Support information

A self-healing and antibacterial electronic skin based on a natural small molecular

Yuqi Wang,[‡a] Shuangsheng Zhang,[‡a] Yuemin Zhou,[a] Fuhao Dong,[*b] He Liu,[b] and Xu Xu,[*a]

a. College of Chemical Engineering, Nanjing Forestry University, Co-Innovation Center of Efficient Processing and Utilization of Forest Resources, Jiangsu Provincial Key Lab for the Chemistry and Utilization of Agro-forest Biomass, Nanjing 210037, Jiangsu Province, China.

b. Institute of Chemical Industry of Forestry Products, Chinese Academy of Forestry, Key Laboratory of Biomass Energy and Material, National Engineering Laboratory for Biomass Chemical Utilization, Key and Open Laboratory of Forest Chemical Engineering, State Forestry Administration, Nanjing 210042, Jiangsu Province, China.

*Corresponding authors: Email: horsedong1993@hotmail.com (F. D.), xuxu200121@hotmail.com (X. X.).

[1]Yuqi Wang and Shuangsheng Zhang have contributed equally to this work.

Cross-linking density test: The cross-linking density of the sample was determined by the equilibrium swelling method. First, the sample was immersed in toluene at room temperature until the swelling was balanced. Then, take out the sample and suck up the excess liquid with filter paper. Finally, the sample is weighed and the cross-linking density is calculated by the following formulas.

$$\varphi = (\frac{m_1}{\rho_1})/[\frac{m_2 - m_1}{\rho_2} + \frac{m_1}{\rho_1}]$$

$$\gamma_e = \frac{\rho_1}{M_c} = -[\ln(1-\varphi) + \varphi + x_1\varphi^2]/(v_0\varphi^{1/3})$$

Where φ, m_1, and ρ_1 are the volume fraction, the weight, and the density of the original sample, respectively. m_2 is the weight of the swollen sample, ρ_2 is the density of toluene (0.87 g/cm^3). γ_e, M_c, x_1, and v_0 are the cross-linking density, the average molecular weight of the cross-linked molecules, the interaction parameter of polymer and solvent (0.465), and the molar volume of toluene (106.54 cm^3/mol).

Results and Discussion

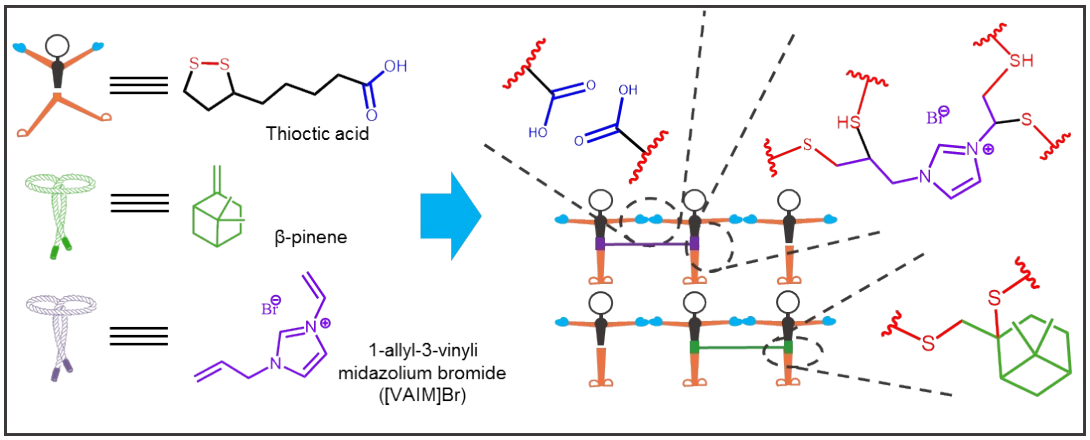


Fig. S1. The illustration of the preparation of the TA-β-[VAIM]Brs.

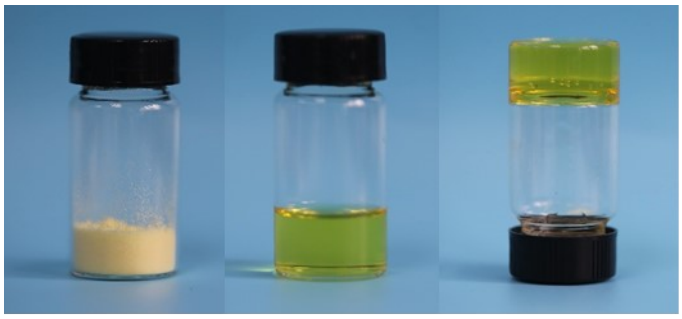


Fig. S2. Photos of the TA, TA/ethanol solution and the TA-β-[VAIM]Br.

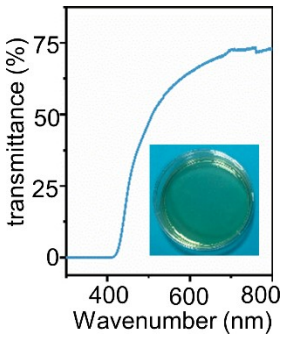


Fig. S3. UV–vis transmission spectra of the TA-β-[VAIM]Br. Inset: photographs of the TA-β-[VAIM]Br

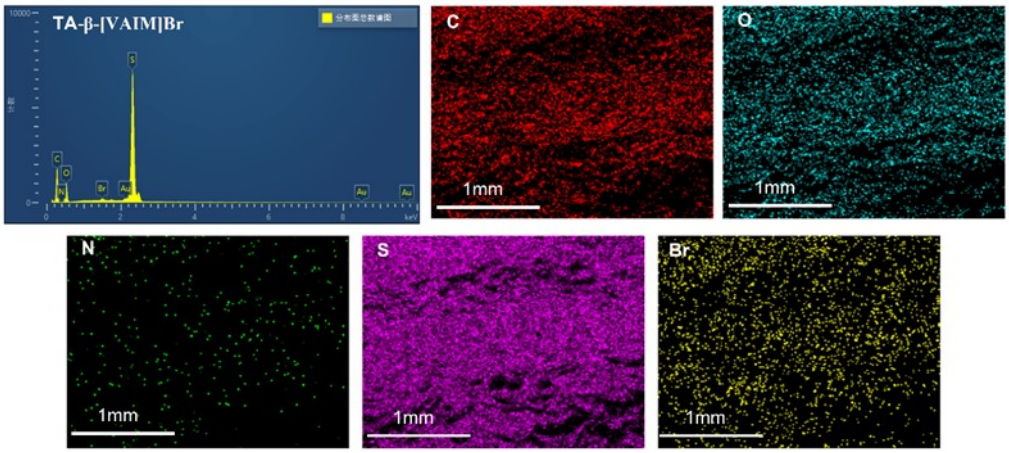


Fig. S4. The EDS spectroscopy of the TA-β-[VAIM]Br.

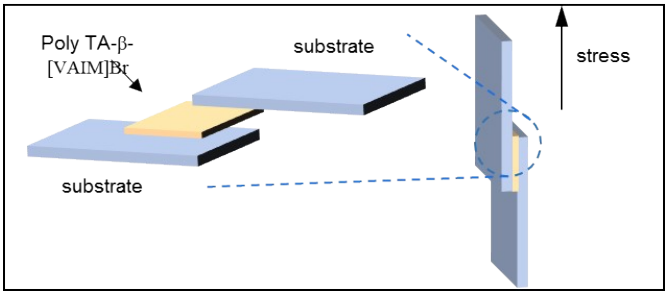


Fig. S5. Illustration of determining the shear strength of the TA-β-[VAIM]Br towards

different substrates.

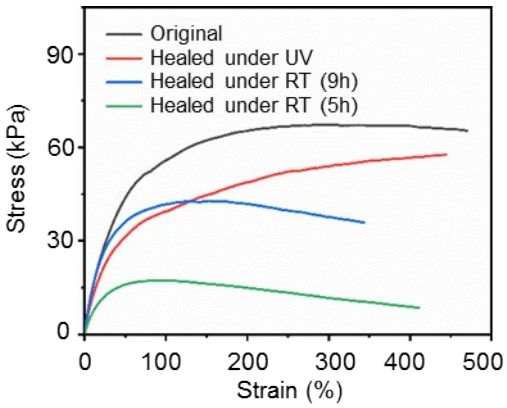


Fig. S6. The stress-strain curves of the healed and the original TA-β-[VAIM]Br.

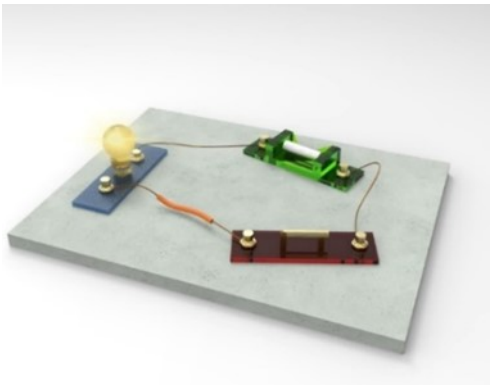


Fig. S7. Illustration of the circuit

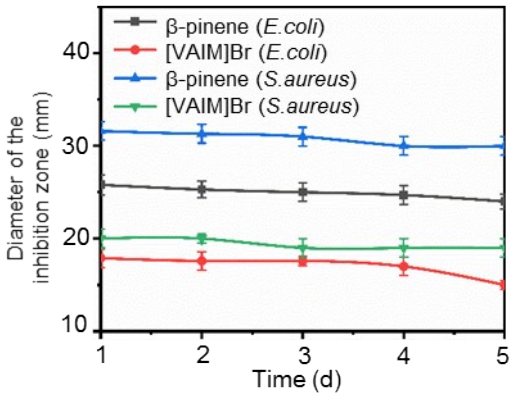


Fig. S8. The diameters of the inhibition zones of the *E.coli* and *S.aureus* treat by the β-pinene and [VAIM]Br with the function of time

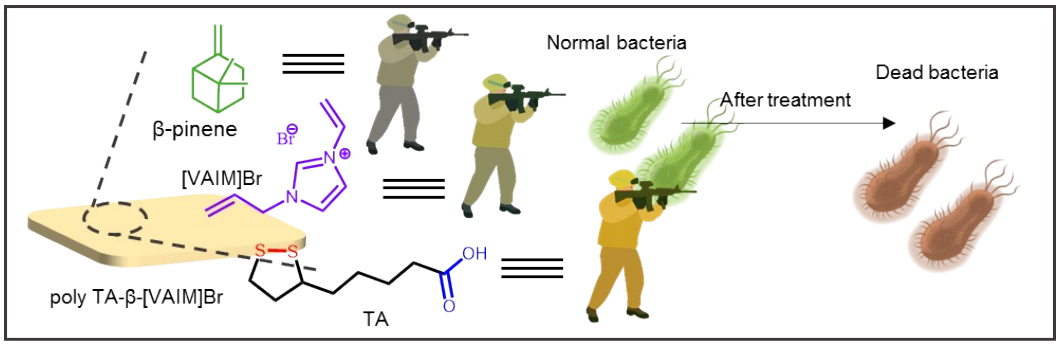


Fig. S9. Illustration of the antibacterial capacity of the TA-β-[VAIM]Br

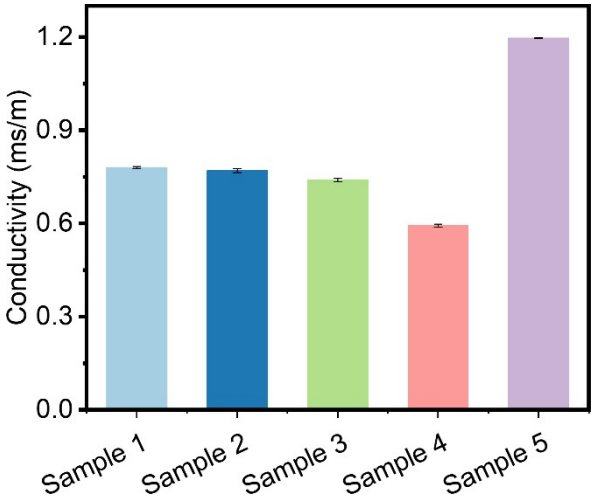


Fig. S10. The conductivity of the different TA-β-[VAIM]Br

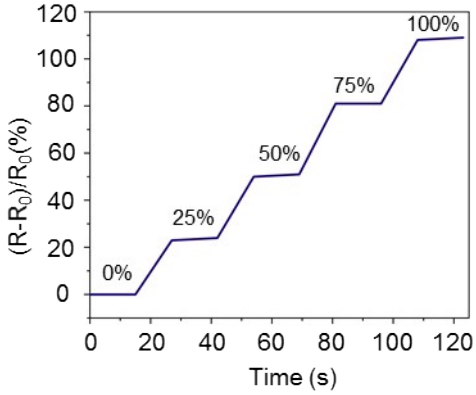


Fig. S11. The resistance changes of the TA-β-[VAIM]Br with the function of time

under different strain

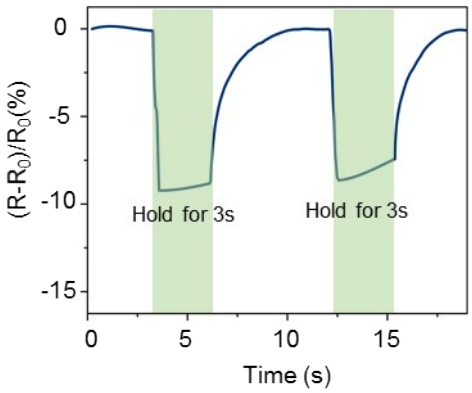


Fig. S12. The resistance changes of the TA-β-[VAIM]Br under pressure

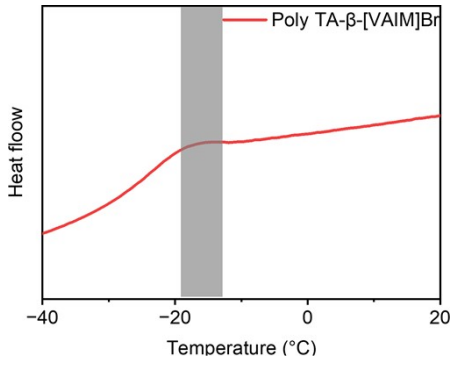


Fig. S13. DSC curves of the poly TA-β-[VAIM]Br.

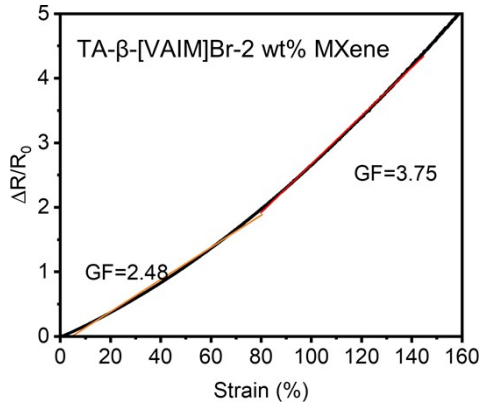


Fig. S14. The gauge factor of the poly TA-β-[VAIM]Br-2 wt% Mxene.

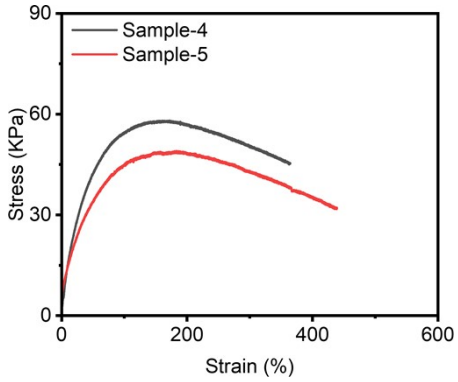


Fig. S15. The mechanical properties of samples 4 and 5.

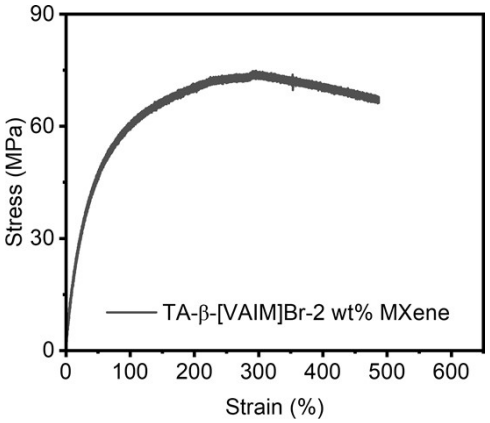
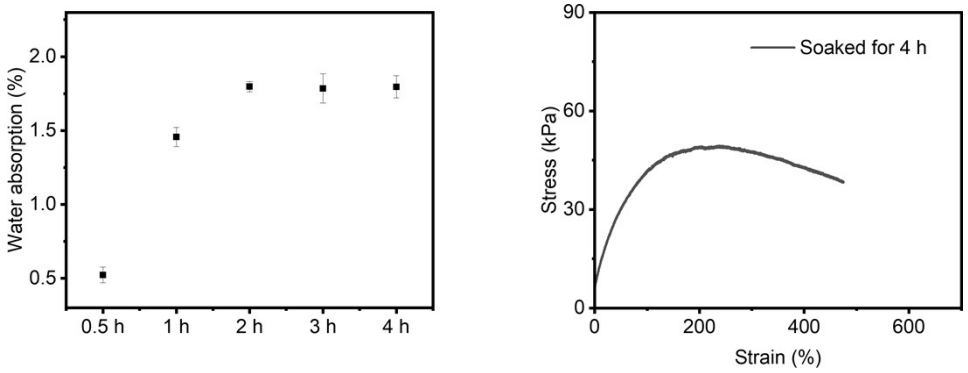


Fig. S16 The mechanical properties of the poly TA-β-[VAIM]Br-2 wt% Mxene.



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157 Fig. S17. Effect of water on the TA-β-[VAIM]Br.

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159 Table S1 The detailed composition of the TA-β-[VAIM]Brs

Sample	TA (g)	Ethanol (mL)	[VAIM]Br (g)	β-pinene (g)
Sample-1	2.00	2.00	0.15	0.10
Sample-2	2.00	2.00	0.15	0.15
Sample-3	2.00	2.00	0.15	0.20
Sample-4	2.00	2.00	0.10	0.15
Sample-5	2.00	2.00	0.20	0.15

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161 Table S2 Luria-Bertani (LB) medium

Sample	Weight (g/L)
Tryptone	10
Yeast	5
NaCl	5

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Table S3 LB-agar medium

Sample	Weight (g/L)
Tryptone	10
Yeast	5
NaCl	5
NaCl	2

Table S3 Comparison of the key characteristics of this work and the reported electronic skin

	Stress (MPa)	Shear strength to the skin (MPa)
This work	0.067	0.06
Wu	0.06	0.029
Han	0.092	0.0178
Wu	0.0924	0.018
Cai	0.7	0.0177
Cai	0.15	0.024
Dong	4	0.009
Jin	0.15	0.03
Ma	0.04	0.02
Yang	0.027	0.012

Zhao	0.59	0.12

Table S4 The detailed composition of the different poly TA-β-[VAIM]Br.

Sample	Cross-linking density/g/cm^3
Sample-1	0.259
Sample-2	0.612
Sample-3	0.467
Sample-4	0.399
Sample-5	0.401