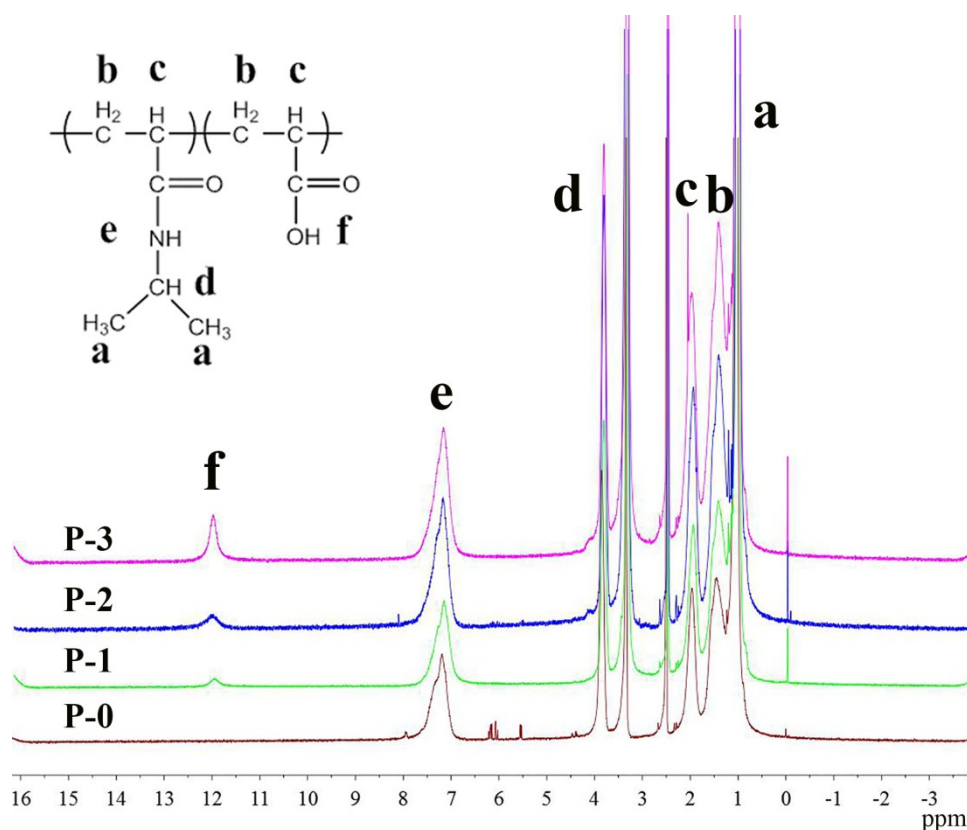# Supporting Information

Aqueous-based Electrospun P(NIPAAm-co-AAc)/RSF Medicated Fibrous Mats for Dual Temperature- and pH-responsive Drug Controlled Release

Juan Li, Jingxin Zhu* Lan Jia, Yanlong Ma, and Haijuan Wu

**1. Characterization of P(NIPAAm-co-AAc)**

1.1. ^{1}H-NMR

Fig. S1 ^{1}H NMR spectra of homopolymer PNIPAAm P-0 and copolymer P(NIPAAm-co-AAc) P-1, P-2 and P-3.

^{1}H NMR spectra were measured using a 400 MHz spectrometer (Avance III, Bruker, Germany) and DMSO-d6 was used as the solvent.

In the ^{1}H NMR spectrum of P(NIPAAm-co-AAc) copolymer and PNIPAAm homopolymer, the proton signals of the NIPAAm moiety are observed at 1.0 ppm which correspond to the Ha, 3.81 ppm which correspond to the Hd and 7.16 ppm which correspond to the He, respectively, while the peak related to AAc moiety is at 11.97 ppm which correspond to the Hf. In addition, the copolymer main chain proton signals Hb and Hc are shown at 1.41-1.94 ppm.

1.2. FTIR
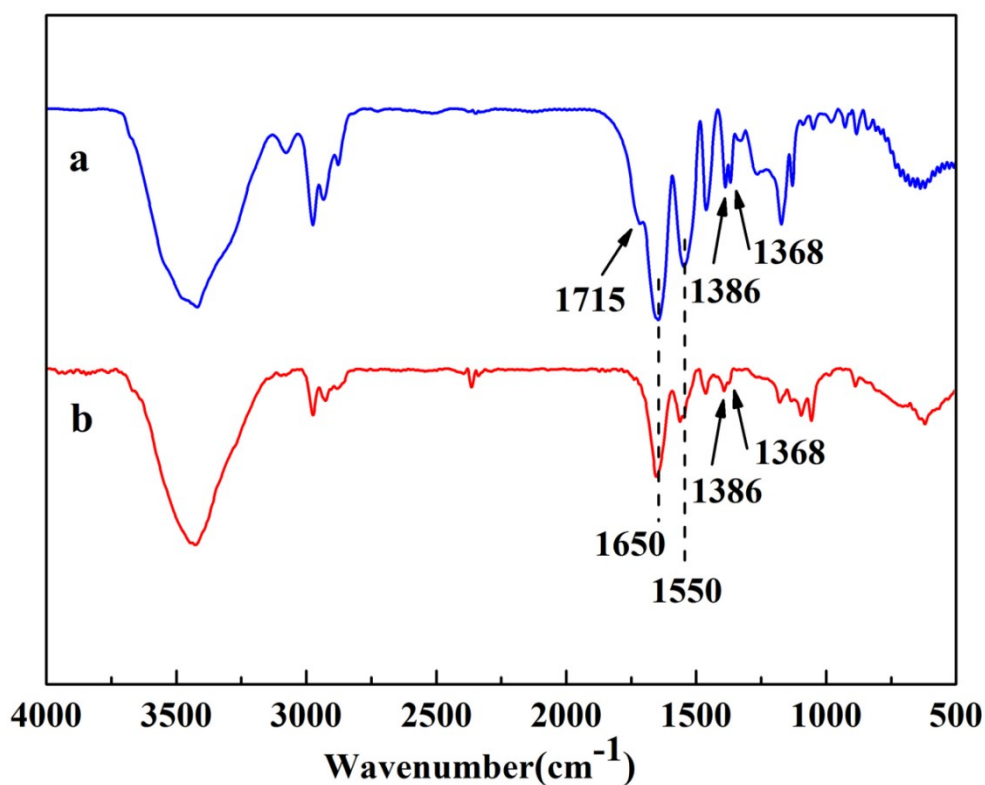
Fig. S2 FTIR spectra of (a) P(NIPAAm-co-AAc) (b) PNIPAAm.

The structure of polymers were determined by Fourier transform infrared spectroscopy (FTIR) (Bruker, Germany) with a resolution of 4 cm^{-1} over the wavenumber range from 400-4000 cm^{-1}.

In the FTIR spectrum of P(NIPAAm-co-AAc), the peaks at 1650 and 1550 cm^{-1} are assigned to C=O bending and N–H stretching, respectively. The broad absorption band at around 3300–3400 cm^{-1} is assigned to the N–H stretching, The peaks at 1368 cm^{-1} and 1386 cm^{-1} are arisen from the stretching of the –CH(CH$_3$)$_2$ groups in NIPAAm. The peaks at 1715 cm^{-1} is assigned to the C=O stretching of carboxylic group of AAc units.

1.3. GPC

The Gel permeation chromatography (GPC) measurement was performed on a Waters 1515 instrument equipped Waters 4.6×30 mm guard column and a differential refractive index detector using DMF (HPLC grade, containning 50 mmol/L LiBr) as the solvent at 35℃ with a flow rate of 1 mL/min.
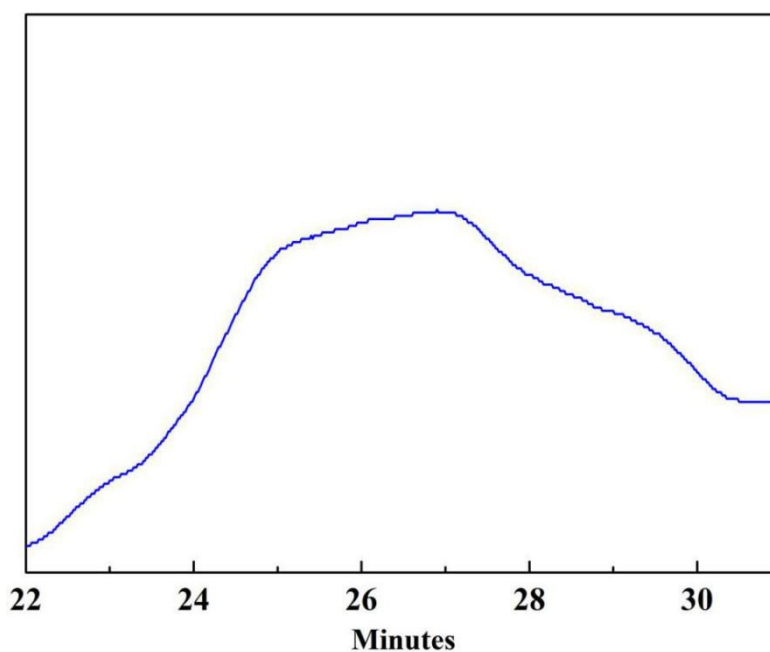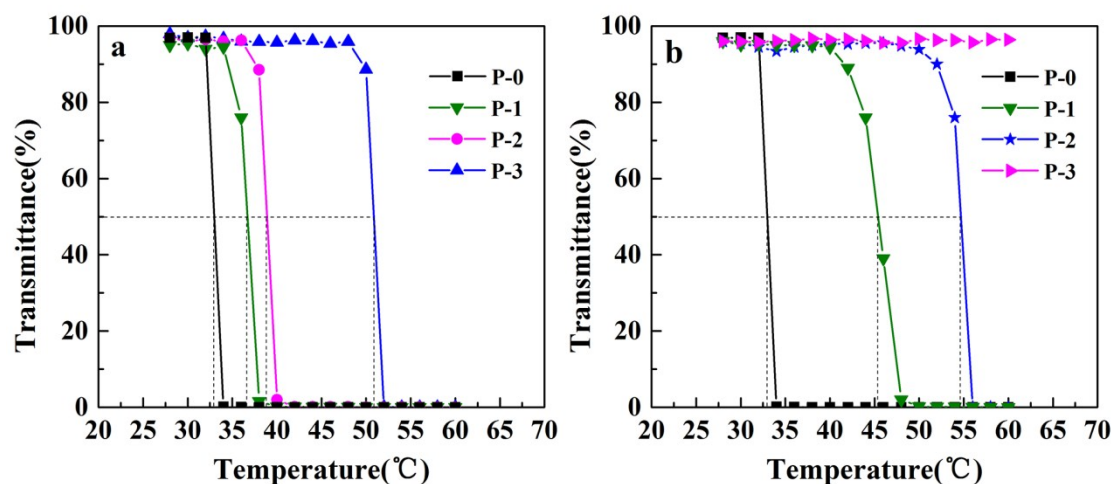

Fig. S3   Molecularweight determination by GPC of P-2.

The results of the GPC are shown in Table S1.

Table S1. GPC results of P-2.

| Sample	Mn (g/mol)	Mw (g/mol)	PDI (Mw/Mn)
P-2	4.2×10^4	6.6×10^4	1.57

1.4. LCST

Fig. S4 LCST of 1wt% P(NIPAAm-co-AAc) in PB aqueous solution (a) different AAc content at pH 5.7 (b) different AAc content at pH 6.6.

The LCST of the copolymer was defined as the temperature at which transmittance of the solution decreased in 50% using a SQ-2800 UV-vis Spectrophotometer (UNICO, China).

Fig. S4a shows that the LCST of the copolymer (P-1, P-2 and P-3) increases from 36.5 to 50.8℃ with the increase of the content of AAc in the copolymer at pH 5.7. Fig. S4b shows that the LCST of the copolymer (P-1, P-2) increases from 45.3 to 54.6℃ with the increase of the content of AAc in the copolymer at pH 6.6 and the LCST of the copolymer P-3 is above 70℃.

2. DSC curves of the fibrous mats
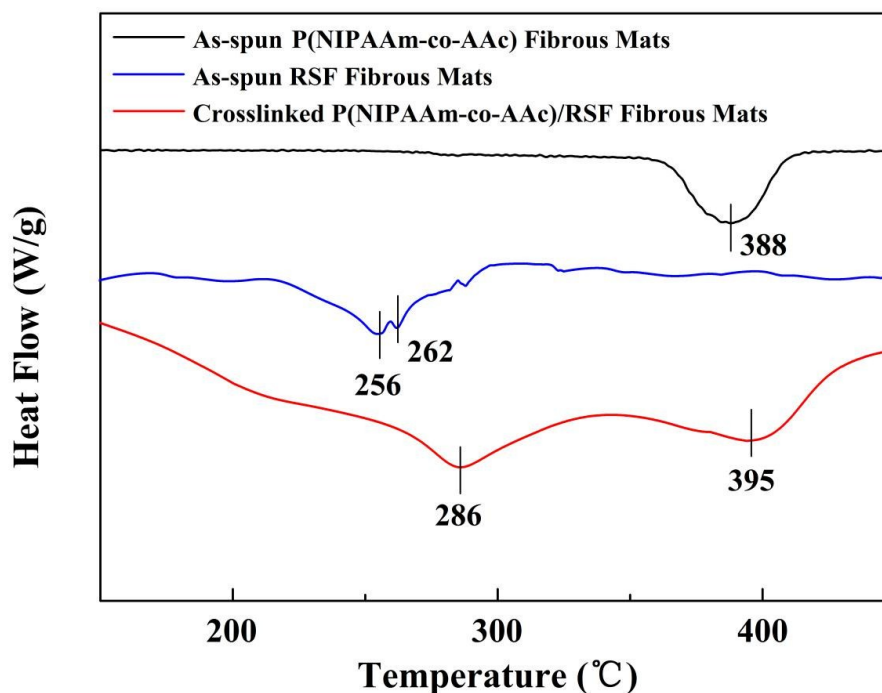
Fig. S5 DSC curves of as-spun P(NIPAAm-co-AAc) fibrous mats, as-spun RSF fibrous mats, and P(NIPAAm-co-AAc)/RSF after crosslinking.

Thermal properties of samples were determined by a TA Instruments Q600 Differential Scanning Calorimeter (DSC). P(NIPAAm-co-AAc), RSF, and P(NIPAAm-co-AAc)/RSF fibrous mats were placed in aluminum holders and heated between 25 and 500 ℃, under the nitrogen atmosphere, at 10 ℃/min.

Fig. S5 shows the DSC curves of fibrous mats. It could be found that endothermic peaks at 256-262℃ were attributed to the thermal decomposition of the as-spun RSF fibrous mats, and the thermal degradation peak of as-spun P(NIPAAm-co-AAc) fibrous mats appeared around 388℃. After crosslinking, the DSC curve of P(NIPAAm-AAc)/RSF fibrous mats shows two peaks, corresponding the thermal decomposition of the RSF and P(NIPAAm-AAc), which increase to 286℃ and 395℃

respectively. So, both in-situ crosslinking and water annealing contribute to the stability of the P(NIPAAm-co-AAc)/RSF fibrous mats.

3. In vitro drug release study

The standard curve of rhodamine B is shown in Fig. S6, which illustrated the concentration and absorbance have a linear relationship. The standard equation of absorbance and concentration is A=0.20663C-0.02461, and the correlation coefficient R^2 is 0.99039.

The cumulative drug release was calculated according to the equation (1).[1]

$$Er\ (\%) = \frac{V_e \sum_1^{n-1} C_i + V_0 C_n}{m_{\text{rhodamine B}}} \times 100\% \qquad (1)$$

In the equation (1), Er is the drug release rate, V_e is the replacement volume of PB (2 mL), V_0 is the total volume of PB (6 mL), C_i is the concentration of rhodamine B taken out for the time i (μg/mL), C_n is the concentration of rhodamine B taken out last time (μg/mL) and m is the total amount of rhodamine B in the fibers.
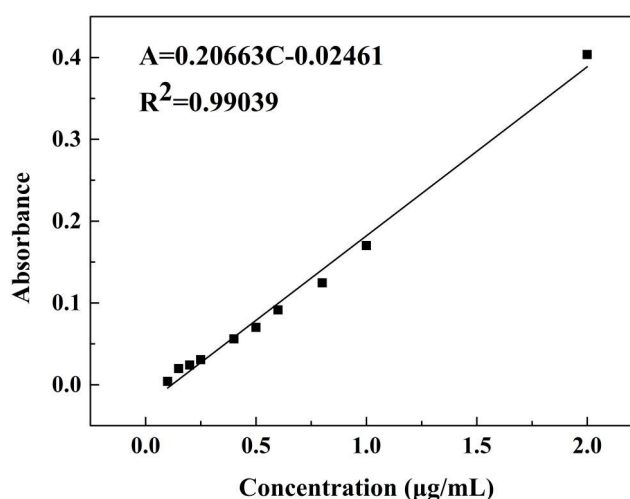
Fig. S6 Standard curve of absorbance-concentration of rhodamine B aqueous solution.

Reference

1. Q. Wu, X. Tang, X. Liu, Y. Hou, H. Li, C. Yang, J. Yi, X. Song and G. Zhang, *Chemistry-An Asian Journal*, 2016, **11**, 112-119.