# Supplementary information

## Comparative analysis of a bulk optode based on a valinomycin ionophore and a nano-optode in micelles with Pluronic F-127 for the quantification of potassium in aqueous solutions.

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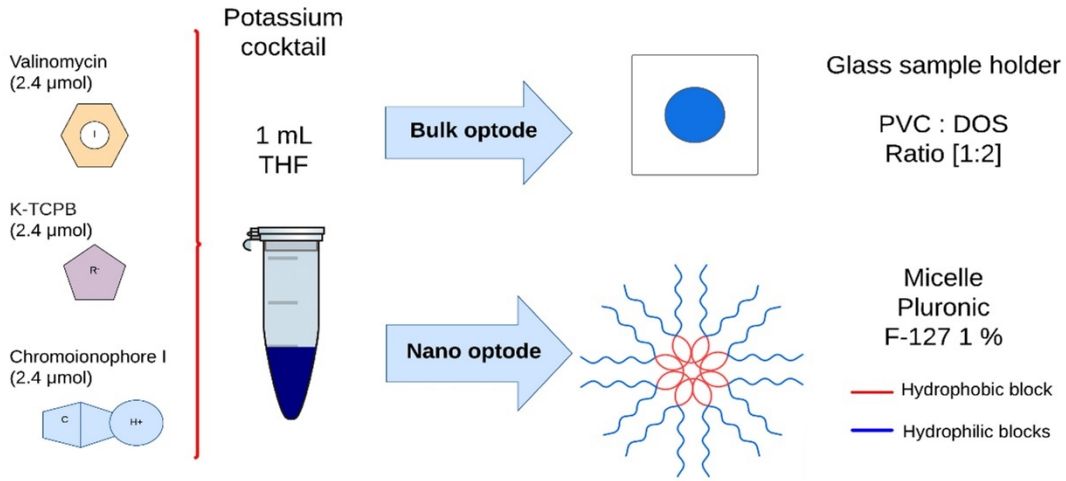


**Figure S1.** Experimental scheme for the synthesis of BO and NO.

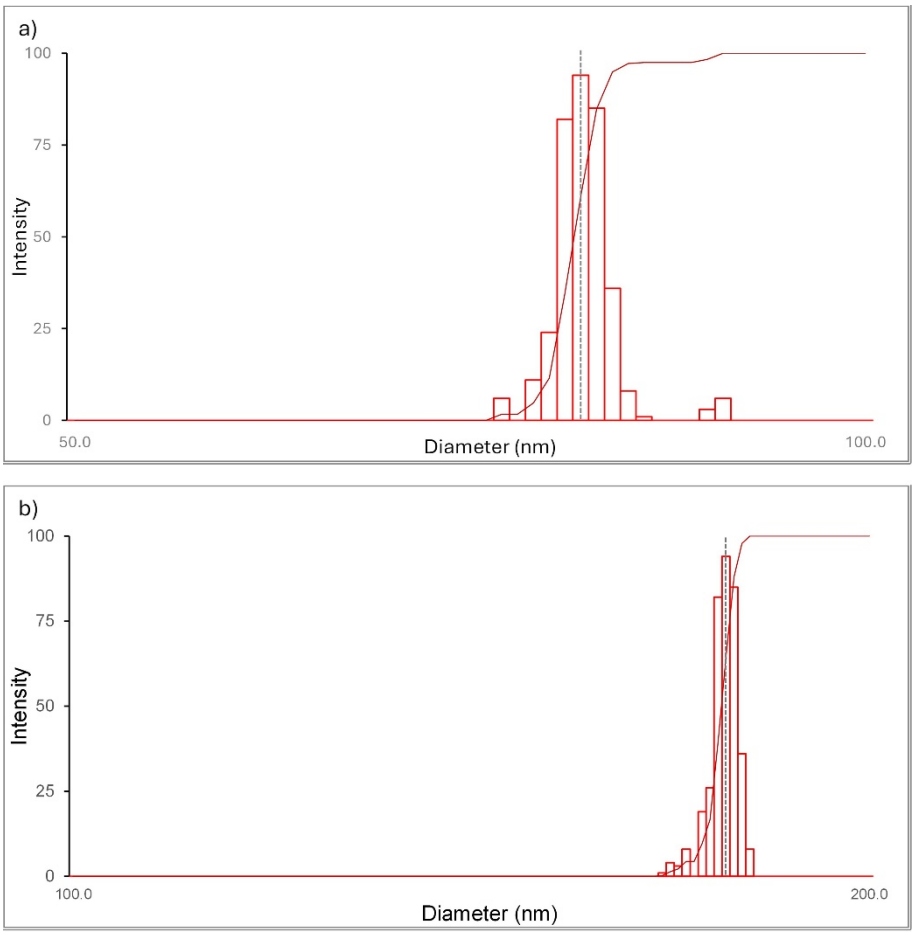


**Figure S2.** DLS analysis for a) Pluronic F-127 micelles and b) NO micelles.

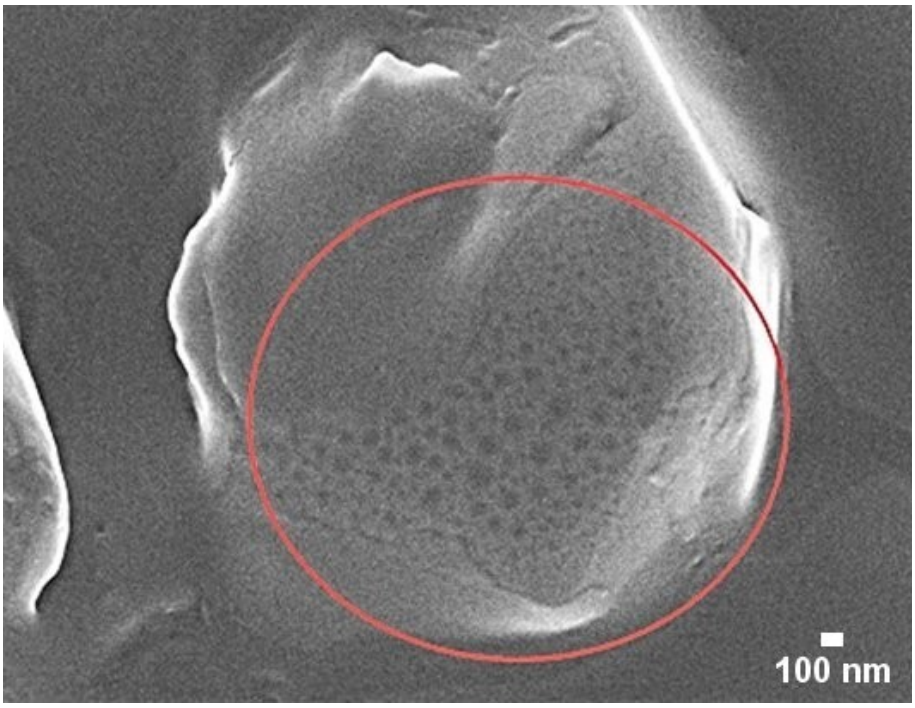


**Figure S3.** SEM image of NO micelles.

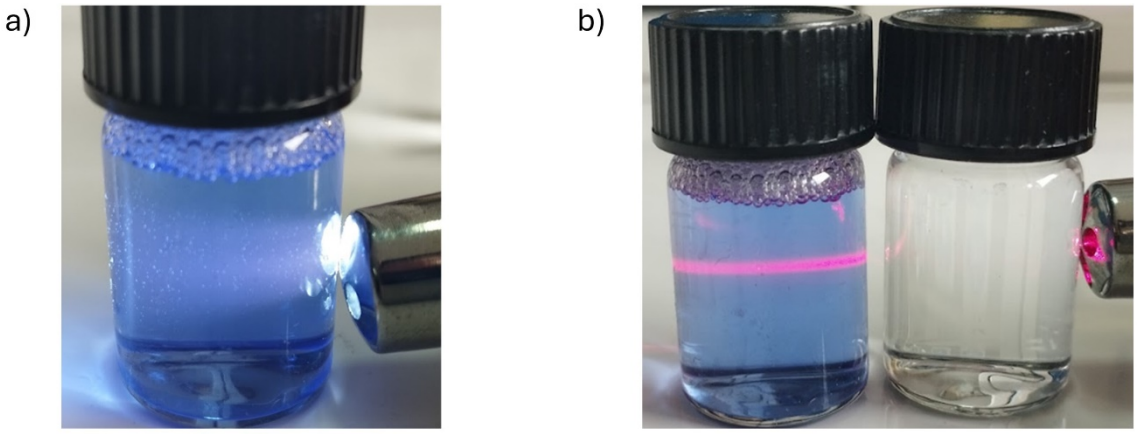


**Figure S4.** Tyndall effect in NO solutions. a) With a light source present. b) With a laser beam present.

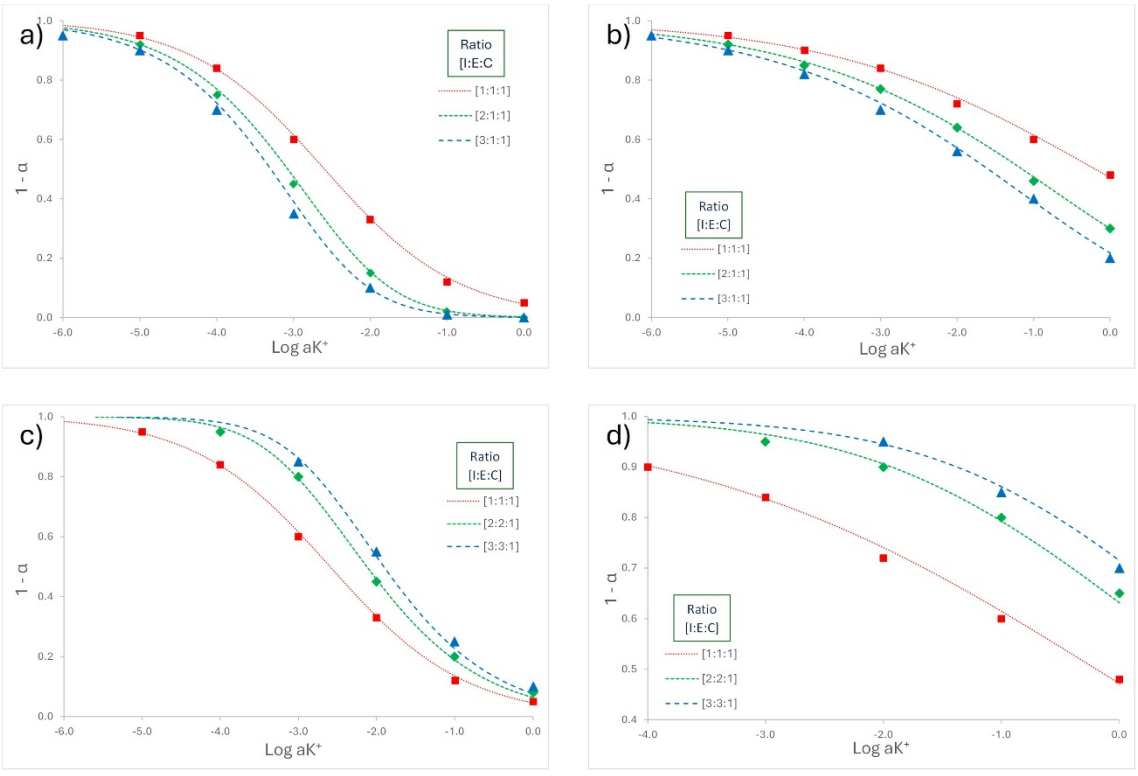


**Figure S5.** Effect of increasing the ionophore valinomycin on the sigmoid model of (a) BO and (b) NO. Effect of increasing the ion exchanger K-TCPB on the sigmoid model of (c) BO and (d) NO. Measurements were performed in 20 mM TRIS-HCl buffer pH 7.0.

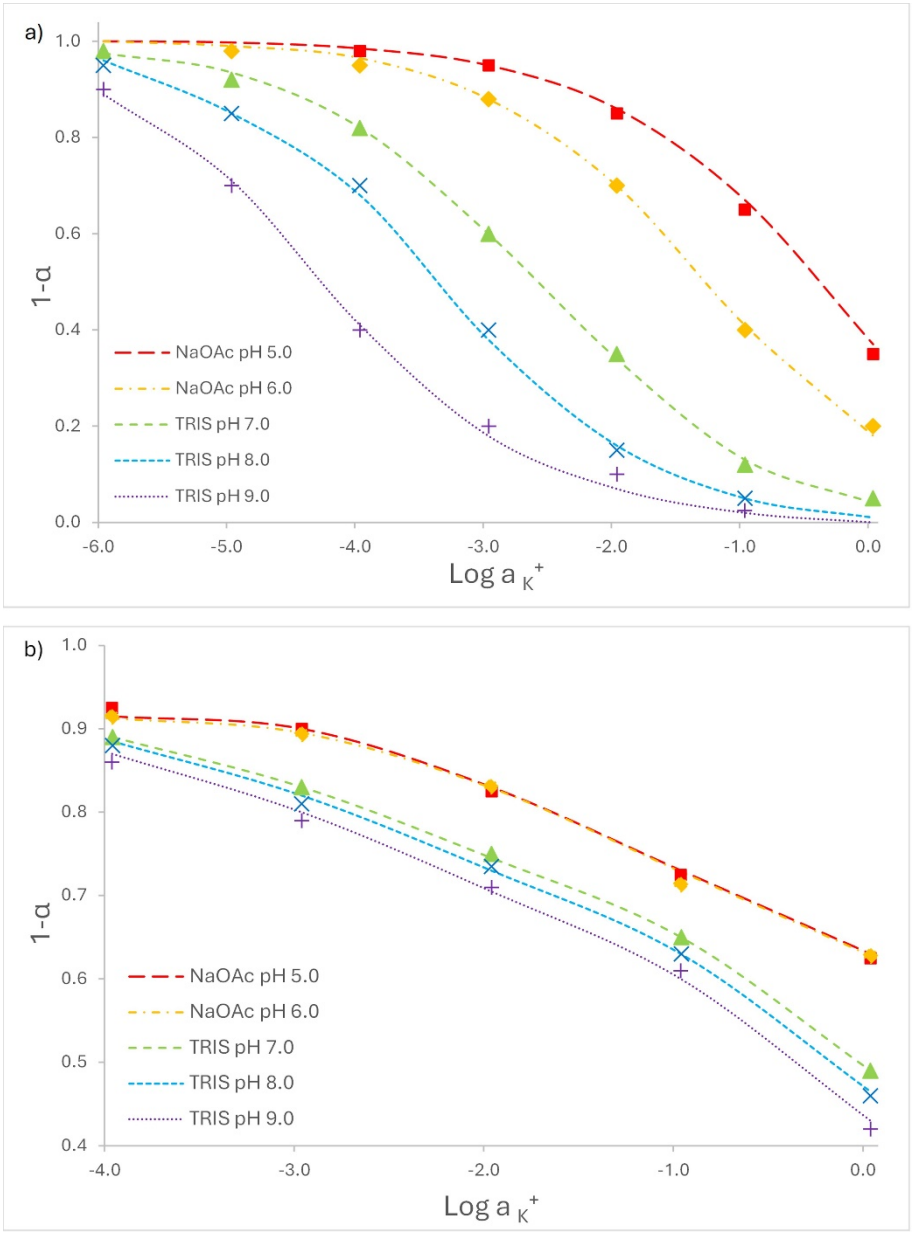


**Figure S6.** Sigmoid curve behavior at pH 5.0-9-0 for (a) BO and (b) NO. Measurements were performed in 0 20 mM TRIS-HCl buffer and 20 mM acetate-acetic buffer.

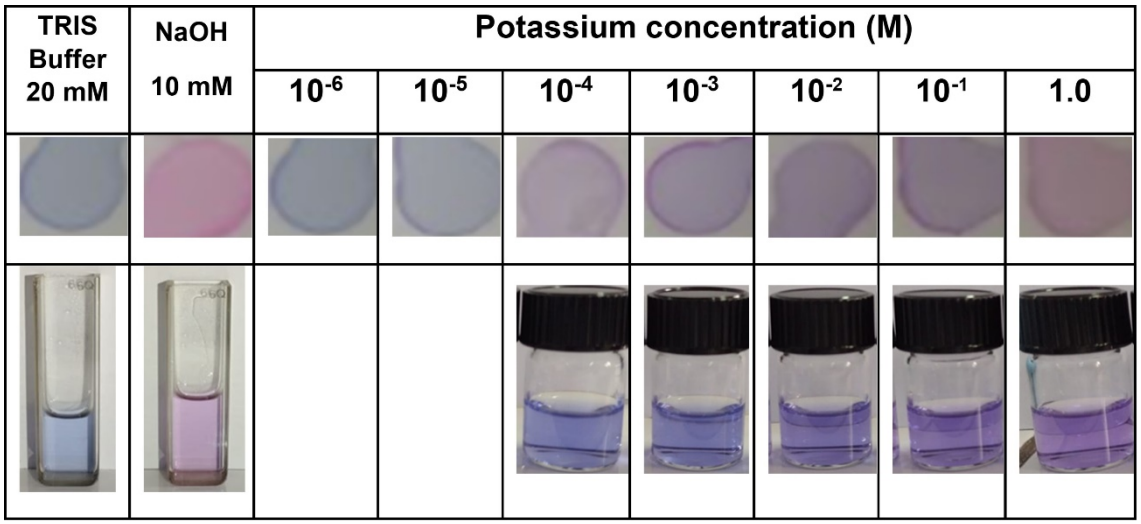


**Figure S7.** Photographs of BO (top) and NO (bottom) for different concentrations of $K^+$ in 20 mM TRIS buffer at pH 7.0.

**Table S1.** The logarithm of the selectivity coefficients of the optodes for potassium ions based on the valinomycin ionophore against interfering ions.

| | *Log K+ - j+* | | | |
|---|---|---|---|---|
| j = interferer | Na+ | Li+ | Ca2+ | Mg2+ |
| Bulk optode | 1.79 | 3.45 | 2.09 | 2.20 |
| Nano optode | 3.04 | 3.21 | 4.01 | 4.20 |

**Table S2.** Publications of potassium optical sensors

| Methodology | Signal | Selective agent $K^+$ | Ion exchanger | Optical agent | Support | Type of sample | Limit of detetion |
|---|---|---|---|---|---|---|---|
| ISO (this work) | Colorimetric | Valinomycin | K-TCPB | CHI | BO: PVC - DOS NO: F-127 | - | BO: 1.0 µM NO: 0.1 mM |
| CQD [71] | Fluorescence quenching | CQD | - | CQD | Gelatin powder | Human blood serum | 0.01 mM |
| POD [70] | Colorimetric | Valinomycin | K-TCPB | CHI | Paper substrate | - | 0.1 mM |
| ISO [72] | Colorimetric | Valinomycin | DOP | CHI | PVC | Blood plasma | 2.3 mM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Polyoctylthiophene nanoptodes [66] | Fluorescence | Valinomycin | Na-TFPB | CHI | POT - PVA - DOS | Bovine serum album | 1.0 -$10^{-6}$ M |
| ISO [67] | Fluorescence | Valinomycin | Na-TFPB | SDI - SDII | Nylon membrane | Aqueous sample solution | 1.0 µM |
| POD [68] | Colorimetric | Valinomycin | BARF | CHI | F-127 - DOS | Biological fluids | 2.0 mM |
| ISO [69] | Colorimetric | Valinomycin | Na-TFPB | CHI | F-127 - Agarose | - | 0 - 2.0 mM |
| ISO [41] | Fluorescence | Valinomycin | Na-TFPB | SD | Organosilica nanospheres - nylon filter paper | Aqueous sample solution | 1.0 µM |

**Method of least-squares for calculated the Ke**

The equilibrium constant of the valinomycin-potassium ion complex ($K^{KI}{}_{e}^{+}$) could be expressed as Equation S1.

$$Log\left(\frac{a_{K^+}}{a_{H^+}}\right) + Log\, K^{KI}{}_{e}^{+} = Log\left(\frac{\alpha}{(1-\alpha)}\frac{[C_E]-(1-\alpha)[C_C]}{[C_I]-[C_E]+(1-\alpha)[C_C]}\right)$$

Equation S1

If we defined $Log\left(\frac{a_{K^+}}{a_{H^+}}\right) = X_i$; $Log\, K^{KI}{}_{e}^{+} = C$ and $\frac{\alpha}{(1-\alpha)}\frac{[C_E]-(1-\alpha)[C_C]}{[C_I]-[C_E]+(1-\alpha)[C_C]} = Y_I$. A simple way to find C is to average the distances between Xi and Yi as an Equation S2.

$$C = \frac{\sum(Y_i - X_i)}{n}$$

Equation S2