

Reagecon

A CALIBRE SCIENTIFIC COMPANY



Electrochemistry Standards and Reagents

- pH Buffer Solutions
- Conductivity Standards
- Electrode Care & Maintenance
- Redox Standards
- Turbidity Standards
- Chemical Oxygen Demand (COD)
- Ion Selective Electrode Standards
- Ionic Strength Adjustors



SCHOTT
pH-Elektrode Blue
pH 0.14 / 6.100

edgecon

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About Reagecon

Reagecon, part of the Calibre Scientific Group of companies is one of the largest producers of Physical and Chemical Standards. The company is based in an 8,000 sq. metre facility that includes a large suite of manufacturing, quality control and research and development laboratories in Shannon, Ireland with sales offices in Shanghai and North America, Europe and the UK through our Calibre Scientific sister companies. Reagecon employs 100 people, 50% are chemistry or science graduates and most are involved in the development, production, testing, quality control and sales & marketing of over 10,000 product references that we currently produce. We have a very active R&D programme and develop and bring to market many hundreds of new standards, every year.

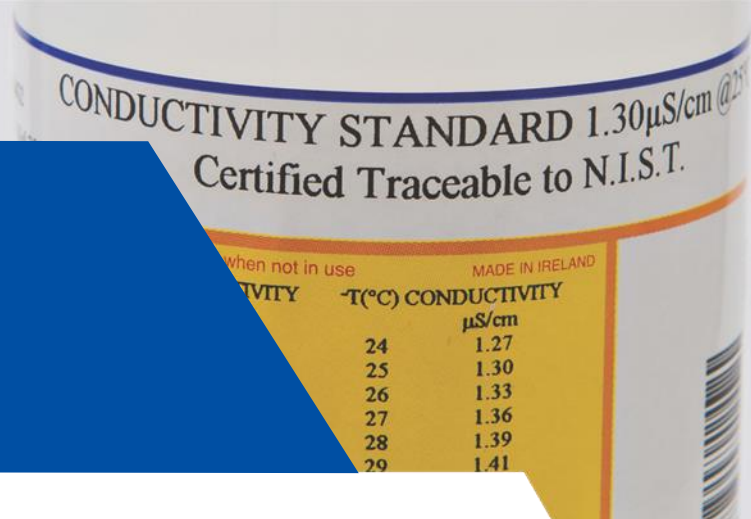
All Reagecon manufactured products are underpinned by and demonstrate our position as a centre of excellence in the science of Metrology. Product is manufactured, tested, and certified under the applicable ISO/IEC 17025 (A2LA Ref: 6739.03) or ISO/IEC 17034 (A2LA Ref: 6739.01) accreditation or ISO/IEC 17025 (A2LA Ref: 6739.02) for Calibration, in one of our 20 specially equipped laboratories.

The resulting product is classified within one of 54 product families, these families are then grouped and promoted under 7 main product headings, as listed below:-

- ✔ Electrochemistry Standards
- ✔ Cation and Anion Standards
- ✔ Pharmacopoeia Reagents and Standards
- ✔ Physicochemical Standards
- ✔ Total Organic and Inorganic Carbon Standards
- ✔ Volumetric Solutions for Titration
- ✔ Customised Standards and Reagents



Conductivity Standards



Summary of Features & Benefits

COMPREHENSIVE RANGE OF PRODUCTS

- ✓ Reagecon offers the widest range available on the market of aqueous standards from 1.3 $\mu\text{S}/\text{cm}$ to 500,00 $\mu\text{S}/\text{cm}$

STABILITY

- ✓ Reagecon is the ONLY producer of low level, aqueous based, stable 1.3 $\mu\text{S}/\text{cm}$ conductivity standard.

ACCURACY

- ✓ Accurate to $\pm 1\%$ of target value, with the exception of 1.30 $\mu\text{S}/\text{cm}$ which has a specification of ± 0.05 $\mu\text{S}/\text{cm}$ from target value

QUALITY PRODUCTION

- ✓ Standards are tested using Accredited test methods to ISO17025

FULLY CHARACTERISED TEMPERATURE VALUES

- ✓ Fully characterised temperature coefficient of variation printed on all product labels.

NON-HAZARDOUS

- ✓ No shipping, storage or disposal issues

TRACEABILITY

- ✓ All directly traceable to N.I.S.T. standard reference materials. These products meet the specification requirements of all the major Pharmacopoeias

COMPREHENSIVE CERTS OF ANALYSIS

- ✓ Certificates of Analysis for all batches

Introduction

Reagecon is the largest producer of **conductivity standards** and is credited with the invention of low level aqueous standards. The company is still the only producer worldwide with the capability to manufacture and stabilise these products at such low levels of conductivity. This low range of standards includes **1.3 $\mu\text{S} \pm 0.05$ $\mu\text{S}/\text{cm}$** - the lowest aqueous conductivity standard available. The following summary details the principle features and benefits of this exciting range of products.

Extensive range of values

Reagecon offer over 45 different values of Conductivity and **Total Dissolved Solids (TDS) standards**, ranging from as low as **1.3 $\mu\text{S}/\text{cm}$** to as high as **500,000 $\mu\text{S}/\text{cm}$** .

Matrix Matched

The matrix of a solution is defined as “the components of the sample other than the analyte”. In all analytical measurements, it is of utmost importance that the matrix of the standard and the sample are the same. As conductivity measurement is, in the main, a water quality measurement, the standard used should also have an aqueous matrix. Reagecon’s **conductivity standards** are all aqueous based, thereby eliminating any errors attributable to matrix mismatch.

Non-Hazardous

As Reagecon's **conductivity standards** are aqueous, they are non-hazardous. They offer the following benefits over solvent-based conductivity standards

- ✔ Ease and cost of shipping, without the need to provide hazardous goods' paperwork
- ✔ Reduced Health & Safety requirements for storage and use
- ✔ Ease and cost of disposal - solvent-based conductivity standards require expensive, specialised disposal to comply with environmental regulations.

Guaranteed Stability

As a result of the extensive R&D that led to our innovative manufacturing process, Reagecon can guarantee the stability of their complete range of conductivity standards over their entire shelf life. The stability offered by Reagecon's conductivity standards varies from that of their competitors in one vital area. We can guarantee that our **conductivity standards** will remain within specification, (up to their expiry date), right through their working life, regardless of when the bottle was first opened provided Good Laboratory Practise is adhered to. This eliminates the need to open a fresh bottle of standard every time the product is used. (The **1.30 $\mu\text{S}/\text{cm}$ conductivity standard** is packaged in single-dose bottles and each bottle when opened can only be used once.) The shelf life of the products from their date of manufacture are given below.

Accuracy

All standards have a specification of $\pm 1\%$, except **1.30 $\mu\text{S}/\text{cm}$** , which has a specification of 1.25 - 1.35 $\mu\text{S}/\text{cm}$. This high level of accuracy enables the standards to be used as calibrators and/or controls in fulfilment of the most exacting industrial statutory requirements, for example the United States Pharmacopoeia monograph for Water for Injection.

Accreditation

Reagecon's conductivity measurement has been covered in the scope of our accreditation to ISO 17025 "General Requirements for the competence of Calibration and Testing Laboratories" and its predecessor, EN 45001, since 1990. ISO/IEC 17025. Achieving accreditation involves fulfilling many highly technical criteria, including fully validating our test methods and instrumentation systems and characterising our measurement uncertainty. Reagecon's accreditation proves the technical competence of our personnel, the technical validity of our test procedures and the traceability of our measurements. Therefore, in purchasing a conductivity standard from us, not only do you have transparent traceability to primary standards, but you also have confidence that our standards are of a well-defined and tightly controlled specification.

All values are Certified & Traceable

Comprehensive Certificates of Analysis are available for all of Reagecon's **conductivity standards**, including detailed information on:

- ✔ Product Number
- ✔ Lot Number
- ✔ Expiry Date
- ✔ Mean specific conductance
- ✔ Date of Measurement
- ✔ Assay limits
- ✔ Test Method Used
- ✔ Uncertainty of Measurement and Traceability Data

The complete range is traceable to primary standards from the United States National Institute for Standards and Technology (NIST). The traceability of these standards is proven by the inclusion of conductivity testing in our ISO 17025 accreditation. It is a fundamental requirement of ISO 17025 that traceability is proven.

Characterised Temperature Coefficient of Variation

Reagecon's standards are aqueous based and consequently have a very low temperature coefficient of variation. A table of conductivity variation with temperature is printed on the label of each bottle. This feature provides the user with all the information necessary to use the products across the full range of measurement temperatures encountered for their application. Non-aqueous standards have a very high coefficient of variation which leads to measurement error and renders the products totally unsuitable for non-temperature controlled conditions, or field work.

Unparalleled Technical Support

We have been manufacturing conductivity standards for over 20 years. In that time, we have built up a vast resource of technical expertise on all aspects of conductivity measurement. The members of Reagecon's Technical Services Department have written a comprehensive series of papers covering all of the practical requirements for accurate conductivity measurement. These papers are available via our website - www.reagecon.com

Our Technical Services team is always on hand to answer any questions regarding the selection and use of conductivity instruments, sensors and standards.

pH Buffer Solutions



Summary of Features & Benefits

QUALITY PRODUCTION

- ✔ pH testing is ISO 17025 Accredited
- ✔ Values specified at specific temperatures e.g. 20°C/25°C
- ✔ Manufactured to exacting specifications with an extended shelf life & stability

TRACEABILITY

- ✔ Directly traceable to the IUPAC pH scale by an unbroken chain of traceability. Reagecon achieve this traceability through a series of comparisons, with the key reference materials being Standard Reference Materials (SRMs) manufactured by NIST

STABILITY

- ✔ Guaranteed stability throughout entire shelf life, even after opening the bottle, eliminates the requirement to open a fresh bottle of standard every time it is used

LABELLING

- ✔ Temperature dependence data is printed on the label as are lot numbers and expiry dates for user convenience

COA & SDS

- ✔ Certificates of Analysis and Safety Data Sheets available online

Extensive range of pH values

Reagecon manufactures the most comprehensive range of **pH Buffer Solutions** available to the marketplace, which have been designed to suit all user requirements

- ✔ Laboratory Grade Buffers, **pH range 1-13**
- ✔ **Colour Coded Buffers** for Calibration pH 4, 7, 10
- ✔ Professional Range (**Technical, NIST/DIN & High Resolution Buffers**)
- ✔ **Low Ionic Strength Buffers**
- ✔ **pH Buffer Capsules**

We are delighted to add several new offerings that include buffers to calibrate

- ✔ **Antimony** Electrodes
- ✔ Sterile Buffers
- ✔ Colour Coded pH Buffers with a three decimal place specification.

Various packaging options are offered for ease of use e.g. Colour Coded, Twin Neck Bottles, Bag-in Box.

All are manufactured to exacting specifications with an extended shelf life and cover the pH range of pH 1.00 to pH 13.00 inclusive. All are supplied with a detailed Certificate of Analysis which outlines traceability to N.I.S.T (the N.I.S.T SRM(s) Lot No. is stated on the certificate). Temperature dependence data is printed on the label as are lot numbers and expiry dates.

Guaranteed Traceability

Reagecon's pH buffer standards are directly traceable to the IUPAC pH scale by an unbroken chain of traceability. Reagecon achieve this traceability through a series of comparisons, with the key reference materials being Standard Reference Materials (SRMs) manufactured by NIST.

For proof of traceability, all of these comparisons must be made in a technically - valid manner and the accuracy of each step must be quantified by calculating the associated Uncertainty of Measurement. Reagecon's pH buffer standards meet the ISO definition of traceability: "The ability to relate measurements back to a stated reference (usually an international standard) through an unbroken chain of comparisons, each having stated uncertainties of measurement." Reagecon's traceability claims are guaranteed by our accreditation to ISO/IEC 17025.

Why use traceable pH Buffers ?

Your pH measurements can only be as good as the pH buffers that you use. If your pH calibration is made using traceable pH buffers then you have a direct link to the International pH scale for your measurements. Without this link, you are not entitled to report your measurements in pH units so the number displayed on your pH meter is just that - a number and is not a pH value. The common link that is achieved by traceability allows comparability of results regardless of:

- ✔ When the measurements were made
- ✔ Where the measurements were made
- ✔ What instrumentation was used to make the measurements

Traceable analysis is necessary for consistency and universal acceptance of your pH results - including acceptance by regulatory bodies.

Fully Accredited

Reagecon's pH analysis is accredited to ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories". Reagecon's accreditation to ISO/IEC 17025 gives independent proof of three key areas:

- ✔ Our pH analysis is technically valid and is carried out in a thoroughly controlled manner by highly - qualified staff.
- ✔ Our claims over the accuracy of our pH analysis are valid and we have properly quantified our accuracy in our Uncertainty of Measurement calculations.
- ✔ Our pH analysis is traceable to NIST SRMs. It is important to note that NIST do not police claims of traceability to their SRMs.

Why take chances with your pH buffer supplier's traceability? By using buffers from a manufacturer that holds ISO/IEC 17025 accreditation you have a guarantee of traceability.

Stability

Reagecon's pH buffers have been specially formulated to ensure their stability. The packaging bottles that we use have also been selected and tested to provide maximum stability. We have conducted stability trials on both freshly-opened and part-full bottles of our pH buffers to validate their shelf-life - an example is given in Figure 2. This demonstrates that Reagecon's pH buffers will stay within their specification limits up to the stated expiry date regardless of when the bottle was first opened (provided that the pH buffer is stored in accordance with good laboratory practice). Most of Reagecon's pH buffers have an expiry date of either 2 years or 3 years from the date of manufacture.

This means that our pH buffers' expiry dates are an absolute value and they have a long "Active Life". We do not quote a short usage period after opening the bottle and there is no need to record by hand an "Opened on date" and a "Use by date". With Reagecon's pH buffers you just open the bottle and use the contents - with other manufacturers' pH buffers you need to record these extra dates and may need to dispose of most of the contents of the bottle at the end of its short "Active Life".

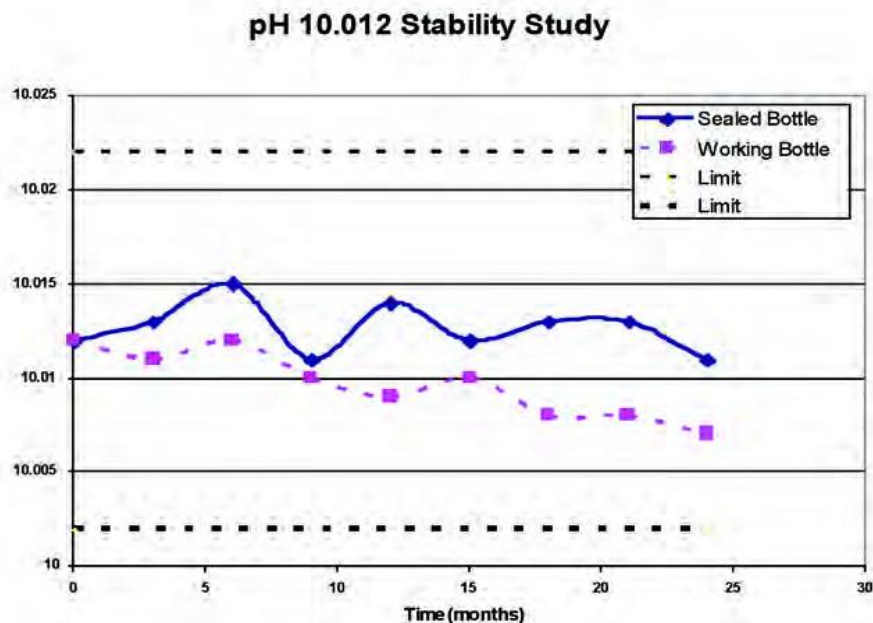


Figure 2: Stability Data for Reagecon pH 10.012 @ 25°C

Calibration Buffers

Reagecon pH Buffers are pre-programmed into the instruments of most major manufacturers.

Control Buffers

For increased confidence in their test measurements, analysts should regularly measure the pH of a Control Standard. If an acceptable value is obtained from the Control Standard measurement then the analysts, can have improved confidence that their test measurements will be correct. Reagecon's extensive range of pH buffers means that there will be a Reagecon pH buffer which can be used as a control buffer for all pH applications.



Packaging Options

Besides regular bottles, Reagecon offer pH buffers in a wide variety of convenient packaging options:

- ✔ Twin-neck bottles. These bottles are ideal for use with portable pH meters. Their integral calibration chamber prevents contamination and removes the need to carry a separate measuring container or to decant buffers for use in the field.
- ✔ Bag-in-Box containers. This packaging consists of a cardboard box with a collapsible plastic liner. This offers a space-saving alternative to bottles and reduces the amount of packaging waste for disposal. Every Bag-in-Box container is supplied with a tap to allow the contents to be easily dispensed.
- ✔ Capsules. The presentation of pH buffers in capsule format is an innovative concept developed by Reagecon, and offers several advantages
- ✔ RECAL Buffers. RECAL is a range of pH Buffers in a wide mouth disposable container which can be used for direct calibration of the electrode and then discarded on completion.





Electrode Care & Maintenance

Summary of Features & Benefits

COMPREHENSIVE RANGE OF PRODUCTS

- ✔ Reagecon offers a full suite of products to optimise the life and use of electrodes.

PACK SIZES

- ✔ Most products available in a choice of pack sizes according to need.

CERTIFICATES OF ANALYSIS & SAFETY DATA SHEETS

- ✔ Certificates of Analysis for all batches and SDS available on line at anytime.

UNIVERSAL USE

- ✔ Products can be used with a wide variety of electrodes, irrespective of brand

Introduction

pH is one of the most frequently and universally made measurements in science. Despite the number of people involved in pH measurement, the practical fundamentals governing it are not widely understood. The literature sometimes offers conflicting advice on how it is best measured and there is often uncertainty about the correct option available to deal with individual measurement applications. What is often not fully appreciated is that the vast majority of pH problems are related to the correct selection, care or maintenance of the electrode with particular emphasis on the reference electrode.

This brief technical note deals specifically with the correct choice of reference Electrode Filling Solution and the compatibility of the filling solution with the sample being measured. It is important to keep two key considerations in mind as part of the selection process of the **Electrode Filling Solution**. Firstly, the issue of the compatibility between the filling solution and the sample relates not only to direct pH measurement but also direct Ion and Redox measurement. It is also relevant to the use of all three sensors when performing potentiometric titrations. Secondly, the direct experience of the analyst, the operating instructions of the electrode or the detail contained within the test method being followed, may be of most value in the selection of the correct filling solution.

Correct choice of Electrode Filling Solution (Electrolyte)

A good electrolyte must fulfil a number of conditions. The equitransference of the cation/anion combination should be as close as possible to being equimobile, have constant chloride activity, be of high electrical conductance and as non-chemically reactive as possible.

Concentrated or saturated Potassium Chloride (KCl) fulfils all of these conditions to a greater or lesser extent and is the filling solution of choice in either potentiometric titrations or direct pH, redox or ion measurements where silver/silver chloride or calomel reference electrodes are used.

However, the use of KCl in any concentration may be problematic in the following situations:

1. The following ions can react with Cl^- to form insoluble precipitates that block the diaphragm, Hg^{++} , Cu^{++} , Ag^+ , Pb^{++} in such cases, a double junction electrode must be used with the outer chamber containing either Potassium Nitrate or Ammonium Sulphate at various concentrations. However, the potassium may also react with anions like Perchlorate (ClO_4^-) to form Potassium Perchlorate (KClO_4) which is sparingly soluble. In this situation Ammonium Sulfate can also be used as the filling solution in the outer chamber.
2. Some electrode manufacturers recommend the use of 3M KCl or 4M KCl saturated with Silver Chloride (AgCl) as the filling solution of choice. In this instance silver may react with several halides including bromides or iodides or may react with cyanides. Most importantly, silver may also react with sulfide which manifests itself in blackening of the diaphragm due to blockage. There may also be ingress of the sulfide into the electrode which will cause poisoning of the reference system, as well as high false liquid junction potentials. In this instance, silver free KCl can be used either as a primary electrolyte or in the outer junction of a double junction electrode.
3. 2M Potassium Nitrate (KNO_3) + 0.001M Potassium Chloride may be used specifically for the measurement of samples containing silver halides or used for argentimetric titrations where silver billet electrodes are used.
4. For pH measurement or titration in non-aqueous media or organic solvents, Lithium Chloride in Ethanol, Methanol, Isopropanol or Glacial Acetic Acid must be used as a filling solution in both the inner and outer chamber.



Reagecon manufactures a complete range of Electrode Care and Maintenance Solutions designed to help calibrate, clean, refill, regenerate, store and extend the useful life of pH electrodes. Included in the range are filling, storage, cleaning and regeneration solution.

Electrode Filling Solutions

A good electrolyte must fulfil a number of conditions. The equitransference of the cation/anion combination should be as close as possible to being equimobile, have constant chloride activity, be of high electrical conductance and be as non-chemically reactive as possible.

Reagecon's **Electrode Filling Solutions** are high quality products that fulfil all of these criteria

Electrode Cleaning Solutions

Reagecon's **Electrode Cleaning Solutions** are designed to extend the useable life of your pH electrode and are also formulated to improve functionality, remove materials that may effect life or functionality and significantly improve the performance of your pH measurement system.

Electrode Storage Solution

Reagecon's **Electrode Storage Solution** is a multi-faceted formulation that maintains both the electrodes sensing and reference systems in optimal condition, between readings or during storage. Both the sensing membrane and the reference diaphragm should always be immersed in this solution, rather than water, filling solution or pH buffer. Reagecon's Electrode Storage Solution is suitable for use with all pH electrodes which is designed to optimise functionality, accuracy, responsiveness and life span of a pH electrode.

Electrode Regeneration Solution

Electrodes that have not been properly stored in storage solution, or which have been scratched, a **regeneration solution** could provide further life.



Redox Standards



Summary of Features & Benefits

- Extensive range 124 mV – 650 mV @ 25°C
- Very high specifications (± 5 mV)
- Extensive technical advice on the measurement techniques available
- All products certified with proven verifiable accuracy and uncertainty of measurement
- Widest range of values and pack options available in the market
- Ready to Use
- Certificates of Analysis and Safety Data Sheets available online

Reagecon produces a complete range of high-quality **Redox Standards** for the control, validation or qualification of Redox measurement. In fact, our range are the widest available on the market, have a very high specification of ± 5 mV and guaranteed stability throughout their entire shelf life, even after opening the bottle.

Products come with comprehensive documentation that includes Safety Data Sheets and detailed Certificates of Analysis with proven verifiable accuracy and fully budgeted Uncertainty of Measurement.

The products are available in several different pack sizes that include 250ml, 500ml, 10 litre and bag-in-box options.

Introduction

During its working life a Redox electrode undergoes no change of zero point or slope. Redox is an absolute measurement expressed in millivolts (unlike pH, which is an artificial logarithmic scale using values of 1 - 14). Therefore, redox electrodes do not require calibration and the **standards** act as control materials rather than calibration standards.

Such control standards not only control the functionality of the sensing and reference electrode, but also control the analyst's technique, environmental conditions and the operation of the measurement meter (pH meter in millivolt mode).



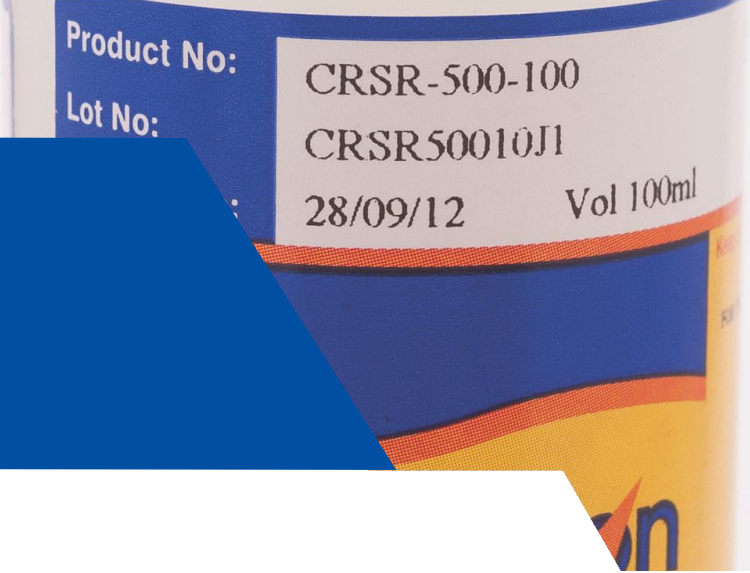
If the measurement of the control material is outside the expected values, it may be due to any or several of the following reasons:

- 🔥 Poor connections or a short circuit within the electrodes or between the electrodes and meter.
- 🔥 Incompatibility between the reference electrode and sample, in particular the use of incorrect electrolyte.
- 🔥 Contamination or poisoning of reference system or reference electrolyte.
- 🔥 Blocked or contaminated diaphragm.
- 🔥 Incorrect choice of sensing electrode.

In choosing an electrode, broadly, but not exclusively the analyst can choose between platinum or gold and choose several different options as to how the platinum or gold is configured on the electrode

Although, platinum is more commonly used, it may give erroneous results in low ionic strength solutions or when its surface is passivated or roughened. It may also show poor results in strongly oxidizing solutions. On the other hand gold is totally unsuitable in the presence of or due to the formation of gold cyanide or gold halide complexes in the sample. Although substantial guidance is offered in the literature on which metal to use, the specific experience of the user, is the most important determinant of the final choice.

Turbidity Standards



Summary of Features & Benefits

- ✔ Extensive range 0.0 – 4000 NTU
- ✔ Accuracy $\pm 1\%$
- ✔ NIST traceable
- ✔ Well defined spherical shape
- ✔ US EPA approved for drinking water turbidity
- ✔ Non-toxic and Non-carcinogenic
- ✔ Long stable shelf life at all concentrations
- ✔ No special handling or disposal requirements
- ✔ Ready to use, our range covers the full turbidity measurement range
- ✔ Certificates of Analysis & Safety Data Sheets available online.

Ratio and Non-Ratio (Polymer Microsphere) Turbidity Standards

Reagecon's turbidity standards for ratio and non-ratio instruments are composed of suspended polymer microspheres. These **turbidity standards** remove the handling, stability and accuracy problems associated with traditional Formazin turbidity standards; (for detailed comparison, see Table 1). Products are extremely accurate ($\pm 1\%$), NIST traceable and US EPA approved and have guaranteed stability throughout their entire shelf life, even after opening the bottle.

Turbidity Measurement

Accurate and precise laboratory or online analytical measurement can be influenced by the following 6 key parameters:

- ✔ Measuring Instrument
- ✔ The Operator
- ✔ Measuring Accessories
- ✔ Standards and Reference Material
- ✔ The Sample
- ✔ Measuring Environment

The technical validation, comparability, quality control/assurance, proficiency testing and traceability of any analysis require significant attention to detail of all these parameters. Turbidity measurement is no different in this respect.

The Standard / Reference Material

The nephelometric turbidity meter is designed to be routinely standardised with a known light scattering standard. As with all analytical standards or reference materials, a **turbidity standard** should fulfil the following criteria:

- ✔ Provide traceability.
- ✔ Demonstrate the accuracy of results.
- ✔ Calibrate the equipment and methodology.
- ✔ Monitor the user performance.
- ✔ Validate the test.
- ✔ Facilitate comparability i.e. to ensure that when the correct procedures have been followed the same analysis of the same materials will produce results that agree with each other whenever they are performed.

Standards and Reference materials should be produced and characterised in a technically competent manner, should be homogenous, stable, certified and have available a known uncertainty of measurement. Presently, there are only two types of standards recognised and approved by the USEPA, Standard Methods, ASTM and other regulatory agencies, these are formazin or formazin derived standards and suspended polymer microspheres.

Table 1: Comparison of Reagecon Polymer Microsphere & Formazin Turbidity

Feature	AMCO APEA-1	Formazin
Toxicity	Non-toxic. No special handling or disposal requirements.	Very toxic, contains a known carcinogen. Requires special handling and disposal.
Particle shape & size	Well defined spherical shape. Mean diameter is 0.06µm with a distribution between 0.01 and 0.2µm.	Irregular shape and distribution. Mean diameter is 3µm with a distribution between 1 and 20µm.
Shelf life	Does not deteriorate or settle out. A long stable shelf life at all concentrations.	Flocculates and deteriorates. Lower concentrations change value within days, or hours, after preparation.
Particle suspension	Particles stay in suspension. Mixing is discouraged as it entrains air.	Particles settle quickly, suspension must be continuously mixed. Mixing induces shearing.
Traceability	Certified traceable to NIST Reference Material 1690	Non traceable
Precision (batch to batch)	Mean of SD's 0 ± 0.00	Mean of SD's 0.9 ± 0.2
Inter-instrument reproducibility	0.5 ± 0.0	0.8 ± 0.2
Stability	0.1 – 4000 NTU (1 year)	4000 NTU (3 months). Need for dilutions to be prepared daily or weekly.
Accuracy	$\pm 1\%$	$\pm 10\%$ (4000 NTUs) up to $\pm 30\%$ for dilute working standards.

Turbiform™ Stabilised Formazin Turbidity Standards

Reagecon’s Research and Development team have developed a new proprietary synthetic process, that produces a family of products called **Turbiform™**. These products combine most of the positive attributes of the formazin and AMCO APEA-1 ranges of standards already available from Reagecon, whilst eliminating most of the shortcomings. Most importantly, this new process, does not interfere adversely with the status of formazin as the recognised primary standard, because the new material is derived from the same 4000 NTU formazin standard base. All of the individual products within the Reagecon range are dilutions of that base material.

Summary of Features & Benefits	
<ul style="list-style-type: none"> ✔ Ready to use at 13 different NTU values (0 – 4000 NTU) ✔ Completely safe, not subject to any regulations ✔ EPA approved ✔ Stable (at least 2 years) for higher values ✔ Accurate, ± 5% at any value ✔ The products save labour costs, time, eliminate hazards and require minimum handling in the user’s laboratory 	<ul style="list-style-type: none"> ✔ Exhibit a wide range of particle sizes and slopes (similar to formazin), that have a particle size distribution of 1 to 20 µm, which is similar to the particle size distribution found in most sample types ✔ Can be used to calibrate, control, validate or qualify any make or model of Turbidity Measurement Instrument

Table 2: Comparison Between Reagecon Turbiform™ Stabilised Formazin and Formazin Turbidity Standards

Features	Turbiform™	Formazin
Toxicity	Non-toxic. No special handling or disposal requirements.	Very toxic, contains a known carcinogen. Requires special handling and disposal.
Particle shape & size	Irregular shape and distribution. Mean diameter is 3µm with a distribution of between 1 micron and 20 microns.	Irregular shape and distribution. Mean diameter is 3µm with a distribution of between 1 micron and 20 microns.
Particle suspension	Does not deteriorate, but like all colloidal suspensions, it does settle out. User instructions must be followed meticulously.	Flocculates and deteriorates. Lower concentrations change value within days or hours after preparation.
Traceability	Certified traceable to NIST Reference Material 1690 and 1691.	Certified traceable to NIST Reference Material 1690 and 1691.
Stability	0 – 1 NTU: 1 Year 10 – 4000 NTU: 2 Years	4000 NTU: 3 Months For lower values, dilutions need to be prepared daily or weekly.
Accuracy	± 5% (all values)	4000 NTU ± 10% Dilute working standards up to ± 30%

Chemical Oxygen Demand (COD)



Chemical Oxygen Demand (COD) Standards

Reagecon's offering includes a comprehensive range of **COD Standards**. These standards are ideal for use as Control Standards to verify that correct analysis for COD has taken place. Achieving an acceptable result for the Control Standard will improve confidence in sample readings for this important environmental parameter.

Summary of Features & Benefits

<ul style="list-style-type: none">✓ Range from 10 to 60000 mg/L✓ Many different values✓ NIST traceable✓ Proven compliance with EPA	<ul style="list-style-type: none">✓ Compatible with any instrument✓ Used as a Control Standard, or for Validation or Qualification✓ Run Control with each set of samples✓ Prepare and analyse in exactly the same way as samples
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Chemical Oxygen Demand (COD) Reagents

Reagecon's product offering includes reagents for the two accepted methods for measuring COD at concentrations less than 400mg/l. Where the concentration is greater than 400mg/l, the sample must be diluted.

* *Methodology as per the Department of the Environment (U.K.) "Chemical Oxygen Demand (Dichromate Value) of Polluted and Waste Waters" published in 1977 and revised in 1986.*

Chemical Oxygen Demand (COD) Vials

Reagecon's **COD Reagent Vials** can be used in conjunction with the Aqualytic PC Spectro[®], PC Compact Vario[®] and all Hach[®] spectrophotometers. . This compatibility is proven in the Reagecon Technical Publication, *A comparative study of the performance of Reagecon COD vials and Hach[®] COD vials using the Hach[®] DR/2010 photometer. Authors: John J. Barron, Colin Ashton & Leo Geary - Technical Services Department, Reagecon Diagnostics Ltd., Shannon Free Zone, County Clare, Ireland*, available from our Knowledge Centre: knowledge.reagecon.com

- ✓ Ready to use in 16mm diameter vials
 - Low range 0 – 150 mg/L
 - Middle range 0 – 1500 mg/L
 - High range 0 – 15000 mg/L
- ✓ Compatible with all dedicated spectrophotometer brands
- ✓ Use in exactly the same way as instrument manufacturer's vials
- ✓ Substantial cost-saving compared to instrument brand vials

Reagecon also offer a collection and disposal service in certain territories for used vials that complies with all relevant dangerous goods disposal and environmental regulations.

Ion Selective Electrode Standards and Ionic Strength Adjustors

Summary of Features & Benefits

- ✔ Extensive Range
- ✔ Many different values
- ✔ NIST traceable
- ✔ Compatible with any instrument
- ✔ Used for Calibration, Control, Validation or Qualification
- ✔ Certificates of Analysis and Safety Data Sheets available online

Ion Selective Electrode Standards (ISE's)

Ion Selective Electrode (ISE) Standards can be used at suitable concentrations to calibrate or control measurements using Ion Selective Electrodes as the sensing technology. Additionally suitable for Method Validation or Instrument Qualification.

Ionic Strength Adjusters (ISA's)

Reagecon's **Ionic Strength Adjusters (ISA's)** are used in conjunction with Ion Selective Electrodes and Ion Selective Electrode Standards to adjust pH, adjust Ionic Strength and suppress interference during measurement..

Introduction

Ion Selective Electrodes, (ISEs) allow specific and quantitative measurement of a wide range of cations, anions and some dissolved gases. These ions can be measured directly like pH measurement, indirectly (see below) or by titrimetry. ISEs respond selectively to the relevant ion activity exactly like pH electrodes respond to hydrogen ion activity. Like pH electrodes, they require a suitable reference electrode, preferably a double junction system. They also require a pH or ion meter and a selection of filling solutions for the outer and inner chambers of the reference electrode. In some instances the reference and sensing electrodes may be combined into one unit.

Types of Measurement

Direct measurement is performed exactly like the measurement of pH. The electrode is calibrated using two concentrations of the relevant standard which are chosen to bracket the expected value of the sample. More than two calibration standards may be used for better linearity or more accurate measurement and a standard curve of mV reading versus concentration of various standards can be constructed.

However, the measurement technique deviates from pH in that both sample and standards require the addition of an **Ionic Strength Adjustor (ISA)**. The addition of this solution confers the following benefits:

- ✔ The ionic strength of the adjustor is much higher than the ionic strength of the sample or standard so it keeps the ionic strength of both high, constant and similar and thus enables what is effectively activity measurement to be read as concentration.
- ✔ The ionic strength adjustor (which should never react with the sample or standard chemically) also keeps the pH value constant in some instances. This combined with high ionic strength and the chemistry of the ISA suppresses or eliminates interfering ions.
- ✔ The ISA when added to sample and standard eliminates any matrix, hysteresis or erroneous liquid junction potentials that might affect the accuracy of the test result.
- ✔ Indirect measurement methodologies include the use of standard addition, sample addition, standard subtraction and sample subtraction. Such methods offer advantages that include:
 - Calibration need only be performed occasionally or not at all, therefore only ISA needs to be added to the sample.
 - The possibility of error due to a temperature co-efficient of variation between the sample and standard is largely eliminated.
 - The ion concentration of solid samples can be measured.
 - The range of types of ions measured and the versatility of the technique is greatly enhanced by careful and considered selection of the optimal indirect method. This is true, in particular, with standard or sample subtraction, where precipitation or complexation may be performed, or where the counter ion to that contained in the standard is measured.

Use of Controls

As with all analytical measurements, no test should be performed without the use of control material. The control should be treated in exactly the same way as the sample including the addition of ISA, thereby picking up any error in the measurement technique, whether it be due to the analyst, environment, meter, sensors or sample in line with the execution of good laboratory practice. **Reagecon's ISE standards**, diluted to a suitable concentration, are particularly suitable for use as control material.



Reagecon

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