# Supporting information Figure Captions:

***S.*Fig.1** Photos of desulfurization process

(a) Pure ChCl/*p*-TsOH (b) Mixture of ChCl/*p*-TsOH and fuels before reaction (c) Mixture of ChCl/*p*-TsOH and fuels after reaction (d) Pure TBAC/*p*-TsOH (e) Mixture of TBAC /*p*-TsOH and fuels before reaction (f) Mixture of TBAC /*p*-TsOH and fuels before reaction

***S.*Fig.2** $^1$H NMR spectrum of ChCl/*p*-TsOH (1:2)

**S.Fig.3** $^1$H NMR spectrum of TBAC/*p*-TsOH (1:2)

***S.*Fig.4** $^1$H NMR spectrum of TEAC/*p*-TsOH (1:2)

***S.*Fig.5** $^1$H NMR spectrum of TEAC/SSA(1:2)

**S.Fig.6** $^1$H NMR spectrum of TEAB/*p*-TsOH (1:2)

***S.*Fig.7** $^1$H NMR spectrum of TBAB/*p*-TsOH (1:2)

***S.*Fig.8** $^1$H NMR spectrum of ChCl/p-TsOH (1:1)

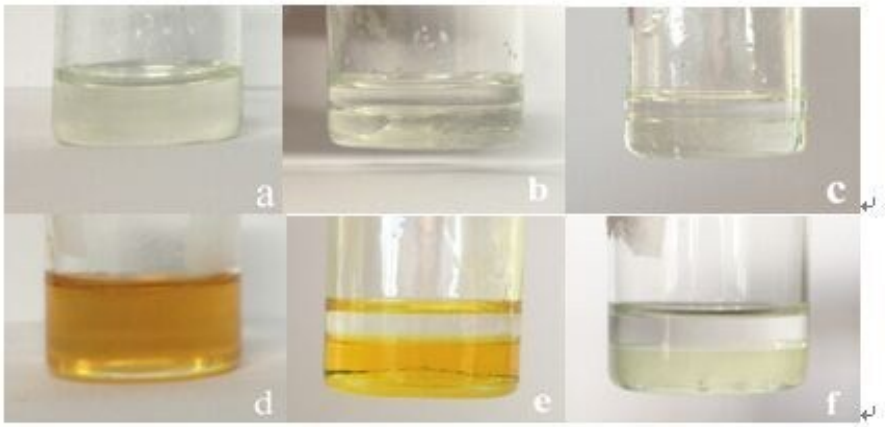
***S.*Fig.9** Analysis of standard curve

***S.*Fig.10** Structures of pure and recycled TBAC/ *p*-TsOH

***S.*Fig.11** $^1$H NMR of the final product

***S.*Fig.12** GC-MS of the final product

*S*.Fig.1

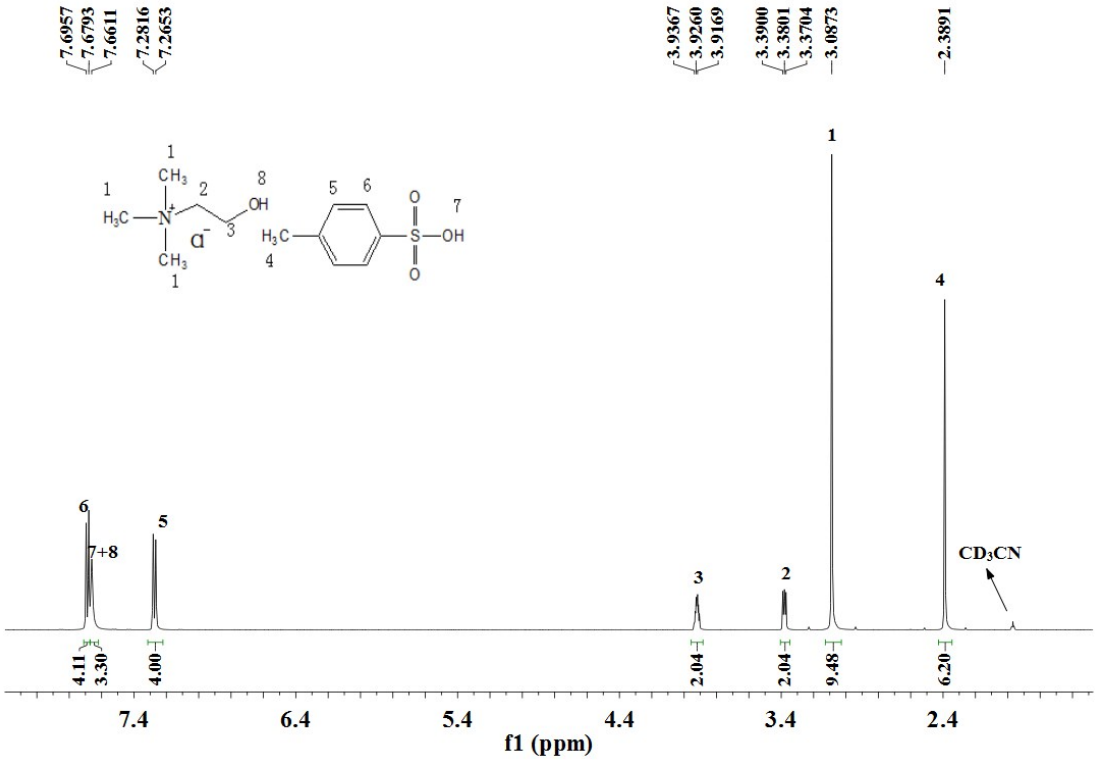



S.Fig.1 Photos of desulfurization process

(a) Pure ChCl/*p*-TsOH (b) Mixture of ChCl/*p*-TsOH and fuels before reaction (c) Mixture of ChCl/*p*-TsOH and fuels after reaction (d) Pure TBAC/*p*-TsOH (e) Mixture of TBAC /*p*-TsOH and fuels before reaction (f) Mixture of TBAC /*p*-TsOH and fuels after reaction

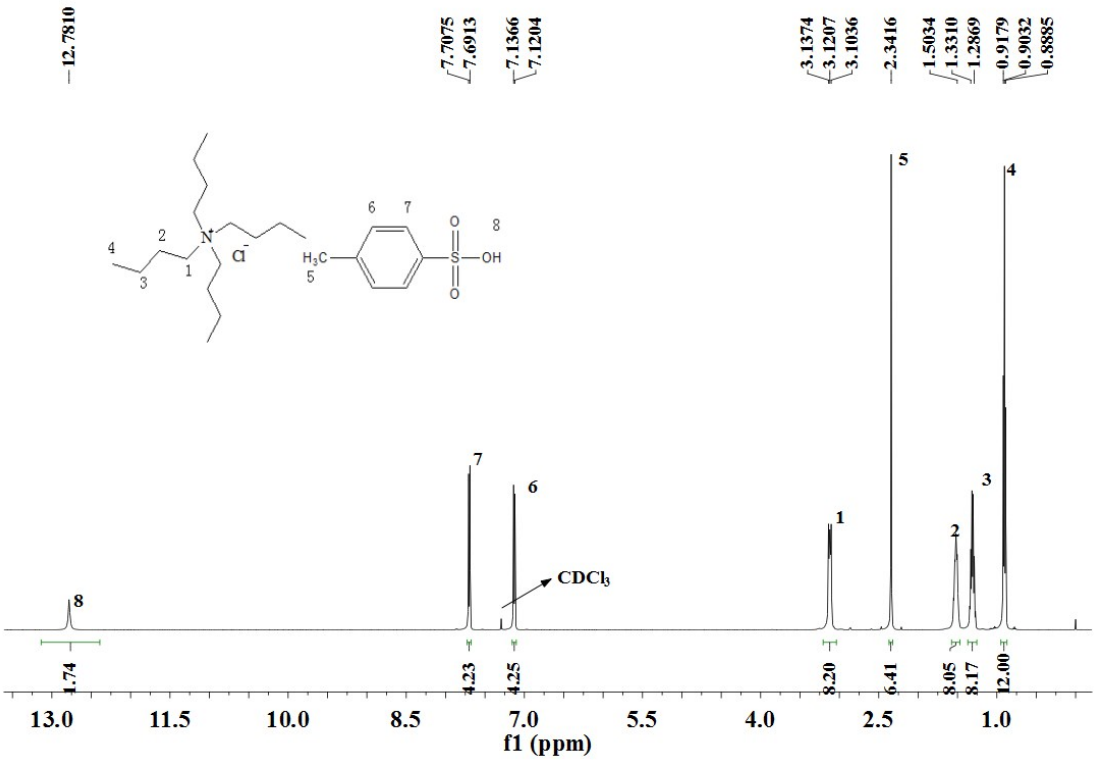
Note: Actually, there is no yellow color in the upper phase of the system from S.Fig.1e. This mainly results from the optical parallax because of the reflection of the color from the lower DES.

*S*.Fig.2



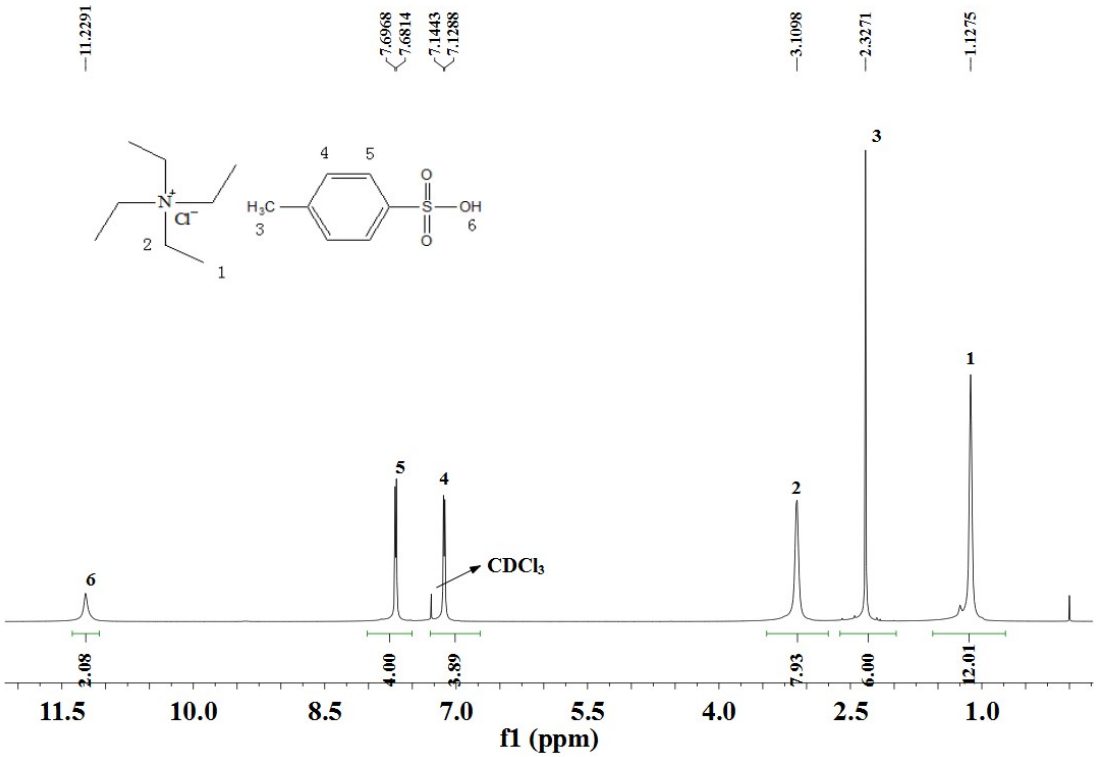

S.Fig.2 $^{1}$H NMR spectrum of ChCl/*p*-TsOH (1:2) ($CD_3CN$)

*S*.Fig.3



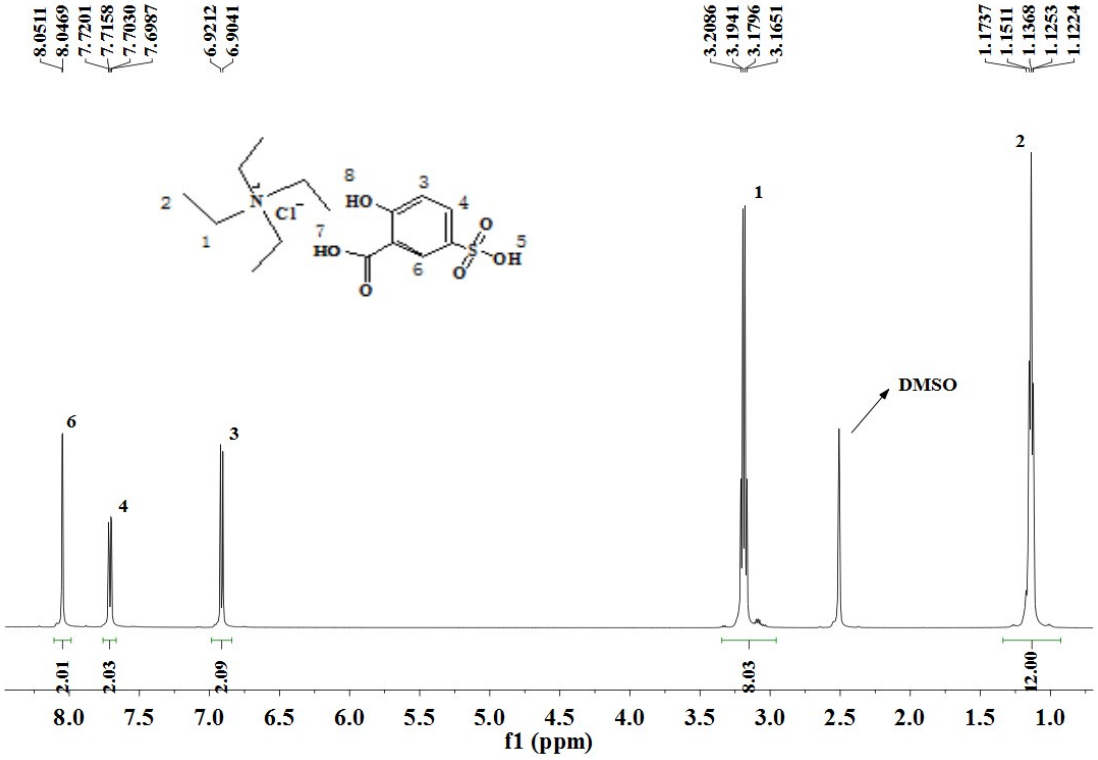

S.Fig.3 $^{1}$H NMR spectrum of TBAC/*p*-TsOH (1:2) ($CDCl_3$)

*S*.Fig.4



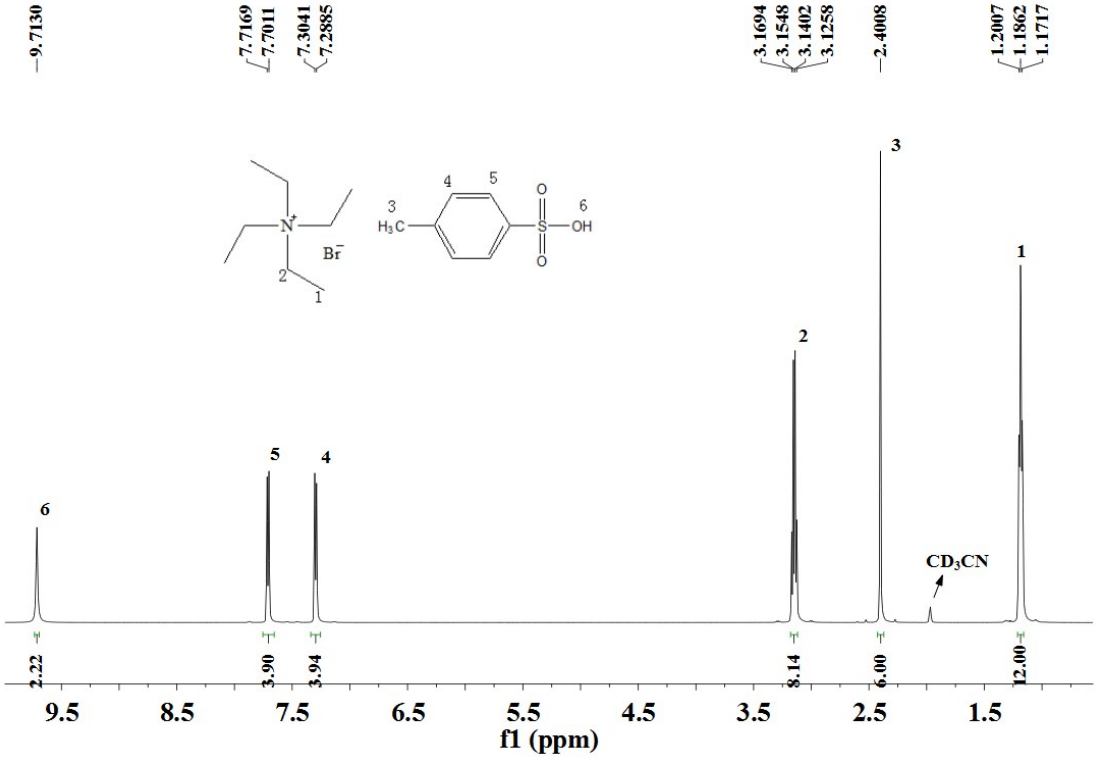

S.Fig.4 $^{1}$H NMR spectrum of TEAC/*p*-TsOH (1:2) ($CDCl_3$)

*S*.Fig.5



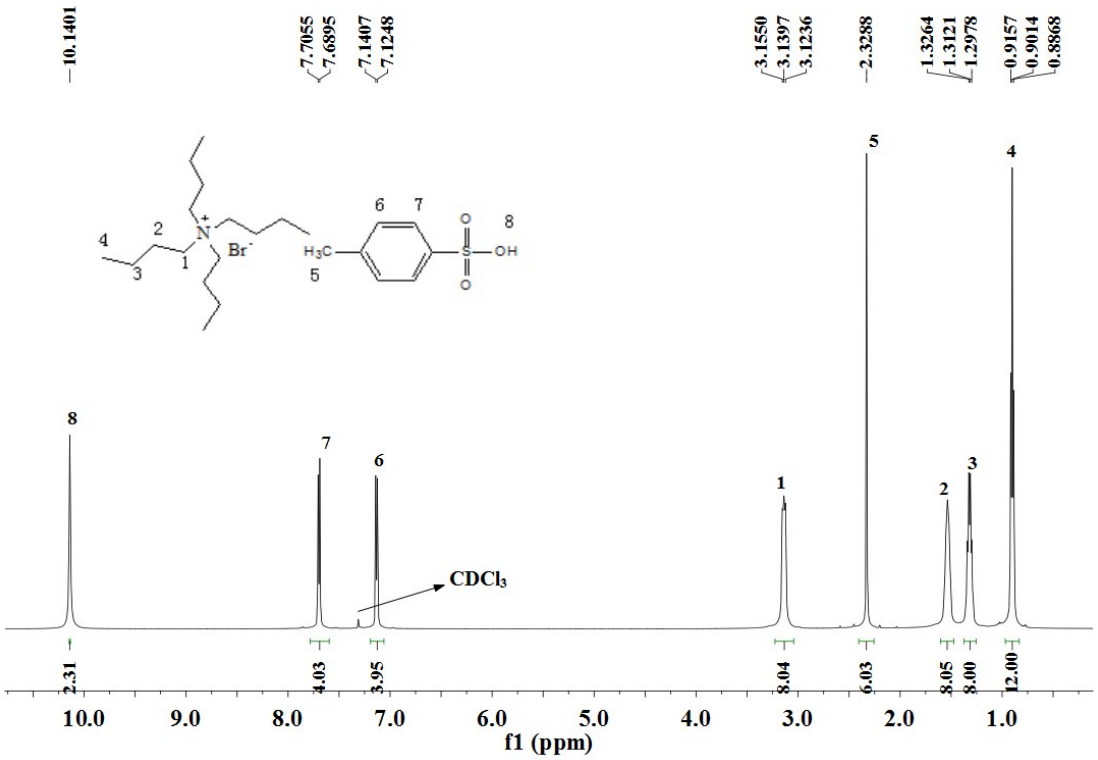

S.Fig.5 $^{1}$H NMR spectrum of TEAC/SSA(1:2) (DMSO-$d_6$)

*S*.Fig.6



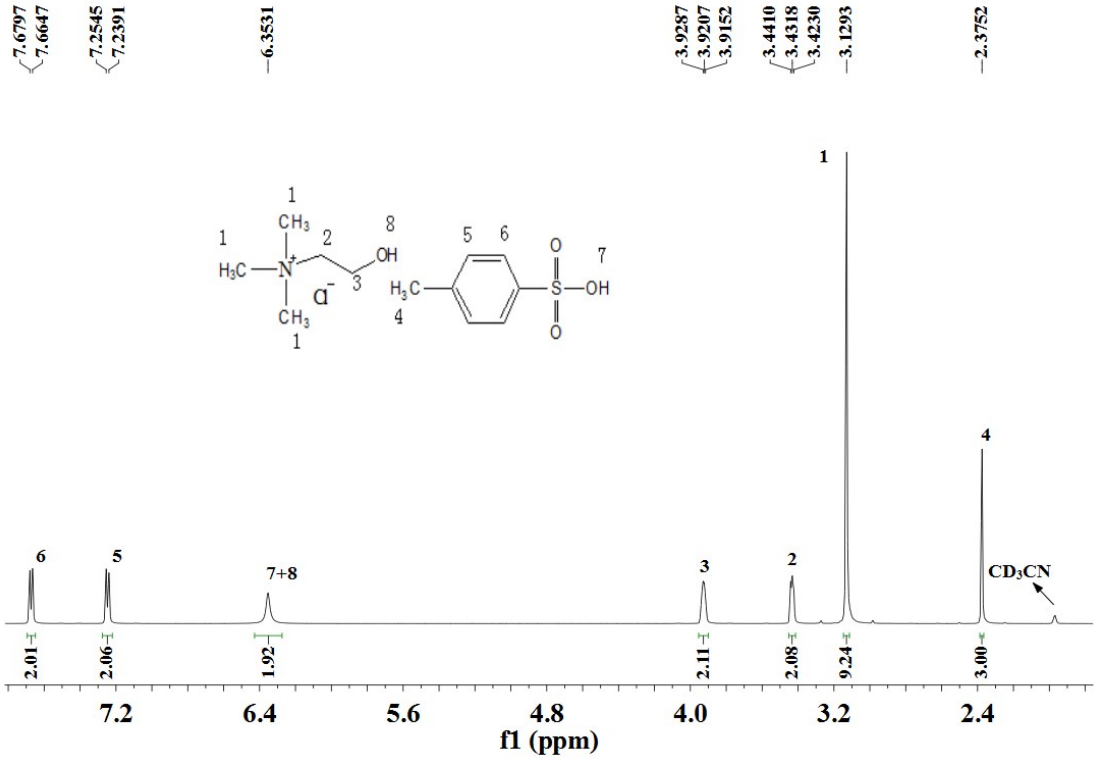

S.Fig.6 $^{1}$H NMR spectrum of TEAB/*p*-TsOH (1:2) ($CD_3CN$)

*S*.Fig.7



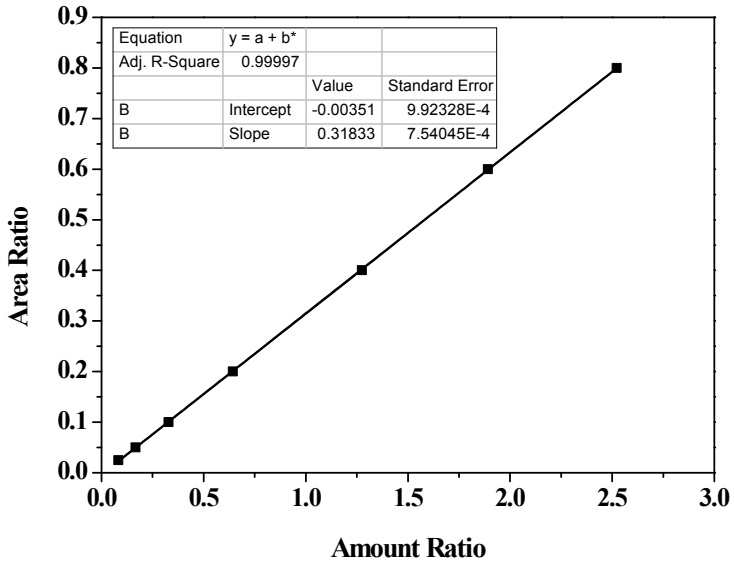

S.Fig.7 $^{1}$H NMR spectrum of TBAB/*p*-TsOH (1:2) ($CDCl_3$)

*S*.Fig.8



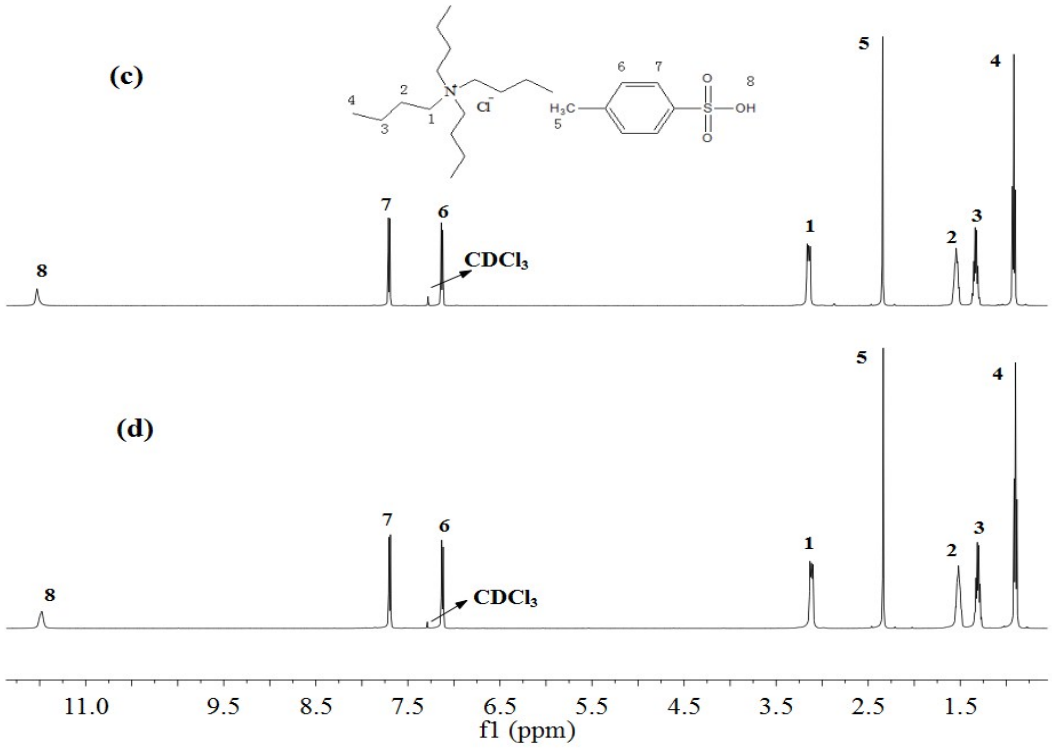

S.Fig.8 $^{1}$H NMR spectrum of ChCl/*p*-TsOH (1:1) ($CD_3CN$)

*S*.Fig.9



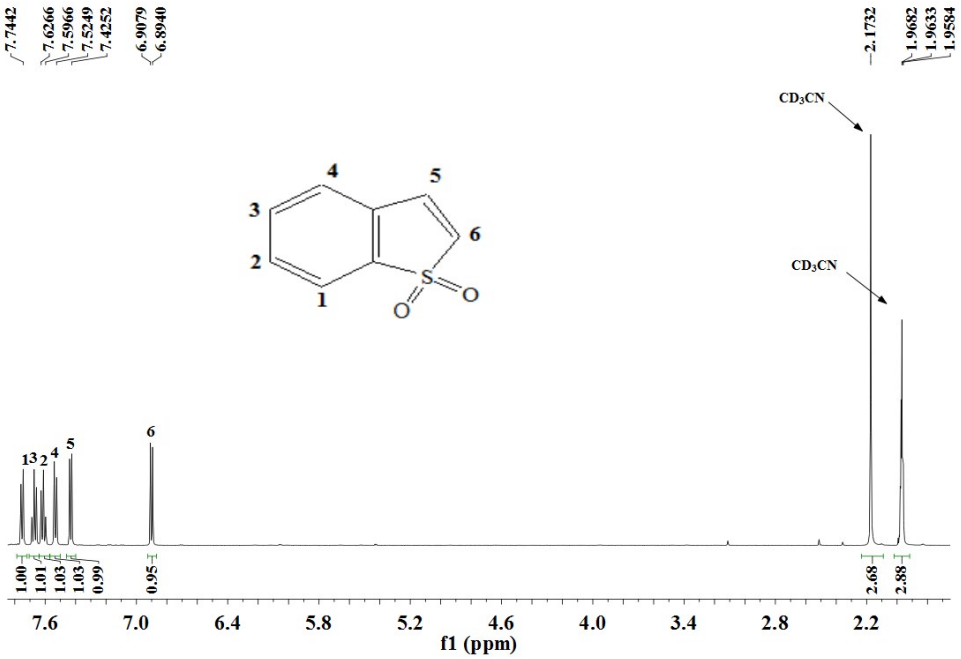

S.Fig.9 Analysis of standard curve

*S*.Fig.10



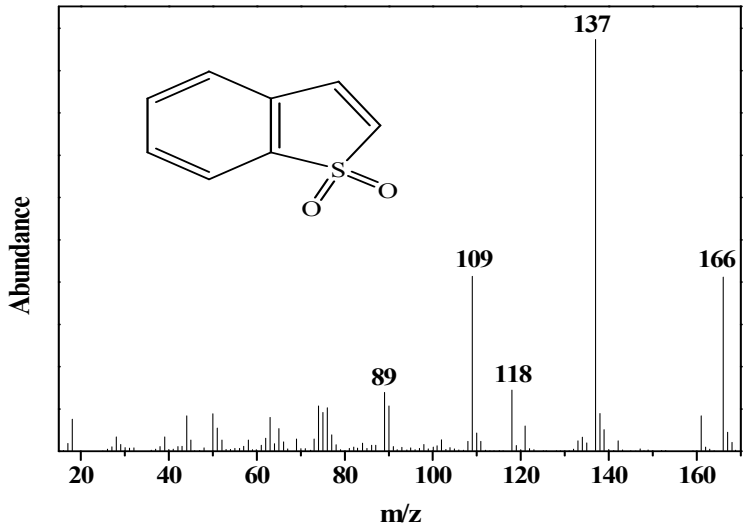

S.Fig.10 Structures of pure and recycled TBAC/*p*-TsOH (1:2) ($CDCl_3$)
(c) Pure TBAC/*p*-TsOH (d) Recycled TBAC/*p*-TsOH

*S*.Fig.11




S.Fig.11 $^{1}$H NMR of the final product

*S*.Fig.12




S.Fig.12 GC-MS of the final product