Instrument required in Quality Control of Pharmaceutical Industry

Analytical Balance

An analytical balance is used to measure mass to a high degree of precision and accuracy. To some the analytical balance may simply be known as a set of scales, but an analytical balance is able to measure down to the ten thousandth of a gram. An analytical balance, also known as a precision balance, it most often found in a laboratory setting and is used only with the most meticulous of measurements. They require a draft-free location on a solid bench that is free of vibrations. Some modern balances have built-in calibration masses to maintain accuracy.

pH Meter

A pH meter is an electronic instrument used for measuring the pH (acidity or alkalinity) of a liquid (though special probes are sometimes used to measure the pH of semi-solid substances). A probe is placed in a liquid, and it generates an electrical voltage that is converted to a logarithmic pH reading. The pH scale range is 1 to 14.

Conductivity Meter

A conductivity meter or electrical conductivity meter (EC meter) measures the electrical conductivity in a solution. Commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water.

Viscometer

A viscometer (also called viscosimeter) is an instrument used to measure the viscosity of a fluid. For liquids with viscosities which vary with flow conditions, an instrument called a rheometer is used. Viscometers only measure under one flow condition. The flow conditions must have a sufficiently small value of Reynolds number for there to be laminar flow. At 20.00 degrees Celsius the viscosity of water is 1.002 mPa•s and its kinematic viscosity (ratio of viscosity to density) is 1.0038mm2/s. These values are used for calibrating certain types of viscometer.

Refractometer

A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). A refractometer measures the extent to which light is bent (i.e. refracted) when it moves from air into a sample and is typically used to determine the index of refraction (aka refractive index or n) of a liquid sample. The refractive index is a unitless number, between 1.3000 and 1.7000 for most compounds, and is normally determined to five digit precision.

Polarimeter

A polarimeter is a scientific instrument used to measure the angle of rotation caused by passing polarized light through an optically active substance. Anisotropic crystalline solids, and samples containing an excess of one enantiomer of a chiral molecule, can rotate the orientation of plane-polarized light. Such substances are said to have optical activity.

Measurement of this change in polarization orientation is called polarimetry, and the measuring instrument is called a polarimeter. These measurements are useful for studying the structure of anisotropic materials, and for checking the purity of chiral mixtures. Research applications for polarimetry are found in industry, research institutes and universities as a means of:

- Isolating and identifying unknowns crystallized from various solvents or separated by high performance liquid chromatography (HPLC).
- Evaluating and characterizing optically active compounds by measuring their specific rotation and comparing this value with the theoretical values found in literature.
- Investigating kinetic reactions by measuring optical rotation as a function of time.
- Monitoring changes in concentration of an optically active component in a reaction mixture, as in enzymatic cleavage.
- Distinguishing between optical isomers.

IR Moisture Balance:

A high performance compact, dependable Infra-red Moisture Balance for measurement of moisture content of material not affected by radiation while losing water under of moisture exposure to Infra-red radiation. IR moisture balance is an accurate method for moisture content and dry weight analysis of a wide range of products and materials. Widely used for testing soils, Agriculture Soils, Chemicals raw materials, food, Pharmaceuticals, Plastic and similar materials..

KF Titrator

Karl Fischer titration is a classic titration method in analytical chemistry that uses coulometric or volumetric titration to determine trace amounts of water in a sample. It was invented in 1935 by the German chemist Karl Fischer.

Karl Fischer titration has established itself as a reference method for general use. KF titration

- is highly specific and precise
- covers a wide concentration range: from ppm up to 100%.
- has short determination times.

IR Spectrophoto Meter

it is used to measure the maximum absorption of infrared spectrum compound and the determination of IR radiation.

Ultraviolet-Visible spectrophotometer

Ultraviolet–visible spectroscopy or ultraviolet-visible spectrophotometer (UV-Vis or UV/Vis) refers to absorption spectroscopy or reflectance spectroscopy in the ultraviolet-visible spectral region. This means it uses light in the visible and adjacent (near-UV and near-infrared (NIR)) ranges.

UV/Vis spectroscopy is routinely used in analytical chemistry for the quantitative determination of different analyses, such as transition metal ions, highly conjugated organic compounds, and biological macromolecules. Determination is usually carried out in solutions.

• Solutions of transition metal ions can be colored (i.e., absorb visible light) because d electrons within the metal atoms can be excited from one electronic state to another. The color of metal ion solutions is strongly affected by the presence of other species, such as certain anions or ligands. For instance, the color of a dilute solution of copper sulfate is a very light blue; adding ammonia intensifies the color and changes the wavelength of maximum absorption (λmax).

• While charge transfer complexes also give rise to colors, the colors are often too intense to be used for quantitative measurement.

High-performance liquid chromatography (HPLC)

High-performance liquid chromatography (sometimes referred to as high-pressure liquid chromatography), HPLC, is a chromatographic technique that can separate a mixture of compounds and is used in biochemistry and analytical chemistry to identify, quantify and purify the individual components of the mixture.

HPLC typically utilizes different types of stationary phases contained in columns, a pump that moves the mobile phase and sample components through the column, and a detector to provide a characteristic retention time for the analyte and an area count reflecting the amount of analyte passing through the detector.

Gas-Liquid chromatography (GLC):

It is a separation technique. It is widely used in chemistry. It is well suited for use in the petrochemical, environmental monitoring and remediation, and industrial chemical fields. It is also used extensively in chemistry research.

Electrolyte analyzer:

It is used for the determination of Sodium, Potassium, Chloride, Calcium, Lithium and pH. Thus it is known as Ion Selective Electrodes (ISE).

Titrator

it is a quantitative chemical analysis. It is used to determine the unknown concentration of an identified analyte. It is known as volumetric analysis.

Atomic absorption spectrophotometer

in analytical chemistry, atomic absorption spectroscopy is a technique used to determine the concentration of a specific metal element in a sample. The technique can be used to analyze the concentration of over 70 different metals in a solution. It is a spectro-analytical procedure. It is used for the qualitative and quantitative determination of chemical elements. To determine the absorption of optical radiation (light) by free atoms in the gaseous state.

Fluorescence spectrophotometer

Fluorescence occurs when a molecule absorbs light photons from the UV-visible light spectrum, known as excitation, and then rapidly emits light photons as it returns to its ground state. Fluorimetry characterizes the relationship between absorbed and emitted photons at specified wavelengths. It is a precise quantitative analytical technique that is inexpensive and easily mastered.

Particle counter

a particle counter is an instrument that detects and counts particles. By its very nature a particle counter is a single particle counter, meaning it detects and counts particles one at a time. The nature of particle counting is based upon either light scattering or light obscuration. A high energy light source is used to illuminate the particle as it passes through the detection chamber. The particle passes through the light source (typically a laser) and if light scattering is used, then the redirected light is detected by a photo detector. Or if light blocking (obscuration) is used the loss of light is detected. The amplitude of the light scattered or light blocked is measured and the particle is counted and tabulated into standardized counting bins. The image to the right shows a light scattering particle counter diagram.

Flame photometer

A photoelectric flame photometer is a device used in inorganic chemical analysis to determine the concentration of certain metal ions, among them sodium, potassium, lithium, and calcium. In principle, it is a controlled flame test with the intensity of the flame color quantified by photoelectric circuitry. Flame photometry is crude but cheap compared to flame emission spectroscopy, where the emitted light is analyzed with a monochromator.

Its status is similar to that of the colorimeter (which uses filters) compared to the spectrophotometer (which uses a monochromator). It also has the range of metals that could be analyzed and the limits of detection are also considered.

Osmometer

An Osmometer is a device for measuring the osmotic strength of a solution, colloid, or compound. Osmometers are useful for determining the concentration of dissolved salts or sugars in blood or urine samples. It is also useful in determining the molecular weight of unknown compounds and polymers.
In summary, Osmometry is a useful analytical tool, often overlooked, because it quickly measures everything in the sample rather than a specific constituent, but vitally important if the overall solution strength is critical.

Dissolution test apparatus

In the pharmaceutical industry, drug dissolution testing is routinely used to provide critical in vitro drug release information for both quality control purposes, i.e., to assess batch-to-batch consistency of solid oral dosage forms such as tablets, and drug development, i.e., to predict in vivo drug release profiles. The designs of the dissolution apparatuses and the ways of operating dissolution apparatuses have huge impacts on the hydrodynamics, thus the performances. Hydrodynamic studies in dissolution apparatuses were carried out by researchers over the past few years with both experimental methods and numerical modeling such as Computational Fluid Dynamics (CFD).

Disintegration test apparatus

it is used to measure the tablet disintegration time and subsequent drug dissolution.

Friability Test Apparatus

Tablet friability test apparatus are used for determination of durability of tablets at the time of production. The apparatus is designed to provide the precise value of rate of abrasion and impact hardness of the tablets. Friability is important since it affects in particle size distribution of granules affecting compressibility into tablet, tablet weight variation, granule

Flowability Friability is determined carrying out Tumbler Test or using Friability Tester (Roche Friabilator) and % loss is determined.

Hardness test facilities

It is to measure the hardness the tablet and it is essential to determine the disintegration and dissolution of drug and efficient of drug.

Leak test facilities

Leak testing is sometimes referred to as pressure testing or vacuum testing. There are many different forms of leak test methods that can be used, from the basic submersing of the test object under water in a dunk tank and watching for bubbles for leak location, to the highly accurate helium leak testing required for very tight leak limits. A commonly used leak test solution is air decay leak testing, this is a good, economical and quantifiable method of testing whether a product passes the specified leak limit, these type of solutions can range from manually loaded to fully automatic production test facilities.

Melting point apparatus

a melting point apparatus is a scientific instrument used to determine the melting point of a substance. Some types of melting point apparatuses include the Thiele tube, Fisher-Johns apparatus, Gallenkamp (Electronic) melting point apparatus and automatic melting point apparatus.

Muffle furnace

A muffle furnace (sometimes, retort furnace) in historical usage is a furnace in which the subject material is isolated from the fuel and all of the products of combustion including gases and flying ash. Today, a muffle furnace is (usually) a front-loading box-type oven or kiln for high-temperature applications such as fusing glass, creating enamel coatings, ceramics and soldering and brazing articles. They are also used in many research facilities, for example by chemists in order to determine what proportion of a sample is non-combustible and non-volatile (i.e., ash).

Hot air oven

the treatment by high temperature and hot have the functions on microbial oxidation, alterative protein and dielectric concentration that cause to poison. It destroys the cell protoplasm and course the microorganism to die, so this method can kill the whole microorganisms in regular heating time. It is use to sterilize glassware, metal, surgical instruments and also to sterilize non-aqueous thermo labile liquids & thermo labile powders.

Hot Water bath

Water baths are used in industrial clinical laboratories, academic facilities, government research laboratories environmental applications as well as food technology and wastewater plants. Because water retains heat so well, using water baths was one of the very first means of incubation. Applications include sample thawing, bacteriological examinations, warming reagents, coliform determinations and microbiological assays.

Ultrasonic Bath

An ultrasonic bath is a cleaning device that uses ultrasound (usually from 20–400 kHz) and an appropriate cleaning solvent (sometimes ordinary tap water) to clean delicate items. Ideal candidates for ultrasonic cleaning include small electronic parts, cables, rods, wires and detailed items, as well as objects made of glass, plastic, aluminum or ceramic. Industrial ultrasonic cleaners are used in the automotive, sporting, printing, marine, medical, pharmaceutical, electroplating, disk drive components, engineering and weapons industries. Ultrasonic baths are also used to experimentally determine the elastic constants of many anisotropic materials.

Hot plate

Hotplates are often used as an alternative to the Bunsen burner. Some hotplates have a stirring mechanism as part of their design and allows for faster dissolving of some solids by heating and stirring at the same time. A hot plate is an adjustable heating source which is ideal for heating beakers, Erlenmeyer flasks, hot water baths, and other flat-bottomed containers. It is essentially an electric stove top that is used in the laboratory.

Magnetic Stirrer

a magnetic stirrer or magnetic mixer is a laboratory device that employs a rotating magnetic field to cause a stir bar (also called "flea") immersed in a liquid to spin very quickly, thus stirring it. The rotating field may be created either by a rotating magnet or a set of stationary electromagnets, placed beneath the vessel with the liquid. Magnetic stirrers often include a hot plate or some other means for heating the liquid. Magnetic stirrers are often used in chemistry and biology. They are preferred over gear-driven motorized stirrers because they are quieter, more efficient, and have no moving external parts to break or wear out (other than the simple bar magnet itself). They can be used inside hermetically closed vessels or systems, without the need for complicated rotary seals.

Vacuum evaporator:

This process is used industrially to make such food products as evaporated milk for milk chocolate, and tomato paste for ketchup. In the sugar industry the vacuum evaporation is used in the crystallization of sucrose solutions. Traditionally, this process was performed in batch mode, but nowadays also continuous vacuum pans are available.

Vacuum pumps:

They are used in many industrial and scientific processes including:

1. The production of most types of electric lamps, vacuum tubes,
2. Electron microscopy
3. Medical processes that require suction
4. Medical applications such as such Radiotherapy, Radiosurgery, Radiopharmacy
5. Analytical instrumentation to analyze gas, liquid, solid, surface and bio materials
6. Mass spectrometers to create an ultra high vacuum between the ion source and the detector
7. Ophthalmic coating
8. Freeze Drying

Thin layer chromatography (TLC):

It is a widely employed laboratory technique. It is used for faster and better separations. It is alos for better resolution.

Pyrometer

A pyrometer is a non-contacting device that intercepts and measures thermal radiation, a process known as pyrometry. This device can be used to determine the temperature of an object's surface. Pyrometer is used for many industrial applications to measure non contact high temperature measurements. This is also useful for temperature measurement of molten iron & steel.

Reference standard:

It is a standardized substance It is used as a measurement base for similar substances. Where the exact active substances of a new drug are not known. A reference standard provides a calibrated level of biological effects against which new preparations of the drug can be compared.

Climate chamber:

It allows investigation of the effects of a gradient in temperature and relative humidity on a porous structure. It also used in measuring how much water it collects or releases.