Recyclable choline nicotinate and ferulate aqueous solutions as efficient lignin solvents

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Figure S1 The $^{13}$C NMR spectra of [Ch][Na] in H$_2$O/[Ch][Na] (R=10) solvent at room temperature
Figure S2 The $^{13}$C NMR spectra of [Ch][CH$_3$CH$_2$COO] in [Ch][Na] in H$_2$O/[Ch][Na] (R=10)/lignin (8 wt.%) solution at room temperature

**FT-IR spectra analysis of the original lignin and the regenerated lignin**

The absorption band at 3429 cm$^{-1}$ in the regenerated lignin is assigned to the stretching vibration of O-H of phenolic OH and aliphatic OH. The absorption band at 2945 cm$^{-1}$ is assigned to the stretching vibration of C-H of CH$_3$ and CH$_2$. The absorption band at 2845 cm$^{-1}$ is assigned to the stretching vibration of C-H of OCH$_3$. The absorption bands at 1600 cm$^{-1}$, 1515 cm$^{-1}$ and 1425 cm$^{-1}$ are assigned to the stretching vibration of C-C of Aromatic skeleton. The absorption band at 1460 cm$^{-1}$ is assigned to the in-plane asymmetric deformation
vibration of C-H of CH$_3$ and CH$_2$. The absorption band at 1270 cm$^{-1}$ is assigned to the stretching vibration of C-O of guaiacyl type. The absorption band at 1218 cm$^{-1}$ is assigned to the stretching vibration of C–O(H) + C–O(Ar) phenolic OH + ether. The absorption band at 1136 cm$^{-1}$ is assigned to the aromatic C-H in-plane deformation for syringyl type. The absorption band at 1030 cm$^{-1}$ is assigned to the stretching vibration of C–O(H) + C–O(C) of 1st order aliphatic OH + ether. The absorption bands at 855 cm$^{-1}$ and 810 cm$^{-1}$ are assigned to the out-of-plane deformation vibration of aromatic C-H of guaiacyl type. The FTIR spectra of the original and regenerated lignin are similar to those reported in the literatures[1-3].

**Measurements of the thermal properties of [Ch][Na], [Ch][Fa], [Ch][Va] and [Ch][Sa]**

Melting temperature or glass transition temperature was determined on a Netzsch DSC 204 F1 differential scanning calorimetry. Each sample was sealed in aluminum pans and heated in the temperature range from -130 °C to 100 °C at a rate of 5 °C min$^{-1}$ under dry N$_2$ atmosphere.

Thermal decomposition temperature was determined on a Netzsch STA 449 C thermal gravimetric analyzer (TGA). Each IL sample was heated from room temperature to 600°C in an alumina crucible with 10 wt% of mass loss at a heating rate of 10 °C min$^{-1}$ under dry N$_2$ atmosphere. The temperatures reported from TGA data were the onset temperatures, which were determined from the step tangent.

**References**
