SUPPORTING INFORMATION FOR

On-line separation/analysis Rhodamine B dye based on solid-phase

extraction high performance liquid chromatography self-designed device

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Results and discussion

The characterization of poly-1-vinyl-3-pentylimidazole hexafluorophosphate(PILs-C$_5$)

PILs-C$_5$ was characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffractometer (XRD), and thermogravimetric analyzer (TGA).

Fourier transform infrared spectroscopy analysis of PILs-C$_5$

FT-IR spectra were used to compare PILs-C$_5$ and 1-vinyl-3-pentylimidazole hexafluorophosphate(ILs-C$_5$), as shown in Fig. S1.

The absorption peaks near 1660 cm^{-1} and 852 cm^{-1} of curve b are due to the

stretching vibration peak and out-of-plane vibration peak of C=C of ILs-C$_5$, respectively. Both of these peaks disappear in curve a, which proved the formation of PILs-C$_5$.

<Fig. S1>

Thermogravimetric analysis of PILs-C$_5$

The thermal stability of PILs-C$_5$ was analyzed by TG, as shown in Fig. S2. In a nitrogen atmosphere, significant weight loss was observed for PILs-C$_5$ when it was heated to 226°C, and the DTG peak appeared at 354°C, indicating good thermal stability.

<Fig. S2>

X-ray diffraction analysis of PILs-C$_5$

Fig. S3 shows the XRD spectrum of PILs-C$_5$. It can be seen from the spectrum that the scattering peak of PILs-C$_5$ appears at 19.86°, for small angle scattering. The XRD spectrum indicates that PILs-C$_5$ is amorphous.

<Fig. S3>

Optimization of elution conditions

Optimization of elution parameters by orthogonal experiment design(OED)

In this study, the factors of extraction parameters, such as eluent concentration, volume of eluent, and rotation of the pump were optimized by OED, and the

results are shown in Table S1.

< Table S1 >

From Table S1, the order of factors affecting the elution ratio is as follows: volume of eluent > concentration of eluent > pump speed. The optimal experimental scheme obtained by OED was eluent concentration of 35%, volume of ethanol of 2.0 mL, and flow through the extraction column at a pump speed of 40 r/min.
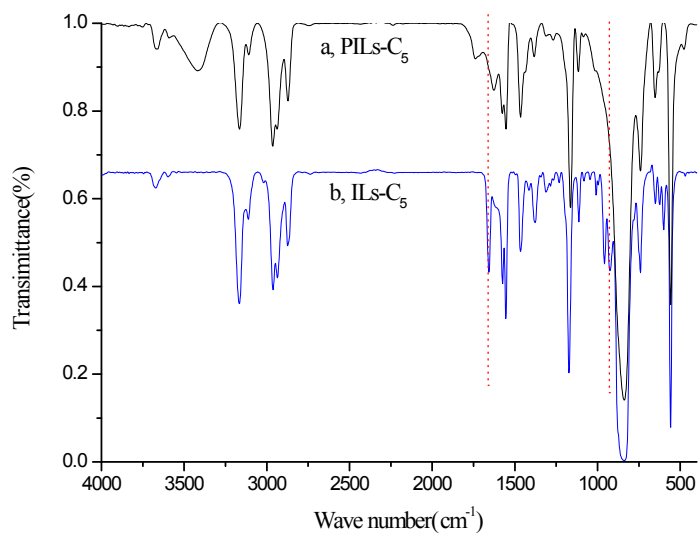
Fig. S1

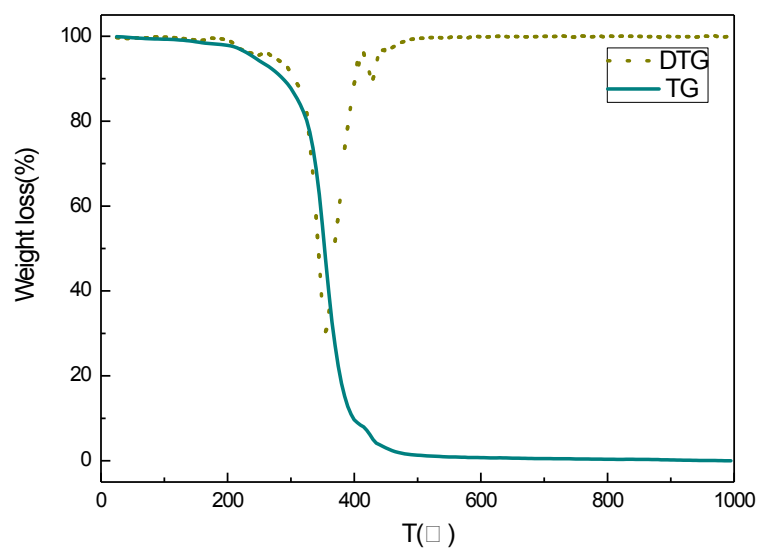Fig. S1 FT-IR spectra of PILs-C_5 (a) and ILs-C_5 (b).
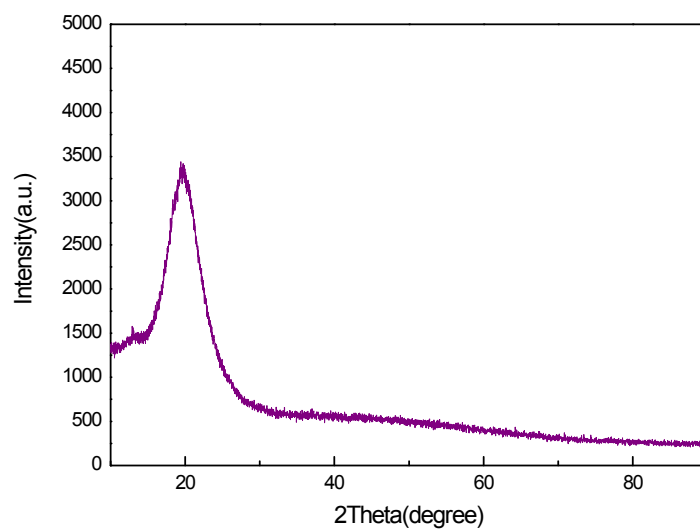
Fig.S2

Fig. S2 TG graph of PILs-C$_5$.

Fig.S3

Fig. S3 XRD analysis of PILs-C$_5$.

Table S1. Optimization of elution parameters by OED.

Level	Concentration of eluent (%)	Volume of eluent (mL)	Pump speed (r/min)	Empty column	Empty column	Elution ratio (%)
1	20	0.5	20	1	1	50.1
2	20	1	30	2	2	76.3
3	20	1.5	40	3	3	88.1
4	20	2	50	4	4	90.2
5	25	0.5	30	3	4	64.7
6	25	1	20	4	3	80.4
7	25	1.5	50	1	2	91.6
8	25	2	40	2	1	93.8
9	30	0.5	40	4	2	79.9
10	30	1	50	3	1	85.4
11	30	1.5	20	2	4	94.7
12	30	2	30	1	3	98.6
13	35	0.5	50	2	3	83.4
14	35	1	40	1	4	90.2
15	35	1.5	30	4	1	97.5
16	35	2	20	3	2	99.0
K1	76.175	69.525	81.05	82.625	81.7	-
K2	82.625	83.075	84.275	87.05	86.7	-
K3	89.65	92.975	88	84.3	87.625	-
K4	92.525	95.4	87.65	87	84.95	-
Range	16.35	25.875	6.95	4.425	5.925	-