Electronic Supplementary Material (ESI) for Green Chemistry.

Supplementary Information

Synthesis of UCST-type zwitterionic polymer for efficiently recycling cellulase at room temperature

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The ^{1}H-NMR characterization of PSPE

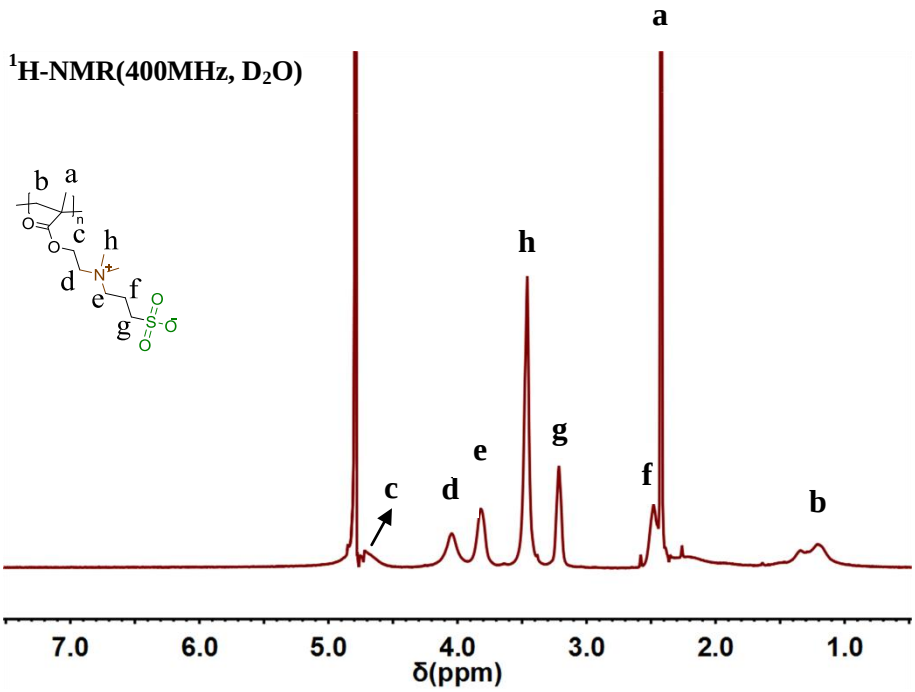
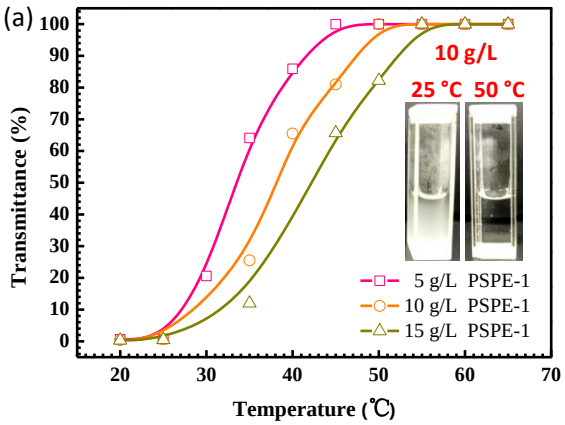


Fig. S1. The ^{1}H-NMR spectra of PSPE.

PSPE with different molecular weights was prepared by free radical polymerization in aqueous solution, recorded as PSPE-1, PSPE-2 and PSPE-3. The structures were characterized by ^{1}H-NMR (400 MHz, D_2O), and the result was as follow (PSPE-3), a, δ2.42 ppm, b, δ1.20 ppm, c, δ4.71 ppm, d, δ4.04 ppm, e, δ3.82 ppm, f, δ2.48 ppm, g, δ3.21 ppm, h, δ3.46 ppm.

UCST-responsive performances of PSPE



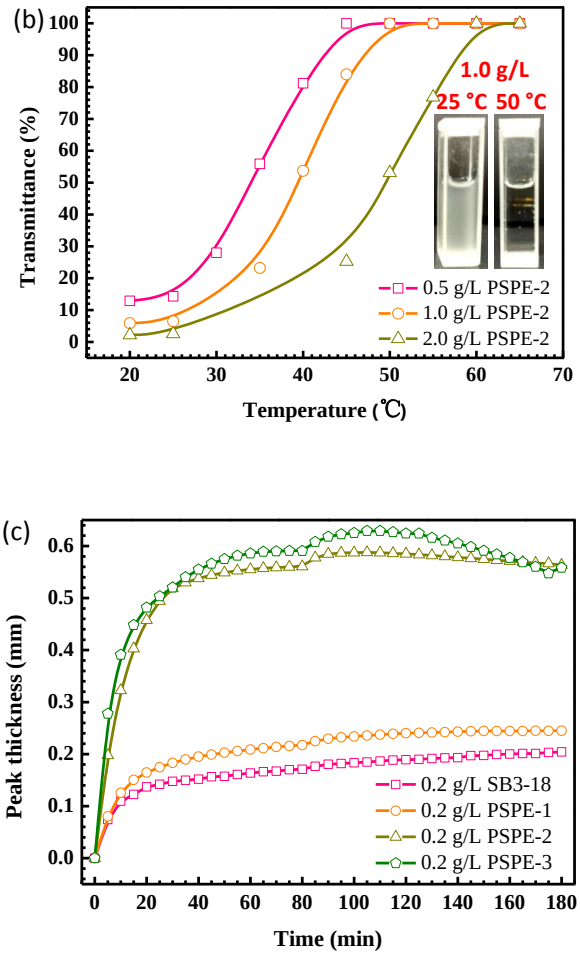


Fig. S2. UCST-responsive performances of PSPE in the acetate buffer solution (pH 5.0, 50 mM), (a) PSPE-1 (b) PSPE-2 (c) peak thickness of SB3-18 and PSPE.

Contact angles measurement

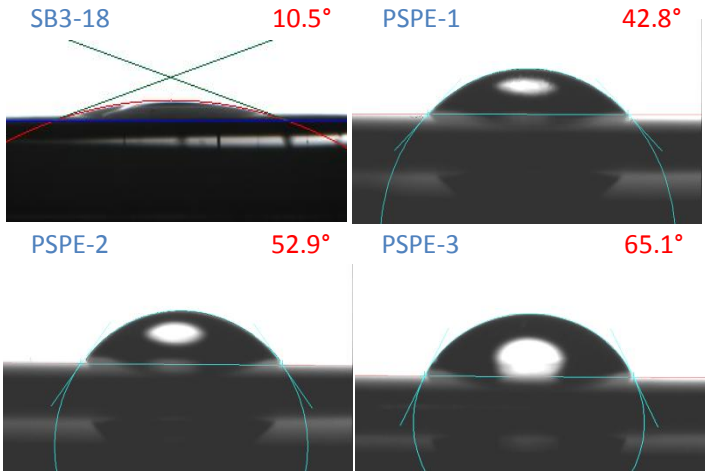


Fig. S3. The contact angles of water on SB3-18 and PSPE films.

The contact angles of distilled water on SB3-18 and PSPE-x (x = 1, 2, 3) films were measured according to the sessile drop method by using contact angle measuring instrument (OCA40Micro, Data physics, Germany).

Recovering cellulase at room temperature

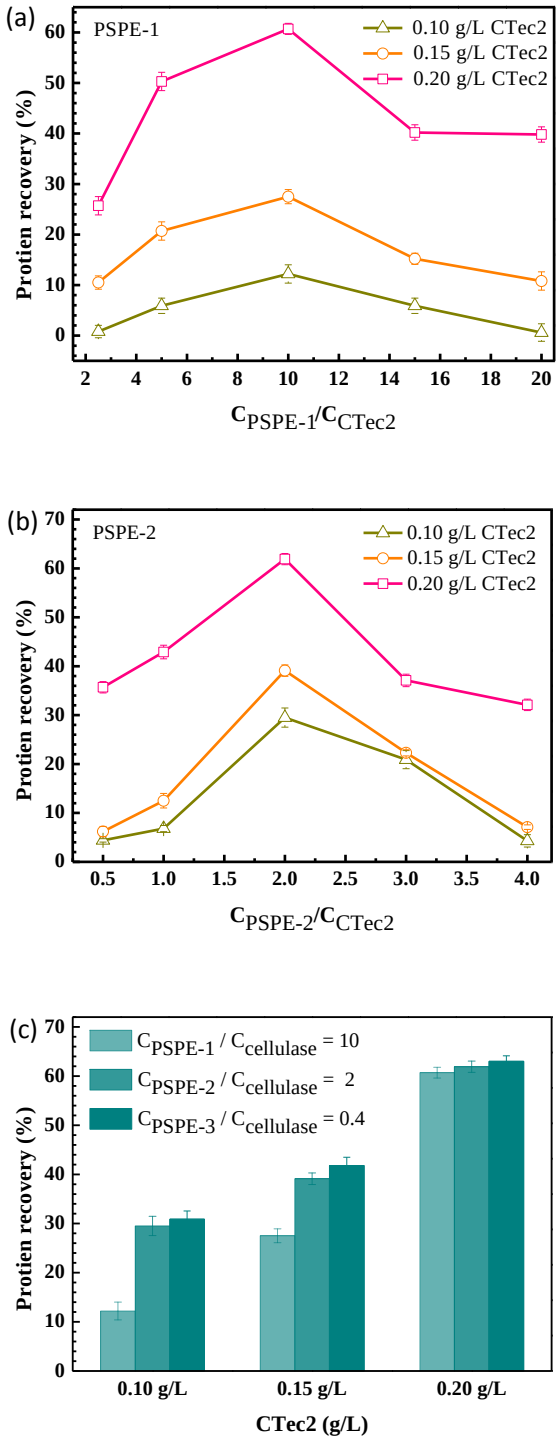
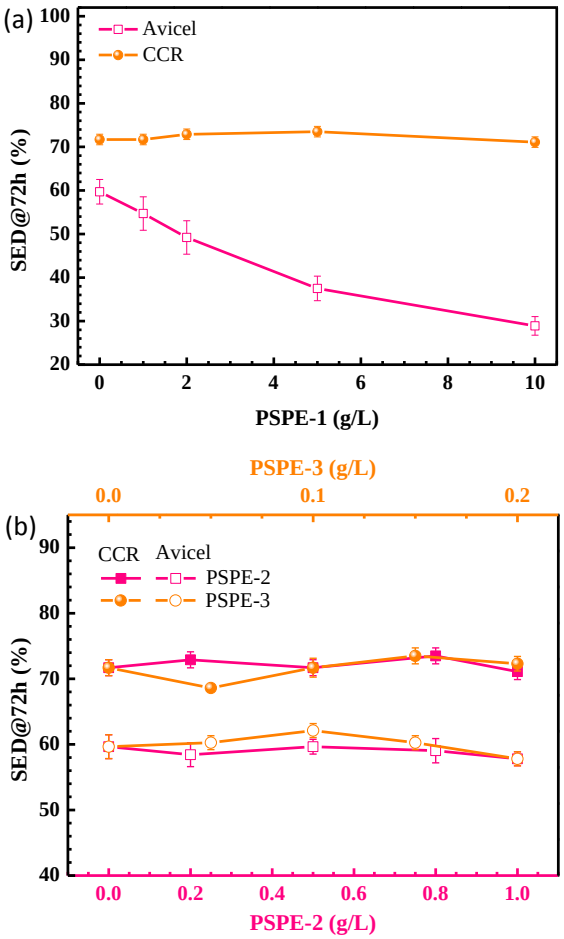


Fig. S4. The effect of concentration ratio upon the recovery of protein in cellulase in buffer solution (a) PSPE-1 (b) PSPE-2, (c) the effect of the molecular weight of PSPE and the concentration of cellulase upon the recovery of protein in cellulase in buffer solution.

The effect PSPE on the enzymatic hydrolysis efficiency of Avicel and lignocelluloses

The conditions of enzymatic hydrolysis were as follows. 0.6 g Avicel or lignocelluloses, PSPE-x (x = 1, 2, 3) and cellulase were added to the mixture of 30 mL buffer (pH 5.0, 50 mM). The enzyme load for Avicel, CCR and Eu-DA were 5, 10, 10 FPU/g glucan, respectively. The enzymatic hydrolysis of the substrate was carried out under the conditions of 2% (w/v) solid concentration at 50 °C at 150 rpm for 48 or 72 h in a shaker (DDHZ-300, Jiangsu Taicang Equipment Factory, China). Aliquots of 0.1 mL were obtained at 48 or 72 h for glucose analysis. The concentration of glucose was monitored by SBA-40E with its own H_2O_2 electrode sensor (Institute of Biology of the Shandong Academy of Sciences, China), and the enzymatic hydrolysis efficiency of lignocelluloses (SED@h) was expressed by the yield of glucose. In addition, the blank experiment without PSPE-x was carried out for comparison, all experimental datas were the average of three parallel experiments, the data deviations were shown in the figures.



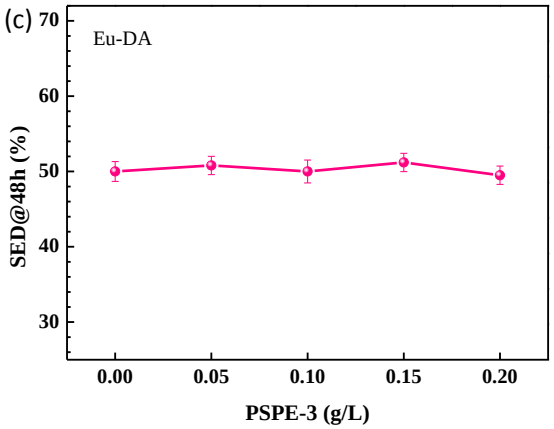


Fig. S5. (a) Effect of PSPE-1 on the enzymatic hydrolysis efficiency of Avicel and CCR, (b) effect of PSPE-2 and PSPE-3 on the enzymatic hydrolysis efficiency of Avicel and CCR, (c) effect of PSPE-3 on the enzymatic hydrolysis efficiency of Eu-DA. (solid concentration, 2% (w/v), pH 5.0, ionic strength, 50 mM, cellulase loading, 5 FPU/g glucan for Avicel, 10 FPU/g glucan for CCR, 10 FPU/g glucan for Eu-DA).

The zeta potentials of PSPE

A zeta potential analyzer (Brookhaven Zeta Plus, Brookhaven, USA) was used to determine the zeta potentials of PSPE solution (1M NaCl).

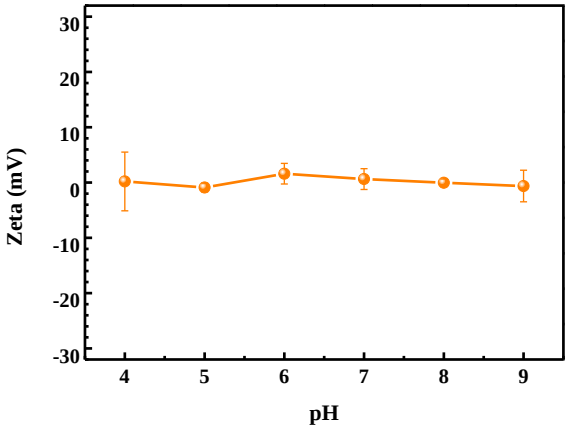


Fig. S6. The zeta potentials of PSPE-2 in NaCl solution (1 M).