Potentiometric Determination of Cyanide in Polluted Water Samples Using Screen-Printed Electrode modified with Ruthenium(II) Complexes Ionophores

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This paper reported a potentiometric cyanide sensors, based on the use of *cis*-(4-nitrobenzonitrile)-bis-(2,2'-bipyridyl)ruthenium(II)hexafluorophosphate (ionophore A) and *cis*-(3-formylbenzonitrile)-bis-(2,2'-bipyridyl)ruthenium(II)hexafluorophosphate (ionophore B). The sensors are prepared by incorporating of A and B ionophores into plasticized screen-printed sensors to form electrodes I and II, respectively. The best performance was obtained with a paste composition of graphite: *o*-NPOE:PVC: ionophore (A or B) ratio (w/w, mg) of 472.5:200:220:7.5. Significantly, the sensors exhibited enhanced selectivity toward cyanide ion over the concentration range 5.0×10^{-6} – 1.0×10^{-2} and 2.0×10^{-6} – 1.0×10^{-2} mol L⁻¹ with a lower detection limit of 5.0×10^{-6} and 2.0×10^{-6} mol L⁻¹ and a Nernstian slope of 58.57 ± 0.88 and 59.09 ± 0.31 mV decade⁻¹ at pH range from 3.0 to 8.0 and 3.0 to 9.0 for electrodes I and II, respectively. Influence of the paste composition and possible interfering ions on the response properties of the electrodes was investigated. Fast and stable response, good reproducibility and long-term stability are demonstrated. The sensors showed response time of <13 and 9 s and can be used for about 170 and 190 days without any considerable divergence in their potential response for electrodes I and II, respectively. Selectivity coefficients determined by fixed interference method (FIM) indicated high selectivity for cyanide ion. The proposed sensors showed fairly good discrimination of cyanide from many metal ions. This method was successfully applied for potentiometric determination of cyanide in environmental samples, and the results obtained agreed with those obtained with liquid chromatography (HPLC).

Keywords: Screen-printed sensor; Selectivity; Environmental samples; cyanide determination; ruthenium(II) complexes ionophores

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