Electronic Supplementary Information

Highly efficient SO_2 Capture by Dual Functionalized Ionic Liquids through a Combination of Chemical and Physical Absorption

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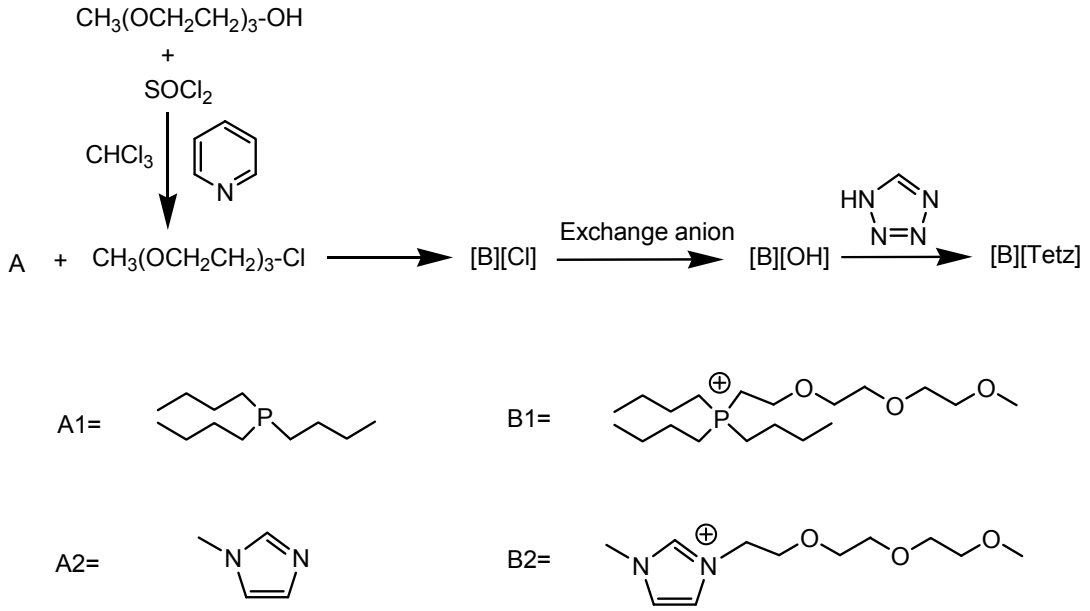
Experimental Section

Materials and general methods

Tri-n-butylphosphine (P_{444}), 1-methylimidzole, 1-bromodecane, triethylene glycol monomethyl ether, thionyl chloride and tetrazole (Tetz), were purchased from Sigma-Aldrich. SO_2 gas with a purity of 99.9% was obtained from Hangzhou Jingong Special Gas Co. Ltd., China. An anion-exchange resin -711(Cl) was botained from Shanghai Huazhen Sci. & Tech. Co., Ltd. of ECUST. All chemicals were obtained in the highest purity grade possible, and were used as received unless otherwise stated. All ILs samples were dried under vacuum at 60 ^{o}C for 24 h to reduce possible traces of water. ^{1}H NMR spectra and ^{13}C NMR spectra were recorded on a Bruker spectrometer (500MHz) in $CDCl_3$ or DMSO-d6 with tetramethylsilane as the standard. FT-IR spectra were recorded on a Nicolet 470 FT-IR spectrometer. In-site IR spectra were recorded on a Bruker MATRIX-MF. Decomposition temperature was measured with a TGA 2100 series of TA Instrument with a heating rate of 10 °C/min, respectively.

Preparation of substances



Scheme S1. Synthetic route to dual functionalized ionic liquids [P_{444E3}][Tetz] (A1 and B1) and [E_3mim][Tetz] (A2 and B2).

Synthesis of 2-[2-(2-methoxyethoxy)ethoxy]ethyl chloride **(**E_3Cl)

E_3Cl was synthesized by the procedure reported by Venugopal Gudipati *et al.*[1] with some slight modifications. A solution of thionyl chloride (53.54 g, 0.45 mol) in $CHCl_3$ (90 ml) was added slowly over 60 min to a stirred solution of triethylene glycol monomethyl ether (49.26 g, 0.30 mol) and pyridine (23.73 g, 0.30 mol) in $CHCl_3$ (200 ml) under nitrogen, followed by refluxing the above reaction mixture at 140 °C for 4 h, then yellow solution was obtained. The above reaction mixture was washed with water (4 × 125 ml), dried with $MgSO_4$, and concentrated under reduced pressure at 50 °C to remove pyridine and $CHCl_3$. The crude product (yellow to orange colored, 51.54 g, 94 %) was spectroscopically pure and can be used in the next step without further purification.

Synthesis of tri-n-butyl{2-[2-(2-methoxyethoxy)ethoxy]ethyl}phosphonium chloride **(**$[P_{444E3}][Cl]$)

$[P_{444E3}][Cl]$ was synthesized by the procedure reported by Suojiang Zhang *et al.*[2] with some slight modifications. A mixture of P_{444} (40.46 g, 0.20 mol) and E_3Cl (32.89 g, 0.18 mol) in acetonitrile (120 ml) was heated with stirring at 80 °C for 48 h. On completion, acetonitrile was evaporated under reduced pressure at 80 °C and the residue was dried under vacuum at 80 °C for 24 h. The product was washed with hexane (100 ml) under reflux at 70 °C for 1 h. After the mixture had cooled, the upper hexane phase was separated. The washing step was repeated until distillation of the separated hexane showed that no more tributylphosphine remained. The product was dried under high vacuum at 80 °C for 24 h to give $[P_{444E3}][Cl]$ (32.54 g, 47 %) as a colorless to light yellow liquid.

Synthesis of tri-n-butyl(decyl)phosphonium bromide **(**$[P_{44410}][Br]$)

$[P_{44410}][Br]$ was prepared from P_{444} and 1-bromodecane using the same mehod as $[P_{444E3}][Cl]$. P_{444} (40.46 g, 0.20 mol) and 1-bromodecane (39.81g, 0.18 mol) were used, and the product $[P_{44410}][Br]$ was obtained as a colorless viscous liquid (70.13 g, 92 %).

Synthesis of 1-{2-[2-(2-methoxy)ethoxy]ethoxy}ethyl-3-methyl imidazolium chloride **(**$[E_3mim][Cl]$)

$[E_3mim][Cl]$ was synthesized by the procedure reported by Jelena Leicunaite *et al.*[3] 2-[2-(2-methoxyethoxy)ethoxy]ethyl chloride (13.70 g, 0.075 mol) and

1-methylimidazole (4.105 g, 0.050 mol) were stirred for 60 h at 80 °C until two phases formed. The top phase, containing unreacted starting material, was decanted and ethyl acetate (50 ml) was added with thorough mixing. The bottom phase was washed with ethyl acetate (25 ml). After the mixture had standed, the upper ethyl acetate phase was separated. The washing step was repeated until the separated ethyl acetate showed that no more 1-bromodecane remained. The product was dried under high vacuum at 80 °C for 24 h to give [E_3mim][Cl] (11.80 g, 89.2 %) as a colourless viscous liquid.

Synthesis of 1-decyl-3-methyl imidazolium bromide **(**[C_{10}mim][Br])

[C_{10}mim][Br] was synthesized by the procedure reported by Sanjit Kanjilal *et al.*[4] with some slight modifications. 1-Methylimidzole (16.42 g, 0.20 mol) and 1-bromodecane (53.08 g, 0.24 mol) were taken up in acetone (120 ml) and refluxed at 60 °C with constant stirring under nitrogen atmosphere for 12 h. The reaction mixture was then cooled. On completion, acetone was evaporated under reduced pressure at 60 °C and the residue was washed with ethyl acetate (100 ml) for 1 h. After the mixture had standed, the upper ethyl acetate phase was separated. The washing step was repeated until the separated ethyl acetate showed that no more 1-bromodecane remained. The product was dried under high vacuum at 80 °C for 24 h to give [C_{10}mim][Br] (56.91 g, 93.84 %) as a colourless viscous liquid.

Synthesis of tri-n-butyl{2-[2-(2-methoxyethoxy)ethoxy]ethyl}phosphonium hydroxide **(**[P_{444E3}][OH])

[P_{444E3}][OH] was prepared from [P_{444E3}][Cl] by the anion-exchange metheod with some slight modifications.[2, 5, 6] During the synthesis process, all aqueous solutions were prepared with deionized water. The anion-exchange resin was pretreated by hydrochloric acid (2 mol L^{-1}) before use. Then, this anion resin was transformed from Cl^- type into OH^- type by passing NaOH solution (2 mol L^{-1}, 10 ml min^{-1}) through the resin column (L = 40 cm, r = 1.5 cm) until Cl^- could not be detected with $AgNO_3/HNO_3$ solution (0.5 mol L^{-1}). As the anion-exchange resin (OH^-) is not stable at temperatures higher than 40 °C, NaOH solution must be used after it is cooled. Excessive NaOH solution was washed with deionised water. Then tranceform the water column into ethanol column. [P_{444E3}][Cl] was diluted with a little ethanol and then transformed into [P_{444E3}][OH] ethanol solution by

passing it through the resin column. The [P_{444E3}][OH] solution was concentrated by rotation evaporation under reduced pressure at 50 °C. Because pure [P_{444E3}][OH] is not stable, we use [P_{444E3}][OH] ethanol solution in the synthesis processes of [P_{444E3}][Tetz]. The concentration of OH^- in [P_{444E3}][OH] ethanol solution was determined by titration with potassium hydrogen phthalate (KHP) water solution.

Synthesis of tri-n-butyl(decyl)phosphonium hydroxide ([P_{44410}][OH])

[P_{44410}][OH] in ethanol was prepared from [P_{44410}][Br] using the same method as [P_{444E3}][OH].

Synthesis of 1-{2-[2-(2-methoxy)ethoxy]ethoxy}ethyl-3-methyl imidazolium hydroxide ([E_3mim][OH])

[E_3mim][OH] in water was prepared from [E_3mim][Cl] using the similar method as [P_{444E3}][OH].

Synthesis of 1-decyl-3-methyl imidazolium hydroxide ([C_{10}mim][OH])

[C_{10}mim][OH] in water was prepared from [C_{10}mim][Br] using the similar method as [P_{444E3}][OH].

Synthesis of tri-n-butyl{2-[2-(2-methoxyethoxy)ethoxy]ethyl}phosphonium tetrazole ionic liquid ([P_{444E3}][Tetz])

The [P_{444E3}][Tetz] was prepared by neutralizing of [P_{444E3}][OH] and tetrazole according to literature's method.[6, 7] Equimolar tetrazole was added to the [P_{444E3}][OH] solution in ethanol. The mixture was then stirred at room temperature for 24 h. Subsequently, ethanol and water were distilled off at 60 ^oC under reduced pressure. The obtained [P_{444E3}][Tetz] was dried under high vacuum for 24 h at 60 ^oC.

Synthesis of tri-n-butyl(decyl)phosphonium tetrazole ionic liquid ([P_{44410}][Tetz])

[P_{44410}][Tetz] was prepared from [P_{44410}][OH] and tetrazole using the same method as [P_{444E3}][Tetz].

Synthesis of 1-{2-[2-(2-methoxy)ethoxy]ethoxy}ethyl-3-methyl imidazolium tetrazole ionic liquid ([E_3mim][Tetz])

[E_3mim][Tetz] was prepared from [E_3mim][OH] and tetrazole using the same method as [P_{444E3}][Tetz].

Synthesis of 1-decyl-3-methyl imidazolium tetrazole ionic liquid ([C_{10}mim][Tetz])

[C_{10}mim][Tetz] was prepared from [C_{10}mim][OH] and tetrazole using the same method as [P_{444E3}][Tetz].

The structures of these dual functionalized ILs and azole-based ILs were confirmed by NMR and IR spectroscopy; no impurities were found by NMR. The water content of these ILs was determined with a Karl Fisher titration and found to be less than 0.1 wt%. The residual bromide content of these basic ILs was determined by a semi-quantitative Nessler cylinder method, which showed that the bromide content was lower than 0.15 wt%.

NMR and IR data of substances

E_3Cl: ^{1}H NMR (DMSO-d6): 3.25 (s, 3H), 3.40-3.45 (m, 2H), 3.50-3.54 (m, 4H), 3.55-3.58 (m, 2H), 3.65-3.69 (m, 2H), 3.69-3.73 (m, 2H) ppm; ^{13}C NMR (DMSO-d6): 44.0, 58.5, 70.1, 70.2, 70.3, 71.0, 71.8 ppm.

[P_{444E3}][Cl]: ^{1}H NMR ($CDCl_3$) 0.98 (t, 9H, C_3CH_3), 1.40-1.60 (m, 12H, $P(CH_2CH_2CH_2)_3$), 2.30-2.50 (m, 6H, $P(CH_2CH_2CH_2)_3$), 2.42 (m, 2H), 3.36 (t, 3H, OCH_3), 3.52 (m, 2H), 3.60 (m, 4H), 3.63 (m, 2H), 3.80-4.0 (m, 2H) ppm; ^{13}C NMR ($CDCl_3$): 12.9, 18.9, 19.3, 20.1, 20.5, 58.3, 63.7, 63.8, 69.5, 69.7, 69.8, 71.3 ppm; IR: 2957, 2931, 2872, 1464, 1381, 1350, 1301, 1241, 1199, 1102, 970, 918, 812, 709, 695, 669, 654 cm^{-1}.

[P_{44410}][Br]: ^{1}H NMR ($CDCl_3$): 0.88 (t, 3H, C_9CH_3), 0.99 (s, 9H, C_3CH_3), 1.25-1.35 (m, 12H, $PC_3(CH_2)_6$), 1.56 (m, 16H, $P(CH_2CH_2CH_2)_4$), 2.46 (m, 8H, PCH_2) ppm; ^{13}C NMR ($CDCl_3$): 13.5, 14.0, 19.0, 19.2, 19.4, 19.6, 21.9, 22.5, 23.8, 24.0, 28.9, 29.1, 29.2, 29.3, 30.7, 30.8, 31.7 ppm; IR: 2957, 2926, 2871, 2858, 1464, 1410, 1380, 1231, 1160, 1099, 1004, 969, 917, 808, 745, 720, 695, 673, 655 cm^{-1}.

[E_3mim][Cl]: ^{1}H NMR ($CDCl_3$) 3.37 (s, 3H), 3.55 (m, 2H), 3.63 (m, 4H), 3.67 (m, 2H), 3.89 (t, 2H), 4.09 (s, 3H), 4.62 (t, 2H), 7.55 (t, 1H, Im C5), 7.77 (t, 1H, Im C4), 10.20 (s, 1H, Im C2) ppm; ^{13}C NMR ($CDCl_3$) 35.8, 48.9, 58.2, 68.3, 69.5, 71.1, 122.7, 122.8, 136.7 ppm; IR: 3140, 3046, 2942, 2872, 1571, 1455, 1352, 1294, 1247, 1198, 1172, 1099, 1028, 933,

848, 702, 678, 662, 645 cm^{-1}.

After the absorption of SO_2: ^1H NMR ($CDCl_3$) 3.25 (s, 3H), 3.45 (m, 2H), 3.52 (m, 4H), 3.56 (m, 2H), 3.78 (t, 2H), 3.93 (s, 3H), 4.39 (t, 2H), 7.37 (t, 1H, Im C5), 7.54 (t, 1H, Im C4), 9.15 (s, 1H, Im C2) ppm; ^{13}C NMR ($CDCl_3$) 36.8, 49.8, 58.7, 68.8, 70.1, 71.7, 123.5, 123.6, 136.9 ppm; IR: 3158, 3116, 2883, 2360, 1566, 1454, 1317, 1199, 1168, 1140, 1101, 1026, 933, 844, 750, 703, 688, 677, 666, 654, 643 cm^{-1}.

[C_{10}mim][Br]: ^1H NMR($CDCl_3$) 0.87 (t, 3H, $NC_9H_{18}CH_3$), 1.20-1.40 (m, 14H, $NC_2H_4(CH_2)_7$), 1.91 (m, 2H, NCH_2CH_2), 4.13 (s, 3H, NCH_3), 4.33 (t, 2H, NCH_2), 7.55 (t, 1H, Im C5), 7.73 (t, 1H, Im C4), 10.07 (s, 1H, Im C2) ppm; ^{13}C NMR ($CDCl_3$): 13.6, 22.1, 25.8, 28.5, 28.7, 28.9, 28.9, 29.8, 31.3, 36.3, 49.6, 121.8, 123.5, 136.4 ppm; IR: 3139, 3052, 2956, 2924, 2854, 2360, 2342, 1570, 1466, 1378, 1338, 1260, 1170, 1088, 1020, 796, 750, 689, 677, 666, 658, 650, 642 cm^{-1}.

After the absorption of SO_2: ^1H NMR($CDCl_3$) 0.75 (t, 3H, $NC_9H_{18}CH_3$), 1.10-1.30 (m, 14H, $NC_2H_4(CH_2)_7$), 1.80 (m, 2H, NCH_2CH_2), 3.95 (s, 3H, NCH_3), 4.17 (t, 2H, NCH_2), 7.36 (t, 1H, Im C5), 7.43 (t, 1H, Im C4), 9.16 (s, 1H, Im C2) ppm; ^{13}C NMR ($CDCl_3$): 14.0, 22.5, 26.1, 28.8, 29.1, 29.2, 29.3, 30.0, 31.7, 36.5, 50.0, 122.2, 123.8, 135.9 ppm; IR: 3157, 3117, 2927, 2856, 2360, 2342, 1571, 1467, 1314, 1166, 1136, 838, 748, 721, 697, 680, 672, 664, 658, 650, 638 cm^{-1}.

[P_{444E3}][Tetz]: ^1H NMR (DMSO-d6): 0.91 (t, 9H, C_3CH_3), 1.10-1.60 (m, 12H, $P(CH_2CH_2CH_2)_3$), 2.10-2.30 (m, 6H, $P(CH_2CH_2CH_2)_3$), 2.59 (m, 2H), 3.24 (t, 3H, OCH_3), 3.42 (m, 2H), 3.50 (m, 4H), 3.54 (m, 2H), 3.70-3.80 (m, 2H), 8.02 (s, 1H, Tetz C2) ppm; ^{13}C NMR (DMSO-d6): 13.6, 18.5, 18.9, 19.5, 19.9, 23.1, 23.2, 23.7, 23.8, 58.5, 60.6, 63.7, 63.8, 70.0, 70.1, 71.8, 72.8, 148.9 ppm; IR: 2959, 2932, 2903, 2873, 1465, 1419, 1381, 1351, 1301, 1240, 1198, 1137, 1107, 1004, 980, 918, 850, 803, 731, 704, 687, 668, 661, 649 cm^{-1}.

After the absorption of SO_2: ^1H NMR (DMSO-d6): 0.88 (t, 9H, C_3CH_3), 1.30-1.50 (m, 12H, $P(CH_2CH_2CH_2)_3$), 2.10-2.30 (m, 6H, $P(CH_2CH_2CH_2)_3$), 2.56 (m, 2H), 3.21 (t, 3H, OCH_3), 3.41 (m, 2H), 3.49 (m, 4H), 3.52 (m, 2H), 3.65-3.75 (m, 2H), 9.20 (s, 1H, Tetz C2) ppm; ^{13}C NMR (DMSO-d6): 13.8, 18.9, 19.3, 19.9, 20.3, 23.4, 23.5, 24.0, 24.1, 58.7, 60.2, 64.1, 64.2, 70.3, 70.5, 72.0, 72.6, 144.0 ppm; IR: 2964, 2936, 2905, 2877, 2360, 1491, 1466, 1403, 1382, 1326, 1230, 1198, 1145, 1099, 1028, 986, 937, 837, 799, 749, 720, 709, 695, 687, 679,

668, 661, 642 cm^{-1}.

[P_{44410}][Tetz]: ^{1}H NMR ($CDCl_3$): 0.88 (t, 3H, C_9CH_3), 0.95 (t, 9H, C_3CH_3), 1.20-1.30 (m, 12H, $PC_3(CH_2)_6$), 1.48 (m, 16H, $P(CH_2CH_2CH_2)_4$), 2.20 (m, 8H, PCH_2), 8.38 (s, 1H, Tetz C2) ppm; ^{13}C NMR ($CDCl_3$): 12.8, 13.5, 17.8, 18.0, 18.2, 18.4, 21.1, 22.1, 23.0, 23.2, 23.4, 28.3, 28.7, 28.9, 30.1, 30.2, 31.3, 149.1 ppm; IR: 2958, 2927, 2872, 2857, 1465, 1418, 1380, 1347, 1312, 1263, 1230, 1155, 1137, 1100, 1044, 1003, 978, 918, 850, 811, 749, 721, 704, 678, 669, 648 cm^{-1}.

After the absorption of SO_2: ^{1}H NMR ($CDCl_3$): 0.84 (t, 3H, C_9CH_3), 0.90 (t, 9H, C_3CH_3), 1.20-1.30 (m, 12H, $PC_3(CH_2)_6$), 1.47 (m, 16H, $P(CH_2CH_2CH_2)_4$), 2.20 (m, 8H, PCH_2), 8.83 (s, 1H, Tetz C2) ppm; ^{13}C NMR ($CDCl_3$): 13.3, 14.1, 18.5, 18.7, 18.8, 19.0, 21.6, 22.6, 23.6, 23.8, 23.9, 28.9, 29.2, 29.4, 30.6, 30.7, 31.8, 143.4 ppm; IR: 2961, 2931, 2873, 2859, 2361, 2343, 1466, 1411, 1382, 1327, 1228 1191, 1144, 1099, 988, 935, 810, 749, 719, 699, 699, 669, 652, 646 cm^{-1}.

[E_3mim][Tetz]: ^{1}H NMR (DMSO-d6): 3.23 (s, 3H), 3.42 (m, 2H), 3.48 (m, 4H), 3.55 (m, 2H), 3.77 (t, 2H), 3.87 (s, 3H), 4.35 (t, 2H), 7.72 (t, 1H, Im C5), 7.76 (t, 1H, Im C4), 8.04 (s, 1H, Tetz C2), 9.11 (s, 1H, Im C2) ppm; ^{13}C NMR (DMSO-d6) 36.2, 49.2, 58.5, 68.6, 70.0, 71.8, 123.2, 123.9, 137.4, 149.2 ppm; IR: 3146, 3094, 2874, 1573, 1454, 1422, 1352, 1295, 1266, 1249, 1198, 1171, 1139, 1106, 1029, 1005, 983, 932, 850, 762, 704, 676, 668, 654, 644 cm^{-1}.

After the absorption of SO_2: ^{1}H NMR (DMSO-d6): 3.23 (s, 3H), 3.40 (m, 2H), 3.48 (m, 4H), 3.54 (m, 2H), 3.76 (t, 2H), 3.89 (s, 3H), 4.35 (t, 2H), 7.69 (t, 1H, Im C5), 7.73 (t, 1H, Im C4), 8.99 (s, 1H, Tetz C2), 9.11 (s, 1H, Im C2) ppm; ^{13}C NMR (DMSO-d6) 36.4, 49.5, 58.7, 68.9, 70.3, 72.0, 123.5, 124.0, 137.8, 144.8 ppm; IR: 3154, 3114, 2883, 2361, 2342, 1567, 1456, 1323, 1169, 1144, 1089, 1030, 989, 938, 846, 753, 697, 670, 653, 644, 628, 618 cm^{-1}.

[C_{10}mim][Tetz]: ^{1}H NMR (DMSO-d6): 0.85 (t, 3H, $NC_9H_{18}CH_3$), 1.24 (m, 14H, $NC_2H_4(CH_2)_7$), 1.77 (m, 2H, NCH_2CH_2), 3.84 (s, 3H, NCH_3), 4.15 (t, 2H, NCH_2), 7.71 (t, 1H, Im C5), 7.78 (t, 1H, Im C4), 8.01 (s, 1H, Tetz C2), 9.17 (s, 1H, Im C2) ppm; ^{13}C NMR (DMSO-d6): 14.3, 22.6, 26.0, 28.9, 29.2, 29.3, 29.4, 29.9, 31.8, 36.4, 49.2, 122.8, 124.1, 137.2, 149.1 ppm; IR: 3144, 3090, 2955, 2924, 2854, 1667, 1599, 1573, 1507,

1466, 1421, 1378, 1326, 1267, 1236, 1171, 1139, 1112, 1044, 1022, 1005, 983, 856, 793, 763, 751, 723, 703, 689, 675, 663, 645 cm^{-1}.

After the absorption of SO_2: ^{1}H NMR (DMSO-d6): 0.82 (t, 3H, $NC_9H_{18}CH_3$), 1.21 (m, 14H, $NC_2H_4(CH_2)_7$), 1.76 (m, 2H, NCH_2CH_2), 3.86 (s, 3H, NCH_3), 4.16 (t, 2H, NCH_2), 7.69 (t, 1H, Im C5), 7.75 (t, 1H, Im C4), 9.11 (s, 1H, Tetz C2), 9.23 (s, 1H, Im C2) ppm; ^{13}C NMR (DMSO-d6): 14.4, 22.6, 26.1, 29.0, 29.2, 29.4, 29.5, 30.0, 31.8, 36.2, 49.3 122.8, 124.1, 137.4, 144.5 ppm; IR: 3151, 3112, 2927, 2856, 2360, 2342, 1717, 1700, 1684, 1653, 1570, 1560, 1541, 1507, 1472, 1457, 1437, 1419, 1326, 1231, 1167, 1145, 1082, 1043, 989, 942, 877, 744, 726, 701, 693, 681, 667, 653, 646 cm^{-1}.

Absorption and desorption of SO_2

In a typical absorption of SO_2, SO_2 of atmospheric pressure was bubbled through about 1.0 g ILs in a glass container with an inner diameter of 10 mm, and the flow rate was about 60 ml min^{-1}. The glass container was partly immersed in a circulation water bath of desirable temperature. The amount of SO_2 absorbed was determined at regular intervals by the electronic balance with an accuracy of ± 0.1 mg. During the absorption of SO_2 under reduced pressure, SO_2 was diluted with N_2 in order to reduce the partial pressure of SO_2 passing through the system. The SO_2 partial pressure was controlled by changing the flow of SO_2 and N_2. The standard deviations of the absorption loadings under 1.0 and 0.1 bar are 0.03 and 0.05 mole SO_2 per mole IL, respectively.

Desorption of SO_2 gas from saturated IL solutions was carried out and monitored in an analogous way as for the described absorption method. The ILs were regenerated by heating or bubbling nitrogen through ILs. In a typical desorption of SO_2, N_2 of atmospheric pressure was bubbled through about 1.0 g captured ILs in a glass container, which was partly immersed in a circulation oil bath of desirable temperature, and the flow rate was about 60 ml min^{-1}. The release of SO_2 was determined at regular intervals by the electronic balance.

Table S1. The effect of contents of SO_2 in the mixture gas on SO_2 capture by these ILs.[a]

Ionic liquids	SO_2 absorption [b]			
	100% SO_2	10% SO_2+ 90% N_2	1% SO_2+ 99% N_2	0.2% SO_2 + 99.8% N_2
$[P_{444E3}][Tetz]$	4.87	1.87	1.13	0.95
$[P_{44410}][Tetz]$	3.87	1.65	1.04	0.93
$[E_3mim][Tetz]$	4.43	1.58	1.16	0.98
$[C_{10}mim]Tetz]$	3.37	1.53	0.92	0.75

[a] Performed at 20 °C. [b] Mole SO_2 per mole IL

Table S2. The effect of water on SO_2 capture by these ILs at 1 atm.[a]

Ionic liquids	Loading (mole/mole IL)	
	100% SO_2 (dry)	100% SO_2 (wet) [b]
$[P_{444E3}][Tetz]$	4.87	4.88
$[P_{44410}][Tetz]$	3.87	3.95
$[E_3mim][Tetz]$	4.43	4.27
$[C_{10}mim]Tetz]$	3.37	3.25

[a] Performed at 20 °C for 30 min. [b] Relative humidity is 100%.

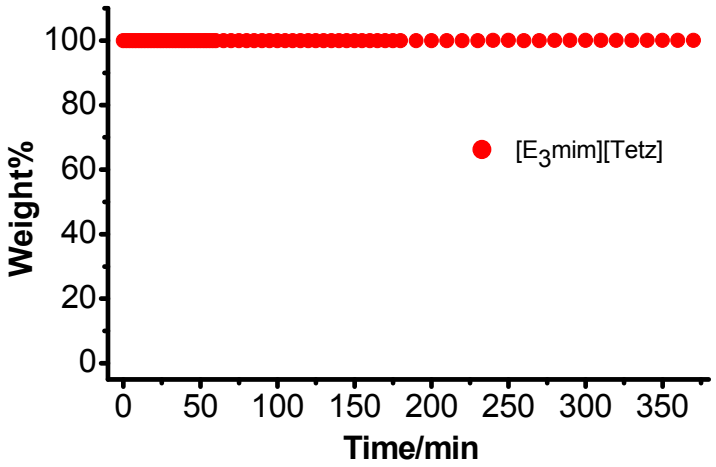


Figure S1. The stability of $[E_3mim][Tetz]$ as a function of time at 80 °C under N_2 containing 100 % humidity.

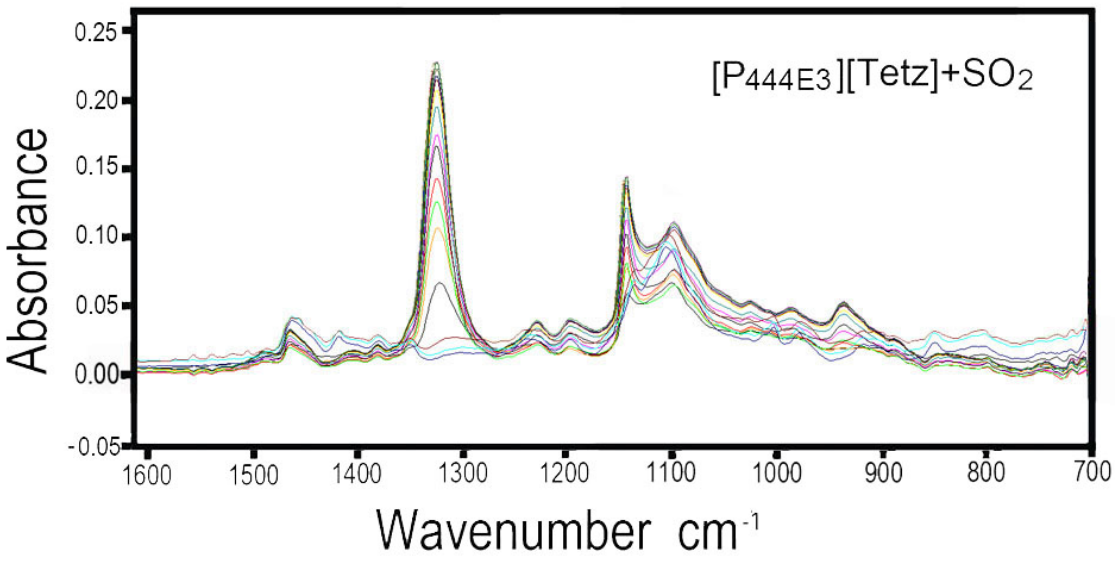


Figure S2. The stack plot of the in-situ FT-IR spectra collected every 30 s for the SO_2 capture by $[P_{444E3}][Tetz]$ in 30 min under 20 °C.

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