Flame-retardant plant thermoplastics directly prepared by single ionic liquid substitution

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Supplementary Information

Flame-retardant plant thermoplastics directly prepared by single ionic liquid substitution

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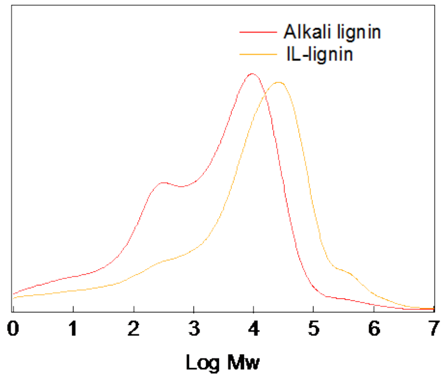
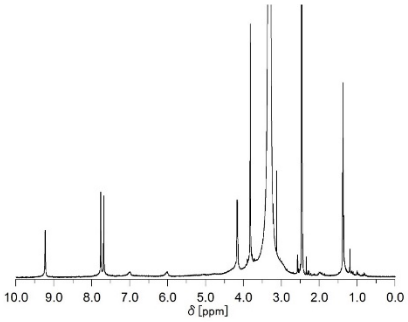
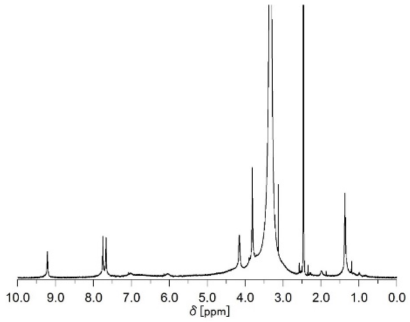


Figure. S1 Molecular weight distribution of IL-lignin and alkali lignin.

IL-bagasse



IL-cedar



IL-eucalyptus

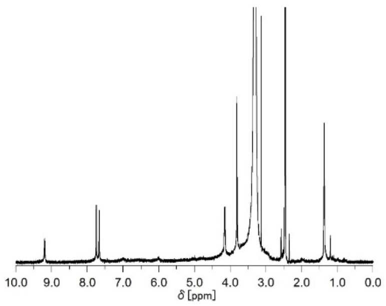


Figure. S2 ^{1}H NMR spectra of IL-bagasse, IL-cedar, and IL-eucalyptus in DMSO-d_6. A large signal at 3.3 ppm is attributed to water included in the samples and solvents. The large signal at 2.5 ppm is attributed to DMSO in DMSO -d_6.

The large sharp signals of the cation (1.37, 3.82, 4.16, 7.68, 7.77, and 9.23 ppm) was observed. It is presumably due to mobility of the free cation in the solution, while the immobilized anion on polymers exhibited broad signals (6.0 and 7.0 ppm). The signals of polymers are not clear because the samples include three different polymers and even each polymer exhibits broad and very complicated spectrum. We can see unclear broad peaks from 2–5 ppm as polysaccharide skeleton and aliphatic protons in lignin and from 6–8 ppm as aromatic protons in lignin.

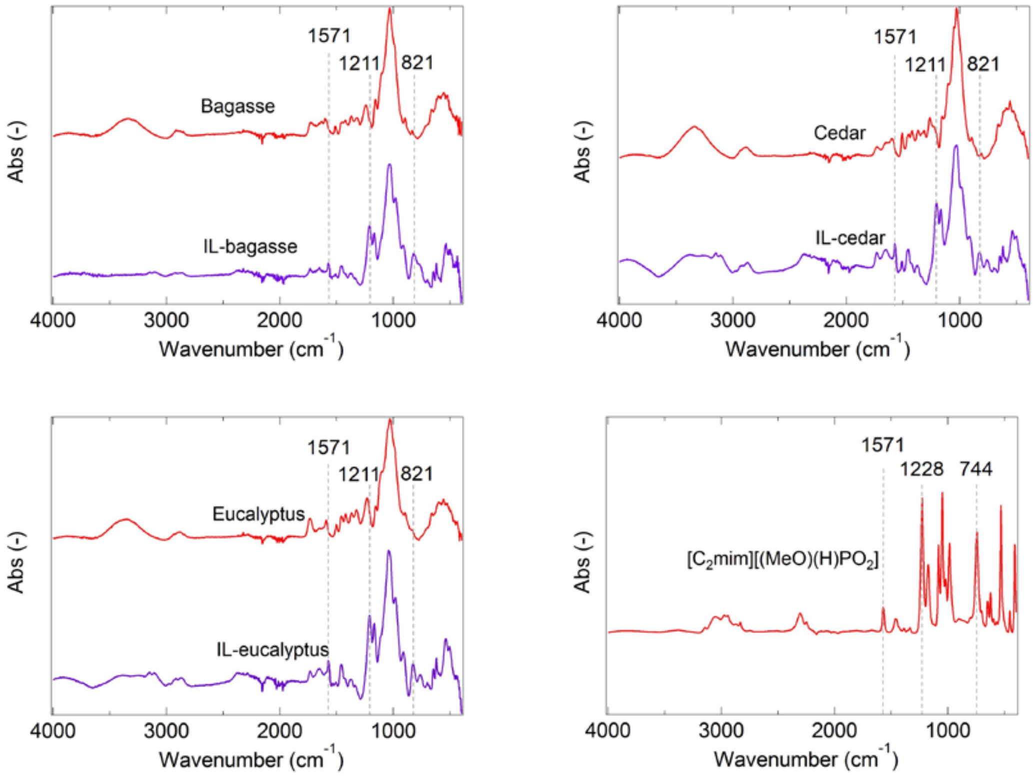


Figure. S3 FT-IR spectra of bagasse, IL-bagasse, cedar, IL-cedar, eucalyptus, IL-eucalyptus, and [C_2mim][(MeO)(H)PO_2].

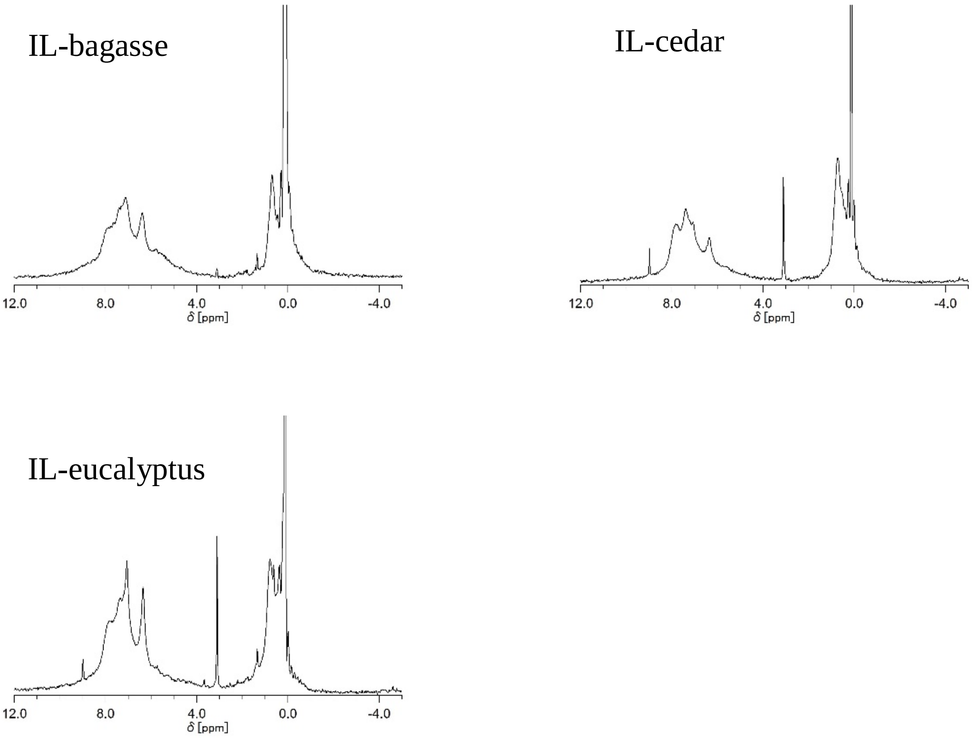


Figure. **S4** ^{31}P NMR spectra of IL-biomass samples.

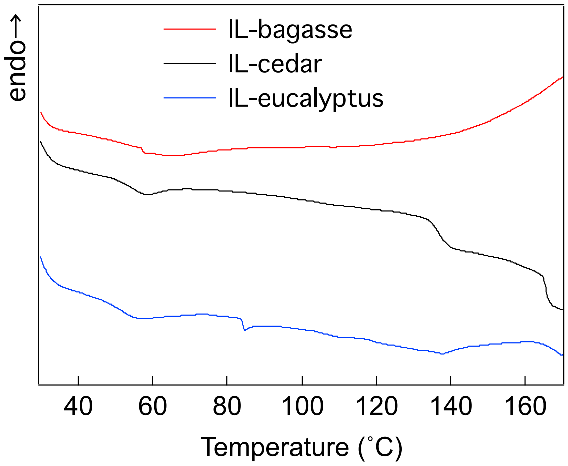


Figure. **S5** DSC profiles of IL-bagasse, IL-cedar, and IL-eucalyptus.

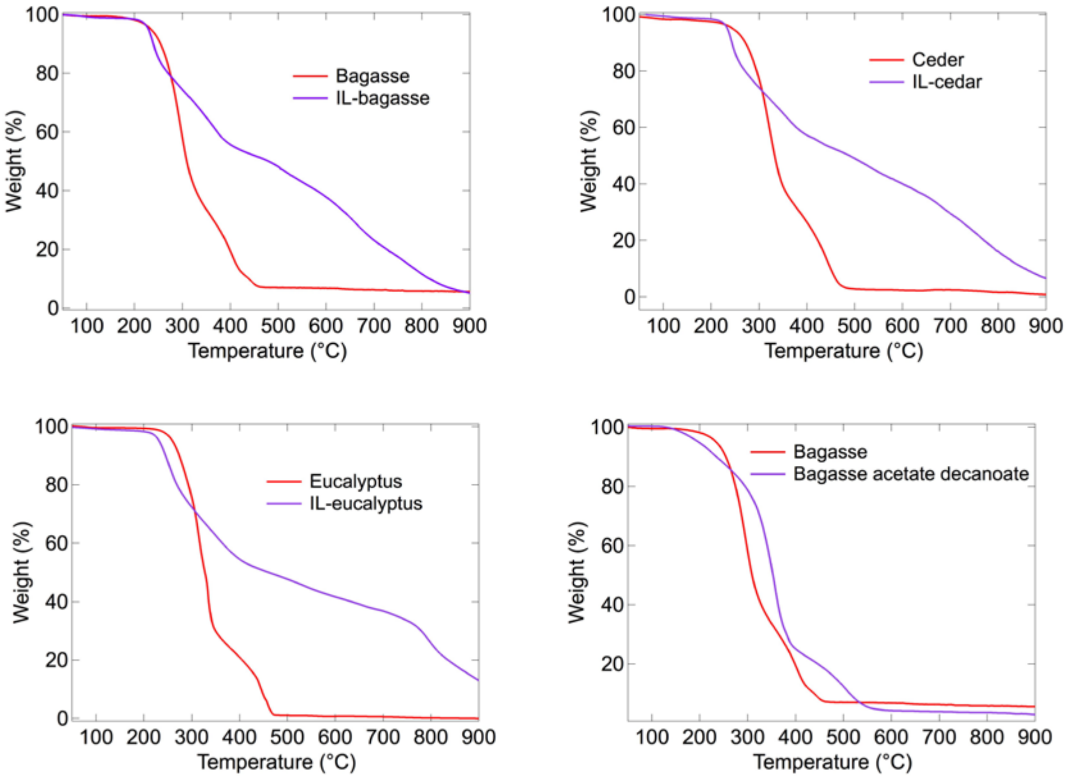


Figure. S6 TGA curves (under air) of bagasse, IL-bagasse, cedar, IL-cedar, eucalyptus, IL-eucalyptus, and bagasse acetate decanoate.

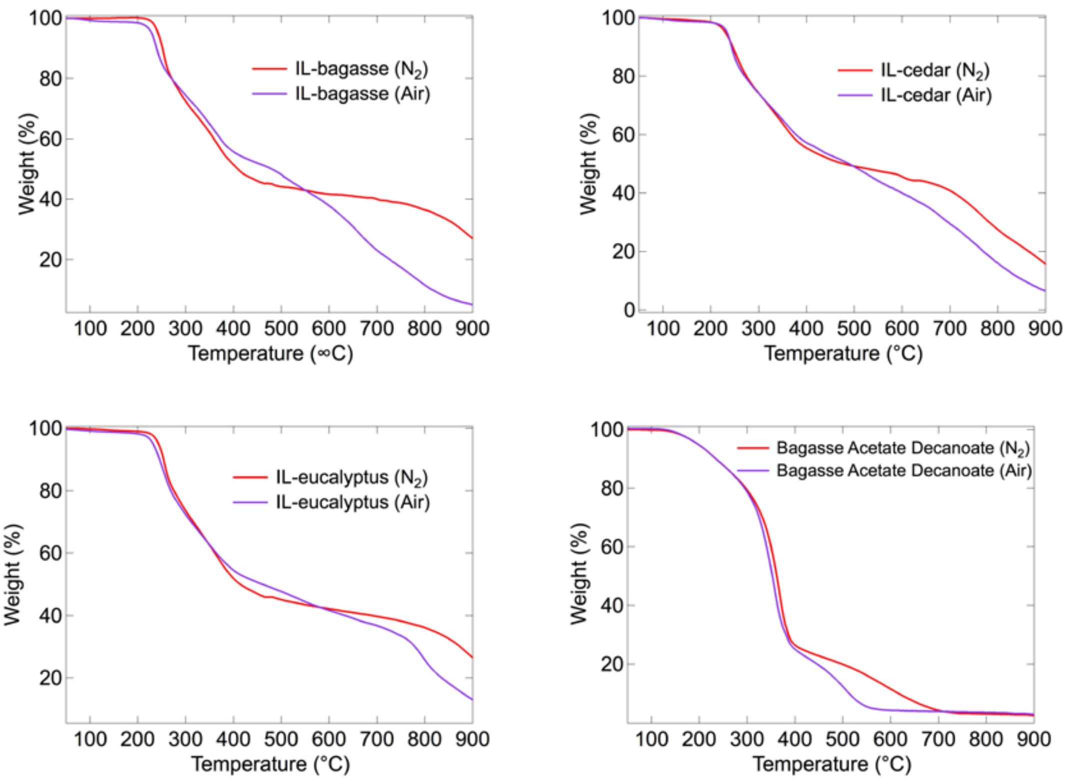


Figure. S7 TGA curves (under air and nitrogen) of bagasse, IL-bagasse, cedar, IL-cedar, eucalyptus, IL-eucalyptus, bagasse acetate decanoate.

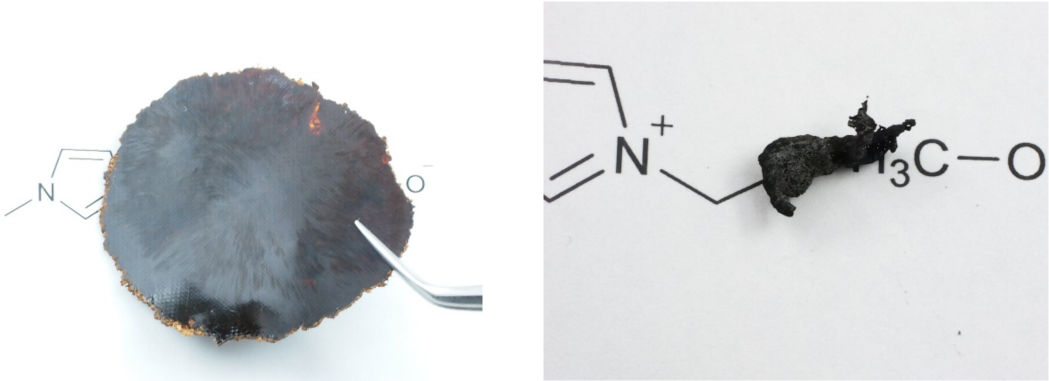
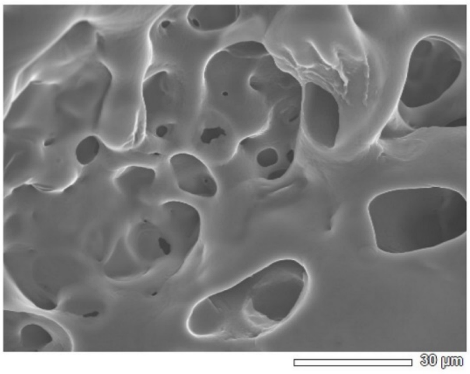
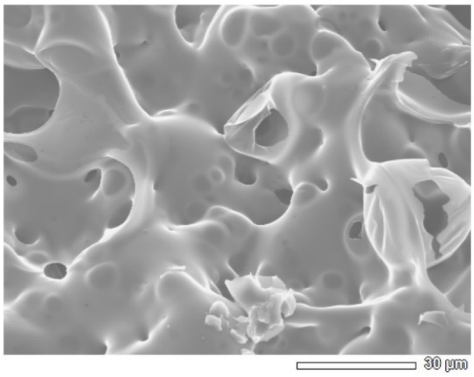


Figure. S8 A thin film of bagasse acetate decanoate prepared by hot press before and after fire test.

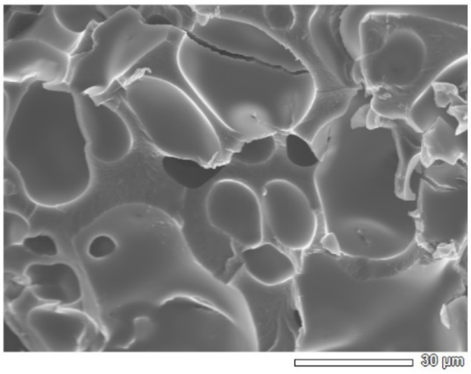
IL-bagasse



IL-cedar



IL-eucalyptus



Bagasse acetate decanoate

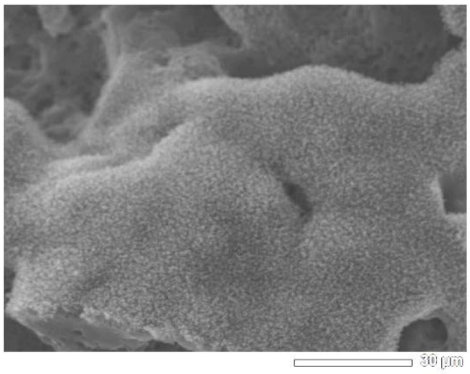


Figure. S9 Scanning electron microscopy images of char layers of IL-bagasse, IL-cedar, IL-eucalyptus, and bagasse acetate decanoate, after fire test.

Table. S1 Composition of bagasse, cedar, and eucalyptus.

	Composition			
	Cellulose	Hemicellulose	Lignin	Others
Bagasse	0.41	0.17	0.27	0.15
Cedar	0.46	0.15	0.36	0.03
Eucalyptus[a]	0.42	0.17	0.26	0.16

[a]The sum is 1.01 because of rounding.

The “others” values are not included in the calculations.