

## Determination of ultra-trace amount of toxic mercury(II) ion in water samples

M. Movahedi\*, A. Firooz

*Department of Chemistry, University of Isfahan, Isfahan, Iran*

**Background and Aims:** Spectrophotometric detection based on optical chemical sensors is a relatively simple method and thus offers several advantages such as speed and ease of preparation and procedures, simple instrumentation, relatively fast response, wide response range, reasonable selectivity and low cost. In particular, there has been a great deal of activity in the field of ion-selective sensors for the trace analysis of toxic heavy metal ions in environmental and biological samples.

**Methods:** An optical chemical sensor based on 3,6,9,14-Tetrathiabicyclo[9,2,1]tetradeca 11,13-diene (TTBTD) in plasticized PVC membrane incorporating chromoionophore I (ETH5294) and sodium tetraphenyl borate (NaTPB) for determination of mercury ion is described. The response of the sensor is based on selective complexation of  $\text{Hg}^{2+}$  with TTBTD in the membrane phase, resulting in an ion exchange process between  $\text{H}^{+}$  in the membrane and  $\text{Hg}^{2+}$  in the sample solution. The influences of several experimental parameters, such as membrane composition, pH, and type and concentration of the regenerating reagent, were investigated.

**Results:** The sensor has a response range of  $3.9 \times 10^{-9}$  to  $7.8 \times 10^{-5}$  mol  $\text{L}^{-1}$   $\text{Hg}^{2+}$  with detection limits of  $8.1 \times 10^{-10}$  mol  $\text{L}^{-1}$   $\text{Hg}^{2+}$  and a response time of 100 s at optimum pH of 7.0 with high measurement repeatability and sensor to sensor reproducibility.

**Conclusions:** The optical sensor proposed here offers high selectivity for  $\text{Hg}^{2+}$  with respect to several common metal ions, and can be used for the determination of this element in water samples down to concentrations that are lower than the permitted level in domestic water supplies without pretreatment of the samples. The sensor offers a wide response range, short response time and can be easily regenerated using dilute nitric acid solution. By the means of an easy and low-cost methodology, satisfactory experimental results were obtained for the determination of Hg(II) ions.

**Keywords:** Optical chemical sensor; Mercury ion; Water analysis