

Supporting information

For:

Study of green epoxy resins derived from renewable cinnamic acid and dipentene: Synthesis, curing and properties

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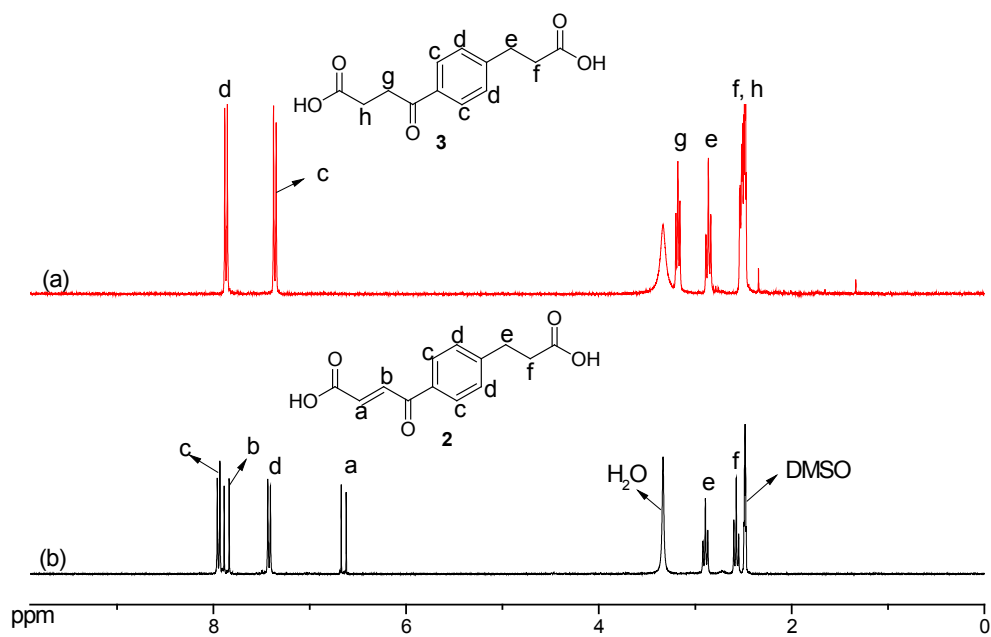
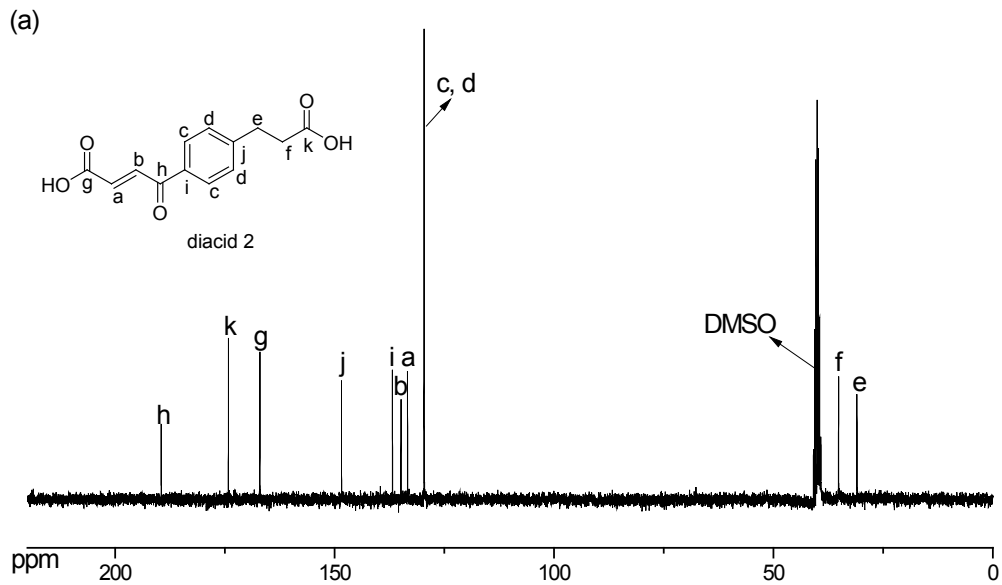


Figure S1. ^1H NMR spectra of diacid 2 (b) and diacid 3 (a)



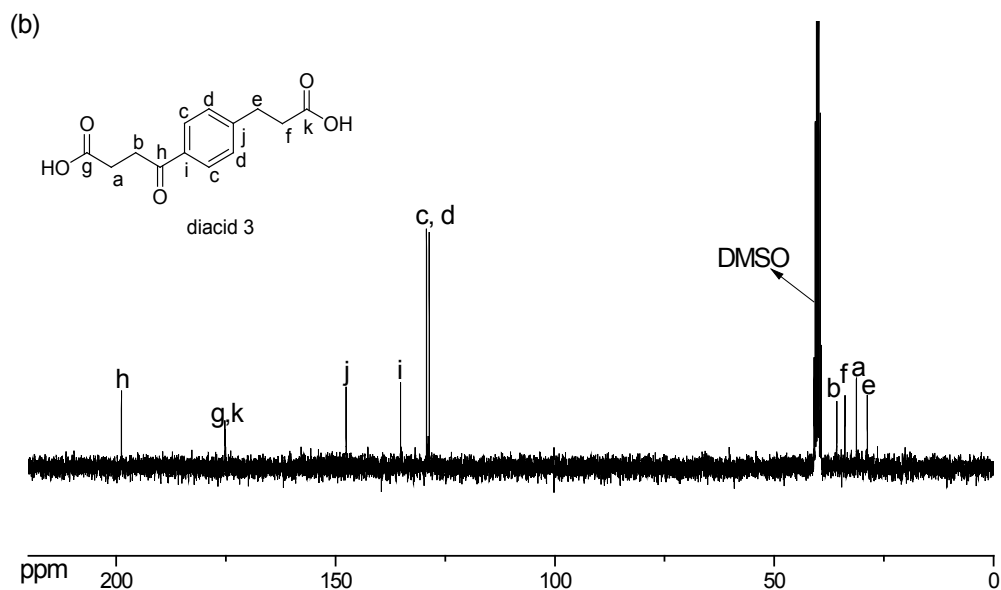


Figure S2. ^{13}C NMR spectra of diacid **2** (a) and diacid **3** (b)

In the spectrum of diacid **2** (Figure S1b), the peaks (e, f) at 2.57 and 2.89 ppm were attributed to the protons of CH_2 from cinnamic acid. The two *dd* peaks (a, b) at 6.52-6.67 and 7.84-7.89 ppm were assigned to the protons of $\text{C}=\text{C}$ from maleic anhydride. Another two *dd* peaks (d, c) at 7.41-7.43 and 7.93-7.95 ppm suggested that Friedel-Craft reaction happened on *para* position of benzene rather than *ortho*-position. After reduction, the two *dd* peaks in diacid **2** disappeared. Accordingly, new peaks (h, g) at 2.84-2.89 and 3.16-3.20 ppm was found in the ^1H NMR of diacid **3**, which were attributed to the protons on the two $-\text{CH}_2-$ originated from $\text{C}=\text{C}$. The molecular structures of diacid **2** and diacid **3** also were characterized by ^{13}C NMR (Figure S2). The chemical shifts of the carbons (a, b) of the double bonds shifted from 134.88, 133.38 ppm (Figure S2a) to 35.74, 31.27 ppm (Figure S2b), respectively.

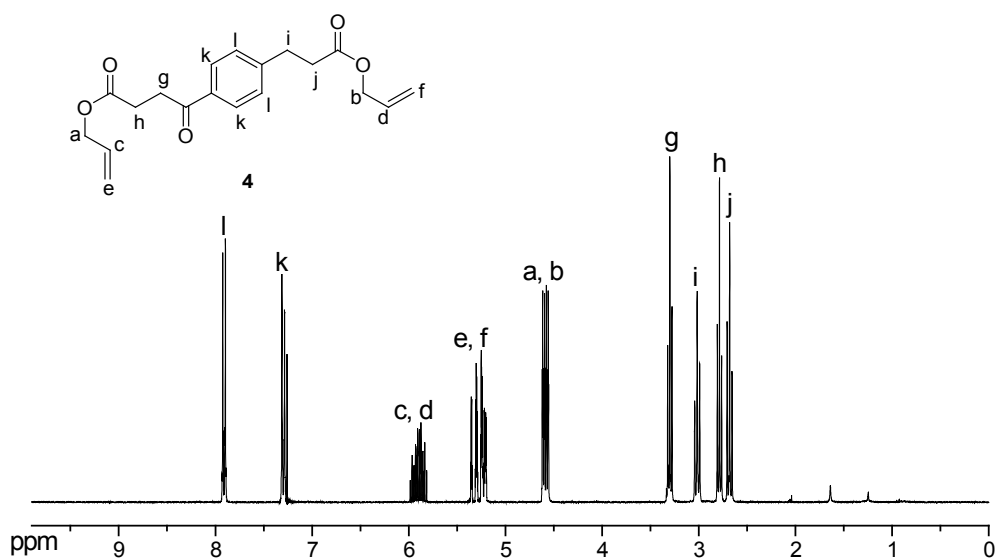


Figure S3. ¹H NMR of allyl 4-(4-(3-(allyloxy)-3-oxopropyl)phenyl)-4-oxobutanoate (compound 4).

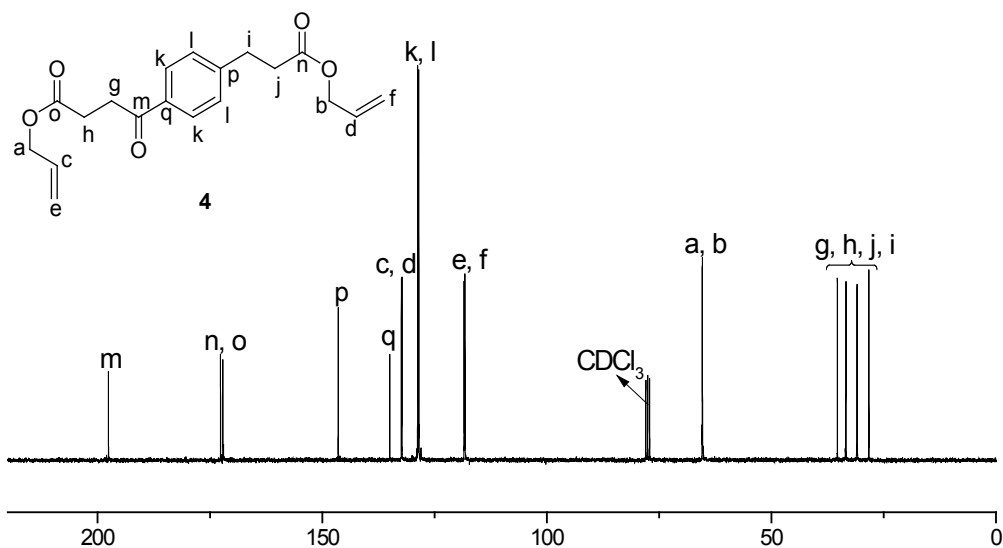


Figure S4. ¹³C NMR of allyl 4-(4-(3-(allyloxy)-3-oxopropyl)phenyl)-4-oxobutanoate (compound 4).

In the ¹H NMR spectrum of compound 4, the protons in the region of 5.20-5.36 (e, f) and 5.81-5.98 ppm (c, d) indicate the presence of two allylic double bonds. The chemical shifts at 4.55-4.62 ppm corresponded to the four CH₂-O protons (a, b). The chemical structure of compound 4

was also identified by ^{13}C NMR (Figure 4S). The *dd* peaks at 132.26-132.39 and 118.22-118.42 ppm belonged to the carbons (c, d, e, f) of the double bonds.

Figure S5 shows the FTIR spectra of compound **4** and Cin-epoxy. The absorption peaks at 3010 and 1510 cm^{-1} were attributed to the CH and C=C stretching of the double bonds of compound **4**. These two peaks in the spectrum of Cin-epoxy disappeared and a new peak at 930 cm^{-1} which was attributed to the oxirane ring was noted. The structure of compound **4** and Cin-epoxy were also identified by ESI-MS.

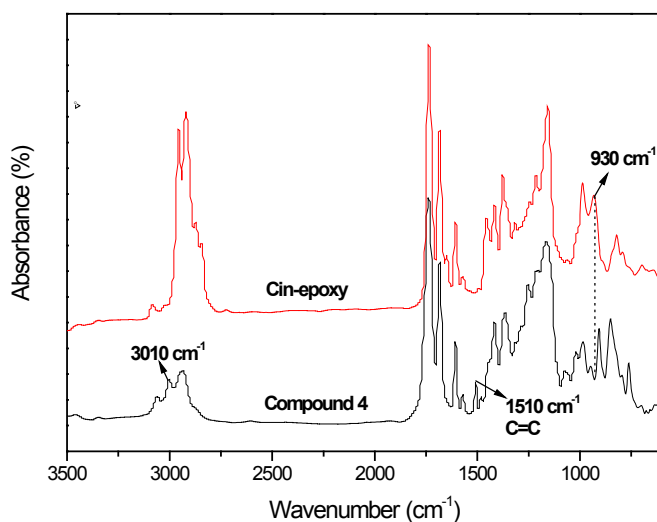


Figure S5. FTIR spectra of compound **4** and Cin-epoxy.