Supplementary Information

A magnetic polymer adsorbent based on porous polystyrene microspheres for efficient extraction of conotoxins in biological fluids

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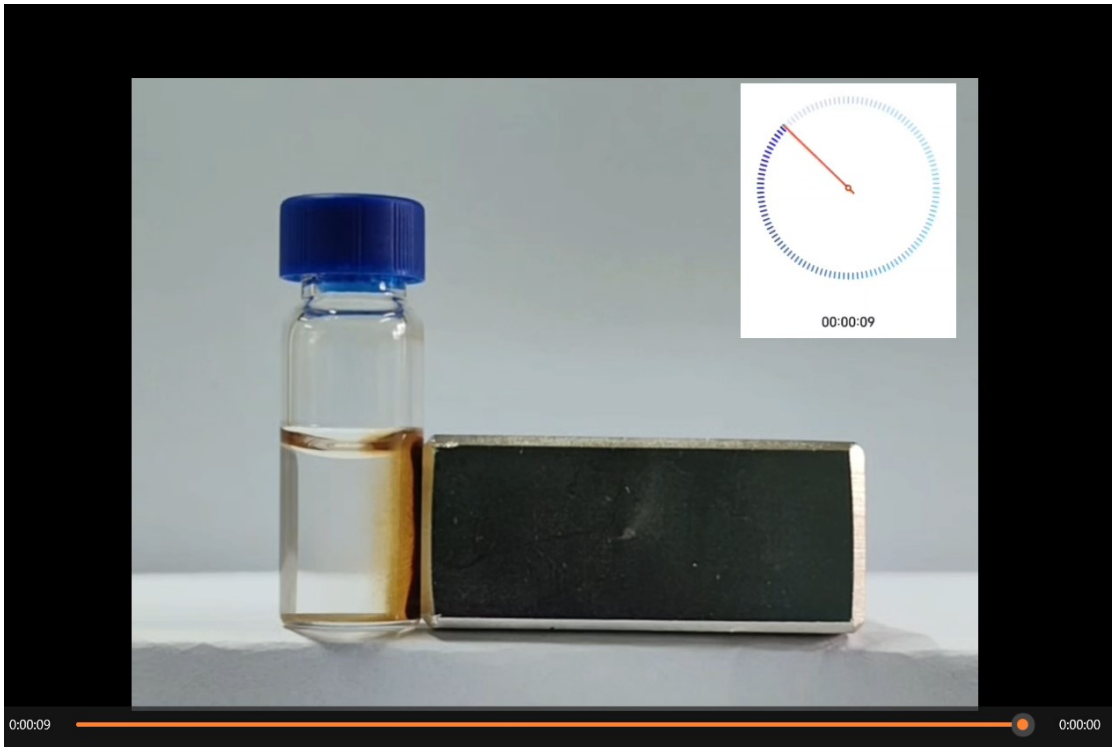
No. of video: 1
No. of table: 3



Magnetic Response Time.mp4

Fig.S1. The magnetic responsiveness demonstration videos of PS@MNs@DVP. (From the video of S1, it was seen that in the presence of an applied magnetic field, PS@MNs@DVP was separated from within the solution for 10s.)

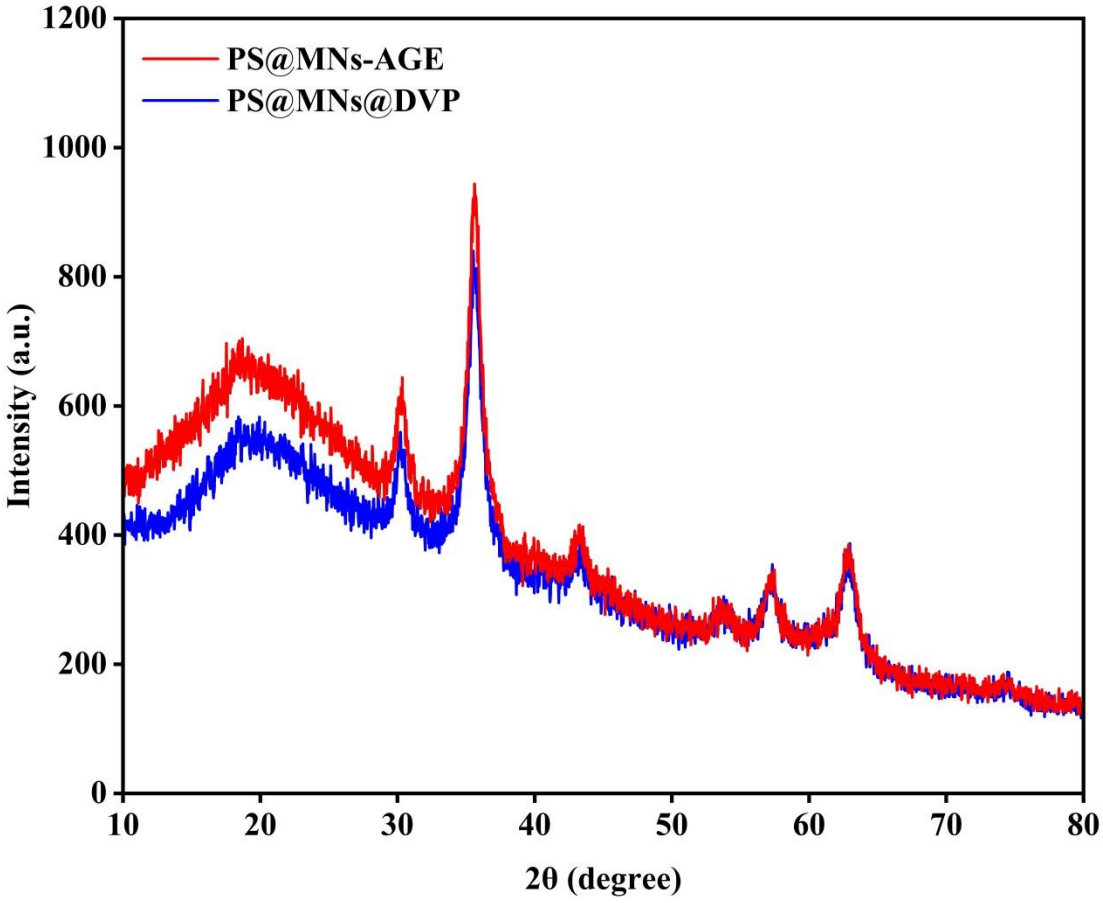


Fig. S2. The XRD image of PS@MNs-AGE and PS@MNs@DVP

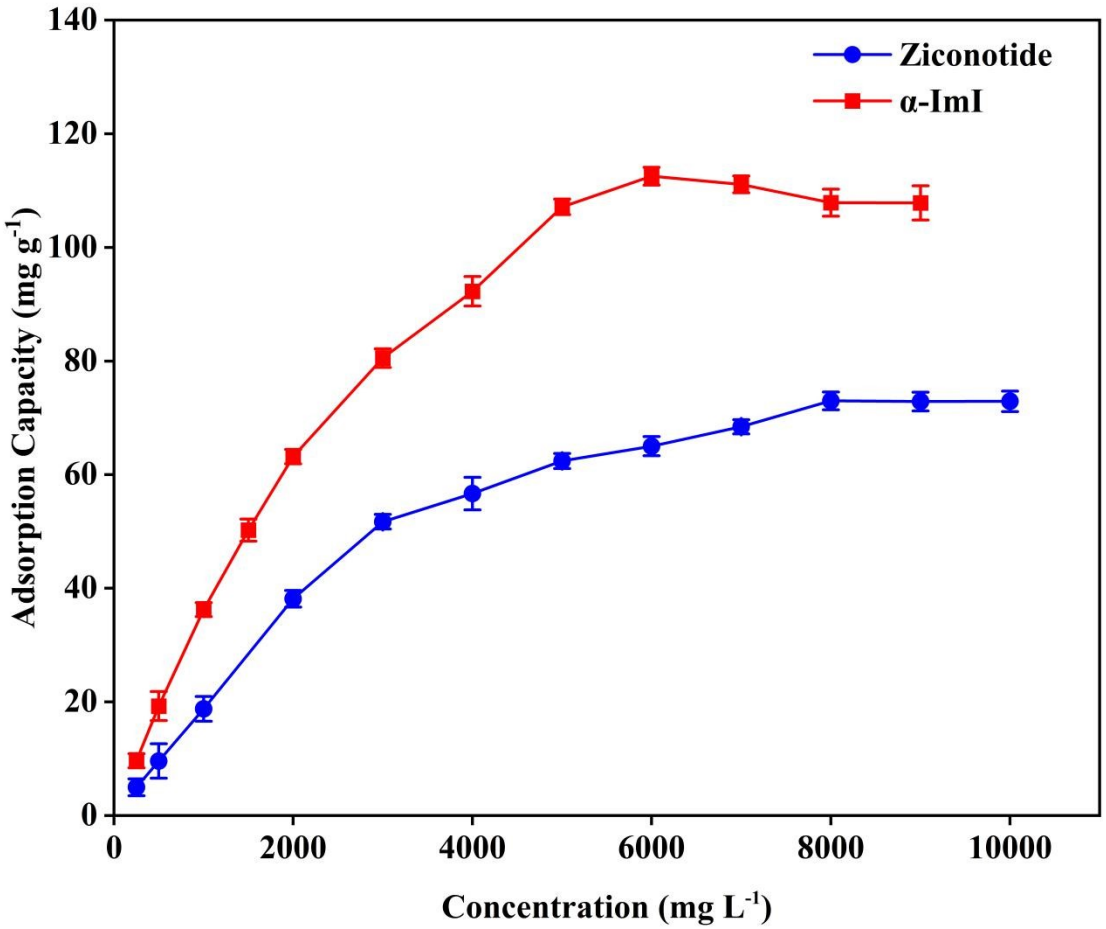


Fig. S3. Adsorption capacity of PS@MNs@DVP for ziconotide and α-ImI.

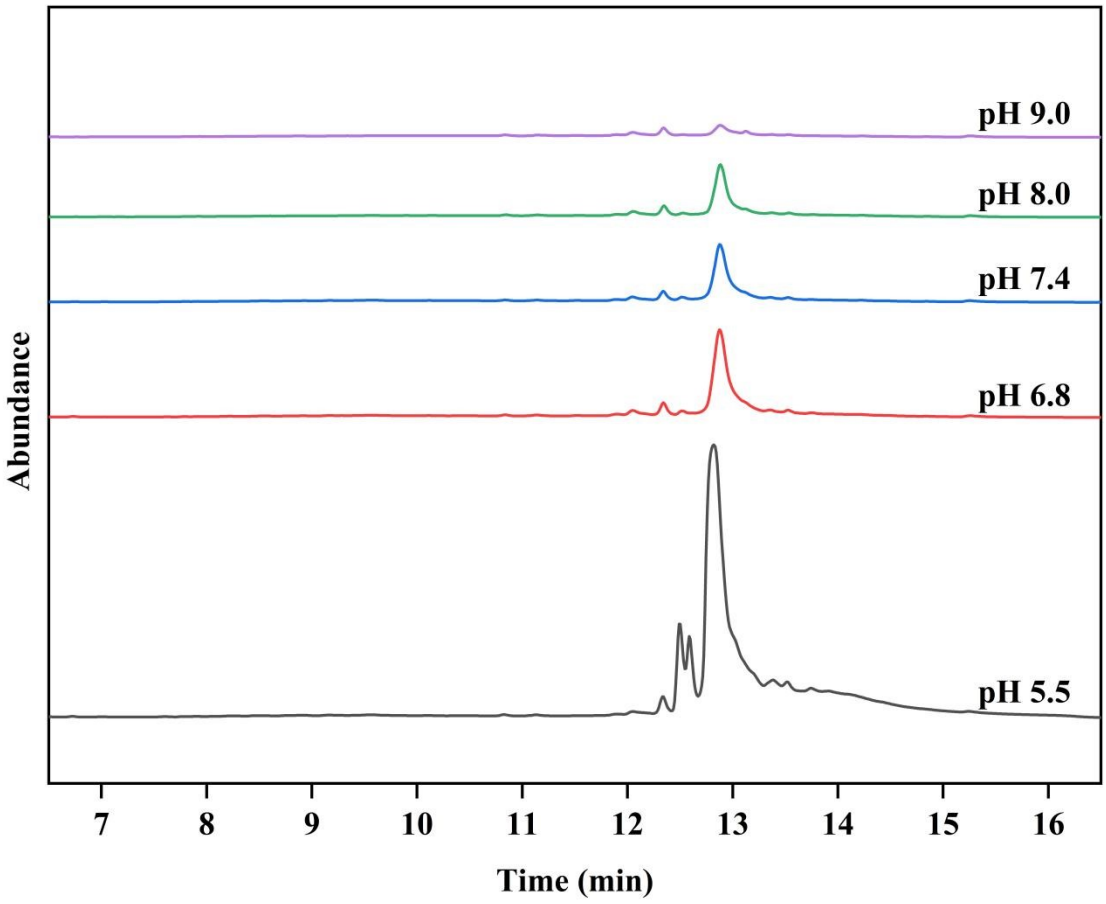


Fig. S4. Influences of pH for the MSPE in the plasma.

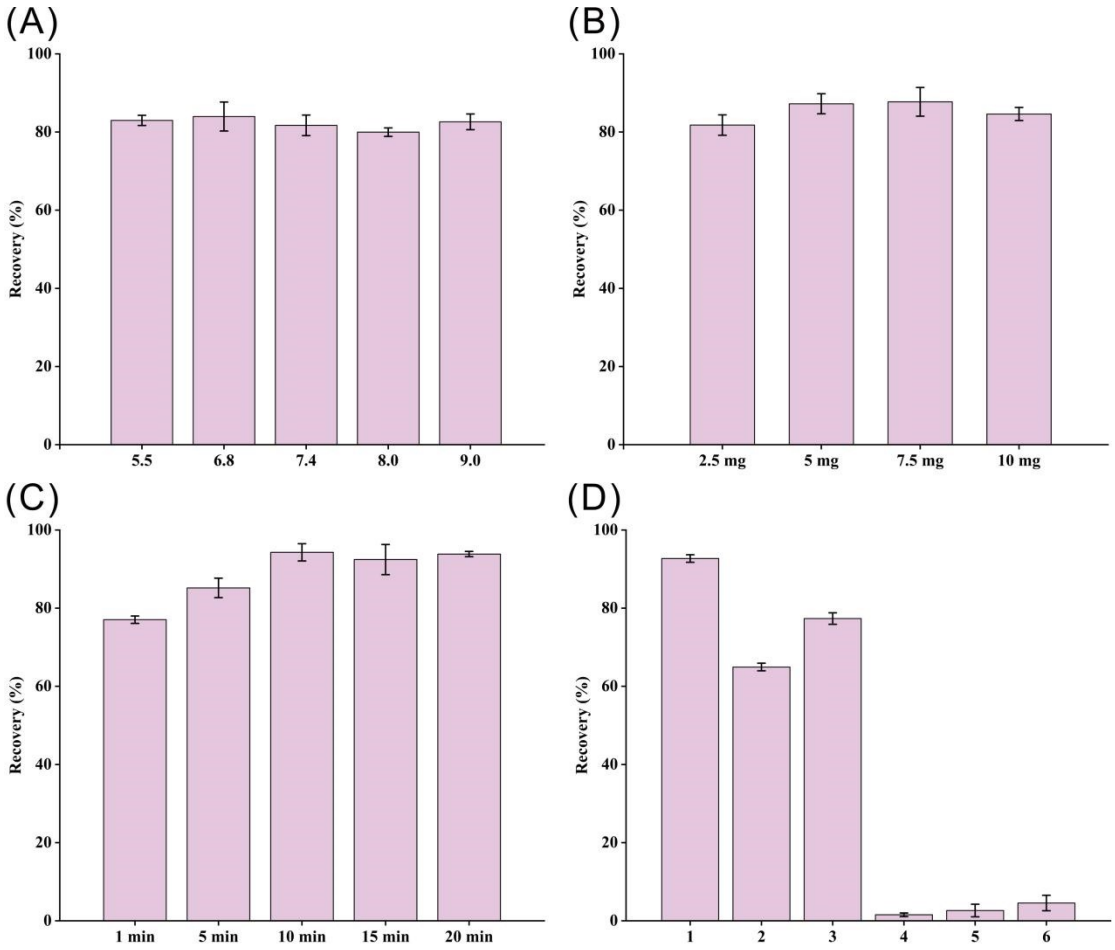


Fig. S5. Optimization of MSPE process. (A) Effect of sample pH value on recovery. (B) Effect of amount of PS@MNs@DVP on recovery. (C) Effect of extraction time on recovery. (D) Effect of elution solvents on recovery: 1, acetonitrile-water (1:1, v/v) containing 1 % TFA; 2, acetonitrile-water (1:3, v/v) containing 1 % TFA; 3, acetonitrile-water (3:1, v/v) containing 1 % TFA; 4, acetonitrile-water (1:1, v/v) containing 1 % ammonia; 5, acetonitrile-water (1:3, v/v) containing 1 % ammonia; 6, acetonitrile-water (3:1, v/v) containing 1 % ammonia.

Table S1. The elution program in UPLC analysis.

Time（min）	Mobile phase A[a]（%）	Mobile phase B[b]（%）
0.50	100.0	0.0
3.00	93.0	7.0
10.00	53.0	47.0
13.00	0.0	100.0
15.00	0.0	100.0
16.00	100.0	0.0
23.00	100.0	0.0

[a] Water (containing 0.1 % trifluoroacetic acid).

[b] Acetonitrile (containing 0.1 % trifluoroacetic acid).

Table S2. Amino Acid Sequences, Theoretical Isoelectric Points, and Molecular Weights of Representative Peptides .

Peptide	Sequence	Theoretical pI*	MW (g mol^{-1})*	Sequence Source
a-Conotoxin IMI (α-ImI)	GCCSDPRCAWRC	12.10	1351.57	PubChem CID 76324742
Ziconotide	CKGKGAKCSRLMYDCCTGSCRSGKC	11.61	2639.15	PubChem CID 16135415
μ-Conotoxin (μ-CnIIIC)	Pyr-GCCNGPKGCSSKWCRDHARCC	12.16	2375.71	PubChem CID 175675721
Exenatide	HGEGTFTSDLSKQMEEEAVRLFIEWLKNGGPSSGAPPPS	4.77	4186.57	PubChem CID 45588096
Acetyl octapeptide-3 (AO-3)	Ac-EEMQRRAD	4.32	1075.16	PubChem CID 76283482

* The theoretical isoelectric point (pI) and molecular weight (MW) were calculated using the following tool: Peptide property calculator (https://pepcalc.com/). They were calculated based on their reported amino acid sequences on PubChem.

Table S3. Evaluation of iron leakage from PS@MNs@DVP

Analytes	The concentration of the analytes (mg mL^{-1}) (n = 3)	
	Incubation under alkaline buffer	Incubation in acid elution solvent
Fe^{2+}	ND	ND

ND: Not detected.

The 1,10-phenanthroline spectrophotometric method

Briefly, the magnetic composite was separately incubated in alkaline buffer solution and acidic elution solution under the same experimental conditions employed during the adsorption and desorption procedures. After incubation, the magnetic materials were rapidly separated using an external magnet, and the supernatants were collected for subsequent analysis. Prior to measurement, the solutions were mildly acidified to dissociate possible iron coordination complexes, followed by reduction with hydroxylamine hydrochloride to convert Fe^{3+} into Fe^{2+}. Subsequently, 1,10-phenanthroline reagent was added to form the characteristic tris(1,10-phenanthroline)iron (II) complex, and the absorbance was measured at 510 nm after color development.