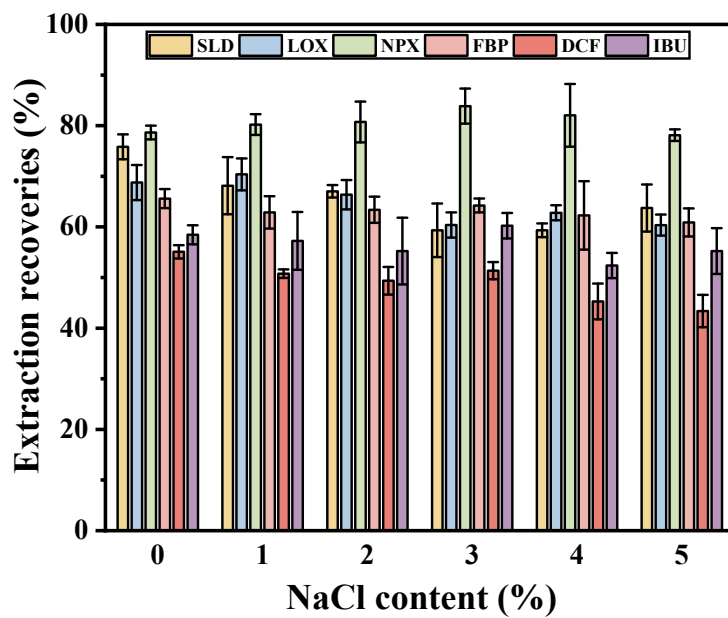
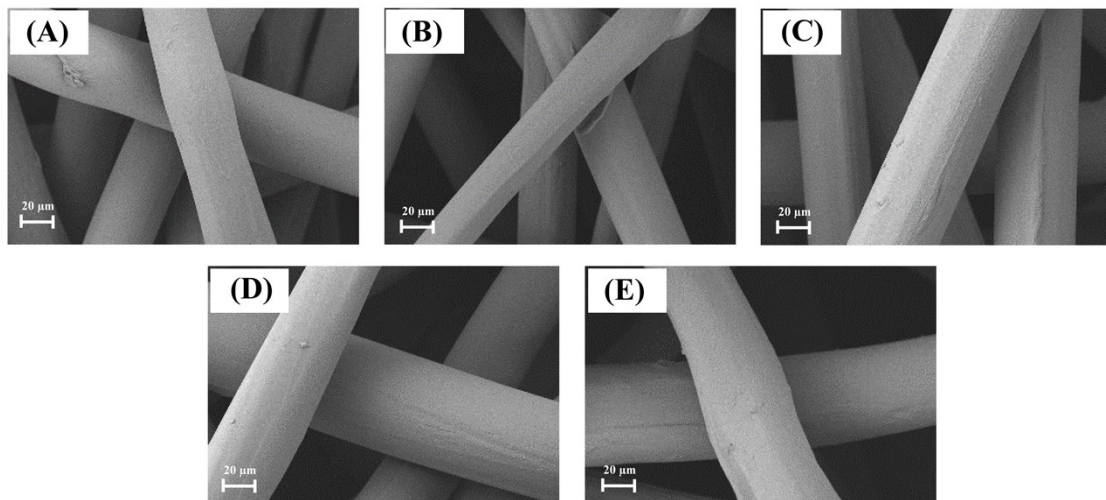


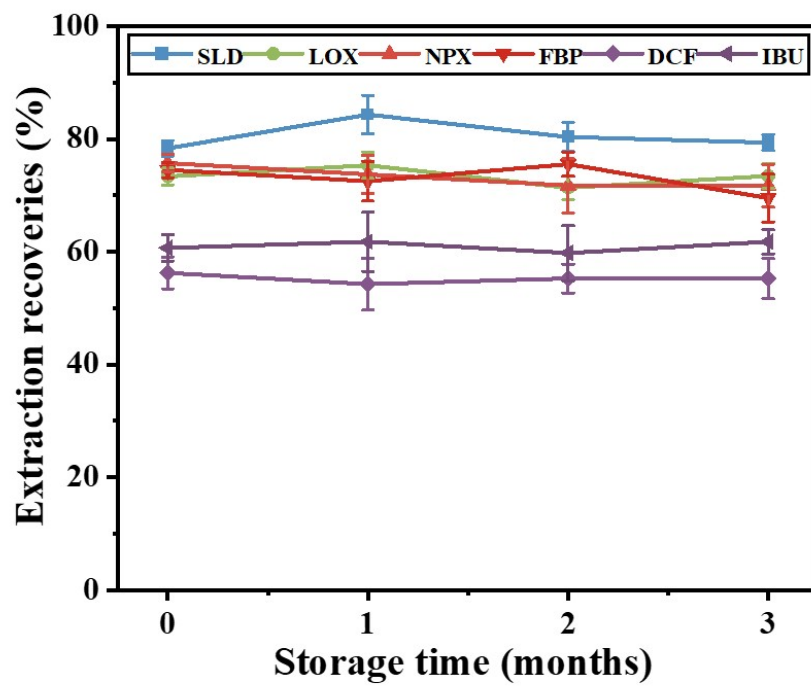
**Fig. S1.** Effect of NaCl concentration (0–5%, w/v) on the extraction recoveries of the six NSAIDs.



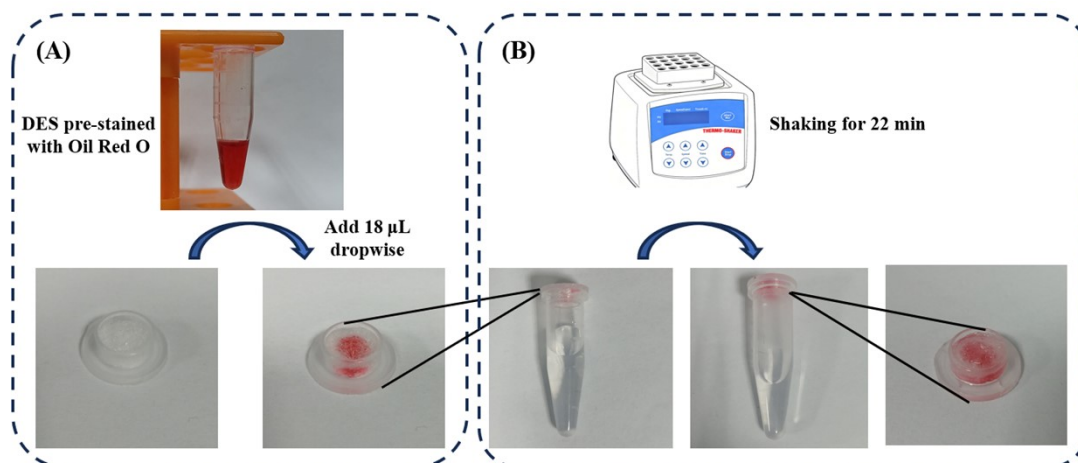
**Fig. S2.** SEM images of polypropylene fabrics with varying nominal pore sizes (500×):  
(A) 25  $\mu\text{m}$ , (B) 50  $\mu\text{m}$ , (C) 100  $\mu\text{m}$ , (D) 150  $\mu\text{m}$ , and (E) 300  $\mu\text{m}$ .



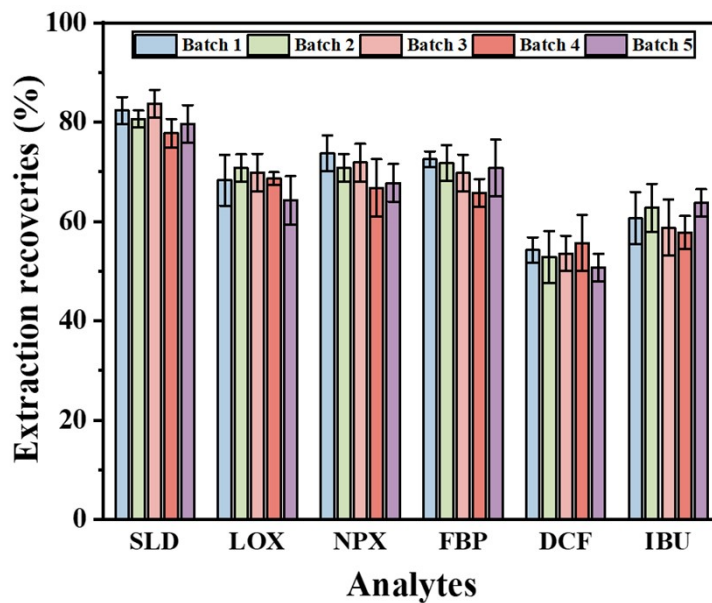
**Fig. S3.** Stability of the DES-PPF-CME device evaluated by the extraction recoveries of six NSAIDs after storage for up to 3 months.



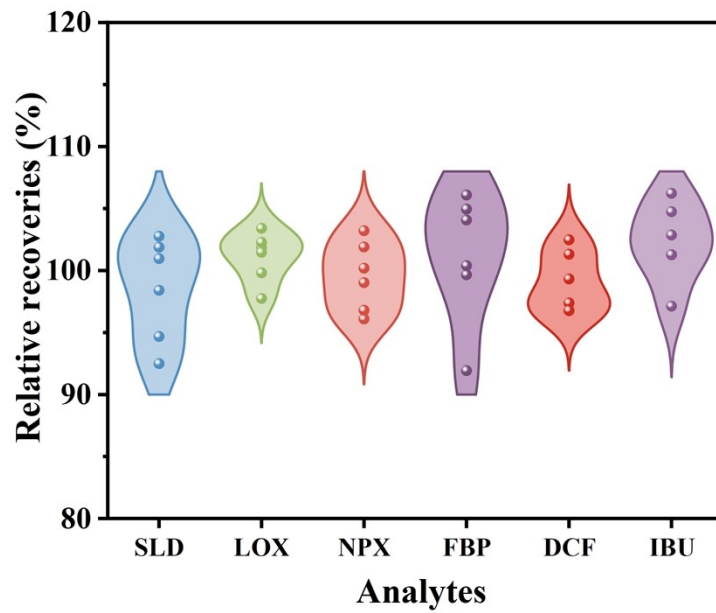
**Fig. S4.** Visualization of DES stability on the polypropylene fabric (PPF) cap before and after extraction: (A) before extraction, and (B) after extraction. The DES was pre-stained with Oil Red O to visualize whether it detached from the polypropylene fabric during the shaking process.



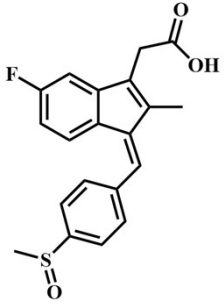
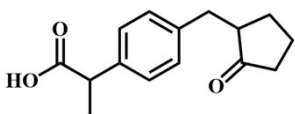
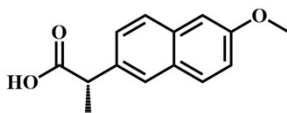
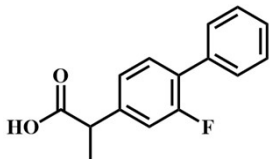
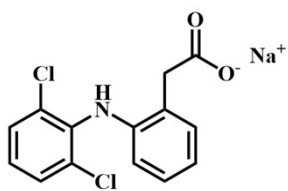
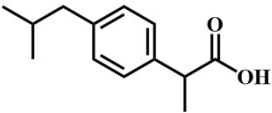
**Fig. S5.** Evaluation of batch-to-batch reproducibility of the DES-PPF-CME device using five independently fabricated batches.



**Fig. S6.** The relative recoveries for all analytes across the six individual sources. (500 ng/mL)



**Table S1.** Chemical information of target analytes.

Name	Abbreviation	Structure	CAS number
Sulindac	SLD		38194-50-2
Loxoprofen	LOX		68767-14-6
Naproxen	NPX		22204-53-1
Flurbiprofen	FBP		5104-49-4
Diclofenac sodium	DCF		15307-79-6
Ibuprofen	IBU		15687-27-1

Reference data source: <https://www.chemicalbook.com/>

**Table S2.** Independent variables and their levels used in the BBD.

Factor	Level		
	Low level	Medium level	High level
DES volume ( $\mu\text{L}$ )	10	20	30
Sample solution pH	3.5	5.5	7.5
Extraction time (min)	10	20	30

**Table S3.** BBD matrix and observed response values for the RSM optimization of NSAIDs extraction.

Number	DES volume ( $\mu\text{L}$ )	Sample solution pH	Extraction time (min)	Extraction recovery (%)
1	20	5.5	20	72.4
2	20	3.5	30	64.0
3	20	7.5	10	47.7
4	30	3.5	20	62.8
5	10	5.5	10	48.5
6	20	7.5	30	58.0
7	20	5.5	20	72.4
8	10	7.5	20	42.1
9	10	5.5	30	61.4
10	20	5.5	20	73.0
11	20	3.5	10	55.6
12	20	5.5	20	72.8
13	30	7.5	20	58.4
14	20	5.5	20	73.0
15	10	3.5	20	57.1
16	30	5.5	10	59.0
17	30	5.5	30	74.0

**Table S4.** Analysis of variance (ANOVA) for the quadratic response surface model.

Source	Sum of squares	DF	Mean square	F Value	P Value	
Model	1604.06	9	178.23	87.63	<0.0001	significant
A- DES volume ( $\mu\text{L}$ )	255.38	1	255.38	125.56	<0.0001	
B- Sample solution pH	132.85	1	132.85	65.31	<0.0001	
C- Extraction time (min)	278.48	1	278.48	136.91	<0.0001	
AB	27.56	1	27.56	13.55	0.0078	
AC	1.10	1	1.10	0.54	0.4855	
BC	0.42	1	0.42	0.21	0.6624	
A <sup>2</sup>	180.50	1	180.50	88.74	<0.0001	
B <sup>2</sup>	518.55	1	518.55	254.94	<0.0001	
C <sup>2</sup>	124.95	1	124.95	61.43	0.0001	
Residual	14.24	7	2.03			
Lack of fit	13.87	3	4.62	50.25	0.0012	significant
Pure error	0.37	4	0.09			
Cor total	1618.30	16				

**Table S5.** Intra-day and inter-day relative recoveries and RSDs of the validated method at three different concentration spiking levels.




Analyte	Added (ng/mL)	Intra-day (n=3)		Inter-day (n=3)	
		Recovery (%)	RSDs (%)	Recovery (%)	RSDs (%)
SLD	100	101.5	1.8	87.3	6.5
	300	101.9	5.0	102.1	7.2
	500	107.3	0.9	96.2	6.6
LOX	100	99.1	7.1	93.6	8.6
	300	104.0	1.9	97.9	6.9
	500	101.0	2.9	92.6	7.5
NPX	20	103.8	2.8	108.4	1.6
	100	102.8	2.0	102.1	2.5
	500	99.6	0.4	92.5	6.9
FBP	50	91.0	5.5	88.6	6.3
	200	104.0	2.8	90.5	5.5
	500	99.6	1.1	94.4	5.2
DCF	100	109.8	2.6	95.8	8.1
	300	102.8	2.6	104.4	1.4
	500	103.3	1.6	98.7	6.1
IBU	100	108.1	5.0	97.8	8.2
	300	106.7	4.5	104.4	7.3
	500	105.7	4.8	94.1	8.0




**Table S6.** Spike recoveries and precision (RSDs) of NSAIDs in plasma samples obtained by spiking known amounts of analytes into blank plasma.

Analyte	Added (ng/mL)	Spike recovery (%)	RSDs (%)
	0	0.0	0.0
SLD	200	103.0	2.3
	500	100.6	2.2
	0	0.0	0.0
LOX	200	96.1	5.2
	500	95.2	1.1
	0	0.0	0.0
NPX	100	88.8	4.3
	500	97.6	4.2
	0	0.0	0.0
FBP	200	105.8	3.1
	500	99.6	2.3
	0	0.0	0.0
DCF	200	101.1	1.7
	500	103.2	3.8
	0	0.0	0.0
IBU	200	95.9	2.2
	500	92.5	4.4

Spike recovery (%) was calculated as (measured concentration / spiked concentration) × 100%.

**Table S7.** Comparison of the proposed method with representative previously reported methods for the determination of NSAIDs (a: Loxoprofen; b: Naproxen; c: Flurbiprofen; d: Diclofenac sodium; e: Ibuprofen; f: Sulindac).

Sample matrix	Extraction sorbent/solvent	Extraction technique	Extraction time (min)	Extraction operation/ready-to-use	Detection technique	Relative recovery (%)	LODs (ng/mL)	Greenness assessment (AGREE)	Reference
Wastewater, plasma	1,2-Dichloroethane	AALLME	68	Air-agitation, vortex and centrifugation	HPLC-DAD	93.0–106.0%	0.3–0.9 <sup>e</sup>		[1]
Simulated aqueous samples	Nitrogen-doped graphene quantum dots	SPE	60.0	Vortex and centrifugation/No	UPLC-UV	95.0–98.7%	15.7–23.6 <sup>d, e</sup>		[2]
Urine, plasma	NADES (Fatty acids, etc), hollow fiber	NADES- HF-LPME-EME	20.0	Stirring/No	HPLC-UV	88.3–104.4%	8 <sup>e</sup>		[3]

Environmental water and milk	DES ([TMGH]Cl, thymol)	UA-DLLME	25.0	Vortex and centrifugation/No	HPLC-UV	79.4–107.5%	0.5–1.0 <sup>e</sup>		[4]
Urine	Copper nanoparticles coated polyester fabric	PF-SPE	>20	Vortex/Yes	HPLC-UV	94.0–110.0%	0.3–1.0 <sup>d, e</sup>		[5]
Plasma	DES (MTOAB, decanoic acid), Polypropylene fabrics	DES-PPF-CME	22	Vortex/Yes	HPLC-UV	87.3–108.4%	1.1–19.7 <sup>a, b, c, d, e, f</sup>		This work

AALLME: air-agitated liquid-liquid microextraction; MF-LPME: Microfluidic-based liquid-phase microextraction; SPE: Solid-phase extraction; NADES-HF-LPME-EME: Natural deep eutectic solvent-based hollow fiber electro-membrane extraction; UA-DLLME: Ultrasound-assisted dispersive liquid-liquid microextraction; PF-SPE: Polyester fabric-based solid-phase extraction.

## References

- [1] M. Bazregar, M. Rajabi, Y. Yamini, A. Asghari, M. Hemmati, Tandem air-agitated liquid-liquid microextraction as an efficient method for determination of acidic drugs in complicated matrices, *Anal. Chim. Acta* 917 (2016) 44-52. <https://doi.org/10.1016/j.aca.2016.03.005>
- [2] A. Alhendal, Silane modified nitrogen-doped graphene quantum dots as a high-efficiency hybrid sorbent for NSAIDs, *RSC Adv.* 15(12) (2025) 9364-9374. <https://doi.org/10.1039/d5ra00253b>
- [3] M. Beiranvand, Y. Yamini, M.M. Khataei, Eco-friendly and efficient electro-membrane extraction coupled with HPLC for simultaneous determination of nonsteroidal anti-inflammatory drugs in biological samples, *Anal. Chim. Acta* 1376 (2025) 344639. <https://doi.org/10.1016/j.aca.2025.344639>
- [4] L. Qiao, R. Sun, C. Yu, Y. Tao, Y. Yan, Novel hydrophobic deep eutectic solvents for ultrasound-assisted dispersive liquid-liquid microextraction of trace non-steroidal anti-inflammatory drugs in water and milk samples, *Microchemical J.* 170 (2021) 106686. <https://doi.org/10.1016/j.microc.2021.106686>
- [5] N. Moradi, G. Soufi, A. Kabir, M. Karimi, H. Bagheri, Polyester fabric-based nano copper-polyhedral oligomeric silsesquioxanes sorbent for thin film extraction of non-steroidal anti-inflammatory drugs, *Anal. Chim. Acta* 1270 (2023) 341461. <https://doi.org/10.1016/j.aca.2023.341461>