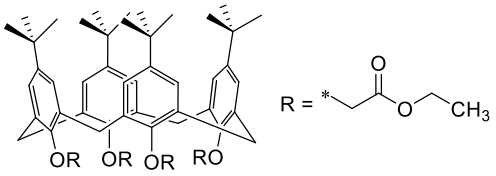
# Product Information




## **71747** Sodium ionophore X

(4-*tert*-Butylcalix[4]arene-tetraacetic acid tetraethylester)
Selectophore®, function tested

## Electrochemical Transduction

### Ion-Selective Electrodes

#### Application 1 and Sensor Type[1]

Assay of $Na^+$ activity with solvent polymeric membrane electrodes based on Sodium Ionophore X.

**Recommended Membrane Composition**

| | |
|---|---|
| 0.70 wt% | Sodium Ionophore X (71747) |
| 0.20 wt% | Potassium tetrakis((4-chlorophenyl)borate (60591) |
| 66.10 wt% | 2-Nitrophenyl octyl ether (73732) |
| 33.00 wt% | Poly(vinyl chloride) high molecular weight (81392) |

**Recommended Cell Assembly**

Reference || sample solution || liquid membrane | 0.1 M NaCl | AgCl, Ag

**Electrode Characteristics and Function**

Selectivity coefficients $\log K_{Na,M}^{Pot}$ as obtained by the separate solution method (0.1 M solutions of the chlorides).

| | | | |
|---|---|---|---|
| $\log K_{Na,Li}^{Pot}$ | -2.5 | $\log K_{Na,Ca}^{Pot}$ | -2.5 |
| $\log K_{Na,K}^{Pot}$ | -1.9 | $\log K_{Na,Mg}^{Pot}$ | <-6 |
| $\log K_{Na,Cs}^{Pot}$ | -1.6 | | |

| | |
|---|---|
| Slope of linear regression: | 60 mV/dec ($10^{-4}$ to $10^{-1}$ M $Na^+$) |
| Detection limit: | $3.5 \cdot 10^{-6}$ M $Na^+$ |
| Response time: | $t_\infty$ ≤20 s |

#### Application 2 and Sensor Type[2]

Aldehyde(heptanal)-selective solvent polymeric membrane electrode based on Sodium ionophore X. The aldehyde is reacted *in situ* with Girard's reagent P to generate the hydrazone which is recognized by the electrode.

**Recommended Membrane Composition**

| | |
|---|---|
| 4.5 wt% | Sodium Ionophore X (71747) |
| 60.3 wt% | Bis(1-ethylhexyl)phthtalate (80030) |
| 35.2 wt% | Poly(vinyl chloride) high molecular weight (81392) |

**Recommended Cell Assembly**

Reference || sample solution || liquid membrane | $10^{-4}$ M heptanal-Girard's reagent adduct | AgCl, Ag

**Electrode Characteristics and Function**

Selectivity coefficients $\log K^{Pot}_{Heptanal,X}$ as obtained by the separate solution method (solution with 0.01 M ammonium acetate as supporting electrolyte (pH 6.0). Concentration of interfering species (except $NH_4^+$) $2 \cdot 10^{-4}$ M).

| | | | |
|---|---|---|---|
| $\log K^{Pot}_{Heptanal,HCHO}$ | -1.8 | $\log K^{Pot}_{Heptanal,NH_4}$ | -5.4 |
| $\log K^{Pot}_{Heptanal,Butanal}$ | -1.7 | $\log K^{Pot}_{Heptanal,K}$ | -2.8 |
| $\log K^{Pot}_{Heptanal,Vanillin}$ | -1.6 | $\log K^{Pot}_{Heptanal,Na}$ | -0.3 |
| $\log K^{Pot}_{Heptanal,n-Butylamine}$ | -1.9 | | |

| | |
|---|---|
| Slope of linear regression: | 68±1 mV/dec ($10^{-6}$ to $10^{-2}$ M heptanal) |
| Detection limit: | $9 \cdot 10^{-7}$ M heptanal |

### Application 3 and Sensor Type[3]

Formaldehyde-selective solvent polymeric membrane electrode based on Sodium ionophore X. The aldehyde is reacted *in situ* with a modified Girard's reagent P to generate a lipophilic hydrazone which is recognized by the electrode.

**Recommended Membrane Composition**

| | |
|---|---|
| 4.5 wt% | Sodium Ionophore X (71747) |
| 60.3 wt% | Bis(1-ethylhexyl)phthtalate (80030) |
| 35.2 wt% | Poly(vinyl chloride) high molecular weight (81392) |

**Recommended Cell Assembly**

Reference || sample solution || liquid membrane | $10^{-3}$ M formaldehyde(modified)-Girard's reagent adduct | AgCl, Ag

**Electrode Characteristics and Function**

Selectivity coefficients $\log K^{Pot}_{Formaldehyde,X}$ as obtained by the separate solution method (solution with 0.01 M ammonium acetate as supporting electrolyte (pH 5.4)).

| | | | |
|---|---|---|---|
| $\log K^{Pot}_{Formaldehyde,n-Propanol}$ | -3.6 | $\log K^{Pot}_{Formaldehyde,NH_4}$ | -3.5 |
| $\log K^{Pot}_{Formaldehyde,n-Butylamine}$ | -1.1 | $\log K^{Pot}_{Formaldehyde,K}$ | -2.6 |
| $\log K^{Pot}_{Formaldehyde,Butanol}$ | 0.8 | $\log K^{Pot}_{Formaldehyde,Na}$ | 0.9 |

| | |
|---|---|
| Slope of linear regression: | 32.4 mV/dec ($4 \cdot 10^{-5}$ to $10^{-2}$ M formaldehyde) |
| Detection limit: | $1.2 \cdot 10^{-5}$ M formaldehyde |

## Other Electrochemical Sensor Types

### Application 1 and Sensor Type[4]

Determination of sodium activity with an All-Solid-State Electrode based on Sodium Ionophore X.

**Cocktail Composition**

| | |
|---|---|
| 0.70 wt% | Sodium Ionophore X (71747) |
| 0.20 wt% | Potassium tetrakis((4-chlorophenyl)borate (60591) |
| 66.10 wt% | 2-Nitrophenyl octyl ether (73732) |
| 33.00 wt% | Poly(vinyl chloride) high molecular weight (81392) |

The sensor is a Pt/polypyrrole electrode coated with the PVC-Film.

**Electrode Characteristics and Function**

Selectivity coefficients $\log K^{Pot}_{Na,M}$ as obtained by the separate solution method.

| | |
|---|---|
| $\log K^{Pot}_{Na,K}$ | -2.7 |
| $\log K^{Pot}_{Na,Cs}$ | -3.4 |
| $\log K^{Pot}_{Na,Li}$ | -3.4 |

| | |
|---|---|
| Slope of linear regression: | 58.7 mV/dec ($10^{-4}$ to $10^{-1}$ M $Na^+$) |
| Detection limit: | $10^{-5}$ M $Na^+$ |
| Response time: | <20 s |

# Optical Transduction

**Application 1 and Sensor Type[5]**

Assay of $Na^+$ activity in aqueous solutions with solvent polymeric optode membranes based on Chromoionophore I (ETH 5294) and Sodium Ionophore X.

**Recommended Membrane Composition**

| | |
|---|---|
| 0.47 wt% | Chromoionophore I (27086) |
| 4.20 wt% | Sodium Ionophore X (71747) |
| 1.45 wt% | Sodium tetraphenylborate (72018) |
| 62.60 wt% | Bis(2-ethylhexyl) phthalate (80030) |
| 31.30 wt% | Poly(vinyl chloride) high molecular weight (81392) |

**Recommended pH Buffer**

0.1 M Tris-HCl buffer

**Absorbance Maxima of Chromoionophore I in Polymeric Optode Membranes**

$\lambda^{max}_{deprot.}$: 545 $nm$ $\lambda^{max}_{prot.}$: 660 $nm$, 614 $nm$

**Optode Characteristics and Function**

Selectivity coefficients $\log K^{Opt}_{Na,M}$ as obtained by the separate solution method (Tris-HCl buffer pH 8.0).

| | | | |
|---|---|---|---|
| $\log K^{Opt}_{Na,Li}$ | -3.1 | $\log K^{Opt}_{Na,Ca}$ | -2.3 |
| $\log K^{Opt}_{Na,K}$ | -2.1 | $\log K^{Opt}_{Na,Mg}$ | -2.9 |

| | |
|---|---|
| Slope of linear regression: | $3 \cdot 10^{-5}$ to $3 \cdot 10^{-2}$ M NaCl (pH 9.0 Tris buffer) |

[1] Sodium-selective polymeric membrane electrodes based on calix[4]arene ionophores. A. M. Cadogan, D. Diamond, M. R. Smyth, M. Deasy, M. A. McKervey, S. J. Harris, Analyst 114, 1551 (1989).
[2] Aldehyde-selective polymeric membrane electrodes based on a calix[4]arene ionophore. W. H. Chan, P. X. Cai, X. H. Gu, Analyst 119, 1853 (1994).
[3] Ion-selective electrodes based on a calix[4]arene tetraester in the determination of formaldehyde via in situ generation of ionic lipophilic hydrazone. W. H. Chan, R. Yuan, Analyst 120, 1055 (1995).
[4] All-solid-state sodium-selective electrode based on a calixarene ionophore in a poly(vinyl chloride) membrane with a polypyrrole solid contact. A. Cadogan, Z. Gao, A. Lewnstam, A. Ivaska, D. Diamond, Anal. Chem. 64, 2496 (1992).
[5] Design and characterization of sodium-selective optode membranes based on the lipophilic tetraester of calix[4]arene. W. H. Chan, A. W. M. Lee, C. M. Lee, K. W. Yau, K. Wang, Analyst 120, 1963 (1995).