

Supplementary material for:

Application of biodegradable cholinium ionic liquids for the extraction of 5-hydroxymethylfurfural (HMF) from honey

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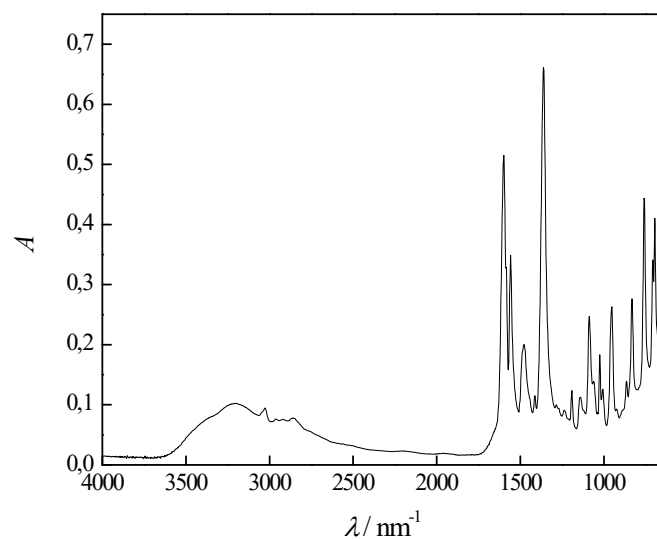
Table S1. Experimental binodal mass fraction data for system {IL (Y) + K₃PO₄ (X) + 20% v/v honey solution} at 296.15 K and at $p = 0.1$ MPa.

[Ch][Cl]		[Ch][Prop]		[Ch][Nic]		[Ch][But]	
100Y	100X	100Y	100X	100Y	100X	100Y	100X
64.41	4.07	59.90	5.86	47.10	12.09	61.90	5.04
41.86	9.31	43.13	7.60	42.71	13.78	39.25	9.90
36.12	13.52	34.65	10.49	38.00	16.28	36.54	11.47
29.49	18.54	26.05	18.19	33.34	19.38	33.35	13.63
22.79	24.73	20.77	23.14	30.86	20.94	31.34	15.04
20.58	26.87	15.68	28.51	27.65	23.19	29.88	16.07
18.47	28.90	12.33	32.25	24.79	25.17	28.03	17.79
15.08	32.69	10.21	34.66	23.21	26.40	26.36	19.11
12.83	35.12	8.50	36.84	21.90	27.14	24.95	20.30
10.73	37.50	7.13	38.71	19.93	28.70	23.65	21.40
7.98	41.42	6.16	40.23	19.13	29.25	21.32	23.42
		5.12	42.08	17.41	30.52	19.27	25.41
		4.28	43.64	15.63	32.00	18.07	26.82
				14.43	32.88	16.96	27.88
				13.16	34.01	16.09	28.56
				12.17	34.88	15.19	29.43
				11.14	35.81	14.44	30.32
				10.35	36.56	13.75	30.99
				9.42	37.47	13.23	31.54
				8.73	38.21	12.62	32.17
						12.03	32.75
						11.64	33.19
						11.26	33.58
						10.91	33.88
						10.44	34.42
						10.07	34.82
						9.75	35.19
						9.41	35.57
						8.97	36.12
						8.38	36.84
						7.79	37.70

Table S2. Corelation parameters of Merchuk equation with standard deviation for the IL + K₃PO₄ + 20% v/v honey solution.

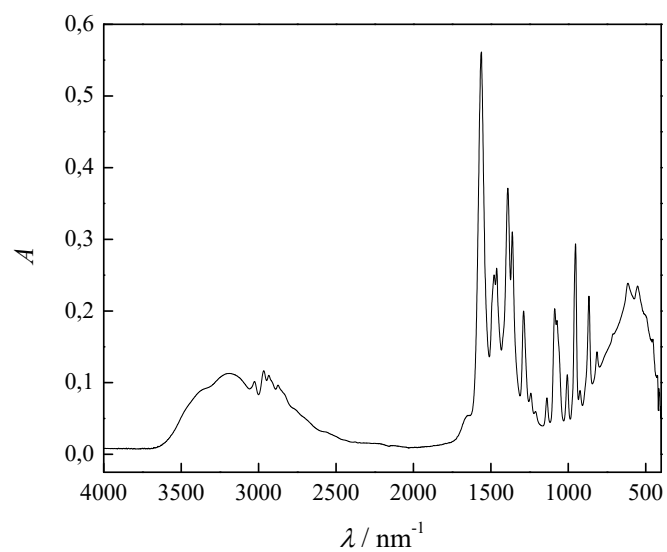
IL	A ± σ	B ± σ	C ± σ	R ²
[Ch][Cl]	121.35 ± 6.64	-0.32 ± 0.019	(7.27 ± 2.01) 10 ⁻⁶	0.994
[Ch][Prop]	151.7 ± 25.56	-0.42 ± 0.058	(6.54 ± 4.72) 10 ⁻⁶	0.978
[Ch][Nic]	111.79 ± 4.09	-0.24 ± 0.01	1.82 10 ⁻⁵ ± 6.21 10 ⁻⁷	0.999
[Ch][But]	83.00 ± 1.36	-0.23 ± 0.0045	1.69 10 ⁻⁵ ± 3.07 10 ⁻⁷	1

Figure S1a–c. IR spectra of the synthesized ionic liquids



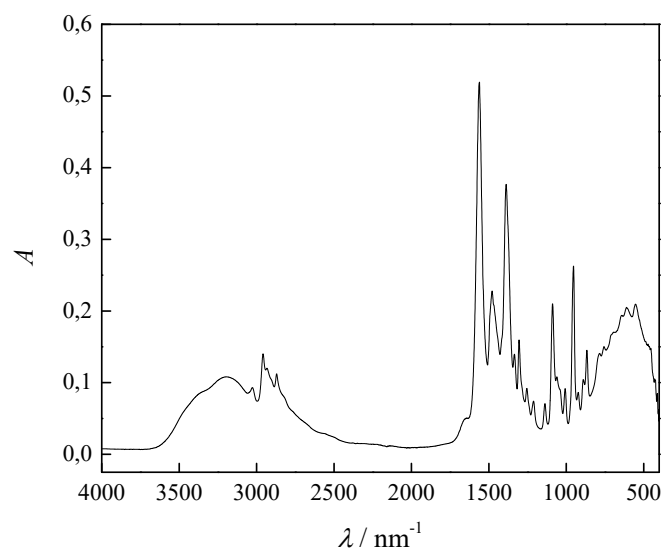
a) IR spectrum [Ch][Nic]

3201 (stretching of the OH group); 1598 (stretching C=C); 1558 (asymmetric stretching of NH); 1478 (CH₃ "zig-zag" vibration); 1361 (symmetric stretching of C=O from COO⁻); 1192 (C-OH stretching); 1088 (stretching C-C-N); 953 (asymmetric C-C-O stretching); 832 (C-C stretching); 759, 708 and 696 (C-H out-of-plane bending).



b) IR spectrum [Ch][Prop]

3190 (stretching of the OH group); 2966 (symmetric stretching of N-CH₃); 1560 (asymmetric stretching of NH); 1462 (CH₃ "zig-zag" vibration); 1390 (symmetric stretch COO⁻); 1361 (symmetric stretching of C=O from COO⁻); 1288 (C-O stretch); 1087 (stretching C-C-N); 953 (asymmetric C-C-O stretching); 866 (C-C stretching); 614 (N-CH₃ stretching).



c) IR spectrum [Ch][But]

3192 (stretching of the OH group); 2958 (symmetric stretching of N-CH₃); 1560 (asymmetric stretching of NH); 1479 (CH₃ "zig-zag" vibration); 1388 (symmetric stretch COO⁻); 1334 (symmetric stretching of C=O from COO⁻); 1305 (C-O stretch); 1088 (stretching C-C-N); 953 (asymmetric C-C-O stretching); 867 (C-C stretching); 553 (N-CH₃ stretching).

Figure S2. Binodal curves of the investigated ABS {IL + K₃PO₄ + H₂O} at 25 °C and standard atmospheric pressure with labeled ABS composition used in the extraction studies.

Legend: ● [Ch][Prop], ● [Ch][But], ● [Ch][Nic] and ● [Ch][Cl]

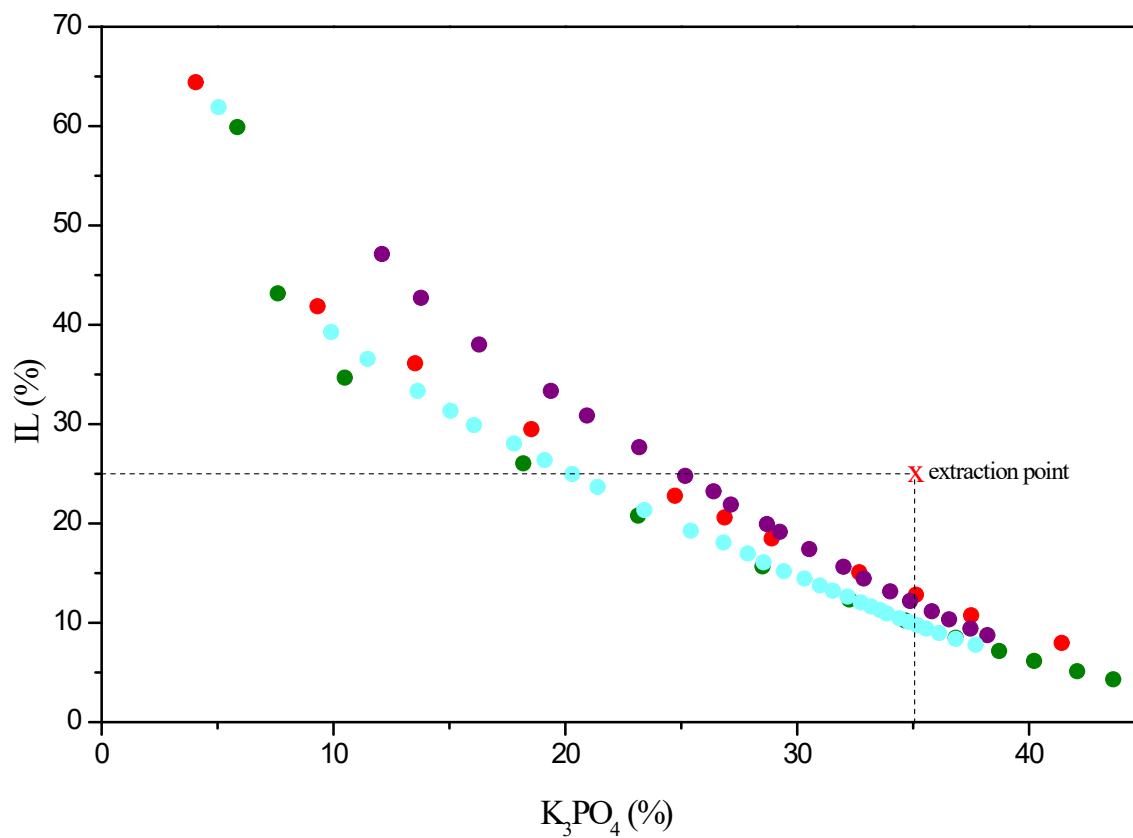


Figure S3. Methodology flowchart

