Supporting information for

K⁺-Selective Optical Microsensors Based On Surface Modified Polystyrene Microspheres

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Experimental Section

Reagents. 3-octadecanoylimino-7-(diethylamino)-1,2-benzophenoxazine (Chromoionophore I), latex beads (polystyrene, 0.8 μ m mean particle size by DSL, without azide), potassium ionophore I (L, valinomycin), tetrahydrofuran (THF), sodium tetrakis-[3,5-bis(trifluoromethyl)phenyl]borate (NaTFPB), 2-amino-2-hydroxymethyl-propane-1,3-diol (Tris), 2-(N-Morpholino)ethanesulfonic acid (Mes), potassium chloride, calcium chloride, lithium chloride, and magnesium chloride were obtained from Sigma-Aldrich. Lumogen Red was obtained from BASF. CML latex (4.2 % w/v, 2.4 μ m by DSL, 2.0 μ m by TEM) was purchased from InvitrogenTM (Eugene, Oregon, USA).

Preparation of exhaustive K⁺-selective microspheres. 1.0 mg of NaTFPB, 0.5 mg of Chromoionophore I, 2.0 mg of potassium ionophore I were dissolved in 3.0 mL of THF to form a homogeneous solution. 10 μ L of commercial PS particle concentrates was diluted to 40 mL in H₂O. 0.5 mL of the THF solution was pipetted and injected into 4.5 mL of the diluted PS particle suspension on a vortex with a spinning speed of 1000 r/min. The resulting blue mixture was blown with compressed air on the surface for 20 min to remove THF. For the preparation of Lumogen Red modified PS microspheres, a THF solution containing Lumgen Red (0.23 mg in 3 mL THF) was used. Microsphere concentratin was calculated with the ion exchanger NaTFPB.

Instrumentation and measurements. The size and zeta-potentials of the modified microspheres were measured with Zetasizer Nano ZS (Malvern Inc.) particle size analyzer in the dynamic light scattering mode at 173° scattering angle in 1 cm plastic cuvette. The absorbance was measured with a UV-Vis spectrometer (SPECORD 250 plus, Analytic Jena, AG, Germany). Confocal microscopic images were obtained under Zeiss LSM 700 upright confocal microscope using 555 nm laserline as excitation and 63x objective lens. Calibration curves were measured in buffer solutions at the indicated pH (10 mM Tris-HCl or 10 mM Mes-NaOH) values with gradual addition of KCl or other salt stock solutions. Response time was recorded under absorption mode in 10 mM pH 7.4 Tris-HCl buffer. Aliquots of KCl solution were pipetted and injected into a cuvette containing the modified PS microspheres (0.8 μ m). Disposable poly(methyl methacrylate) cuvettes with path length of 1 cm were for absorbance interrogation.

Supplementary Figures



Fig. S1 Fluorescence confocal microscope image for Lumogen Red adsorbed CML latex microspheres of 2.0 μm diameter in H_2O.



Fig. S2 (a) Absorbance change for the K⁺-selective PS microspheres (0.8 μ m) in 10 mM pH 7.4 Tris-HCI with different levels of KCI (for concentrations, see b). (b) Calibration curve using absorbance difference at 663 nm (A₀-A) against K⁺ concentration, where A₀ is the initial absorbance in buffer.



Fig. S3 Calibration curve for the K⁺-selective PS microspheres (0.8 μ m) in pH 5.6 10 mM MES-NaOH buffer using the absorbance difference at 663 nm (A₀-A) against the logarithm of K⁺ concentration, where A₀ is the initial absorbance in buffer.



Fig. S4 (a) Absorbance change for the K^+ -selective PS microspheres (2.0 µm, carboxylate modified) in 10 mM pH 5.6 Mes-NaOH with different level of KCI. (b) Calibration curve using absorbance difference at 663 nm (A₀-A) against K^+ concentration, where A₀ is the initial absorbance in buffer.



Fig. S5 Interference from other commonly seen ions to the K⁺-selective PS microspheres (0.8 μ m) evaluated in absorbance mode. The absorbance value at 663 nm divided by the initial absorbance (A₆₆₃/A₀) was plotted against the logarithm of the interfering ion (J) concentration.