated under vacuo. The residue was purified by silica chromatography (ethyl acetate/petroleum ether = 1/2) to afford the product as a yellow oil (1.21 g, 88% yield).

^{1}H NMR (400 MHz, DMSO-d_6, δ/ppm): 9.00 (s, 1H, N<u>H</u>), 7.03 (d, *J* = 8.1 Hz, 2H, OCCH), 6.73 (d, *J* = 8.1 Hz, 2H, CHCC<u>H</u>), 4.78 (s, 1H, CCH), 4.74 (q, *J* = 7.4 Hz, 1H, SCH), 4.20 (t, *J* = 4.4 Hz, 2H, $COCH_2$), 3.97 (m, 4H, $CHCO_2C\underline{H_2}$, CCO_2CH_2), 3.69 (t, *J* = 4.4 Hz, 2H, $COCH_2C\underline{H_2}$), 3.61 (t, *J* = 4.4 Hz, 2H, $CO_2CH_2C\underline{H_2}$), 3.56 (m, 4H, $CO_2CH_2CH_2OC\underline{H_2}C\underline{H_2}$), 3.37 (q, *J* = 7.2 Hz, 2H, CH_2S), 2.40 (d, *J* = 17.1 Hz, 1H, $COCH_2$), 2.26 (d, *J* = 17.1 Hz, 1H, $CCOC\underline{H_2}$), 2.26 (s, 3H, $NHCC\underline{H_3}$), 2.15 (d, *J* = 16.1 Hz, 1H, $NHCC\underline{H_2}$), 1.96 (d, *J* = 16.1 Hz, 1H, $NHCC\underline{H_2}$), 1.51 (d, *J* = 7.3 Hz, 3H, $SCHC\underline{H_3}$), 1.26 (t, *J* = 7.2 Hz, 3H, $C\underline{H_3}CH_2S$), 1.13 (t, *J* = 7.1 Hz, 3H, $CO_2CH_2C\underline{H_3}$), 1.00 (s, 6H, $C(CH_3)_2$), 0.84 (s, 3H, $C(CH_3)_2$).

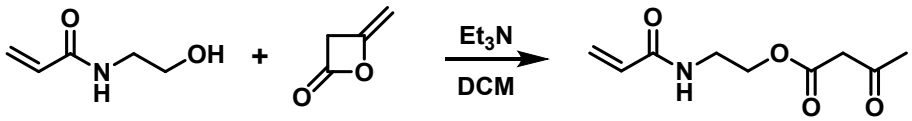
^{13}C NMR (101 MHz, DMSO-d_6, δ/ppm): 221.90, 194.24, 170.19, 166.90, 156.48, 149.18, 144.67, 140.08, 128.40, 113.57, 110.21, 103.85, 69.84, 69.02, 68.10, 66.87, 64.7, 59.76, 58.98, 54.90, 50.28, 47.62, 34.92, 32.12, 31.09, 29.16, 26.47, 18.27, 16.41, 14.18, 12.92.

FT-IR (v/cm^{-1}): 3291, 2929, 1734, 1693, 1606, 1485, 1377, 1215, 1167, 1029, 938, 852, 825, 767.

ESI-MS: observed (expected): 702.2202 (702.2200) [M+Na$^+$].

Fluorescent analysis: Ex: 370 nm, Em: 440 nm.

3.3 Sythesis of 2-(acetoacetoxy)ethyl acrylamide (AEAm, monomer a)



N-(2-Hydroxyethyl) acrylamide (5.75 g, 50 mmol) and triethylamine (Et_3N, 7 ml, 50 mmol) were dissolved in dichloromethane (50 mL). The solution was kept in an ice-water bath and 4-methyleneoxetan-2-one was added dropwise (4.25 g, 50.5 mmol), then the mixture was stirred at 20^{o}C for 10 h. The reaction mixture was washed by brine thrice, then the organic phase was dried over $MgSO_4$ and concentrated under vacuo. The residue

was purified by silica chromatography (ethyl acetate/petroleum ether = 1/5) to afford the product as a white solid (8.9 g, 89% yield).

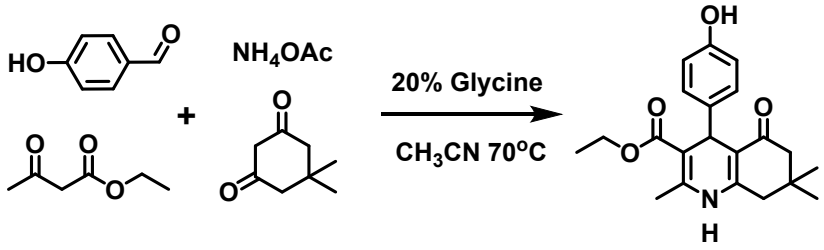
^{1}H NMR (400 MHz, DMSO-d_6, δ/ppm): 8.23 (s, 1H, NH), 6.21 (dd, J_1 = 17.1 Hz, J_2 = 10.0 Hz, 1H, CH_2CH), 6.08 (dd, J_1 = 17.1 Hz, J_2 = 2.32 Hz, 1H, CH_2CH), 5.58 - 5.61 (dd, J_1 = 10.0 Hz, J_2 = 2.32 Hz, 1H, CH_2CH), 4.09 (t, J = 5.7 Hz, 2H, CO_2CH_2), 3.59 (s, 2H, $CH_3COCH_2CO_2CH_2$), 3.38 (d, J = 5.7 Hz, 2H, $NHCH_2CH_2$), 2.17 (s, 3H, CH_3CO).

^{13}C NMR (101 MHz, DMSO-d_6, δ/ppm): 201.51, 167.24, 164.87, 131.49, 125.41, 63.08, 49.53, 37.58, 30.04.

IR (v/cm^{-1}): 3257, 3081, 1741, 1709, 1664, 1562, 1312, 1250, 1155, 1049, 963, 703.

ESI-MS: observed (expected): 222.0736 (222.0737) [M+Na$^+$].

3.4 The internal standard for RP-HPLC



4-Hydroxybenzaldehyde (1.4 g, 10 mmol), ethyl acetylacetate (1.3 g, 10 mmol), dimedone (1.4 g, 10 mmol), NH_4OAc (1.2 g, 15 mmol) and glycine (0.15 g, 2 mmol) were dissolved in acetonitrile (10 mL). The mixture stirred at 70°C for 2 h, then cooled down to room temperature in a water bath. 50 mL of water was added and the precipitation was collecetd and washed by water three times to get the product (3.0 g, 85%).

^{1}H NMR (400 MHz, DMSO-d_6, δ/ppm): 9.06 (s, 1H, OH), 8.99 (s, 1H, NH), 6.92 (d, J = 8.0 Hz, 2H, CHCOH), 6.55 (d, J = 8.0 Hz, 2H, CCHCH), 4.73 (s, 1H, CCHC), 3.97 (q, J = 6.9 Hz, 2H, $CO_2CH_2CH_3$), 2.39 (d, J = 17.0 Hz, 1H, $COCH_2$), 2.28 (d, J = 17.0 Hz, 1H,

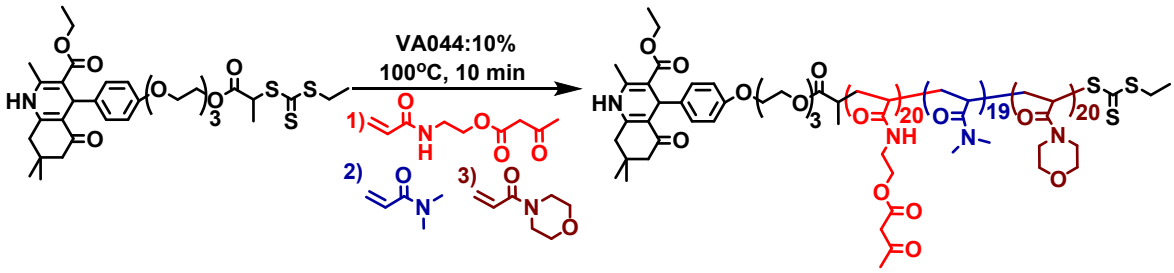
$COCH_2$), 2.25 (s, 3H, NHCC<u>H</u>$_3$), 2.15 (d, J = 16.2 Hz, 1H, NHCC<u>H</u>$_2$), 1.96 (d, J = 16.2 Hz, 1H, NHCC<u>H</u>$_2$), 1.13 (t, J = 6.9 Hz, 3H, $CO_2CH_2CH_3$), 1.00 (s, 3H, $C(CH_3)_2$), 0.85 (s, 3H, $C(CH_3)_2$).

^{13}C NMR (101 MHz, DMSO-d_6, δ/ppm): 194.41, 167.09, 155.30, 149.24, 144.47, 138.49, 128.41, 114.50, 110.38, 104.18, 59.05, 50.35, 34.84, 32.21, 29.25, 26.52, 18.33, 14.26.

FT-IR (v/cm^{-1}): 3440, 3277, 1682, 1613, 1373, 1214, 847, 767, 655.

ESI-MS: observed (expected): 356.1856 (356.1855) [M+H$^+$]

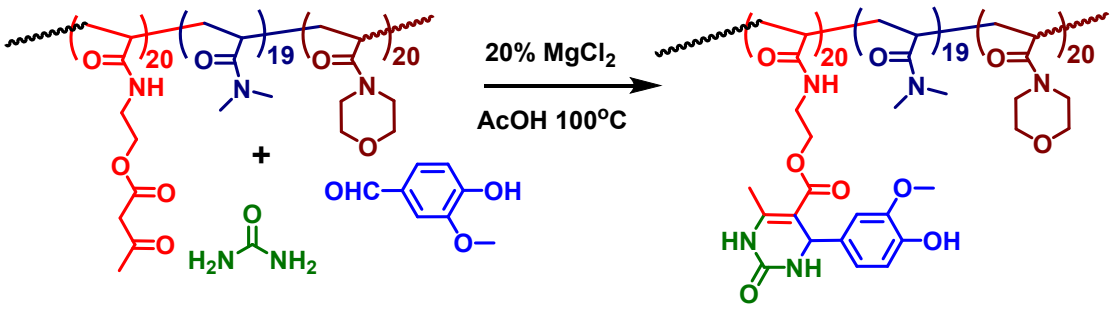
3.5 Synthesis of polymer precursor P-abc (A(1)) through the ultra-fast RAFT polymerization (stage 1)



The typical procedure to synthesize the polymer precursor P-abc (A(1)) was: the chain transfer agent (CTA, 0.068 g, 0.1 mmol) was dissolved in dioxane-water (2/1) mixture (0.2 mL), the tube (open to the air) with a magnetic stirrer was then placed in a 100°C oil bath. The AEAm (monomer a, 0.4 g, 2 mmol) in dioxane-water mixture (2/1, 0.2 mL) was added, then the aqueous solution of initiator VA-044 (10 μL, 1 mM) was added. After 10 minutes, sample (~ 20 μL) was withdrawn for ^{1}H NMR, GPC and MALDI-TOF MS analyses. Then, the DMAm (monomer b, 0.2 g, 2 mmol) in dioxane-water mixture (2/1, 0.2 mL) and the aqueous solution of initiator VA-044 (10 μL, 1 mM) were added, respectively to continue the ultra-fast RAFT polymerization. That procedure (adding monomer, taking sample for analyses) was repeated until all monomers were added, then the P-abc polymer was obtained by simple precipitation in diethyl ether.

Other polymer precursors were prepared through the same method with different monomer addition orders.

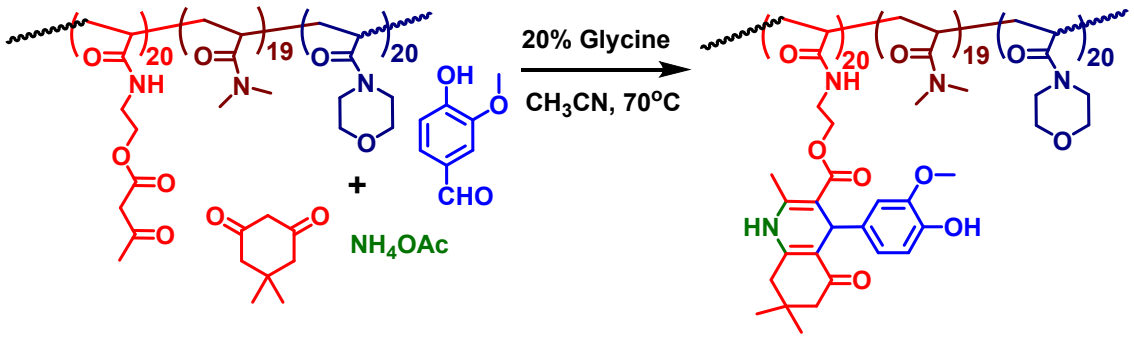
3.6 Synthesis of polymer A(1)B(3)C(1) through PPM of A(1) by the Biginelli reaction (Stage 2)



The PPM of all polymer precursors could be carried out in a HTP manner through different combinations of reactants for the Biginelli reaction. When urea was used, 30 polymers could be simultaneously synthesized in centrifuge tubes in a homothermal shaker. For example, the polymer precursor P-abc (A(1), 94 mg, ~ 0.01 mmol; ß-ketoester in A(1), ~ 0.20 mmol), vanillin (B(3), 34 mg, 0.22 mmol) and urea (C(1), 15 mg, 0.24 mmol) were put in a 2 mL centrifuge tube. Then, acetic acid (0.4 mL) and magnesium chloride (4 mg, 0.044 mmol) were added. The tube was sealed and put in a homothermal shaker (100°C) for 4 h. Samples were taken at different time points for ^{1}H NMR and GPC analyses to test the conversion and molecular weights. The crude was simply purified by precipitation into cold water, then washed by diethyl ether to get the final A(1)B(3)C(1) polymer as a pale yellow powder (107 mg, ~ 87% yield).

All other polymers were prepared through the same procedure.

3.7 PPM of A(1) by the Hantzsch reaction



The PPM of A(1) by the Hantzsch reaction was also performed in a homothermal shaker. The polymer precursor A(1) (94 mg, ~ 0.01 mmol; ß-ketoester in A(1), ~ 0.20 mmol), vanillin (B(3), 34 mg, 0.22 mmol), dimedone (34 mg, 0.24 mmol) and ammonium acetate (18 mg, 0.24 mmol) were put in a 2 mL centrifuge tube. Then, acetonitrile (0.4 mL) and glysine (3 mg, 0.044 mmol) were added. The tube was sealed and put in a shaker (70°C) for 4 h. The crude was simply purified by precipitation into cold water, then washed by diethyl ether to get the final Hantzsch modified polymer as a pale yellow powder (118 mg, ~ 82% yield).

3.8 RP-HPLC analyses

All polymers (6 polymer precursors and 60 final polymers) were analyzed by the RP-HPLC using the same program (temperature, flow rate, solvent gradient). Typically, a CH_3CN/H_2O (1/1) mixture containing internal standard compound (1 µg/mL) was prepared and used to dissolve polymers (1 mg/mL). The samples were analyzed by a diode array detector (1100 DAD from Agilent, USA) at a wavelength of 370 nm.

3.9 HTP analyses

3.9.1 Radical scavenger

Polymer solutions (100 µL, 5 mg/mL in CH_3CN/H_2O (1/1)) were added in a 96-well plate, the wells containing CH_3CN/H_2O (1/1) solution (100 µL) were used as the control. Then, the solution of radical (DPPH radical as a model) (10 µL, 20 mg/mL in

CH_3CN/H_2O (1/1)) was added to each polymer solution and the control row. The 96-well plate was kept at 25°C with gentle shaking for 15 mins prior to taking the photos.

Polymer samples and control group were listed in the same way in other 96-well plates for metal chelating test (Cu(II) as the model, 10 μL, saturated aqueous solution) and 1,2-diol recognition test (ARS as the model, 10 μL, 15 mg/mL in CH_3CN/H_2O (1/1)) through the same procedure.

To quantitatively analyze the fluorescent intensity of A(X)B(5)C(1,2)-ARS, 20 μL of each polymer-ARS solution was taken from the 96-well plate and diluted to 400 μL using CH_3CN/H_2O (1/1), then the mixture was tested on a Perkin-Elmer LS-55 spectrometer. Each sample was tested three times in parallel, and the intensity was present as Mean ± SD.

3.9.2 CT-imaging agent

Polymer solutions (100 μL, 100 mg/mL in CH_3CN/H_2O (2/1)) were added in 250 μL centrifuge tubes and listed in a lattice, using the CH_3CN/H_2O (2/1) solution (100 μL) as the control and H_2O as the blank. The samples were directly scanned using a clinical equipment. Same area of each sample's image was measured to get the signal intensity as Mean ± SD.

Supporting Data

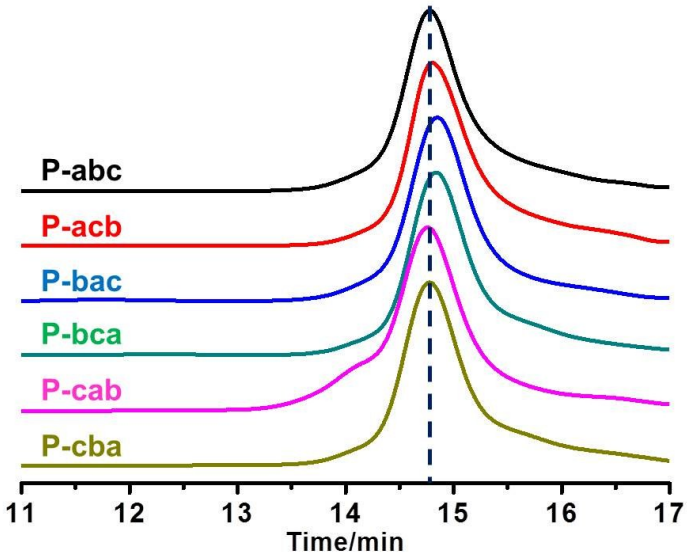


Fig S1. The GPC curves of the 6 polymer precursors.

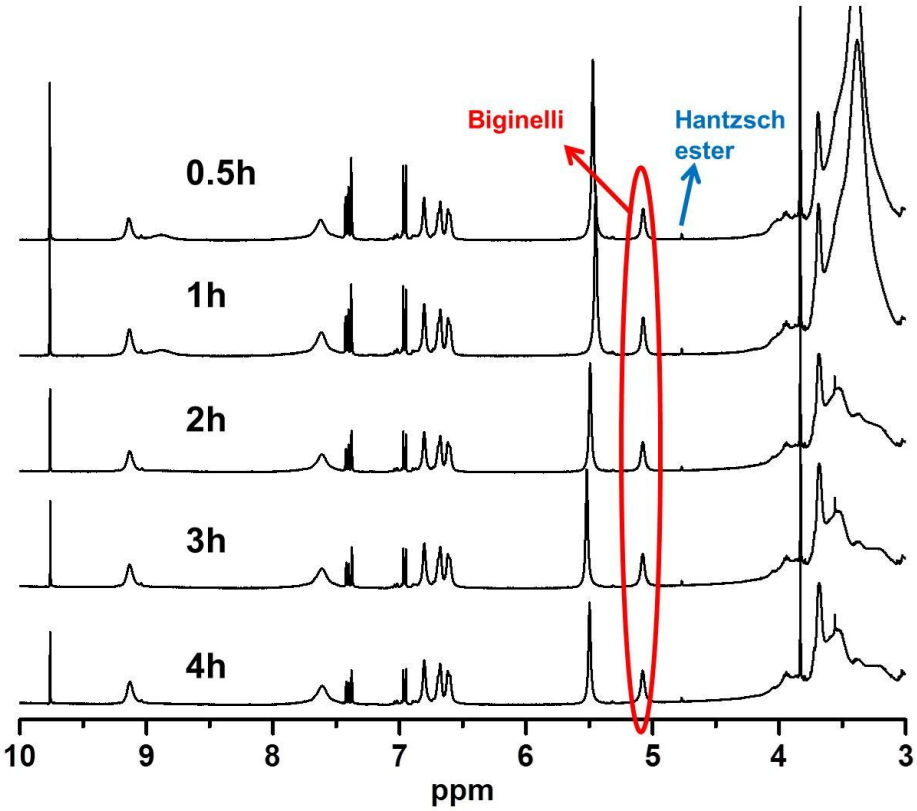


Figure S2. ^{1}H NMR spectra (DMSO-d_6, 400 MHz) during the PPM of A(1) through the Biginelli reaction (urea system).

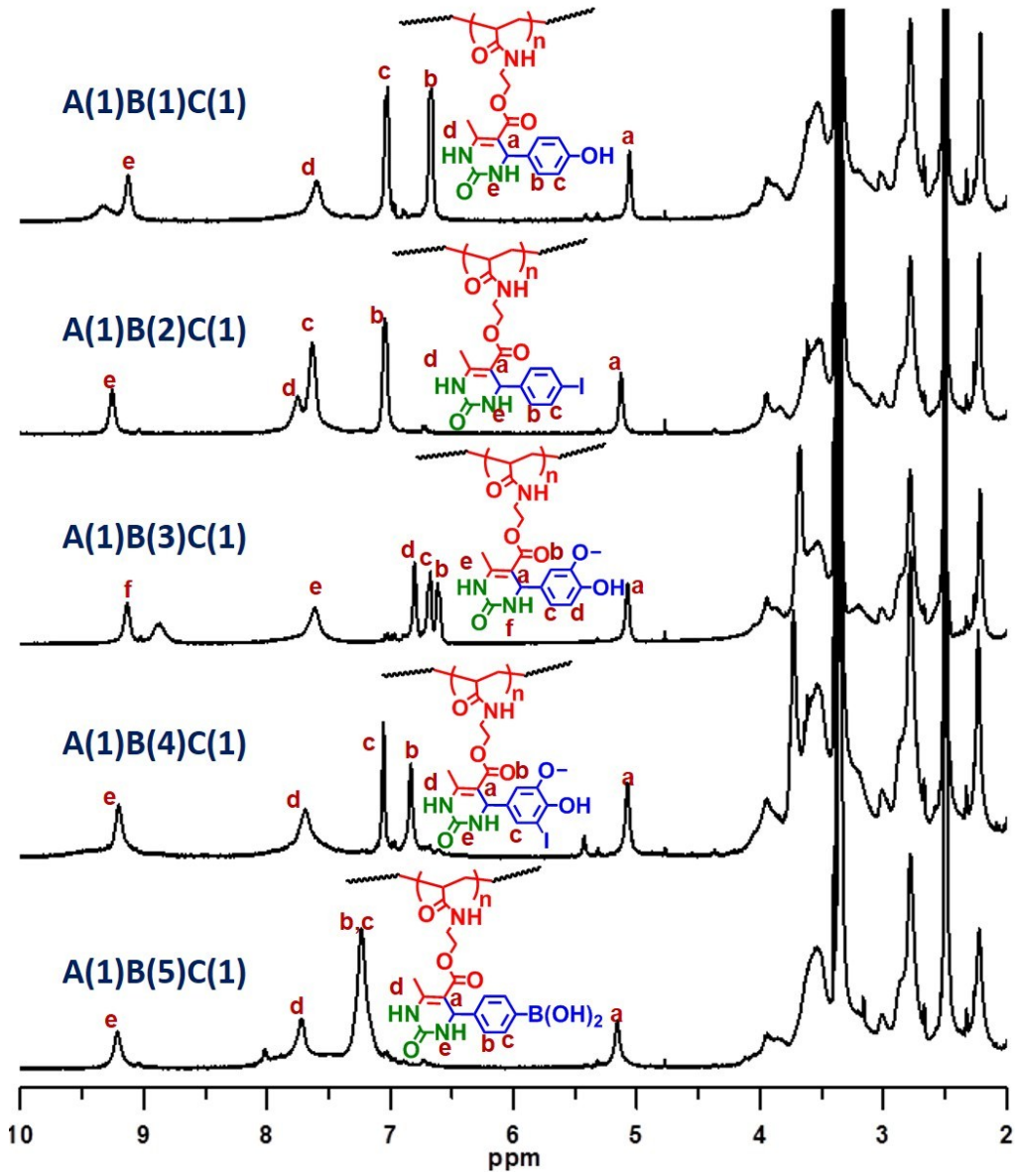


Figure S3. ^{1}H NMR spectra (DMSO-d_6, 400 MHz) of the A(1)B(Y)C(1) polymers (urea system).

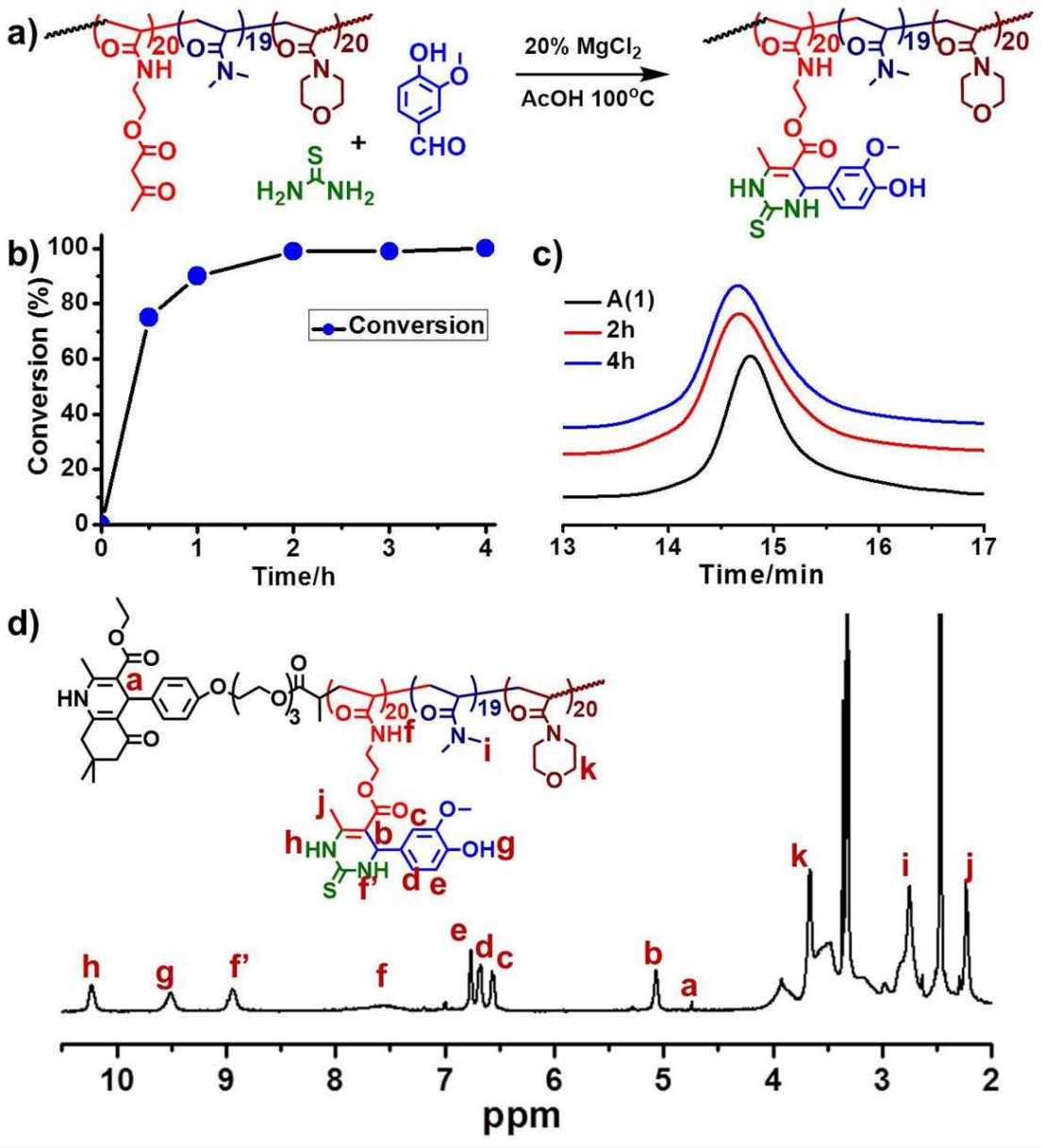


Figure S4 a) Reaction conditions: AcOH as solvent, 100°C, 4h. A(1): B(3): thiourea: $MgCl_2$ = 1: 22: 24: 4.4. b) Conversion of Biginelli reaction versus time. c) The GPC curves during the PPM process. d) ^1H NMR spectrum (DMSO-d_6, 400 MHz) of the A(1)B(3)C(2) polymer (thiourea system).

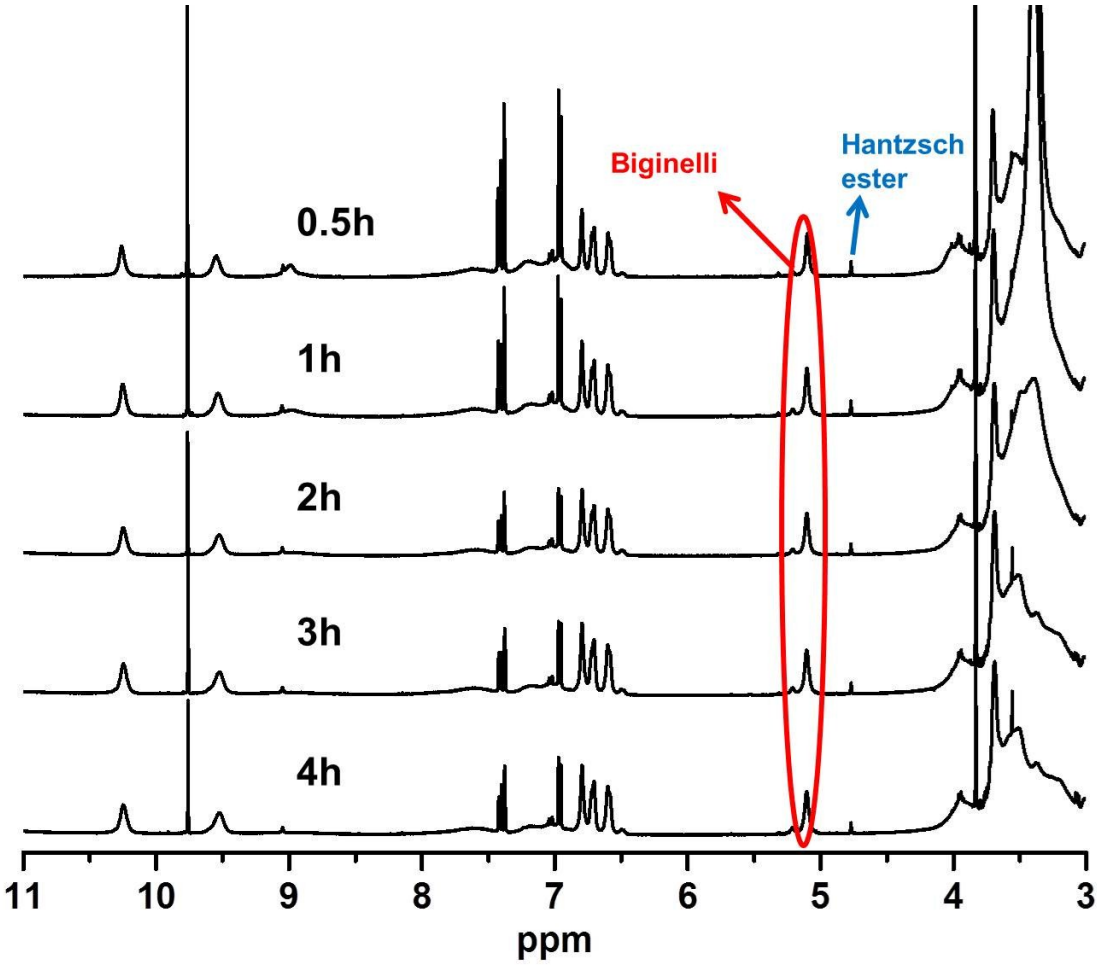


Figure S5. ^{1}H NMR spectra (DMSO-d_6, 400 MHz) during the PPM of A(1) through the Biginelli reaction (thiourea system).

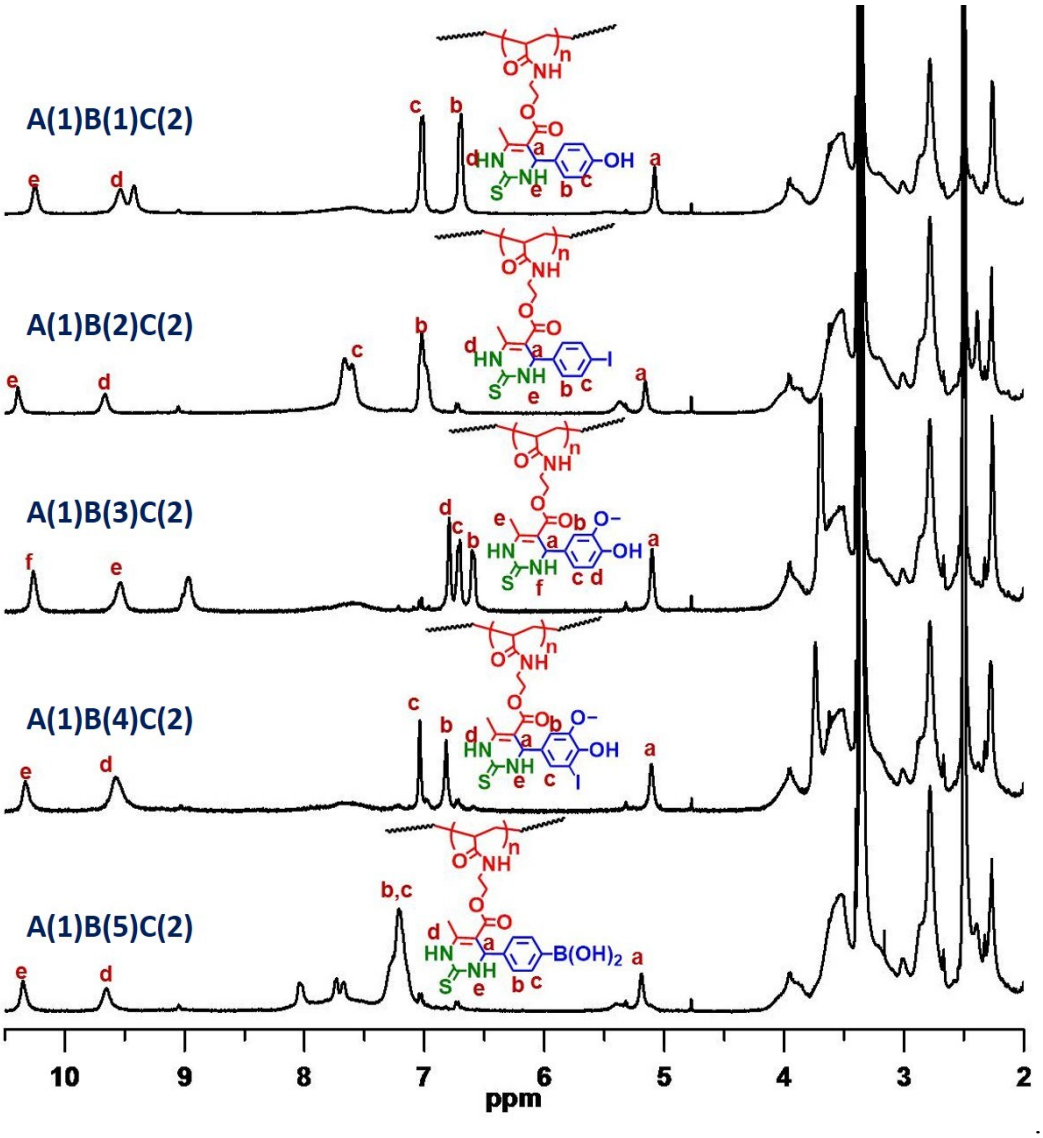


Figure S6. ^{1}H NMR spectra (DMSO-d_6, 400 MHz) of the A(1)B(Y)C(2) polymers (thiourea system).

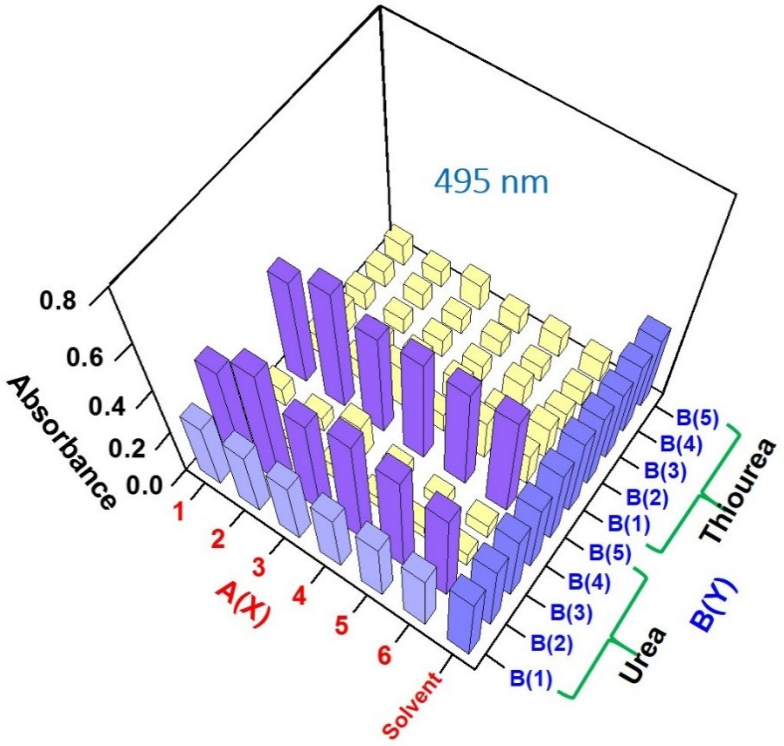


Fig S7. The UV absorbance data of polymer solutions ((100 μL, 5 mg/mL in CH_3CN/H_2O (1/1))) under UV (495 nm) after adding DPPH radical.

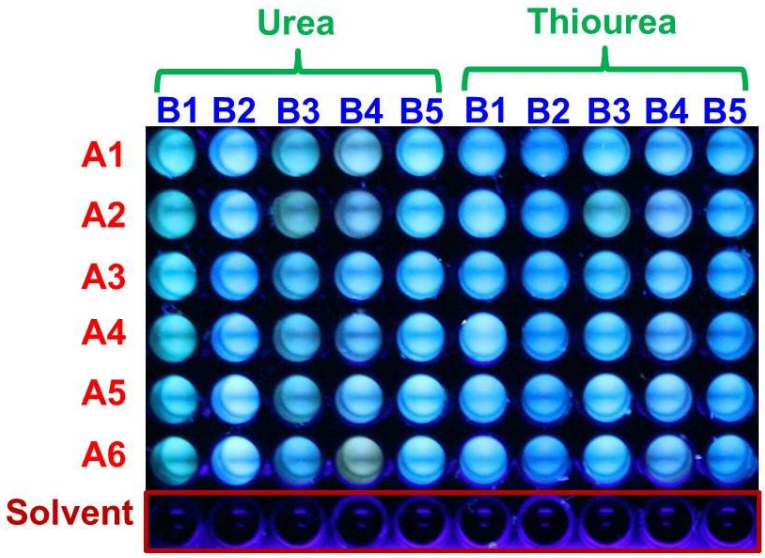


Fig S8. Polymer solutions ((100 μL, 5 mg/mL in CH_3CN/H_2O (1/1))) under UV (365 nm) before adding ARS.

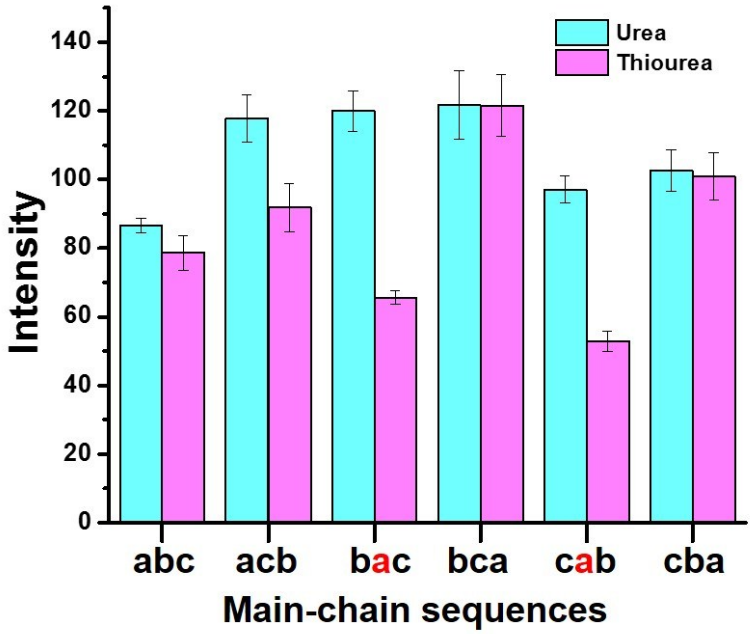


Fig S9. The fluorescence data of the A(X)B(5)(C1) and A(X)B(5)(C2) polymers after adding ARS solution. Each polymer-ARS solution (20 μL) was diluted to 400 μL using CH_3CN/H_2O (1/1) and tested three times in parallel. Intensity was present as Mean ± SD.

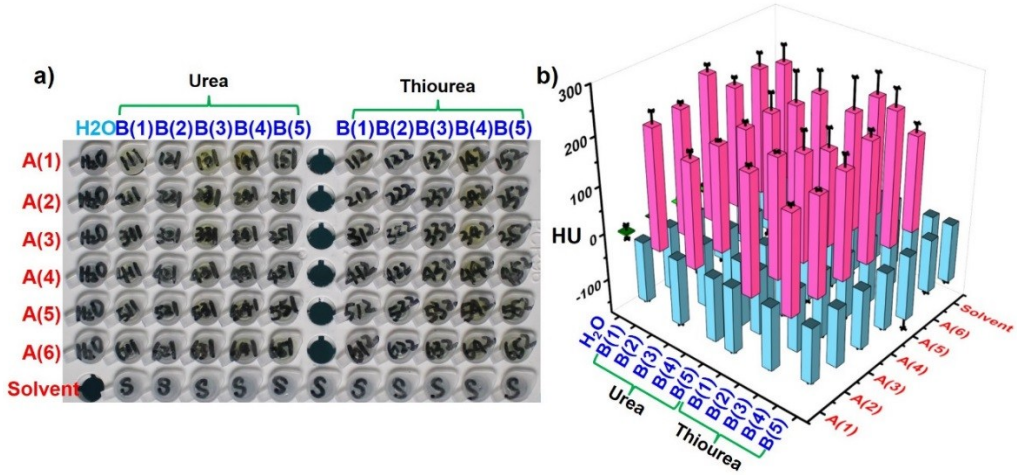


Fig S10. CT test of all the 60 polymers. a) Experiment setup for CT test. b) The CT signal intensities of all polymer solutions (100 μL, 100 mg/mL in CH_3CN/H_2O (2/1)), CH_3CN/H_2O (2/1) (100 μL) solution and H_2O.

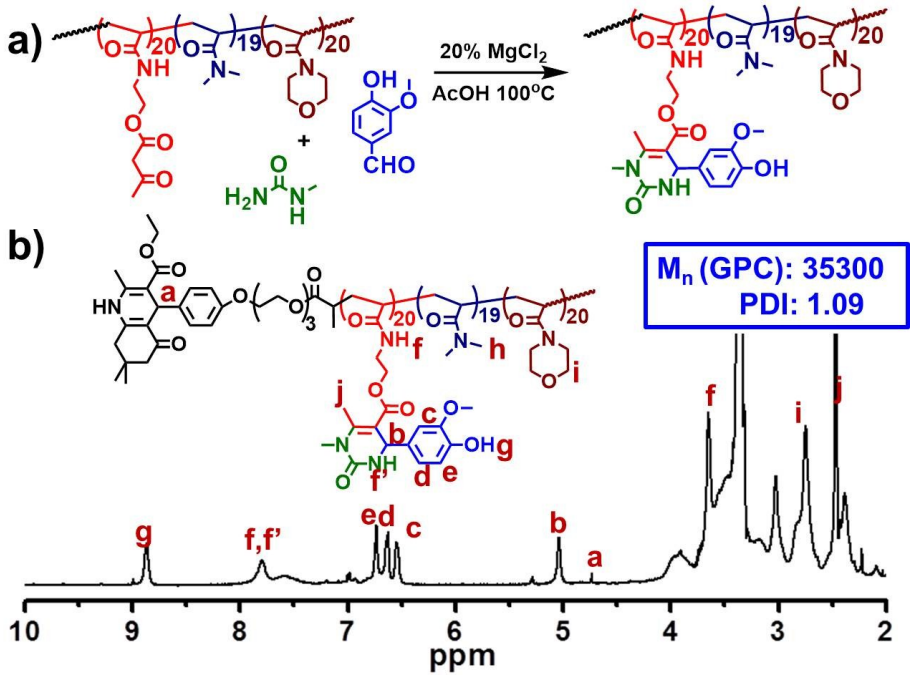


Fig S11. a) Reaction conditions: AcOH as solvent, 100°C, 4 h. A(1): B(3): C(3): $MgCl_2$ = 1: 22: 24: 4.4. b) ^1H NMR spectrum (DMSO-d_6, 400 MHz) of the A(1)B(3)C(3) polymer (*N*-methylurea as the third module).

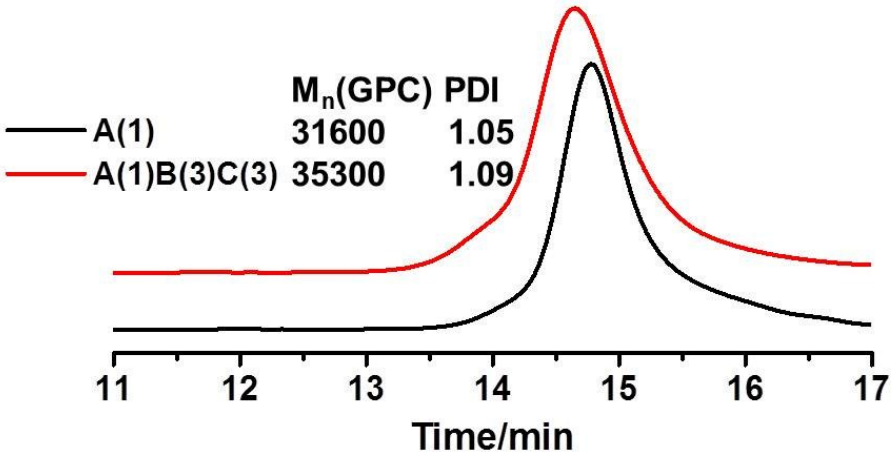


Fig S12. The GPC curves of the A(1)B(3)C(3) and A(1) polymers.

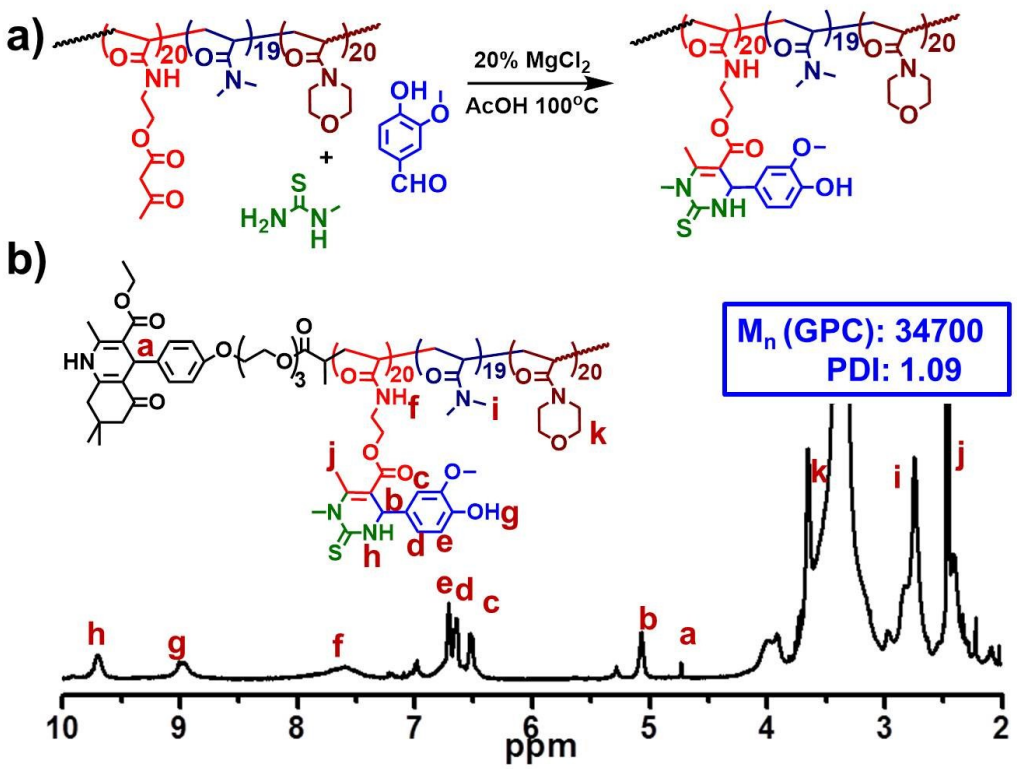


Fig S13. a) Reaction conditions: AcOH as solvent, 100°C, 4 h. A(1): B(3): C(4): $MgCl_2$ = 1: 22: 24: 4.4. b) ^{1}H NMR spectra (DMSO-d_6, 400 MHz) of the A(1)B(3)C(4) polymer (*N*-methylthiourea as the third module).

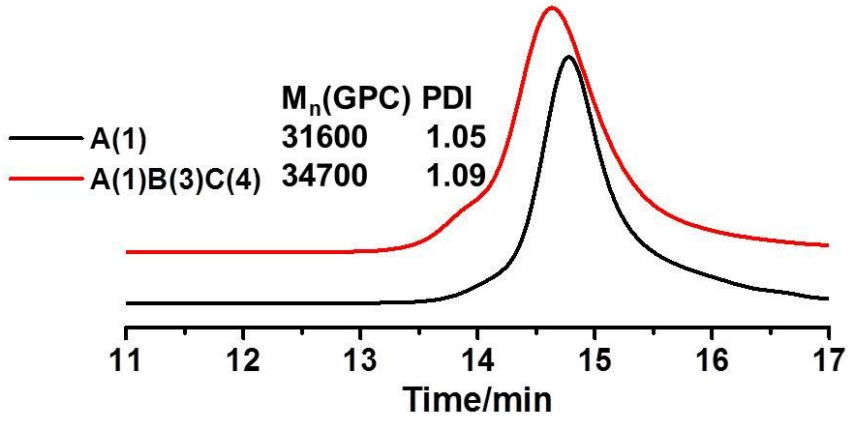


Fig S14. The GPC curves of the A(1)B(3)C(4) and A(1) polymers.

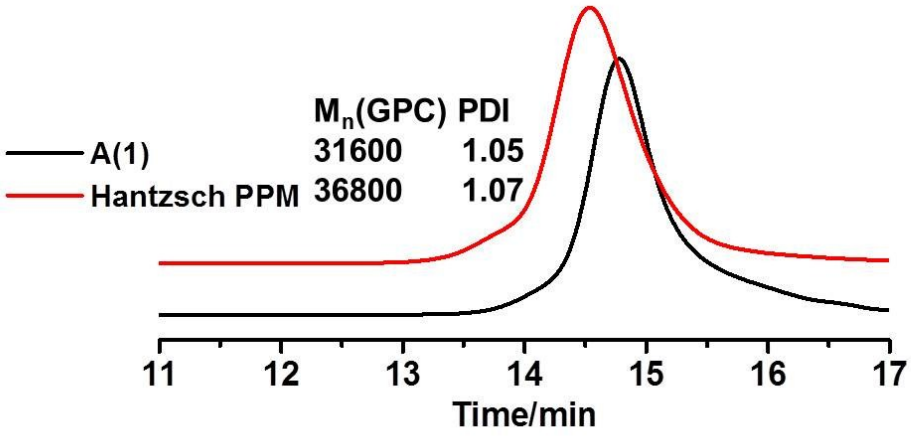


Fig S15. The GPC curves of the polymer modified by the the Hantzsch reaction and its precursor A(1).

Table S1. The syntheses of the polymer precursors in stage 1[a].

Name	Monomer	Conversion (%)[b]	M_n(GPC)[c]	PDI[c]
P-abc	AEAm	97	21100	1.04
	DMAm	95	26400	1.05
	AMPL	98	31600	1.05
P-acb	AEAm	97	19800	1.05
	AMPL	98	25600	1.04
	DMAm	95	29600	1.07
P-bac	DMAm	99	13700	1.03
	AEAm	96	24000	1.06
	AMPL	98	30100	1.07
P-bca	DMAm	99	13200	1.03
	AMPL	99	19800	1.04
	AEAm	95	29900	1.06
P-cab	AMPL	99	14000	1.03
	AEAm	95	27100	1.08
	DMAm	95	33300	1.09
P-cba	AMPL	99	13600	1.04
	DMAm	99	20600	1.03
	AEAm	95	32700	1.08

a) Reaction conditions: dioxane-water (2/1) as solvent, 100°C, [VA044]/[CTA]/[Monomer] = 0.1/1/20. Polymerization time: 10 min/block.

b) Calculated by ^{1}H NMR (DMSO-d_6, 400 MHz).

c) By GPC using DMF as eluent (1 mL/min).

Table S2. Preparation of the 30 A(X)B(Y)C(1) polymers in satge 2[a].

A(X)	B(Y)	Conversion %[b]	M_n(GPC)[c]	PDI[c]
P-abc	1	99	37800	1.10
	2	98	35500	1.08
	3	99	36900	1.09
	4	99	36600	1.08
	5	97	34900	1.04
P-acb	1	98	35100	1.09
	2	99	34200	1.03
	3	98	36000	1.05
	4	99	36000	1.08
	5	97	32300	1.02
P-bac	1	98	34400	1.07
	2	99	33100	1.05
	3	99	34600	1.05
	4	100	31500	1.09
	5	95	31800	1.10
P-bca	1	97	35600	1.06
	2	99	32800	1.06
	3	100	35900	1.07
	4	99	36800	1.06
	5	98	32600	1.09
P-cab	1	99	36400	1.08
	2	99	32500	1.08
	3	98	34900	1.06
	4	99	35900	1.09
	5	99	30700	1.10
P-cba	1	99	35700	1.08
	2	98	32900	1.06
	3	100	34000	1.03
	4	100	36300	1.06
	5	100	30900	1.09

a) Reaction conditions: AcOH as solvent, 100°C, 4 h. [A(X)]/[B(Y)]/[C(1)]/[$MgCl_2$] = 1/22/24/4.4.

b) Calculated by ^{1}H NMR (DMSO-d_6, 400 MHz).

c) By GPC using DMF as eluent (1 mL/min).

Table S3. Preparation of the 30 A(X)B(Y)C(2) polymers in satge 2[a].

A(X)	B(Y)	Conversion %[b]	M_n(GPC)[c]	PDI[c]
P-abc	1	96	41100	1.09
	2	98	35300	1.10
	3	98	38900	1.08
	4	99	39100	1.09
	5	95	31800	1.10
P-acb	1	98	38200	1.06
	2	99	34000	1.03
	3	99	38200	1.02
	4	100	36800	1.09
	5	98	33300	1.04
P-bac	1	99	35900	1.08
	2	96	32700	1.08
	3	99	35700	1.07
	4	98	35900	1.10
	5	97	32100	1.07
P-bca	1	100	36700	1.09
	2	99	32900	1.09
	3	100	36700	1.05
	4	100	36200	1.10
	5	98	35100	1.08
P-cab	1	99	38700	1.08
	2	95	34000	1.10
	3	100	35300	1.08
	4	100	38200	1.09
	5	95	33900	1.10
P-cba	1	100	37100	1.09
	2	98	34000	1.07
	3	99	35000	1.06
	4	100	36700	1.10
	5	100	30000	1.09

a) Reaction conditions: AcOH as solvent, 100°C, 4 h. [A(X)]/[B(Y)]/[C(2)]/[$MgCl_2$] = 1/22/24/4.4.

b) Calculated by ^{1}H NMR (DMSO-d_6, 400 MHz).

c) By GPC using DMF as eluent (1 mL/min).

Referance:

(1) Heredia, K. L.; Grover, G. N.; Tao, L.; Maynard, H. D. *Macromolecules* **2009**, *42*, 2360.

(2) Zhao, Y.; Yu, Y.; Zhang, Y. Y.; Wang, X.; Yang, B.; Zhang, Y. L.; Zhang, Q. D.; Fu, C. K.; Wei, Y.; Tao, L. *Polym. Chem.* **2015**, *6*, 4940.