Renewable Atom-Efficient Polyesters and Thermosetting Resins Derived from High Oleic Soybean Oil

Shichao Xu[a,b], Meghan E. Lamm[a], Md Anisur Rahman[a], Xinzhou Zhang[a], Tianyu Zhu[a], Zhendong Zhao[b], Chuanbing Tang[a*]

[a]*Department of Chemistry and Biochemistry, University of South Carolina, Columbia, South Carolina 29208, USA*

[b]*Institute of Chemical Industry of Forest Products, Chinese Academy of Forestry, Nanjing 210042, China*

[*]Corresponding author E-mail: tang4@mailbox.sc.edu

Supplementary Information

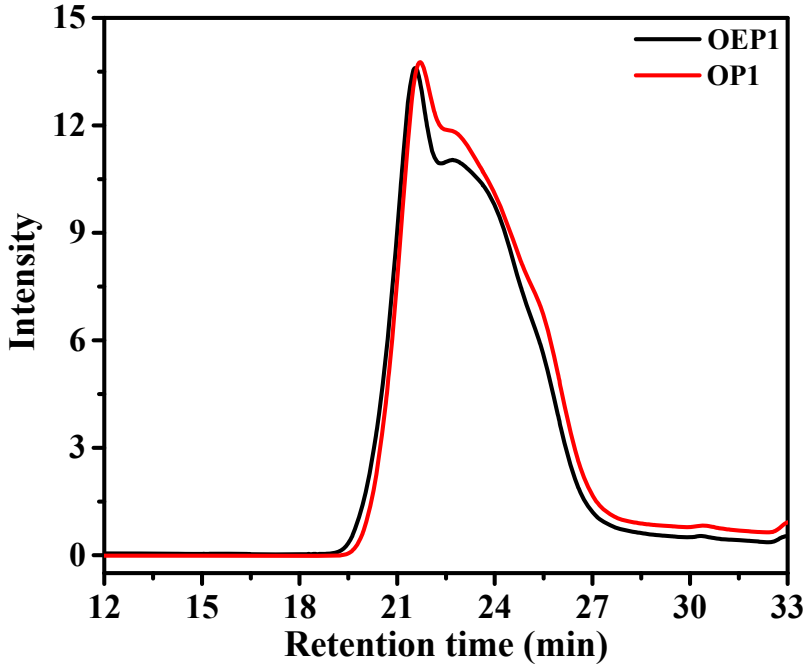


Figure S1. GPC curves of OP1 and OEP1.

Table S1. Curing results of OEPs with a ratio of epoxide to anhydride at 1:0.7.

Sample name	Curing time (h)	T_{peak} (°C)	ΔH (J/g)	ΔH_t (J/g)	Cure degree (α_t)
OEP1	12	170.5	−121.9	−23.5	80.7%
OEP2	12	165.7	−96.5	−18.5	81.8%
OEP3	12	165.0	−114.0	−13.8	87.9%
OEP4	12	160.8	−126.4	−18.8	85.1%

Table S2. Mechanical properties of RESINs.

Thermosets	Epoxide/anhydride ratio	Tensile strength (MPa)	Strain at Break (%)	Young's Modulus (MPa)
RESIN1	1:0.9	1.6 ± 0.1	68 ± 4	3.5 ± 0.1
RESIN1	1:0.8	2.0 ± 0.2	73 ± 5	4.1 ± 0.3
RESIN1	1:0.7	2.1 ± 0.2	72 ± 5	3.9 ± 0.1
RESIN1	1:0.6	1.5 ± 0.1	50 ± 3	4.4 ± 0.2
RESIN1	1:0.5	1.3 ± 0.2	36 ± 2	5.6 ± 0.2
RESIN1	1:0.4	1.2 ± 0.1	29 ± 2	5.8 ± 0.4
RESIN2	1:0.7	1.9 ± 0.2	97 ± 7	2.5 ± 0.1
RESIN3	1:0.7	4.7 ± 0.3	91 ± 6	7.6 ± 0.5
RESIN4	1:0.7	10.4 ± 0.6	86 ± 6	208.1 ± 10

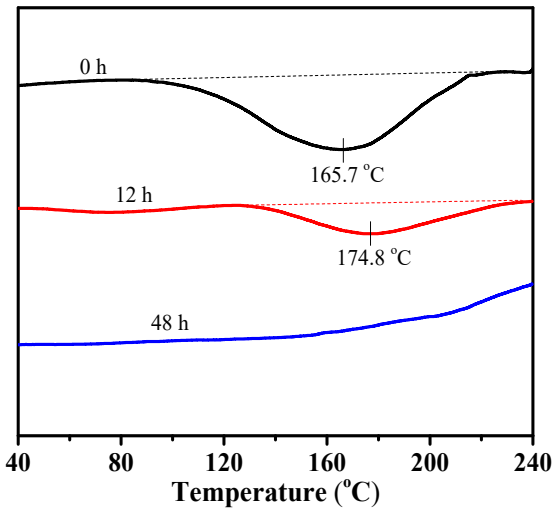


Figure S2. DSC curves of RESIN2 with the ratio of OEP2 to anhydride at 1:0.7.

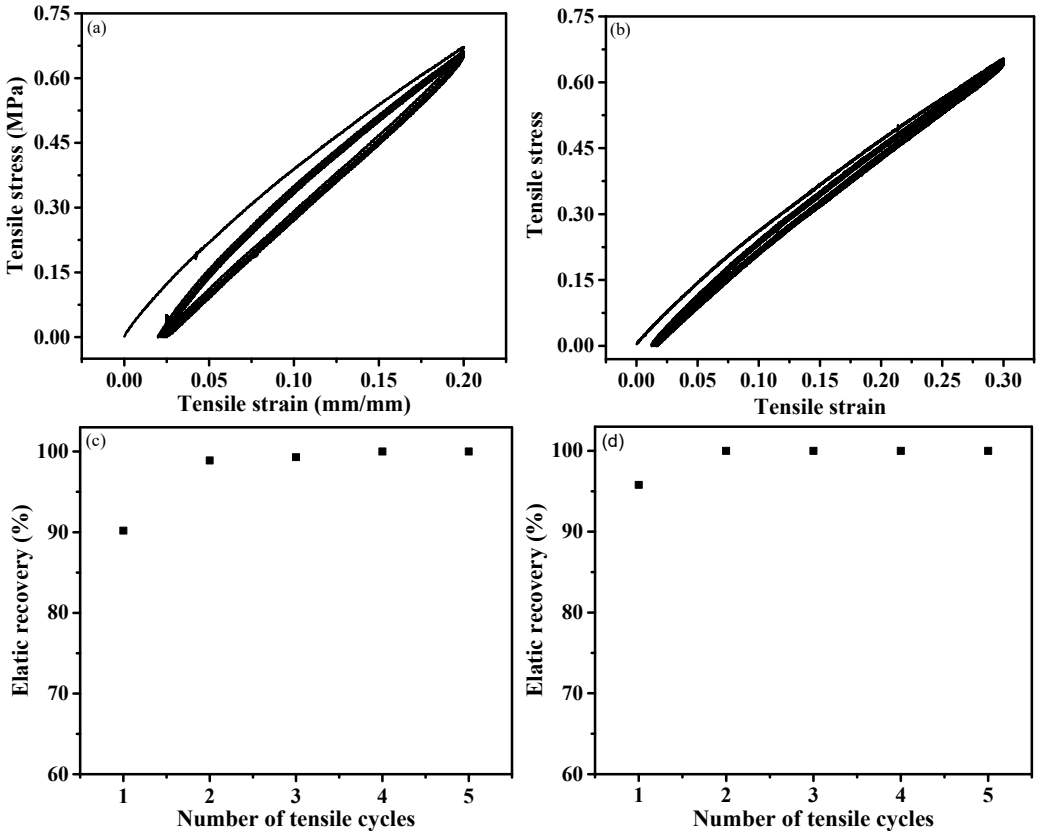


Figure S3. Cyclic tensile tests of RESIN1 (a) and RESIN2 (b) and elastic recovery as a function of tensile cycles for RESIN1 (c) and RESIN2 (d).

Table S3. The main thermal property data of RESINs.

Sample name	T_d (°C)	T_{10} (°C)	T_{50} (°C)	T_{max} (°C)	Residue (%)
RESIN1	274.9	324.9	382.4	382.6	1.50
RESIN2	262.6	307.6	377.6	383.3	0.66
RESIN3	264.8	327.3	382.3	383.7	3.17
RESIN4	276.2	321.2	378.7	380.5	0.58

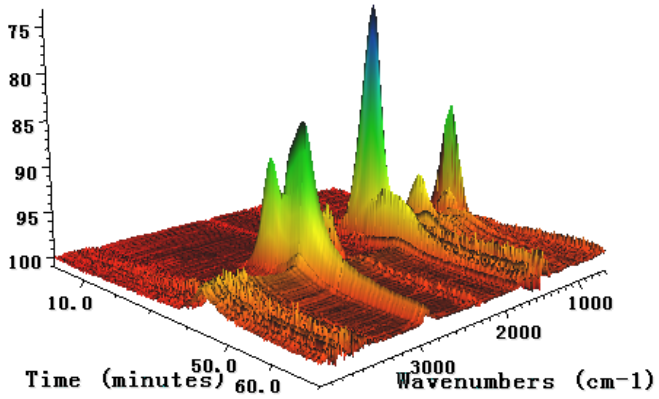


Figure S4. TG-FTIR spectrum of RESIN2.

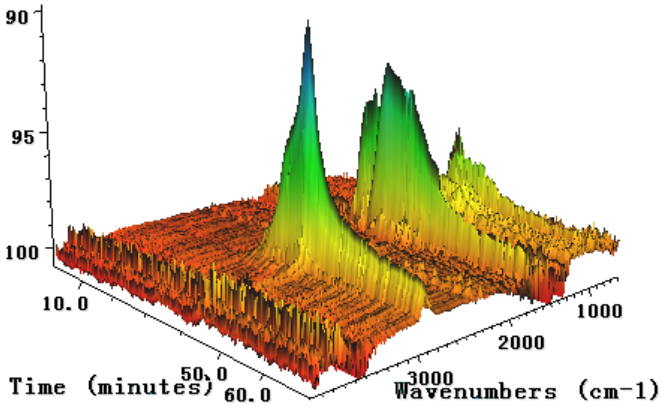


Figure S5. TG-FTIR spectrum of RESIN3.

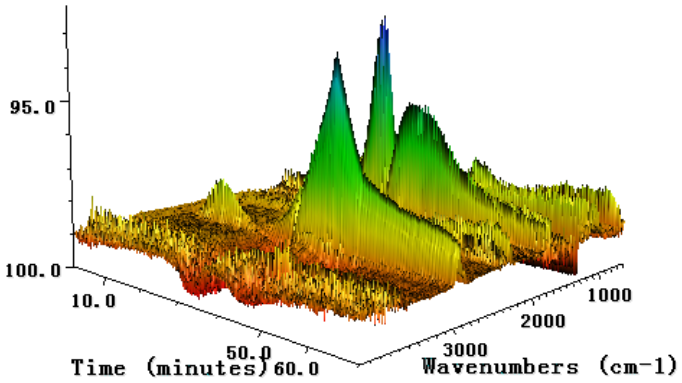
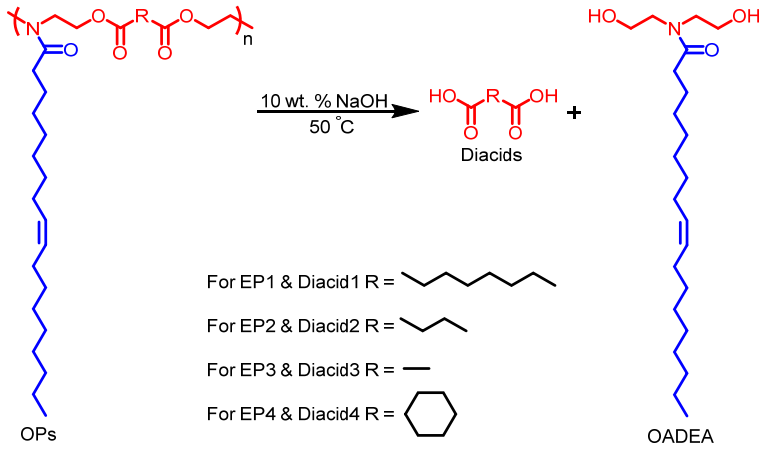
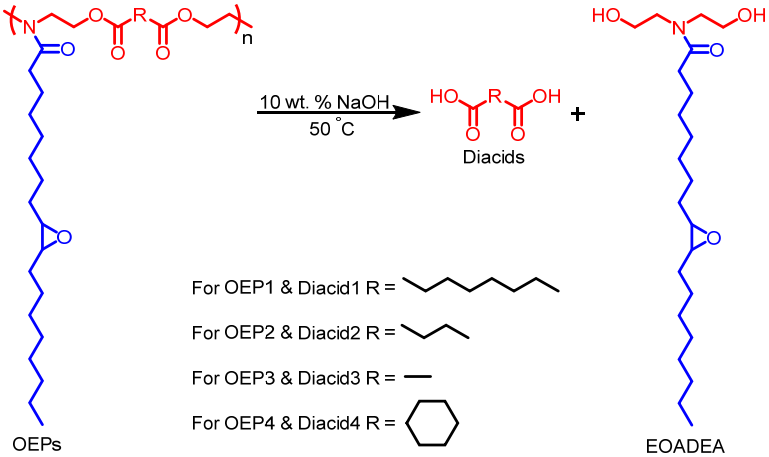


Figure S6. TG-FTIR spectrum of RESIN4.

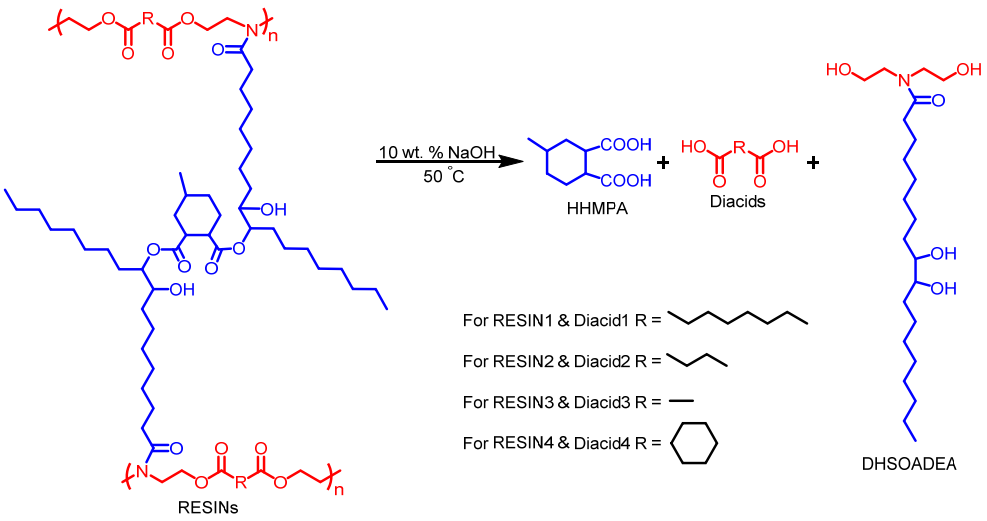
Scheme S1. Schematic illustration for the degradation of OPs.



Scheme S2. Schematic illustration for the degradation of OEPs.



Scheme S3. Schematic illustration for the degradation of RESINs.



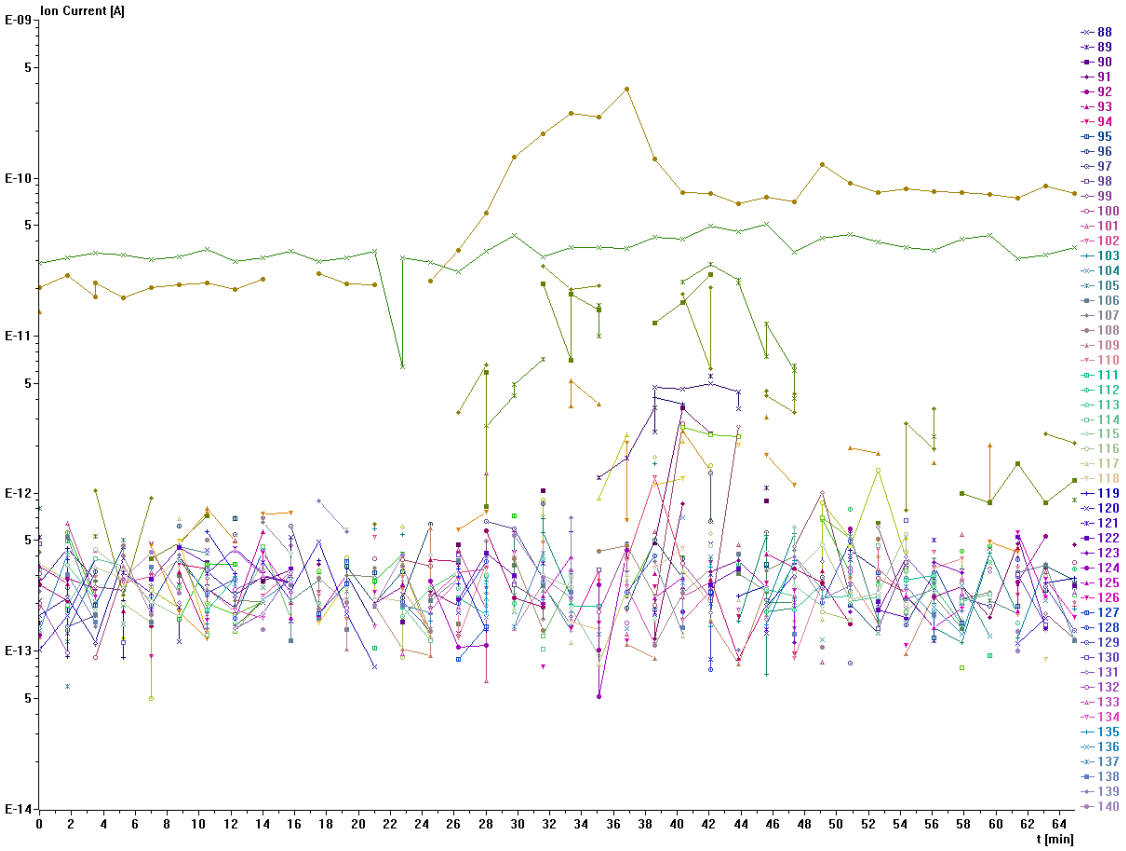


Figure S7. MS spectra of decomposition products of RESIN1 at the highest decomposition temperature.

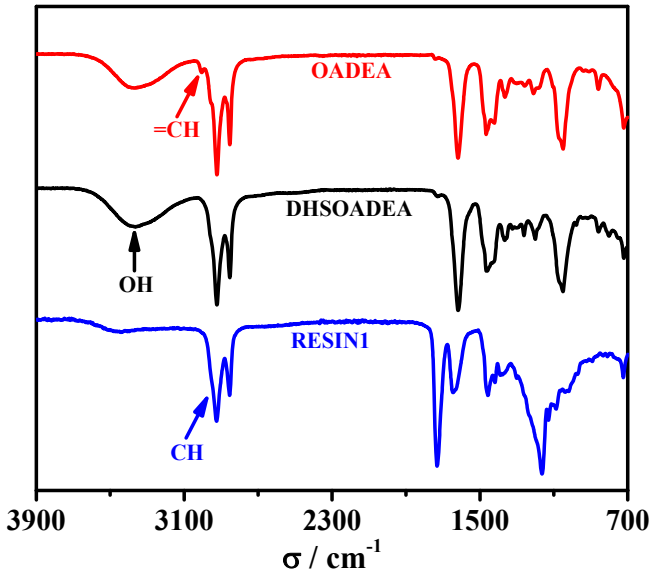


Figure S8. FT-IR spectra of OADEA, DHSOADEA and RESIN1.