Electronic Supplementary Material (ESI) for Energy Advances.

Photo-Thermal Conversion Ability of PEG and H_2O Based Microfluids of Sodium Lignosulfonate and Its Carbonized Form

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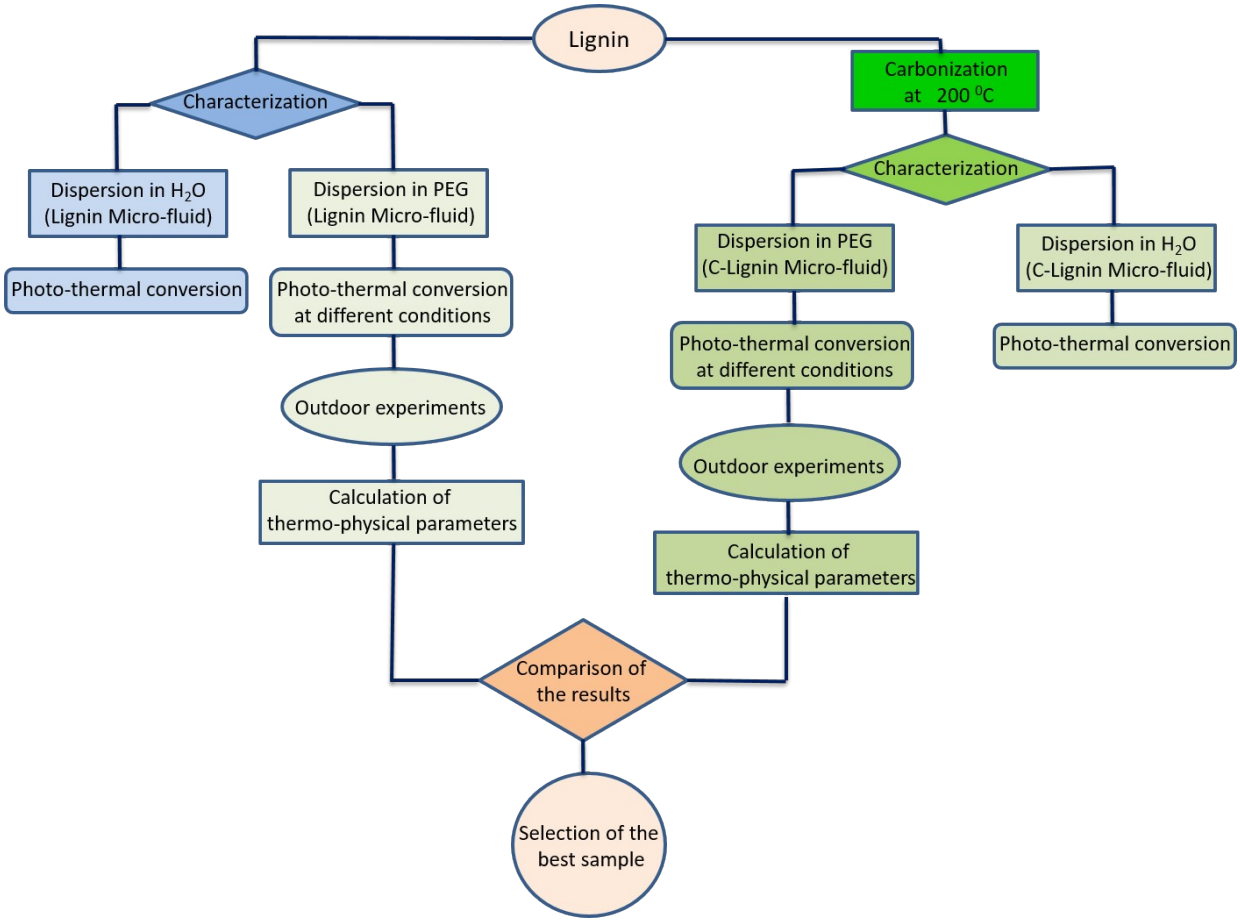


Fig. S1. The research flow chart of the present work.

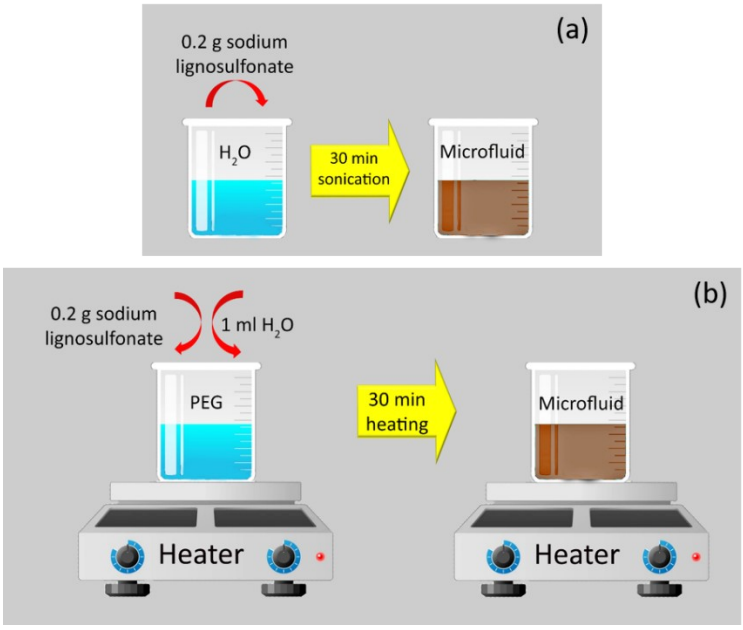


Fig. S2. The schematic of the used steps for preparation of (a) Lignin/H_2O and (b) Lignin/PEG microfluids.

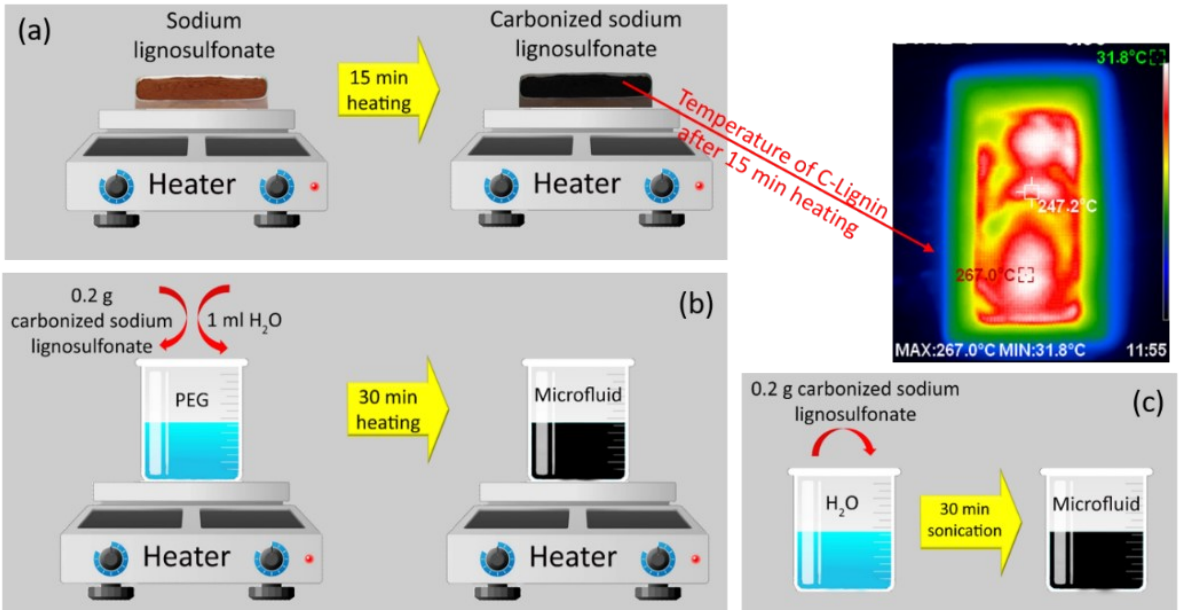
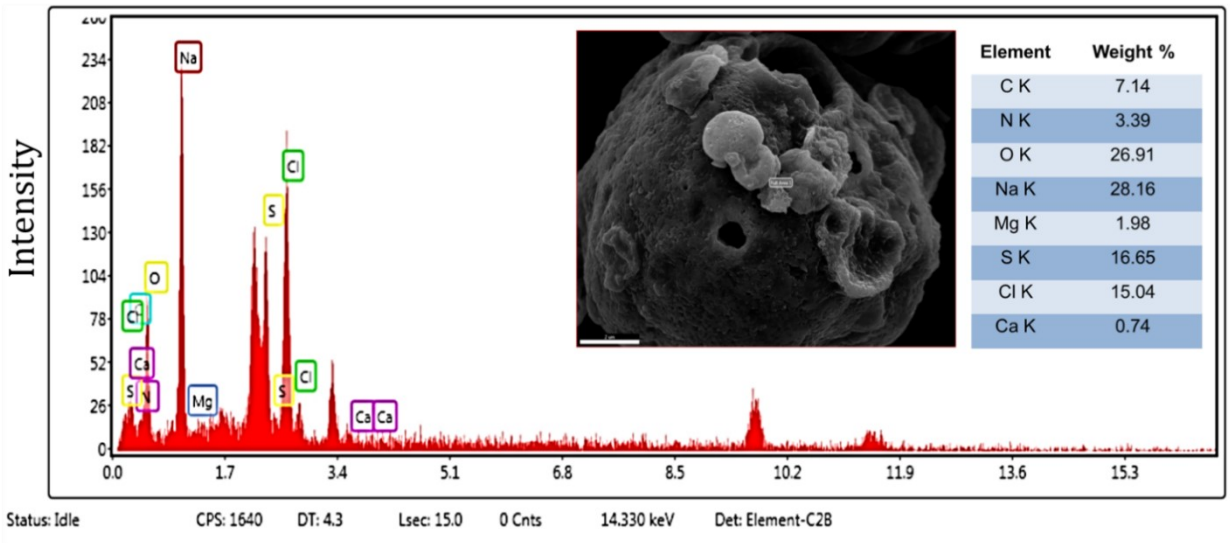


Fig. S3. The schematically representation of the preparation steps of (a) C-Lignin, (b) C-Lignin/H_2O, and (c) C-Lignin/PEG microfluids.

(a)



Binding energy (k eV)

(b)

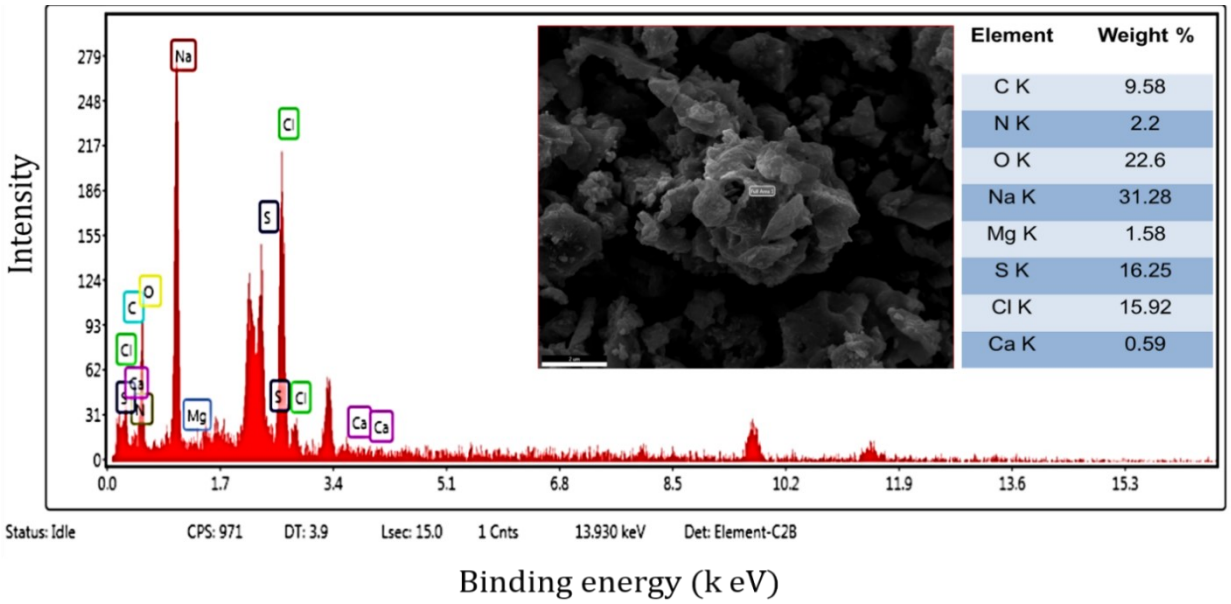
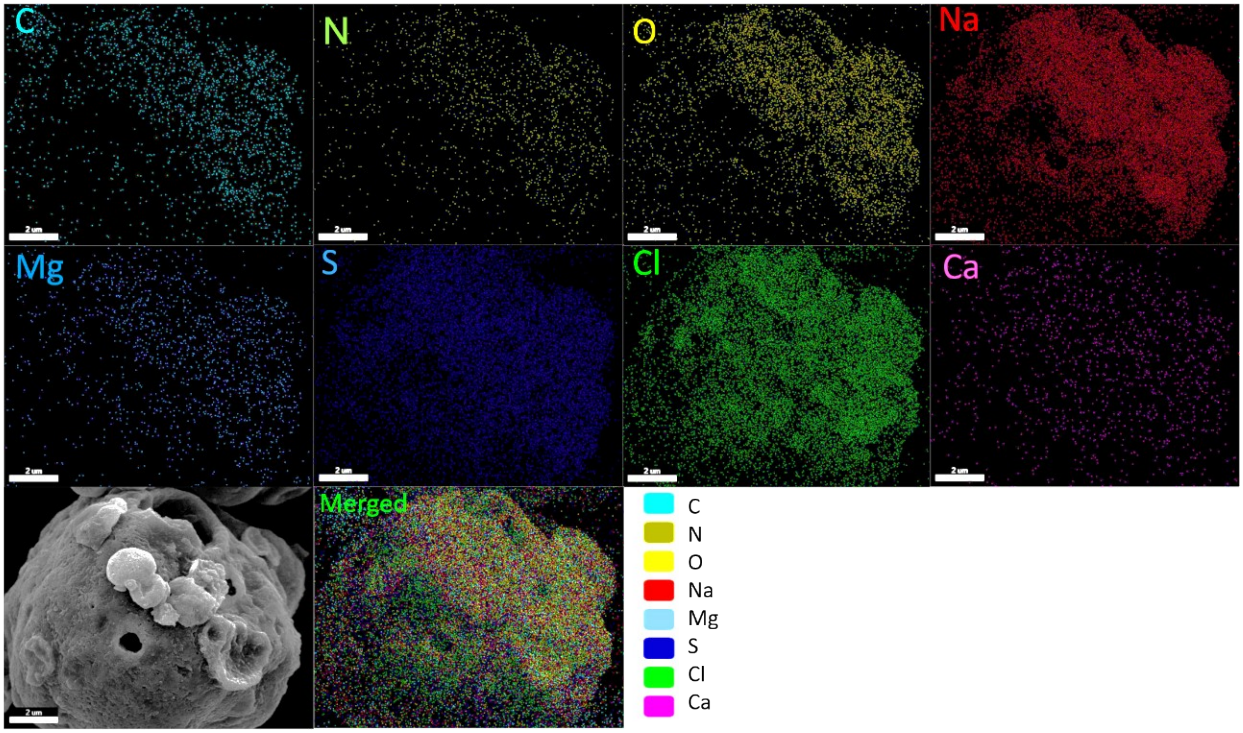


Fig. S4. EDX diagram of (a) Lignin and (b) C-Lignin.

(a)



(b)

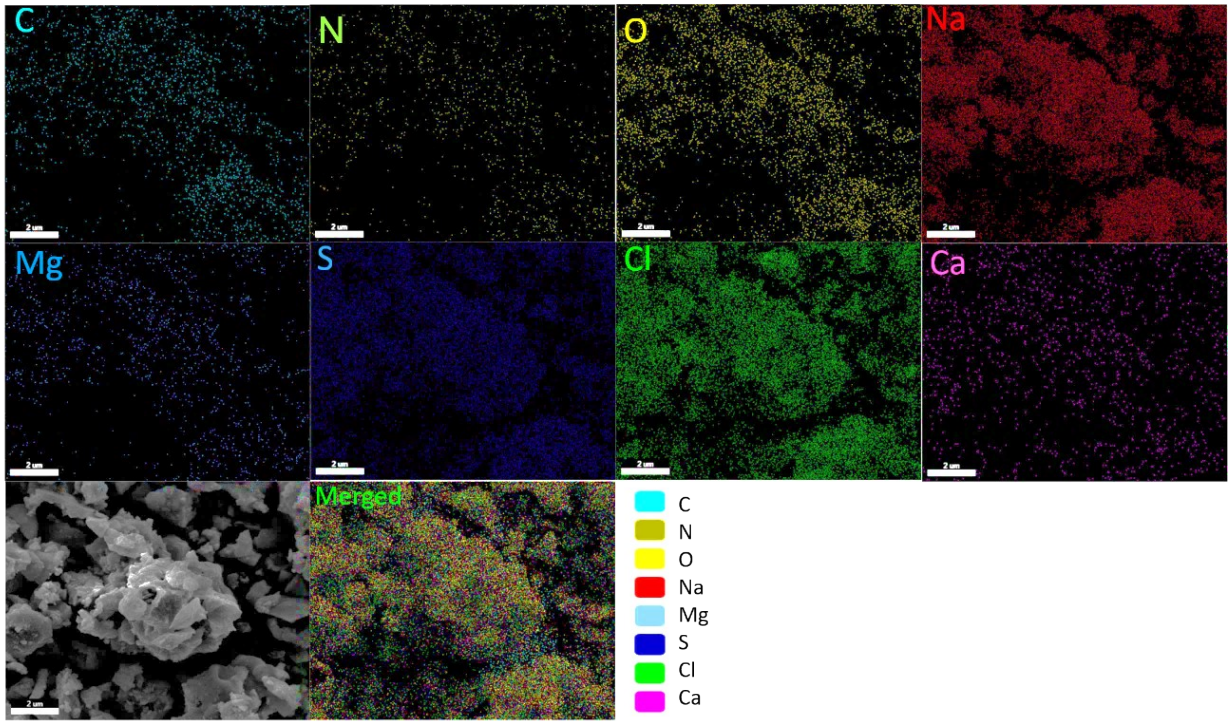


Fig. S5. Elemental map and corresponding SEM image of (a) Lignin and (b) C-Lignin.

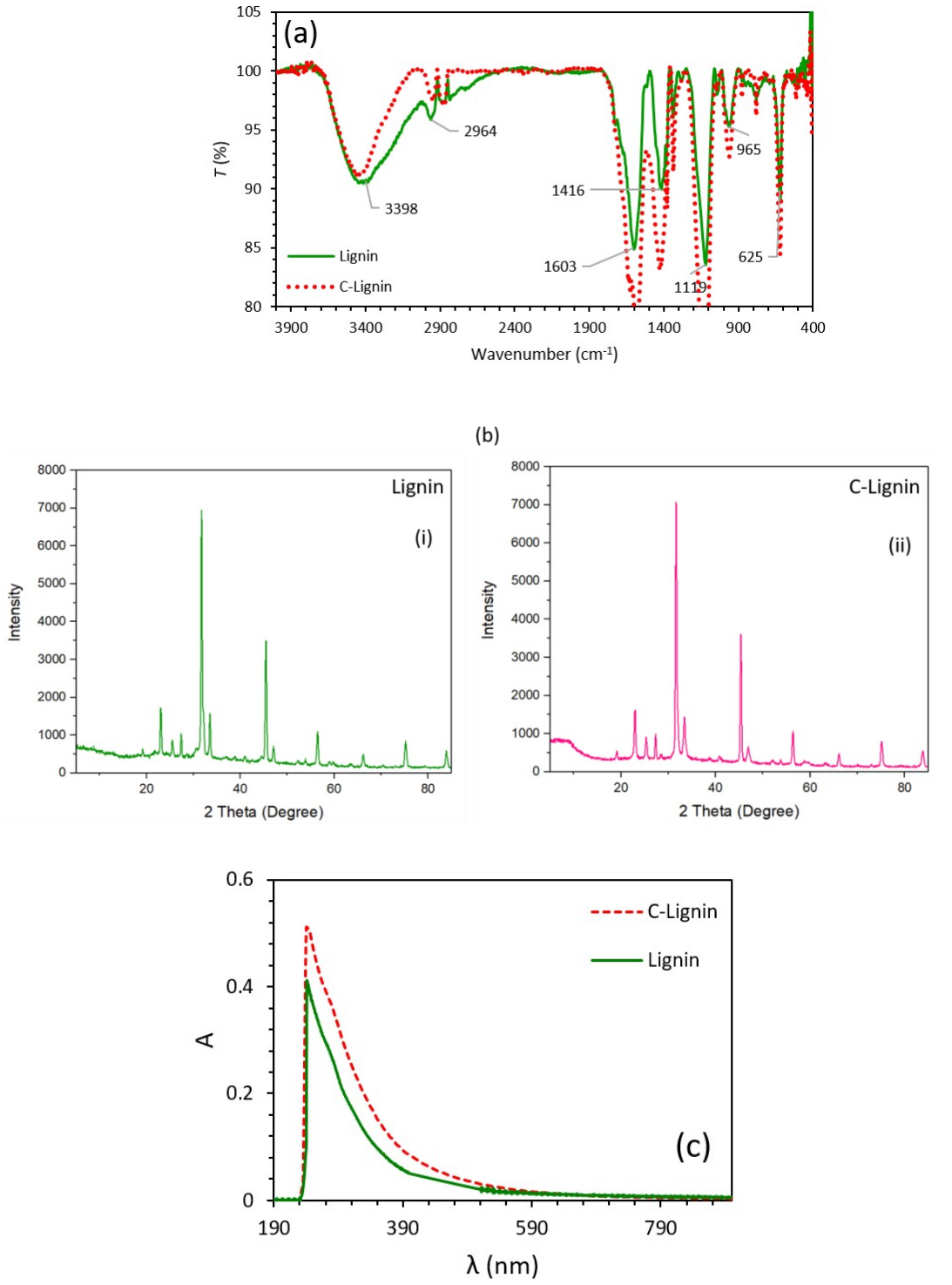
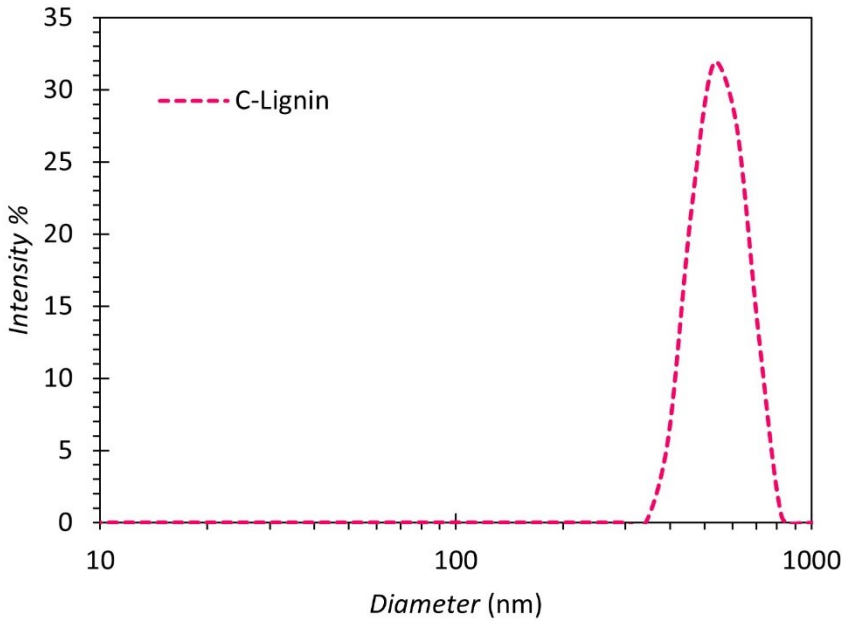


Fig. S6. (a) FT-IR spectra of Lignin and C-Lignin. (b) XRD spectrum of (i) Lignin and (ii) C-Lignin. (c) Absorption spectra of Lignin/PEG (diluted 83 times) and C-Lignin/PEG (diluted 20 times).

(a)



(b)

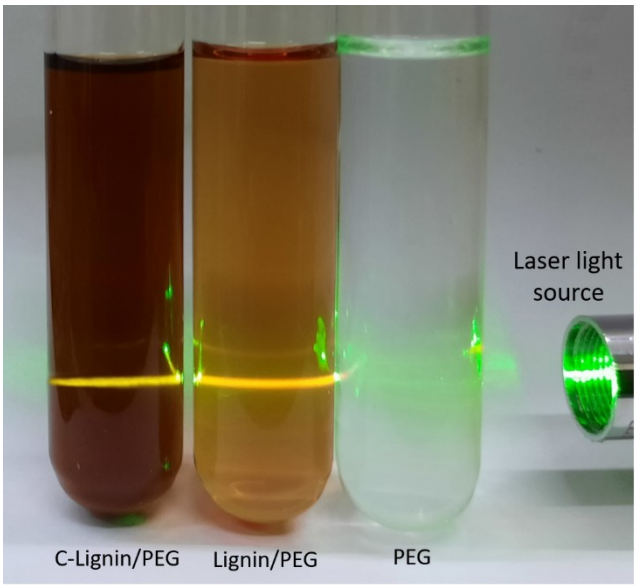


Fig. S7. (a) DLS histogram of the C-Lignin/PEG (diluted 10 times). (b) Path of the laser light in Lignin/PEG, C-Lignin/PEG, and PEG fluids.

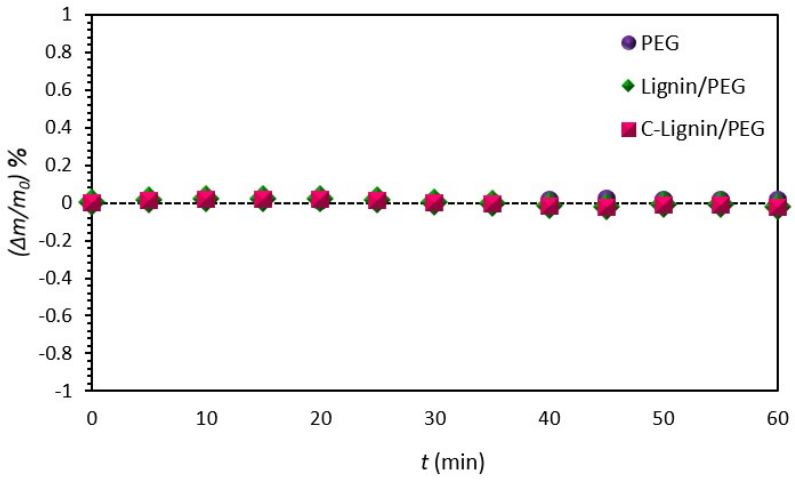


Fig. S8. Graph of $\left(\frac{\Delta m}{m_0}\%\right)$ of synthesized MFs and PEG vs. time during 60 min light irradiation.

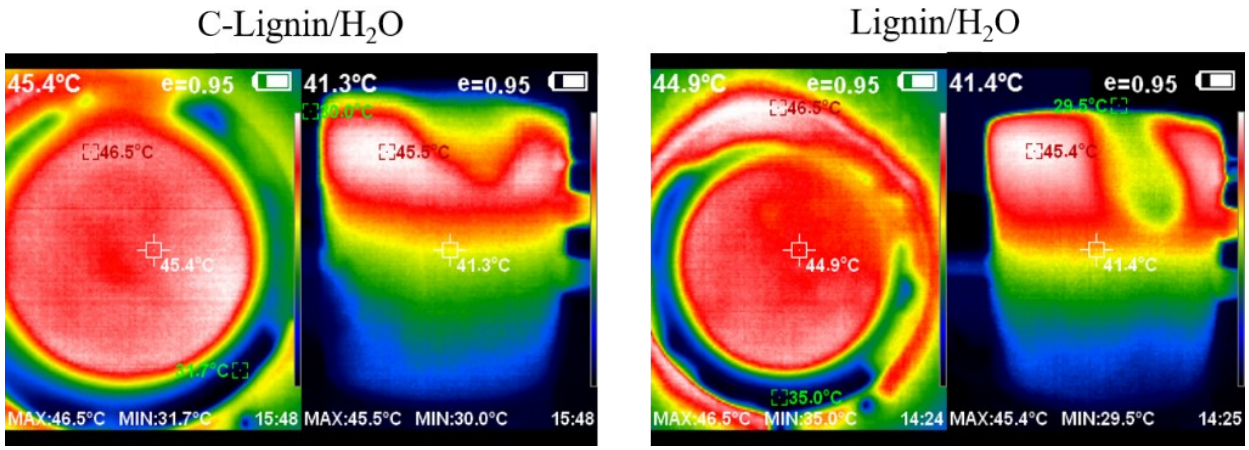


Fig. S9. The corresponding IR images from different views of Lignin/H_2O and C-Lignin/H_2O fluids.

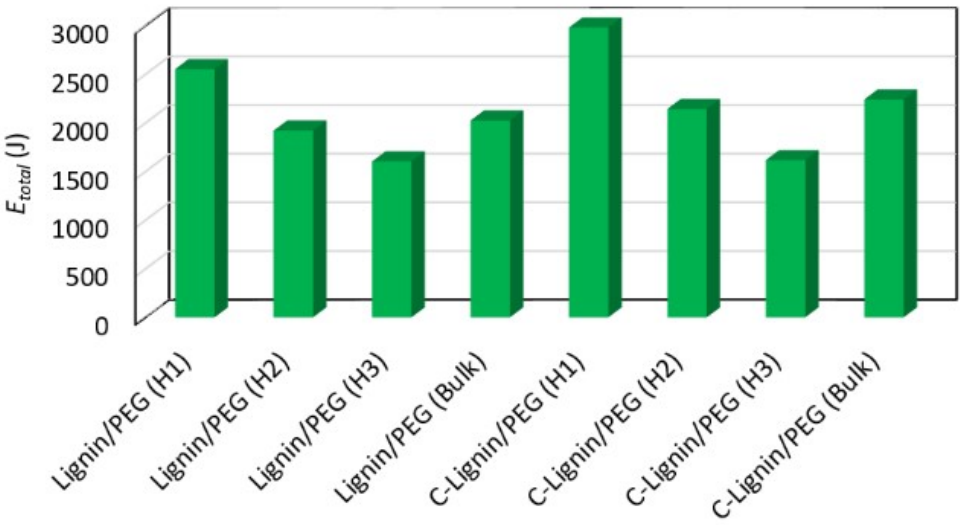


Fig. S10. Graphs of total stored energy for Lignin/PEG and C-Lignin/PEG MFs at different heights from the surface.

Table S1. The constants A and B obtained from fitting the experimental data of the heating and cooling stages of samples.

Height	A ($^{\circ}C/s$)	B (s^{-1})	R^2
H1 (Heating)	0.0156	0.00062	0.992243
H2 (Heating)	0.0073	0.00020	0.999427
H3 (Heating)	0.0046	0.00005	0.999575
Bulk	0.0092	0.00029	-
H1 (Cooling)	-	0.00044	0.903122
H2 (Cooling)	-	0.00023	0.990456
H3 (Cooling)	-	0.00011	0.899733
Bulk	-	0.00026	-