Supporting Information

Soybean Oil-Derived, Non-Isocyanate Polyurethane-TiO_2 Nanocomposites with Enhanced Thermal, Mechanical, Hydrophobic and Antimicrobial Properties

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Figure S1. Images of ESBO and CSBO Resin.

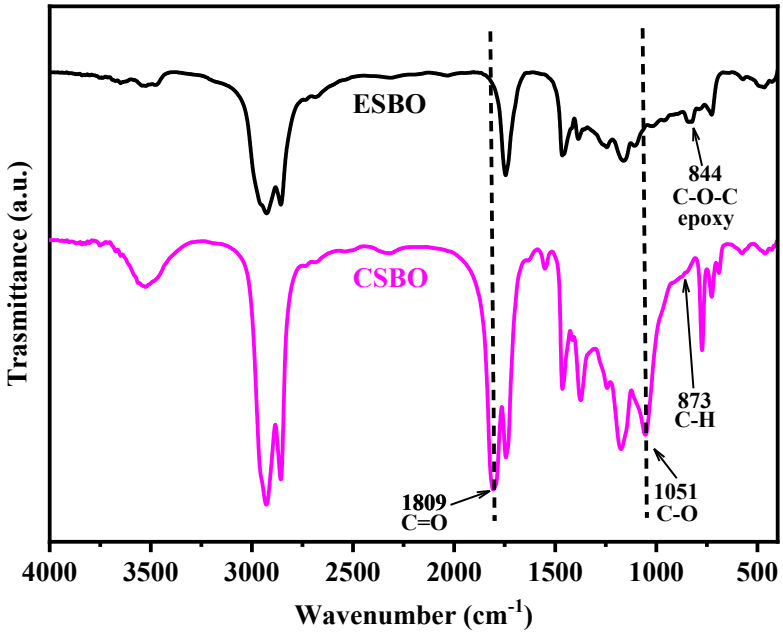

Figure S2. FT-IR spectra of ESBO and CSBO.

The IR spectra for both ESBO and CSBO are depicted in Figure S2. In the FTIR spectrum, a peak at 844 cm^{-1} indicates the presence of epoxy groups in ESBO. This peak is entirely absent in the CSBO spectrum, confirming the consumption of the epoxy groups during the carbonation process. Additionally, new peaks emerge at approximately 1809 cm^{-1}, 1175 cm^{-1}, 1051 cm^{-1}, and 873 cm^{-1}, corresponding to carbonyl stretching of the cyclic carbonate, C-O of carbonyl attached, C–O stretching of alkyl chain attached, and C–H stretching at the α-

position of the carbonate ring, respectively, also confirmed from our previously reported studies.[1–3]

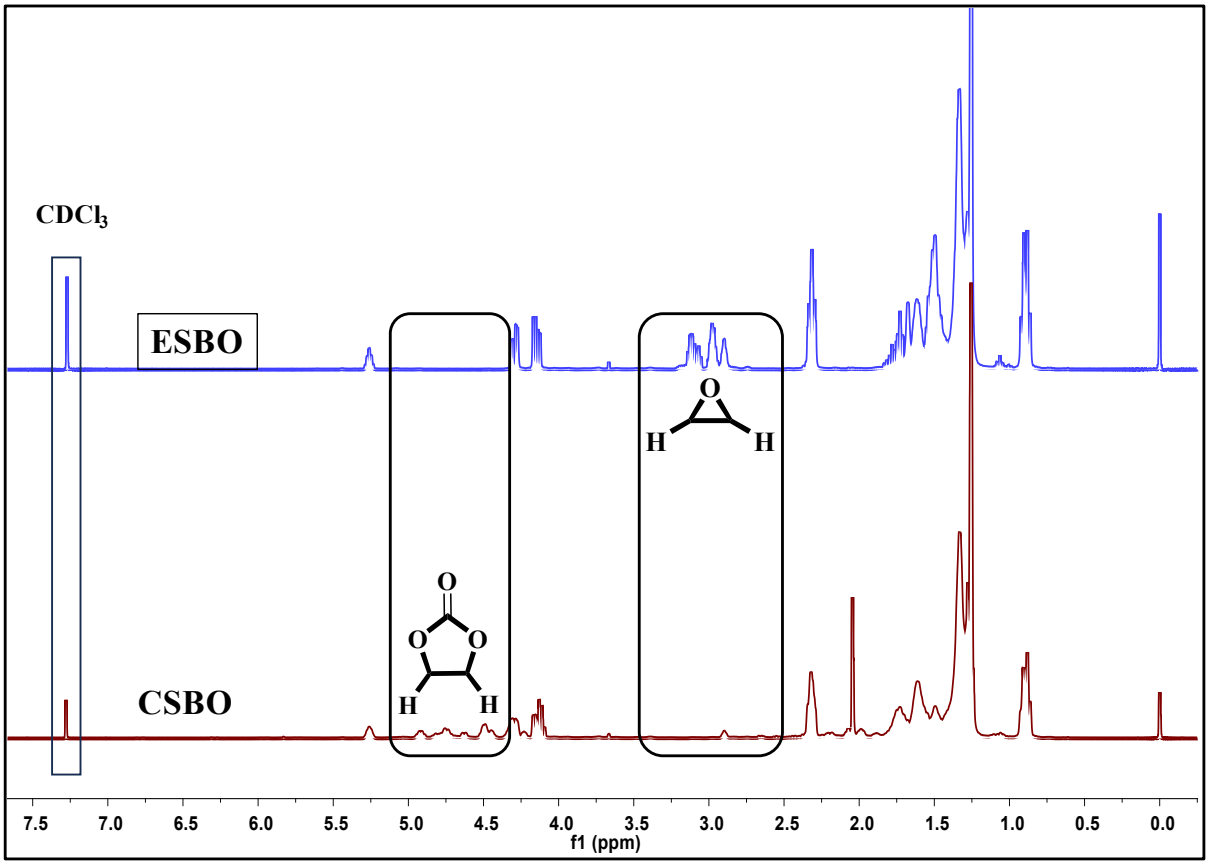

Figure S3. ^{1}H NMR of ESBO and CSBO.

Further confirmation of the epoxy-to-carbonate conversion was obtained using ^{1}H NMR spectroscopy, as shown in Figures S3. In the ^{1}H NMR spectra, the complete disappearance of signals between 2.7 and 3.3 ppm, which correspond to the protons attached to the epoxy groups in ESBO, and the appearance of new signals between 4.3 and 4.8 ppm, representing the hydrogens attached to the cyclic carbonate in CSBO, verify the successful formation of the cyclic carbonate structure. This shift in chemical shifts indicates the successful insertion of CO_2 and the formation of the cyclic carbonate structure.[1–3]

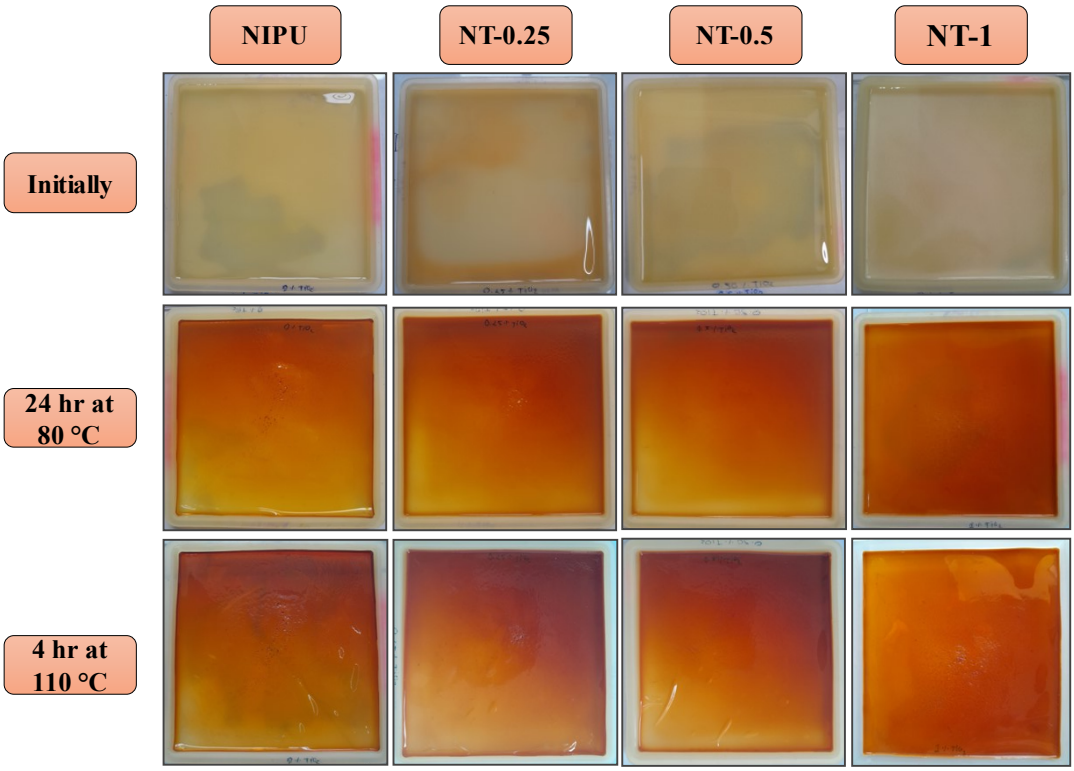

Figure S4. Synthesized film curing appearance after 6 days of NIPU, NT-0.25, NT-0.5, and NT-1 films.

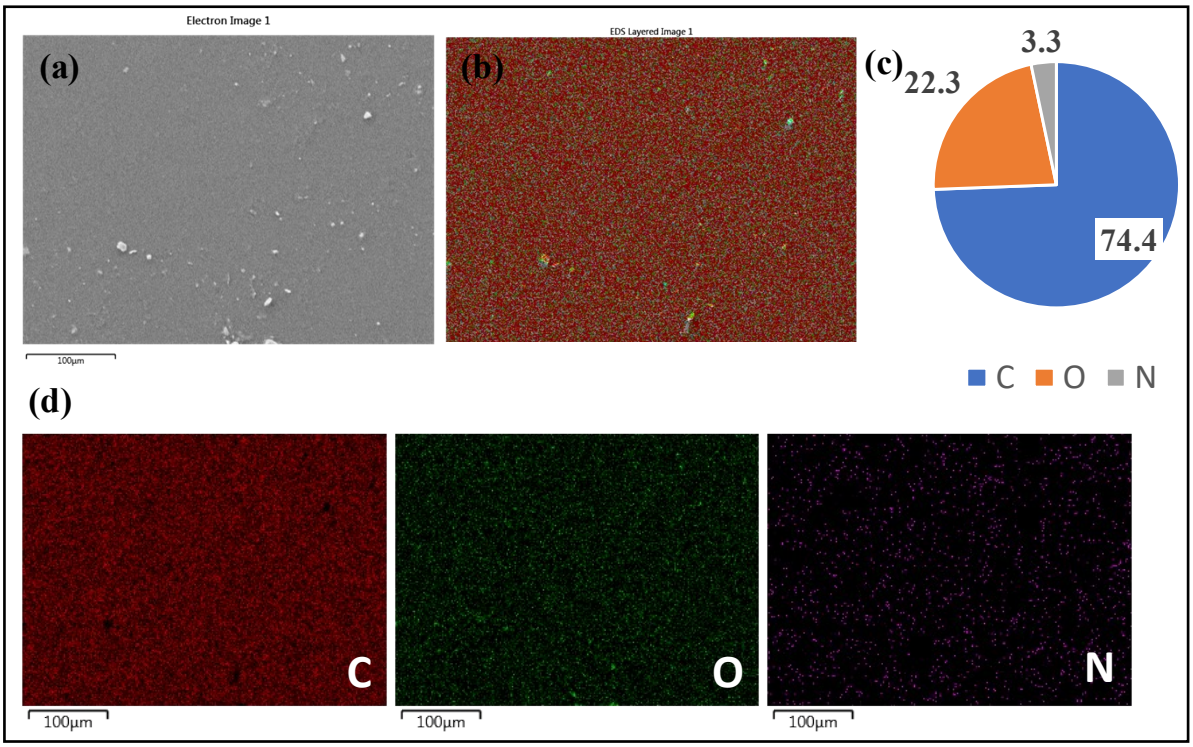

Figure S5. NIPU Films of (a) FE-SEM Image, (b) EDS mapping, (c) EDX percentage distributions of elements, and (d) elemental mapping of C, O, and N.

Reference.

1 L. Poussard, J. Mariage, B. Grignard, C. Detrembleur, C. Jéroîme, C. Calberg, B. Heinrichs, J. De Winter, P. Gerbaux, J. M. Raquez, L. Bonnaud and P. Dubois, *Macromolecules*, 2016, **49**, 2162–2171.

2 N. Dhore, E. Prasad, R. Narayan, C. R. K. Rao and A. Palanisamy, *Sustain. Chem.*, 2023, **4**, 95–109.

3 P. Patel, F. M. de Souza and R. K. Gupta, *ACS Omega*, 2024, **9**, 5862–5875.