

Supporting Information

VOC-free tricomponent reaction platform for epoxy network formation mediated by a recyclable ionic liquid

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Purification of 1-butyl-3-methylimidazolium chloride

The active carbon (5 w%) was added to the IL in presence of dichloromethane to decrease the viscosity of the mixture. The mixture was stirred for 24 h, then filtered and was left to dry at room temperature. The solvent was removed under vacuum. After, the ionic liquid was put in a freezer overnight for crystallization. The structure and purity of IL was confirmed by ^1H NMR (600 MHz - $\text{DMSO}-d_6$ - Fig. S1), δ 9.33 (s, 1H), 7.81 (t, $J = 1.76$ Hz, 1H), 7.74 (t, $J = 1.73$ Hz, 1H), 4.18 (t, $J = 7.17$ Hz, 2H), 3.86 (s, 3H), 1.76 (quint, $J = 7.26$ Hz, 2H), 1.25 (sext, $J = 7.6$, 2H), 0.89 (t, $J = 7.37$ Hz, 3H).

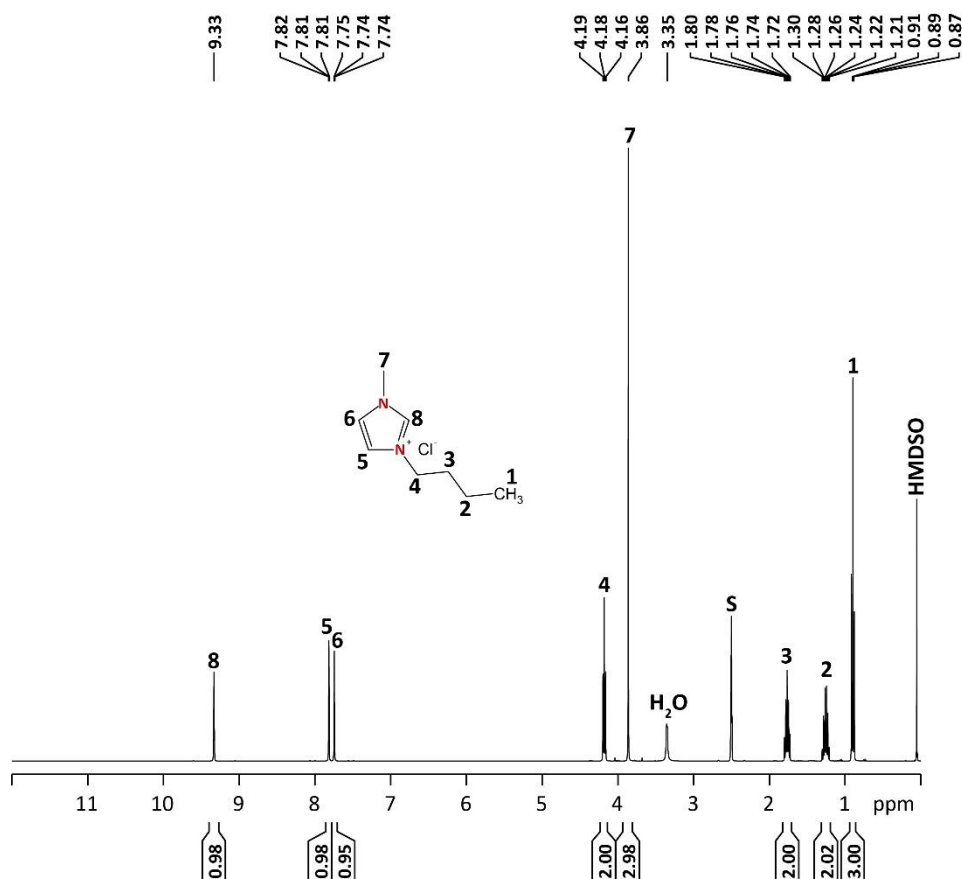


Figure S1: ^1H NMR spectra of BMImCl (in $\text{DMSO}-d_6$).

Synthesis of bio-based epoxy resin (DGEMHQ)

The synthesis of bio-based epoxy resin was proceeded as follows: methoxyhydroquinone (1 mol), TEBAC (1 mol) and epichlorohydrin (10 mol), were mixed at room temperature for 1 h and at 80 °C for 30 min. The mixture was then cooled down to room temperature and 266 mL of NaOH solution (5 M) and of TEBAC (0.1 mol) were added to the mixture and it was stirred for 30 min at 25 °C. After, a mixture of ethyl acetate/distilled water was added to the mixture and mixed for 5 min. Then, an extraction was carried out in an aqueous phase with ethyl acetate. The organic phase containing the epoxy resin was rinsed with an aqueous solution of sodium chloride. The excess of ethyl acetate and epichlorohydrin was eliminated by rotary evaporator. The final product was dried overnight under vacuum and measurements as FTIR, ^1H and ^{13}C NMR, GC/MS were carried out.

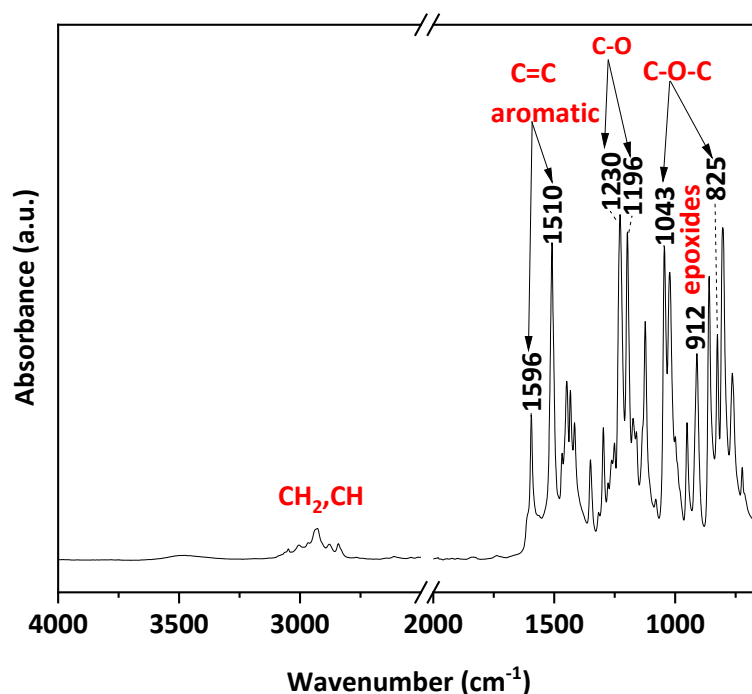


Figure S2. FTIR spectra of bio-based epoxy (DGEMHQ).

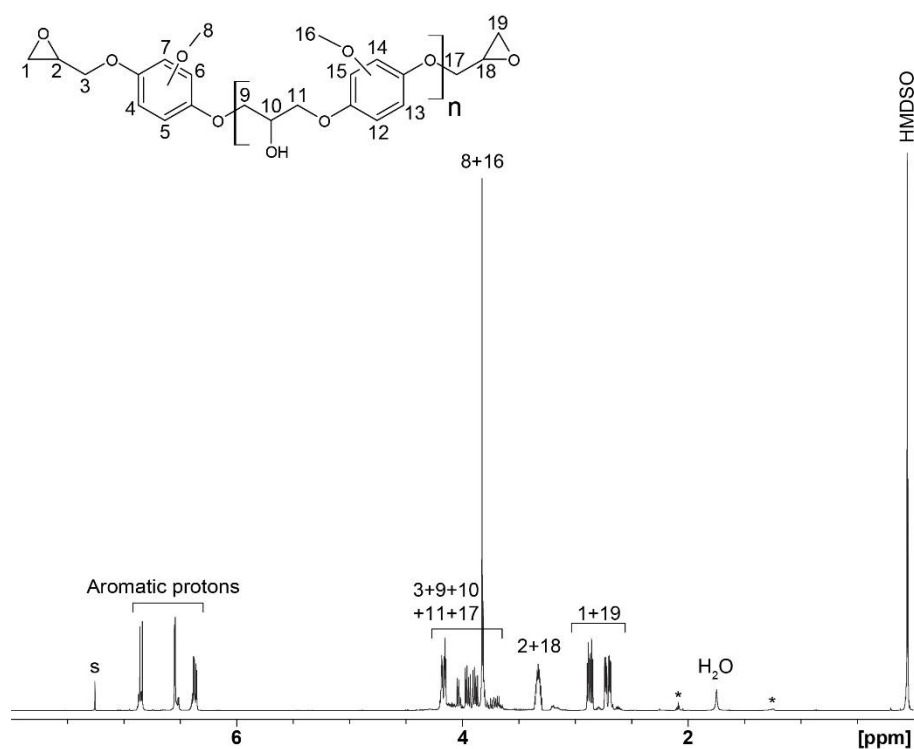


Figure S3. ^1H NMR spectra of DGEMHQ. Traces of impurities are denoted by an asterisk (*).

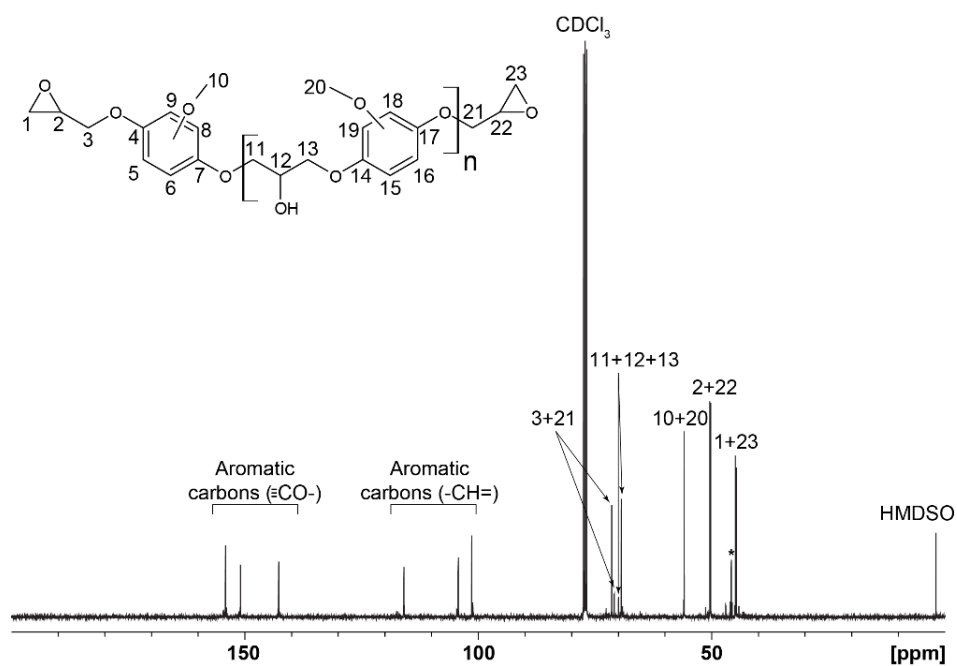


Figure S4. ^{13}C NMR spectra of DGEMHQ. Traces of impurities are denoted by an asterisk (*).

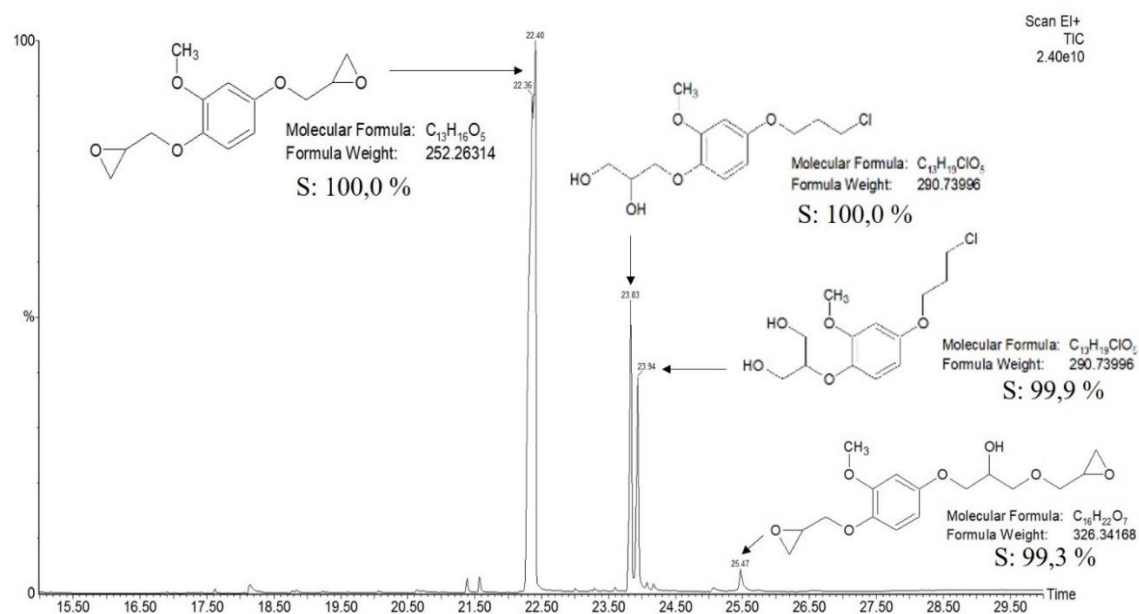


Figure S5. GC/MS spectra of DGEMHQ.

Epoxide ring-opening mechanism investigation

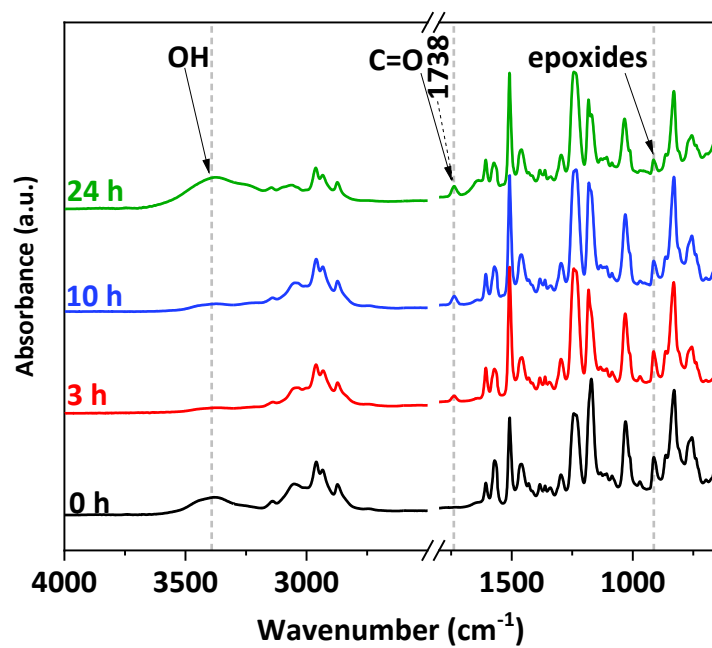


Figure S6. FTIR spectra of system DGEBA/BMIImCl (1/1.6) cured at 80 °C.

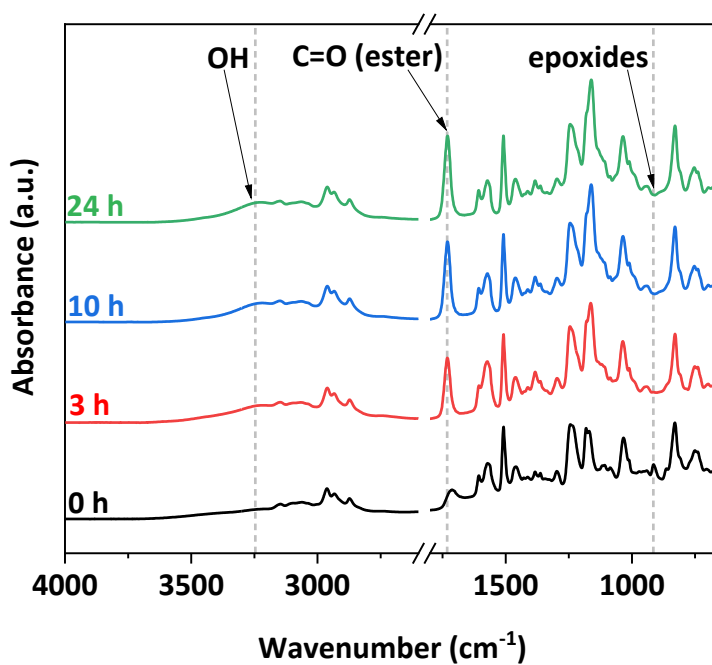


Figure S7. FTIR spectra of system DGEBA/SA/BMIImCl (1/1/1.6) cured at 80 °C.

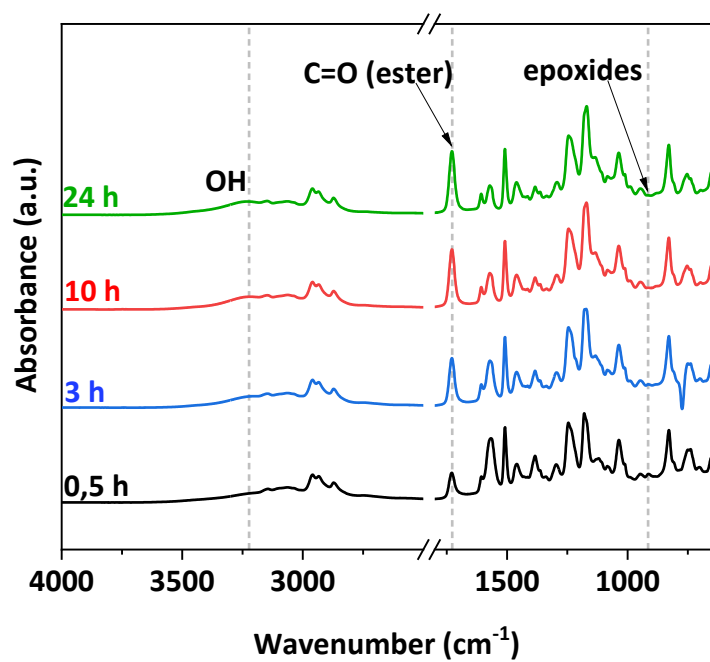


Figure S8. FTIR spectra of system DGEBA/Adipic acid/BMIImCl (1/1/1.6) cured at 80 °C.

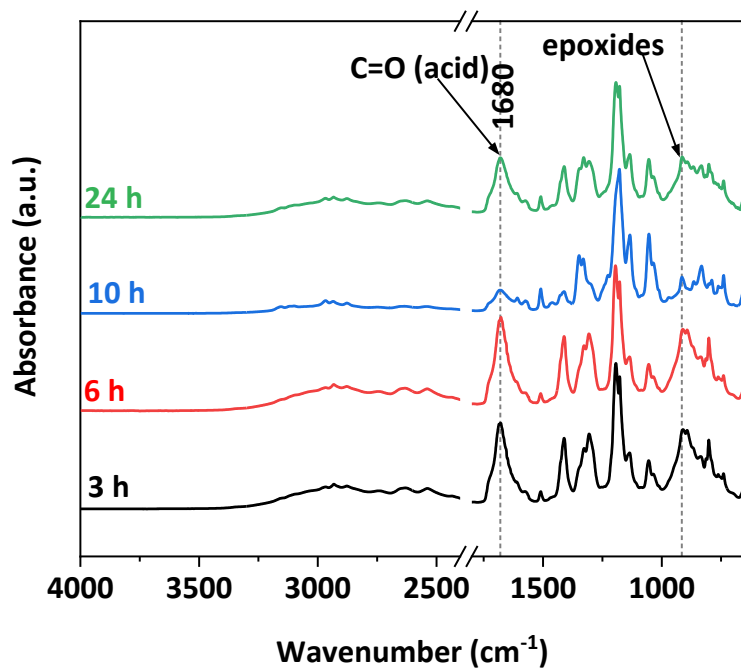


Figure S9. FTIR spectra of system DGEBA/SA/BMIImNTf₂ (1/1/1.6) cured at 80 °C.

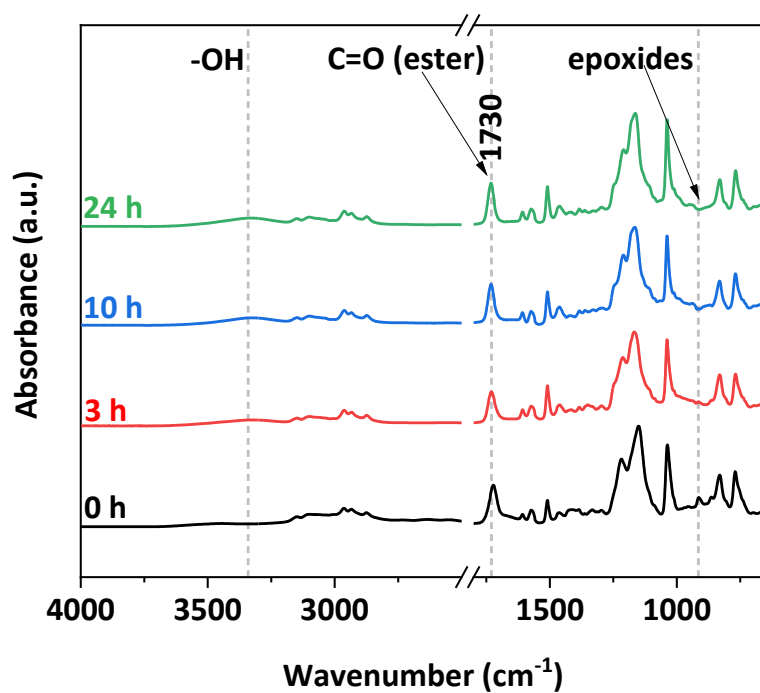


Figure S10. FTIR spectra of system DGEBA/SA/BMIImMeS (1/1/1.6) cured at 80 °C.

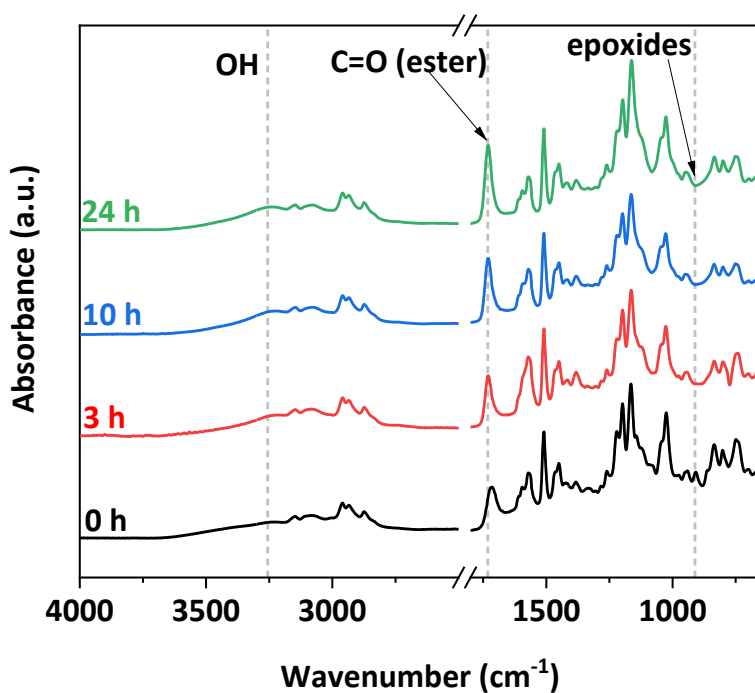


Figure S11. FTIR spectra of system DGEMHQ/SA/BMIImCl (1/1/1.6) cured at 80 °C.

Optimized epoxy networks

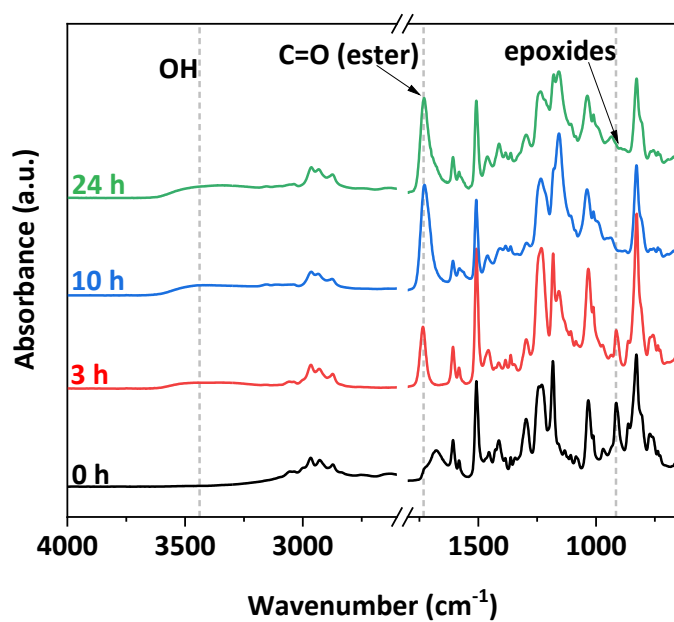


Figure S12. FTIR spectra of system DGEBA/SA/BMIImCl (1/1/0.2) cured at 80 °C.