Corrective Protocol to Predict Interference Free Sensor Response for Paper-based Solution Sampling Coupled with Heavy Metal Sensitive Ion-Selective Electrodes

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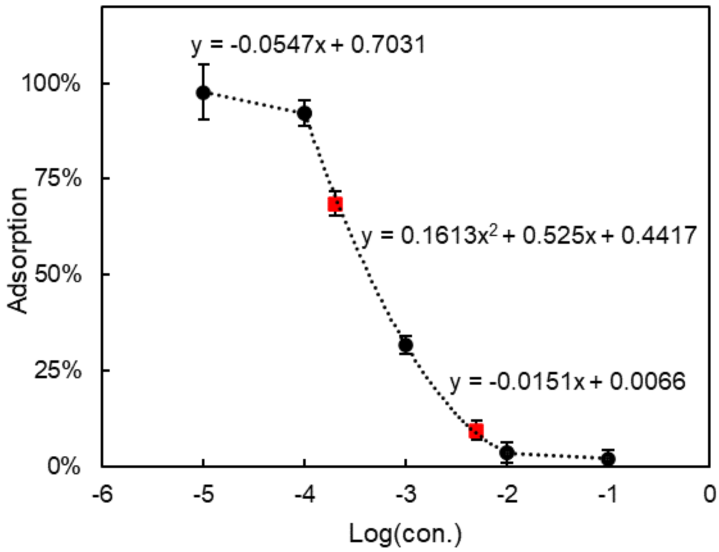

Figure S1 Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 1. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

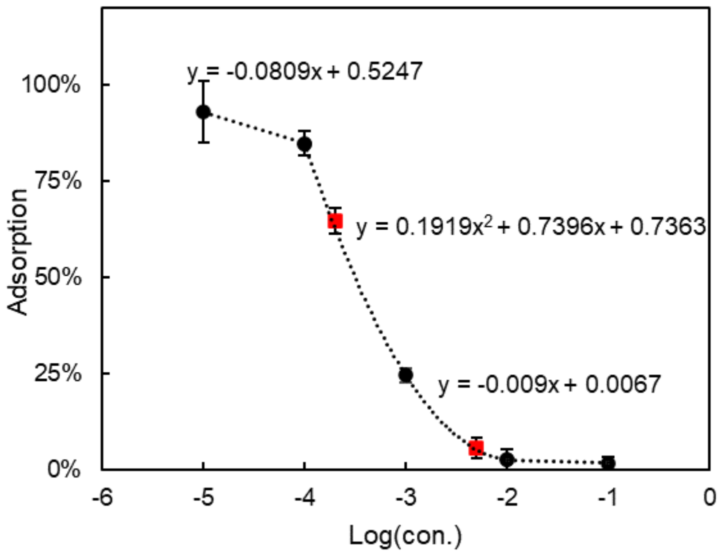

Figure S2 Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 2. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

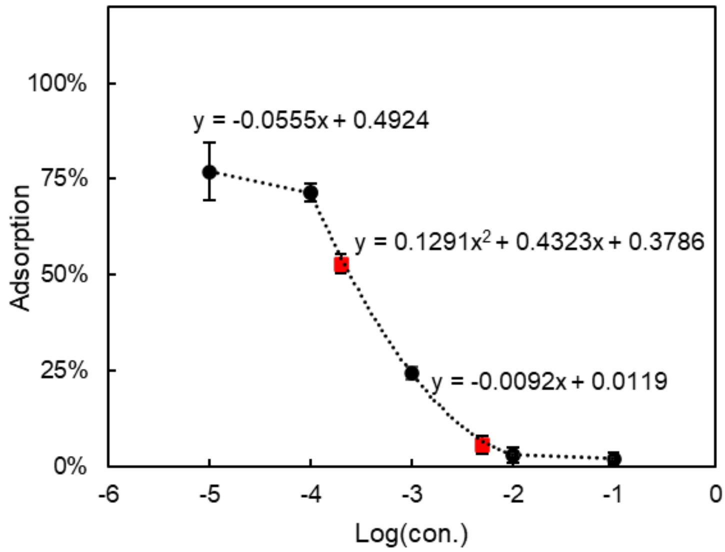

Figure S3. Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 3. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

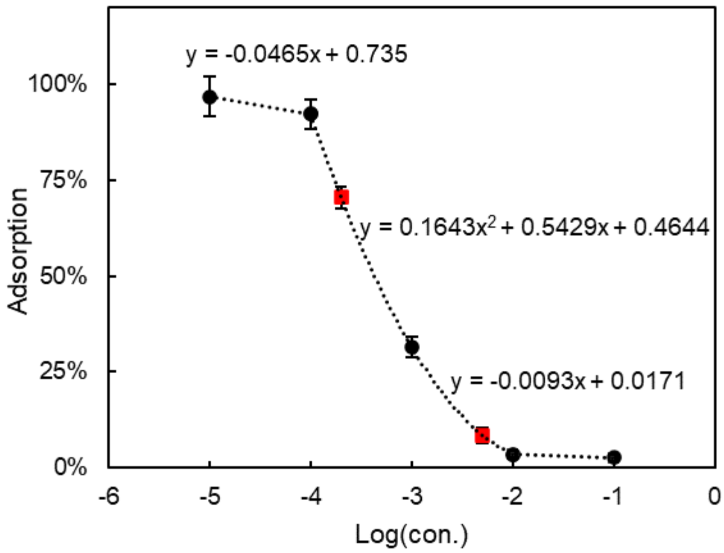

Figure S4 Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 4. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

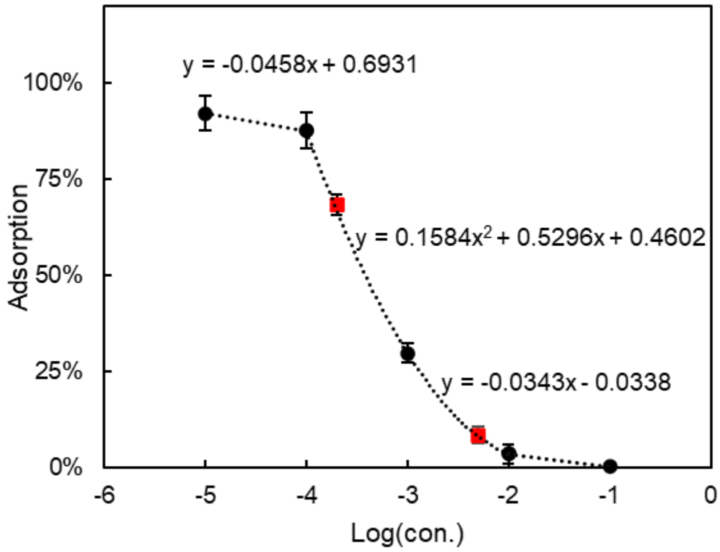

Figure S5. Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 5. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

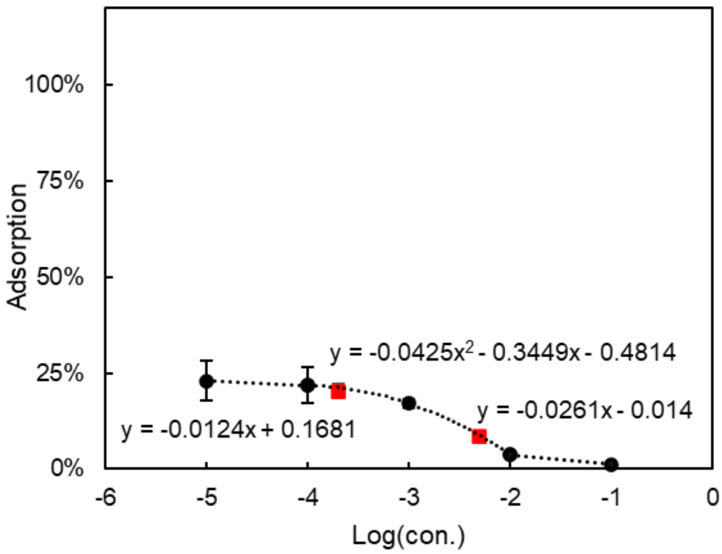

Figure S6. Segmented fitting curve and verification of lead ion absorption on paper substrate in Case 6. The experimental measurement data are indicated by red boxes, providing validation for the fitting curve.

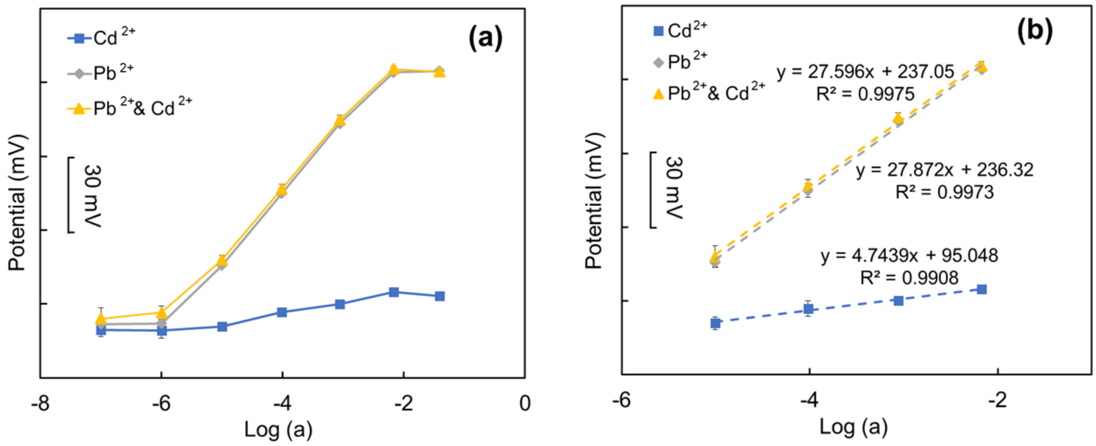

Figure S7 (a) Calibration curves of the fabricated Pb^{2+} ISE (after being conditioned in 10^{-3} mol L^{-1} $Pb(NO_3)_2$ for 12 h) in case 2 (interfering ion is Cd^{2+} with the same concentration of the Pb^{2+}). The calibration curves were obtained as the following sequence: in interfering ion solution, in primary ion solution, and in mixed solution; (b) a comparison of linear functions of the three obtained calibration curves.

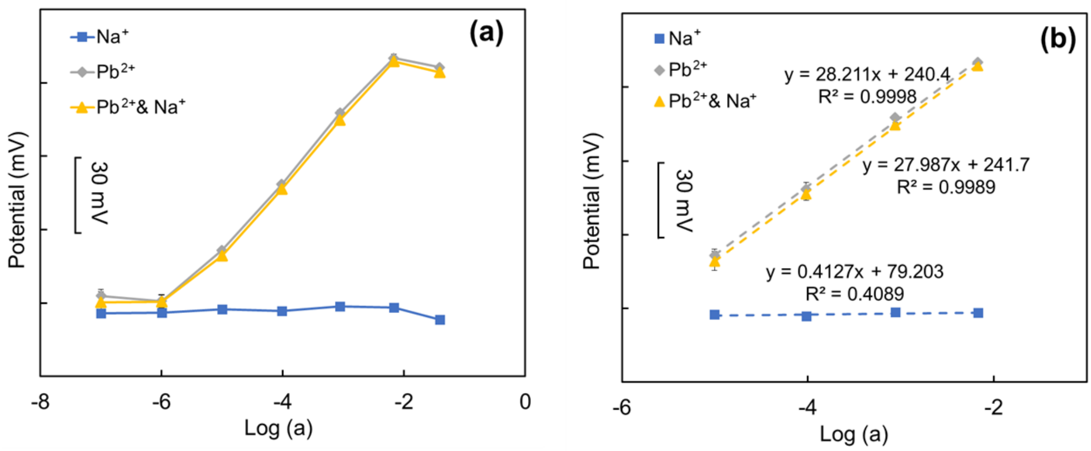

Figure S8 (a) Calibration curves of the fabricated Pb^{2+} ISE (after being conditioned in 10^{-3} mol L^{-1} $Pb(NO_3)_2$ for 12 h) in Case 3 (interfering ion is Na^+ with a concentration of 10^{-3} mol L^{-1}). The calibration curves were obtained as the following sequence: in interfering ion solution, in primary ion solution, and in mixed solution; (b) a comparison of linear functions of the three obtained calibration curves.

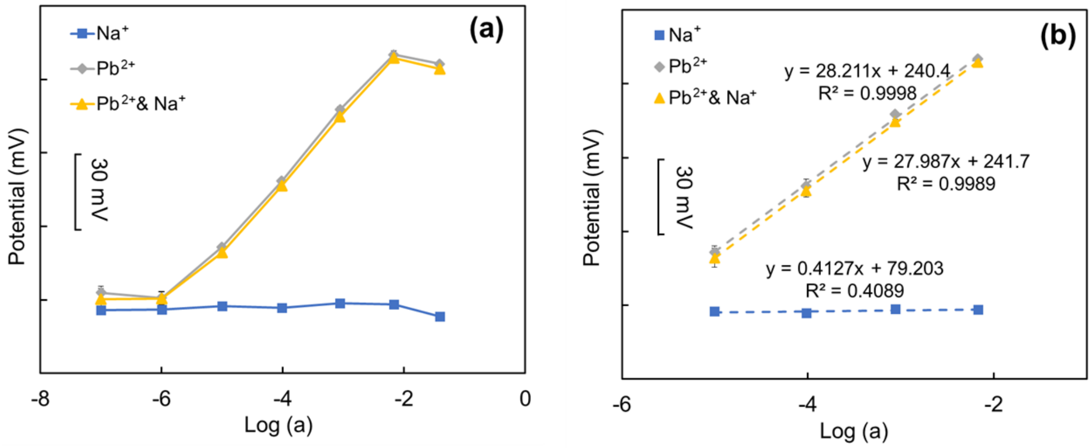

Figure S9 (a) Calibration curves of the fabricated Pb^{2+} ISE (after being conditioned in 10^{-3} mol L^{-1} $Pb(NO_3)_2$ for 12 h) in Case 4 (interfering ion is Cd^{+} with a concentration of 10^{-3} mol L^{-1}). The calibration curves were obtained as the following sequence: in interfering ion solution, in primary ion solution, and in mixed solution; (b) a comparison of linear functions of the three obtained calibration curves.

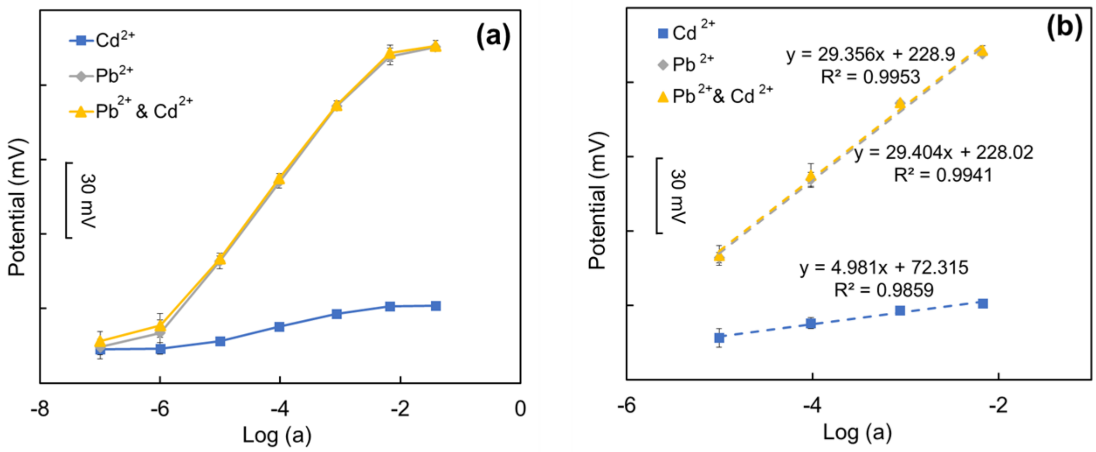

Figure S10 (a) Calibration curves of the fabricated Pb^{2+} ISEs (after being conditioned in 10^{-3} mol L^{-1} $Pb(NO_3)_2$ for 12 h) in Case 5 (interfering ion is Cd^{+} with a concentration of 10^{-5} mol L^{-1}). The calibration curves were obtained as the following sequence: in interfering ion solution, in primary ion solution, and in mixed solution; (b) a comparison of linear functions of the three obtained calibration curves.

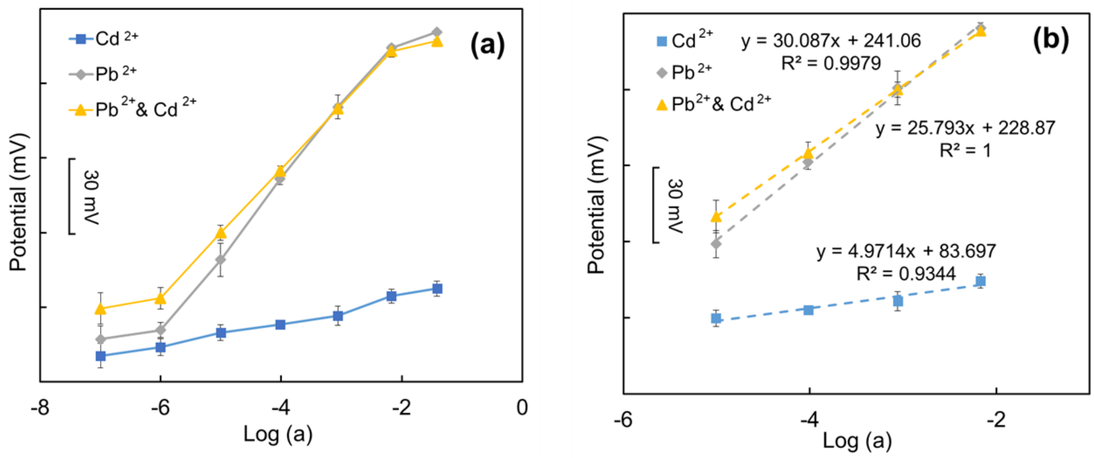

Figure S11. (a) Calibration curves of the fabricated Pb^{2+} ISEs (after being conditioned in 10^{-3} mol L^{-1} $Pb(NO_3)_2$ for 12 h) in Case 6 (interfering ion is Cd^{+} with a concentration of 10^{-1} mol L^{-1}). The calibration curves were obtained as the following sequence: in interfering ion solution, in primary ion solution, and in mixed solution; (b) a comparison of linear functions of the three obtained calibration curves.

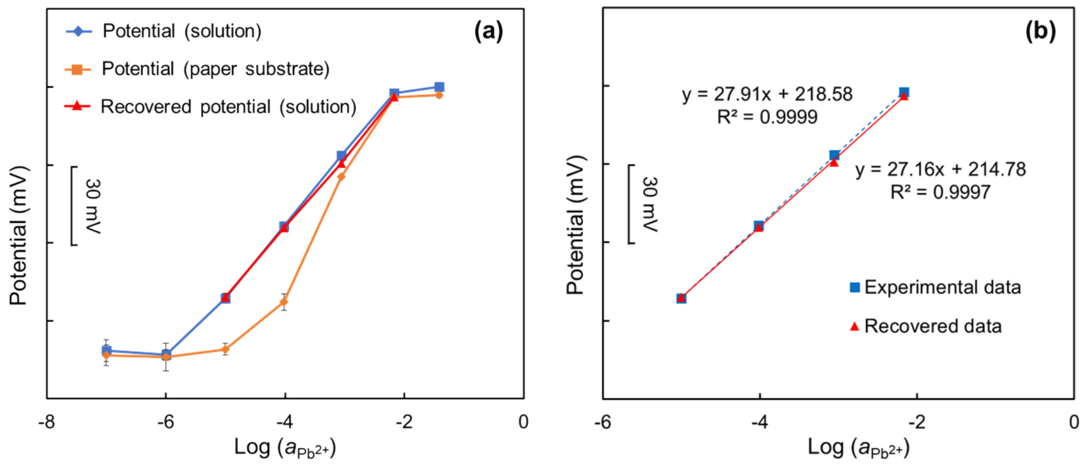

Figure S12 Corrective protocol to predict interference free sensor response from the paper-based potential in Case 3: (a) calibration curves of the fabricated Pb^{2+} ISEs on paper substrate, on standard mixed solution and recovered solution-based calibration curve from paper-based calibration curve; (b) linear functions of the experimental solution-based calibration curve and the recovered solution-based calibration curve.

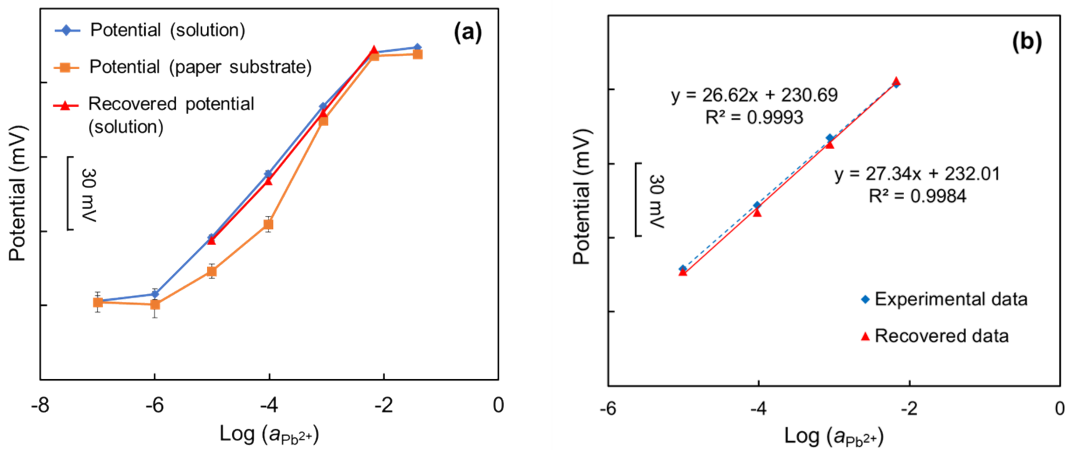

Figure S13 Corrective protocol to predict interference free sensor response from the paper-based potential readout in Case 4: (a) calibration curves of the Pb^{2+} ISEs coupled with paper-based solution sampling, conventional solution-based measurement and predicted interference free calibration curve from paper-based solution sampling measurement; (b) linear functions of the experimental solution-based calibration curve and the recovered solution-based calibration curve.

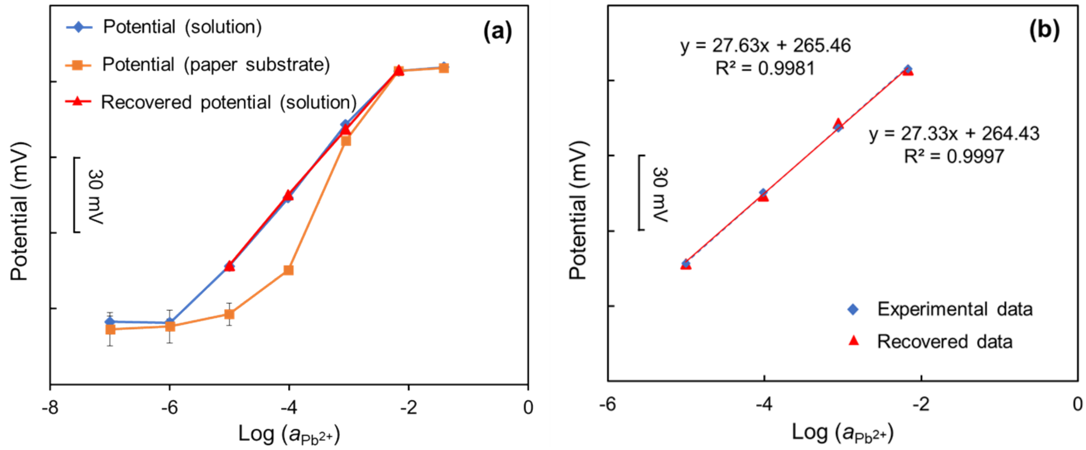

Figure S14 Corrective protocol to predict interference free sensor response from the paper-based potential in Case 5: (a) Calibration curves of the fabricated Pb^{2+} ISEs on paper substrate, on standard mixed solution and recovered solution-based calibration curve from paper-based calibration curve; (b) linear functions of the experimental solution-based calibration curve and the recovered solution-based calibration curve.

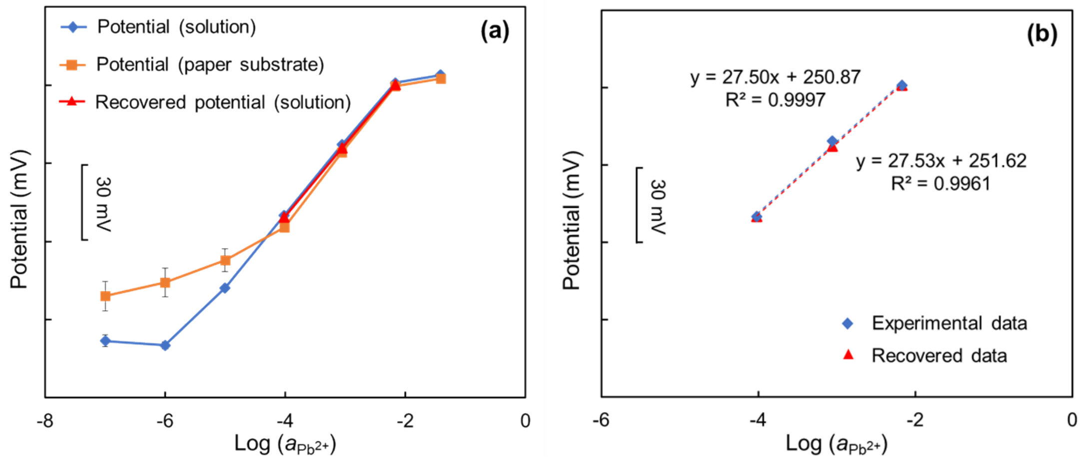

Figure 15 Corrective protocol to predict interference free sensor response from the paper-based potential in Case 6: (a) Calibration curves of the fabricated Pb^{2+} ISEs on paper substrate, on standard mixed solution and recovered solution-based calibration curve from paper-based calibration curve; (b) linear functions of the experimental solution-based calibration curve and the recovered solution-based calibration curve.

Table S1 Typical cases of interfering ion influence on potentiometric cell coupled with paper-based solution sampling.

	Primary ion[a] (mol L^{-1})	Interfering ion[b] (mol L^{-1})	Note
Case 1	Pb^{2+} (10^{-5} to 10^{-1})	—	Simulate a pure heavy metal ion, sole interactions with paper substrates
Case 2	Pb^{2+} (10^{-5} to 10^{-1})	Cd^{2+} (10^{-5} to 10^{-1})	Simulate a heavy metal ion mixed with interfering ion[c] with similar concentrations.
Case 3	Pb^{2+} (10^{-5} to 10^{-1})	Na^{+} (10^{-3})	Simulate a heavy metal ion mixed with a weak-interfering ion[d]
Case 4	Pb^{2+} (10^{-5} to 10^{-1})	Cd^{2+} (10^{-3})	Simulate a heavy metal ion mixed with an interfering ion with a constant concentration
Case 5	Pb^{2+} (10^{-5} to 10^{-1})	Cd^{2+} (10^{-5})	Simulate a heavy metal ion mixed with an interfering ion at a low concentration
Case 6	Pb^{2+} (10^{-5} to 10^{-1})	Cd^{2+} (10^{-1})	Simulate a heavy metal ion mixed with an interfering ion at a high concentration

[a] Ion(s) to be tested

[b] Ion(s) other than the primary ion(s), interfering ions

[c] Ion(s) in sample that might significantly interfere

[d] Ion(s) in sample that might not significantly interfere

Table S2 Contents of background solutions used for real sample tests

Contents	Lab recycling water (ppm)	Lab waste water (ppm)	Lake water (ppm)
K^+	2.156	696	5.522
Na^+	21.19	360	5.364
Ca^{2+}	26.66	99	22.25
Mg^{2+}	0.817	-	1.478
Pb^{2+}	-	570	-
Cd^{2+}	128.3	2480	-

Table S3 Three types of water samples used for real sample analyses

Water type	Note [a]
Lake water (pH=7.1)	Falling in Case 3 (mixed with low interfering ion(s))
Lab recycled water (pH=7.3)	Falling in Case 5 (mixed with interfering ion(s) at low concentration)
Lab wastewater (pH=4.6)	Falling in Case 6 (mixed with interfering ion(s) at high concentration)

[a] The interfering metal ions were analyzed by ICP-OES, and the concentrations were listed in Table S2 in Supplementary Material.