Supporting Information

PERFORMANCE OF TETRAALKYLAMMONIUM-BASED IONIC LIQUIDS AS CONSTITUENTS OF AQUEOUS BIPHASIC SYSTEMS IN THE EXTRACTION OF OVALBUMIN AND LYSOZYME

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Table S1. HPLC conditions used for the identification and quantification of ovalbumin and lysozyme.

	Ovalbumin	**Lysozyme**
Eluent	50 mM sodium phosphate buffer (NaH_2PO_4/Na_2HPO_4), 0.3 M NaCl at pH 7.0	Solvent A = 100 : 38.4 (Stock solution I:Stock solution II), Solvent B = Stock solution II; Stock solution I = aq. 0.01% TFAA solution, Stock solution I = 0.01% TFAA in ACN solution
Eluting conditions	Isocratically	Gradient†
Run time	45 min	40 min
Flow rate	0.5 $mL.min^{-1}$	1.0 $mL.min^{-1}$

†expressed as proportion of solvent A: 0 − 20 min, 100%; 20 − 21 min, 100 − 50%; 21 − 22 min, 50%; 22− 23 min, 50 − 100%; 23 − 45 min, 100%

Table S2. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{4444}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2) at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2	w_1	w_2
57.61	0.66	26.02	8.44	18.65	12.04
56.69	1.27	25.58	8.29	18.48	12.28
50.73	1.14	25.29	8.63	18.33	12.18
49.63	1.96	25.15	8.59	18.01	12.64
46.55	1.84	24.88	8.92	17.84	12.52
45.76	2.46	24.59	8.82	17.57	12.92
43.10	2.32	24.35	9.12	17.38	12.78
42.32	2.98	24.22	9.07	17.10	13.20
40.66	2.86	23.94	9.42	16.85	13.01
40.08	3.38	23.67	9.31	16.55	13.48
38.64	3.25	23.39	9.66	16.41	13.37
38.10	3.75	23.16	9.57	16.18	13.73
37.10	3.65	22.92	9.87	15.94	13.53
36.45	4.27	22.65	9.76	15.73	13.86
35.42	4.15	22.41	10.08	15.53	13.68
34.67	4.88	22.31	10.04	15.35	13.99
34.18	4.81	22.10	10.31	15.28	13.93
33.80	5.19	21.87	10.19	15.22	14.04
33.33	5.12	21.67	10.46	15.10	13.93
32.90	5.55	21.56	10.40	14.92	14.23
32.06	5.41	21.33	10.71	14.78	14.10
31.66	5.82	21.21	10.65	14.70	14.24
31.18	5.74	20.98	10.97	14.60	14.14
30.28	6.70	20.75	10.85	14.50	14.32
29.94	6.62	20.53	11.14	14.39	14.22
29.75	6.83	20.43	11.08	14.21	14.53
29.57	6.79	20.26	11.32	14.06	14.39
29.24	7.16	20.10	11.24	13.98	14.54
28.82	7.05	19.92	11.49	13.89	14.45
28.73	7.16	19.74	11.39	13.79	14.61
28.52	7.11	19.58	11.63	13.75	14.56
28.13	7.54	19.52	11.59	13.65	14.73
27.88	7.47	19.37	11.81	13.56	14.63
27.46	7.95	19.22	11.72	13.37	14.97
27.03	7.82	19.06	11.94	13.20	14.78
26.70	8.20	18.94	11.87		
26.32	8.08	18.77	12.12		

Table S3. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{4444}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
41.64	2.16	19.73	10.70
40.93	2.79	19.56	10.61
39.36	2.68	19.19	11.13
38.68	3.31	18.85	10.93
37.26	3.19	18.23	11.85
36.65	3.77	18.03	11.71
35.43	3.65	17.72	12.17
34.83	4.25	17.57	12.06
33.67	4.11	17.30	12.46
33.21	4.58	17.11	12.32
32.30	4.46	16.61	13.10
31.78	5.01	16.48	13.00
31.28	4.93	16.23	13.39
30.82	5.43	16.11	13.29
30.31	5.34	16.07	13.35
29.89	5.79	15.91	13.22
29.05	5.63	15.21	14.36
28.67	6.07	15.11	14.26
27.83	5.89	14.89	14.62
27.26	6.57	14.80	14.53
26.88	6.48	14.63	14.81
26.25	7.25	14.53	14.70
25.58	7.07	14.27	15.12
24.97	7.82	14.22	15.06
24.35	7.63	13.99	15.44
23.81	8.32	13.91	15.36
23.51	8.21	13.64	15.81
23.00	8.87	13.55	15.71
22.77	8.78	13.30	16.14
22.17	9.58	13.21	16.03
21.53	9.31	12.88	16.60
21.41	9.48	12.71	16.39
21.25	9.41	12.34	17.04
20.97	9.81	12.26	16.94
20.75	9.71	11.90	17.59
20.33	10.29	11.83	17.48
20.10	10.17		

Table S4. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{444(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2	w_1	w_2
57.64	0.69	27.04	8.07	18.64	12.70
56.69	1.32	26.77	7.99	18.10	13.47
53.05	1.24	26.45	8.36	17.97	13.37
51.90	2.05	26.16	8.27	17.72	13.74
47.07	1.86	25.88	8.60	17.59	13.64
46.40	2.39	25.58	8.50	17.30	14.06
44.65	2.30	25.30	8.83	17.19	13.97
43.91	2.91	25.05	8.75	16.91	14.38
42.30	2.80	24.78	9.07	16.79	14.28
41.49	3.49	24.52	8.98	16.53	14.66
39.48	3.32	24.28	9.27	16.42	14.56
38.89	3.86	24.03	9.18	16.22	14.84
37.75	3.74	23.62	9.69	16.12	14.75
37.27	4.19	23.39	9.60	15.86	15.13
36.67	4.13	23.12	9.94	15.77	15.03
36.09	4.68	22.91	9.85	15.54	15.37
35.11	4.55	22.68	10.15	15.46	15.29
34.43	5.22	22.49	10.07	15.30	15.54
33.43	5.07	22.05	10.63	15.25	15.49
32.92	5.60	21.86	10.54	15.03	15.83
32.44	5.52	21.66	10.81	14.95	15.75
31.99	5.98	21.46	10.71	14.85	15.91
31.52	5.89	21.04	11.27	14.76	15.81
31.09	6.35	20.87	11.18	14.45	16.29
30.33	6.20	20.66	11.45	14.39	16.22
29.96	6.60	20.48	11.35	14.19	16.54
29.61	6.52	20.10	11.86	14.10	16.43
29.31	6.85	19.95	11.76	13.93	16.69
28.95	6.77	19.77	12.00	13.86	16.60
28.33	7.46	19.61	11.90	13.60	17.01
28.03	7.38	19.23	12.42	13.52	16.91
27.70	7.76	19.09	12.32		
27.39	7.67	18.76	12.78		

Table S5. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{1118}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
45.17	5.76	20.94	18.19
44.34	5.66	20.75	18.03
43.09	6.60	20.02	18.76
42.33	6.49	19.85	18.60
41.60	7.04	18.95	19.52
40.81	6.91	18.79	19.35
39.43	7.99	18.19	19.97
38.72	7.85	18.04	19.80
37.56	8.78	16.13	21.82
36.99	8.64	16.00	21.64
35.85	9.57	15.20	22.51
35.32	9.43	15.13	22.41
34.27	10.31	14.67	22.91
33.75	10.15	14.57	22.74
32.54	11.18	13.89	23.49
32.12	11.03	13.79	23.32
31.24	11.79	13.06	24.16
30.82	11.63	12.97	24.00
29.19	13.06	12.40	24.65
28.96	12.96	12.33	24.50
28.43	13.44	11.68	25.26
28.05	13.27	11.61	25.10
26.98	14.24	10.93	25.91
26.62	14.06	10.87	25.76
24.60	15.94	9.84	26.99
24.31	15.75	9.79	26.87
23.31	16.70	9.18	27.62
23.05	16.51	9.14	27.50
22.18	17.36	8.08	28.82
21.96	17.18	8.05	28.70

Table S6. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{111(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
55.90	1.47	36.20	7.28
54.39	2.48	35.69	7.17
51.52	2.35	34.25	8.45
50.23	3.26	33.41	8.24
48.17	3.13	31.50	10.00
47.00	3.99	31.13	9.88
44.64	3.79	30.20	10.75
43.67	4.56	29.85	10.62
43.00	4.49	28.45	11.95
42.05	5.24	28.12	11.81
40.71	5.08	26.87	13.02
39.85	5.79	26.59	12.88
39.24	5.70	24.67	14.76
38.55	6.29	24.49	14.65
37.99	6.20	21.63	17.49
37.24	6.84	21.42	17.32
36.79	6.76		

Table S7. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{222(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
53.15	0.89	26.37	10.51
50.76	2.59	25.51	11.44
46.34	2.37	25.24	11.32
45.41	3.10	24.45	12.18
43.06	2.94	24.21	12.06
41.69	4.09	23.50	12.85
40.34	3.95	23.27	12.73
39.65	4.55	22.28	13.84
39.03	4.48	22.06	13.70
38.39	5.04	21.07	14.83
37.26	4.89	20.90	14.70
36.64	5.45	19.92	15.84
36.05	5.36	19.78	15.73
35.52	5.86	18.93	16.73
35.00	5.77	18.87	16.68
34.45	6.30	17.60	18.17
33.98	6.21	17.54	18.10
32.94	7.21	16.73	19.07
32.46	7.10	16.61	18.94
31.99	7.55	15.49	20.29
31.56	7.45	15.39	20.16
30.69	8.32	14.04	21.80
30.30	8.21	13.96	21.67
29.93	8.58	12.97	22.89
29.58	8.48	12.90	22.76
28.72	9.36	11.66	24.31
28.38	9.25	11.61	24.21
27.67	9.99	10.54	25.56
27.35	9.87	10.51	25.47
26.65	10.62		

Table S8. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{222(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 8.

w_1	w_2	w_1	w_2
67.52	4.67	20.48	14.53
39.36	4.66	20.10	14.75
37.49	5.23	19.50	15.31
35.81	5.87	19.20	15.41
34.19	6.43	18.67	15.92
32.87	6.97	18.23	16.29
31.98	7.55	17.80	16.65
30.69	7.97	17.37	17.10
29.84	8.44	17.08	17.27
28.98	8.95	16.75	17.52
28.20	9.48	16.36	17.89
27.44	9.88	15.96	18.25
26.68	10.27	15.58	18.62
26.03	10.66	15.23	18.97
25.38	11.01	14.89	19.28
24.81	11.40	14.70	19.40
24.22	11.80	14.39	19.71
23.67	12.16	14.08	19.99
23.16	12.50	13.79	20.25
22.67	12.79	13.52	20.48
22.24	13.08	13.25	20.79
21.60	13.66	13.00	21.01
21.19	13.88	12.78	21.18

Table S9. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{222(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 9.

w_1	w_2	w_1	w_2
47.23	2.62	18.03	16.68
43.46	3.48	17.73	16.84
40.34	4.21	17.45	17.00
38.03	5.15	17.06	17.43
35.57	5.82	16.80	17.58
33.99	6.55	16.52	17.78
32.48	7.15	16.27	17.94
31.15	7.65	16.03	18.14
30.39	8.11	15.67	18.63
29.21	8.54	15.40	18.71
28.50	9.04	15.17	18.89
27.78	9.48	14.95	19.08
26.80	9.75	14.62	19.54
26.21	10.19	14.37	19.61
25.63	10.52	14.20	19.77
24.98	11.11	14.00	19.92
24.48	11.51	13.81	20.04
23.92	11.92	13.43	20.69
23.10	12.83	13.15	20.68
22.67	13.07	12.90	21.01
22.23	13.34	12.73	21.13
21.84	13.58	12.56	21.24
21.43	13.91	12.40	21.34
21.03	14.23	12.17	21.69
20.62	14.49	12.00	21.73
19.90	15.09	11.88	21.87
19.45	15.54	11.74	21.97
19.13	15.70	11.54	22.28
18.80	15.91	11.41	22.35
18.35	16.44	11.29	22.45

Table S10. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{222(C7H7)}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 13.

w_1	w_2	w_1	w_2
68.94	1.08	20.41	12.83
61.89	1.68	20.06	12.96
47.36	2.39	19.57	13.30
43.72	3.02	19.05	13.67
41.27	3.62	18.57	13.98
39.03	4.13	18.14	14.34
37.37	4.60	17.87	14.45
35.25	5.60	17.44	14.74
33.69	6.16	17.02	15.08
32.70	6.57	16.78	15.17
31.79	6.94	16.39	15.47
30.91	7.27	16.01	15.77
30.04	7.66	15.65	16.00
29.03	8.18	15.33	16.21
28.30	8.47	14.73	16.61
27.63	8.74	14.45	16.80
26.69	9.34	14.14	17.01
26.07	9.59	13.88	17.22
25.49	9.83	13.64	17.40
24.64	10.39	13.28	17.70
24.13	10.60	12.98	17.92
23.40	11.05	12.74	18.07
22.72	11.49	12.23	18.51
22.27	11.66	12.03	18.64
21.62	12.02	11.85	18.77
21.00	12.43	11.60	19.00

Table S11. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
43.55	2.77	24.16	12.90
42.73	3.46	24.00	12.82
41.47	3.35	22.90	14.01
40.81	3.92	22.66	13.86
39.93	3.84	22.05	14.53
39.09	4.58	21.85	14.40
38.39	4.50	20.82	15.55
37.71	5.10	20.76	15.51
37.11	5.02	20.22	16.12
36.68	5.41	20.08	16.01
36.17	5.33	19.19	17.02
35.63	5.84	19.12	16.96
35.03	5.74	18.32	17.87
34.17	6.55	18.22	17.78
33.61	6.44	17.65	18.44
32.87	7.16	17.58	18.37
32.63	7.11	16.70	19.40
32.22	7.51	16.58	19.26
31.97	7.46	15.65	20.37
31.53	7.90	15.58	20.28
30.98	7.76	14.89	21.10
30.19	8.55	14.84	21.03
29.96	8.48	14.12	21.90
29.33	9.12	14.02	21.74
29.18	9.07	13.26	22.67
28.53	9.74	13.18	22.54
28.16	9.61	12.51	23.38
27.50	10.30	12.47	23.32
27.29	10.22	11.75	24.22
26.59	10.96	11.72	24.16
26.43	10.89	11.25	24.75
25.84	11.52	11.19	24.60
25.56	11.39		

Table S12. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 8.

w_1	w_2	w_1	w_2
67.11	1.56	22.45	14.35
46.77	2.31	21.54	14.82
43.78	3.29	20.80	15.51
41.29	3.92	20.10	16.14
38.82	4.72	19.45	16.71
36.76	5.50	18.90	17.22
34.83	6.09	17.84	18.15
33.65	6.76	17.22	18.45
32.50	7.37	16.77	18.83
30.02	9.10	16.23	19.43
29.13	9.60	15.81	19.80
28.37	10.09	15.44	20.13
27.56	10.58	14.76	20.72
26.87	11.02	14.42	20.98
26.20	11.45	13.98	21.46
25.63	11.80	13.54	21.74
24.61	12.70	13.26	21.97
23.78	13.35	12.98	22.21
23.22	13.65	12.72	22.46

Table S13. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 9.

w_1	w_2	w_1	w_2
74.69	1.15	19.96	15.29
49.15	2.03	19.48	15.87
46.04	3.07	19.00	16.41
41.80	3.79	18.60	16.48
39.48	4.55	18.29	16.71
37.35	5.25	17.97	16.94
35.72	5.73	17.67	17.14
34.15	6.33	17.26	17.61
33.23	6.81	17.01	17.79
32.16	7.26	16.75	17.99
31.32	7.85	16.35	18.52
30.22	8.18	15.86	18.85
29.59	8.58	15.51	19.30
28.89	9.03	15.08	19.63
28.15	9.60	14.79	19.65
27.53	10.03	14.60	19.78
27.01	10.40	14.41	19.92
26.45	10.71	14.22	20.05
25.92	11.05	14.02	20.25
25.38	11.44	13.84	20.38
24.79	11.80	13.60	20.74
24.28	12.15	13.41	20.87
23.79	12.51	12.97	21.76
23.40	12.76	12.74	21.75
22.98	13.03	12.59	21.87
22.54	13.28	12.44	21.95
21.86	14.04	12.29	22.05
21.49	14.24	12.07	22.35
21.08	14.48	11.94	22.48
20.71	14.72	11.80	22.58
20.33	15.01		

Table S14. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Br$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 13.

w_1	w_2	w_1	w_2
69.86	2.21	20.54	13.27
64.21	2.20	19.97	13.64
43.99	2.77	19.36	14.12
41.55	3.35	18.86	14.43
39.98	3.96	18.24	14.90
38.24	4.41	17.82	15.16
37.10	4.77	17.40	15.43
35.79	5.28	16.87	15.85
34.83	5.71	16.44	16.11
33.73	6.13	16.09	16.34
32.83	6.60	15.67	16.67
31.83	6.99	15.36	16.87
30.95	7.30	14.95	17.22
29.74	7.94	14.64	17.38
29.02	8.36	14.29	17.61
28.00	8.70	13.92	17.91
27.04	9.17	13.66	18.09
26.22	9.63	13.36	18.32
25.34	10.17	12.80	18.96
24.94	10.44	12.49	19.23
24.56	10.70	12.21	19.46
23.77	11.19	11.99	19.58
23.11	11.55	11.74	19.76
22.54	11.94	11.43	20.02
21.67	12.59	11.08	20.37
21.12	12.90		

Table S15. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 7.

w_1	w_2	w_1	w_2
56.85	0.92	31.42	6.10
50.07	0.81	30.98	6.55
49.01	1.61	30.55	6.46
44.44	1.46	29.70	7.37
43.27	2.44	29.32	7.27
41.72	2.36	28.52	8.13
40.97	3.02	28.22	8.05
39.61	2.92	27.41	8.93
38.86	3.60	27.07	8.82
37.63	3.48	24.93	11.20
37.00	4.08	24.39	10.96
36.40	4.01	23.47	12.01
35.83	4.56	23.01	11.78
35.31	4.49	21.76	13.25
34.82	4.97	21.56	13.12
34.28	4.89	19.55	15.52
33.81	5.36	19.38	15.38
33.31	5.28	18.09	16.95
32.78	5.81	17.79	16.67
32.30	5.72	15.96	18.96
31.86	6.18	15.73	18.69

Table S16. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 8.

w_1	w_2	w_1	w_2
56.35	2.14	19.66	15.26
40.10	3.05	19.02	15.80
37.36	4.10	18.29	16.63
34.94	5.15	17.57	17.36
32.98	5.82	17.24	17.59
30.36	7.58	16.73	18.24
28.08	9.08	15.97	19.13
25.65	10.27	15.46	19.62
24.02	11.26	14.55	20.90
22.87	12.40	12.72	23.61
21.47	13.36	11.86	24.80
20.50	14.38	11.24	25.72

Table S17. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 9.

w_1	w_2	w_1	w_2
55.06	1.93	18.00	15.75
42.11	3.47	17.57	16.09
37.04	4.10	16.84	17.15
33.39	5.37	16.22	18.03
30.08	6.34	15.67	18.55
28.29	7.33	15.07	19.30
27.32	8.08	14.63	19.82
26.24	9.05	13.68	20.75
25.20	9.97	13.17	21.14
23.88	10.70	12.79	21.74
23.03	11.44	12.34	22.22
22.28	12.16	11.88	22.67
21.51	12.92	11.44	23.08
20.50	13.74	11.04	23.51
19.66	14.18	10.70	23.79
19.10	14.67	10.40	24.13
18.55	15.20	10.19	24.10

Table S18. Experimental weight fraction data for the binodal curves of the ABS formed by $[N_{2222}]Cl$ (1) + K_2HPO_4/KH_2PO_4 (2), at (25 ± 3)˚C and pH 13.

w_1	w_2	w_1	w_2
56.93	1.38	19.12	13.33
50.30	2.26	18.41	13.91
40.18	3.30	17.60	14.62
36.81	3.94	16.77	15.46
34.42	4.58	15.99	16.23
32.95	5.35	15.33	16.89
29.08	6.39	14.72	17.48
27.97	6.99	14.32	17.78
26.91	7.57	13.76	18.32
25.57	8.60	13.26	18.79
24.79	8.99	12.83	19.20
23.64	9.88	12.40	19.61
22.71	10.56	11.84	20.29
21.70	11.24	11.47	20.64
20.79	11.97	11.00	21.19
19.90	12.69		

For the determination of each TL, the following system of four equations (equations (S1)–(S4)) and four unknown parameters ($[IL]_T$, $[IL]_B$, $[Salt]_T$, $[Salt]_B$) was applied:

$$[\mathrm{IL}]_\mathrm{T} = A\exp[(B \times [\mathrm{Salt}]_\mathrm{T}^{0.5}) - (C \times [\mathrm{Salt}]_\mathrm{T}^{3})] \quad \text{(S1)}$$

$$[\mathrm{IL}]_\mathrm{B} = A\exp[(B \times [\mathrm{Salt}]_\mathrm{B}^{0.5}) - (C \times [\mathrm{Salt}]_\mathrm{B}^{3})] \quad \text{(S2)}$$

$$[\mathrm{IL}]_\mathrm{T} = \frac{[\mathrm{IL}]_\mathrm{M}}{\alpha} - \frac{1-\alpha}{\alpha} \times [\mathrm{IL}]_\mathrm{B} \quad \text{(S3)}$$

$$[\mathrm{Salt}]_\mathrm{T} = \frac{[\mathrm{Salt}]_\mathrm{M}}{\alpha} - \frac{1-\alpha}{\alpha} \times [\mathrm{Salt}]_\mathrm{B} \quad \text{(S4)}$$

where the subscripts M, T and B designate, respectively, the initial mixture, the top and bottom phases. The value α is the ratio between the mass of the top phase and the total mass of the mixture experimentally determined. Each tie-line length (TLL) was determined through the application of the following equation:

$$\mathrm{TLL} = \sqrt{([\mathrm{Salt}]_\mathrm{T} - [\mathrm{Salt}]_\mathrm{B})^2 + ([\mathrm{IL}]_\mathrm{T} - [\mathrm{IL}]_\mathrm{B})^2} \quad \text{(S5)}$$

Table S19. Weight fraction compositions for the TLs and respective Tie-Line Lengths (TLLs), at the Top (T) and Bottom (B) phases, and at the initial biphasic composition of the mixture (M), composed of ILs and salts at T = (25 ± 3) ºC and atmospheric pressure.

IL +	weight fraction composition/wt %							
$[KH_2PO_4/K_2HPO_4$ at pH 7]	$[IL]_T$	$[Salt]_T$	$[IL]_M$	$[Salt]_M$	$[IL]_B$	$[Salt]_B$	TLS	TLL
$[N_{111(C7H7)}]Cl$	35.16	7.90	27.99	16.13	9.86	36.97	-0.87	38.54
	39.48	6.08	31.08	16.09	6.96	44.84	-0.84	50.60
$[N_{222(C7H7)}]Cl$	35.00	6.04	29.14	11.96	2.94	38.60	-0.98	45.83
	38.80	4.82	27.81	15.42	3.04	39.29	-1.04	49.67
$[N_{2222}]Cl$	33.13	5.74	27.90	14.92	5.27	37.39	-0.88	42.09
	40.18	3.80	31.35	14.72	1.14	43.22	-0.99	52.65
$[N_{2222}]Br$	34.13	6.74	26.90	13.92	4.27	36.39	-1.01	42.09
	39.18	4.80	30.35	13.72	2.14	42.22	-0.99	52.65
$[N_{444(C7H7)}]Cl$	40.41	3.57	21.82	18.97	1.81	35.54	-1.21	50.12
	44.50	2.76	21.33	20.99	1.54	36.56	-1.27	54.67
$[N_{4444}]Cl$	28.88	5.87	23.15	11.99	1.80	34.74	-0.94	39.58
	38.27	3.36	29.13	11.62	1.89	36.25	-1.11	49.04
$[N_{4444}]Br$	38.63	3.71	30.04	9.03	2.37	26.54	-1.59	43.36
	45.93	2.17	29.67	11.74	1.49	28.33	-1.70	51.56
$[N_{1118}]Br$	51.48	3.81	33.04	15.99	3.16	35.72	-1.51	57.91
	45.21	5.60	30.15	15.96	4.19	33.85	-1.45	49.81

Table S20. Adjusted parameters and respective standard deviations obtained from the regression of equation (1) at (25 ± 3) °C and different pH values.

IL	pH	$A \pm \sigma$	$B \pm \sigma$	$10^5 (C \pm \sigma)$
$[N_{111(C7H7)}]Cl$	pH 7	90.02 ± 5.39	-0.334 ± 0.02	0.35 ± 0.62
$[N_{222(C7H7)}]Cl$		80.53 ± 1.74	-0.337 ± 0.008	1.97 ± 0.22
$[N_{2222}]Cl$		70.11 ± 2.94	-0.317 ± 0.021	1.17 ± 1.64
$[N_{2222}]Br$		73.88 ± 0.91	-0.298 ± 0.004	2.49 ± 0.14
$[N_{444(C7H7)}]Cl$		88.70 ± 1.33	-0.415 ± 0.001	3.15 ± 0.42
$[N_{4444}]Cl$		79.40 ± 2.41	-0.414 ± 0.013	3.20 ± 0.88
$[N_{4444}]Br$		77.76 ± 1.83	-0.360 ± 0.012	10.2 ± 1.23
$[N_{1118}]Br$		93.37 ± 2.63	-0.304 ± 0.009	3.44 ± 1.79
$[N_{222(C7H7)}]Cl$	pH 8	81.97 ± 1.20	-0.340 ± 0.005	2.99 ± 0.13
$[N_{2222}]Cl$		73.43 ± 3.16	-0.324 ± 0.015	1.43 ± 0.34
$[N_{2222}]Br$		71.27 ± 1.39	-0.280 ± 0.007	3.38 ± 0.20
$[N_{222(C7H7)}]Cl$	pH 9	79.26 ± 2.05	-0.329 ± 0.009	3.27 ± 0.24
$[N_{2222}]Cl$		64.35 ± 3.30	-0.292 ± 0.017	2.59 ± 0.36
$[N_{2222}]Br$		76.51 ± 1.23	-0.313 ± 0.005	3.26 ± 0.16
$[N_{222(C7H7)}]Cl$	pH 13	78.60 ± 0.87	-0.337 ± 0.004	6.50 ± 0.20
$[N_{2222}]Cl$		73.67 ± 3.03	-0.354 ± 0.016	2.62 ± 0.54
$[N_{2222}]Br$		75.88 ± 0.87	-0.323 ± 0.004	5.54 ± 0.18

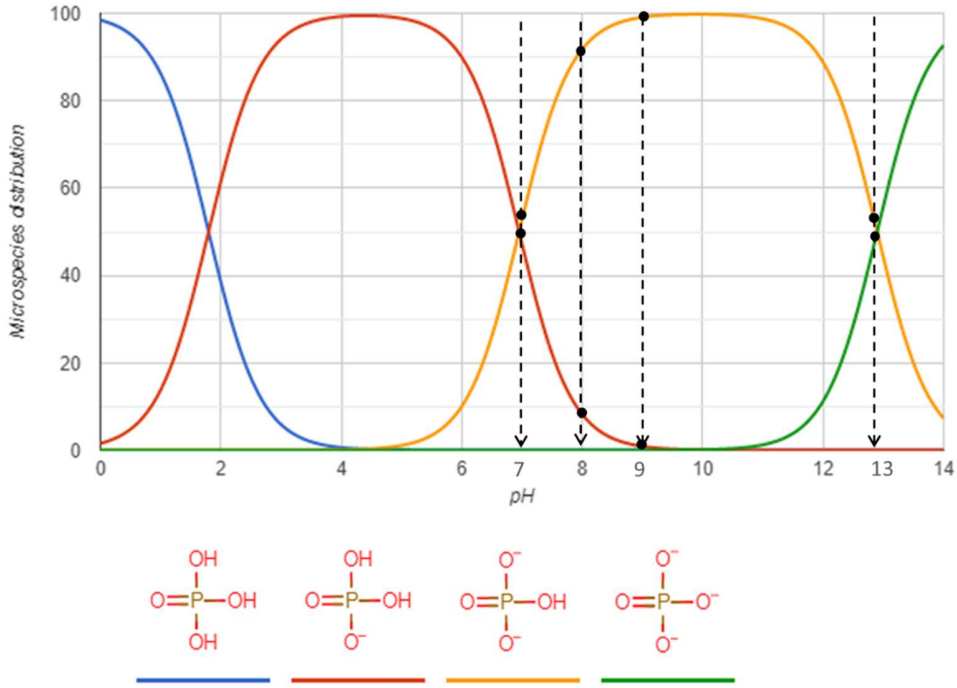

Figure S1. Anions distribution as function of the pH. The pH values studied in this work (7, 8, 9 and 13) are indicated. Information taken from the Chemspider database (www.chemspider.com).

Table S21. Extraction efficiencies (*EE*%) and recovery yields (*RY*%) of ovalbumin and lysozyme at pH 7 and respective mixture compositions.

Ionic liquid	weight fraction percentage / wt %		EE_{Ova}%	RY_{Ova}%	EE_{Lys}%	RY_{Lys}%
	$[IL]_M$	$[Salt]_M$				
$[N_{111(C7H7)}]Cl$	31.08	16.09	100.0 ± 0.2	77.3 ± 1.1	100.0 ± 0.2	100.0 ± 0.2
$[N_{222(C7H7)}]Cl$	27.81	15.42	100.0 ± 0.2	58.8 ± 0.9	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Cl$	31.35	14.72	100.0 ± 0.2	100.0 ± 0.2	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Br$	30.35	13.72	100.0 ± 0.2	100.0 ± 0.2	100.0 ± 0.2	100.0 ± 0.2
$[N_{444(C7H7)}]Cl$	21.33	20.99	100.0 ± 0.2	33.3 ± 1.8	100.0 ± 0.2	100.0 ± 0.2
$[N_{4444}]Cl$	29.13	11.62	100.0 ± 0.2	56.7 ± 1.7	100.0 ± 0.2	100.0 ± 0.2
$[N_{4444}]Br$	29.67	11.74	100.0 ± 0.2	42.6 ± 2.3	100.0 ± 0.2	100.0 ± 0.2
$[N_{1118}]Br$	30.15	15.96	100.0 ± 0.2	36.0 ± 1.6	100.0 ± 0.2	100.0 ± 0.2

Table S22. Extraction efficiencies (*EE*%) and recovery yields (*RY*%) of lysozyme at different pH values and respective mixture compositions.

Ionic liquid	pH	weight fraction percentage / wt %		EE_{Lys}%	RY_{Lys}%
		$[IL]_M$	$[Salt]_M$		
$[N_{222(C7H7)}]Cl$	pH7	27.81	15.42	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Cl$		31.35	14.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Br$		30.35	13.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{222(C7H7)}]Cl$	pH8	27.81	15.42	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Cl$		31.35	14.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Br$		30.35	13.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{222(C7H7)}]Cl$	pH9	27.81	15.42	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Cl$		31.35	14.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{2222}]Br$		30.35	13.72	100.0 ± 0.2	100.0 ± 0.2
$[N_{222(C7H7)}]Cl$	pH13	27.81	15.42	100.0 ± 0.2	36.7 ± 1.5
$[N_{2222}]Cl$		31.35	14.72	100.0 ± 0.2	78.8 ± 0.4
$[N_{2222}]Br$		30.35	13.72	100.0 ± 0.2	30.9 ± 1.9

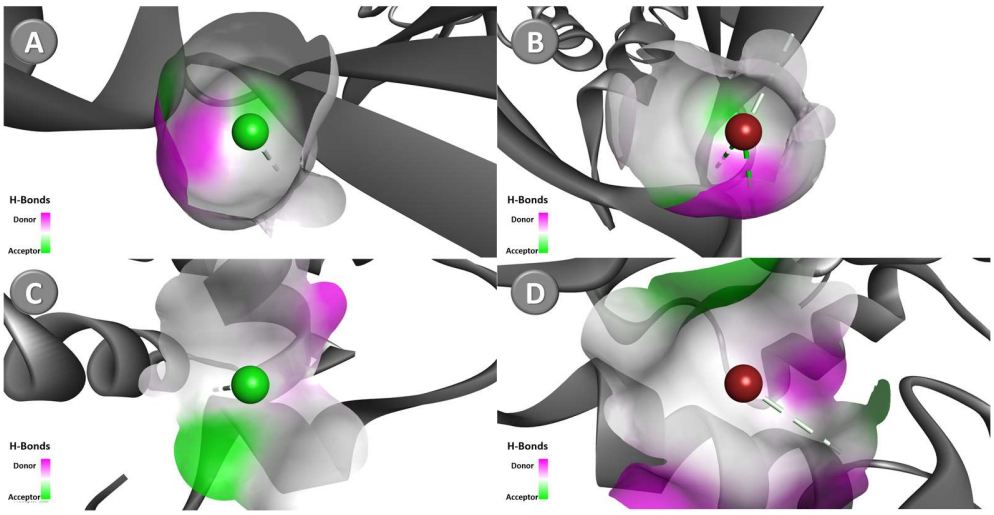

Figure S2. Docking pose with the lowest absolute value of affinity for ovalbumin: (A) Cl^- and (B) Br^-; and lysozyme with: (C) Cl^- and (D) Br^-.

Table S23. Docking affinity energy and interacting amino acids residues predicted by AutoDock vinna for Ovalbumin-IL ions.

IL ion	Affinity (kcal/mol)	Interacting nucleic acids	Type of interaction	From	To	Distance (Å)
$[N_{111(C7H7)}]^+$	-3.8	ARG290	Hydrophobic	$[N_{111(C7H7)}]^+$	ARG290	4.49
$[N_{2222}]^+$	-2.9	GLU27	Electrostatic	$[N_{2222}]^+$	GLU27	4.94
$[N_{222(C7H7)}]^+$	-4.4	VAL333	Hydrophobic	$[N_{222(C7H7)}]^+$	VAL333	3.95
$[N_{4444}]^+$	-3.6	ARG29	Hydrogen Bond	$[N_{4444}]^+$	ARG29	3.53
$[N_{444(C7H7)}]^+$	-3.6	LYS199	Hydrophobic	$[N_{444(C7H7)}]^+$	LYS199	3.61
		VAL347			VAL347	5.31
$[N_{1118}]^+$	-3.2	GLU122	Electrostatic	$[N_{1118}]^+$	GLU122	5.50
		ALA149	Hydrophobic	ALA149	$[N_{1118}]^+$	4.00
Cl^-	-1.2	PRO243	Hydrogen Bond	PRO243	Cl^-	2.72
Br^-	-1.3	GLU195	Hydrogen Bond	GLU195	Br^-	3.81
		LYS196		LYS196		3.00
		LEU242		LEU242		3.75

Table S24. Docking affinity energy and interacting amino acids residues predicted by AutoDock vinna for Lysozyme-IL ions.

IL ion	Affinity (kcal/mol)	Interacting nucleic acids	Type of interaction	From	To	Distance (Å)
$[N_{111(C7H7)}]^+$	-4.3	ALA107	Hydrogen Bond	$[N_{111(C7H7)}]^+$	ALA107	3.57
		TRP108	Hydrophobic	TRP108	$[N_{111(C7H7)}]^+$	4.93
		ILE98		$[N_{111(C7H7)}]^+$	ILE98	5.16
		ALA107			ALA107	4.36
$[N_{2222}]^+$	-2.7	ASP52	Electrostatic	$[N_{2222}]^+$	ASP52	3.88
		ASP46	Hydrogen Bond		ASP46	3.66
		ASP52			ASP52	3.31
						3.75
$[N_{222(C7H7)}]^+$	-3.8	ASP101	Electrostatic	$[N_{222(C7H7)}]^+$	ASP101	5.33
				ASP101	$[N_{222(C7H7)}]^+$	4.51
		TRP62	Hydrophobic	TRP62		4.02
						3.72
$[N_{4444}]^+$	-3.1	TRP123	Electrostatic	$[N_{4444}]^+$	TRP123	4.92
			Hydrophobic			3.79
$[N_{444(C7H7)}]^+$	-3.6	GLU7	Electrostatic	$[N_{444(C7H7)}]^+$	GLU7	5.12
				GLU7	$[N_{444(C7H7)}]^+$	4.00
		ALA10	Hydrophobic	$[N_{444(C7H7)}]^+$	ALA10	5.43
		ALA11			ALA11	4.84
$[N_{1118}]^+$	-2.8	CYS76	Hydrogen Bond	$[N_{1118}]^+$	CYS76	3.55
						3.47
		LYS96	Hydrophobic		LYS96	4.67
Cl^-	-0.8	TRP123	Hydrogen Bond	TRP123	Cl^-	3.17

Br^-	-1.0	ILE58	Hydrogen Bond	GLU195	Br^-	3.89

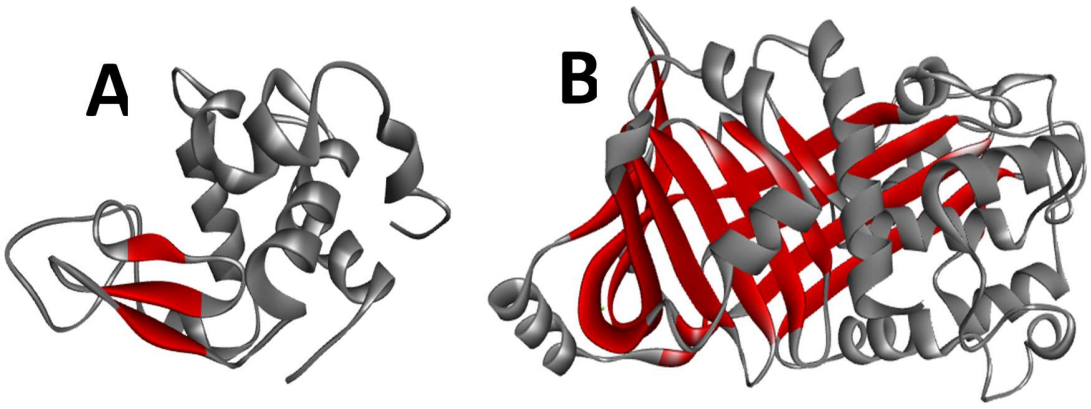

Figure S3. B-sheet content (in red) of lysozyme (A) and ovalbumin (B).

Table S25. Percentage recovery yield (*RY*%) of Lysozyme after the purification and precipitation steps the ABS composed of ILs + K_2HPO_4/KH_2PO_4 + H_2O at pH 7 and 8.

IL-rich phase	RY_{Lys}%
$[N_{222(C7H7)}]Cl$ pH7	80.76 ± 2.25
$[N_{2222}]Cl$ pH7	99.04 ± 2.98
$[N_{2222}]Br$ pH7	93.45 ± 3.45
$[N_{222(C7H7)}]Cl$ pH8	81.02 ± 1.67
$[N_{2222}]Cl$ pH8	99.32 ± 2.72
$[N_{2222}]Br$ pH8	96.68 ± 2.05

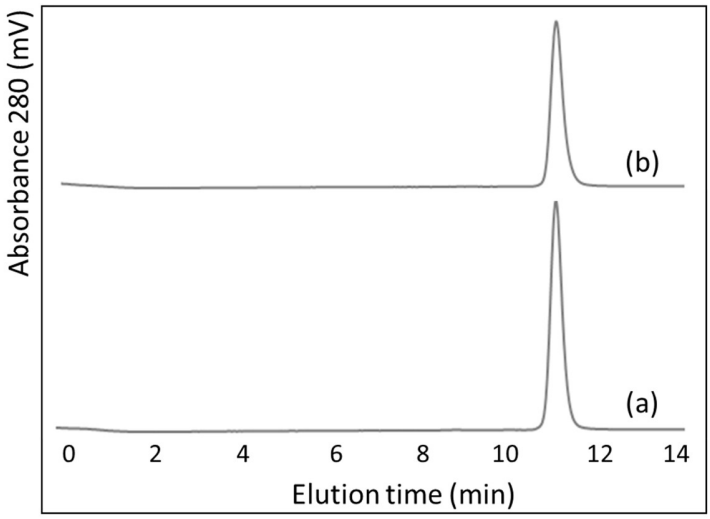

Figure S4. Size exclusion chromatograms of (a) lysozyme solution in PBS and (b) recovered lysozyme from the IL-rich phase of the ABS composed of $[N_{2222}]Cl + K_2HPO_4/KH_2PO_4 + H_2O$ at pH 8.