Enhanced extraction of bovine serum albumin with aqueous biphasic systems of phosphonium- and ammonium-based ionic liquids

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Supporting Information

Table S1

Experimental weight fraction data for the systems composed of IL (1) + $C_6H_5K_3O_7$/$C_6H_8O_7$ (2) + H_2O (3) at 25°C.

[P$_{4444}$]Br		[P$_{4441}$][MeSO$_4$]		[P$_{i(444)1}$][Tos]	
100 w_1	100 w_1	100 w_2	100 w_2	100 w_1	100 w_2
47.8388	0.4370	56.6986	1.3192	75.0208	4.9219
43.1597	0.6590	47.4375	2.9804	59.0400	8.4023
40.1121	0.8976	41.1468	4.2037	51.2389	11.3257
38.1240	1.0659	38.3272	5.4815	46.1956	12.6033
36.3785	1.1897	35.7905	6.0568	44.0170	13.6880
33.5144	1.6411	31.0666	7.5380	39.8392	15.9586
30.2567	2.1531	29.4275	8.1733	35.8389	16.3896
19.2260	5.1635	28.1825	9.0201	33.8655	17.9247
9.5022	15.0050	26.9444	9.6570	32.6041	18.6099
5.7890	23.2343	25.5742	9.9455	32.0466	18.9232
5.2514	26.3552	23.9893	11.2778	30.9711	19.3291
4.6391	26.5561	23.0484	11.7249	29.5810	20.2982
3.9429	28.3602	22.4124	12.0319	28.3531	20.4044
3.2088	29.3497	21.2283	12.9313	26.3549	21.7354
3.0881	31.0576	20.5209	13.3704	25.6420	21.9617
2.0531	40.2288	19.9960	13.9119	24.9033	22.2586
1.6293	42.9543	19.3293	14.1657	24.0632	23.0090
1.4306	43.0913	18.5344	14.8994	23.4145	23.2715
1.1906	43.9595	18.0235	15.1199	22.5863	24.0136
		17.2124	15.9367	20.8279	24.6423
		16.7184	16.2356	20.3996	24.8575
		16.0916	16.7175	19.9438	25.0807
		15.6444	17.0013	19.5664	25.3059
		15.2076	17.3501	18.9791	25.8348

14.6634	17.8620	18.5981	26.0797
14.4839	17.6352	18.2917	26.1410
13.7880	18.6043	17.9134	26.3303
13.2213	18.8075	17.6349	26.4507
12.7655	19.2995	17.2022	26.8071
12.2857	19.7923	16.7512	27.1170
12.2565	19.1829	16.4947	27.2218
11.4734	19.0956	16.2380	27.2667
10.8963	19.6156	15.6235	27.8635
10.4880	19.6969	15.4141	28.0551
9.9797	20.5787	15.2192	28.0490
9.7096	20.9184	14.9494	28.4711
9.2204	21.5358	14.6383	28.7265
8.8098	21.9017	14.3991	29.0902
8.4510	22.3908	14.1926	29.1553
8.0010	23.2081	13.9835	29.1822
		13.6886	29.4696
		13.4918	29.5053
		12.9818	29.9173
		12.7009	30.1312
		12.5818	30.1172
		12.4371	30.1693
		12.3459	30.0383
		12.2228	30.2212
		12.0441	30.4163
		11.5321	31.1580
		11.2065	31.1134

10.9317	31.1274
10.6328	31.4308
10.3840	31.6882
10.1343	31.8178
9.8418	31.9182
9.4906	32.2824
9.0729	33.1904
8.8289	33.2905
8.3966	33.0807

Table S2

Experimental weight fraction data for the systems composed of IL (1) + $C_6H_5K_3O_7/C_6H_8O_7$ (2) + H_2O (3) at 25ºC and pH 7.

[P4444]Cl		[N4444]Cl	
100 w_1	100 w_2	100 w_1	100 w_2
86.4924	1.0557	50.1620	1.9141
63.9963	2.1215	45.2156	3.4470
54.1184	3.0299	42.0719	5.0582
48.8418	3.8526	38.4429	7.4342
45.1634	4.9749	36.2246	8.6956
41.6605	5.6622	34.5441	9.5152
38.3788	6.9352	32.5062	10.6393
35.4859	8.1447	29.6917	12.9078
33.2368	9.1887	27.6777	14.3710
32.0140	10.4540	25.3324	16.1640
31.2483	10.8314	23.7616	17.2831
30.5379	11.2235	21.2843	19.2403
29.8257	11.5870	19.5450	19.3433
28.8400	12.3574	18.0172	21.1155
28.2796	12.6258	15.9995	23.1501
27.6475	12.9362	14.0455	25.3000
27.0681	13.2758	12.9804	26.3039
25.1693	14.1107	11.6673	28.1300
24.0642	14.9879	11.0443	28.5202
23.5031	15.3220	10.0017	29.7699
22.8671	15.6276	9.0441	30.9635
22.0932	16.1253	8.2642	31.9726
21.4158	16.5200	7.8630	32.5237
20.6174	17.1369	7.2713	33.2358
19.8613	17.7528	6.8774	33.9086

19.4211	17.9311	6.3816	34.5217
18.8651	18.2848	6.0857	34.9466
18.2412	18.8202		
17.8484	19.0146		
17.2806	19.4545		
16.9682	19.6283		
16.4548	20.0527		
15.9250	20.4714		
15.4629	20.8920		
15.1644	21.0156		
14.7427	21.3710		
14.3337	21.7670		
14.0974	21.8658		
13.7232	22.1883		
13.3256	22.5398		
12.9924	22.8022		
12.6610	23.0760		
12.3382	23.3616		
12.0179	23.6156		
11.6960	23.8891		
11.3895	24.2068		
11.2217	24.2950		
10.9611	24.5733		
10.8120	24.6647		
10.4943	25.0120		
10.2971	25.1279		
10.0704	25.3459		
9.9706	25.3551		
9.7907	25.5576		
9.5933	25.7322		

9.4068	25.9006
9.2592	26.0450
9.0738	26.2066
8.9031	26.3534
8.7424	26.4771
8.6448	26.5315
8.5041	26.6767
8.3424	26.8247
8.1868	26.9672
8.0522	27.1411
7.9174	27.2373
7.7751	27.3717
7.6558	27.5242
7.4726	27.7560
7.3972	27.7587
7.2689	27.8644
7.0996	28.0967
7.0320	28.1204
6.9784	28.1906
6.9154	28.2171
6.7833	28.3706
6.6517	28.5458
6.5472	28.6451
6.4414	28.7360
6.3508	28.8701
6.2583	28.9889
6.1654	29.0779
6.0494	29.2289
5.9604	29.3077
9.5933	25.7322

9.4068	25.9006
9.2592	26.0450
9.0738	26.2066
8.9031	26.3534
8.7424	26.4771
8.6448	26.5315
8.5041	26.6767
8.3424	26.8247
8.1868	26.9672
8.0522	27.1411
7.9174	27.2373
7.7751	27.3717
7.6558	27.5242
5.7127	30.3562
5.2826	31.1830
4.2756	32.3747
3.8831	33.5204
3.3983	34.9449
2.2193	36.3959
1.9091	39.8339
1.7341	43.2143
1.5590	45.9750
1.4739	48.4673
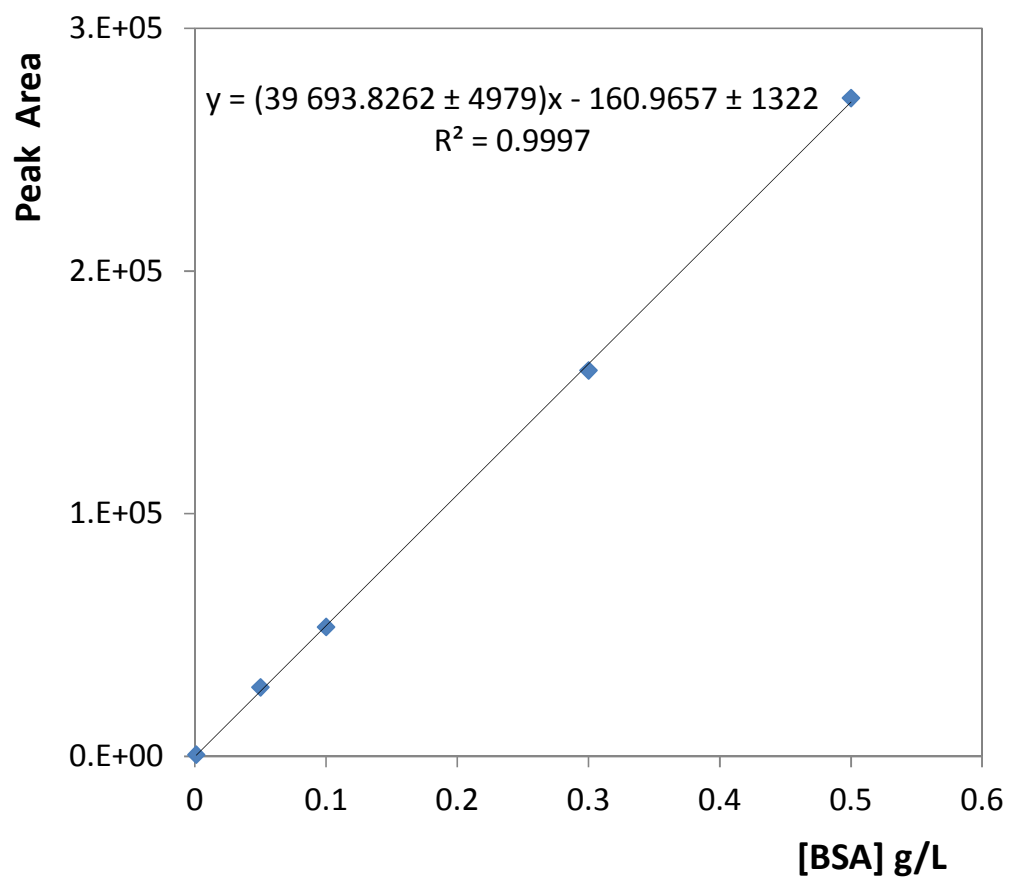
Figure S1 - BSA calibration curve by SE-HPLC.
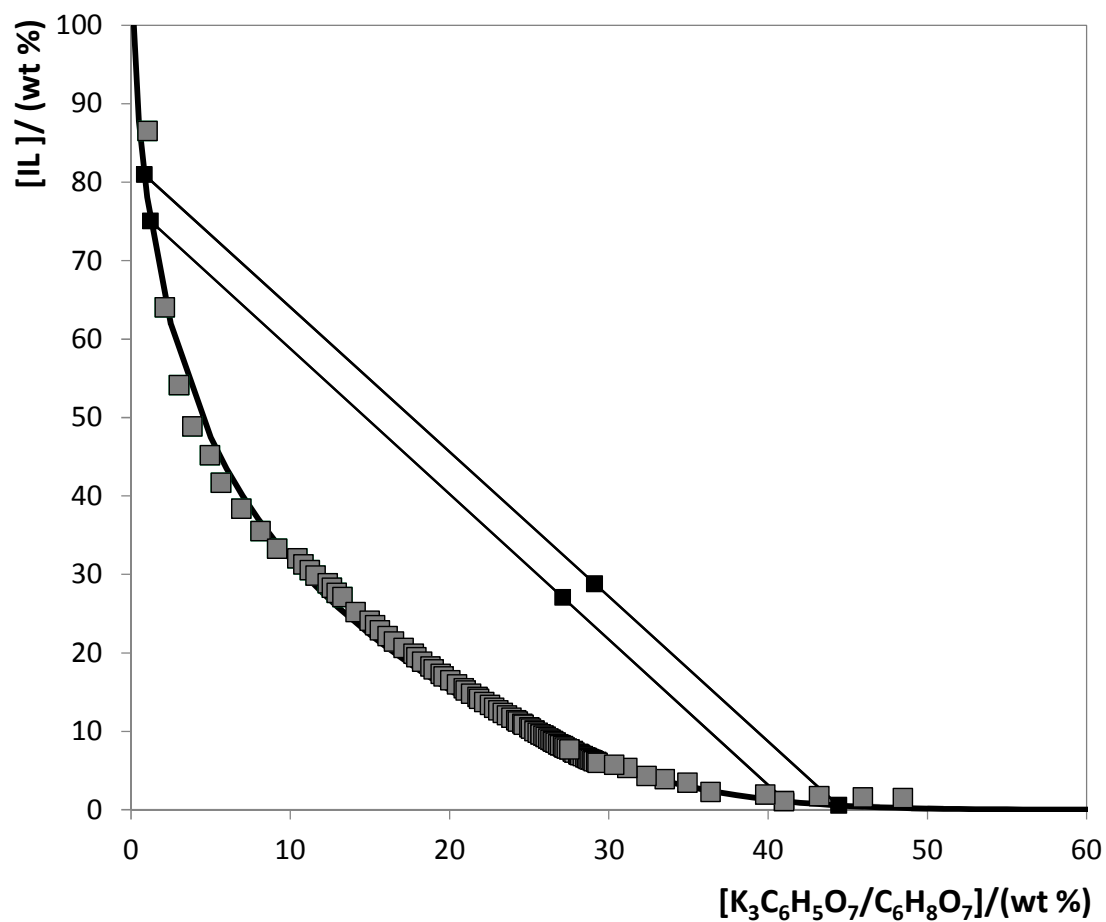
Figure S2 - Phase diagram for the system composed of [P$_{4444}$]Cl + K$_3$C$_6$H$_5$O$_7$/C$_6$H$_8$O$_7$ + H$_2$O at 25°C and pH 7.0: binodal curve data (■); TL data (■); adjusted binodal data through Equation 1 (—).
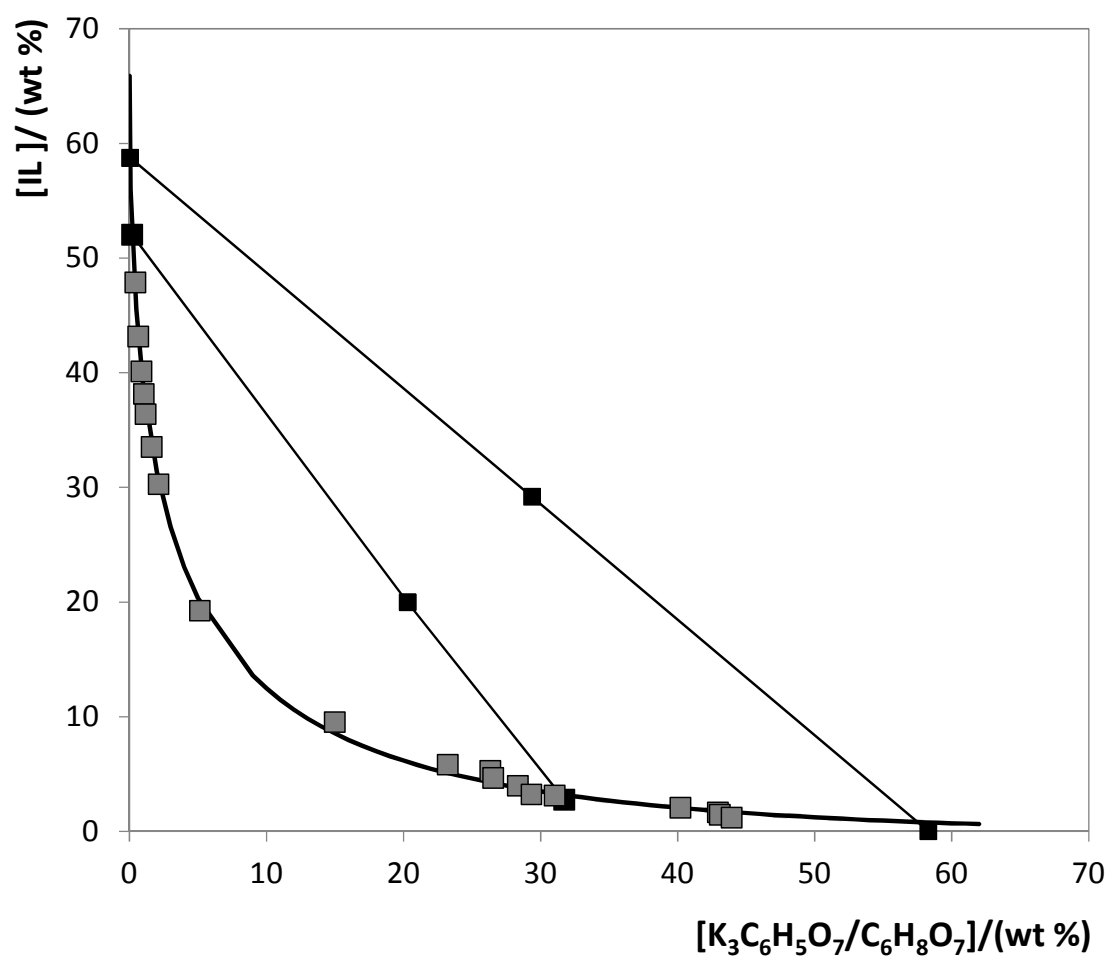
Figure S3 - Phase diagram for the system composed of $[P_{4444}]Br + K_3C_6H_5O_7/C_6H_8O_7 + H_2O$ at 25°C and pH 7.0: binodal curve data (■); TL data (■); adjusted binodal data through Equation 1 (—).
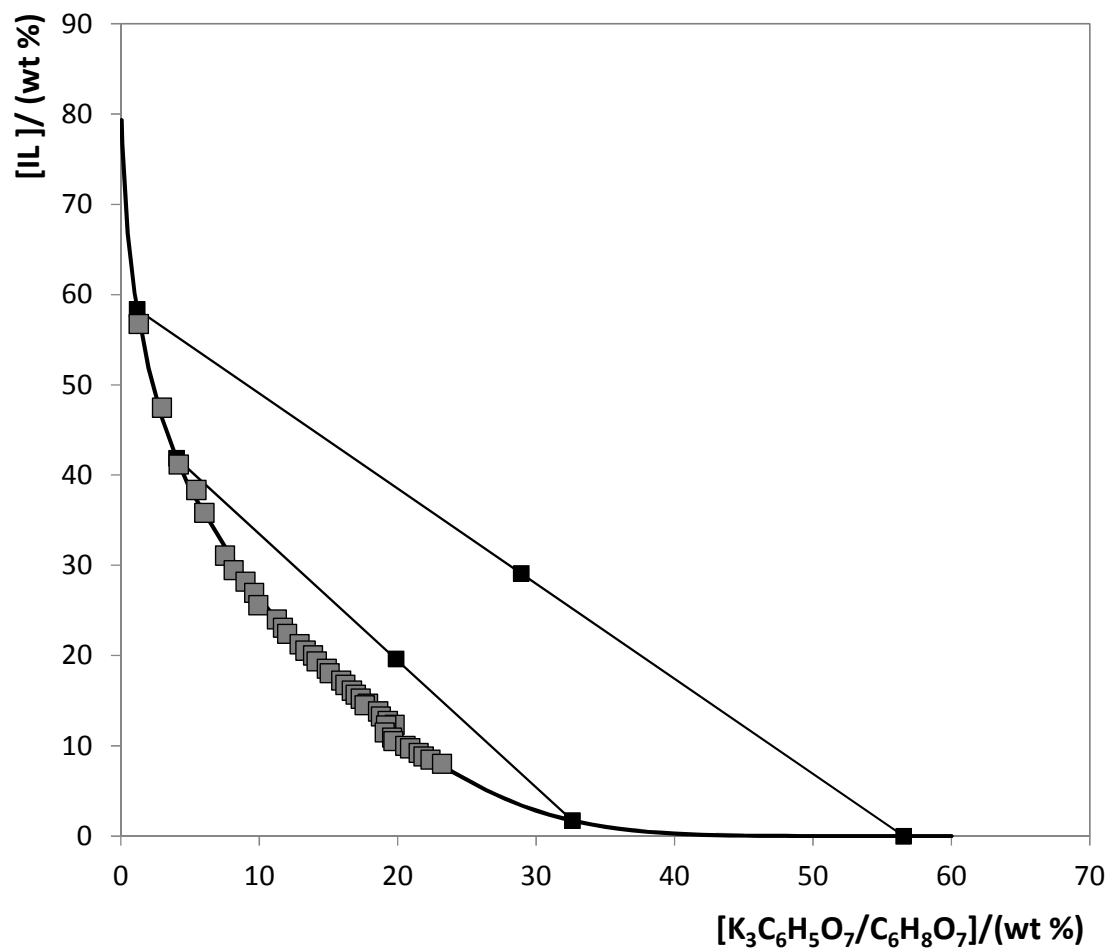
Figure S4 - Phase diagram for the system composed of [P$_{4441}$][MeSO$_4$] + K$_3$C$_6$H$_5$O$_7$/C$_6$H$_8$O$_7$ + H$_2$O at 25°C and pH 7.0: binodal curve data (■); TL data (■); adjusted binodal data through Equation 1 (—).
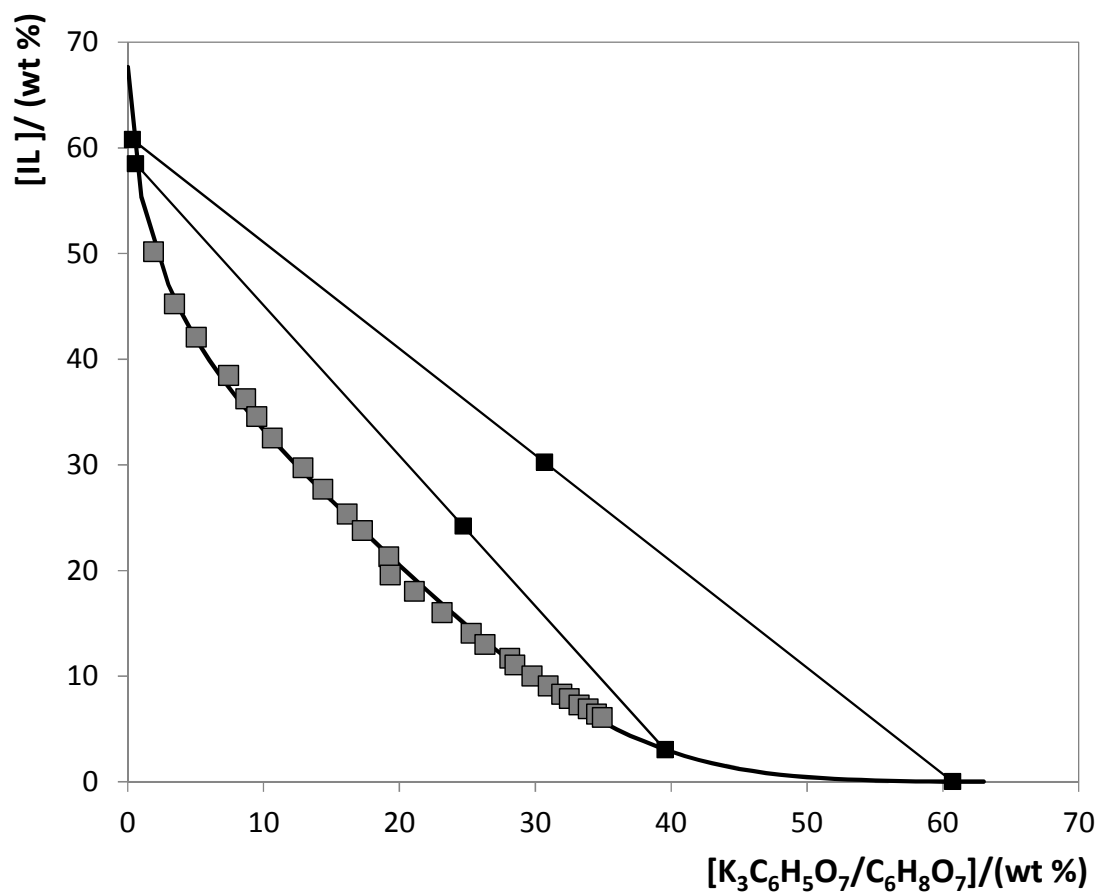
Figure S5 - Phase diagram for the system composed of [N$_{4444}$]Cl + K$_3$C$_6$H$_5$O$_7$/C$_6$H$_8$O$_7$ + H$_2$O at 25°C and pH 7.0: binodal curve data (■); TL data (■); adjusted binodal data through Equation 1 (—).