Electronic Supplementary Material (ESI) for Analyst.

Supplementary Information

Dual-mode Ion-Selective Electrodes and Distance-based Microfluidic Device for Detection of Multiple Urinary Electrolytes

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Table S1. Estimated cost breakdown of reagents and materials for each device.

	Materials	Estimated cost/device ($)
dPAD	Whatman® qualitative filter paper	0.0075
	Solid wax ink	0.0050
	Double-side adhesive	0.203
	$AgNO_3$	0.0010
	$K_2Cr_2O_7$	0.000054
	Subtotal	**0.22**
Electrode	Graphite powder	0.0014
	Carbon ink	0.015
	Ag|AgCl ink	0.009
	Carbon black	0.00000025
	Subtotal	**0.025**
ISM components	Valinomycin	0.032
	KTClPB	0.0012
	NaTFPB	0.0024
	DOS	0.048
	High molecular weight PVC	0.000047
	P(BMA-co-MM)	0.000412
	KCl	0.0000544
	ETH500	0.00464
	THF	0.000772
	Subtotal	**0.089**
Total	**$ 0.33**	

Table S2 The effect of carbon black modification on potentiometric response of the ISEs (n=4)

target ion	slope (mV/decade)	
	with carbon black	without carbon black
K^+	54.16 ± 3.94	44.54 ± 3.49
Na^+	55.82 ± 1.15	38.03 ± 6.78

Table S3 Potentiometric response of K^+-ISE and Na^+-ISE obtained in absence and in presence of conditioning step (n=4)

target ion	slope (mV/decade)	
	non conditioned	overnight conditioned
K^+	54.16 ± 3.94	43.81 ± 2.22
Na^+	55.82 ± 1.15	38.42 ± 5.14

Table S4 Potentiometric response parameters of K^+-ISE and Na^+-ISE (n=10)

target ion	slope (mV/decade)	RSD %	intercept (mV)	RSD %
K^+	52.85±2.65	5.0	386.38±7.91	2.0
Na^+	52.10±1.41	2.7	333.77±9.78	2.9

Table S5 Shelf life of dual-ISE-dPAD (n=4)

weeks	slope (mV/decade)		%Recovery
	K^+	Na^+	Cl^-
0	54.14 ± 3.94	55.08 ± 1.15	94 ± 5
1	53.50 ± 1.63	53.98 ± 3.41	92 ± 5
2	52.70 ± 1.20	52.62 ± 0.41	102 ± 6
3	51.10 ± 0.28	51.63 ± 2.06	92 ± 5
4	50.70 ± 0.42	51.09 ± 2.18	90 ± 9
5	50.18 ± 1.22	51.53 ± 0.21	94 ± 5
6	50.40 ± 0.85	50.53 ± 0.71	99 ± 5
7	51.40 ± 1.84	50.34 ± 1.51	97 ± 8
8	50.04 ± 0.85	51.65 ± 1.38	94 ± 5
Average	51.57 ± 1.51	52.05 ± 1.58	95 ± 4

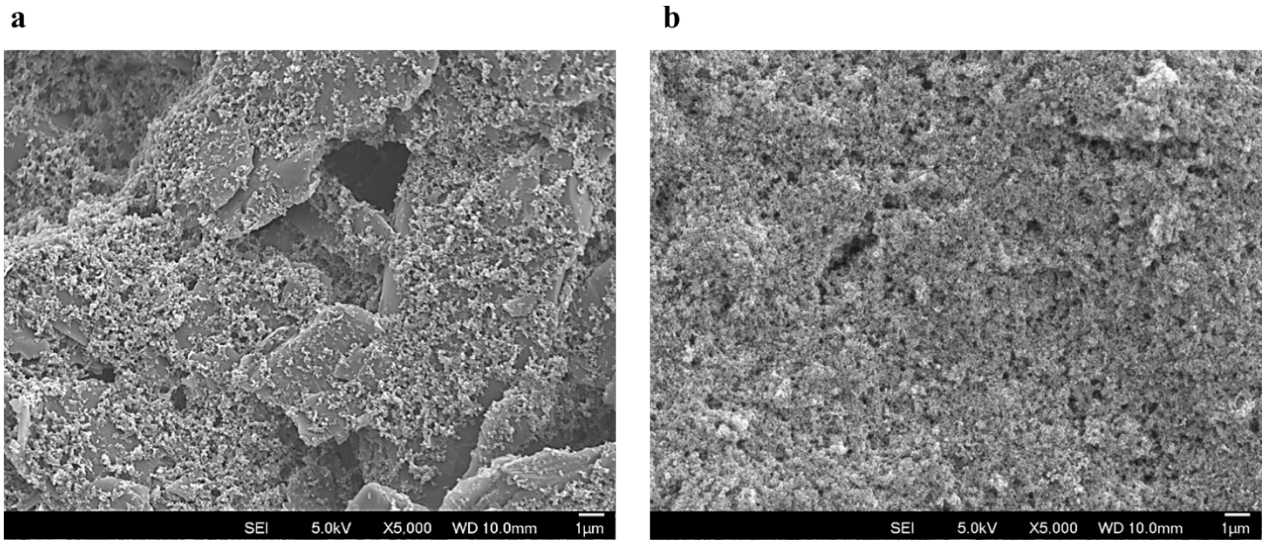

Figure S1 SEM images of (a) unmodified, (b) carbon black (5 mg/mL in THF) modified screen-printed electrodes (x5000 magnified).

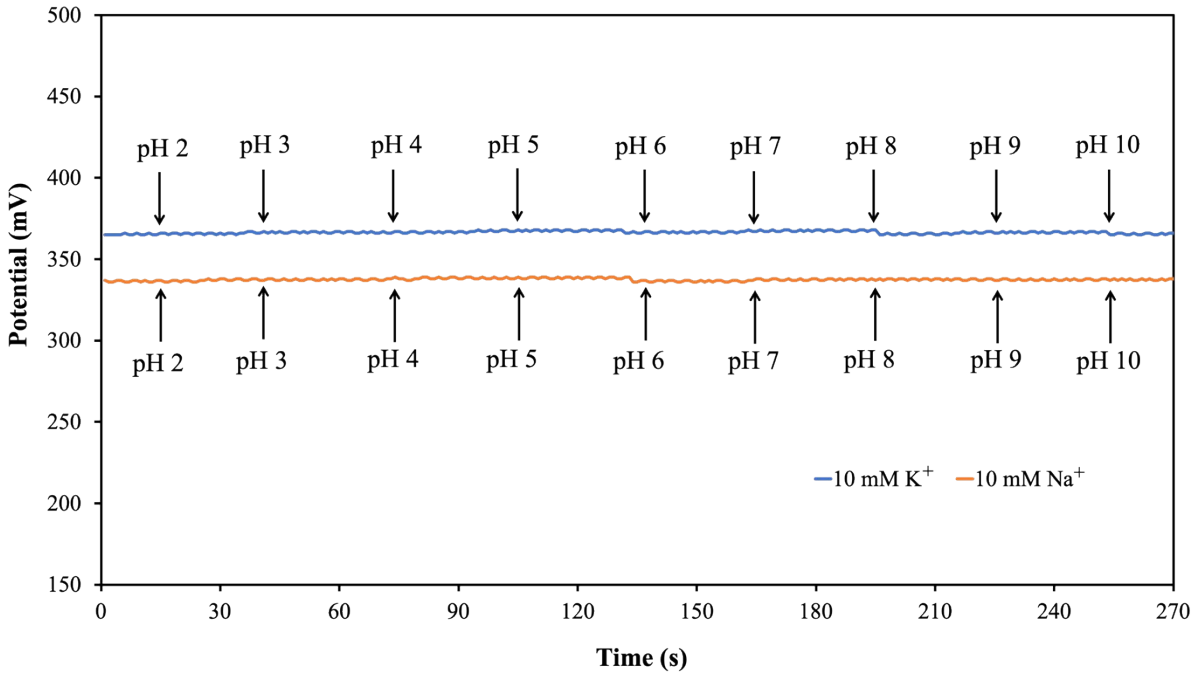

Figure S2 The selectivity of (a) K^+-ISE and (b) Na^+-ISE in the coexistence of interference ions. (Concentration: 10 mM of targets analyte (K^+ or Na^+) and potential interferences including 100 mM of Ca^{2+}, Mg^{2+}, PO_4^{3-}, CO_3^{2-}, D-glucose, and Urea)

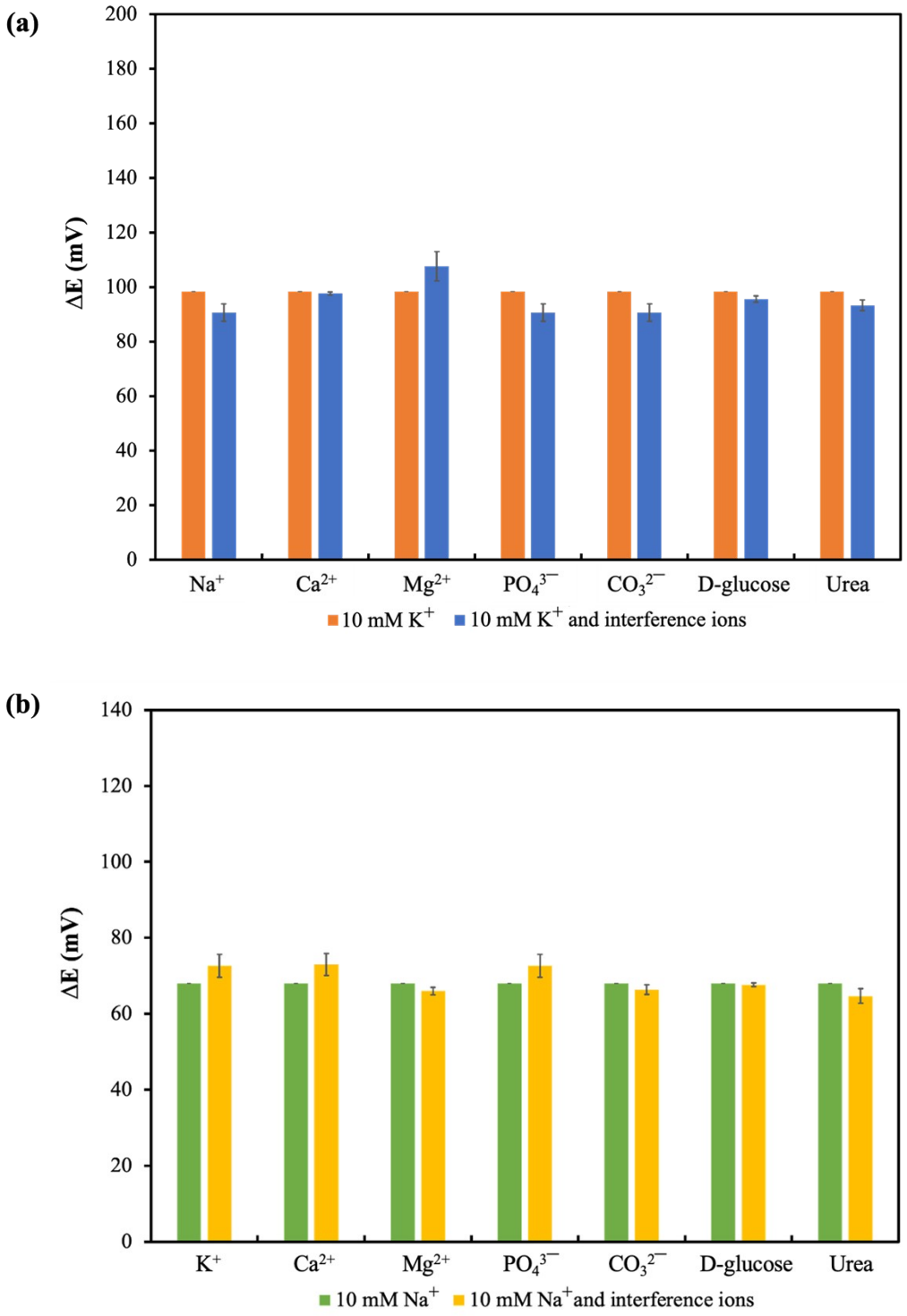

Figure S3 The selectivity of (a) K^+ and (b) Na^+ in the coexistence of interference ions. (Concentration: 10 mM of targets analyte (K^+ or Na^+) and potential interferences including 100 mM of Ca^{2+}, Mg^{2+}, PO_4^{3-}, CO_3^{2-}, D-glucose, and Urea)

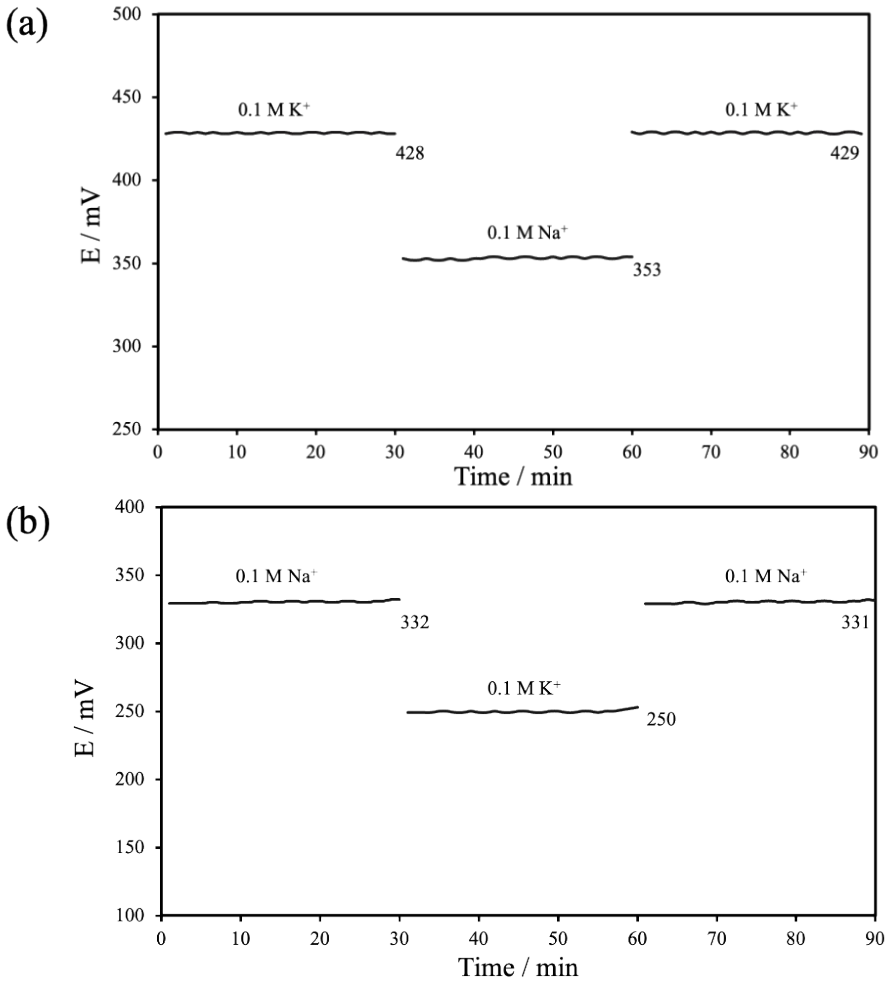

Figure S4 Water layer tests of the (a) K^+-ISE and (b) Na^+-ISE.

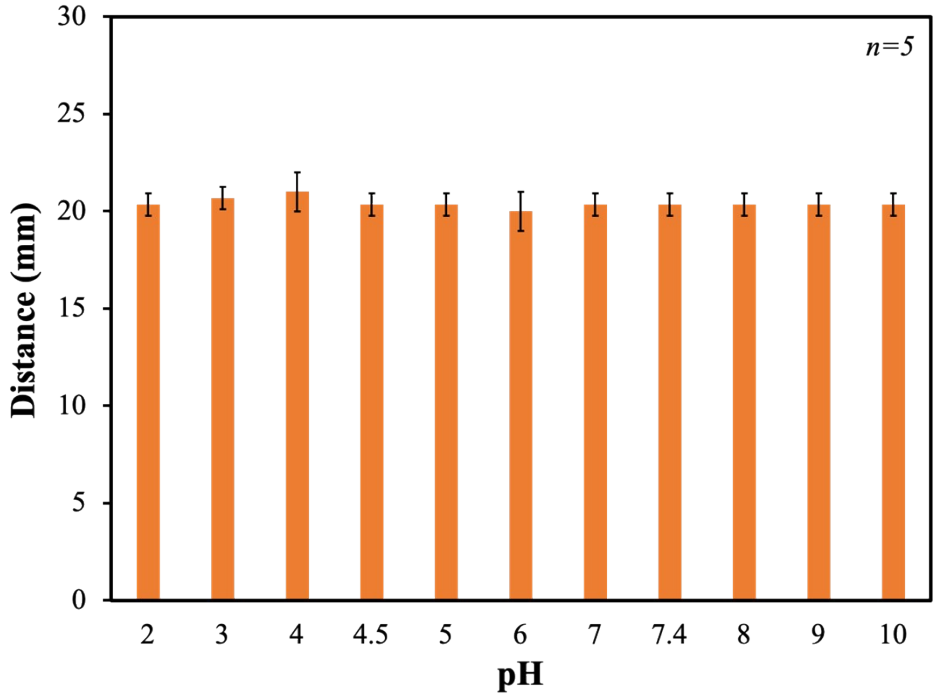

Figure S5 Effect of pH on the Cl^- detection on dPAD (20 mM Cl^-)

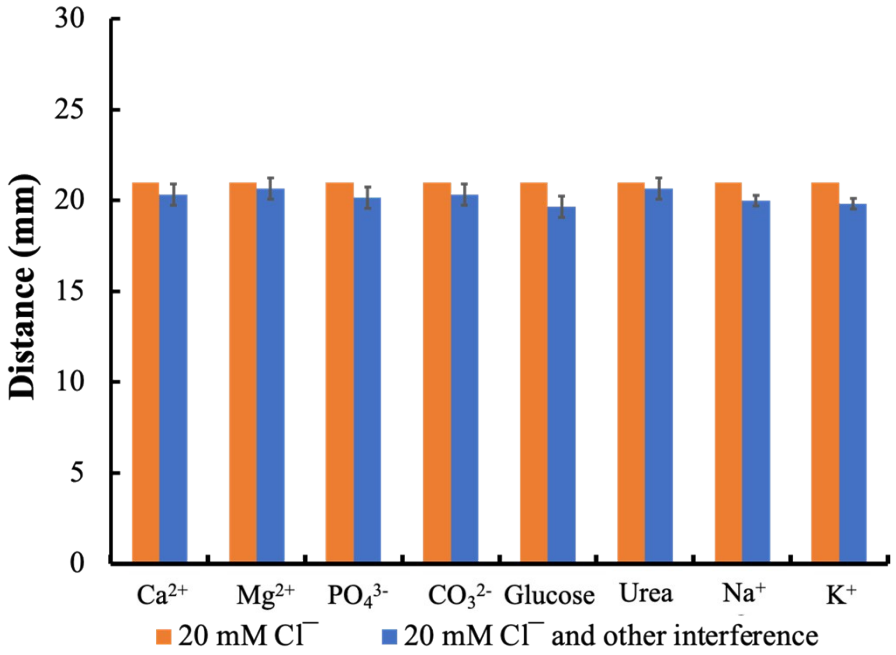

Figure S6 The selectivity of Cl^- in the coexistence of interference ions. Concentration: 20 mM Cl^- and potential interferences including 100 mM of Ca^{2+}, Mg^{2+}, PO_4^{3-}, CO_3^{2-}, glucose, urea, Na^+, and K^+