Tuning Biphasic Electrolytes for Membrane-free Redox Flow Batteries: Influence of Sodium Thiocyanate on Partition and Viscosity

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Supplementary information

Contents

1 Uncertainty

The uncertainties in this study were treated according to the Guide to the Expression of Uncertainty in Measurement (GUM) [1]. Below is a brief description of the calculations and considerations applied.

All uncertainties were calculated assuming a normal error distribution function. The uncertainties for UV-Vis and water content measurements were classified as Type A and determined based on the standard deviation of repeated measurements. For ion chromatography (IC) measurements, the uncertainty was assumed to be 2.5% of the measured value, except for aqueous biphasic systems (ABS) formed with [P_{44414}]Cl, where a Type B uncertainty of 7.5% was incorporated due to high viscosity and the associated difficulty in solubilizing samples in the IC solvent.

All error bars presented in the manuscript represent expanded uncertainties at a 95% confidence level. The correction factor used to convert standard deviation into expanded uncertainties is 2 (k = 2).

1.1 Calculation of the Partition Coefficient (K)

The partition coefficient (K) is determined as the ratio between the solute concentration in the top phase (C_{top}) and the bottom phase (C_{bottom}), according to Equation (1).

$$K = \frac{C_{\text{top}}}{C_{\text{bottom}}} \qquad (1)$$

1.2 Uncertainty Propagation for K

The uncertainty in K is propagated according to the general formula for the division of two independent variables (2):

$$u(K) = K \times \sqrt{\left(\frac{u(C_{\text{top}})}{C_{\text{top}}}\right)^2 + \left(\frac{u(C_{\text{bottom}})}{C_{\text{bottom}}}\right)^2} \qquad (2)$$

Where $u(C_{top})$ and $u(C_{bottom})$ are the standard deviations associated with the measured concentrations in the top and bottom phases, respectively.

1.3 Calculation of log K

To express the partition coefficient in logarithmic form, the base-10 logarithm is applied (3):

$$\log K = \log_{10}(K) \quad (3)$$

1.4 Uncertainty Propagation for log K

The uncertainty in $LogK$ is obtained by propagating the uncertainty from K through the logarithmic transformation (4):

$$u(\log K) = \frac{1}{\ln(10)} \times \frac{u(K)}{K} \quad (4)$$

2 Calculus considerations

2.1 Mass and Charge Balance Calculation

2.1.1 Conversion of IC Data into Molar Concentration

The ion chromatography (IC) measurements provided the mass concentration of each ion in ppm (mg/L) for both top and bottom phases of all ABS under study. These values were converted into weight percentage by considering the total mass of the respective phase.

To obtain the molar concentration (mol/L) of each species, the weight percentage was divided by the respective molar mass of the ions, using the following molar masses shown in Table S1.

Table S1. Molar mass of IC ions

Ion	Molar Mass (g/mol)
NH_4^+	18.038
Na^+	22.990
Cl^-	35.453
SO_4^{2-}	96.063
Br^-	79.900
SCN^-	58.078

The densities of the phases were also required to convert from mass concentration (g/L) to molar concentration (mol/L). When density measurements at the mixture point were unavailable, an average density of 1.00 g/cm³ for the top phase and 1.65 g/cm³ for the bottom phase was used.

2.1.2 Charge Balance for Ionic Liquids' Cations

Since ionic liquids (ILs) do not appear in IC measurements, their cation concentrations were inferred by ensuring charge neutrality in each phase. The following cation molar masses were used as shown in Table S2.

Table S2. Molar mass of ILs' cations

IL Cation	Molar Mass (g/mol)
$[P_{4444}]^+$	259.44
$[P_{44414}]^+$	399.71
$[N_{4444}]^+$	242.47

The **charge balance equation** was applied according to equation (5):

$$\sum(\text{cationic charge} \times \text{cation concentration}) = \sum(\text{anionic charge} \times \text{anion concentrati} \qquad (5)$$

In cases where small negative values were obtained due to measurement uncertainties, a fixed concentration of 0.01 mol/L was assigned to the IL cations in that phase.

2.1.3 Determination of Water Content

Once the molar concentrations of all species were obtained, the IL cation concentrations were converted back to mass concentrations. The total mass concentration was then summed for all species, and the remaining fraction required to reach 100% mass composition was attributed to water (6).

$$\%\text{Water} = 100\% - \sum \text{mass concentrations of all detected species} \qquad (6)$$

2.1.4 Mass Balance and Mixture Point Calculation

For each ABS, the total mass of the top and bottom phases at equilibrium was recorded. The weight of each phase was multiplied by the corresponding mass concentration of each species to determine the total mass of each ion in the entire system. For this, the total ion content in the system was computed, the mixture point composition (before phase separation) was estimated, and the total ion balance was compared with the initially prepared ABS composition.

2.1.5 Validation and Comparison

The total mass of each ion in the system (calculated from IC and mass balance) was compared with the initial amounts used to prepare the ABS. Discrepancies between the measured mixture point and the prepared mixture composition are reported in the comparison tables.

This approach ensures that the mass and charge balances are consistent and that all experimental uncertainties are accounted for within the ABS analysis.

3 Binodal curves

3.1 [P_{4444}]Cl + $(NH_4)_2SO_4$ binodal curve

Table S3 presents the binodal curve of [P_{4444}]Cl + $(NH_4)_2SO_4$ ABS.

Table S3. Binodal [P_{4444}]Cl + $(NH_4)_2SO_4$

IL (1) + salt (2) + H_2O (3) at 298.15 K		
100 w1	**100 w2**	**100 w3**
40.69	7.07	52.24
36.72	8.91	54.37
34.01	9.70	56.29
32.04	10.35	57.61
29.66	11.15	59.19
27.14	12.27	60.59
25.30	13.19	61.51
22.92	14.36	62.73
22.03	14.69	63.28
20.79	15.46	63.75
19.34	16.42	64.25
18.54	16.77	64.69
18.00	16.94	65.07
17.21	17.44	65.35
16.70	17.58	65.71
16.00	18.00	66.00
15.41	18.32	66.27
14.41	18.96	66.63
13.83	19.30	66.87
13.31	19.57	67.13
12.79	19.90	67.31
12.35	20.19	67.46
11.87	20.60	67.52
11.48	20.59	67.93
11.01	20.99	68.00
10.57	21.33	68.10
10.36	21.35	68.29
10.09	21.55	68.36
9.80	21.76	68.44
9.31	22.24	68.44
8.98	22.61	68.40
8.82	22.53	68.64
8.48	22.86	68.66

8.23	23.05	68.72
8.00	23.19	68.81
7.76	23.45	68.79
7.51	23.73	68.76
7.29	23.93	68.78
7.09	24.11	68.80
6.88	24.31	68.81
6.35	24.88	68.77
6.13	25.03	68.84
5.54	25.67	68.79

Table S4 presents the binodal chart of [P_{4444}]Cl + $(NH_4)_2SO_4$ prepared by replacing pure water over 1M aqueous solution of NaSCN, given: IL (1) + salt (2) + H_2O (3) at 298.15 K.

Table S4. Binodal [P_{4444}]Cl + $(NH_4)_2SO_4$ + 1M NaSCN aqueous solution.

x2*100%	x1*100%	x3*100%
1.02	20.10	78.88
1.58	15.97	82.45
2.03	12.80	85.16
2.14	10.34	87.52
2.46	9.23	88.31
2.64	7.80	89.56
2.74	6.74	90.52
2.84	5.96	91.20
2.82	5.38	91.81
2.89	4.95	92.16
47.74	1.00	51.26
56.62	0.56	42.82
70.64	0.95	28.41

3.2 [N_{4444}]Cl + $(NH_4)_2SO_4$ binodal curve

Table S5 presents the binodal curve of [N_{4444}]Cl + $(NH_4)_2SO_4$ ABS

Table S5. Binodal [N_{4444}]Cl + $(NH_4)_2SO_4$

IL (1) + salt (2) + H_2O (3) at 298.15 K		
100 w1	100 w1	100 w1
40.69	40.69	40.69
63.27	3.22	33.51
57.94	3.55	38.50

46.44	4.26	49.30
44.08	4.75	51.17
41.80	5.34	52.87
39.81	5.89	54.30
38.10	6.37	55.53
36.13	6.72	57.14
34.62	7.24	58.14
33.50	7.64	58.87
31.84	8.35	59.82
30.05	9.23	60.72
29.09	9.50	61.41
28.01	10.05	61.94
27.09	10.52	62.39
25.95	11.11	62.94
24.90	11.64	63.46
23.80	12.29	63.91
23.07	12.71	64.22
22.86	12.85	64.28
21.47	13.64	64.89
20.60	14.18	65.22
19.50	14.92	65.58
18.67	15.46	65.88
17.67	16.22	66.11
16.93	16.73	66.34
16.21	17.32	66.47
15.55	17.82	66.62
15.29	18.06	66.65
14.70	18.53	66.77
14.20	18.95	66.86
13.78	19.26	66.97
13.26	19.65	67.10
12.86	19.97	67.17
12.64	20.19	67.18
12.01	20.70	67.29
11.81	20.90	67.29
11.48	21.17	67.35
11.32	21.32	67.36
10.93	21.65	67.42
10.62	21.89	67.49
10.18	22.26	67.56
9.82	22.58	67.60
9.57	22.80	67.62
9.26	23.10	67.64
9.05	23.27	67.68
8.77	23.54	67.70

8.42	23.90	67.68
8.14	24.17	67.69
7.86	24.45	67.69
7.63	24.67	67.71
7.38	24.92	67.70
7.12	25.21	67.67
6.89	25.46	67.65
6.82	25.54	67.64
6.62	25.77	67.61

Table S6 present the binodal chart of $[N_{4444}]Cl$ + $(NH_4)_2SO_4$ prepared by replacing pure water over 1M aqueous solution of NaSCN, given: IL (1) + salt (2) + H_2O (3) at 298.15 K.

Table S6. Binodal $[N_{4444}]Cl$ + $(NH_4)_2SO_4$ + 1M NaSCN aqueous solution.

x2*100%	x1*100%	x3*100%
0.80	30.30	68.90
1.33	24.62	74.05
1.70	20.17	78.13
2.15	18.36	79.48
2.41	16.17	81.42
2.67	14.71	82.61
2.77	13.22	84.01
3.00	12.37	84.63
3.12	11.45	85.43
3.20	10.49	86.31
1.00	47.74	51.26
0.56	56.62	42.82
0.95	70.64	28.41

3.3 $[N_{4444}]Br$ + $(NH_4)_2SO_4$ binodal curve

Table S7 present the binodal curve of $[N_{4444}]Br$ + $(NH_4)_2SO_4$ ABS.

Table S7. Binodal $[N_{4444}]Br$ + $(NH_4)_2SO_4$

IL (1) + salt (2) + H_2O (3) at 298.15 K		
100 w1	100 w1	100 w1
62.04	4.29	33.66
56.79	4.07	39.14
41.58	4.80	53.62
38.85	5.03	56.12
37.56	5.58	56.86

35.71	6.13	58.16
34.10	6.51	59.39
32.60	6.88	60.52
31.63	7.35	61.02
30.32	7.76	61.92
29.45	8.17	62.38
28.35	8.39	63.26
27.69	8.74	63.57
26.99	9.14	63.86
26.34	9.43	64.23
25.36	9.67	64.97
24.80	9.96	65.24
24.23	10.24	65.53
23.72	10.48	65.80
23.02	10.61	66.37
22.56	10.83	66.60
22.13	11.06	66.81
21.71	11.24	67.05
21.28	11.41	67.31
20.89	11.64	67.48
20.51	11.80	67.69
20.08	11.92	68.00
19.80	12.10	68.10
19.47	12.26	68.27
18.59	12.68	68.73
18.33	12.76	68.90
18.05	12.85	69.09
17.64	12.90	69.46
17.40	13.05	69.55
17.16	13.17	69.67
16.94	13.27	69.80
16.60	13.28	70.12
16.28	13.57	70.16
16.00	13.58	70.42
15.80	13.67	70.53
15.50	13.90	70.60
15.29	14.00	70.71
15.03	14.04	70.93
14.84	14.12	71.04
14.67	14.21	71.12
14.49	14.32	71.19
14.31	14.46	71.23
14.15	14.56	71.29
13.99	14.62	71.40
13.84	14.71	71.46

13.68	14.80	71.51
13.54	14.89	71.57
13.38	14.97	71.64
13.24	15.04	71.72
13.10	15.14	71.77
12.97	15.21	71.83
12.84	15.26	71.90
12.72	15.31	71.97
12.60	15.39	72.01
12.49	15.43	72.08
12.36	15.48	72.16
12.25	15.55	72.20
12.07	15.71	72.22
11.95	15.78	72.27
11.84	15.83	72.33
11.71	15.89	72.40
11.59	15.93	72.47
11.48	15.99	72.53
11.37	16.04	72.59
11.09	16.27	72.65
10.98	16.34	72.68
10.88	16.43	72.69
10.78	16.56	72.66
10.69	16.62	72.69
10.53	16.78	72.68
10.44	16.81	72.74
10.36	16.86	72.78
10.22	17.01	72.77
10.13	17.03	72.83
9.99	17.19	72.82
9.91	17.21	72.88
9.83	17.25	72.93
9.71	17.37	72.92
9.62	17.39	72.99

Table S8

3.4 [P_{44414}]Cl + $(NH_4)_2SO_4$ binodal curve

Table S8. Binodal [P_{44414}]Cl + $(NH_4)_2SO_4$

IL (1) + salt (2) + H_2O (3) at 298.15 K		
100 w1	**100 w1**	**100 w1**

63.40	1.25	35.35
58.28	2.58	39.14
51.56	3.79	44.64
46.42	4.73	48.85
42.36	5.55	52.10
38.61	6.08	55.31
36.15	6.62	57.23
33.92	7.03	59.04
31.91	7.52	60.57
30.08	7.89	62.03
28.91	8.39	62.70
27.84	8.81	63.35
26.77	9.35	63.88
24.80	9.94	65.25
23.33	10.23	66.43
22.70	10.56	66.74
22.06	10.89	67.06
20.20	11.61	68.20
19.48	11.69	68.83
18.97	11.86	69.17
18.54	12.09	69.37
18.04	12.36	69.60
17.59	12.52	69.89
17.14	12.75	70.12
16.58	13.24	70.18
15.81	13.43	70.76
15.33	13.41	71.26
14.71	13.82	71.47
14.04	14.11	71.84
13.54	14.40	72.07
13.11	14.57	72.32
12.75	14.85	72.41
11.96	15.24	72.80
11.51	15.44	73.05
11.22	15.63	73.16
10.86	15.82	73.32
10.44	16.16	73.39
10.09	16.47	73.44
9.58	16.75	73.68
8.90	17.33	73.78
8.45	17.64	73.91
8.16	18.07	73.77
7.74	18.39	73.88
7.40	18.74	73.86
7.05	18.93	74.02

6.75	19.33	73.92
6.47	19.38	74.15
6.20	19.69	74.11
5.74	20.14	74.12
5.60	20.21	74.19
5.44	20.35	74.22
5.31	20.55	74.15
5.12	20.72	74.15
5.04	20.72	74.24
4.99	20.79	74.21
4.90	20.92	74.18
4.84	20.96	74.20
4.79	21.01	74.19
4.75	21.09	74.16
4.70	21.13	74.18
4.65	21.19	74.17
4.58	21.26	74.16
4.49	21.32	74.19
4.43	21.41	74.16
4.33	21.52	74.16
4.24	21.60	74.16
4.17	21.76	74.07
4.07	21.86	74.07

4 Species concentration

4.1 Ion chromatography (experimental)

This section presents the concentrations of Na^+, NH_4^+, SCN^- , Cl^-, Br^- and SO_4^{2-} acquired by Ionic chromatography at room temperature, in the bottom and top phases of 19 ABS under study. Table S9 contains the rough experimental data acquired by ion chromatography of all systems under study, measured in ppm. Table S10 present the same data but at mass fraction (wt.%).

Table S9. Concentrations of Na^+, NH_4^+, SCN^-, Cl^-, Br^- and SO_4^{2-} of studied systems in ppm concentrations.

		Concentration (ppm)					
ABS	**Phase**	**NH_4^+**	**Na^+**	**Cl^-**	**SO_4^{2-}**	**Br^-**	**SCN^-**
0% NaSCN; 25% $[P_{4444}]Cl$ + 17% $(NH_4)_2SO_4$	top	1.23E+04		4.16E+04	3.53E+04		
	bottom	9.97E+04		1.15E+04	2.70E+05		
4 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	top	3.44E+03	9.55E+01	4.97E+04	4.99E+03		4.04E+04
	bottom	9.61E+04	2.35E+04	3.63E+04	2.69E+05		3.97E+01
4 % NaSCN + 30% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	top	2.19E+03	8.48E+01	3.88E+04	4.64E+03		5.40E+04
	bottom	1.00E+05	1.97E+04	3.51E+04	2.64E+05		3.88E+01
4 % NaSCN + 40% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	top	3.14E+03	4.54E+01	5.71E+04	4.88E+03		3.60E+04
	bottom	1.30E+05	2.09E+04	3.27E+04	3.52E+05		3.80E+01
9 % NaSCN + 15% $[P_{4444}]Cl$ + 16% $(NH_4)_2SO_4$	top	7.01E+03	9.86E+01	1.37E+03	1.69E+03		1.54E+05
	bottom	6.11E+04	3.25E+04	2.46E+04	1.71E+05		3.17E+04
0% NaSCN; 31% $[N_{4444}]Cl$ + 12% $(NH_4)_2SO_4$	top	1.74E+04		4.39E+04	4.61E+04		
	bottom	1.08E+05		1.37E+04	3.03E+05		
4 % NaSCN + 40% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	top	5.20E+03	1.54E+02	6.20E+04	5.48E+03		4.00E+04
	bottom	1.08E+05	2.67E+04	2.89E+04	3.33E+05		4.14E+01
4 % NaSCN + 30% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	top	5.94E+03	6.95E+02	4.34E+04	1.45E+04		6.16E+04
	bottom	8.05E+04	2.38E+04	3.12E+04	2.17E+05		6.03E+01
4 % NaSCN + 40% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	top	3.91E+03	2.33E+02	5.54E+04	6.63E+03		4.00E+04
	bottom	7.59E+04	3.28E+04	3.22E+04	2.27E+05		5.68E+01
13 % NaSCN +20% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	top	1.03E+04	2.12E+03	1.74E+03	1.47E+03		1.94E+05
	bottom	3.78E+04	5.33E+04	3.38E+04	1.09E+05		5.57E+04
0% NaSCN; 32% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	top	1.08E+04			2.90E+04	1.11E+05	
	bottom	7.16E+04			1.90E+05	1.84E+04	
4 % NaSCN + 30% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	top	3.70E+03	1.61E+02		4.21E+03	8.45E+04	7.01E+04

	bottom	7.24E+04	2.20E+04		1.96E+05	6.79E+04	3.34E+02
4 % NaSCN + 40% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	top	5.41E+03	5.87E+02		4.44E+03	1.29E+05	4.94E+04
	bottom	6.47E+04	2.88E+04		1.91E+05	7.21E+04	2.37E+02
4 % NaSCN + 40% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	top	5.60E+03	1.78E+02		4.31E+03	1.32E+05	4.34E+04
	bottom	9.29E+04	2.39E+04		2.67E+05	5.93E+04	1.58E+02
11 % NaSCN +21% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	top	7.94E+03	7.89E+02		1.97E+03	5.43E+03	1.78E+05
	bottom	3.86E+04	4.39E+04		1.11E+05	7.18E+04	3.98E+04
0% NaSCN; 30% $[P_{44414}]Cl$ + 10% $(NH_4)_2SO_4$	top	8.75E+03		3.86E+04	3.10E+04		
	bottom	5.69E+04		8.47E+03	1.78E+05		
4 % NaSCN + 40% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	top	7.58E+02	1.50E+01	3.03E+04	4.33E+03		3.11E+04
	bottom	1.20E+05	2.08E+04	3.16E+04	3.34E+05		4.51E+01
4 % NaSCN + 30% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	top	8.28E+03	2.47E+03	1.74E+04	1.54E+04		9.33E+03
	bottom	9.43E+04	2.87E+04	4.20E+04	2.56E+05		4.51E+01
4 % NaSCN + 40% $[P_{44414}]Cl$ + 15% $(NH_4)_2SO_4$	top	5.67E+02	1.17E+00	3.36E+04	4.90E+02		2.67E+04
	bottom	9.36E+04	2.23E+04	3.58E+04	2.24E+05		3.47E+01

Table S10. Concentrations of Na^+, NH_4^+, SCN^-, Cl^-, Br^- and SO_4^{2-} of studied systems in mass percentage (wt.%).

ABS	**NH4+**	**Na+**	**Cl-**	**SO_4^{2-}**	**Br-**	**SCN-**	**Cation**	**H_2O (IC)**
0% NaSCN; 25% $[P_{4444}]Cl$ + 17% $(NH_4)_2SO_4$	1.23%	0.00%	4.16%	3.53%	0.00%	0.00%	31.88%	59.21%
	9.97%	0.00%	1.15%	27.00%	0.00%	0.00%	10.88%	51.00%
4 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.34%	0.01%	4.97%	0.50%	0.00%	4.04%	50.35%	39.79%
	9.61%	2.35%	3.63%	26.95%	0.00%	0.00%	12.37%	45.09%
4 % NaSCN + 30% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	0.22%	0.01%	3.88%	0.46%	0.00%	5.40%	50.79%	39.24%
	10.02%	1.97%	3.51%	26.40%	0.00%	0.00%	3.27%	54.84%
4 % NaSCN + 40% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	0.31%	0.00%	5.71%	0.49%	0.00%	3.60%	53.89%	35.99%

	13.04%	2.09%	3.27%	35.20%	0.00%	0.00%	4.78%	41.62%
9 % NaSCN + 15% [P_{4444}]Cl + 16% $(NH_4)_2SO_4$	0.70%	0.01%	0.14%	0.17%	0.00%	15.44%	60.71%	22.83%
	6.11%	3.25%	2.46%	17.06%	0.00%	3.17%	1.30%	66.65%
0% NaSCN; 31% [N_{4444}]Cl + 12% $(NH_4)_2SO_4$	1.74%	0.00%	4.39%	4.61%	0.00%	0.00%	29.87%	59.39%
	10.79%	0.00%	1.37%	30.33%	0.00%	0.00%	17.51%	40.01%
4 % NaSCN + 40% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	0.52%	0.02%	6.20%	0.55%	0.00%	4.00%	52.88%	35.83%
	10.78%	2.67%	2.89%	33.26%	0.00%	0.00%	24.08%	26.32%
4 % NaSCN + 30% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	0.59%	0.07%	4.34%	1.45%	0.00%	6.16%	52.26%	35.13%
	8.05%	2.38%	3.12%	21.68%	0.00%	0.01%	0.24%	64.52%
4 % NaSCN + 40% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	0.39%	0.02%	5.54%	0.66%	0.00%	4.00%	51.02%	38.37%
	7.59%	3.28%	3.22%	22.68%	0.00%	0.01%	0.24%	62.98%
13 % NaSCN +20% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	1.03%	0.21%	0.17%	0.15%	0.00%	19.43%	66.89%	12.11%
	3.78%	5.33%	3.38%	10.91%	0.00%	5.57%	1.21%	69.82%
0% NaSCN; 32% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	1.08%	0.00%	0.00%	2.90%	11.07%	0.00%	33.68%	51.26%
	7.16%	0.00%	0.00%	18.99%	1.84%	0.00%	5.19%	66.82%
4 % NaSCN + 30% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	0.37%	0.02%	0.00%	0.42%	8.45%	7.01%	52.34%	31.38%
	7.24%	2.20%	0.00%	19.58%	6.79%	0.03%	0.24%	63.91%
4 % NaSCN + 40% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	0.54%	0.06%	0.00%	0.44%	12.87%	4.94%	55.72%	25.43%
	6.47%	2.88%	0.00%	19.09%	7.21%	0.02%	1.67%	62.66%
4 % NaSCN + 40% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	0.56%	0.02%	0.00%	0.43%	13.19%	4.34%	54.37%	27.10%
	9.29%	2.39%	0.00%	26.73%	5.93%	0.02%	4.73%	50.91%
11 % NaSCN +21% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	0.79%	0.08%	0.00%	0.20%	0.54%	17.82%	65.54%	15.02%
	3.86%	4.39%	0.00%	11.07%	7.18%	3.98%	1.21%	68.31%
0% NaSCN; 30% [P_{44414}]Cl + 10% $(NH_4)_2SO_4$	0.88%	0.00%	3.86%	3.10%	0.00%	0.00%	30.30%	61.86%
	5.69%	0.00%	0.85%	17.84%	0.00%	0.00%	32.01%	43.62%
4 % NaSCN + 40% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	0.08%	0.00%	3.03%	0.43%	0.00%	7.35%	79.57%	9.53%
	11.96%	2.08%	3.16%	33.40%	0.00%	0.00%	20.40%	29.00%

4 % NaSCN + 30% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	0.83%	0.25%	1.74%	1.54%	0.00%	8.78%	64.17%	22.70%
	9.43%	2.87%	4.20%	25.63%	0.00%	0.00%	2.86%	55.01%
4 % NaSCN + 40% $[P_{44414}]Cl$ + 15% $(NH_4)_2SO_4$	0.06%	0.00%	3.36%	0.05%	0.00%	7.75%	82.99%	5.80%
	9.36%	2.23%	3.58%	22.35%	0.00%	0.00%	0.40%	62.08%

4.2 Mass and charge balance

Table S11 presents molar concentrations. Observe that within these tables one can find the estimated concentrations of ILs' cations (acquired by charge balance) and water content (acquired by mass balance). Table S12 presents the total mass concentration of each ion in the ABS. While ionic chromatography (IC) measurements were converted into ABS mass concentration by charge and mass balance, the weighted concentrations were acquired straight by weighting the mass of each species added to the flask to for the ABS.

Table S11. Concentrations of Na^+, NH_4^+, SCN^-, Cl^-, Br^- and SO_4^{2-} of studied systems in Molar concentration (mol/L).

ABS	NH4+	Na+	Cl-	SO_4^{2-}	Br-	SCN-	Cations
0% NaSCN; 25% $[P_{4444}]Cl$ + 17% $(NH_4)_2SO_4$	6.8E-01	0.0E+00	1.2E+00	3.7E-01	0.0E+00	0.0E+00	1.2E+00
	5.5E+00	0.0E+00	3.2E-01	2.8E+00	0.0E+00	0.0E+00	4.2E-01
4 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	1.8E-01	4.0E-03	1.4E+00	5.0E-02	0.0E+00	6.7E-01	1.9E+00
	8.8E+00	1.7E+00	1.7E+00	4.6E+00	0.0E+00	1.1E-03	4.8E-01
4 % NaSCN + 30% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	1.2E-01	3.6E-03	1.1E+00	4.7E-02	0.0E+00	9.1E-01	2.0E+00
	9.2E+00	1.4E+00	1.6E+00	4.5E+00	0.0E+00	1.1E-03	1.3E-01
4 % NaSCN + 40% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	1.7E-01	1.9E-03	1.6E+00	4.9E-02	0.0E+00	6.0E-01	2.1E+00
	1.2E+01	1.5E+00	1.5E+00	6.0E+00	0.0E+00	1.1E-03	1.8E-01

9 % NaSCN + 15% [P_{4444}]Cl + 16% $(NH_4)_2SO_4$	3.9E-01	4.3E-03	3.9E-02	1.8E-02	0.0E+00	2.7E+00	2.3E+00
	3.4E+00	1.4E+00	6.9E-01	1.8E+00	0.0E+00	5.5E-01	5.0E-02
0% NaSCN; 31% [N_{4444}]Cl + 12% $(NH_4)_2SO_4$	9.6E-01	0.0E+00	1.2E+00	4.8E-01	0.0E+00	0.0E+00	1.2E+00
	6.0E+00	0.0E+00	3.9E-01	3.2E+00	0.0E+00	0.0E+00	7.2E-01
4 % NaSCN + 40% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	2.8E-01	6.5E-03	1.7E+00	5.5E-02	0.0E+00	6.7E-01	2.2E+00
	9.9E+00	1.9E+00	1.3E+00	5.7E+00	0.0E+00	1.2E-03	9.9E-01
4 % NaSCN + 30% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	3.2E-01	2.9E-02	1.2E+00	1.5E-01	0.0E+00	1.0E+00	2.2E+00
	7.4E+00	1.7E+00	1.5E+00	3.7E+00	0.0E+00	1.7E-03	1.0E-02
4 % NaSCN + 40% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	2.1E-01	9.9E-03	1.5E+00	6.7E-02	0.0E+00	6.7E-01	2.1E+00
	6.9E+00	2.4E+00	1.5E+00	3.9E+00	0.0E+00	1.6E-03	1.0E-02
13 % NaSCN +20% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	5.7E-01	9.2E-02	4.9E-02	1.5E-02	0.0E+00	3.3E+00	2.8E+00
	2.1E+00	2.3E+00	9.5E-01	1.1E+00	0.0E+00	9.6E-01	5.0E-02
0% NaSCN; 32% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	6.0E-01	0.0E+00	0.0E+00	3.0E-01	1.4E+00	0.0E+00	1.4E+00
	4.0E+00	0.0E+00	0.0E+00	2.0E+00	2.3E-01	0.0E+00	2.1E-01
4 % NaSCN + 30% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	2.1E-01	7.1E-03	0.0E+00	4.4E-02	1.1E+00	1.2E+00	2.2E+00
	6.6E+00	1.6E+00	0.0E+00	3.4E+00	1.4E+00	9.5E-03	1.0E-02
4 % NaSCN + 40% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	3.1E-01	2.6E-02	0.0E+00	4.8E-02	1.7E+00	8.8E-01	2.3E+00
	5.9E+00	2.1E+00	0.0E+00	3.3E+00	1.5E+00	6.7E-03	6.9E-02
4 % NaSCN + 40% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	3.2E-01	8.0E-03	0.0E+00	4.6E-02	1.7E+00	7.7E-01	2.2E+00
	8.5E+00	1.7E+00	0.0E+00	4.6E+00	1.2E+00	4.5E-03	2.0E-01
11 % NaSCN +21% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	4.4E-01	3.4E-02	0.0E+00	2.1E-02	6.8E-02	3.1E+00	2.7E+00
	2.1E+00	1.9E+00	0.0E+00	1.2E+00	9.0E-01	6.8E-01	5.0E-02
0% NaSCN; 30% [P_{44414}]Cl + 10% $(NH_4)_2SO_4$	4.9E-01	0.0E+00	1.1E+00	3.2E-01	0.0E+00	0.0E+00	1.2E+00
	3.2E+00	0.0E+00	2.4E-01	1.9E+00	0.0E+00	0.0E+00	8.0E-01
4 % NaSCN + 40% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	3.9E-02	6.0E-04	7.9E-01	4.1E-02	0.0E+00	1.2E+00	2.0E+00
	1.1E+01	1.5E+00	1.5E+00	5.7E+00	0.0E+00	1.3E-03	5.1E-01
4 % NaSCN + 30% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	4.2E-01	9.8E-02	4.5E-01	1.5E-01	0.0E+00	1.4E+00	1.6E+00
	8.6E+00	2.1E+00	2.0E+00	4.4E+00	0.0E+00	1.3E-03	7.2E-02

4 % NaSCN + 40% [P_{44414}]Cl + 15% $(NH_4)_2SO_4$	2.9E-02	4.7E-05	8.7E-01	4.7E-03	0.0E+00	1.2E+00	2.1E+00
	8.6E+00	1.6E+00	1.7E+00	3.8E+00	0.0E+00	9.8E-04	1.0E-02

Table S12. Species mass concentration in the whole ABS (mixture point) acquired from IC measurements.

ABS	measurement	NH4+	Na+	Cl-	SO_4^{2-}	Br-	SCN-	Cation	H_2O (mp)
0% NaSCN; 25% [P_{4444}]Cl + 17% $(NH_4)_2SO_4$	Weighted	4.5%	0.0%	2.9%	12.1%	0.0%	0.0%	21.0%	59.5%
	IC	5.3%	0.0%	2.8%	14.4%	0.0%	0.0%	22.1%	55.4%
4 % NaSCN + 40% [P_{4444}]Cl + 15% $(NH_4)_2SO_4$	Weighted	4.1%	0.9%	4.7%	10.9%	0.0%	2.3%	34.4%	42.7%
	IC	4.2%	1.0%	4.4%	11.5%	0.0%	2.4%	34.6%	42.0%
4 % NaSCN + 30% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	Weighted	5.5%	1.0%	3.5%	14.5%	0.0%	2.6%	25.8%	47.0%
	IC	5.9%	1.1%	3.7%	15.6%	0.0%	2.3%	23.1%	48.3%
4 % NaSCN + 40% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	Weighted	5.5%	0.8%	4.7%	14.5%	0.0%	2.1%	34.3%	38.1%
	IC	5.9%	0.9%	4.6%	15.6%	0.0%	2.0%	32.5%	38.4%
9 % NaSCN + 15% [P_{4444}]Cl + 16% $(NH_4)_2SO_4$	Weighted	4.4%	2.4%	1.8%	11.6%	0.0%	6.1%	13.1%	60.6%
	IC	5.3%	2.7%	2.1%	14.4%	0.0%	5.1%	10.7%	59.7%
0% NaSCN; 31% [N_{4444}]Cl + 12% $(NH_4)_2SO_4$	Weighted	3.1%	0.0%	3.6%	8.3%	0.0%	0.0%	26.3%	58.4%
	IC	3.3%	0.0%	3.9%	9.0%	0.0%	0.0%	27.7%	56.1%
4 % NaSCN + 40% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	Weighted	4.1%	0.8%	4.9%	10.9%	0.0%	2.1%	33.7%	43.5%
	IC	4.2%	1.0%	5.0%	12.1%	0.0%	2.6%	42.7%	32.5%
4 % NaSCN + 30% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	Weighted	4.1%	1.1%	3.7%	10.9%	0.0%	2.9%	25.3%	52.0%
	IC	4.4%	1.2%	3.7%	11.7%	0.0%	3.0%	25.8%	50.1%
4 % NaSCN + 40% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	Weighted	2.7%	1.0%	4.9%	7.3%	0.0%	2.6%	33.7%	47.7%
	IC	2.5%	1.0%	4.9%	7.0%	0.0%	2.8%	36.4%	45.5%
13 % NaSCN +20% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	Weighted	2.7%	3.6%	2.3%	7.3%	0.0%	9.1%	16.5%	58.4%
	IC	3.1%	4.1%	2.6%	8.3%	0.0%	8.9%	16.9%	56.0%

0% NaSCN; 32% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	Weighted	2.7%	0.0%	0.0%	7.1%	7.8%	0.0%	23.5%	58.9%
	IC	3.1%	0.0%	0.0%	8.3%	8.0%	0.0%	24.2%	56.5%
4 % NaSCN + 30% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	Weighted	4.1%	1.1%	0.0%	10.9%	7.4%	2.9%	22.4%	51.1%
	IC	4.6%	1.3%	0.0%	12.1%	7.4%	2.7%	20.5%	51.3%
4 % NaSCN + 40% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	Weighted	2.7%	1.0%	0.0%	7.3%	9.9%	2.6%	29.9%	46.5%
	IC	3.1%	1.3%	0.0%	8.6%	10.4%	2.8%	32.2%	41.6%
4 % NaSCN + 40% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	Weighted	4.1%	0.9%	0.0%	10.9%	9.9%	2.3%	29.9%	41.9%
	IC	4.7%	1.1%	0.0%	12.8%	9.8%	2.3%	31.0%	38.3%
11 % NaSCN +21% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	Weighted	2.7%	3.1%	0.0%	7.2%	5.1%	7.8%	15.4%	58.6%
	IC	3.2%	3.5%	0.0%	8.9%	5.8%	6.8%	14.1%	57.6%
0% NaSCN; 30% $[P_{44414}]Cl$ + 10% $(NH_4)_2SO_4$	Weighted	2.6%	0.0%	3.5%	7.0%	0.0%	0.0%	26.7%	61.2%
	IC	2.5%	0.0%	2.9%	8.0%	0.0%	0.0%	30.9%	55.8%
4 % NaSCN + 40% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	Weighted	5.5%	0.8%	3.3%	14.5%	0.0%	2.1%	35.2%	38.6%
	IC	6.6%	1.1%	3.1%	18.6%	0.0%	3.3%	47.0%	20.2%
4 % NaSCN + 30% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	Weighted	5.5%	1.0%	2.5%	14.6%	0.0%	2.6%	26.4%	47.5%
	IC	6.6%	2.0%	3.4%	17.6%	0.0%	2.9%	23.3%	44.3%
4 % NaSCN + 40% $[P_{44414}]Cl$ + 15% $(NH_4)_2SO_4$	Weighted	4.1%	0.9%	3.3%	10.9%	0.0%	2.3%	35.2%	43.2%
	IC	5.0%	1.2%	3.5%	11.9%	0.0%	3.6%	39.2%	35.6%

5 Experimental validation

The goal of these sections is to study the reliability of the experimental data acquired in the present study. It was performed by comparing [SCN]- obtained from IC and UV-vis, and by comparing the concentration of all species obtained from IC measurement and weighted amount used on the actual preparation of the samples.

5.1 [SCN] concentration

UV-vis spectroscopy calibration curves were produced with at least 5 points and present a linear behavior, as expected. The concentration range is within the measurements of species' present in the studied ABS. Table S13 presents the data of calibration, which can be visualized in Figures S1, S2 and S3. Table S14 summarizes the triplicates and partition coefficient of [SCN] on ABS prepared with 1M solution used to validate the ionic Chromatography (IC) measurements of partition.

Tables S15 and S16 present the concentration and partition of [SCN]- on top and bottom phases. Figure S4 shows the visualization of partition of [SCN]- was that was acquired by the ratio of its concentrations on top and bottom phase, both acquired by IC and UV-vis. The error bars presented in this chart were calculated considering confidence interval of 95% and normal error distribution, which produced uncertainties 2 times higher than the conventional standard deviation conventionally used to produce error bars on other studies [1]. This strategy allows a more realistic evaluation of interval of variation of partition measurements. The comparison among the [SCN]- partition measured by UV-vis and IC indicates quite close results, therefore high reliability on predicting partition coefficients of [SCN]-, except for ABS formed with $[P_{44414}]Cl$ which presented higher deviations. It was attributed to the difficult handling of the top phases of $[P_{44414}]Cl$-based ABS due to their significantly higher viscosity and low solubility to the solvent used on IC analysis. Higher deviations were found for the rough measurements of concentrations of [SCN]- on top and bottom phase, indicating that higher reliability is associated with the ratio of concentrations instead of the measurements itself.

Table S13. Data points for the calibration curve of $FeSCN^{+2}$

Sample	Fe Solution (g)	NaSCN (g)	Water (g)	$FeSCN^{+2}$ Concentration (mol/g)	ABS (447nm)
1	1.074	0.101	0.904	2.473E-08	0.044
2	1.069	0.2	0.799	4.923E-08	0.097
3	1.068	0.298	0.697	7.353E-08	0.150
4	1.068	0.4	0.596	9.865E-08	0.203
5	1.065	0.498	0.498	1.230E-07	0.260
6	1.063	0.599	0.397	1.481E-07	0.315
7	1.061	0.698	0.296	1.729E-07	0.369
8	1.066	0.799	0.199	1.971E-07	0.423
9	1.064	0.901	0.1	2.221E-07	0.497
10	1.064	1.002	0	2.469E-07	0.551
11	0.798	1.249	0	3.106E-07	0.686
12	0.531	1.5	0	3.759E-07	0.797

Table S14. UV-vis measurements and partition coefficient of $[SCN]^-$

ABS	Phase	mol/L					Partition			
		Sample 1	Sample 2	Sample 3	Average	stdev	K	uc	Log K	uc
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	Top	0.964199	0.877603	0.885976	9.1E-01	4.8E-02	1550	213	3.190	0.060
	Bottom	0.000666	0.000577	0.000518	5.9E-04	7.4E-05				
$[P_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.283536	1.139934	1.160131	1.2E+00	7.8E-02	2123	230	3.327	0.047
	Bottom	0.000514	0.000611	0.000563	5.6E-04	4.9E-05				
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	0.829515	0.761856	0.73816	7.8E-01	4.7E-02	1353	96	3.131	0.031
	Bottom	0.000586	0.000585	0.00055	5.7E-04	2.0E-05				
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	0.794249	0.781035	0.807643	7.9E-01	1.3E-02	1249	30	3.096	0.010
	Bottom	0.00064	0.000624	0.000644	6.4E-04	1.1E-05				
$[N_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	1.196067	1.233311	1.226829	1.2E+00	2.0E-02	1157	19	3.0634	0.0071
	Bottom	0.001053	0.001052	0.001055	1.1E-03	1.3E-06				
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	Top	0.815003	0.788781	0.798201	8.0E-01	1.3E-02	981	53	2.9916	0.0233
	Bottom	0.000855	0.000821	0.000773	8.2E-04	4.2E-05				
$[N_{4444}]Br$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	1.612459	1.61457	1.62032	1.6E+00	4.1E-03	168.56	0.51	2.2268	0.0013
	Bottom	0.009589	0.009568	0.0096	9.6E-03	1.6E-05				
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	Top	0.97855	0.960928	0.987762	9.8E-01	1.4E-02	134.6	2.6	2.129	0.0083
	Bottom	0.007144	0.007273	0.00733	7.2E-03	9.5E-05				
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	0.952511	0.901772	0.945761	9.3E-01	2.8E-02	201.8	6.8	2.305	0.015
	Bottom	0.004675	0.004541	0.004659	4.6E-03	7.3E-05				
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.161726	1.388198	1.400685	1.3E+00	1.3E-01	1991	327	3.299	0.071
	Bottom	0.000758	0.000629	0.000597	6.6E-04	8.5E-05				
$[P_{44414}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.382739	1.448049	1.173942	1.3E+00	1.4E-01	1782	228	3.251	0.056
	Bottom	0.000698	0.000803	0.000746	7.5E-04	5.3E-05				
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	Top	1.224338	1.08609	1.104491	1.1E+00	7.5E-02	2059	536	3.31	0.11
	Bottom	0.000393	0.000647	0.000619	5.5E-04	1.4E-04				

Table S15. [SCN]- concentrations measured by UV-vis

IL	Phase	SCN Concentration				
		mol/L			Average	stdev
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	Top	0.9642	0.8776	0.8860	0.9093	0.0478
	Bottom	0.0007	0.0006	0.0005	0.0006	0.0001
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	0.8295	0.7619	0.7382	0.7765	0.0474
	Bottom	0.0006	0.0006	0.0006	0.0006	0.0000
$[P_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.2835	1.1399	1.1601	1.1945	0.0777
	Bottom	0.0005	0.0006	0.0006	0.0006	0.0000
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	Top	1.2243	1.0861	1.1045	1.1383	0.0751
	Bottom	0.0004	0.0006	0.0006	0.0006	0.0001
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.1617	1.3882	1.4007	1.3169	0.1345
	Bottom	0.0008	0.0006	0.0006	0.0007	0.0001
$[P_{44414}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	Top	1.3827	1.4480	1.1739	1.3349	0.1432
	Bottom	0.0007	0.0008	0.0007	0.0007	0.0001
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	0.7942	0.7810	0.8076	0.7943	0.0133
	Bottom	0.0006	0.0006	0.0006	0.0006	0.0000
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	Top	0.8150	0.7888	0.7982	0.8007	0.0133
	Bottom	0.0009	0.0008	0.0008	0.0008	0.0000
$[N_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	1.1961	1.2333	1.2268	1.2187	0.0199
	Bottom	0.0011	0.0011	0.0011	0.0011	0.0000
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	0.9525	0.9018	0.9458	0.9333	0.0276
	Bottom	0.0047	0.0045	0.0047	0.0046	0.0001
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	Top	0.9786	0.9609	0.9878	0.9757	0.0136
	Bottom	0.0071	0.0073	0.0073	0.0072	0.0001
$[N_{4444}]Br$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	Top	1.6125	1.6146	1.6203	1.6158	0.0041
	Bottom	0.0096	0.0096	0.0096	0.0096	0.0000

Table S16. [SCN]- partition coefficients by UV-Vis

IL	K			logK			Avg	Stdev
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	1449	1522	1711	3.161	3.182	3.233	3.192	0.037
$[P_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	1415	1303	1342	3.151	3.115	3.128	3.131	0.018
$[P_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	2498	1865	2061	3.398	3.271	3.314	3.327	0.065
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%)+ NaSCN 1M	3116	1679	1785	3.494	3.225	3.252	3.323	0.148
$[P_{44414}]Cl$ (40%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	1533	2206	2346	3.186	3.344	3.370	3.300	0.100
$[P_{44414}]Cl$ (30%) + $(NH_4)_2SO_4$ (20%)+ NaSCN 1M	1981	1804	1573	3.297	3.256	3.197	3.250	0.050
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	1241	1252	1253	3.094	3.097	3.098	3.096	0.002
$[N_{4444}]Cl$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	953	961	1033	2.979	2.983	3.014	2.992	0.019
$[N_{4444}]Cl$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	1135	1172	1163	3.055	3.069	3.066	3.063	0.007
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	204	199	203	2.309	2.298	2.307	2.305	0.006
$[N_{4444}]Br$ (40%) + $(NH_4)_2SO_4$ (10%) + NaSCN 1M	137	132	135	2.137	2.121	2.130	2.129	0.008
$[N_{4444}]Br$ (30%) + $(NH_4)_2SO_4$ (15%) + NaSCN 1M	168	169	169	2.226	2.227	2.227	2.227	0.001

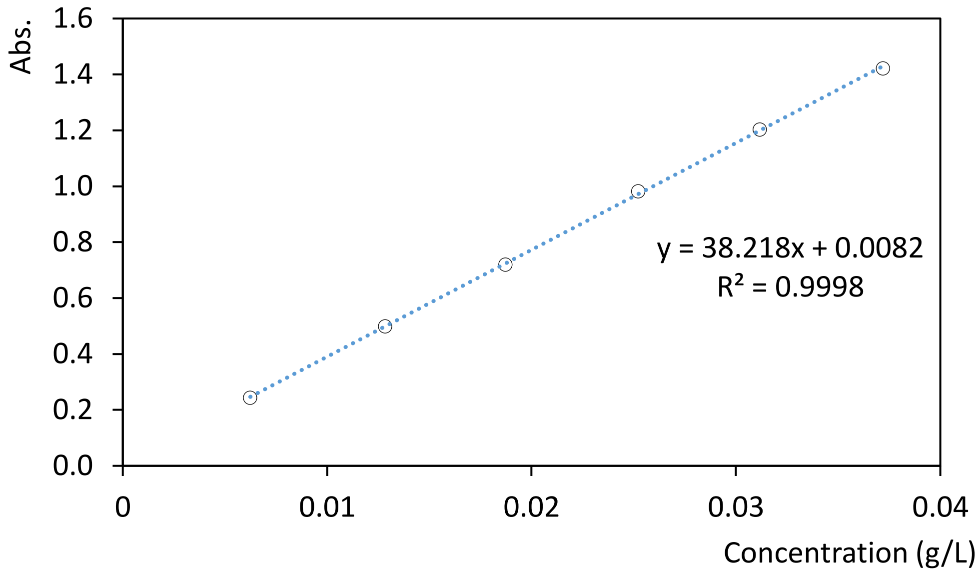

Figure S1. Calibration of UV-vis of MV in water at room temperature.

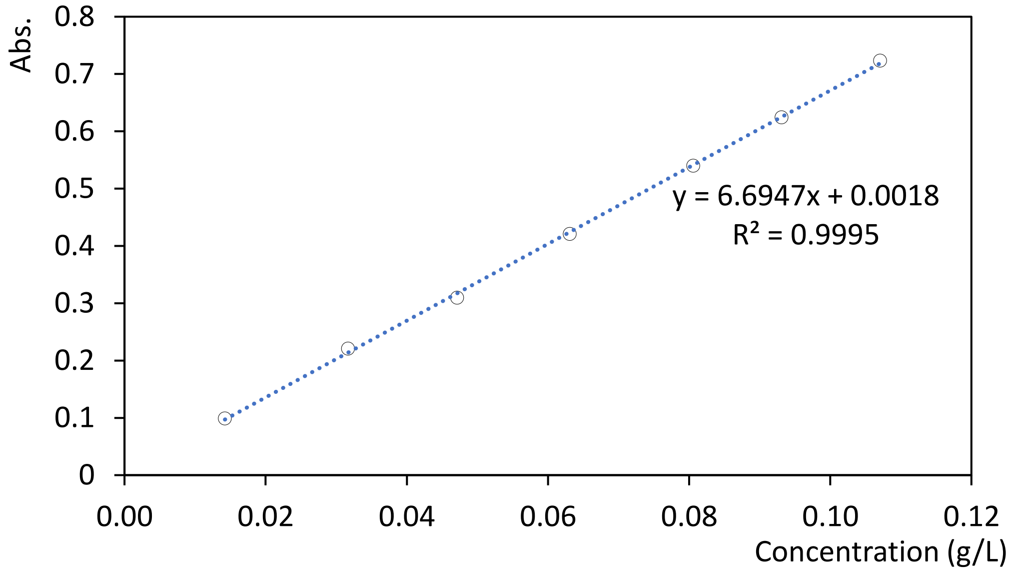

Figure S2. Calibration of UV-vis of TEMPO in water at room temperature.

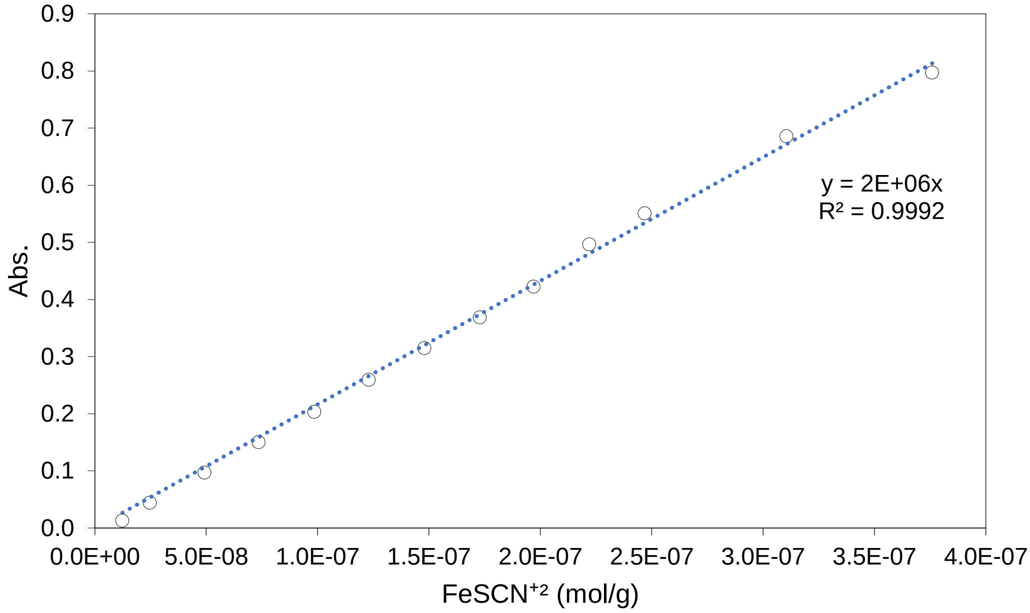

Figure S3. Calibration curve of $FeSCN^{+2}$

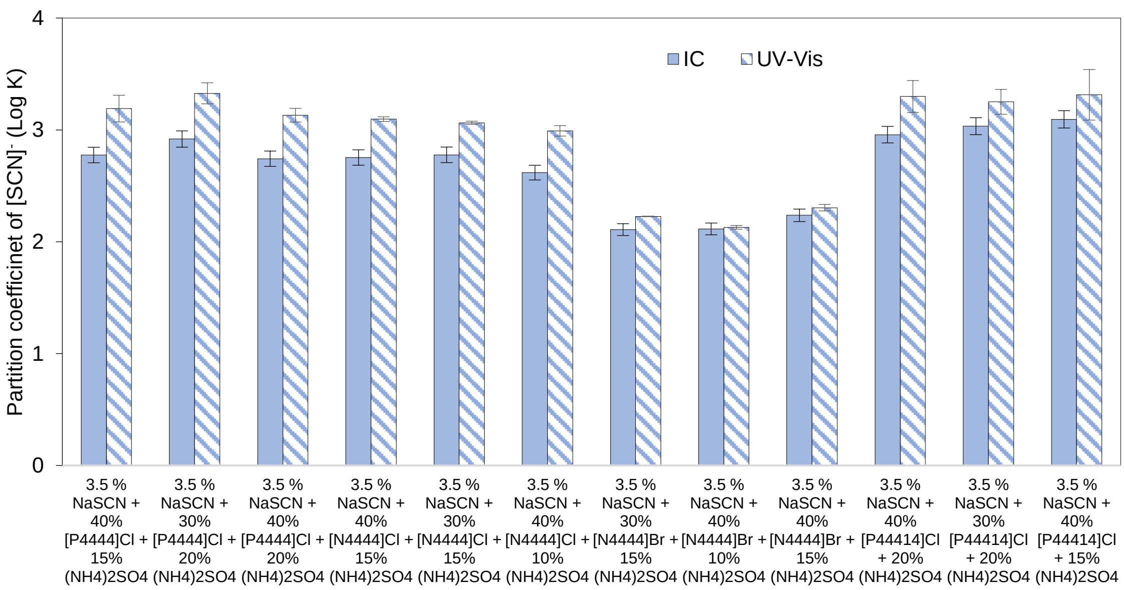

Figure S4. Comparison of partition coefficient of [SCN]- on studied ABS measured by UV-vis spectroscopy and ionic chromatography, at room temperature.

5.2 Deviation on mass balance

Table S17 presents the average absolute deviation of the mass concentration of each species in the system, determined through ion chromatography (IC) mass and charge balance, as well as the measured weights of species used in ABS preparation. Deviations are color-coded: blue represents small deviations (0–5%), while red indicates deviations between 5–20 wt.%.

An overall small average deviation of 1.7 wt.% was observed across all species and ABS, including cations and H_2O, which were estimated via charge and mass balance. When considering only IC-acquired data, this deviation was reduced to 0.7 wt.%. The small deviation between IC measurements and the weighed amount of species confirms the consistency and reliability of the experimental data. However, the estimation of cation and water concentrations exhibited higher deviations due to the propagation of uncertainties from multiple ion measurements.

Notably, higher deviations were observed for species concentrations in $[P_{44414}]Cl$-based ABS, particularly for water and cations. This was attributed to the measurement of species in the ABS top phase, which exhibited high viscosity and low solubility in the solvent used for IC analysis. Additionally, the high molar weight of $[P_{44414}]$ amplified deviations in charge balance calculations, which further propagated to water content estimation via mass balance.

Table S17. Weight percentage deviation of species measured by mass balance of IC concentrations and weighted number of species added to for the ABS.

ABS	NH_4^+	Na^+	Cl^-/Br^-	SO_4^{2-}	SCN^-	Cation	H_2O
0% NaSCN; 25% [P_{4444}]Cl + 17% $(NH_4)_2SO_4$	0.7%		0.2%	2.3%		0.7%	3.6%
3.5 % NaSCN + 15% [P_{4444}]Cl + 16% $(NH_4)_2SO_4$	0.1%	0.1%	0.3%	0.6%	0.1%	0.2%	0.7%
3.5 % NaSCN + 30% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	0.5%	0.1%	0.1%	1.0%	0.4%	2.7%	1.3%
3.5 % NaSCN + 40% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	0.4%	0.1%	0.0%	1.1%	0.1%	1.8%	0.3%
8 % NaSCN + 15% [P_{4444}]Cl + 16% $(NH_4)_2SO_4$	0.9%	0.3%	0.3%	2.8%	1.1%	2.7%	0.4%
0% NaSCN; 31% [N_{4444}]Cl + 12% $(NH_4)_2SO_4$	0.2%		0.1%	0.7%		0.5%	1.3%
3.5 % NaSCN + 40% [N_{4444}]Cl + 20% $(NH_4)_2SO_4$	0.1%	0.1%	0.1%	1.2%	0.5%	9.0%	11.0%
3.5 % NaSCN + 30% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	0.3%	0.1%	0.0%	0.8%	0.2%	0.5%	2.0%
3.5 % NaSCN + 40% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	0.3%	0.1%	0.0%	0.3%	0.2%	2.7%	2.3%
13 % NaSCN +20% [N_{4444}]Cl + 10% $(NH_4)_2SO_4$	0.4%	0.4%	0.3%	1.1%	0.5%	0.2%	1.3%
0% NaSCN; 32% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	0.4%		0.2%	1.2%		0.5%	2.3%
3.5 % NaSCN + 30% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	0.5%	0.2%	0.0%	1.2%	0.1%	1.9%	0.1%
3.5 % NaSCN + 40% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	0.4%	0.3%	0.5%	1.3%	0.2%	2.2%	4.9%
3.5 % NaSCN + 40% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	0.6%	0.2%	0.1%	1.9%	0.0%	1.1%	3.6%
11 % NaSCN +20% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	0.5%	0.4%	0.7%	1.7%	1.1%	1.4%	0.8%
0% NaSCN; 30% [P_{44414}]Cl + 10% $(NH_4)_2SO_4$	0.1%		0.7%	1.0%		4.2%	5.4%
3.5 % NaSCN + 40% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	1.2%	0.3%	0.2%	4.0%	1.2%	11.8%	18.3%
3.5 % NaSCN + 30% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	1.1%	1.0%	0.9%	3.1%	0.3%	3.1%	3.2%
3.5 % NaSCN + 40% [P_{44414}]Cl + 15% $(NH_4)_2SO_4$	0.9%	0.3%	0.2%	0.9%	1.3%	4.0%	7.5%
Average	**0.5%**	**0.3%**	**0.3%**	**1.7%**	**0.5%**	**3.5%**	**4.6%**

6 Water content, density and viscosity

The water content of all species under study can be found in Table S18. The IL with the highest water content was the $[N_{4444}]Cl$ with 3.68% ±0.15 wt.% (Confidence level = 95%). The water content of all species was considered on the mass balance and the report of mixture points used in this study.

Table S18. Water content of all species used in the ABS preparation.

Species	Water content			Average	Deviation	Ua* (k=2, 95%)
$[P_{4444}]Cl$	2.56%	2.27%	2.06%	2.30%	0.25%	0.50%
$[P_{44414}]Cl$	3.21%	3.50%	3.81%	3.51%	0.30%	0.60%
$[N_{4444}]Cl$	3.68%	3.62%	3.77%	3.690%	0.075%	0.15%
$[N_{4444}]Br$	0.47%	0.45%	0.40%	0.440%	0.036%	0.072%
NaSCN	2.59%	2.83%	3.28%	2.90%	0.35%	0.70%
$(NH_4)_2SO_4$	0.07%	0.08%	0.06%	0.070%	0.010%	0.020%

*Ua = expanded uncertainty

Table S19-21 present the mass of phases, viscosity, density pH and water content of the top and bottom phases of all species under study. It is worth noting that the values of water content were all acquired at room temperature. These data were added in the same line of different temperatures just for the purpose of fitting experimental data in the same table.

The expanded uncertainty of measurements of phases mass was attributed qualitatively as 2% of the mass. This uncertainty is mostly related to the difficulty in sampling the phases with the aid of a syringe.

Table S19. Mass of phases, viscosity, density pH and water content of the top and bottom phases of ABS formed without NaSCN or with excessive amount of it.

Sample Name	Phase	m phase	pH	Temp.	Viscosity	ny	Density	Water content (%g_{water} /g_{sol})[a]		
		g		K	mPa.s	mm2/s	g/cm3	wt%	avg	stdev
13 % NaSCN +20% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	Top	4.791	4.821	293.15	131.34	135.92	0.9664	14.88%	14.86%	0.18%
				298.15	93.938	97.521	0.9633	14.68%		
				303.15	68.853	71.711	0.9601	15.03%		
				308.15	51.679	53.999	0.957			
	Bottom	15.241	5.164	293.15	1.6719	1.4442	1.1577	74.22%	73.55%	0.77%
				298.15	1.5043	1.3022	1.1552	72.71%		
				303.15	1.3606	1.1803	1.1527	73.72%		
				308.15	1.2367	1.0752	1.1501			
0% NaSCN; 31% $[N_{4444}]Cl$ + 12% $(NH_4)_2SO_4$	Top	14.681	5.23	293.15	8.0521	7.9103	1.0179	54.27%	54.65%	0.38%
				298.15	6.5495	6.4547	1.0147	55.03%		
				303.15	5.4318	5.3703	1.0115	54.65%		
				308.15	4.5773	4.54	1.0082			
	Bottom	3.055	4.862	293.15	2.2495	1.9187	1.1724	64.52%	64.76%	0.40%
				298.15	2.0679	1.7652	1.1715	64.54%		
				303.15	1.8954	1.6188	1.1709	65.22%		
				308.15	1.7447	1.4917	1.1696			
9 % NaSCN + 15% $[P_{4444}]Cl$ + 16% $(NH_4)_2SO_4$	Top	3.101	4.467	293.15	104.7900	108.5500	0.9653	9.66%	9.94%	0.68%
				298.15	78.3920	81.4660	0.9623	9.45%		
				303.15	59.8170	62.3630	0.9592	10.71%		
				308.15	46.4750	48.61	0.9561			

	Bottom	16.428	4.66	293.15	1.7314	1.4889	1.1629	70.88%	71.40%	0.45%
				298.15	1.5601	1.3442	1.1606	71.63%		
				303.15	1.4123	1.2194	1.1583	71.69%		
				308.15	1.2848	1.1116	1.1559			
0% NaSCN; 25% [P_{4444}]Cl + 17% $(NH_4)_2SO_4$	Top	11.095	4.503	293.15	9.3263	9.2462	1.0087	49.52%	49.74%	0.34%
				298.15	7.5752	7.5344	1.0054	49.56%		
				303.15	6.2814	6.2682	1.0021	50.13%		
				308.15	5.2872	5.2913	0.9992			
	Bottom	9.589	4.113	293.15	1.9381	1.6548	1.1712	66.94%	67.35%	0.67%
				298.15	1.7430	1.4906	1.1693	68.12%		
				303.15	1.5735	1.3475	1.1678	66.99%		
				308.15	1.4319	1.2280	1.1660			
11 % NaSCN +21% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	Top	3.816	4.939	293.15	125.07	129.32	0.9672	14.61%	15.06%	0.42%
				298.15	89.473	92.807	0.9641	15.45%		
				303.15	65.549	68.213	0.961	15.12%		
				308.15	49.02	51.179	0.9578			
	Bottom	15.191	5.235	293.15	1.5591	1.3191	1.1820	69.73%	71.7%	2.0%
				298.15	1.4013	1.1880	1.1795	73.65%		
				303.15	1.2675	1.0769	1.1770	71.86%		
				308.15	1.1541	0.9827	1.1744			
0% NaSCN; 32% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	Top	12.367	5.225	293.15	9.0967	8.6112	1.0564	50.09%	50.22%	0.12%
				298.15	7.5902	7.2087	1.0529	50.23%		
				303.15	6.6992	6.3833	1.0495	50.33%		
				308.15	6.1185	5.8496	1.046			

	Bottom	6.202	4.89	293.15	1.9017	1.6829	1.1300	73.43%	72.2%	1.5%
				298.15	1.6655	1.4757	1.1286	70.85%		
				303.15	1.4851	1.3177	1.1270	73.65%		
				308.15	1.3392	1.1900	1.1253	70.94%		
0% NaSCN; 30% [P_{44414}]Cl + 10% $(NH_4)_2SO_4$	Top	12.913		293.15	107.05	114.34	0.936	48.58%	48.74%	0.53%
				298.15	81.184	87.026	0.933	49.33%		
				303.15	62.716	67.475	0.93	48.30%		
				308.15	49.229	53.159	0.926			
	Bottom	6.453		293.15	1.752			77.76%	78.16%	0.76%
				298.15	1.577			79.04%		
				303.15	1.428			77.69%		
				308.15	1.303					

[a] Water content triplicates were measured at room temperature, about 293 K. The temperature variation is only related to density and viscosity.

Table S20. Mass of phases, viscosity, density pH and water content of the top and bottom phases of ABS formed with 1M NaSCN solution and [P_{4444}]Cl or [N_{4444}]Cl ILs.

Sample Name	Phase	m phase g	Temp. K	eta mPa.s	ny mm2/s	rho g/cm3	Water content (%g_{water} /g_{sol})[a] wt%	avg	stdev
3.5 % NaSCN + 40% [N_{4444}]Cl + 15% $(NH_4)_2SO_4$	Top	1.27	293.15	40.48	41.741	0.9698	31.01%	31.47%	0.89%
			298.15	30.47	31.527	0.9665	30.91%		
			303.15	23.391	24.287	0.9631	32.50%		
			308.15	18.349	19.118	0.9597			
	Bottom	0.696	293.15				59.61%	60.56%	0.89%
			298.15				60.71%		

			303.15				61.37%		
			308.15						
3.5 % NaSCN + 40% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	Top	1.401	293.15	26.125	26.742	0.9769	38.13%	38.15%	0.20%
			298.15	20.031	20.572	0.9737	37.96%		
			303.15	15.643	16.121	0.9703	38.36%		
			308.15	12.464	12.89	0.9669			
	Bottom	0.568	293.15				70.80%	70.26%	0.51%
			298.15				69.79%		
			303.15				70.19%		
			308.15						
3.5 % NaSCN + 30% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	Top	0.959	293.15	36.097	37.181	0.9708	32.11%	32.38%	0.47%
			298.15	27.3	28.216	0.9675	32.92%		
			303.15	20.979	21.76	0.9641	32.11%		
			308.15	16.443	17.115	0.9607			
	Bottom	0.993	293.15				68.44%	69.9%	1.4%
			298.15				71.14%		
			303.15				70.21%		
			308.15						
3.5 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	Top	1.144	293.15	33.368	34.363	0.9711	26.32%	25.31%	0.92%
			298.15	25.881	26.745	0.9677	25.08%		
			303.15	20.448	21.205	0.9643	24.52%		
			308.15	16.43	17.099	0.9609			
	Bottom	0.81	293.15				62.79%	64.4%	1.4%
			298.15				65.45%		

			303.15				64.97%		
			308.15						
3.5 % NaSCN + 30% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	Top	0.831	293.15	44.126	44.813	0.9847	20.44%	20.0%	1.2%
			298.15	33.785	34.426	0.9814	18.63%		
			303.15	26.329	26.922	0.978	20.79%		
			308.15	20.909	21.453	0.9746			
	Bottom	1.163	293.15				66.39%	65.2%	1.8%
			298.15				66.10%		
			303.15				63.13%		
			308.15						
3.5 % NaSCN + 40% [P_{4444}]Cl + 20% $(NH_4)_2SO_4$	Top	1.106	293.15	43.991	45.49	0.9671	24.64%	24.40%	0.85%
			298.15	33.871	35.144	0.9638	25.10%		
			303.15	26.445	27.534	0.9605	23.45%		
			308.15	21.006	21.947	0.9571			
	Bottom	0.852	293.15				53.78%	54.6%	2.1%
			298.15				53.05%		
			303.15				56.97%		
			308.15						

[a] Water content triplicates were measured at room temperature, about 293 K. The temperature variation is only related to density and viscosity.

Table S21. Mass of phases, viscosity, density pH and water content of the top and bottom phases of ABS formed with 1M NaSCN solution and [P_{44414}]Cl or [N_{4444}]Br ILs.

Sample Name	Phase	m phase	Temp.	eta	ny	rho	Water content (%g_{water} /g_{sol})[a]		
		g	K	mPa.s	mm2/s	g/cm3	wt%	avg	stdev
3.5 % NaSCN + 40% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	Top	6.294	293.15	67.552	65.119	1.0374	20.07%	20.05%	0.70%
			298.15	50.218	48.568	1.034	19.34%		
			303.15	37.962	36.838	1.0305	20.73%		
			308.15	29.283	28.513	1.027			
	Bottom	5.584	293.15				56.79%	57.12%	0.43%
			298.15				57.61%		
			303.15				56.97%		
			308.15						
3.5 % NaSCN + 40% [N_{4444}]Br + 10% $(NH_4)_2SO_4$	Top	6.687	293.15	43.448	41.981	1.0349	23.77%	23.83%	0.96%
			298.15	32.688	31.692	1.0314	22.91%		
			303.15	25.125	24.444	1.0279	24.82%		
			308.15	19.706	19.239	1.0243			
	Bottom	5.152	293.15				61.74%	63.0%	1.1%
			298.15				63.70%		
			303.15				63.59%		
			308.15						
3.5 % NaSCN + 30% [N_{4444}]Br + 15% $(NH_4)_2SO_4$	Top	4.613	293.15	72.112	71.292	1.0115	18.82%	18.90%	0.10%
			298.15	53.102	52.677	1.0081	19.01%		
			303.15	39.946	39.762	1.0046	18.86%		
			308.15	30.699	30.664	1.0011			
	Bottom	7.243	293.15				62.13%	61.44%	0.96%

			298.15				60.35%		
			303.15				61.85%		
			308.15						
3.5 % NaSCN + 40% [P_{44414}]Cl + 15% $(NH_4)_2SO_4$	Top	5.585	293.15	197.62	214.5	0.9213	10.54%	10.96%	0.60%
			298.15	146.96	160.07	0.9181	10.70%		
			303.15	111.23	121.59	0.9148	11.65%		
			308.15	85.622	93.923	0.9116			
	Bottom	6.299	293.15				64.64%	63.1%	1.3%
			298.15				62.35%		
			303.15				62.38%		
			308.15						
3.5 % NaSCN + 30% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	Top	3.949	293.15	245.22	267.23	0.9176	6.80%	6.37%	0.38%
			298.15	181.55	198.54	0.9144	6.22%		
			303.15	136.91	150.24	0.9113	6.09%		
			308.15	104.87	115.47	0.9082			
	Bottom	7.915	293.15				60.56%	60.64%	0.36%
			298.15				60.33%		
			303.15				61.03%		
			308.15						
3.5 % NaSCN + 40% [P_{44414}]Cl + 20% $(NH_4)_2SO_4$	Top	5.363	293.15	204.65	222.21	0.921	8.81%	8.85%	0.06%
			298.15	152.11	165.75	0.9177	8.92%		
			303.15	115.12	125.88	0.9145	8.81%		
			308.15	88.622	97.248	0.9113			
	Bottom	6.552	293.15				54.44%	54.42%	0.24%

		298.15	54.18%
		303.15	54.65%
		308.15	

[a] Water content triplicates were measured at room temperature, about 293 K. The temperature variation is only related to density and viscosity.

7 Partition coefficient of MV and TEMPO

Table S22 contain data of partition coefficient of MV and TEMPO on all ABS under study.

Table S22. Partition coefficient of MV and tempo on top and bottom phases of all 19 ABS under study.

ABS	MV					TEMPO				
	Kavg	Kstdev	logKavg	logKstdev	Ua (k=2, CL=95%)	Kavg	Kstdev	logKavg	logKstdev	Ua (k=2, CL=95%)
0% NaSCN; 25% $[P_{4444}]Cl$ + 17% $(NH_4)_2SO_4$	0.190	0.031	-0.721	0.071	0.14	65	28	1.82	0.18	0.37
0 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.0475	0.0034	-1.324	0.031	0.06	200		2.30		
3.5 % NaSCN + 40% $[P_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.0391	0.0041	-1.409	0.045	0.09	200		2.30		
0 % NaSCN + 30% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	0.0442	0.0033	-1.356	0.032	0.06	200		2.30		
3.5 % NaSCN + 30% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	0.0216	0.0043	-1.669	0.086	0.17	200		2.30		
0 % NaSCN + 35.3% $[P_{4444}]Cl$ + 17.6% $(NH_4)_2SO_4$	0.0386	0.0017	-1.413	0.019	0.04	200		2.30		
3.5 % NaSCN + 40% $[P_{4444}]Cl$ + 20% $(NH_4)_2SO_4$	0.0162	0.0049	-1.80	0.13	0.26	200		2.30		
9 % NaSCN + 15% $[P_{4444}]Cl$ + 16% $(NH_4)_2SO_4$	0.273	0.035	-0.567	0.056	0.11	1.344	0.073	0.13	0.024	0.047
0% NaSCN; 31% $[N_{4444}]Cl$ + 12% $(NH_4)_2SO_4$	0.299	0.018	-0.524	0.026	0.05	39.7	2.5	1.60	0.027	0.055
0 % NaSCN + 40% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.0622	0.0074	-0.849	0.051	0.10	200		2.30		
3.5 % NaSCN + 40% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.0904	0.0040	-1.044	0.019	0.04	200		2.30		
0 % NaSCN + 30% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.197	0.012	-0.706	0.026	0.05	200		2.30		
3.5 % NaSCN + 30% $[N_{4444}]Cl$ + 15% $(NH_4)_2SO_4$	0.0628	0.0073	-1.204	0.051	0.10	200		2.30		

0 % NaSCN + 40% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	0.142	0.010	-0.849	0.031	0.06	200		2.30		
3.5 % NaSCN + 40% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	0.171	0.015	-1.044	0.038	0.08	200		2.30		
13 % NaSCN +20% $[N_{4444}]Cl$ + 10% $(NH_4)_2SO_4$	0.627	0.070	-0.205	0.049	0.10	10.8	1.4	1.03	0.06	0.11
0% NaSCN; 32% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	0.204	0.026	-0.694	0.057	0.11	24.60	0.90	1.39	0.016	0.032
0 % NaSCN + 30% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	0.099	0.026	-1.02	0.11	0.23	45.7	2.3	1.66	0.022	0.045
3.5 % NaSCN + 30% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	0.089	0.024	-1.06	0.12	0.23	200		2.30		
0 % NaSCN + 40% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	0.059	0.010	-1.232	0.077	0.15	200		2.30		
3.5 % NaSCN + 40% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	0.2493	0.0042	-0.603	0.007	0.01	200		2.30		
0 % NaSCN + 40% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	0.0446	0.0026	-1.351	0.025	0.05	200		2.30		
3.5 % NaSCN + 40% $[N_{4444}]Br$ + 15% $(NH_4)_2SO_4$	0.210	0.031	-0.682	0.064	0.13	200		2.30		
11 % NaSCN +21% $[N_{4444}]Br$ + 10% $(NH_4)_2SO_4$	0.455	0.032	-0.343	0.031	0.06	200		2.30		
0% NaSCN; 30% $[P_{44414}]Cl$ + 10% $(NH_4)_2SO_4$	0.079	0.015	-1.105	0.083	0.17	39	12	1.59	0.13	0.26
0 % NaSCN + 40% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	0.018	0.014	-1.82	0.33	0.66	200	0	2.30		
3.5 % NaSCN + 40% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	0.0128	0.0053	-1.92	0.18	0.36	28	14	1.44		
0 % NaSCN + 30% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	0.018	0.014	-1.82	0.33	0.66	200		2.30		
3.5 % NaSCN + 30% $[P_{44414}]Cl$ + 20% $(NH_4)_2SO_4$	0.0128	0.0053	-1.92	0.18	0.36	28	14	1.44	0.21	0.42
0 % NaSCN + 40% $[P_{44414}]Cl$ + 15% $(NH_4)_2SO_4$	0.0143	0.0003	-1.843	0.010	0.02	200	0	2.30		
3.5 % NaSCN + 40% $[P_{44414}]Cl$ + 15% $(NH_4)_2SO_4$	0.0071	0.0034	-2.18	0.21	0.42	200	0	2.30		

8 Reference

[1] GUM-6, Guide to the expression of uncertainty in measurement — Part 1: Introduction, Sevres, 2023. https://doi.org/10.59161/JCGMGUM-1-2023.