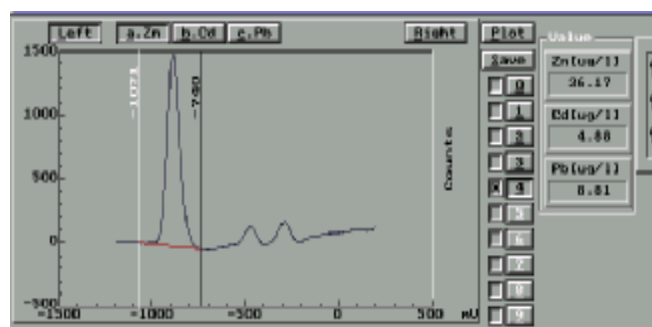




Operation principle

EcaFlow is based on flow-through electrochemistry/coulometry. The system enables coulometric and voltammetric measurements, as well as coulometric microtitrations. In the coulometric mode a special cell equipped with porous flow-through working electrode is used.

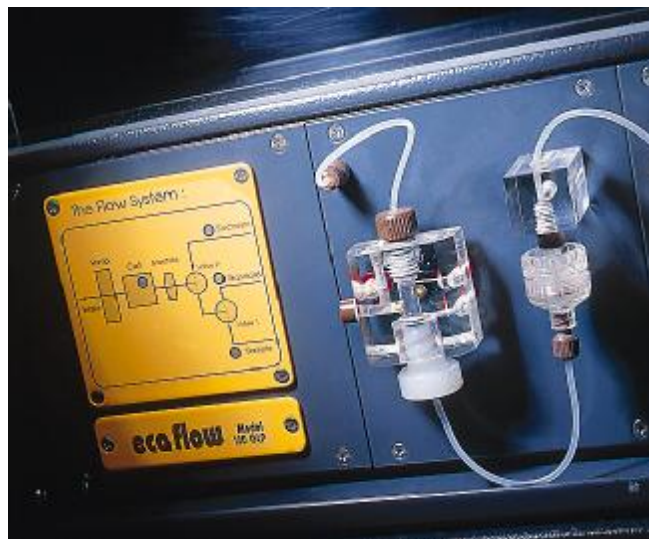


Moreover, if appropriate, the system can make determinations in the classical voltammetric mode by using any electrode system e.g. hanging mercury drop electrode, wall-jet electrode, rotating disk electrode etc..

Technical description

EcaFlow is a compact laboratory instrument controlled by an IBM compatible PC.

The control unit contains the current support unit, control processor with the channel analyser, fast A/D and D/A converters and a switchable potentiostat/galvanostat.



The compact flow system is controlled by the control unit and operates fully automatically. It contains computer controlled electromagnetic valves for switching either to the sample solution or to an electrolyte solution or to a standard solution for the standard addition. Solutions are driven by a peristaltic pump. The heart of the system is the patented compact electrochemical cell.

The cell uses a disposable porous flow-through working electrode made of suitable inert material. The counter and reference electrodes are separated from the flowing solutions either by an ionex membrane or hydrodynamically, so the reaction products at the counter electrode cannot interfere at the working electrode. The working electrode can be easily changed simply by loosening a screw. The cell is fixed to the panel of the instrument by a special connector which serves as an electrical contact to the electrodes. The connections of the tubes are made of Luer-type fitting, which facilitates fast manipulation when the electrode or cell is changed.



Determined species

The following groups of metal species can be determined simultaneously in the calibrationless or calibration mode by

the use of the delivered applications prepared according to ISO 78/2-1982:

Zn, Cd, Pb, Cu in various matrices,
Hg, Cu, As in various matrices
Se, As in waters
As in urine and complex matrices
Sn, Sb, Bi in various matrices
Au, Ag in various matrices
Mn in various matrices
Fe in waters
Cr(VI) and total Cr in waters
Ni in various matrices
Cl, Br, I in waters
I in urine, beverages
NO₃⁻, chlorites, bromates in waters
Ascorbic acid in foods and beverages
Phosphates in waters

Metrological data

The guaranteed *accuracy* of the method checked by reference materials is better than 10 % for the ppb concentration region. The *precision* in the same region is between 1 and 5 % depending on the element determined. The *detection limits* for 5 ml sample volumes are about 0.1 ppb (Cd, Pb, Hg), 0.3 ppb (Se, As, Cu), 1 ppb (Zn), 5 ppb (Mn, Sn, Bi) and 10 ppb (Fe, Cr, iodine, sulphide). However, these values can be improved by using purified reagent solutions and larger sample volumes. The *concentration range* without sample dilution expands from the sub-ppb region up to 10-100 ppm, i.e. at least 5 concentration ranges.

Sample throughput

5 to 20 analyses per hour can be performed with the system. The sample throughput depends on the sample volume taken for analysis. For example, by analysing 1 ml sample solution, 10 complete analyses can be carried out in an hour.

The autosampler AS-150 for 42 sample solutions makes the analyses more efficient.

Samples and sample preparation

Various sample types can be analysed by the system:

- Water samples (tap water, mineral waters, surface waters, waste waters)
- Wines, beers, spirits
- Sludges and wastes after digestion
- Biological materials (urine, blood, plants, tissues) after digestion
- Solid inorganic samples (geological materials, soils) after digestion.

Interferences

Possible interferences arising from the sample matrix (surfactants, strong oxidants, etc.) can be managed by proper sample preparation. Details are given in the application lists.

Limitations

Electrochemically active species (e.g. aquated metal and non-metal ions, labile complexes, etc.) can be determined only, especially those forming reversible redox systems. Like in potentiometry with ion selective electrodes, the response signal corresponds to these species rather than to total metal ion concentrations. However, if regarding metal mobility, toxicity and biological activity, this information is more relevant than those about total metal concentrations obtained by spectroscopic means.

Advantages over other analytical systems

- The analysis including the calibration proceeds totally automatically and with much higher sample throughput than in classical stripping voltammetry.
- The presented systems is the only one on the market which enables fully automatic determination of metal ions in the mg/l and lower concentration range in the calibrationless mode.
- Since coulometry is used as the determining method, the dynamic concentration range is virtually unlimited, spanning the ppb and sub-ppb region up to the upper ppm concentrations.
- The system is flexible, the hardware and software allows the use of other modes such as direct coulometry, voltammetry, potentiometry, conductimetry as well as other electrode systems.
- There is no need to use technical gases for sample deairation (a unique feature absent in other electrochemical instruments), so the system is also suitable for field applications.
- The GLP software features automatic validation, automatic archivation of the results and parameters of the analyses and printing of the reports.

Technical parameters

Potential-/galvanostat:	12 V / 10 mA
Cell:	Model 353b with three electrodes
Flow system:	Full computer control with peristaltic pump
Mass:	7 kg
Dimensions:	500 x 450 x 140 mm
Software:	Determination of heavy metals pH-metry, ionometry (option) Conductometry (option)
Computer (option)	Any IBM compatible PC .
Autosampler (option)	42 or 10 positions + blank + standard

Producer:	ISTRAN Ltd. , Radlinskeho 27 811 07 Bratislava, Slovakia Tel.: +421-2-5263 3171 Fax: +421-2-5263 3172 e-mail: istran@istran.sk
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