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Surfactant electrodes / Surfactrodes

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1 Surfactant electrodes / Surfactrodes

1.1 General

Immediately after receiving the electrode, check to make sure that it works properly. Electrodes that do not work properly must be sent back for warranty processing within two months (starting from the day of delivery). If the defect is proven to be due to a material or manufacturing defect, the electrode will be replaced at no charge. The transport costs are to the customer's account.

An external reference electrode, e.g. 6.0726.100, is required for all surfactant electrodes. More detailed application information can be found at *www.metrohm.com/com/Applications*.

1.2 Sensors for aqueous titrations

These are chiefly used for "unproblematic" samples. In contrast to the manual Epton two-phase titration (where toxic chloroform is used) this analysis is environmentally friendly.

1.2.1 Surfactant electrodes

The following Application Bulletins (AB) deal with aqueous titration of surfactants:

AB 233: Ionic surfactants

AB 263: Nonionic surfactants

The electrodes are not resistant to solvents as its membrane contains PVC. It can be briefly cleansed or rinsed with methanol. The amount of methanol should not exceed 5% for long-term use.

Electrode handling

CAUTION

Do not use the ultrasonic bath for electrodes, as they may be damaged by such a treatment.

CAUTION

The electrode is not resistant to most organic solvents (PVC membrane). Chloroform, hydrocarbons, acetone, methyl isobutyl ketone, tetrahydrofuran, etc. destroy the electrode. Large amounts of methanol or ethanol shorten the lifetime of the electrode.

- Store the electrode dry.
- Carry out two to three test titrations to condition the electrode without using the titration data.
- Adhesive precipitates can be removed using a soft cloth moistened with methanol. In sample changer operation, briefly immerse the electrode in methanol under stirring.
- Under normal conditions, the electrode lasts for several thousand titrations. A deterioration in its sensitivity is indicated by the titration curves becoming flatter and a reduced potential range. In the short-term such an electrode can be regenerated as follows:
  - Ionic Surfactant electrode: Immerse in sodium dodecyl sulfate solution (0.004 mol/L) for approx. 30 min.
  - Cationic Surfactant electrode: Immerse in TEGO®trant solution (0.004 mol/L) for approx. 30 min.
  - NIO Surfactant electrode: Immerse in sodium tetraphenylborate (0.01 mol/L) for approx. 30 min. (NIO = nonionic)

  If these measures do no longer have the desired effect, the electrode must be replaced.

Special points regarding the handling of NIO Surfactant electrodes

- Carry out two to three test titrations to condition the electrode without using the titration data.
  If you frequently carry out nonionic surfactant titrations the electrode can be stored in a 1% aqueous solution of polyethylene glycol 1,000. It is then no longer necessary to condition it before use.
- The electrode should be used either for nonionic surfactant titrations or for the titration of pharmaceutically active substances (not for both applications).

1.3 Sensors for two-phase titrations

These electrodes are used in accordance with the classical Epton two-phase titration method. As a result, the results that are obtained are comparable. As an alternative to chloroform, other solvents which are immiscible with water can be used, for example methyl isobutyl ketone, hexane or cyclohexane. The electrodes are suitable for the titration of ionic surfactants. They are used in the following cases:

- When large amounts of nonionic surfactants and/or betaines are present in formulations.
- When the sample contains interfering fat or oil components (cooling lubricants, drilling oils, oil-containing cosmetic formulations such as shower gels, bath additives, skin-protecting hand-washing detergents, oil-containing furniture care products).
- When water-insoluble surfactants are used.
- When shorter-chain surfactants (e.g. C8) or ether sulfates with a higher share of ethoxy groups are used.
- When samples with strong oxidants such as active chlorine or hydrogen peroxide and other peroxides are used.
- When washing powders are used.

1.3.1 Surfactrode Resistant electrodes

This electrode is mainly used for the analysis of raw materials, drilling and cutting oils, cooling lubricants and other oil-containing samples, also when chloroform is used as the solvent. See Application Bulletins No. 269 and No. 275.

Electrode handling

CAUTION

Do not use the ultrasonic bath for electrodes, as they may be damaged by such a treatment.

CAUTION

The electrode is not resistant to alkaline solutions. Therefore, do not use above pH = 10. It should also not be exposed to higher salt concentrations.

CAUTION

Do not drop the electrode on hard surfaces, as it is shock-sensitive.

- Store the electrode dry.
- The electrode is resistant to all solvents normally used in surfactant analysis. All these solvents can be used to clean it.
- Under normal conditions, the electrode lasts for several thousand titrations. A deterioration in its sensitivity is indicated by the titration curves becoming flatter, a reduced potential range and uneven curves. It can be regenerated at any time by roughening the sensor material (e.g. with sandpaper). In some cases storing it in a drying oven for one hour at 60 °C or immersing it in a 1% aqueous solution of polyethylene glycol 1,000 helps.

1.3.2 Surfactrode Refill electrodes

This electrode is mainly used for titrating washing powders and soaps, etc. It cannot be used in conjunction with chloroform, as this substance dissolves the sensor material too quickly. See Application Bulletins No. 269 and No. 275.

Principle

Owing to its concept, the electrode has a virtually unlimited lifetime. During titration, layers of the sensor material are stripped from the electrode. As a result, a new sensor surface is formed with each titration, which results in a fast response behavior and a high tolerance towards components in the measuring solution that might cover the sensor surface. The Surfactrode Refill's sensor material is ductile and can therefore be refilled or replaced very easily and as often as needed.

A small bore hole is located on the shaft base (**1**). The sensor material is pressed into this hole using a simple tool. After filling, the electrode is immediately ready for use. However, a check titration is recommended. One filling is sufficient for at least one day of continuous work. If the electrode is used for an entire week (perhaps in conjunction with a sample changer), for example, it should be refilled daily.

Electrode handling

CAUTION

Do not use the ultrasonic bath for electrodes, as they may be damaged by such a treatment.

- Store the electrode dry.
- The electrode is immediately ready for use and does not normally need to be conditioned. In special cases a pretitration may be required.
- The electrode is resistant to all solvents normally used in surfactant analysis but not to chloroform.

Filling the Surfactrode Refill with sensor material

Sensor material and one tool are contained in the scope of delivery. To fill or refill the Surfactrode Refill, proceed as follows:

- Screw off the connecting cable and screw on the protective cap.

- Place the electrode head vertically on a hard surface with the base (**1**) facing upwards.
- Fill the sensor material into the bore hole and compact the material using the tool supplied. (It is not necessary to remove sensor material residues still present in the bore hole before the refill process.)
  When refilling the electrode it is important that the electrode head is held firmly on the hard surface and that the tool is pressed in until the built-in spring reaches its stop.
- If the filling level is not sufficient, repeat the filling and pressing process.

In an electrode which has been properly filled, the fill level of the compacted sensor material is slightly below the electrode shaft and its surface is uniformly smooth. Any sensor material remaining on the base of the shaft after the filling process can be simply wiped off with a soft paper towel. The sensor material has a storage life of several years.

1.4 Literature

- R. Schulz, Titration von Tensiden und Pharmaka - Moderne Methoden für den Praktiker Verlag für chemische Industrie, H. Ziolkowsky GmbH, Augsburg 1996, ISBN 3-87846-182-8
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- D.C. Cullum, Introduction to Surfactant Analysis, Blackie Academic & Professional, London 1994, ISBN 0-7514-0025-4