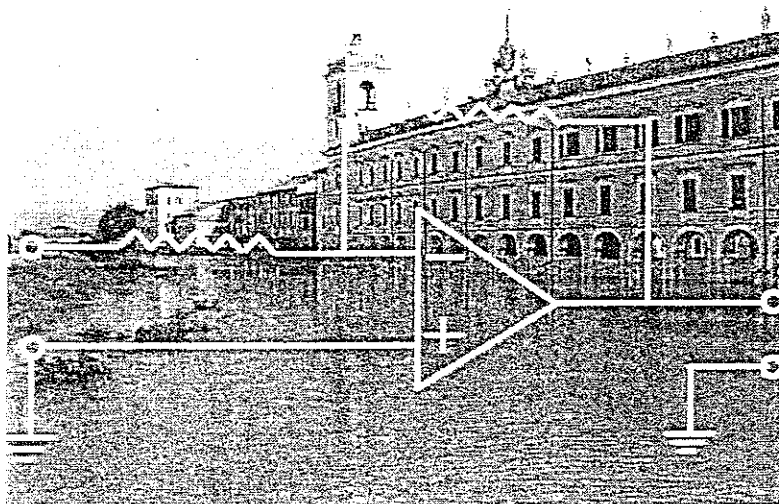


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Giornata di Studio

**I METODI ELETTROANALITICI
PER L'AMBIENTE:
POTENZIALITÀ E LIMITI**

Parma 16 maggio 2002

Centro S. Elisabetta
Università degli Studi di Parma

P4

Determination of total selenium in mineral and drinking waters by derivative constant current stripping analysis.

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Selenium is present on earth in small amounts, 0.6 mg Kg⁻¹ on an average (1). Selenium concentration is about 4 µg L⁻¹ in the oceans (2), whereas it is usually less than 10 µg L⁻¹ in surface and underground waters (3). Surface waters from regions with high selenium concentrations may contain from 50 to 300 µg L⁻¹ of selenium (4). Selenium is an essential element for man, as it enters the human metabolism and in particular it plays a role in the systems of antioxidant defence (5). Selenium is characterized by a very narrow margin between essentiality and toxicity levels. Toxicity appears at levels only from three to five times higher than those which are nutritionally recommended.

A method for the determination of total selenium in mineral and drinking waters by derivative constant current stripping analysis (dCCSA) using a mercury film-plated electrode is described. The sample after a proper concentration was prepared by addition of 6 M hydrochloric acid and mercury ions. During electrolysis, Se (IV) is reduced to Se (2⁻) on the surface of the electrode. The Se (2⁻) reacts with Hg (II) ions to form the insoluble salt, mercury selenide, HgSe, on the mercury film. During stripping, the mercury in form of HgSe is reduced to metallic mercury by means of a reducing constant current. Selenium is determined indirectly by measuring the signal from the amount of Hg obtained from the reduction of HgSe. Potential and time data were digitally converted into dtdE⁻¹, and E was plotted vs. dtdE⁻¹, thus increasing both sensitivity of the method and resolution of the analysis. Quantitative analysis was carried out by the method of standard additions; a good linearity was obtained in the range of concentrations examined, which represent values typically found in real samples. Recoveries of 95% were obtained from a mineral water spiked at different levels. The detection limit (expressed as 3σS⁻¹) was 0.1 µg L⁻¹ and the coefficient of variation (mean of six determinations) was 5.0%. The method was applied to selenium determination in different both mineral and drinking waters; the range of concentrations found was 0.8-1.2 µg L⁻¹.

Key words: water, selenium, dCCSA

References

- 1) A. E. Busev, V. G. Tiptsova, V. M. Ivanov, Analytical Chemistry of Rare Elements, Mir Publishers, Mosca, 1981.
- 2) J. L. Mero, The Mineral Resources of the Sea, Elsevier oceanography series I, Elsevier publishing company, Amsterdam, London, New York, 1965.
- 3) American Public Health Association, Standard Methods for the examination of water and wastewater, New York, 1971.
- 4) M. Floccia, G. Gisotti, M. Sanna, Dizionario dell'inquinamento, Editore NIS, 1985.
- 5) M. E. Shils, J. A. Olson, M. Shike, Modern nutrition in health and disease, 8th edition Ed. Lea & Febiger, Philadelphia, 1994.