

## Supporting Information

### **A lignin silver nanoparticles/polyvinyl alcohol/sodium alginate hybrid hydrogel with potent mechanical properties and antibacterial activity**

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## 1. Experimental Procedures

**Measurement of Growth inhibition on *E. coli* with Lig-Ag NPs.** The sample was Lig-Ag NPs, with Ag<sup>+</sup> concentration of 40 mM during the preparation of silver from lignin. In the antibacterial evaluation, 0.1 g of lignin silver suspension was taken and mixed with 20 mL of diluted bacterial suspension (*E. coli* bacterial load of 10<sup>5</sup> CFU/mL), and the remaining bacterial count in the suspension was assessed at 0, 3, 6, and 12 hours. The pre-treatment and bacterial enumeration methods for bacterial suspensions were conducted in accordance with the hydrogel antibacterial assay protocol.

## 2. Supplementary Figures

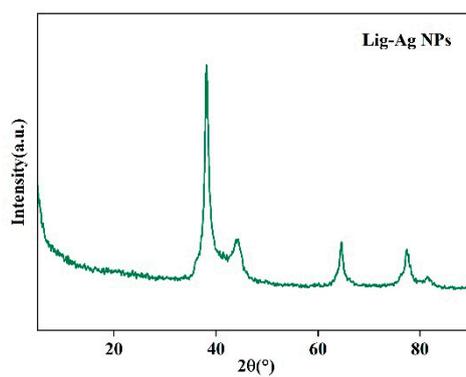


Fig. S1. XRD measurement of Lig-Ag NPs.

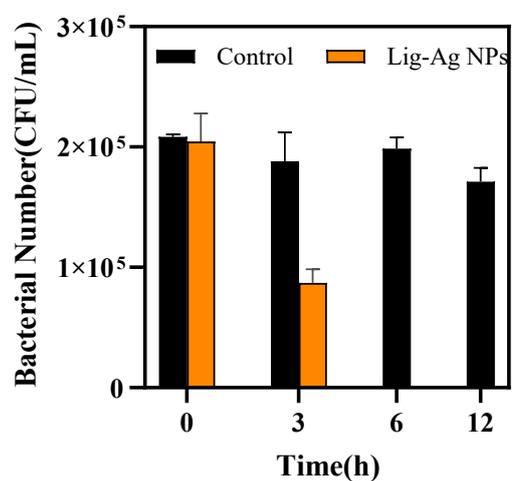


Fig. S2. Growth inhibition on *E. coli* with Lig-Ag NPs.

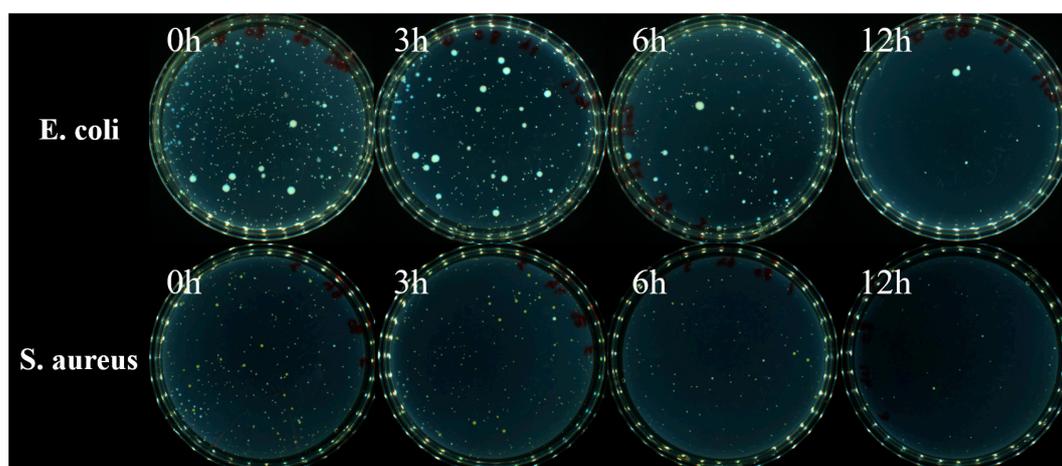


Fig. S3. Photos of the live bacteria colony on solid LB agar plates exposure to PVA:SA-9:1-80 hydrogel for different durations.

### 3. Supplementary Figures

**Table S1.** Comparison PVA/SA/Lig-Ag NPs hydrogels with other hydrogels.

No.	Materials	the antimicrobial substances	Test microorganism	The antibacterial ratio of the hydrogel	Ref.
1	ATC/SA/PVA hydrogel	Ag NPs	<i>Escherichia coli</i>	97.1%	[42]
			<i>Staphylococcus aureus</i>	95.9%	[42]
2	SS/PNIPAAm/Ag NPs IPN hydrogel	Ag NPs	<i>Escherichia coli</i>	95%	[43]
			<i>Staphylococcus aureus</i>	97%	[43]
3	Gel/PP-TA-Ag hydrogel	Ag NPs, TA	<i>Escherichia coli</i>	70.56%	[44]
			<i>Staphylococcus aureus</i>	75.52%	[44]
4	Ag NPs@MIL-100(Fe)/ GG hybrid hydrogel	Ag NPs, MIL100(Fe)	<i>Escherichia coli</i>	99.6%	[45]
5	SS/NIPAAm-Ag <sub>3</sub> hydrogel	Ag NPs	<i>Escherichia coli</i>	99.8%	[46]
			<i>Staphylococcus aureus</i>	93.4%	[46]
6	C <sub>3</sub> N <sub>4</sub> -PDA-Ag@CS composite film	C <sub>3</sub> N <sub>4</sub> , Ag NPs	<i>Pseudomonas aeruginosa</i>	>80%	[47]
			<i>Staphylococcus aureus</i>	>80%	[47]
7	Ch-3/Ag hydrogel	Ch, Ag NPs	<i>Escherichia coli</i>	>90%	[48]
			<i>Staphylococcus aureus</i>	>90%	[48]
This work	PVA/SA/Lig-Ag NPs hydrogel	Lig-Ag NPs	<i>Escherichia coli</i>	95.53%	
			<i>Staphylococcus aureus</i>	98.37%	

