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Supporting Information

Niflumic acid-doped ZIF-8 hybrid membrane for continuous antimicrobial treatment

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Experiment Section

Powder X-ray diffraction Powder X-ray

diffraction (PXRD) experiments were conducted on a Brucker D8 advance.

FTIR

FTIR spectra were acquired in the range of 600–4000 cm^{-1} using Vertex 70 (BRUKER Corp, Germany) to examine the incorporation of NIF into CS.

TGA

The weight loss curves were obtained using a thermo gravimetric analyzer (TGA) apparatus from 25 to 600 °C at the ramp rate of 5 °C min^{-1} under a nitrogen flow.

BET detection

The Brunauer–Emmett–Teller (BET) surface area was confirmed by the N2 adsorption–desorption isotherms (ASAP 2420, Micromeritics) at −196 °C. Before the measurements,the samples were degassed at 200 °C for 12 hours.

pH response experiment

The ZIF-NIF-ALG-loaded tetracycline material was placed in a buffer solution of pH

5.4 and pH 7.5, and the supernatant concentration was measured at 350 nm with an ultraviolet spectrophotometer at different time intervals.

Zinc Ions Released Properties of ZIF-NIF-ALG

To study the Zn^{2+} ions release amount from the ZIF-NIF-ALG, the material with the concentration of 50 μg/mL were soaked in phosphatebuffered saline (PBS, pH 7.4) at 25℃.The released amounts of Zn^{2+} ions at different time scales were then monitored by ICP-OES method.

Antibacterial Experiment of Different Materials

In this study, E.coli (ATCC 6538) was selected as a Gram-negative bacterium, and S.aureus (ATCC 25922) was used as a model for Gram-positive bacteria. E. coli colonies were scraped off and inoculated overnight in 3 mL LB broth. One hundred microliters of the overnight culture was suspended in 3 Ml of Mueller-Hinton Broth (MHB) and incubated for 2-3 h to obtain a bacterial culture at a concentration of 5 x 106 CFU/mL. The cultured Escherichia coli was diluted to 50 mL, and ZIF-8, ZIF-NIF, ZIF-NIF-ALG, 2-MI, NIF was added thereto. After 24 h of treatment, the sample was removed by centrifugation at 2000 rpm. An aliquot (0.5 mL) was collected and the absorbance was measured at the 600nm with UV visible light. In the blank control experiment, the cultured Escherichia coli was diluted to 50 mL and cultured under the same conditions. After 24 h, an aliquot (0.5 mL) was used and the absorbance was measured at a 600nm using an ultraviolet-spectrophotometer.

Integrity of cell membrane.

Bacterial 's cell membrane integrity was examined by determination of the release of material absorption value at 260 nm. The cultured bacterial were harvested, washed and suspended in sterile physiological saline. The final bacteria suspension was adjusted to an optical density absorbance at 630 nm (OD630nm) of 0.6 to measure OD260nm. The complexes solution of 1.0 mg /mL was mixed with bacteria suspension to the ratio of 1:1 (v /v) , the absorbance values of the liquid were tested

at different time periods using an ultraviolet spectrophotometer (Rayleigh, UV).

Stability Test

To assess the stability of ZIF-NIF-ALG, ZIF-NIF-ALG was incubated in freshly diluted mouse blood for 3 days. After the experiment ZIF-NIF-ALG was washed twice with sterile water and dried at room temperature. Then, after coating with platinum sputtering, the morphological change was examined using FESEM.

Table S1 Specific surface area and pore size data of ZIF-8 and ZIF-NIF

	BET Surface Area(m^2/g)	Adsorption average pore diameter(nm)
ZIF-8	8.6743	4.14091
ZIF-NIF	6.1189	4.61032

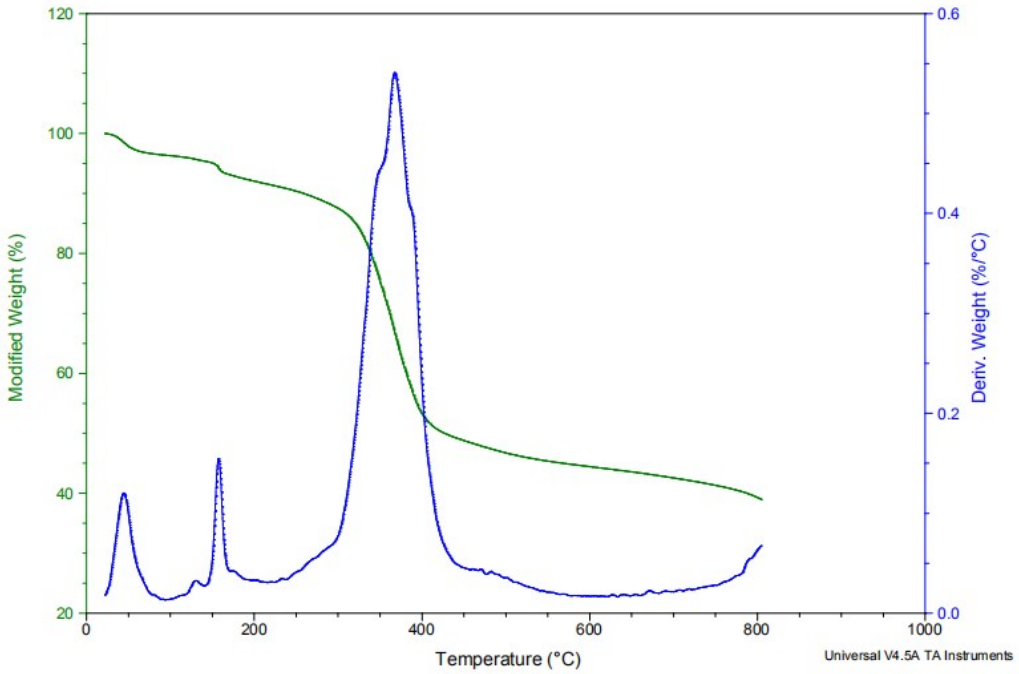

Fig S1. Thermogravimetric analysis profifile of ZIF-8 .

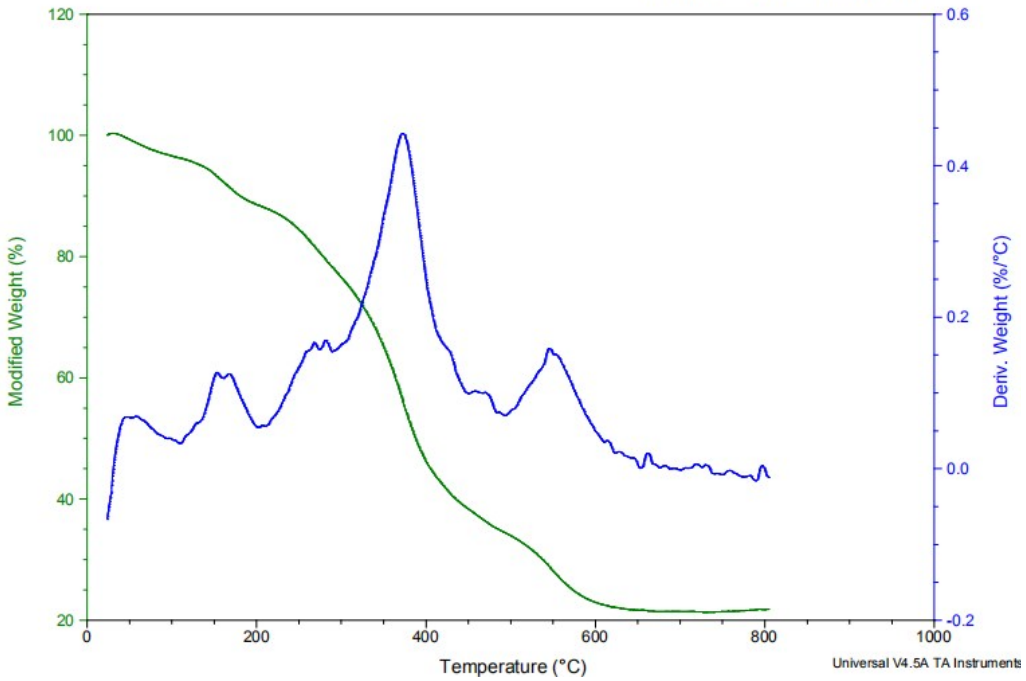

Fig.S2 Thermogravimetric analysis profifile of ZIF-NIF .

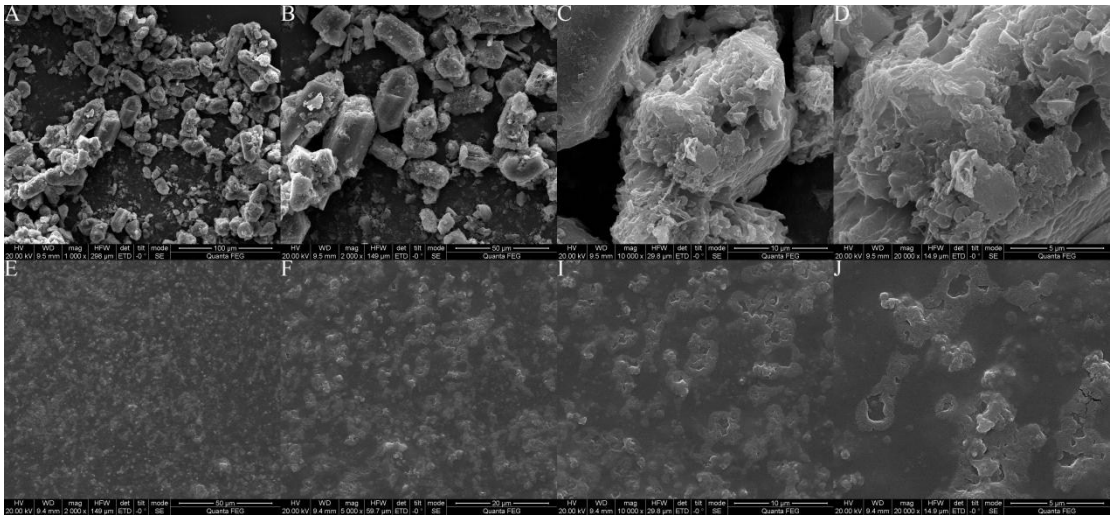

Fig.S3 (A-D) SEM of ZIF-NIF at different scales;(E-J)SEM of ZIF-NIF-ALG in a slightly acidic environment at different scales.

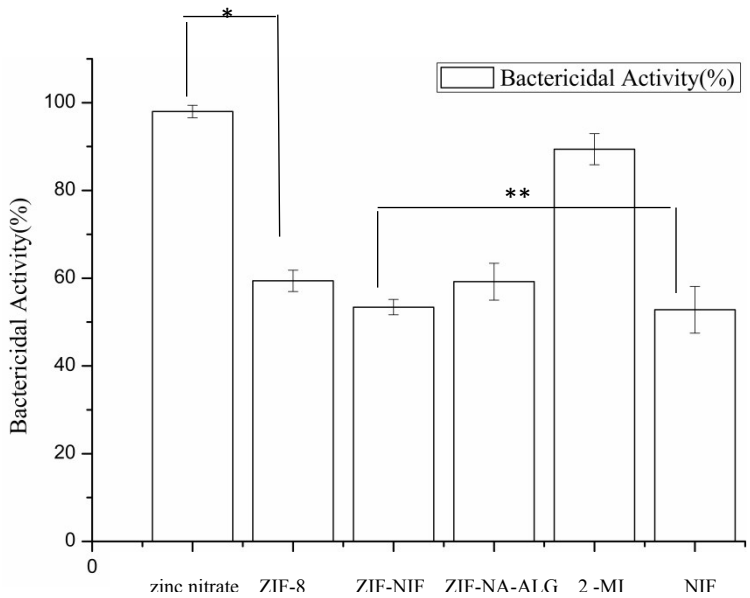

Fig.S4 MIC of different materials.

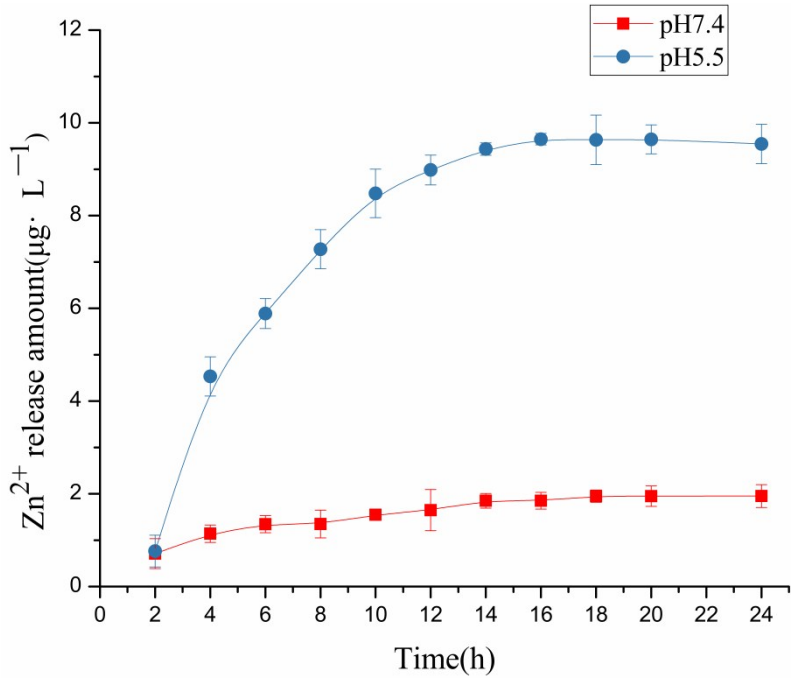

Fig.S5 Release of zinc ions in ZIF-NIF-ALG at pH 5.5 and pH 7.4.

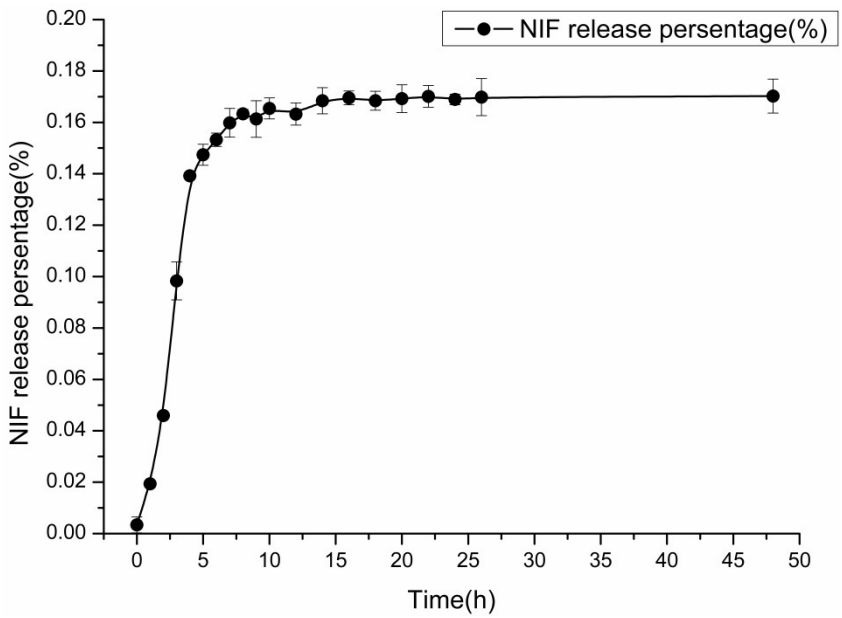

Fig.S6 Release of niflumic acid in ZIF-NIF-ALG at pH5.5.

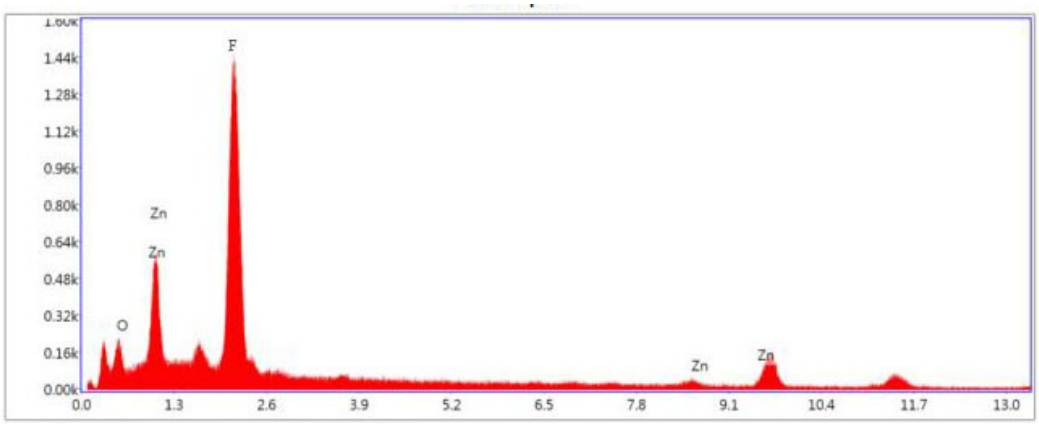

Fig.S7 EDS analysis of ZIF-NIF-ALG

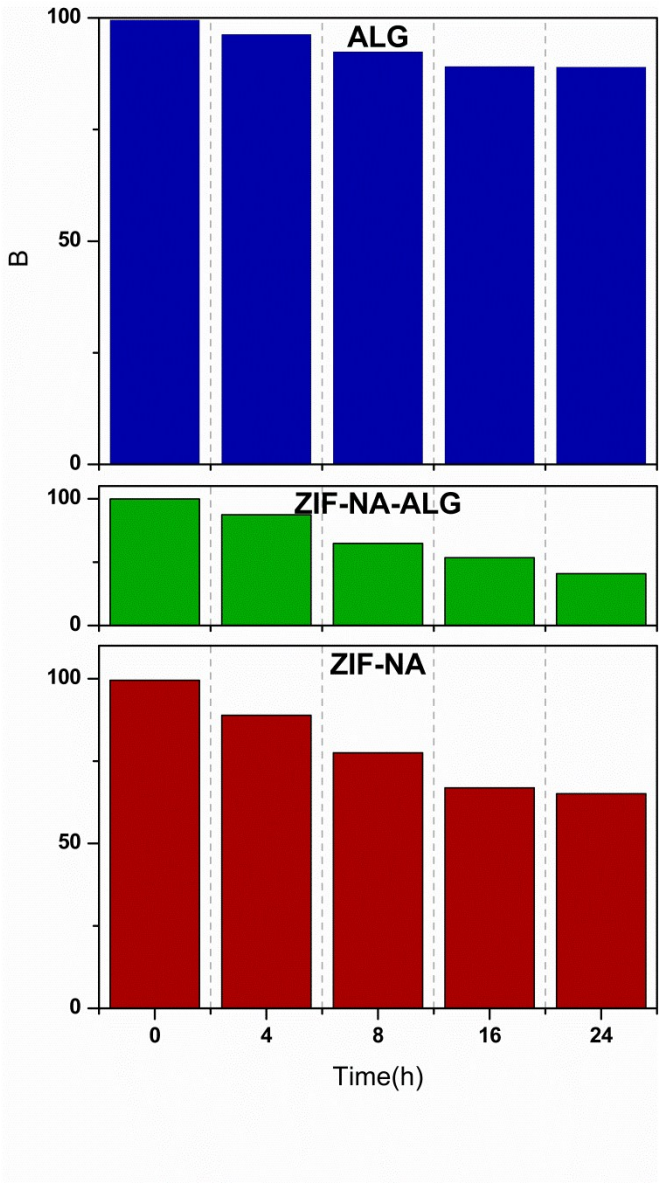

Fig.S8 Antibacterial effect of ZIF-8\ZIF-NIF\ZIF-NIF-ALG on Escherichia coli within 24h.

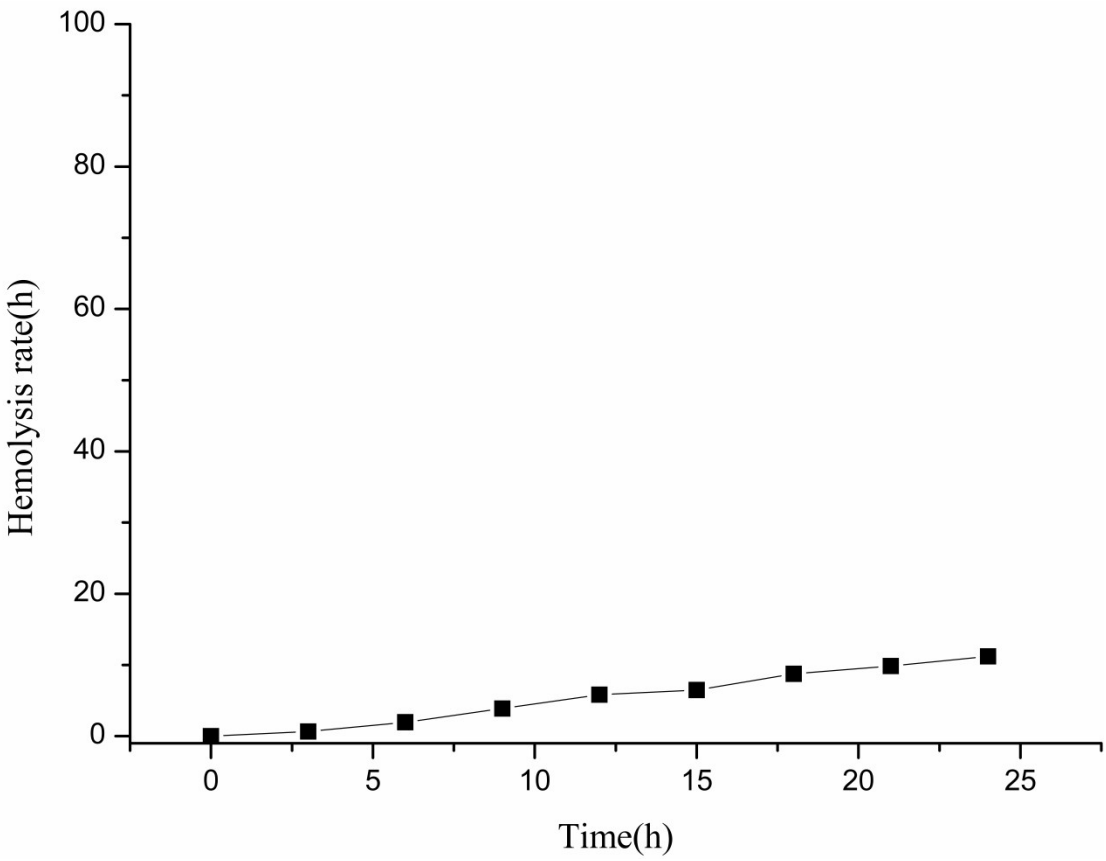

Fig.S9 Hemolysis rate curve of ZIF-NIF-ALG at different times

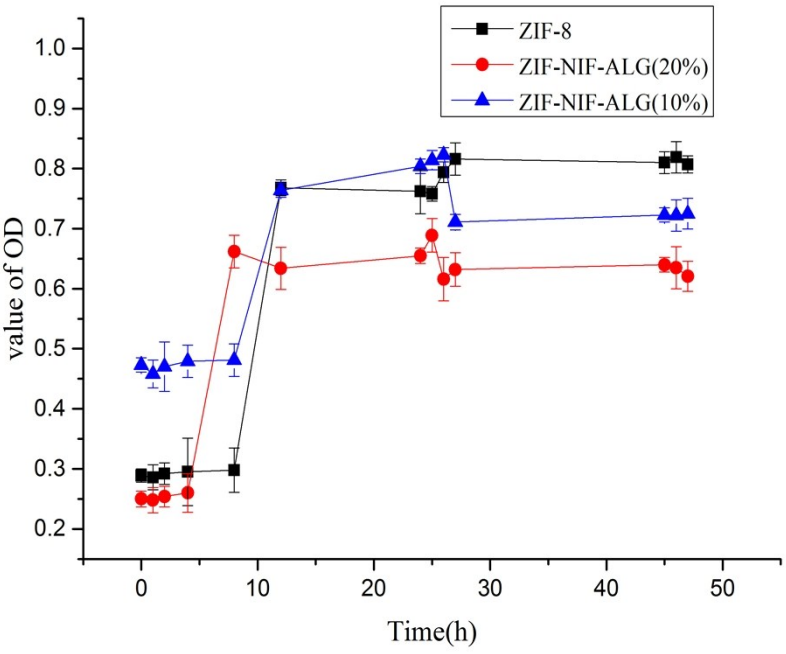

Fig.S10 Effects of ZIF-8, ZIF-NIF-ALG (10%), ZIF-NIF-ALG (20%) on the growth curve of

Staphylococcus aureus