

Selectophore Products – New Ion-Selective Sensor Materials for Food, Environmental, Biomedical and Industrial Applications

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INTRODUCTION

Ionophores are lipophilic, electron-rich complexing agents that are capable of reversibly binding ions and transporting them across organic membranes by carrier translocation. Because of the importance of developing new synthetic receptor molecules in construction of liquid membrane ion-selective electrodes, many cyclic and acyclic macromolecules have been introduced as ionophores.

For the following fields of applications we present the newest ionophores (see following columns):

Environment Industry Food and Beverages Pharmacy and Medicine

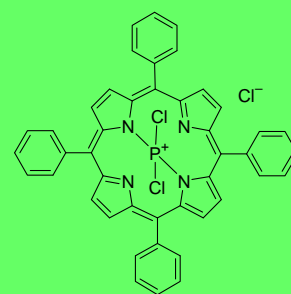
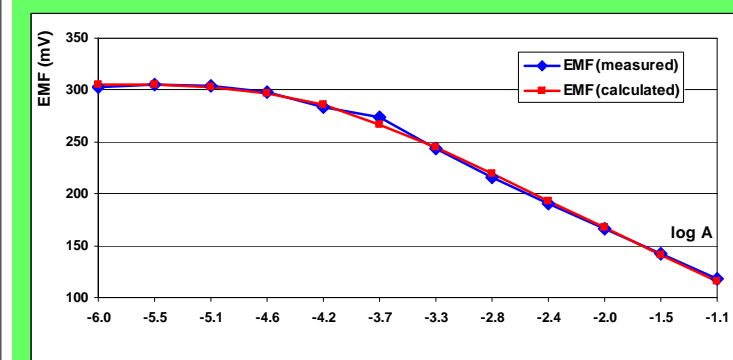
Potentiometric detectors based on ISEs are used in a wide range of applications for detecting various ions important in the clinical, environmental, and industrial areas, because they offer advantages such as high selectivity, sensitivity, good precision, simplicity, portable, non-destructive analysis, and low cost. Nowadays it is possible to obtain information concerning speciation by means of direct potentiometry using ISE. The continuous nature of the ISE measurement allows monitoring applications such as to environmental and medical samples.

Ion-selective polymeric membranes are containing usually about 30-33% (w/w) polymer and 60-66% plasticizer. Films with such a high plasticizer amount demonstrate optimum physical properties and ensure relatively high mobilities of their constituents. In order to give a homogeneous organic phase, the membrane solvent must be physically compatible with the polymer. For various reasons, it also has an influence on the selectivity behavior. Some of the common plasticizers are dioctyl phthalate (DOP), dioctyl sebacate (DOS), and 2-nitrophenyl octyl ether (o-NPOE). Ionic additives produce significant improvements in selectivity and decrease membrane resistance and electrode response time.

Environmental Application

05539 – Perchlorate Ionophore I, Selectophore®

Determination of perchlorate in surface and ground waters.⁴

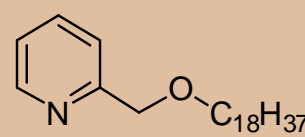
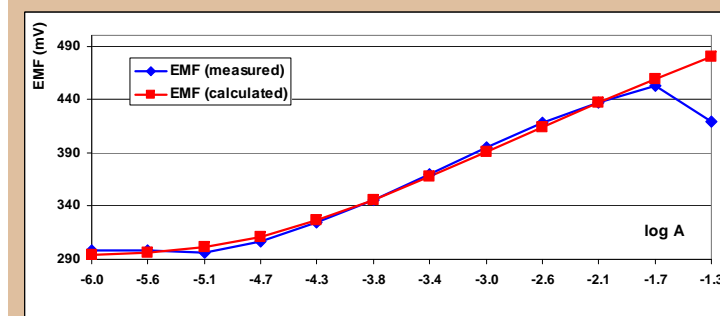


Potentiometric response of Perchlorate ionophore VI based PVC membrane sensor.

Slope (mV/decade)	-60.85
Linear range (M ZrCl₃)	0.079 to 2.18 • 10 ⁻⁴
Detection limit (mol/l)	1.09 • 10 ⁻⁴
Selectivity (logK^{pot}_{Zr3+,X}), X=	SCN ⁻ I ⁻ Cl ⁻ SO ₄ ²⁻ NO ₃ ⁻ acetate
(0.1M chloride solutions)	-2.72 -3.28 -6.18 -6.33 +1.33 -4.58

Industrial Application

19115 – Silver Ionophore VI, Selectophore

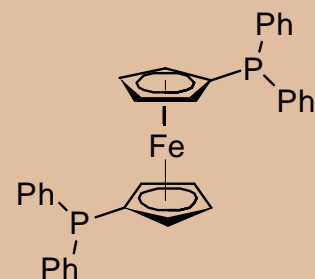
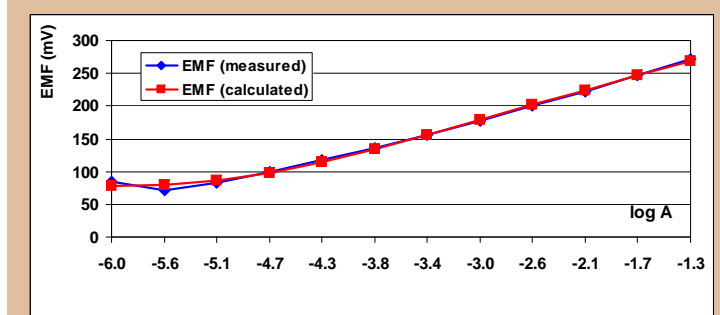


Potentiometric response of Silver ionophore VI based PVC membrane sensor.

Slope (mV/decade)'	54.57
Linear range (M AgNO₃)	6.8 • 10 ⁻⁵ to 0.04
Detection limit (mol/l)	3.4 • 10 ⁻⁵
Selectivity (logK^{pot}_{Ag+,X}), X=	Hg ²⁺ Zn ²⁺ Pb ²⁺ Ni ²⁺ Mg ²⁺ Na ⁺
(0.01M nitrate solutions)	-0.24 -3.04 -2.54 -0.50 -7.98 -1.91

68646 – Zirconium Ionophore I, Selectophore

Used as an indicator electrode in the potentiometric titration of zirconium ions with sodium fluoride and in the determination of zirconium ion in some alloy, tape and waste water samples.³



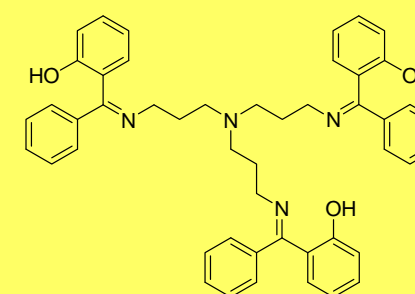
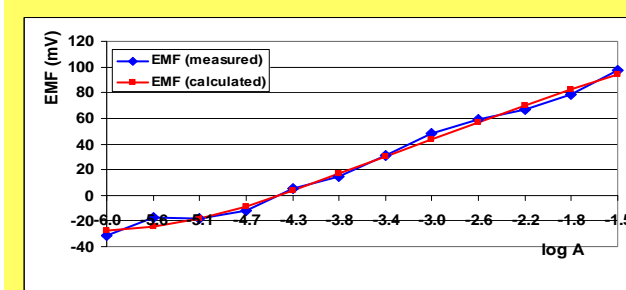
Potentiometric response of Zirconium ionophore I based PVC membrane sensor.

Slope (mV/decade)	+54.18
Linear range (M ZrCl₃)	0.05 to 5.05 • 10 ⁻⁵
Detection limit (mol/l)	2.02 • 10 ⁻⁵
Selectivity (logK^{pot}_{Zr3+,X}), X=	Co ²⁺ Ni ²⁺ Sr ²⁺ Ca ²⁺ K ⁺ Na ⁺
(0.1M chloride solutions)	-6.4 -8.4 -6.6 -9.5 -6.5 -20.7

Food and Beverage Application

41223 – Tin Ionophore III, Selectophore

Tin is widely applied in industrial processes especially in food industry for canned food. This is the main source for tin uptake by human. Although tin is not a highly toxic element, high concentration of tin affects the flavor of the juice and can also cause diarrhea. The maximum tolerance level of tin in foods defined by the WHO is 250 mg/g.⁵



Potentiometric response of Tin ionophore III based PVC membrane sensor.

Slope (mV/decade)	+33.15
Linear range (M SnCl₂)	0.033 to 2.02 • 10 ⁻⁵
Detection limit (mol/l)	1.11 • 10 ⁻⁵
Selectivity (logK^{pot}_{Sn2+,X}), X=	Cu ²⁺ Co ²⁺ Cd ²⁺ Ni ²⁺
(0.1M chloride solutions in 0.001M HCl)	-0.71 -3.68 -3.92 +1.01

All solutions contain 0.001M HCl.

Ionophores

Cat. No.	Ionophore	Package Size
61796	Lead VIII	50 mg
42942	Iron VI	50 mg
19115	Silver VI	50 mg
68646	Zirconium I	50 mg
05539	Perchlorate I	25 mg, 500 mg
41223	Tin III	50 mg

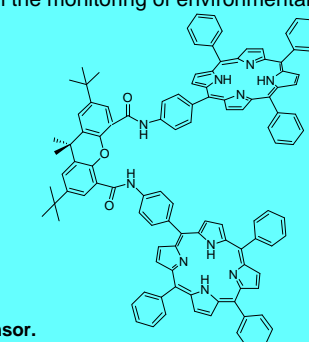
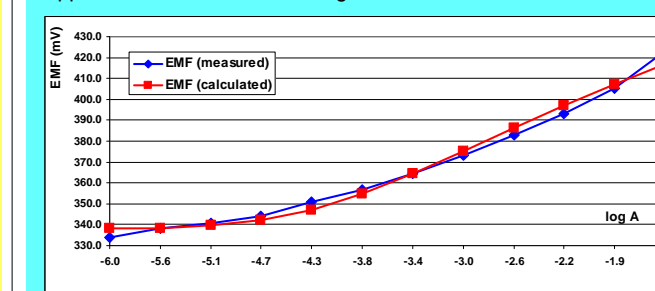
Literature

1	61796 Lead Ionophore VIII	W.-J. Zang et al., Analytical Letters 40 (2007) 1023-1035
2	42942 Iron Ionophore VI	R. Maleki et al., Turk. J. Chem. 33 (2009) 1-10
3	68646 Zirconium Ionophore I	M.B.Gholivand et al., Anal. Chim. Acta 584 (2) (2007) 302-307
4	05539 Perchlorate Ionophore I	M.Shamsipur et al., Sens. a. Act. B 89 (2003) 9-14
5	41223 Tin Ionophore III	M.Hosseini et al. Electroan. 2009, 21, No. 7, 859 - 866

Pharmaceutical / Medical Application

61796 – Lead Ionophore VIII, Selectophore

Application: used within the diagnosis of clinical disorders as well as in the monitoring of environmental samples.¹



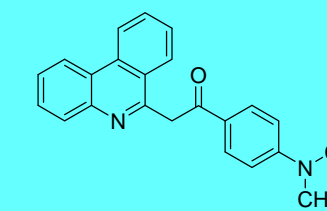
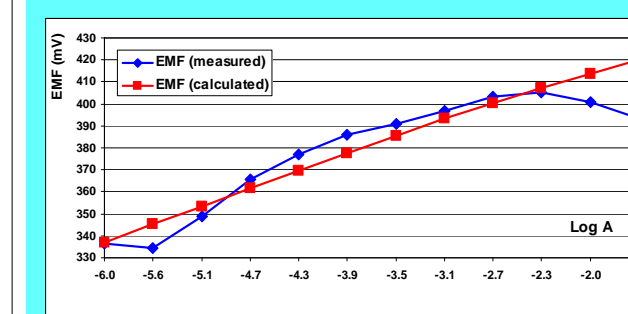
Potentiometric response of Lead ionophore VIII based PVC membrane sensor.

Slope (mV/decade)	+28.23
Linear range (M Pb(NO₃)₂)	1.93 • 10 ⁻⁴ to 0.03
Detection limit (mol/l)	9.65 • 10 ⁻⁵
Selectivity (logK^{pot}_{Pb2+,X}), X=	Na ⁺ K ⁺ Mg ²⁺ Ca ²⁺ Zn ²⁺ Cu ²⁺
(0.01M nitrate solutions)	-0.95 -0.6 -3.26 -3.14 -2.79 -14.47

All solutions are buffered with 0.001M TRIZMA-HNO₃ buffer, pH 6.0.

42942 – Iron Ionophore VI, Selectophore

Application: used within clinical analysis as well as in routine chemical and environmental analysis.²



Potentiometric response of Iron ionophore VI based PVC membrane sensor.

Slope (mV/decade)	+19.24
Linear range (M Fe(NO₃)₃)	0.024 to 2.87 • 10 ⁻⁸
Detection limit (mol/l)	1.44 • 10 ⁻⁸
Selectivity (logK^{pot}_{Fe3+,X}), X=	Cu ²⁺ Cd ²⁺ Zn ²⁺ Ca ²⁺ Co ²⁺ Ag ⁺
(0.01M nitrate solutions)	-6.4 -8.4 -6.6 -9.5 -6.5 -20.7