Supporting Information for

One-pot rapid preparation of long-term antioxidant and antibacterial biomedical gels based on lipoic acid and eugenol for accelerating cutaneous wound healing

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This supplemental document contains 15 Figures and 1 table over 9 pages.

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As can be seen in **Fig. S1**, with the increase of eugenol content (4eq and 5eq), the gel system of lipoic acid and eugenol showed a transparent shape, and the hemimeric polylipoic acid did not spontaneously produce. On the contrary, when the content of eugenol is 1eq-3eq, the reverse vulcanization of polylipoic acid in the gel system can be seen. This shows that the proper amount of eugenol in the gel system can completely achieve the purpose of quenching terminal two radicals based on the effect of multi-site binding and scavenging free radicals.

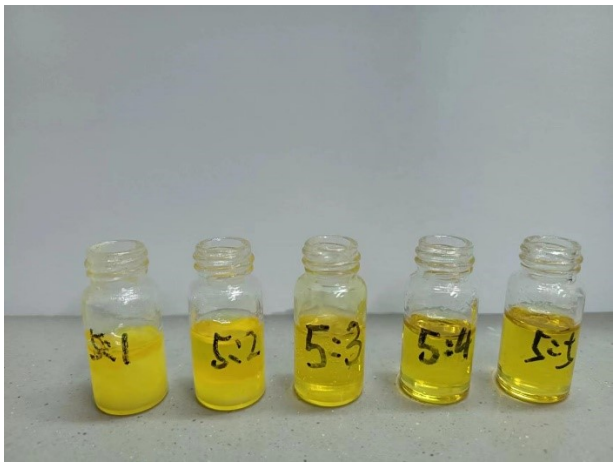


Fig. S1. The performance diagram of the gel system prepared by different proportions of lipoic acid and eugenol.

It was found that PLA-E1 and PLA-E2 have good adhesion effect through pig skin adhesion experiment. In order to further study the adhesion of PLA-E1 and PLA-E2, the shear strength of the two with different substrates (PET, glass, silicone rubber, alloy, PTFE, PP, paper) was respectively tested. The bonding area is 4 cm^2 (**Fig. S2**).

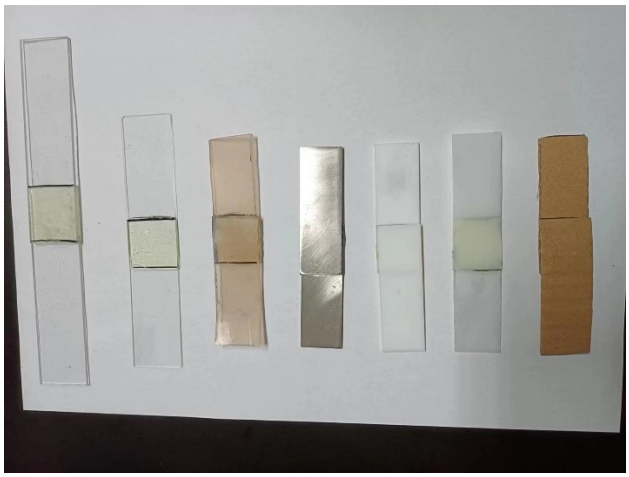


Fig. S2. Demonstration of the adhesion effect of PLA-E1 and PLA-E2 to different substrates.

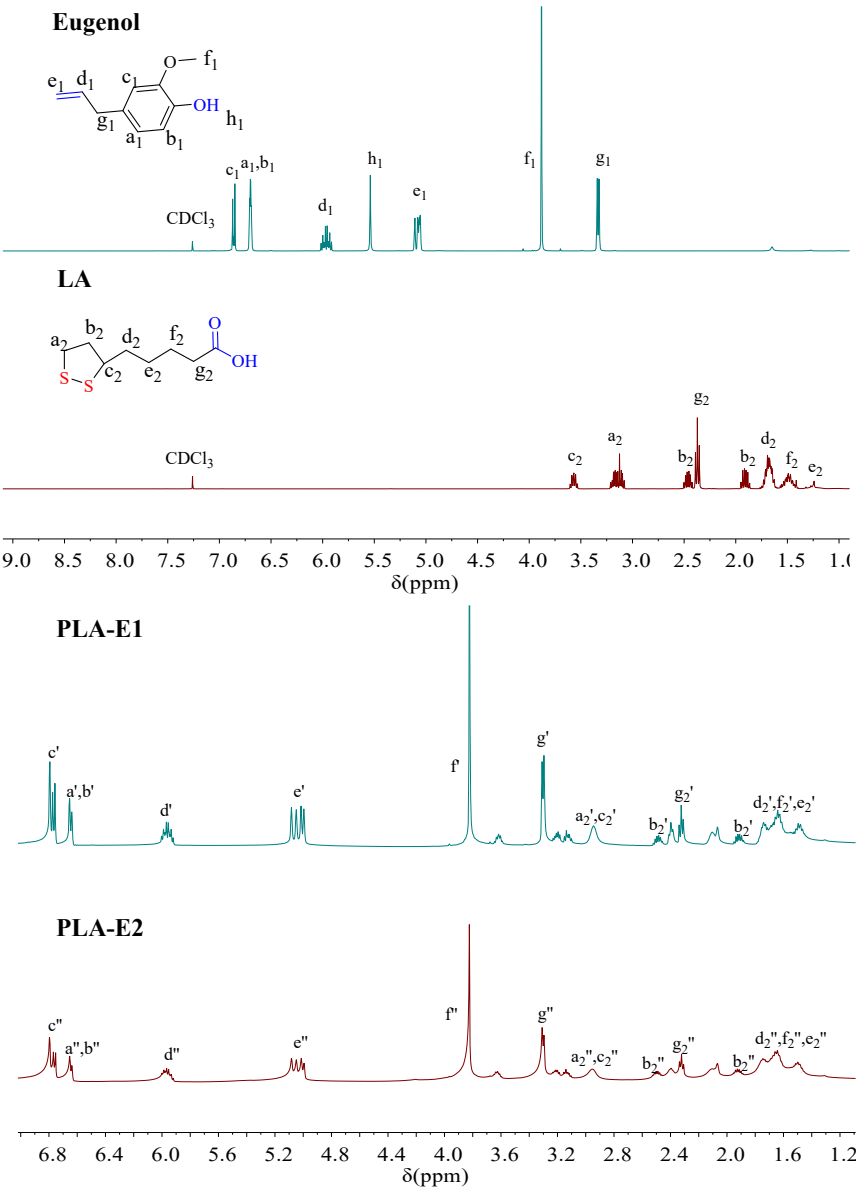


Fig. S3. ^{1}H NMR spectra of Eugenol, LA, PLA-E1 and PLA-E2.

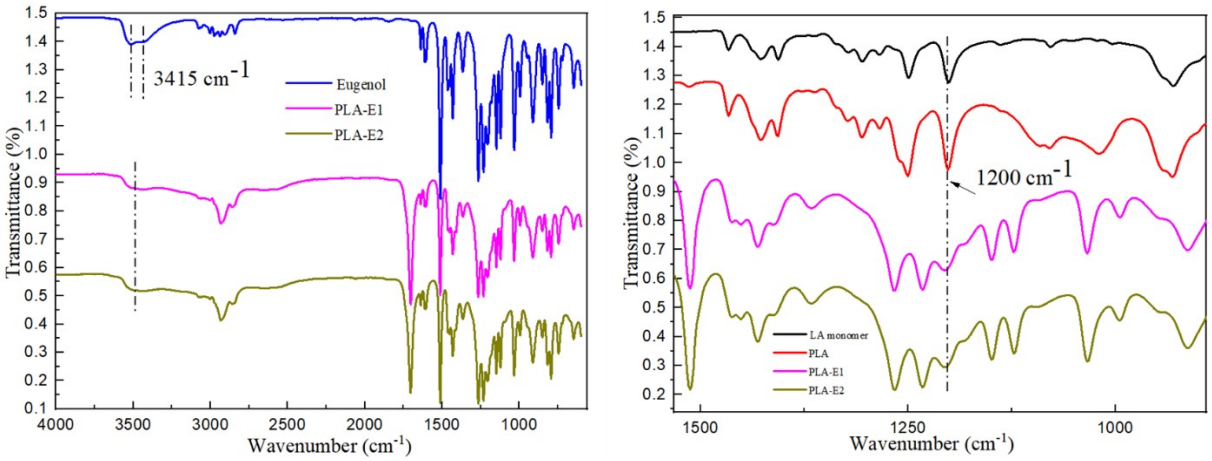


Fig. S4. FTIR spectra of Eugenol, LA monomer, PLA, PLA-E1 and PLA-E2.

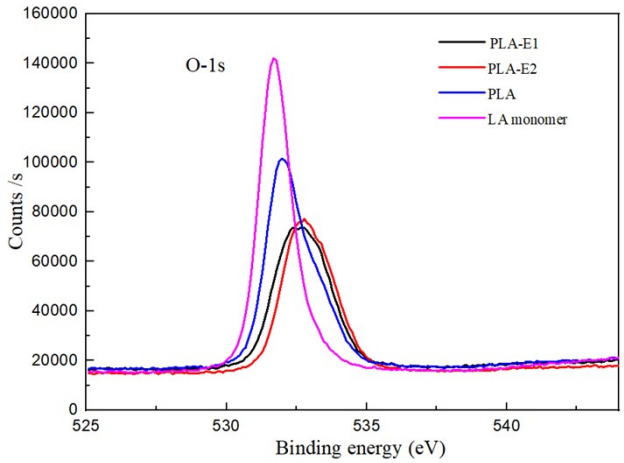


Fig. S5. The XPS survey spectrum of the LA monomer, PLA, PLA-E1 and PLA-E2.

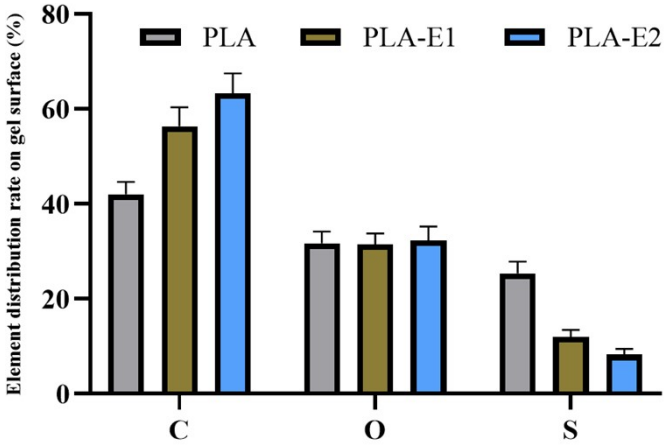


Fig. S6. Distribution ratio of elements on the gel surface of PLA, PLA-E1 and PLA-E2.

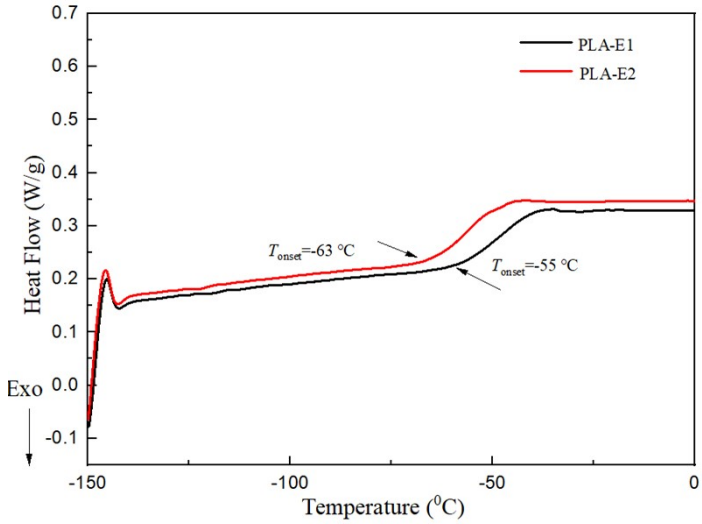


Fig. S7. DSC traces of PLA-E1 and PLA-E2 with a heating rate of 10 °C min^{-1} under N_2 atmosphere.

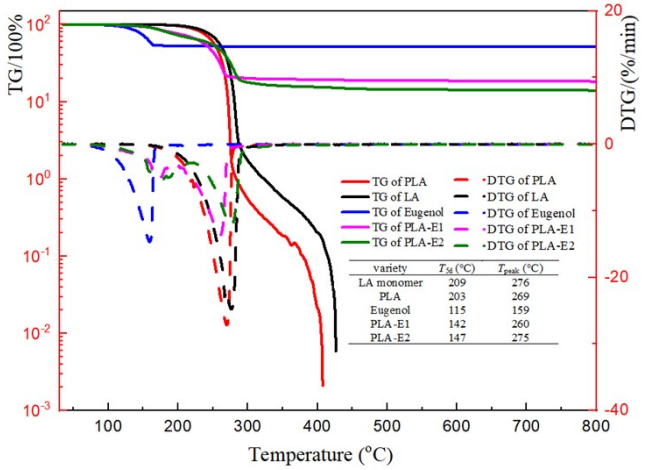


Fig. S8. Thermogravimetric analysis curves of Eugenol, monomer LA, PLA, PLA-E1 and PLA-E2 under N_2 atmosphere.

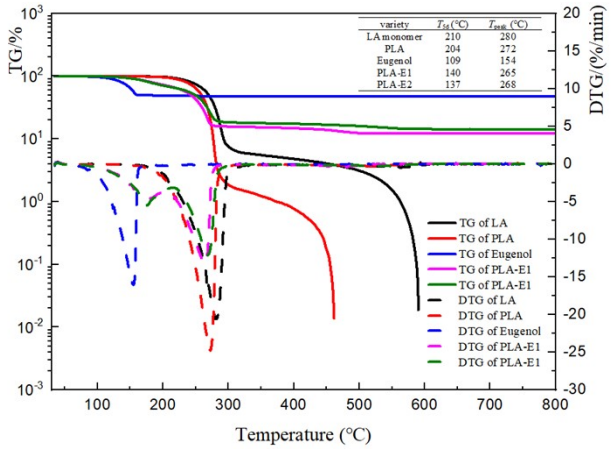


Fig. S9. Thermogravimetric analysis curves of Eugenol, monomer LA, PLA, PLa-E1 and PLA-E2 under air atmosphere.

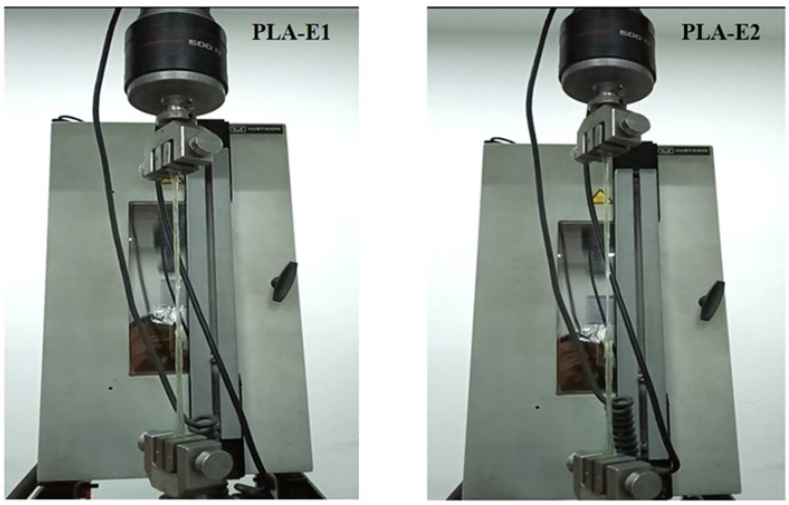


Fig. S10. PLA-E1 and PLA-E2 tensile test strain demonstration diagram.

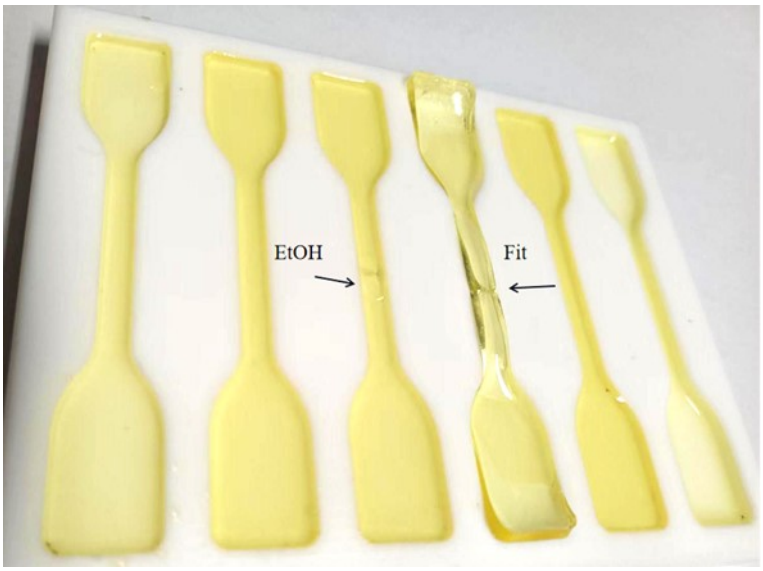


Fig. S11. Diagram of different self-healing processing methods of PLA-E1 and PLA-E2 stretch splines.

Fig. S12. PLA, PLA-E1 and PLA-E2 pig skin adhesion test demonstration with the bonding area of 1 cm^2.

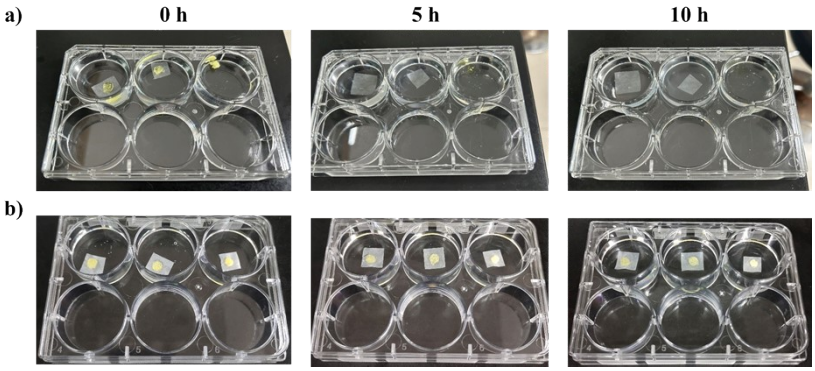


Fig. S13. Demonstration of degradation of PLA-E1, PLA-E2 and PLA in vitro. a) Schematic diagram of the degradation effect induced by GSH; b) Schematic diagram of the degradation of pure PBS buffer.

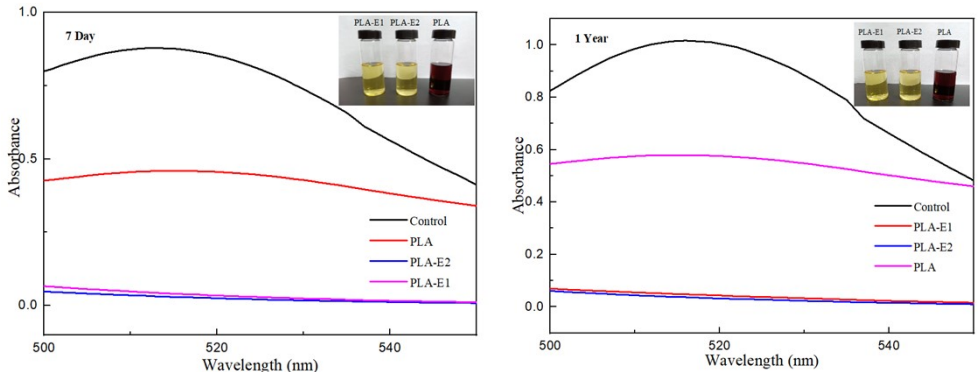
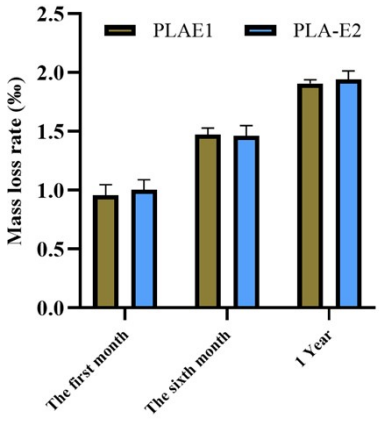


Fig. S14. UV absorption curves of PLA, PLA-E1 and PLA-E2 at different time.

Mass change rates of PLA-E1 and PLA-E2 at different times were calculated. As shown in **Fig. S15**, the mass was only two thousandths, indicating that the gel system had a stable network structure. The mass loss was calculated as follows:

$$\text{Swelling } \% = \frac{M_2 - M_1}{M_1} \times 100\%$$

Where, M1 and M2 are the initial weight and the measured weight respectively.



Mass change rate of PLA-E1 and PLA-E2 at different time

Fig. S15. Mass loss rate of PLA-E1 and PLA-E2 in one year.

Table. S1. Proportion of each component of the prepared gel

Gel	Lipoic acid (g)	Eugenol (g)	Molar weight (mmol)	Molar ratio (eq)	Remark
PLA-EA	2.0	0.32	9.69, 1.94	5:1	Hemimer precipitation
PLA-EB	2.0	0.64	9.69, 3.88	5:2	Hemimer precipitation
PLA-EC	2.0	0.96	9.69, 5.82	5:3	Hemimer precipitation
PLA-E1	2.0	1.28	9.69, 1.94	5:4	Transparent
PLA-E2	2.0	1.60	9.69, 1.94	5:5	Transparent
PLA	2.0	-	9.69, 0	5:0	Hemimer precipitation