

Supporting Information

The lignin content in terms of mass percentage in both macro-initiators and copolymer samples was estimated from the UV absorption of lignin. Figure S1a shows the plot of UV-vis spectra of lignin samples with known concentrations. A calibration curve was obtained by plotting the lignin peak absorbance at 282 nm versus the lignin concentration (Figure S1b).

The calibration curve gives the linear equation as follows:

$$\text{Lignin Concentration (mg/mL)} = \frac{\text{Peak Absorbance at 282nm}}{26.397}$$

The UV-vis spectra of both macro-initiators (MIs) and copolymers are shown in Figure S2. The peak absorbance data at 282 nm are listed in Table S1. The lignin content was computed from the equation mentioned above, which was obtained from the calibration curve.

Table S2 demonstrates thermo-responsive rheology data. The data were collected under a controlled stress of 2.0 dyn/cm² and a frequency of 1.0 rad/s. The heating rate was 0.5 °C/min.

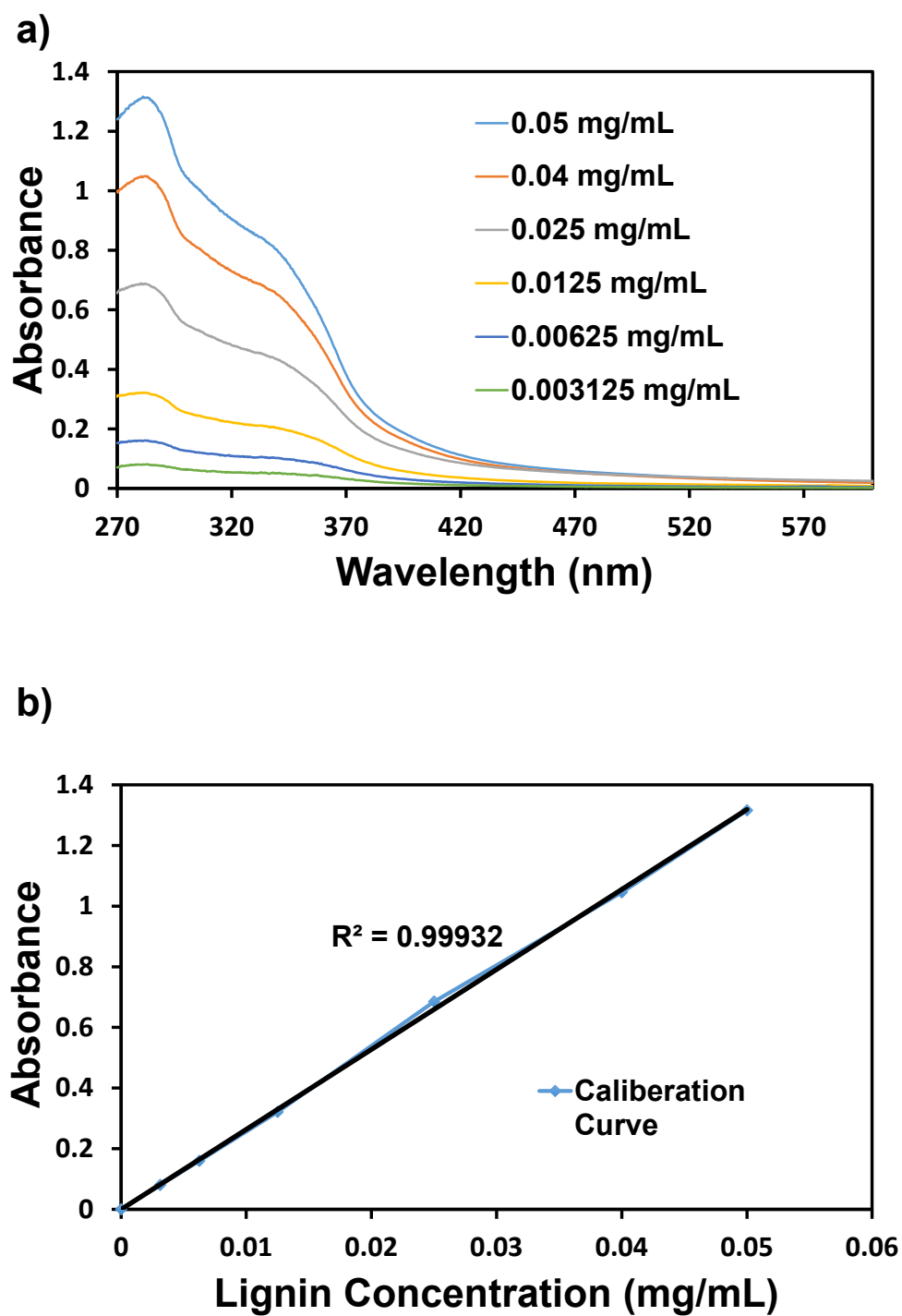


Figure S1. a) UV-vis spectra for lignin of different concentrations. b) Calibration curve for lignin content computation.

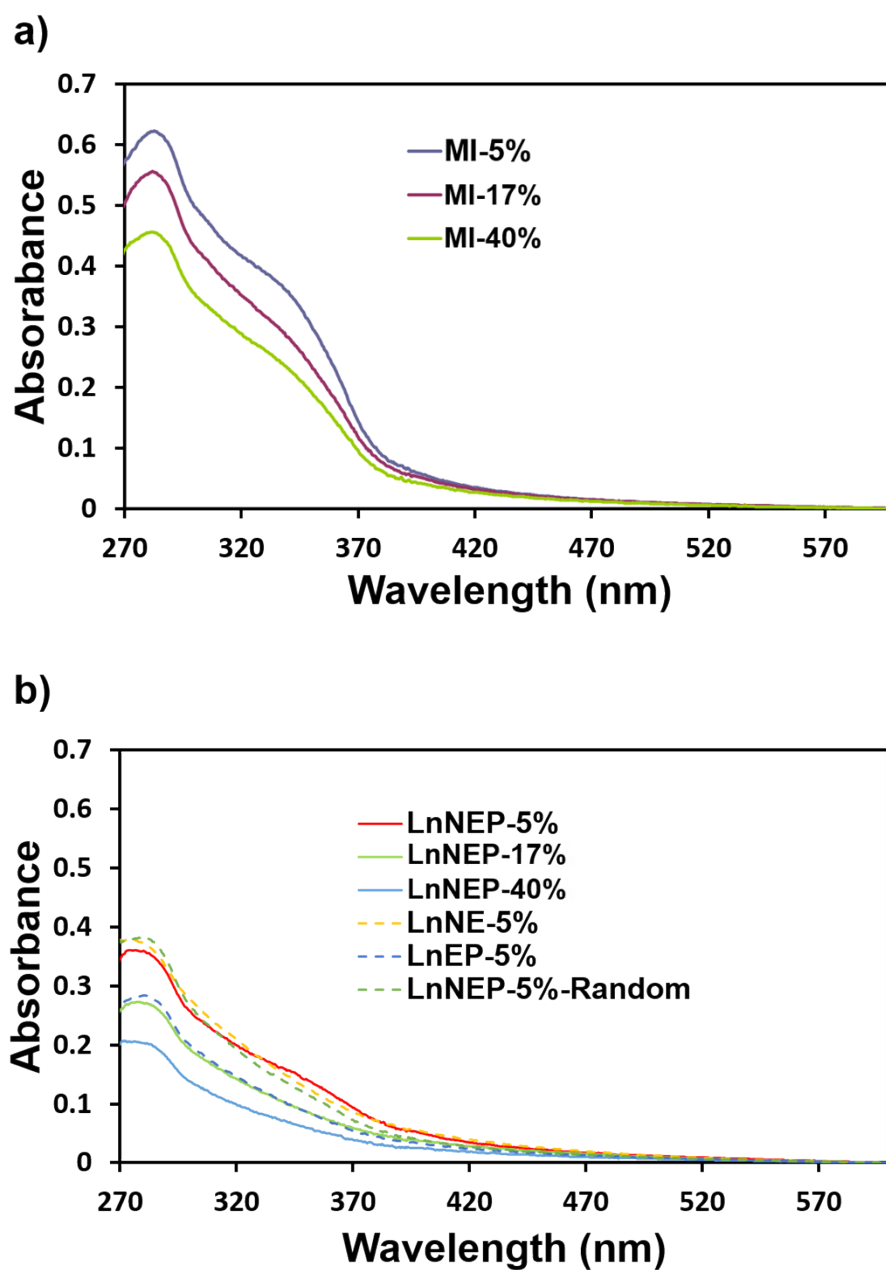


Figure S2. UV-vis spectra for lignin macro-initiators (MIs) at 0.025mg/mL. b) UV-vis spectra for lignin-based copolymers (LnNEPs) at 0.125mg/mL.

Table S1. UV absorbance data for lignin macroinitiators (MIs), lignin-based copolymers (LnNEPs) and control copolymers.

Sample Name	Peak Absorbance Value at 282 nm	Lignin Content (%)
MI-5%	0.623	94.4
MI-17%	0.555	84.1
MI-40%	0.456	69.1
LnNEP-5%	0.355	10.8
LnNEP-17%	0.270	8.18
LnNEP-40%	0.202	6.12
LnNE-5%	0.380	11.52
LnEP-5%	0.283	8.58
LnNEP-5%-Random	0.378	11.51

Table S2. Rheological Characteristics of Hydrogels of LnNEP Copolymers at 7wt% Concentration

Sample Name	Concentration (wt %)	G' (Pa) ^a	G'' (Pa) ^a	CGT (°C) ^b
LnNEP-5%	7.0	13870	6597	33.7
LnNEP-17%	7.0	9112	4234	32.8
LnNEP-40%	7.0	2722	1159	32.1

^a G' , G'' values recorded at 35.7 °C. ^b Critical gelation temperature (CGT) determined at the crossover point of G' and G'' in temperature sweep.