

Stripping Voltammetry

Voltammetry refers to techniques in which the relationship between voltage and current is observed during an electrochemical process.

IF YOU ARE THINKING OF BUYING AN AAS OR ICP STOP AND PLEASE READ THIS FIRST

Many good reasons why you should consider buying a 797 VA Computrace instead:-

- The 797 offers lower limits of detection (LOD) than spectroscopic techniques , parts per trillion limits of detection are easily achievable (new directives on effluent monitoring and drinking water regulations now mean even lower LOD's are required)
- Capital outlay is a fraction of spectroscopic techniques coupled with extremely low running costs.
- No alterations to the infrastructure of your laboratory as instrument is portable and space saving.
- Doesn't just analyze for transition metals, can also do anions and organics if electrochemically active.
- Can speciate certain metals if required.
- Calibrates each and every time via standard addition eliminating many matrix effects seen in other techniques.
- Even normally difficult samples by spectroscopic techniques are easy e.g. salt solutions or plating baths.
- Many official methods available e.g. 'Blue Book', EPA and DIN standards.

As one of the most versatile analytical techniques, Voltammetry serves a broad array of applications. Metals, non-metals, anions, and organics can be determined in a wide range of sample matrices, including:

- Foods / Polymers
- Beverages / Plastics
- Drugs / Chemicals
- Cosmetics / Plating Baths
- Animal Feeds / Raw Materials
- Water / Wastewater / Pollution Monitoring
- Herbicides / Pesticides

If there is a very complex mixture of ions and molecules in the sample matrix e.g. seawater, Voltammetry can still monitor an ionic species down to parts per billion sensitivity.

A considerable increase in the sensitivity of polarographic & voltammetric methods can be obtained by enrichment of the substances to be determined prior to the polarographic or voltammetric determination itself, usually by electrolysis at a stationary working electrode.

The determination process is known as "inverse" because it generally takes place with the current flowing in the reverse direction to, that which was used, for the electrolytic enrichment. In the simplest case, the enrichment electrolysis consists of the reduction of a cation to the free metal, which, for example, may be soluble in a stationary mercury electrode owing to amalgam formation. If the enriched electrolysis, which may be likened to electrolytic extraction, is carried out under suitable conditions, the amalgam will contain a higher concentration of the element under investigation than was to be found in the original aqueous sample solution. The concentration of the metal in the amalgam depends on the electrolysis conditions (such as time). The "amalgam electrode" can carry out the actual voltammetric determination thus formed.

Suppose, for example, that we plot the current/voltage curve by normal DC Polarography in the anodic direction (i.e. from the negative to a positive voltage); we will obtain a current peak whose height is a function of the concentration of the metal in the amalgam and hence, provided the electrolysis conditions were constant, of the concentration of the metal in the original aqueous sample solution.

$\text{Cd}^{2+} + 2\text{e}^- \rightarrow \text{Cd}^0$ (Hg) enrichment

$\text{Cd}^0 \rightarrow +\text{Cd}^{2+} + 2\text{e}^-$ inverse voltammetric determination

Inverse Voltammetry is a highly sensitive analytical method enabling solutions on the ppb range and even below to be analyzed with a high degree of efficiency using comparatively inexpensive apparatus.

After separation either as a mercury amalgam or on inert electrodes, the following elements can be determined: gallium, indium, thallium, lead, tin, antimony, bismuth, copper, silver, zinc, cadmium, mercury, manganese, iron, cobalt, nickel, etc.

Halides and a few other anions may be determined by using electrodes, which react chemically with them, while beryllium and aluminum can be determined after adsorptive enrichment.

The full range of Metrohm Titration products can be viewed at www.metrohm.co.uk