Electronic Supplementary Information (ESI)

Antibacterials loaded electrospun composite nanofibers: release profile and sustained antibacterial efficacy

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The compositions and nomenclatures of all solutions are provided in Tables S1.

Table S1. Fiber Sizes with the Surface Tension, Viscosity, Conductivity of Solutions from Given Solution.

Sample	Agar wt% in the solution	PAN wt% in the solution	Agar：PAN ratio in solution by wt）	Fiber diameter（nm）	Viscosity（PaS）	Conductivity（μS/cm）	Surface tension（dyn/cm）	Fiber morphology
1	Agar solution only（4 wt%）	0	-	620±20	0.07132	31.5	60.77	no fiber formation
2	0.25%	3.2%	1:11	32±5	0.001013	45.2	36.21	bead defect nanofibers
3	0.5%	3.2%	2:11	50±5	0.001870	48.1	40.10	bead defect nanofibers
4	1%	3.2%	4:11	120±8	0.002333	50.3	44.71	highly bead nanofibers
5	2%	3.2%	8:11	130±10	0.016	51.5	49.23	a little

					97			bead nanofibers
6	3%	3.2%	12:11	210±10	0.05486	55.5	51.86	bead-free nanofibers
7	4%	3.2%	16:11	230±10	0.06125	52.9	58.93	good-quality bead-free nanofibers
8	PAN only（7 wt%）	7.2%	-	300±15	0.01553	91.7	40.10	good-quality bead-free nanofibers

Table S2. Pore characteristics of the agar/PAN composite nanofibers used in this study.

Samples	BET surface area (m^2g^{-1})	Total pore volume (cm^3g^{-1})	Average pore diameter (nm)
PAN	20.41	0.04687	9.186
0.5% Agar@PAN	16.52	0.05250	10.98
1 % Agar@PAN	18.57	0.07525	13.80
2 % Agar@PAN	22.56	0.07784	15.68
3 % Agar@PAN	33.28	0.1305	16.21
4 % Agar@PAN	49.42	0.1357	32.20

Pore parameters were obtained from N_2 adsorption.

Table S3. Different drug loading efficiencies in different drug content without or with 4% agar/PAN nanofibers.

	Entrapment efficiency（%）	
Composition	With PAN only（without Agar）	With 4% agar/PAN
22.7% AMC	54.8	80.4
11.4% AMC	71.9	92.6
5.7% AMC	74.4	95.5

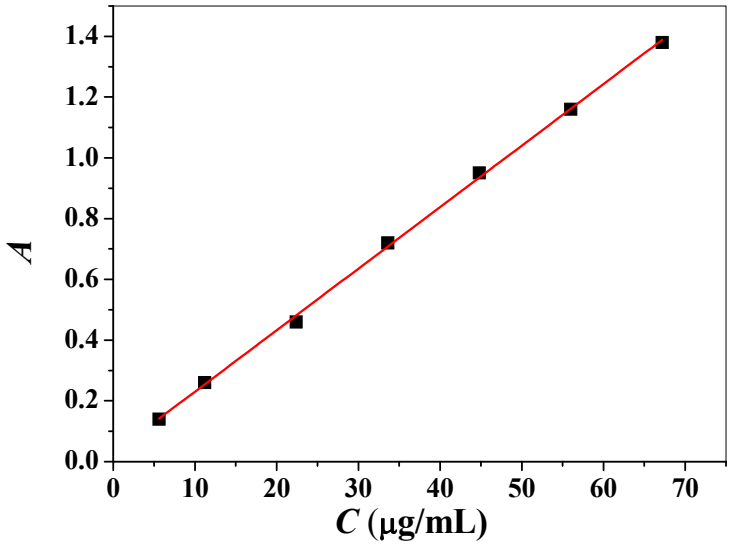

Fig. S1 A calibration curve showing the relationship between AMC concentration in PBS and absorbance.

The obtained relationship is shown in the following equation (Eq. (1)):

$y = 0.02778+0.02025\ x$, $r^2 = 0.9991$.

The absorbance readings were within the calibration range for all the measurements in this study.

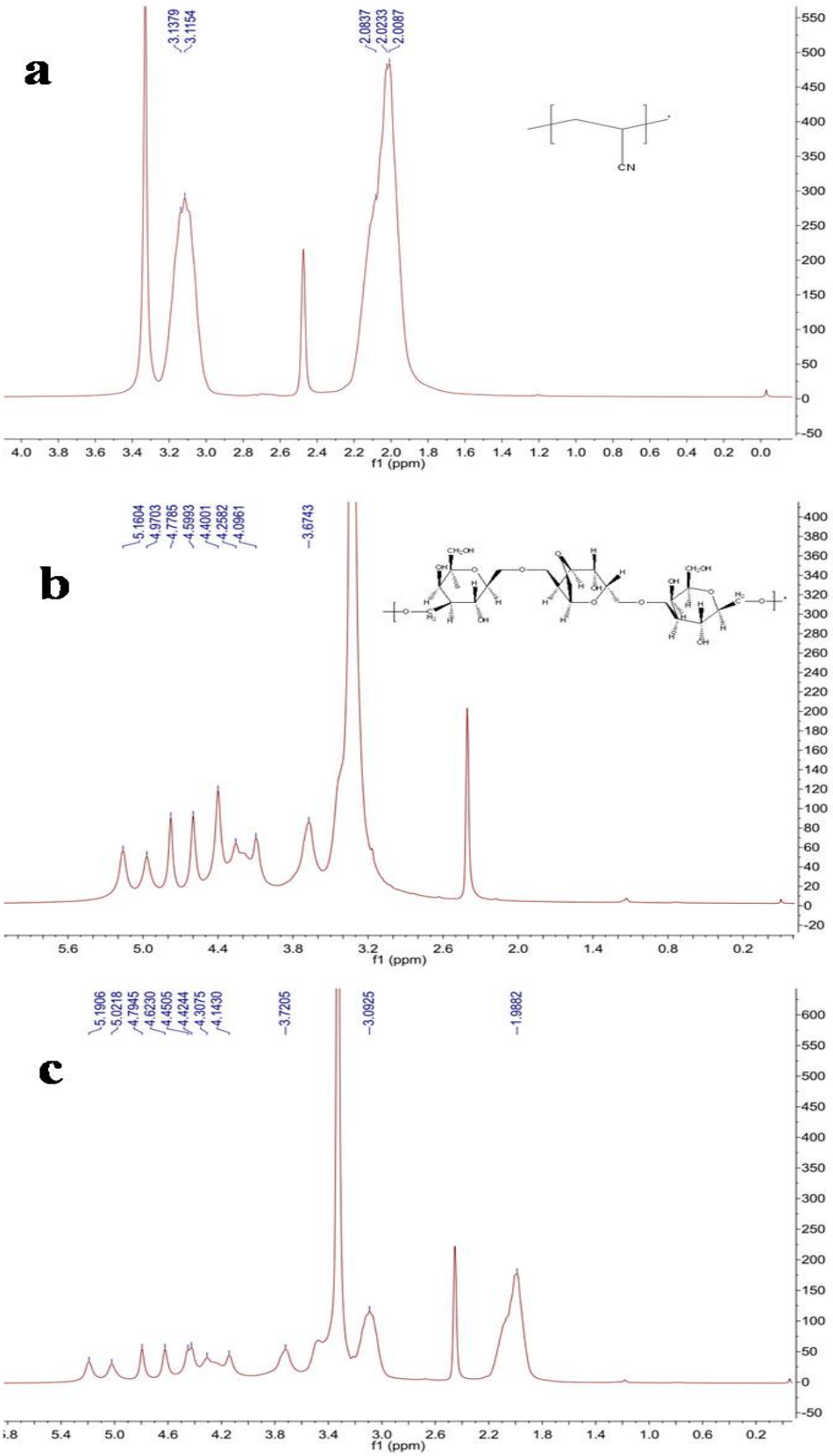

Fig. S2 ^{1}H-NMR spectra of PAN (a), agar (b), 4% agar agar/PAN (c). ^{1}H-NMR (300MHz, d~DMSO): PAN (a): δ 3.1379; 2.0837 Agar (b): δ 5.1604; 4.9703; 4.7785; 4.5993; 4.4001; 4.2582; 4.0961; 3.6743 Agar/PAN (c): δ 5.1906; 5.0218;

4.7945; 4.6230; 4.4505; 4.3075; 4.1430; 3.7205; 3.0925; 1.9882. An apparent singal at a chemical shift toward low field assigned to –OH.

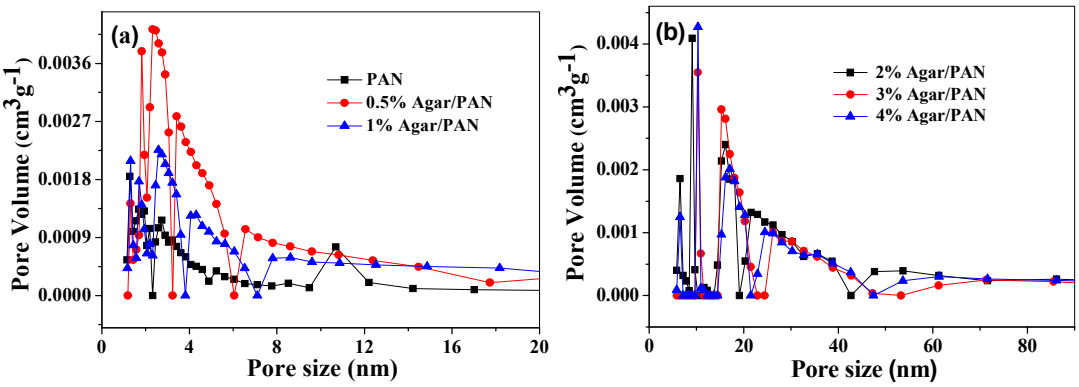

Fig. S3 Differential pore volume of various agar content.

Fig. S3 showed that as the agar content was increased, the average pore size increased and the size distribution narrowed, indicating the better homogeneity of the mesopores with the further increased content of agar.[1-3] In summary, these isotherm plots showed that the mesopores in the agar/PAN nanofibers were irregular, but the pores became more regular along with the more addition of agar.

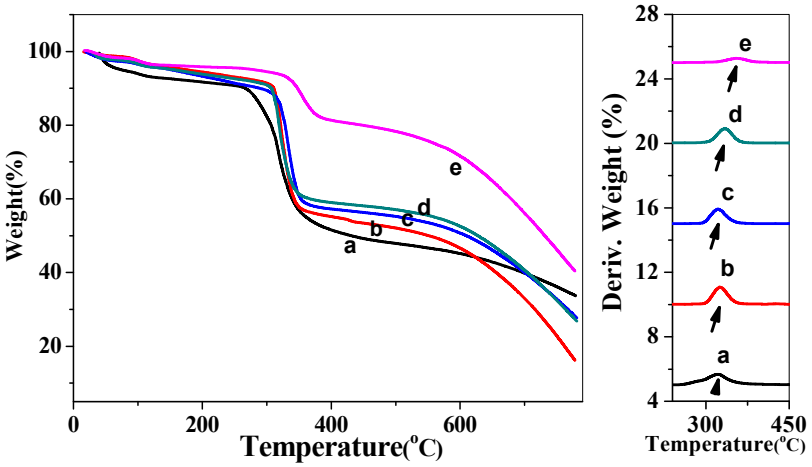

Fig. S4 TGA thermograms (left), and differential thermogravimetry curves (right) of agar/PAN electrospun mats with different agar contents. (a) PAN nanofibers, (b) pure agar, (c) 0.5% agar/PAN nanofibers, (d) 2% agar/PAN nanofibers, (e) 4% agar/PAN nanofibers.

The TGA curve for the PAN nanofibers showed two weight losses: the initial weight loss at temperatures below 100°C was due to water loss, and the major weight loss above 300°C corresponded to the main thermal degradation of PAN (Fig. S4a). In the case of the agar/PAN nanofibers, three weight losses were observed: a water loss below 100°C, a second weight loss between 150°C and 350°C that was due to the degradation of PAN, and the main degradation of agar above 400°C (Fig. S4e). The TGA initial amount of agar was preserved, and no loss of agar molecules occurred during the electrospinning process. The preservation of agar during electrospinning

was also evidence of its hydrogen bonding interactions in the agar/PAN nanofibers, because its stability was preserved at high temperatures. Moreover, the TGA results for the agar/PAN nanofibers showed that the thermal degradation temperature (T*d*) had shifted slightly to a higher temperature (T*d* onset at ~355°C) compared with that observed for pure agar (T*d* onset at ~325°C). In a word, the TGA results showed that the thermal stability of the nanocomposite membranes has been significantly improved due to the incorporation of agar.

The decomposition behavior showed no fundamental changes when agar was added; one degradation step was observed in the temperature range between 320°C and 400°C. The decomposition temperature turned higher than the initial when the agar concentration was low, and it continued to increase with the content of agar further increased. Some interesting features were observed when agar was added to the fibers making up the mats; for example, a new peak centered at approximately 350 °C was identified in the agar/PAN systems with an agar loading of 4 wt%, which was attributed to the decomposition of agar.

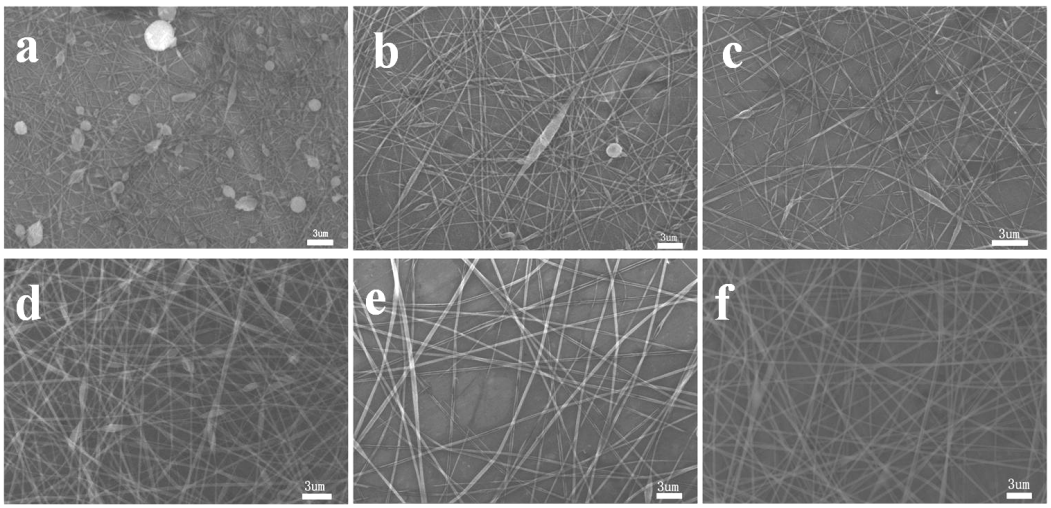

Fig. S5 As-spun composite fibers after a 24-h soak in deionized water bath (55 ˚C) and subsequent drying under vacuum with varied agar content: (a) 0.5% agar/PAN, (b) 1% agar/PAN, (c) 2% agar/PAN, (d) 3% agar/PAN, (e) 4% agar/PAN, (f) PAN only.

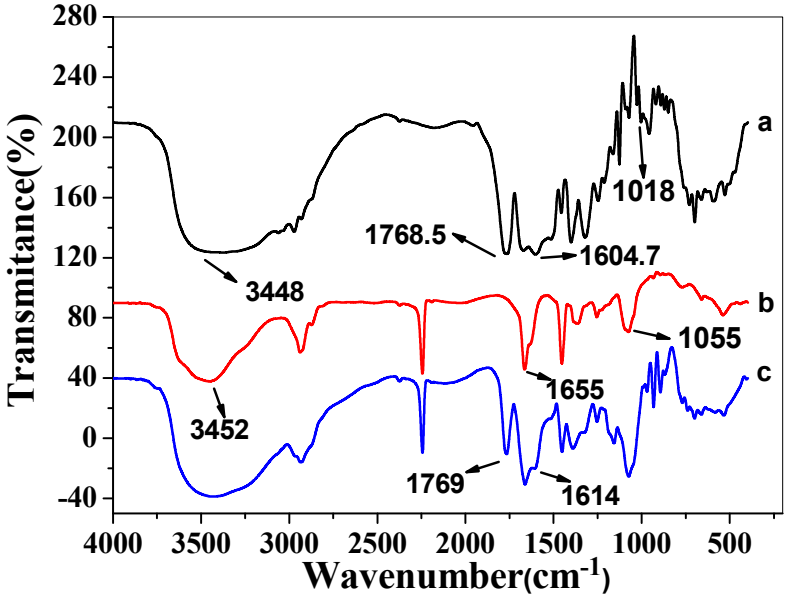

Fig. S6 FTIR spectra of free AMC (a), and agar/PAN before (b) and after (c) AMC loading.

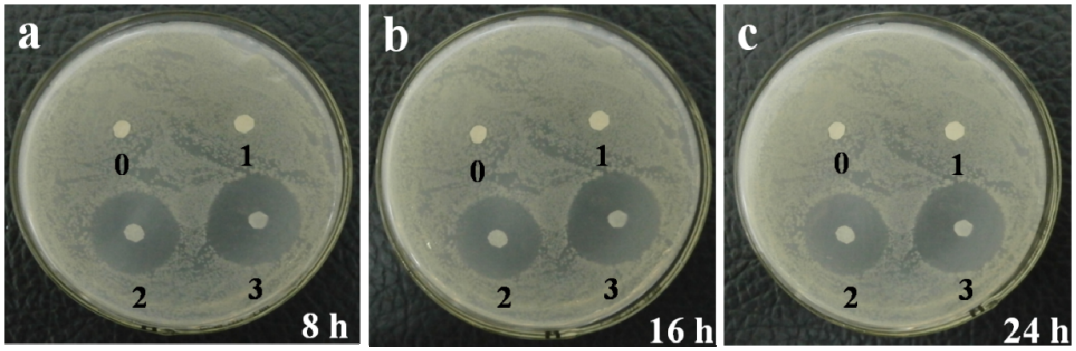

Fig. S7 Growth inhibition of bacteria (*E. coli*) on agar plate at the incubation time of 8 h (a), 16 h (b), and 24 h (c). spot 0,1, 2, and 3 represent Agar/PAN, PAN, AMC/Agar/PAN, and AMC/PAN nanofibers, respectively.

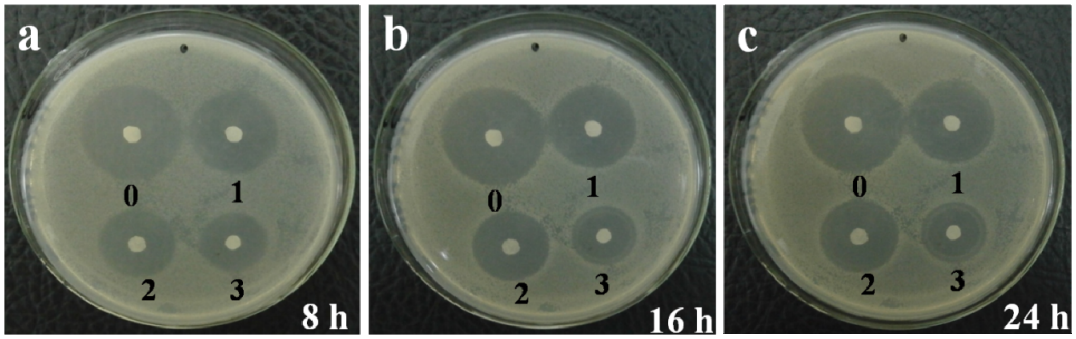

Fig. S8 Growth inhibition of bacteria (*E. coli*) on agar plate at the incubation time of 8 h （a）, 16 h (b), and 24 h (c). spot 0, 1, 2, and 3 represent 5%AMC/0%Agar/PAN, 5% AMC/0.5%Agar/PAN, 5%AMC/2%Agar/PAN, and 5% AMC/4%Agar/PAN

nanofibers, respectively.

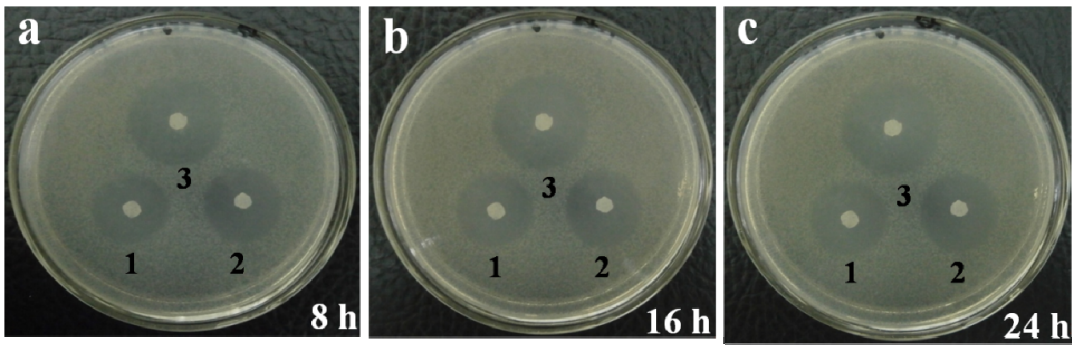

Fig. S9 Growth inhibition of bacteria (*E. coli*) on agar plate at the incubation time of 8 h （a）, 16 h (b), and 24 h (c). spot 1, 2, and 3 represent 5% AMC/4%Agar/PAN, 11% AMC/4%Agar/PAN, and 22% AMC/4%Agar/PAN nanofibers, respectively.

Ref:

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