NOVEL POLYMERIC CHEMICAL SENSORS FOR DETERMINATION OF Pb(II) IONS

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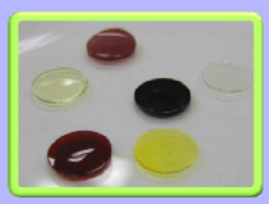
Novel poly(vinyl chloride) (PVC) plasticized membrane electrodes for determination of lead(II) ions based on N,N'-tetrabutyldiamide of dipicolinic acid as a neutral carrier were developed and studied. The sensors have demonstrated high sensitivity to Pb2+ ions over a wide concentration range 10-7 – 10-2 mol/L in unbuffered lead solutions with the slope of calibration curves in the range 30-45mV/decade, depending on concentration and the detection limit was about 7.0 pPb2+. The detection limit in buffered solutions was found to be as low as <10-9 mol/L (less then 200 ng of lead ions per litre) and the slope was 25 mv/pPb. Selectivity (expressed as logK) in the presence of Cu2+, Cd2+and Zn+2 ions is about -2, which means that 50-100 excess of interfering ions is acceptable for this Pb polymeric sensor.

Introduction

Determination of Pb^{2+} is very important analytical task. Chemical sensors seems to be attractive tool for this task as they are comparatively cheap, do not require complex equipment, measurements are fast and can be fully automated. We suggest novel ionophore for lead N,N'-tetrabutyldiamide of dipicolinic acid which allows to produce the sensors with high sensitivity and selectivity for Pb^{2+} .



Experimental

PVC sensor membranes were prepared according to the standard procedure. Measurements were performed with multichannel digital mV-meter connected to the PC for data acquisition and processing. Following galvanic cell was used:

Ag | AgCl, KClsat | sample | sensor membrane | solid inner contact | Ag

Results

Typical view of the calibration curve is presented in the Fig.1

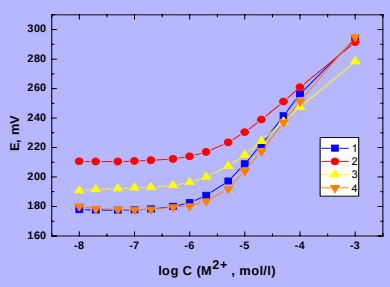


Figure 1. Calibration curve in water solutions of Pb^{2+}

When dealing with buffered solutions DL of the sensors can be significantly lower (see Fig.2).

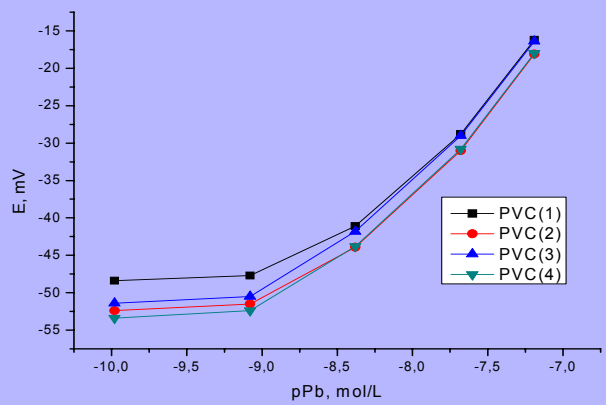


Figure 2. Calibration curve in model brackish sea water

Sensors selectivities were studied with fixed interference method at background different concentration levels of the interferring ions Zn^{2+}, Cu^{2+},Cd^{2+}. Results presented in the Fig. 3

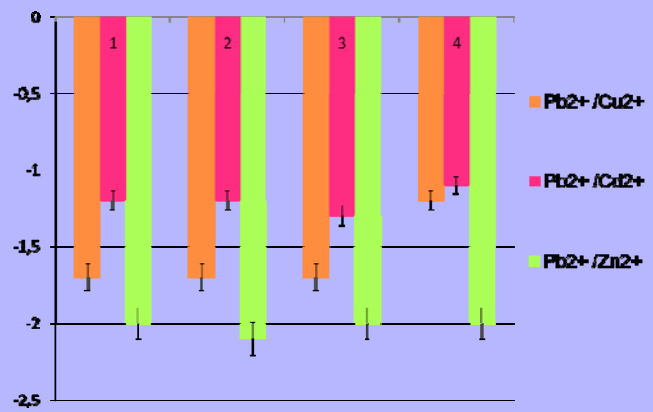


Figure 3. Selectivity coefficients (Log(Ksel))

Novel sensors have shown high selectivity to lead in presence of Zn^{2+}, Cu^{2+} and Cd^{2+}. Their application for real life lead monitoring task seems to be a nice alternative for the methods currently in use.

Sensors developed in the framework of WARMER project FP6-034472 and fully comply with the requirements specified therein.