# Supplementary Information

## Efficient and sustainable solvents for lignin dissolution: Aqueous choline carboxylate solutions

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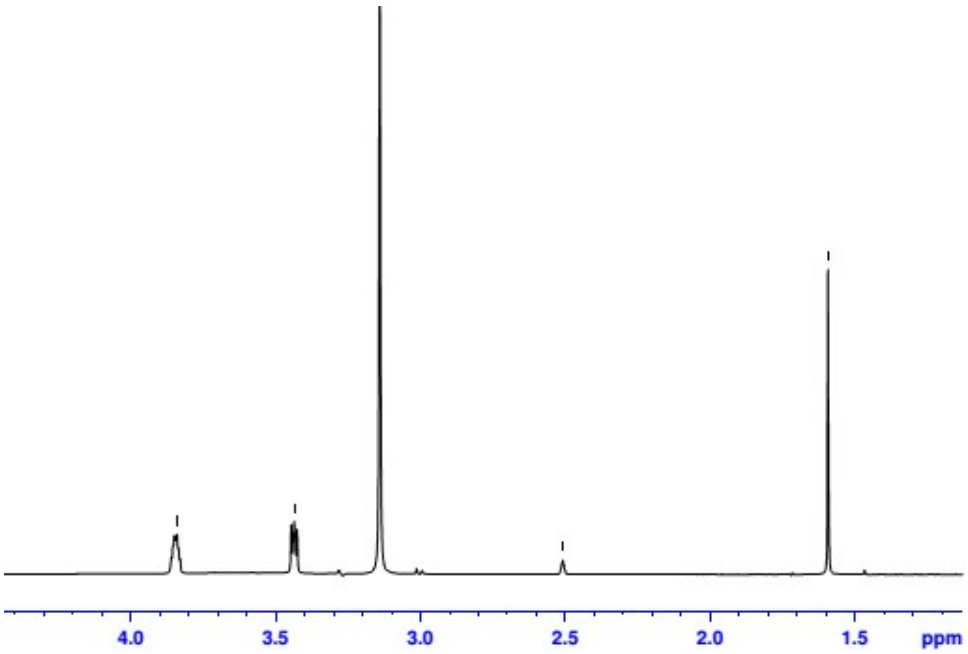
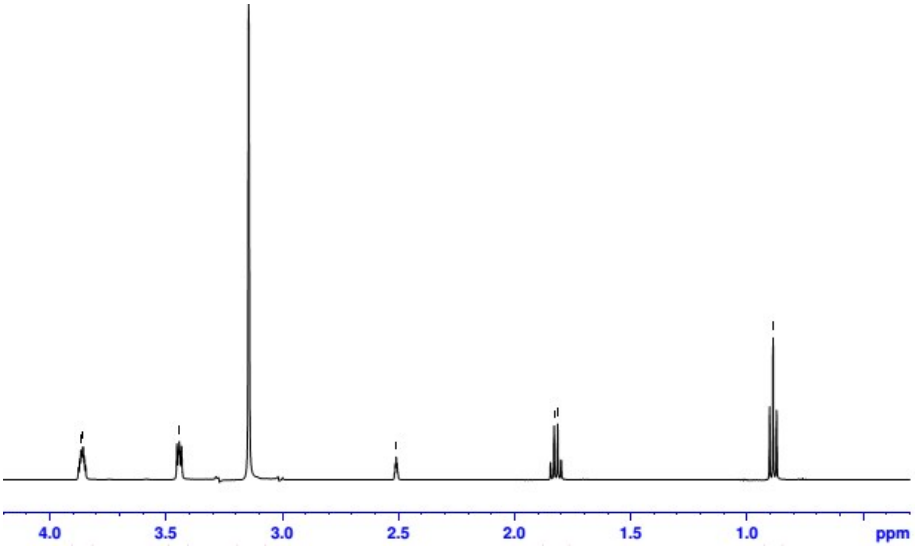
### $^1$H-NMR Data of the ILs

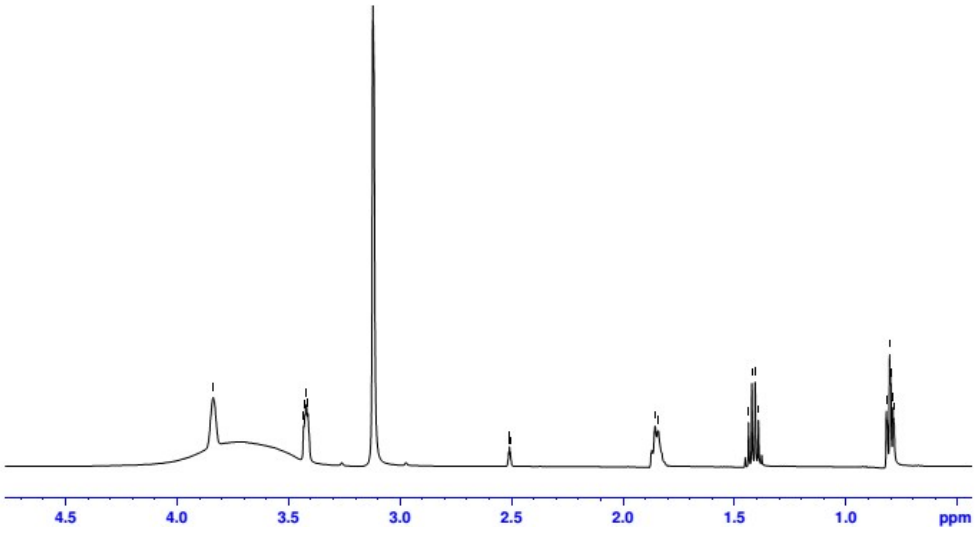
1. [Ch][$CH_3COO$]: $^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 1.59 (3H, s, $CH_3CO_2$), 3.14 (9H, s, $CH_3$), 3.44 (2H, t, $NCH_2$), 3.84 (2H, m, $CH_2OH$).



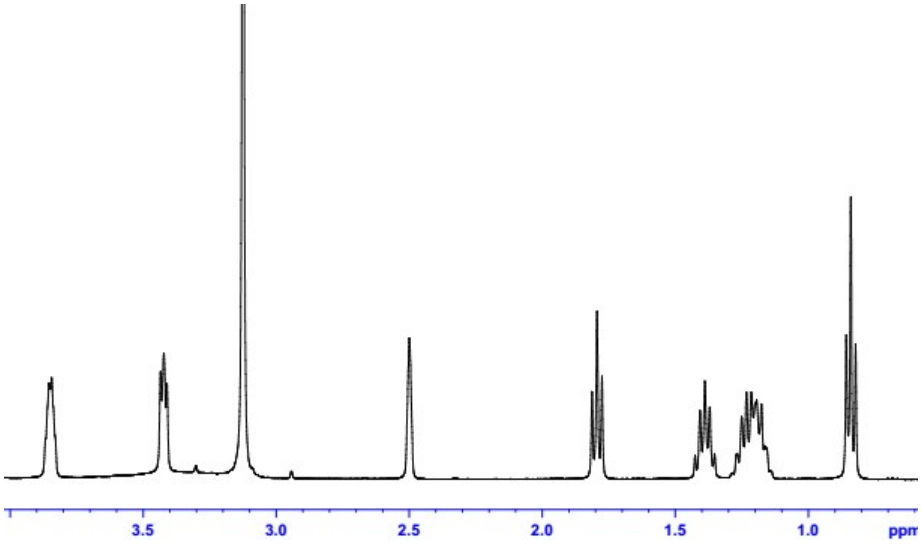
2. [Ch][$CH_3CH_2COO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative toTMS): 0.89 (3H, t, $CH_3CH_2$), 1.82 (2H, m, $CH_3CH_2$), 3.14 (9H, s, $CH_3$), 3.44 (2H, t, $NCH_2$), 3.86 (2H, m, $CH_2OH$).



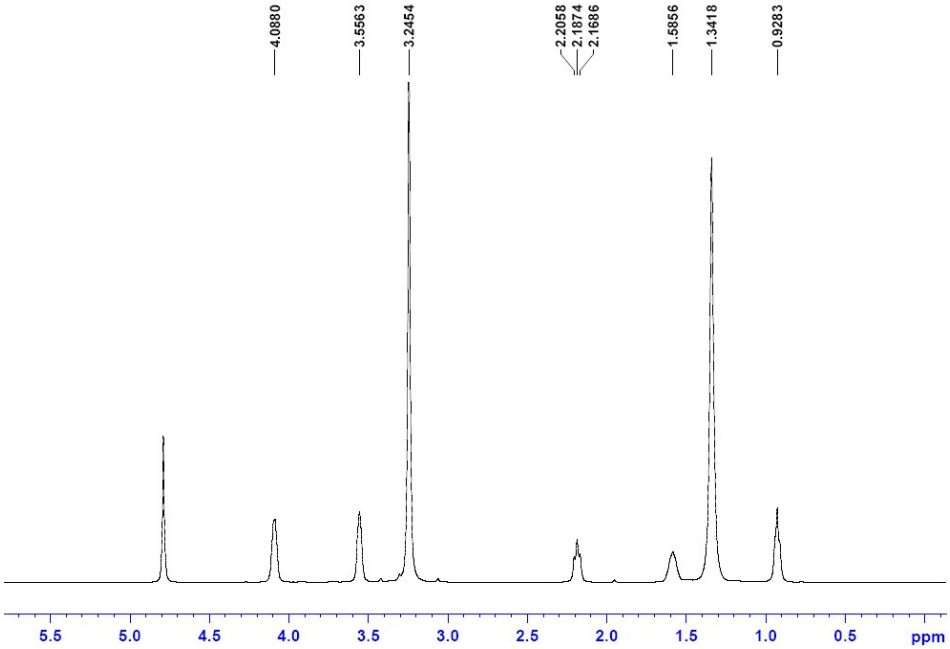

3. [Ch][$CH_3(CH_2)_2COO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 0.80 (3H, t, but-$CH_3$), 1.41 (2H, m, $CH_3CH_2$), 1.86 (2H, m, $CH_2CO_2$), 3.12 (9H, s, $CH_3N$), 3.43 (2H, t, $NCH_2$), 3.84 (2H, s, $CH_2OH$).



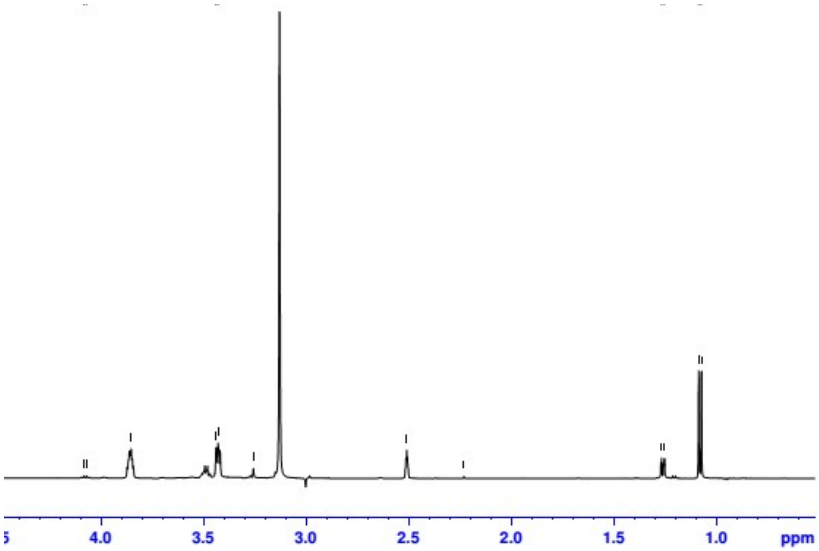
4. [Ch][$CH_3(CH_2)_4COO$]: $^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 0.84 (3H, t, $CH_3$), 1.16-1.27 (4H, m, $CH_3(CH_2)_2$), 1.35-1.43 (2H, m, $CH_2$-$CH_2$-$CH_2CO_2$), 1.79 (2H, t, $CH_2CO_2$)



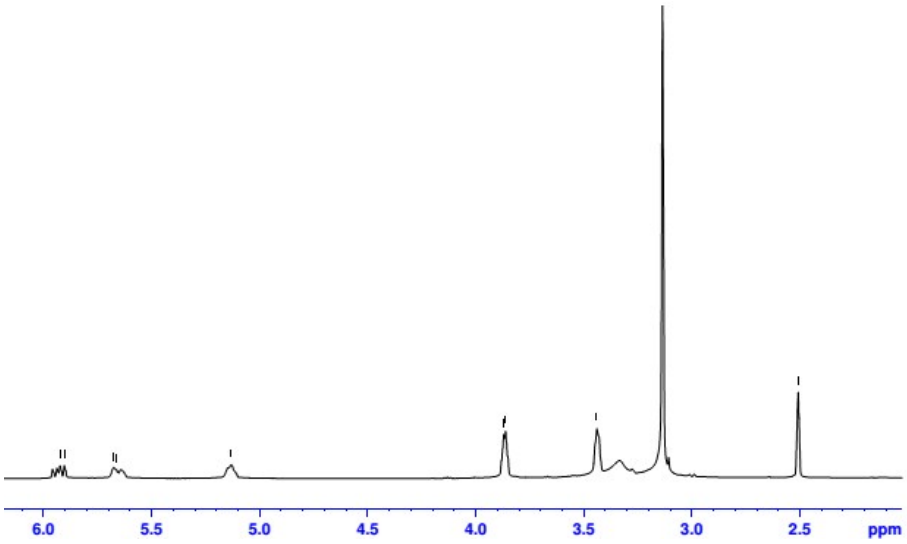

5. [Ch][$CH_3(CH_2)_{10}COO$]: $^1$H NMR (500MHz: $D_2O$; $\delta$/ppm relative to TMS): 0.93 (3H, t, $CH_3$), 1.34 (16H, m, $CH_3CH_2CH_2(CH_2)_8$), 1.59 (2H, m, $CH_3CH_2$), 2.19 (2H, m, $CH_3CH_2CH_2$), 3.25 (9H, s, $CH_3N$), 3.56 (2H, t, $NCH_2$), 4.09 (2H, t, $CH_2OH$)



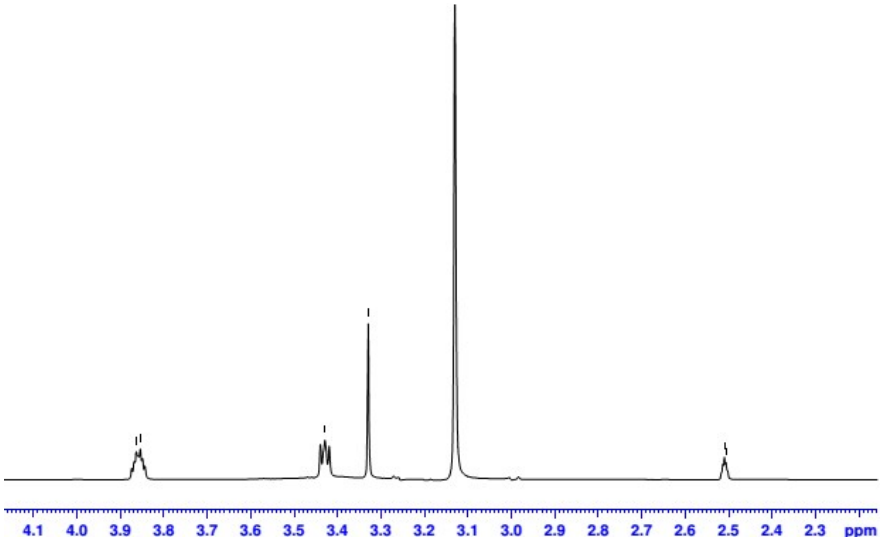
6. [Ch][$CH_3CH(OH)COO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 1.08 (3H, d, $CH_3CH$), 1.25 (1H, m, $CH_3CH$), 3.13 (9H, s, $CH_3$), 3.43 (2H, t, $NCH_2$), 3.85 (2H, m, $CH_2OH$)



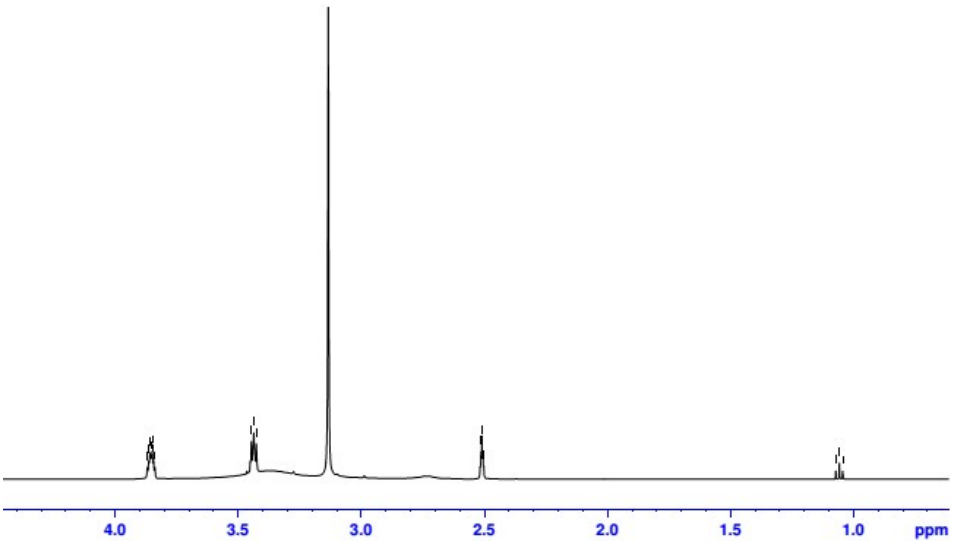

7. [Ch][$CH_2$=$CHCOO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 3.14 (9H, s, $CH_3$), 3.44 (2H, t, $NCH_2$), 3.86 (2H, m, $CH_2OH$), 5.13, 5.91 (2H, m, $CH_2CH$), 5.68 (1H, t, $CH_2CH$).



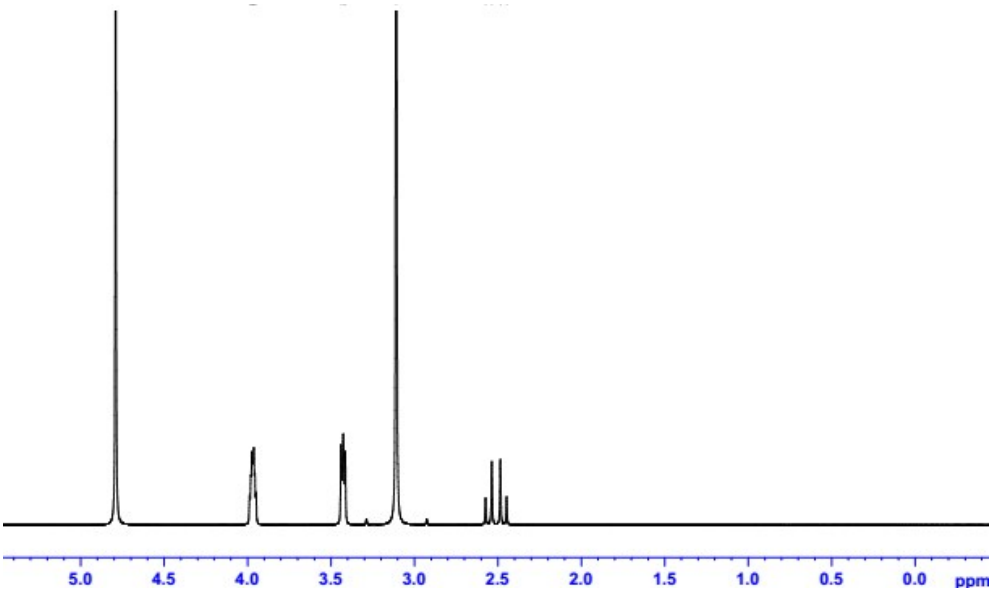
8. [Ch][$HOCH_2COO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 3.13 (9H, s, $CH_3$), 3.33 (2H, s, $CH_2CO_2$), 3.43 (2H, t, $NCH_2$), 3.85 (2H, m, $CH_2OH$).



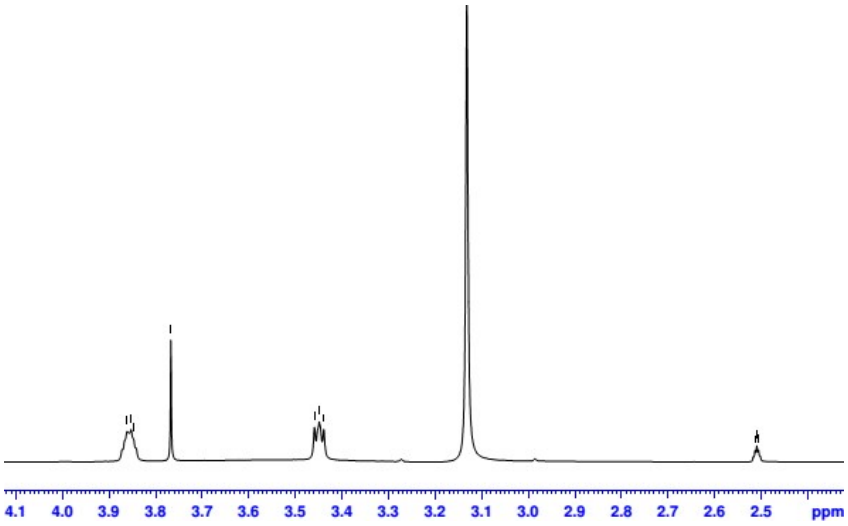

9. [Ch][$NH_2CH_2COO$]：$^1$H NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 3.13 (9H, s, $CH_3$), 3.45 (2H, t, $NCH_2$), 3.85 (2H, m, $HOCH_2$)



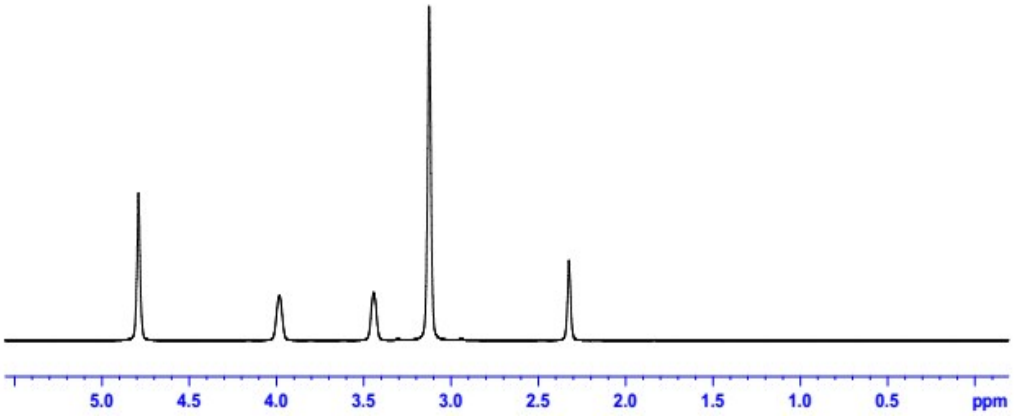
10 $[Ch]_3[OOCCH_2(HO)C(COO)CH_2COO]$：$^1H$ NMR (500MHz: $D_2O$; $\delta$/ppm relative to TMS): 2.51 (4H, m, $CH_2COO$), 3.11 (27H, s, $CH_3N$), 3.43 (6H, t, $CH_2N$), 3.97 (6H, m, $CH_2OH$)



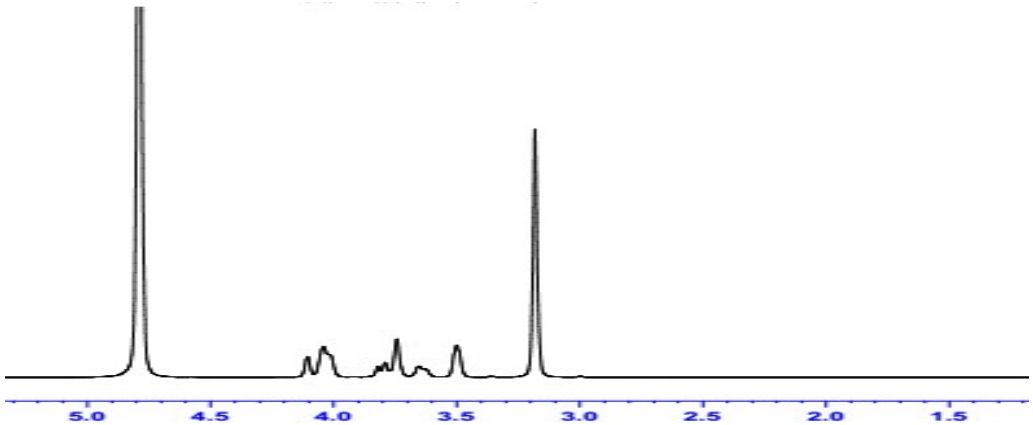

11. $[Ch]_2[OOC(CHOH)_2COO]$：$^1H$ NMR (500MHz: DMSO-$d_6$; $\delta$/ppm relative to TMS): 3.13 (18H, s, $CH_3$), 3.45 (4H, t, $NCH_2$), 3.77 (2H, s, $CHCO_2$), 3.85 (4H, m, $CH_2OH$).



12. $[Ch]_2[OOC(CH_2)_2COO]$: $^1H$ NMR (500MHz: $D_2O$; δ/ppm relative to TMS): 2.33 (4H, t, $CH_2CO_2$), 3.13 (18H, s, $CH_3N$), 3.44 (4H, t, $NCH_2$), 3.98 (4H, t, $CH_2O$).




13. $[Ch][HOCH_2(CHOH)_4COO]$: $^1H$ NMR (500MHz: $D_2O$; δ/ppm relative to TMS): 3.18 (9H, s, $CH_3$), 3.50 (2H, t, $NCH_2$), 3.63 (1H, d, CH), 3.74 (2H, m, $CH_2OH(NCH_2CH_2OH)$), 3.80 (1H, d, CH), 4.01(1H, s, CH), 4.04 (2H, m, $HOCH_2(HOCH_2(CHOH)_4COO)$), 4.10 (1H, t, CH).



**The $^{13}C$ NMR and $^{15}N$ NMR spectra of [Ch][$CH_3CH_2COO$] in $H_2O$-[Ch][$CH_3CH_2COO$] solvent and $H_2O$-[Ch][$CH_3CH_2COO$]-lignin (8 wt%) solution**

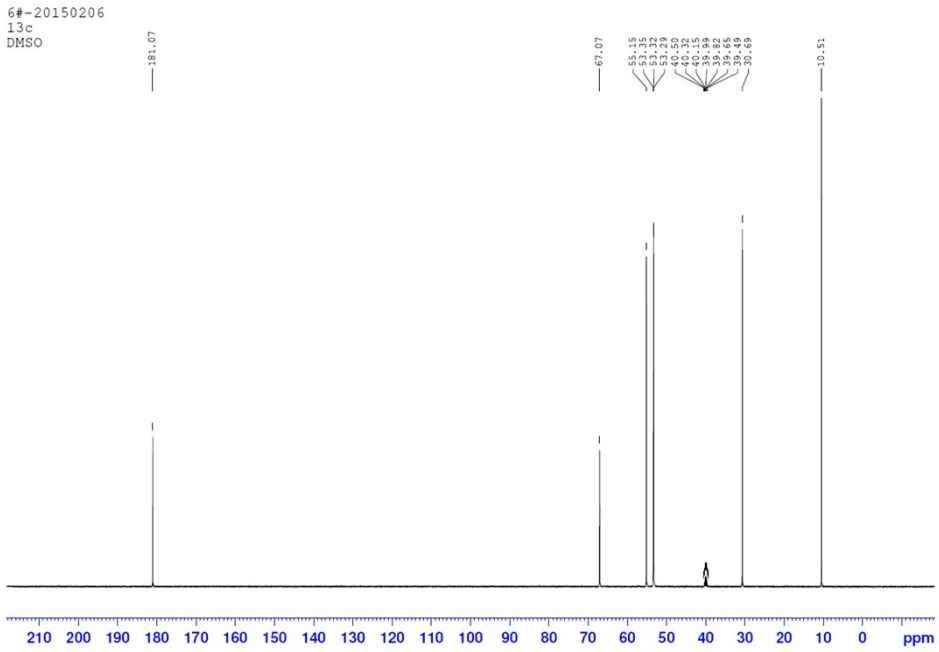



**Fig. S1** $^{13}C$ NMR spectra of [Ch][$CH_3CH_2COO$] in $H_2O$-[Ch][$CH_3CH_2COO$] solvent

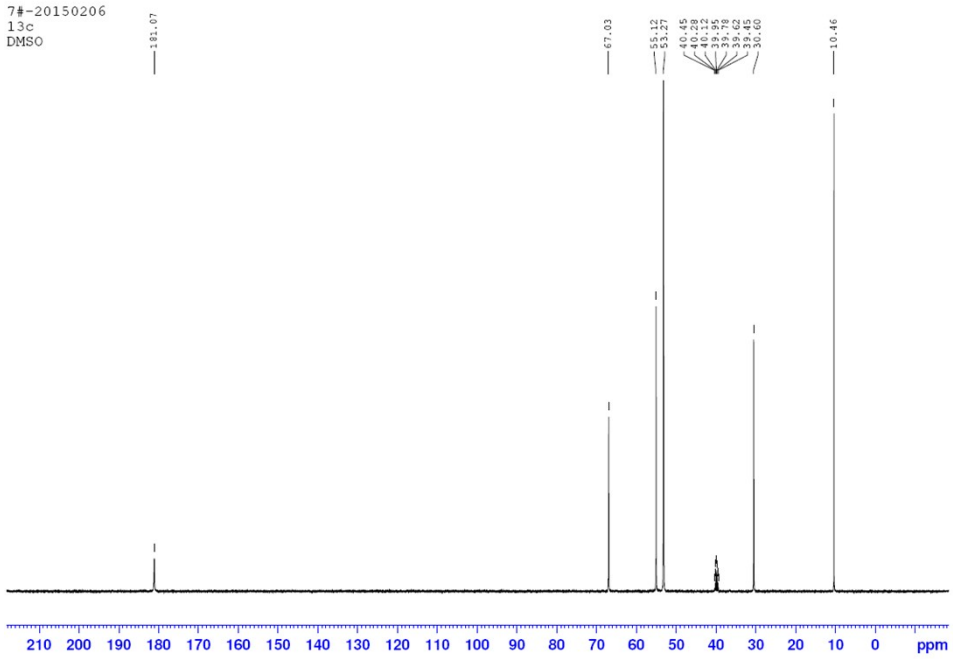



**Fig. S2** The $^{13}C$ NMR spectra of [Ch][$CH_3CH_2COO$] in $H_2O$-[Ch][$CH_3CH_2COO$]-lignin (8 wt%) solution

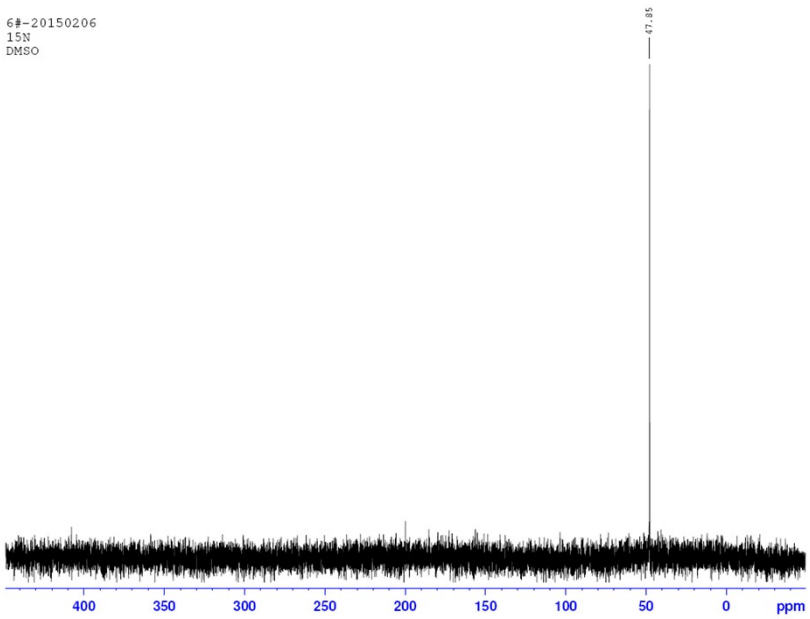



**Fig. S3** The $^{15}N$ NMR spectra of [Ch][$CH_3CH_2COO$] in $H_2O$-[Ch][$CH_3CH_2COO$] solvent.

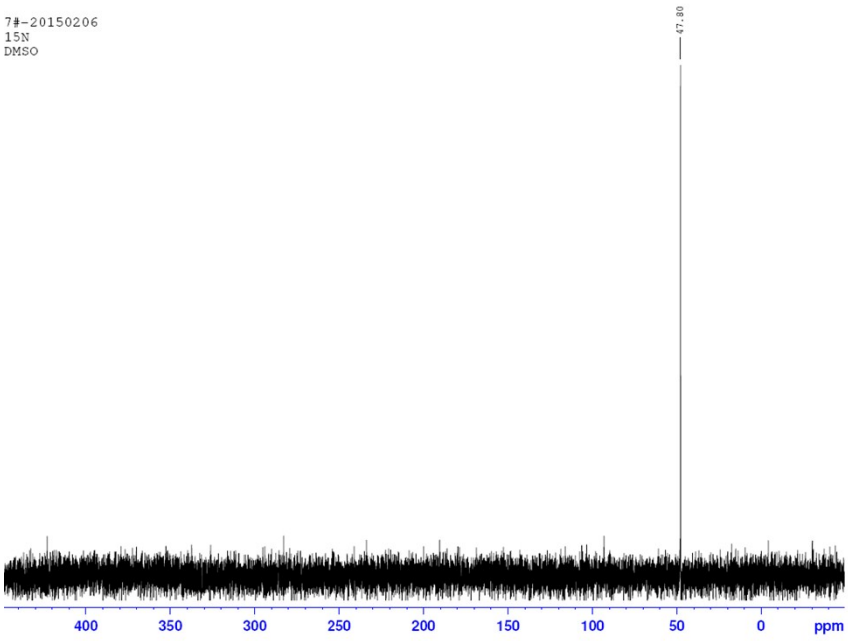



**Fig. S4** The $^{15}N$ NMR spectra of [Ch][$CH_3CH_2COO$] in $H_2O$-[Ch][$CH_3CH_2COO$]-lignin (8 wt%) solution

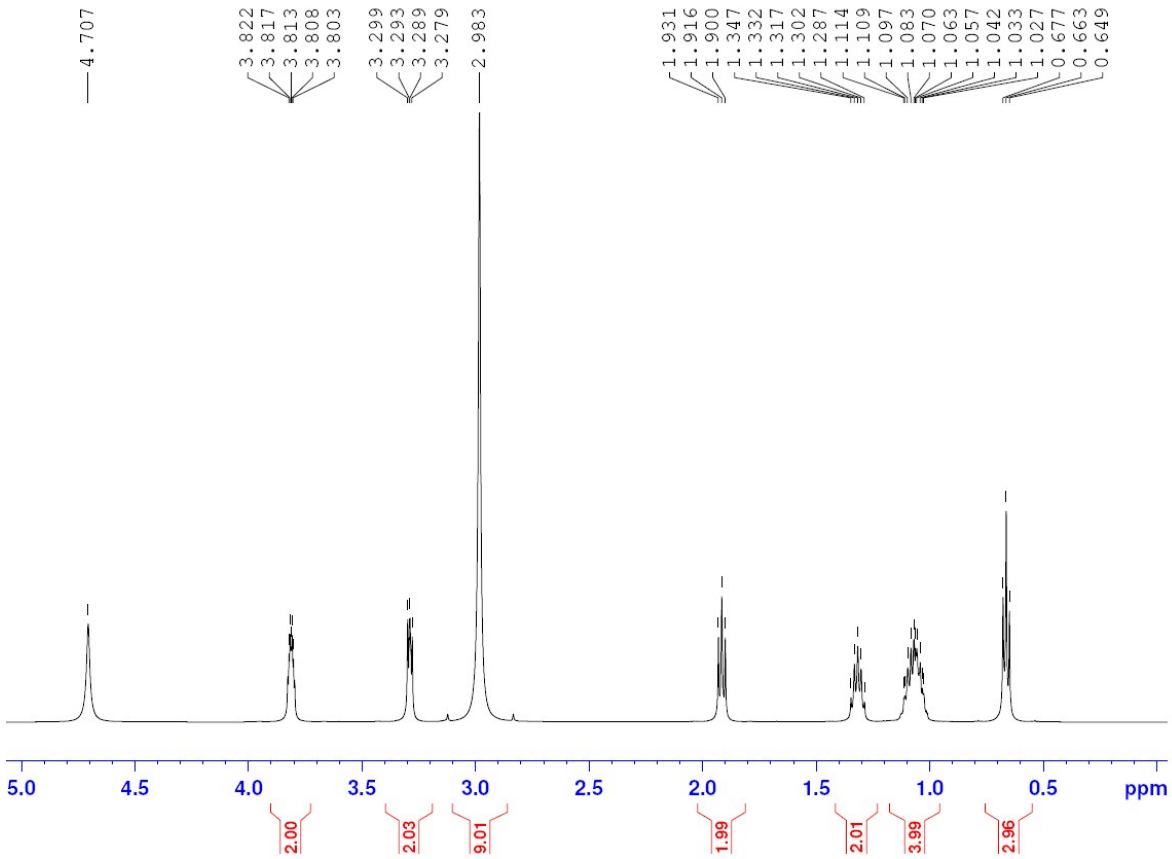



**Fig. S5** $^{1}$H NMR spectrum of the recovered [Ch][$CH_3(CH_2)_4COO$] at room temperature. $D_2O$ is used as an internal standard.

**Table S1** Solubility of lignin in $H_2O$-[$C_4$mim][$CH_3COO$] solvents at 25 °C

| Entry | *R* | Solubility (gram per 100g of solvent) |
|---|---|---|
| 1 | 1 | 47 |
| 2 | 3 | 58 |
| 3 | 6 | 67 |
| 4 | 9 | 70 |
| 5 | 12 | 62 |
| 6 | 15 | 0 |

*R* is the molar ratio of $H_2O$ to [$C_4$mim][$CH_3COO$].