Supplementary Information

Bio-based Photo-reversible Self-healing Polymer Designed from Lignin

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1. 3-D structures of the synthesized monomers [M-1 – M-5]



Figure S1. 3D structure of the monomers M-1 – M-5.

2. ¹H and ¹³C NMR spectra of the synthesized monomers [M-1 – M-5]



Figure S2. ¹H NMR spectrum of tris-O-malonate mono glycerol in DMSO-d₆.



Figure S3. ¹³C NMR spectrum of tris-*O*-malonate mono glycerol in DMSO-*d*₆.



Figure S4. ¹H NMR spectrum of tetra-O-malonate mono pentaerythritol in DMSO-d₆.



Figure S5. ¹³C NMR spectrum of tetra-*O*-malonate mono pentaerythritol in DMSO-*d*₆.



Figure S6. ¹H NMR spectrum of M-1 in DMSO- d_6 .



Figure S7. ¹³C NMR spectrum of M-1 in DMSO-*d*₆.



Figure S8. ¹H NMR spectrum of M-2 in DMSO- d_6 .



Figure S9. ¹³C NMR spectrum of M-2 in DMSO- d_6 .



Figure S10. ¹H NMR spectrum of M-3 in DMSO- d_6 .



Figure S11. ¹³C NMR spectrum of M-3 in DMSO- d_6 .



Figure S12. ¹H NMR spectrum of M-4 in DMSO-*d*₆.



Figure S13. ¹³C NMR spectrum of M-4 in DMSO- d_6 .



Figure S14. ¹H NMR spectrum of M-5 in (CD₃)₂CO.



Figure S15. ¹³C NMR spectrum of M-5 in (CD₃)₂CO.



3. Comparison of FTIR spectra for compound M-1 before crosslinking and at crosslinked and decrosslinked state

Figure S16. Comparison of FTIR spectra for M-1 before crosslinking and at crosslinked and decrosslinked state.



4. UV-Vis spectra for crosslinking and decrosslinking of compounds M-2 to M-5

Figure S17. UV-Vis spectra for compound M-2. (a) Crosslinking at 365 nm (90%). (b) Decrosslinking at 254 nm (30%).



Figure S18. UV-Vis spectra for compound M-3. (a) Crosslinking at 365 nm (89%). (b) Decrosslinking at 254 nm (31%).



Figure S19. UV-Vis spectra for compound M-4. (a) Crosslinking at 365 nm (90%). (b) Decrosslinking at 254 nm (40%).



Figure S20. UV-Vis spectra for compound M-5. (a) Crosslinking at 365 nm (93%). (b) Decrosslinking at 254 nm (45%).

5. Glass transition temperature of compounds M-1 to M-5 at crosslinked and decrosslinked state obtained from Differential Scanning Calorimetry (DSC)



Figure S21. DSC data for M-1 at crosslinked state.



Figure S22. DSC data for M-1 at decrosslinked state.



Figure S23. DSC data for M-2 at crosslinked state.



Figure S24. DSC data for M-2 at decrosslinked state.



Figure S25. DSC data for M-3 at crosslinked state.



Figure S26. DSC data for M-3 at decrosslinked state.



Figure S27. DSC data for M-4 at crosslinked state.



Figure S28. DSC data for M-4 at decrosslinked state.



Figure S29. DSC data for M-5 at crosslinked state.



Figure S30. DSC data for M-5 at decrosslinked state.

6. Thermogravimetric analysis (TGA) data of M-5 polymer



Figure S31. TGA data for M-5 polymer.

7. GPC analysis data of the M-5 sample at the decrosslinked state



Figure S32. GPC data for M-5 sample after decrosslinking.