NIPER GUWAHATI

National Institute of
Pharmaceutical Education and Research, Guwahati
(NIPER-G)

INSTRUMENT HANDBOOK

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National Institute of Pharmaceutical Education and Research, Guwahati (NIPER - G)

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Forward

National Institute of Pharmaceutical Education and Research (NIPER) Guwahati is the first premier national institute in the North Eastern region of our country for providing high quality Pharmacy Education and Research. It is an Institute of National Importance and was established in 2008 to provide high quality pharma education and research with focus on utilization of natural products of the region for drug discovery and development. It is also a place where knowledge in science and education stimulates technological innovation to inspire student community to pursue scientific and industrial careers. At present NIPER Guwahati is dealing with seven major discipline of the Pharmaceutical Science namely: Pharmacology and Toxicology, Biotechnology, Pharmacy Practice, Pharmaceutics, Pharmaceutical Analysis, Medicinal Chemistry and Pharmaceutical Technology & formulations.

Proper combination of the knowledge and the cutting-age technological facility is the greatest requirement for the growing sector of the pharmaceutical and biomedical sciences of the country. NIPER-G has a wide range of sophisticated state-of-the-art laboratory equipment at its Central Instrumentation facility (CIF) in its campus at Changsari, North Guwahati. The equipments are being maintained by the experienced technical experts. It is our endeavor that the facilities available at NIPER-G are utilized to the fullest extent for the benefit of the North-Eastern India. In addition of utilization of the equipments for its in-house teaching and research purpose, NIPER-G is also willing to make the equipments available for use by any researcher/ innovator/ academic or R&D organization/ start-ups and industries. The intended beneficiaries of our laboratory equipments may also approach our scientific experts for taking necessary consultancy about the use of equipments.

NIPER-G is committed to strengthen and upgrade its CIF on regular basis as per the requirements. Opening up of its laboratory instruments for the scientific community of the region, is a humble effort of NIPER-G towards creation of a modern India.

Dr USN Murty
Director, NIPER-G
Chairman, Bio-NEST

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Animal House and Their Facilities

LC-MS/MS

FUNDAMENTAL PRINCIPLE

The Liquid chromatography coupled with Mass spectrometry (LC-MS) wherein the individual components in a mixture are first separated based on interaction of analyte to stationary/mobile phase followed by ionization (soft ionization, ESI), and separation of the ions on the basis of their mass/charge ratio.

APPLICATION

- Useful for quantification of various pharmaceuticals compounds [APIs, impurities, and metabolites (plant/biological)]
- To study drug pharmacokinetic and preclinical assays related to DMPK studies
- Bio-distribution studies
- Analytical and bioanalytical method development and validation
- Metabolomics and lipidomics

REFERENCE

Scherf-Clavel, Oliver, et al. "The contamination of valsartan and other sartans, Part 2: Untargeted screening reveals contamination with amides additionally to known nitrosamine impurities." *Journal of pharmaceutical and biomedical analysis* 172 (2019): 278-284.

GC-MS

FUNDAMENTAL PRINCIPLE

GC-MS/MS is a qualitative, quantitative, and destructive technique. Sample (Volatile/semi solid) is vaporised and injected onto head of a chromatography column. Elution is effected by the flow of an inert gaseous mobile phase. Separation is based upon the partition of the analyte between a gaseous mobile phase and a liquid phase immobilised on the surface of an inert solid at a temperature above boiling point of analyte. Initially GC separated components will be further fragmented using hard ionization (EI) technique followed by separation on the basis of mass/charge ratio using mass detector.

APPLICATION

- Quantification of various volatile samples in flavor and fragrances, Phytopharmaceutical, petrochemical and essential oils.
- Quantification of various intermediate or finished organic products
- Fatty acids profiling of fats and oils

REFERENCE

Tsutsumi, Tomoaki, et al. "Analysis of an impurity, N-nitrosodimethylamine, in valsartan drug substances and associated products using GC-MS." *Biological and Pharmaceutical Bulletin* (2019): b19-00006.

Analytical UHPLC with DAD, FLD, ECD detector

FUNDAMENTAL PRINCIPLE

Ultra High Performance Liquid Chromatography utilizes different types of stationary phase (typically, hydrophobic saturated carbon chains), mobile phase (liquid) and detectors to detect /quantify the various components from a mixture. The interaction between the analytes and the stationary phase is most often based on adsorption and solubility. Pump delivers the mobile phase (s) and analyte through the column, and a detector provides a characteristic retention time for the analyte.

APPLICATION

- It is used for quantification of large range of chemical compounds including pharmaceuticals, herbal maker compounds, food ingredients, and other similar applications.
- To analyze drug stability and drug excipient interaction study
- Pharmacokinetic and neurotransmitter detections in brain tissues
- Detection of endogenous neuropeptides in extracellular fluid of brain
- Routine quality control and assay for finished pharmaceutical products and APIs
- Impurity profiling
- Method development and validation of the new chemical entities

REFERENCE

Viñas, Pilar, et al. "Dispersive liquid–liquid micro extraction in food analysis. A critical review." Analytical and bioanalytical chemistry 406.8 (2014): 2067-2099.

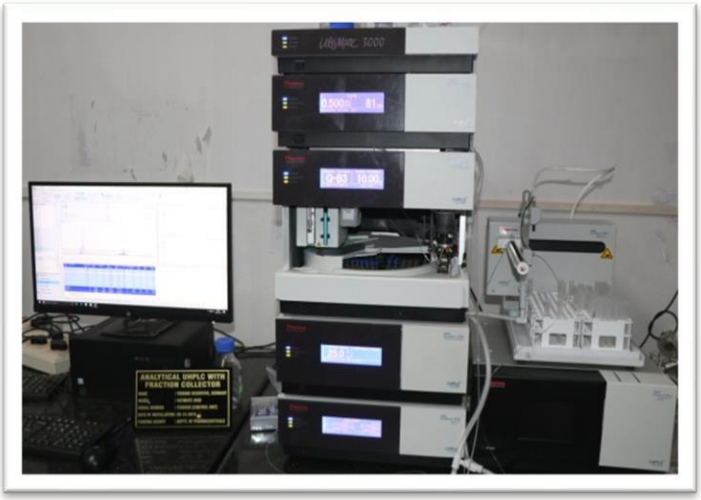
Analytical and Semi Preparative HPLC

FUNDAMENTAL PRINCIPLE

Analytical and Semi preparative HPLC is Similar to HPLC but flow cell is different to flow high flow rate and more sample volume injection. Load efficiency, flow rate and separation of degradants and ,metabolites can be achieved easily and fraction can be collected.

APPLICATION

- It is used to isolate/purify of various chemicals such as impurities and pharmaceutical compounds



REFERENCE

Zhang, Yuping, et al. "Analytical and semi-preparative HPLC enantio separation of novel pyridazin-3 (2H)-one derivatives with α-aminophosphonate moiety using immobilized polysaccharide chiral stationary phases." *Journal of separation science* 34.4 (2011): 402-408.

Flash Chromatography

FUNDAMENTAL PRINCIPLE

Basic principle of chromatography involves separation of components in a mixture introduced into chromatography system based on the relative difference in adsorption of components to stationary phase present in chromatography column. The eluent (solid or liquid dissolved in proper solvent) is pushed rapidly through a short glass or cartridge column packed with an adsorbent of silica gel (40-63µm) under pressure (automatically generated) and separation of compound occurs as a result of interaction with mobile phase and stationary phase, and separated components are collected through fraction collector. Both normal and reverse phase materials are used in Flash chromatography for separation.

APPLICATION

- Separation of isomers from mixture of compounds.
- High speed purification, fractionation and isolation of herbal extracts
- Isolation of drug impurities

REFERENCE

Kramer, Jessica R., and Timothy J. Deming. "General method for purification of α-amino acid-N-carboxyanhydrides using flash chromatography. "*Biomacromolecules* 11.12 (2010): 3668-3672.

Thermo Gravimetric Analysis (TGA)

FUNDAMENTAL PRINCIPLE

TGA is a method of thermal analysis in which changes in physical, and chemical properties of materials are measured as a function of increasing temperature or as a function of time. Basically, it measure percent weight loss/gain of a sample under variable temperature conditions with the help of thermo balance.

APPLICATION

- Information about the thermal stability of a material, exothermic, endothermic behaviour.
- To study kinetics of reaction, rate constant
- Determination of composition of complex mixture, and decomposition of complex.
- Polymer identification, separation, purity of samples etc can be obtained using TGA analysis.
- It also provide information regarding molecular weight, and structural difference between similar material.

REFERENCE

El-Sayed, Saad A., and M. E. Mostafa. "Pyrolysis characteristics and kinetic parameters determination of biomass fuel powders by differential thermal gravimetric analysis (TGA/DTG)." *Energy conversion and management* 85 (2014): 165-172.

Differential Scanning Calorimetry (DSC)

FUNDAMENTAL PRINCIPLE

DSC measures the heat difference between sample and reference while heating at a linear temperature ramp.

APPLICATION

- Widely used in pharmaceuticals for drug excipients compatibility screening studies.
- In polymer industries, DSC is a handy tool for studying curing processes, which allows the fine tuning of polymer properties, cross-linking of polymer molecules.
- To estimate the polymorphic forms of drug
- Information such as oxidative stability, polymer composition, melting point, crystallization temperature, glass transition temperature can be obtained using DSC.
- DSC also help to determine heat capacity, percent purity, heat of cure, completeness of cure etc.

REFERENCE

Qiao, J. C., and Jean-Marc Pelletier. "Crystallization kinetics in Cu46Zr45Al7Y2 bulk metallic glass by differential scanning calorimetry (DSC)." *Journal of non-crystalline solids* 357.14 (2011): 2590-2594.

FT-NIR

FUNDAMENTAL PRINCIPLE

Molecular vibration takes place as a result of absorption of Infrared (IR) radiation when applied IR frequency matches with the natural frequency of vibration. Every bond or functional groups in a molecule require different frequency of absorption. Hence, characteristic peak is observed for every functional group. In FT-NIR, molecule will absorb in near infrared region (4000-12000 cm^{-1}) and reflected light will be detected by detector.

APPLICATION

- It is used to determine the functional group
- Quantification of various molecules in the process development

REFERENCE

Ye, Mengqi, et al. "Application of FT-NIR spectroscopy to apple wine for rapid simultaneous determination of soluble solids content, pH, total acidity, and total ester content." *Food and bioprocess technology* 7.10 (2014): 3055-3062.

Double Beam UV Spectrophotometer

FUNDAMENTAL PRINCIPLE

When a molecule is exposed to electromagnetic radiation in uv-visible region of spectrum, absorption of photon occurs; result in the electronic transition from ground state to higher excited state.

APPLICATION

- Determination of wavelength and absorbance
- Chemical kinetics studies

REFERENCE

Su, Na Ri, et al. "Fabrication of MgFe2O4–ZnO heterojunction photo catalysts for application of organic pollutants." *Materials Letters* 122 (2014): 201-204.

Nano Spray Dryer

FUNDAMENTAL PRINCIPLE

The drying gas enters the system via the heater. A new kind of heater system allows for laminar flow. The spray head sprays the fine droplets with a narrow size distribution into the drying chamber. The droplets dry and become solid particles. The solid particles are separated in the electrostatic particle collector. The exhaust gas is filtered and sent to a fume hood or the environment. The inlet temperature is controlled by a temperature sensor

APPLICATION

- Widely used in pharmaceuticals, materials science, and food industry

REFERENCE

Lee, Sie Huey, et al. "Nano spray drying: a novel method for preparing protein nanoparticles for protein therapy." *International journal of pharmaceutics* 403.1-2 (2011): 192-200.

Freeze Dryer (Lyophilizer)

FUNDAMENTAL PRINCIPLE

Lyophilization is based on a simple principle of physics called "SUBLIMATION". Sublimation is the process of transition of a substance from solid to the vapor state without passing through an intermediate liquid phase. The process of lyophilization consists of following steps:

Freezing of the product to convert the water in the product to ice form, Sublimation of ice directly into water vapor under vacuum, Drawing off the water vapor, Once the ice has been sublimated, the products are freeze-dried and can be removed from machine

APPLICATION

- Widely used in Pharmaceuticals, Food Industries
- Chemical synthesis
- Biological science
- Nanotechnology etc.
- Used for drying of heat sensitive compounds/products of soft drinks and water and so on.

REFERENCE

Viñas, Pilar, et al. "Dispersive liquid–liquid micro extraction in food analysis. A critical review." Analytical and bioanalytical chemistry 406.8 (2014): 2067-2099.

Nanodrop

FUNDAMENTAL PRINCIPLE

When a molecule is exposed to electromagnetic radiation in uv-visible region of spectrum, absorption of photon occurs; result in the electronic transition from ground state to higher excited state

APPLICATION

- Nucleic acid concentration and purity of nucleic acid samples up to 3700 ng/µl without dilution can be estimated.
- Fluorescent dye labeling density of nucleic acid microarray samples, Purified protein analysis (A280) up to 100 mg/ml (BSA),
- Expanded spectrum measurement and quantification of fluorescent dye labeled proteins, conjugates, and metalloproteinase, Bradford Assay analysis of protein, BCA Assay analysis of protein, Lowry Assay analysis of protein, Pierce Protein 660 nm Protein Assay, Cell density measurements.

REFERENCE

Hamner, Kristen, et al. "Quantification of Gold Nanoparticles Using the Thermo Scientific Nanodrop 2000 Spectrophotometer." *J. Am. Chem. Soc* 128 (2006): 14020-14021.

Particle Size Analyzer (Zetasizer)

FUNDAMENTAL PRINCIPLE

Zetasizer is used to measure particle and molecular size. It measures the diffusion of particles moving under Brownian motion, and converts this to size and a size distribution using Stokes-Einstein relationship. Zeta potential is a scientific term for electro kinetic potential in colloidal dispersions. The electric potential at the boundary of the double layer is known as the Zeta potential of the particles, and has values that typically range from +100 mV to -100 mV.

APPLICATION

- Estimation of particle size, particle surface charge through zeta potential, poly dispersity index of different nanoparticulate formulations.

REFERENCE

Annamalai, A., et al. "Green synthesis, characterization and antimicrobial activity of Au NPs using Euphorbia hirta L. leaf extract." *Colloids and Surfaces B: Biointerfaces* 108 (2013): 60-65.

Hot Melt Extruder

FUNDAMENTAL PRINCIPLE

Hot melt extrusion (HME) is the process of applying heat and pressure to melt a polymer and forcing it through an orifice in a continuous process. HME is well-known, developed to produce polymer products of uniform shape and density.

APPLICATION

- Blending, Melting, and extrusion
- Shaping of polymer product in a single step process
- Creation of biofilaments for FDM mediated 3D printing

REFERENCE

Maniruzzaman, Mohammed, et al. "Taste masking of paracetamol by hot-melt extrusion: an in vitro and in vivo evaluation." *European Journal of Pharmaceutics and Biopharmaceutics* 80.2 (2012): 433-442.

3D-Printer

FUNDAMENTAL PRINCIPLE

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. 3D-Printer works on either fused deposition modeling (FDM), selective laser sintering (SLS) and sterolithography (SLA).

APPLICATION

- Designing & delivering of innovative pharmaceutical delivery systems.
- FDM, SLS and SLA technology mediated rapid prototyping
- Next generation 3D printed medicines

REFERENCE

Ota, Hiroki, et al. "Application of 3D printing for smart objects with embedded electronic sensors and systems." *Advanced Materials Technologies* 1.1 (2016): 1600013.

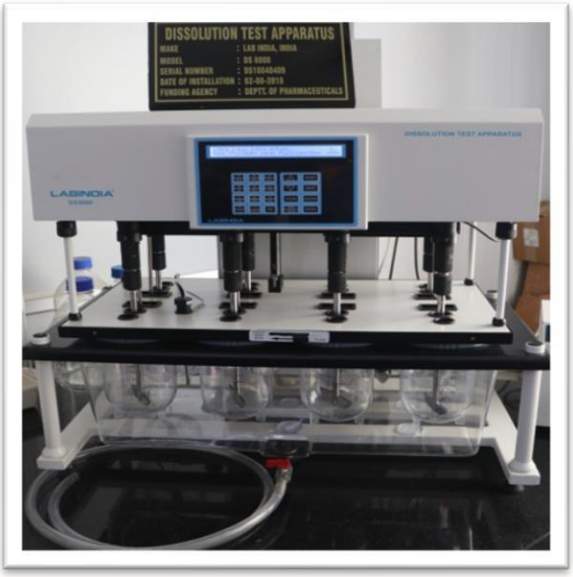
Dissolution Test Apparatus

FUNDAMENTAL PRINCIPLE

Dissolution is a process by which a solid substance enters the dissolution medium (purified water, dilute acid, stimulated gastric fluid, surfactant, aqueous buffer etc) to yield a solution. i.e. mass transfer from solid surface to liquid phase.

APPLICATION

- To estimate the amount of drug released into the medium per unit time
- Batch to batch drug release uniformity.
- To study the drug-drug interaction at acidic stomach and intestinal conditions



REFERENCE

Garbacz, Grzegorz, et al. "Comparison of dissolution profiles obtained from nifedipine extended release once a day products using different dissolution test apparatuses." *European Journal of Pharmaceutical Sciences* 38.2 (2009): 147-155.

Tablet Disintegration Machine

FUNDAMENTAL PRINCIPLE

Tablet Disintegration Machine is used for testing the disintegration time for tablets, capsules, and other solid dosage forms when placed in a liquid medium. Disintegration is defined as the state in which no residue of the unit under test remains on the screen of the instrument or if a residue remains, it consist of fragments of disintegrated parts of tablet component such as capsule shell, insoluble coating of the tablets.

APPLICATION

- Determination of complete disintegration time of pharmaceutical formulations

REFERENCE

Avachat, Amelia, and V. J. Ahire. "Characterization and evaluation of spray dried co-processed excipients and their application in solid dosage forms." *Indian journal of Pharmaceutical sciences* 69.1 (2007): 85.

Tablet Friability Tester

FUNDAMENTAL PRINCIPLE

A friable substance is any substance that can be reduced to finer particles by the action of a small pressure or friction against the substance. Tablets are constantly subjected to mechanical shocks & aberration during the manufacturing, packing, and transportation process. Such stress can lead to capping, aberration, or eve breakage of the tablets. Friability test is defined as the % weight loss by tablets due to mechanical action during the test

APPLICATION

- Used in drug formulation step to withstand stress during the test

REFERENCE

Osei-Yeboah, Frederick, and Changquan Calvin Sun. "Validation and applications of an expedited tablet friability method." *International journal of pharmaceutics* 484.1-2 (2015): 146-155.

Tablet Coating Machine

FUNDAMENTAL PRINCIPLE

This machine coats the external surface of a tablet using a thin film of coating material. The hot air penetrates through the tablet core layers and is discharged from the bottom of the layers, so that the coating medium sprayed on the surface of tablet cores will dry rapidly and evenly, thus forming a solid and smooth surface film.

APPLICATION

- Used in pharmaceuticals especially for tablet coating purpose

REFERENCE

Cole, G. C., et al. "The design and performance of an instrumentation system for aqueous film coating in an industrial tablet coating machine." *Drug Development and Industrial Pharmacy* 9.6 (1983): 909-944.

Fluidized Bed Processor with Compressor

FUNDAMENTAL PRINCIPLE

The equipment works on a principle of fluidization of the feed materials. In fluidization process, hot air is introduced at high pressure through a perforated bed of moist solid particulate. The wet solids are lifted from the bottom and suspended in a stream of air (fluidized state)

APPLICATION

- Used for drying of powders, mixing of powders and agglomeration.
- This is efficiently employed for applications in chemical, pharmaceutical, dyestuff, foodstuff, dairy and various other process industries.

REFERENCE

Viviente, Jose Luis, et al. "Advanced m-CHP fuel cell system based on a novel bio-ethanol fluidized bed membrane reformer." *International Journal of Hydrogen Energy* 42.19 (2017): 13970-13987.

Stability Chamber

FUNDAMENTAL PRINCIPLE

A stability chamber`s working principle is based on its ability to maintain a stable temperature and humidity to mimic environmental conditions

APPLICATION

- Short-term/accelerated, mid-term and long-term stability testing of drug substance and drug products at per ICH guidelines

REFERENCE

Bajaj, Sanjay, Dinesh Singla, and Neha Sakhuja. "Stability testing of pharmaceutical products." *J App Pharm Sci* 2.3 (2012): 129-138.

Sieve Shaker

FUNDAMENTAL PRINCIPLE

Sieve shakers are used for separation and size determination of particles. A typical sieve shaker separates particle by passing them through a series of chambers with mesh filters and agitating the sample in order to obtain complete separation

APPLICATION

- Particle sizing analysis of a wide range of material sizes

REFERENCE

Utsumi, Ryoji, et al. "An attrition test with a sieve shaker for evaluating granule strength." *Powder technology* 122.2-3 (2002): 199-204.

Rapid Mixer Granulator (RMG)

FUNDAMENTAL PRINCIPLE

In Rapid mixture granulator, mixing, densification, agglomeration id achieved using shear mixing (breaking intermolecular forces) and compaction forces exerted by impeller on the powder mass. RMG consists of Mixing chamber, Impeller, Chopper, Discharge port, Filter assembly, Purging air and solution inlet port.

APPLICATION

- In pharmaceutical industry rapid mixer granulator plays vital role to mix the ingredients and make granules before compression.
- It can be used to granulate pharmaceutical blend up to 3.5 kg maximum using 10 liters bowl.

REFERENCE

Suresh, Pathi, Vikranth Kumar Surasani, and Inkollu Sreedhar. "Investigations at an industrial scale on granule and tablet attributes in high shear rapid mixer granulator." *Particulate Science and Technology* 36.4 (2018): 457-463.

Bursting Strength Tester

FUNDAMENTAL PRINCIPLE

Bursting strength tester adopts signal transmission pressure, and the sample rupture automatically retain maximum fracture strength. The test piece is placed on the rubber mold, and is clamped by the clamping piece, and then the pressure is uniformly applied, so that the test piece and the adhesive film are free to bulge together, until the test piece is broken, the maximum value of the hydraulic pressure is applied, that is, the bursting or breaking strength value of the test sample or piece.

APPLICATION

- Quality control testing of paper and cardboard to know bursting strength values

REFERENCE

Koç, Erdem, and Emel Çinçik. "An investigation on bursting strength of polyester/viscose blended needle-punched nonwovens." *Textile Research Journal* 82.16 (2012): 1621-1634.

Horizontal Shaker Incubator

FUNDAMENTAL PRINCIPLE

A shaker is a piece of laboratory equipment used to mix, blend, or agitate substances in a tube or flask by shaking them.

APPLICATION

- It is mainly used in the fields of chemistry and biology

REFERENCE

Nejaddehbashi, Fereshte, et al. "Application of polycaprolactone, chitosan, and collagen composite as a nanofibrous mat loaded with silver sulfadiazine and growth factors for wound dressing." *Artificial organs* 43.4 (2019): 413-423.

Rotary Evaporator

FUNDAMENTAL PRINCIPLE

Boiling points of liquids reduces on decreasing their pressure, allowing solvents to be vaporized at much lower temperatures than their boiling points at normal pressure.

APPLICATION

- Solvent evaporation and to concentrate the herbal/impurities extracts

REFERENCE

Giri, Ramesh, Jonathan K. Lam, and Jin-Quan Yu. "Synthetic applications of Pd (II)-catalyzed C− H carboxylation and mechanistic insights: expedient routes to anthranilic acids, oxazolinones, and quinazolinones." *Journal of the American Chemical Society* 132.2 (2010): 686-693.

Cryotank-Liquid Nitrogen Container

FUNDAMENTAL PRINCIPLE

Cryopreservation is a process where organelles, cells, tissues, extracellular matrix, organs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temperature (-196^{0}C using liquid nitrogen)

APPLICATION

- For cryopreservation of different cell lines

REFERENCE

Zheng, Hongfei, et al. "The Application of Carbon Fiber Composites in Cryotank." *Solidification* (2018): 111.

N_2 Concentrator

FUNDAMENTAL PRINCIPLE

It works by blowing nitrogen into the heated surface of the sample and makes the solvent evaporate and separated rapidly; thereby reaching the sample enrichment purpose without oxygen, keep the sample purer. accelerates liquid evaporation and sample concentration

APPLICATION

- Drying of herbal extracts
- Evaporation of solvents
- Deconcentrate the biological samples

REFERENCE

Liang, Xiaorong, et al. "Study of dried blood spots technique for the determination of dextromethorphan and its metabolite dextrorphan in human whole blood by LC–MS/MS." *Journal of Chromatography B* 877.8-9 (2009): 799-806.

Soxhlet Extraction

FUNDAMENTAL PRINCIPLE

A Soxhlet extraction is a continuous solid/liquid extraction technique. These devices allow for continuous treatment of a sample with a solvent over a period of hours or days to extract compounds of interest. Typically, a Soxhlet extraction is only required where the desired compound has a limited solubility in a solvent

APPLICATION

- Extraction of bioactive molecules from spices and medicinal plants

REFERENCE

Anderson, Shirley. "Soxtec: Its principles and applications." *Oil Extraction and Analysis: Critical Issues and Competitive Studies* (2004).

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Ultra Centrifuge

FUNDAMENTAL PRINCIPLE

Centrifugation is a technique of separating substances which involves the application of centrifugal force. The particles are separated from a solution according to their size, shape, density, the viscosity of the medium and rotor speed. Current ultracentrifuge can spin to as much as 150 000 rotations per minute (rpm)

APPLICATION

- To separate two miscible substances,
- Purification of mammalian cells
- Fractionation of sub cellular organelles (including membranes/ membrane fractions)
- Fractionation of membrane vesicles
- Separating chalk powder from water, Removing fat from milk to produce skimmed milk.
- Separating particles from an air-flow using cyclonic separation
- The clarification and stabilization of wine

Separation of urine components and blood components in forensic and research laboratories,

REFERENCE

Ansevin, Allen T., Dennis E. Roark, and David A. Yphantis. "Improved ultracentrifuge cells for high-speed sedimentation equilibrium studies with interference optics." *Analytical biochemistry* 34.1 (1970): 237-261.

Karl Fischer Titrator

FUNDAMENTAL PRINCIPLE

Karl Fischer titration is a widely used analytical method for quantifying water content in a variety of products. The fundamental principle behind it is based on the Bunsen Reaction between iodine and sulfur dioxide in an aqueous medium.

APPLICATION

- To measure water content from cosmetic products and pharmaceutical products

REFERENCE

Ronkart, Sebastien N., et al. "Determination of total water content in inulin using the volumetric Karl Fischer titration." *Talanta* 70.5 (2006): 1006-1010.

High Shear Homogenizer

FUNDAMENTAL PRINCIPLE

It is a process in which coarse globules in emulsion are converted into smaller globules of uniform composition so that each measured dose has the same composition. It is based on the principle that when large globules in coarse emulsion are passed through a narrow orifice is broken into smaller globules having a greater degree of uniformity, and stability

APPLICATION

- Chemical emulsions, dairy and food processing.

REFERENCE

Lee, Sun-Young, et al. "Preparation of cellulose nanofibrils by high-pressure homogenizer and cellulose-based composite films." *Journal of Industrial and Engineering Chemistry* 15.1 (2009): 50-55.

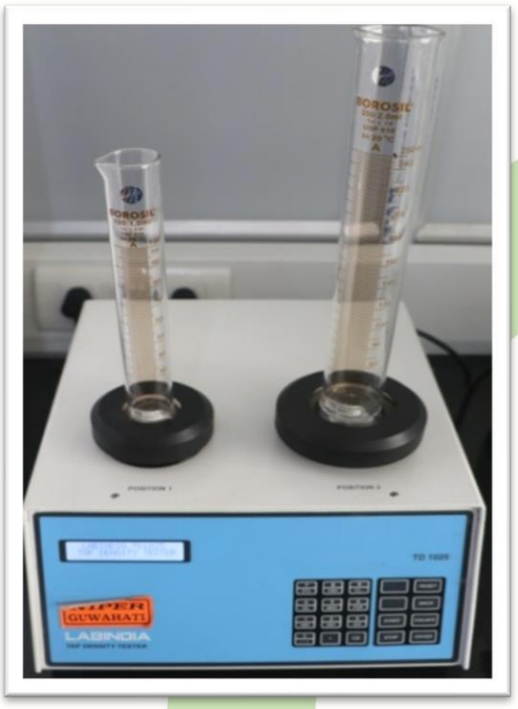
Bulk and Tap Density Meter

FUNDAMENTAL PRINCIPLE

Tapped density of a powder is the ratio of the mass of the powder to the volume occupied by the powder after it has been tapped for a defined period of time. The tapped density of a powder represents its random dense packing. Tapped density can be calculated using the formula i.e. M=mass in grams divided by V_f=the tapped volume in milliliters.

APPLICATION

- To measure the tapped density or tapped volume of powders, granules, flakes, and pellets, and other bulk substance



REFERENCE

Mohammadi, M. S., and N. Harnby. "Bulk density modelling as a means of typifying the microstructure and flow characteristics of cohesive powders." *Powder technology* 92.1 (1997): 1-8.

Multimode Reader

FUNDAMENTAL PRINCIPLE

The Spectramax® i3x Multi-Mode micro plate reader measures spectral-based Absorbance, Fluorescence, and Luminescence with the added functionality of modular upgrades for Western Blot, Imaging, and Fast Kinetics. It uses different modes of imaging like absorbance, fluorescence and luminescence. It has two different optical configuration which includes monochromators (absorbance, fluorescence and luminescence) whereas minim ax is useful for cell imaging.

APPLICATION

- Binding and enzymology assays
- Cell growth and viability assays
- Cell signalling & transport
- Early ADME permeability & solubility
- ELISA-endpoint and ELISA-Kinetic assays
- Nucleic acids and protein quantification
- TR-FRET assays and mini max imaging

REFERENCE

Yu, Jinghua, et al. "Highly selective molecular recognition and high throughput detection of melamine based on molecularly imprinted sol–gel film." *Analytica chimica acta* 651.2 (2009): 209-214.

Real-Time Polymerase Chain Reaction (RT-PCR)

FUNDAMENTAL PRINCIPLE

RT-PCR is carried out in a thermal cycler with the capacity to illuminate each sample with a beam of laser light of at least one specified wavelength and detect the fluorescence emitted by fluorophore at real time. In RT-PCR, the RNA template is first converted into a complementary DNA (cDNA) using a reverse transcriptase. The cDNA is then used as a template for exponential amplification using PCR

APPLICATION

- The amount of the nucleic acid present into the sample is quantified using the fluorescent dye or using the fluorescent labeled oligos.
- Real-time PCR thermal cyclers/thermocyclers carry out quantitative PCR (qPCR) for experiments in gene expression, genetic variation, genotyping, and specific detection of rare targets, bacteria, and viruses.
- Using smaller starting amounts of DNA or RNA and combining nucleic acid amplification and detection allows for efficiency and eliminates the post-amplification process

REFERENCE

Salihah, Nur Thaqifah, et al. "Trends and advances in food analysis by real-time polymerase chain reaction." *Journal of food science and technology* 53.5 (2016): 2196-2209.

Thermo Scientific™ Arktik™ Thermal Cycler

FUNDAMENTAL PRINCIPLE

Thermo cyclers, or thermal cyclers, are instruments used to amplify DNA and RNA samples by the polymerase chain reaction. A polymerase chain reaction (PCR) consists of three steps: denaturation, annealing (hybridization), and extension. The thermo cycler raises and lowers the temperature of the samples in a holding block in discrete, pre-programmed steps, allowing for denaturation and re annealing of samples with various reagents.

APPLICATION

- To evaluate the biological samples
- A wide variety of applications, such as determining viral load, measuring responses to therapeutic agents
- Quantitative determination of target abundance through characterization of gene expression

REFERENCE

Kozdrój, Jacek, and Jan Dirk van Elsas. "Application of polymerase chain reaction-denaturing gradient gel electrophoresis for comparison of direct and indirect extraction methods of soil DNA used for microbial community fingerprinting." *Biology and Fertility of Soils* 31.5 (2000): 372-378.

Gel Documentation System

FUNDAMENTAL PRINCIPLE

A fluorescent substance that has bound to nucleic acid or protein is excited by uv-irradiation or chemiluminescence, thereby emits fluorescent light. Fusion imaging system functions on multiple principles including the imaging of Chemiluminescence, fluorescence and Colorimetry, where visualization of the emitted light in the earlier and the absorbed light in the later takes place depending on the type of sample.

APPLICATION

- Molecular biology laboratories for the imaging and documentation of nucleic acid and protein suspended within polyacrylamide or agarose gels.
- Colony counting
- Immunoassay
- Gel and blot imaging
- Multiplex protein detection
- Protein quantification
- Monoclonal and polyclonal antibody binding affinities

REFERENCE

Faller, Daniel et al. "An open source protein gel documentation system for proteome analyses." *Journal of chemical information and computer sciences* 44.1 (2004): 168-169.

Micro Plate Reader

FUNDAMENTAL PRINCIPLE

A micro plate reader detects light signals produced by samples which have been pipetted into a micro plate. The optical properties of these samples are the result of a biological, chemical, biochemical or physical reaction. Different analytic reactions result in different optical changes used for analysis. Absorbance, fluorescence intensity and luminescence are the most popular and most frequently used detection modes in laboratories worldwide.

APPLICATION

- A micro plate reader is used for the quantification of several biological and chemical assays in a micro plate.
- chemiluminescence, bioluminescence, absorbance all these information can be obtained using micro plate reader.

REFERENCE

Feng, Steve, et al. "High-throughput and automated diagnosis of antimicrobial resistance using a cost-effective cellphone-based micro-plate reader." *Scientific reports* 6 (2016): 39203.

Incubator Shaker

FUNDAMENTAL PRINCIPLE

Incubator Shaker is to provide controlled environmental incubator with a continuous-duty shaking mechanism. A versatile unit with fully integrated heating and refrigeration systems where the temperatures can be accurately regulated from 4oC to 80oC. The rotary shaker mechanism has a range of speeds between 25 rpm and 500 rpm. Thus, Incubator Shaker provide advantage of traditional incubator and a laboratory shaker for efficient performance in applications like culturing microorganisms under controlled conditions of temperature, atmosphere, and agitation.

APPLICATION

- To grow bacteria, yeast, fungus, insect cells, plant cells and algae
- Protein expression studies in lab scale
- Plasmid DNA production
- Process and media development
- Culture optimization
- Seed cultures for bioprocess scale-up

REFERENCE

Morgan, D. R et al. "Growth of Campylobacter pylori in liquid media" Journal of clinical microbiology, 1987, *25*(11): 2123–2125.

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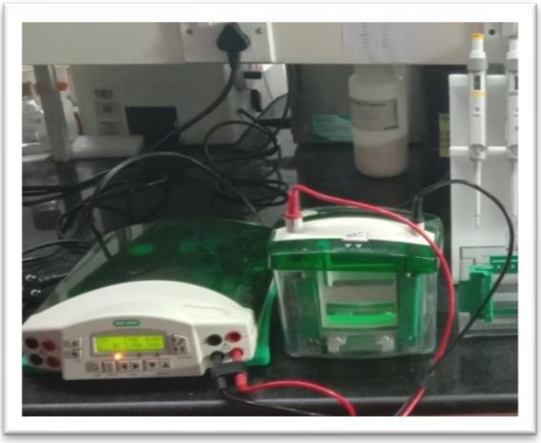
Vertical Gel Electrophoresis

FUNDAMENTAL PRINCIPLE

This technique involved separation of proteins according to their electrophoretic mobility which depends on charge, size and structure of the proteins. Mixtures of proteins are run on a sodium dodecyl sulfate–polyacrylamide gel electrophoresis (SDS-PAGE) by applying a constant voltage where the proteins get resolved according to its molecular weight. Finally the proteins are transferred on a membrane made of Nitrocellulose (NC) or Polyvinylidene difluoride (PVDF) and incubated with desired primary antibody and enzyme conjugated secondary antibody for detection. Bands are visualized by addition of substrate that reacts with the enzyme that is bound to the secondary antibody to generate coloured substance.

APPLICATION

- Identification of a specific protein in a complex mixture of proteins
- Estimation of the size and the amount of protein present in the mixture
- It is most widely used as a confirmatory test for various diagnosis purposes
- The technique is used in the analysis of biomarkers such as hormone, growth factor, cytokines etc.



REFERENCE

Alabakovska S. B et al. “Gradient gel electrophoretic separation of LDL and HDL subclasses on BioRad Mini Protean II and size phenotyping in healthy Macedonians” ClinChimActa. 2002, 317(1-2):119-123.

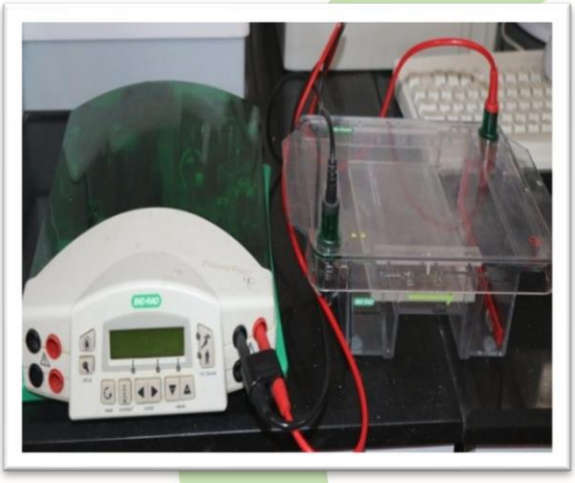
Horizontal Electrophoresis

FUNDAMENTAL PRINCIPLE

In horizontal gel electrophoresis, a gel is cast in a horizontal orientation and submerged in running buffer within the gel box. The gel box is divided into two compartments, with agarose gel separating the two. As previously stated, an anode is located at one end, while a cathode is located at the other. The ionic running buffer allows for a charge gradient to be created when a current is applied. In addition, the buffer serves to cool the gel, which heats up as a charge is applied.

APPLICATION

- Gel electrophoresis allows for the separation of nucleic acids (DNA or RNA) and proteins based on their size.
- Electrophoresis is used by labs studying vaccines, medications, forensics, and DNA profiling or other life science applications.
- The technique is also used in industry such as mining or food sciences.
- Horizontal Electrophoresis is mostly used for DNA and RNA separation.



REFERENCE

Dowdle M. E et al. “Horizontal Gel Electrophoresis for Enhanced Detection of Protein-RNA Complexes.” J Vis Exp. 2017, (125): 56031.

Western Blotting, Biorad

FUNDAMENTAL PRINCIPLE

Western blot is the analytical technique used in molecular biology, immunogenetics and other molecular biology to detect specific proteins in a sample of tissue homogenate or extract. In this method, known antigens of well-defined molecular weight are separated by SDS-PAGE and blotted onto nitrocellulose or PVDF membrane. The separated bands of known antigens are then probed with the sample suspected of containing antibody specific for one or more of these antigens. Reaction of an antibody with a band is detected by using either radio labeled or enzyme-linked secondary antibody that is specific for the species of the antibodies in the test sample.

APPLICATION

- Quantitative estimation as well as the size of protein present in the mixture can be performed.
- It is also widely used as a confirmatory test for diagnosis of various diseases, where this procedure is used to determine whether the patient has specific antibodies for specific disease.

REFERENCE

Crone M et al. “The antiestrogenic effects of black cohosh on BRCA1 and steroid receptors in breast cancer cells.” Breast Cancer (Dove Med Press). 2019, 11:99-110

Cryotome

FUNDAMENTAL PRINCIPLE

A cold cutting tool for making very thin sections of tissues after they have been removed from the body and frozen for rapid microscopic analysis without embedding tissue in paraffin. After tissue fixation, tissues are embedded in OCT freezing medium. Embedded tissues are cut to desired thickness ranging from 1 to 100 µm in a cold freezing condition of -20^{0}c. Thin sections are taken on a clean glass slides stained with appropriate dye(s) or incubated with appropriate primary antibodies for Immuno histochemistry (IHC) or confocal microscopy. Desired sections can be examined using a light microscope or a confocal microscope.

APPLICATION

- To cut very thin sections from varying ranges from 1 to 100 µm in a cold freezing condition of -20^{0}C
- These range of thin sections are required to examine the slide by using confocal microscope

REFERENCE

Gerbig, S. et al.” Spatially resolved investigation of systemic and contact pesticides in plant material by desorption electrospray ionization mass spectrometry imaging (DESI-MSI)” Analytical and Bioanalytical Chemistry 2015, 407(24) 7379-738

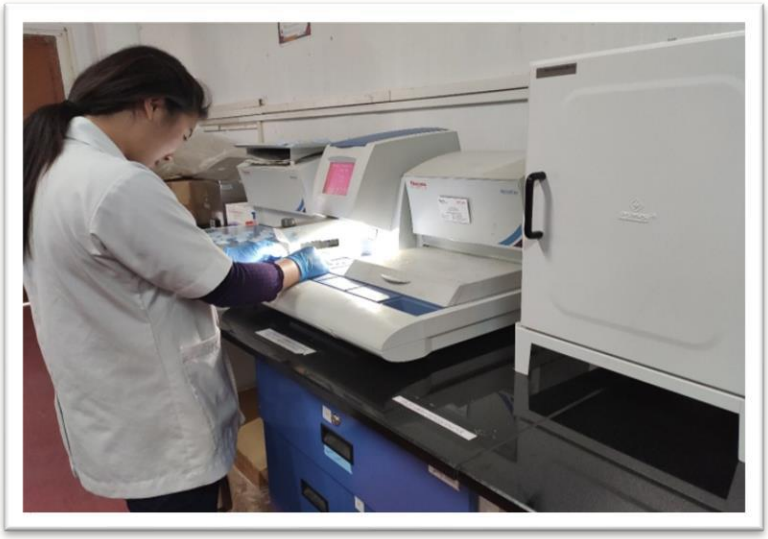
Tissue Embedding Working Station

FUNDAMENTAL PRINCIPLE

A modular tissue embedding system incorporates two separate components; heated embedding module and the cold plate. The heated embedding module allows for a smooth workflow for molten paraffin on to the tissue embedded cassettes and cold platform allows immediate freezing of the blocks. It utilizes LED lighting for uniform illumination of the workspace. The main advantage of automatic embedding unit is that it is simple operation, fast and can be precise control thus reducing fatigue and minimizing errors.

APPLICATION

- Preparing paraffin blocks for further cutting sections on a microtome



REFERENCE

Sexton T et al. “Optimization of Tissue Microarrays from Banked Human Formalin-Fixed Paraffin Embedded Tissues in the Cancer Research Setting ” *Biopreserv Biobank*. 2019, 17(5):452-457

Tissue Lyser II

FUNDAMENTAL PRINCIPLE

The Tissue Lyser II thoroughly disrupts and simultaneously homogenizes biological samples in the presence of lysis buffer. Plant tissues can alternatively be disrupted and homogenized in the absence of lysis buffer

APPLICATION

- The Tissue Lyser II enables disruption and homogenization of
- Human and animal tissues
- Human and animal cells
- Plant tissues
- Yeast
- Gram-positive and gram-negative bacteria.

REFERENCE

Nakaune, Ryoji, and Masaaki Nakano. "Efficient methods for sample processing and cDNA synthesis by RT-PCR for the detection of grapevine viruses and viroids." *Journal of virological methods* 134.1-2 (2006): 244-249.

Confocal Microscope

FUNDAMENTAL PRINCIPLE

Confocal microscopy, is an optical imaging technique for increasing optical resolution and contrast of a micrograph. The laser light is passed through a pinhole into a dichromatic mirror that reflects the light and focused on a defined spot at a specific depth within the sample. This leads to the emission of fluorescent light at exactly this point. A pinhole inside the optical pathway cuts off signals that are out of focus, thus allowing only the fluorescence signals from the illuminated spot to enter the light detector (photomultiplier tubes).

APPLICATION

- Live Cell Imaging, Co-localization of Fluorophores, Deep Tissue Imaging
- Resolve the detailed structure of specific objects within the cell.
- Cell biology, genetics to microbiology, Quantum optics, nanocrystal imaging
- Stem cell research, Photo bleaching studies
- Fluorescence resonance energy transfer (FRET), Multi-photon microscopy
- DNA hybridization, Bio-luminescent proteins, Epitope imaging

REFERENCE

Ahmed, Khalid, Phillip Gribbon, and Malcolm N. Jones. "The application of confocal microscopy to the study of liposome adsorption onto bacterial biofilms." *Journal of liposome research* 12.4 (2002): 285-300.

Inverted Tissue Culture Microscope

FUNDAMENTAL PRINCIPLE

Basic principle behind the tablet compression machine is hydraulic pressure. A tablet is formed by the combined pressing action of two punches and a die. In the first step, the bottom punch is lowered in the die creating a cavity into which the granulated feedstock is fed. The exact depth of the lower punch can be precisely controlled to meter the amount of powder that fills cavity. The excess is scrapped from the top of die, and the lower punch is drawn down and temporarily covered to prevent spillage. Then the upper punch is brought down into contact with powder as the cover is removed. The force of compression rolls which fuse the granulated material together into a hard tablet. After compression, the lower punch is raised to eject the tablet.

APPLICATION

- Inverted microscopy is a very popular technique for live cell imaging.
- Additional application is the micros-copy of fixed cells or tissue sections
- Observation of intercellular structures
- Observation of blood smears
- Observation of motility
- It is useful in observing cell-cultured *in vitro* during mitosis
- Observation of morphology of microorganism
- Information about structure, genetic alteration, heterogeneity, kinetics can be obtained using this tool.

REFERENCE

Kahle, Jennifer, et al. "An inexpensive simple-to-use inverted fluorescence microscope: a new tool for cellular analysis." *JALA: Journal of the Association for Laboratory Automation* 15.5 (2010): 355-361.

Fluorescence Microscope

FUNDAMENTAL PRINCIPLE

When light radiation of high energy strikes a substance that can fluoresce, the substance absorbs that energy and converts a small part of it into energy (i.e. heat). The energy that is not absorbed by the substance is emitted again as light. The emitted light is called fluorescent light.

APPLICATION

- It is used in medical microbiology
- bacterial pathogen detection
- chromosomal anomalies etc.

REFERENCE

Tsuji, Akihiko, et al. "Direct observation of specific messenger RNA in a single living cell under a fluorescence microscope." *Biophysical journal* 78.6 (2000): 3260-3274.

Biosafety Cabinet

FUNDAMENTAL PRINCIPLE

A biosafety cabinet (BSC)—also called a biological safety cabinet or microbiological safety cabinet is an enclosed, ventilated laboratory workspace for safely working with materials contaminated with (or potentially contaminated with) pathogens requiring a defined biosafety level.

APPLICATION

- It is used in microbiology, molecular biology, and cell biology for culturing of microorganisms, animal and plant cell culture.

REFERENCE

Lennartz, Klaus, et al. "Improving the biosafety of cell sorting by adaptation of a cell sorting system to a biosafety cabinet." *Cytometry Part A: The Journal of the International Society for Analytical Cytology* 66.2 (2005): 119-127.

CO_2 Incubator

FUNDAMENTAL PRINCIPLE

A CO_2 incubator is used to culture cells to provide it with the optimum temperature, moisture (sterile environment) and to maintain optimum pH. When the media contains carbonate buffer, the CO_2 gas from the cylinder is let into the incubator in such a way that the pH remains constant

APPLICATION

- To grow and maintain cell cultures.
- Other applications include tissue engineering, in vitro fertilization, neuroscience, cancer research and other mammalian cell research.

REFERENCE

Makinistian, Leonardo, and I. Belyaev. "Magnetic field inhomogeneities due to CO2 incubator shelves: a source of experimental confounding and variability?." *Royal Society open science* 5.2 (2018): 172095

Refrigerated Centrifuge

FUNDAMENTAL PRINCIPLE

Refrigerated centrifuge works on the concept of sedimentation principle by holding up the sample tubes with rotation around a fixed axis. In this, particles are separated from a solution according to their size, shape, density, viscosity of the medium and rotor speed with the application of centrifugal force. Refrigerated centrifuge additionally provides the cooling mechanism to maintain the uniform temperature throughout the operation of the sample. This centrifuge has a maximum speed of 14,000 RPM with temperature range from -9 to 40℃.

APPLICATION

- To separate two miscible solution
- Purification of mammalian cells
- Fractionation of sub cellular organelles, fractionation of membrane vesicles
- Separation of urine components and blood components in forensic and research laboratories.

REFERENCE

Sureda-Vives M et al. “Stability of serum, plasma and urine osmolality in different storage conditions: Relevance of temperature and centrifugation” ClinBiochem. 2017, 50(13-14):772-776.

Microtome

FUNDAMENTAL PRINCIPLE

Cut high-quality thin paraffin embedded sections without a power supply. The advantage of model HM 325 includes one-handed zero orientation head, quick-trim button, section counter etc. Briefly tissues are fixed, dehydrated, cleared, and embedded in melted paraffin, which when cooled forms a solid block. The tissue is then cut in the microtome at thicknesses varying from 2 to 50 µm. From there the tissue can be mounted on a microscope slide, stained with appropriate aqueous dye(s) after removal of the paraffin, and examined using a light microscope for morphological changes.

APPLICATION

- Used for to cut high quality thin section at a varying from 2 to 50 µm from paraffin embedded blocks
- Used for tissue histology.

REFERENCE

Mousum, S. A. et al. "*Nyctanthesarbor-tristis* leaf extract ameliorates hyperlipidemia- and hyperglycemia-associated nephrotoxicity by improving anti-oxidant and anti-inflammatory status in high-fat diet–streptozotocin-induced diabetic rats" Inflammopharmacol 2018, 26**,** 1415–1428.

Flow Cytometer

FUNDAMENTAL PRINCIPLE

The Invitrogen™ Attune™ NxT Flow Cytometer combines precision with performance in a true benchtop flow cytometer with up to 4 lasers and 16 parameters of detection with the power of flow cytometry to the analysis of more sample types, including cancer cells. The addition of the Invitrogen™ Attune™ NxTAutosampler enables significantly faster high-throughput screening on a multiparametric platform. Run samples faster and achieve greater resolution with little fear of sample loss due to clogging

APPLICATION

- Cell cycle analysis,
- Immunophenotyping,
- Cell proliferation assays,
- Apoptotic marker analysis,
- Signalling pathways.

REFERENCE

Safford et al. ““Performance comparison of four commercially available cytometers using fluorescent, polystyrene, submicron-scale beads” *Data in brief* 2019, vol. 24 103872. 23 Mar.

Hematology Analyser

(Funded by DBT NER,
File No. BT/PR25319/NER/95/1133/2017)

FUNDAMENTAL PRINCIPLE

Automated hematology analyzer works on different principles: Electrical impedance (coulter's principle), colorimetry and flow cytometry (Light scatter and Light absorption). Most analyzers are based on a combination of different principles

APPLICATION

- Hematology analyzer is used to conduct a complete blood count (CBC), which include red blood cell (RBC), white blood cell (WBC), hemoglobin and platelet count.
- The ADVIA 2120i Hematology System directly measures the hemoglobin concentration and volumes of individual RBCs and allows the determination of hematocrit and erythrocyte size on a cell-by-cell basis. RBC distribution width, Mean corpuscular volume, Mean corpuscular hemoglobin, Mean corpuscular hemoglobin concentration.
- WBC differential count (percentage and absolute value).
- Platelet distribution width, Platelet mean volume, Large platelet cell ratio, Platelet criteria.

REFERENCE

Bruegel M et al. "Comparison of five automated hematology analyzers in a university hospital setting: Abbott Cell-Dyn Sapphire, Beckman Coulter DxH 800, Siemens Advia 2120i, Sysmex XE-5000, and Sysmex XN-2000" ClinChem Lab Med. 2015, 53(7):1057-1071.

Deep Freezer (-80) ℃

FUNDAMENTAL PRINCIPLE

Deep freezer is a highly sophisticated machine equipped with cooling compressors which removes the heat from the close system to surrounding and maintained the low temperature inside the freezer. This freezer maintains the temperature up to -80 ℃.

APPLICATION

- Long term storage of Biological samples like DNA, RNA, and proteins, cell extracts, or reagents, Blood and vaccines, Drugs Chemical formulation

REFERENCE

Ito D et al. “Effect of trehalose on the preservation of freeze-dried mice spermatozoa at room temperature” J Reprod Dev. 2019, 65(4):353-359.

LC-HRMS

FUNDAMENTAL PRINCIPLE

The Liquid chromatography coupled with High resolution Mass spectrometry (LC-HRMS) wherein the individual components in a mixture are first separated based on interaction of analyte to stationary/mobile phase followed by soft ionization (ESI), and separation of the ions on the basis of their mass/charge ratio (accurate mass measurement).

APPLICATION

- Identification and characterization of impurities in drug substances
- Forced degradation studies and characterization of degradation products
- Chemical characterization of biomarkers in herbal products
- MS/MS analysis of metabolite, drug degradation and impurities

Instrument is in transit

ICP-MS

FUNDAMENTAL PRINCIPLE

It is an analytical instrument based on the use of high temperature ionization source (ICP) coupled to mass spectrometer. Liquid samples initially form aerosol in nebulizer. Introduction of argon to the ICP torch, located in the centre of a radio frequency coil for energy supply. RF field causes collision of Ar atoms, generating high energy plasma. Sample aerosol decomposed in plasma to form ions. Ions extracted from the plasma into mass spectrometer region.

APPLICATION

- Quantification of multiple heavy metal analysis at a time in different food, drug substances and drug products

Instrument is in transit

ANIMAL HOUSE AND THEIR FACILITIES

Small Animal Imaging System

FUNDAMENTAL PRINCIPLE

This is Multi-Modal Imaging for preclinical research which covers both functional and anatomical parameters. This system is non-invasive and it gives real time data for the preclinical research The Vevo lazr-X system combines Photo acoustic and Ultrasonography. This system uses hemoglobin as internal standard so there is no need to inject any specific dye for the purpose of imaging.

APPLICATION

- Oncology (Tumor detection and sizing in 2D and 3D, Vascularity and perfusion, Tumor model characterization, Response to therapy, Hypoxia).
- Molecular Biology (Characterization of nanoparticles, dyes and other contrast agents, Drug delivery, pharmacokinetic analysis, Micro distribution of biomarkers, Cell tracking)
- Cardiology (Cardiac function in 2D, 3D and 4D), Hypoxia, ischemia, measurement, Hemodynamics, Myocardial and vascular strain, Cardiotoxicity)
- Neurobiology (Functional imaging with oxygen saturation, total hemoglobin and glio ma research, Stroke assessment, Image-guided injection)

REFERENCE

Yu, Qian., Huang, Shanshan., Wu, Zhiyou., Zheng, Jiadi., Chen, Xiaoyuan and Nie, Liming "Label-free Visualization of Early Cancer Hepatic Micrometastasis and Intraoperative Image-guided Surgery by Photoacoustic Imaging." Journal of Nuclear Medicine, 2020, DOI: 10.2967/jnumed.119.233155.

Colonoscopy

FUNDAMENTAL PRINCIPLE

Colonoscopy used for the macroscopic evaluation of the colon. In the area of Inflammatory bowel diseases drug discovery especially like ulcerative colitis visual observation of colon required to monitor pathological changes. Using colonoscopy drug can be delivered directly into the colon in the drug discovery of IBD and Cancer. It is also useful to assess macroscopic evaluation of the colon in the area of colon cancer drug discovery and development. Colonoscopy also having a provision to collect the biopsy sample from colon to diagnose the inflammatory bowel diseases and colon cancer.

APPLICATION

- It is useful to assess macroscopic evaluation of the colon
- It is useful in pharmacological screening of the drugs for ulcerative colitis, Inflammatory bowel diseases, Colon cancer etc.

REFERENCE

Yashiro M. et al. “Ulcerative colitis-associated colorectal cancer” World J Gastroenterol. 2014, 20(44):16389-16397.

Animal Anesthesia System

FUNDAMENTAL PRINCIPLE

Animal anesthesia system and accessories used to anaesthetize the smallest pre-clinical research subjects like rat and mice. Such devices are designed to provide highly efficient depth modulation anesthesia. Rats / mice are anesthetized by placing them individually in an induction chamber where oxygen and isoflurane are delivered at a specified concentration. UNO BV systems are designed with priority for user safety. The device provides excellent waste gas storage to protect consumers from the harmful effects of short-term exposure to anesthetic gases. It also ensures the safety of the working personnel from being anesthesia

APPLICATION

- Ideal flow meter range for rodents suitable to induce anesthesia for mice, rats and other small animals under 10 lb

REFERENCE

Ari C et al. “Nutritional ketosis delays the onset of isoflurane induced anesthesia” *BMC* Anesthesiol. 2018, 18(1):85.

Whole- Body Inhalation Exposure System

FUNDAMENTAL PRINCIPLE

It is the most efficient test article inhalation exposure system with the lowest dead space. It relying on dynamic exposure chambers that maintain a constant throughput of air so that the subjects are exposed while free to move about in groups or segregated in single animal cells. It also having a provision for aerosol generation, sampling and monitoring facilities. It can accommodate up to 10 mice or 5 rats each in single chamber. The chamber design allows for optimal continual mixing of fresh test atmosphere. This minimizes the variation of exposure to each individual animal and leads to results that are more precise.

APPLICATION

- Best suited for longer term studies such as sub-chronic or chronic studies, or for exposures that require simultaneous exposure of large numbers of animals.
- Suitable for gasses, vapors, aerosols and mixed atmosphere exposures
- Pulmonary disease model development
- Inhalation safety and toxicological profiling

REFERENCE

Veldhuis, Marcel JW, and Gijsbert W. Kraay. "Comparison between whole-body inhalation and nose-only inhalation on the deposition and health effects of nanoparticles " Environ health Prev Med. 2016, 21(1): 42–48.

Flexi Vent

FUNDAMENTAL PRINCIPLE

The flexi Vent is regarded as the gold standard for *in vivo* lung physiological function measurements in mouse model. It goes beyond traditional resistance and compliance measurements, and captures crucial details about the mechanical properties of conducting airways, terminal airways and parenchyma.

APPLICATION

- Drug discovery for respiratory diseases
- Assessment of lung physiology and airway hype responsiveness features
- Diagnosis of Asthma, COPD, Pulmonary fibrosis and other respiratory changes via assessing inspiratory capacity, elasticity, airway resistance and P-V curve
- Assessment of Pulmonary Toxicity

REFERENCE

Yadav, Shikha., Yadav, N. D. S., Gheware, A.; Kulshreshtha, A., Sharma, Pankaj., Singh, V. P. " Oral Feeding of Cow Milk Containing A1 Variant of β Casein Induces Pulmonary Inflammations in Male Balb/c Mice." *Scientific Reports* | (2020), https://doi.org/10.1038/s41598-020-64997-z.

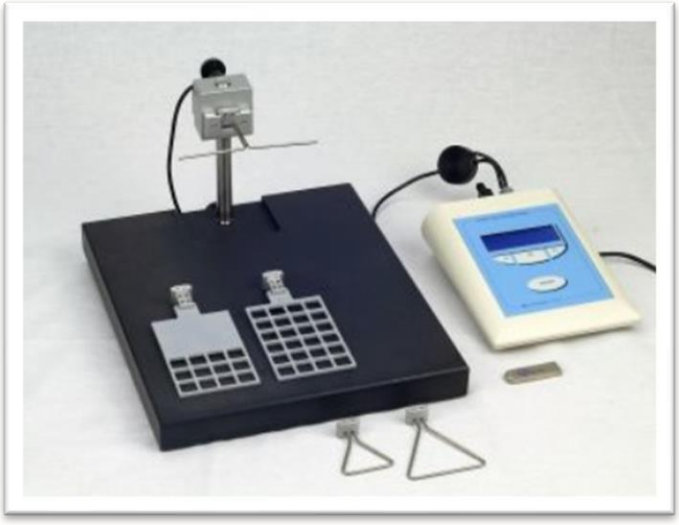
Grip Strength Meter

FUNDAMENTAL PRINCIPLE

The Ugo Basile Grip-Strength Meter automatically measures grip-strength (i.e. peak force and time resistance) of forelimbs and - via the optional grid - hind limbs in rats and mice. The effects of drugs, toxins, muscle relaxants, disease, ageing or neural damage on muscle strength may be assessed. When pulled by the tail, rodents instinctively grab anything they can, to try to stop this involuntary backward movement, until the pulling force overcomes their grip strength. when positioned in front of the GSM bar, or trapeze, or grid, the animal grasps at it. After the animal loses its grip on the grasping bar, the peak amplifier automatically records and stores the peak pull-force achieved by the limbs and shows it on the display.

APPLICATION

- To assess the effect of drugs and disease on the muscle strength of the small animals and motor coordination



REFERENCE

R. Barone et al. “Skeletal muscle Heat shock protein 60 increases after endurance training and induces peroxisome proliferator-activated receptor gamma co activator 1 α1 expression” Scientific Reports 6(19781), 2016.

Radial Arm Maze

FUNDAMENTAL PRINCIPLE

The mouse Radial Maze has eight 35cm long arms, 5cm wide and 9 cm tall. In the rat model the 8 arms are 50cm long, with a 10 cm width and a 13 cm height.
The Radial Arm-Maze has been used extensively in evaluating spatial learning and memory. The apparatus consists of eight equally spaced arms radiating from a small circular central platform. The design ensures that after checking for food at the end of an arm the animal is forced to return to the central platform before making another choice. As a result, the animal always has eight possible options. The animal can rely on egocentric or allocentric (cues outside of the maze) strategies and working versus reference memory can be assessed by adopting intra- or inter trial protocols. It is an appetitive test and in fact the motivation for the animal (mice or rats) is to find a food reward in one or more arms. In short, the many variants of the radial arm maze allow the experimenter to assess spatial memory in mice and rats by measuring the avoidance of re-entry in already visited and non-baited arms. Both intra-maze and external cues can be used and optional feeders or doors can be added to the maze to separate the central arena from the arms and deliver the reward only when the task has been completed.

APPLICATION

- To assess spatial and learning memory
- To screen drugs for Alzheimer's disease

REFERENCE

Delcourt J et al. "Methods for the effective study of collective behavior in a radial arm maze" Behav Res Methods. 2018, 50(4):1673-1685.

Plethysmometer

FUNDAMENTAL PRINCIPLE

Paw volume meter enables researcher to measure the effectiveness of anti-inflammatory agents. Here, the paw is inserted into plain water, which contains a special water cell of which the pressure is changed due to the immersion. The pressure change is calibrated in ml and shown on a special electronic monitor. This form of detection eliminates changes due to conductivity alterations at repeated insertions as found on comparable unit. The measurements are shown on the units LCD readout in 0.01 ml for rat and 0.001 ml for mice.

APPLICATION

- The animal paw is inserted into water, contained in a special water cell of which the resistance is changed.

REFERENCE

Sharma, Jagdish N., Awatef M. Samud, and M. Zaini Asmawi. "Comparison between plethysmometer and micrometer methods to measure acute paw oedema for screening anti-inflammatory activity in mice." *Inflammopharmacology* 12.1 (2004): 89-94.

Cage Changing Station

FUNDAMENTAL PRINCIPLE

This instrument used for Animal Research Laboratories. Assures an effective barrier, prevents cross-contamination and allergen exposure while animal experimentation. Dual access animal biosafety: Cage Changing Station with superior ventilation system and airflow balancing technology. Working surface double configuration, flat for experimental procedures and recessed for cage changing. Also ensures that Operator's protection from infectious particulates, dust and allergens

APPLICATION

- Useful for animal handling procedures for cage changing operations
- To maintain nude mice facility
- Provides protection to the users from infectious particulates, dust and allergens

REFERENCE

Feistenauer et al. "Influence of 5 different caging types and the use of cage-changing stations on mouse allergen exposure." *Journal of the American Association for Laboratory Animal Science : JAALAS* vol. 53,4 (2014): 356-63

Elevated Plus Maze

FUNDAMENTAL PRINCIPLE

The mouse Elevated Plus Maze (EPM), has four 5cm wide and 35cm long arms, two of which are open: the wall in the closed arms is 15cm high. Height from the floor is 50cm. The EPM is supported by 4 metal legs, which make the device very stable. The elevated plus-maze test is used as a rodent model of anxiety, and is representative of those tests that are based upon the study of spontaneous behaviour patterns. The model is based on the test animal's aversion to open spaces. In the EPM, this anxiety is expressed by the animal spending more time in the enclosed arms. The elevated plus maze is a widely used in behavioural assay for rodents and it has been validated to assess the anti-anxiety effects of pharmacological agents and steroid hormones, and to define brain regions and mechanisms underlying anxiety-related behaviour

APPLICATION

- To screen the anxiolytic drugs

REFERENCE

Kraeuter A. K et al. The Elevated Plus Maze Test for Measuring Anxiety-Like Behavior in Rodents. Methods Mol Biol. 2019, 1916:69-74.

IVC System for Rat and Mice

FUNDAMENTAL PRINCIPLE

It consists of high performance individual ventilated cages along with specially designed racks. The air circulation (Inlet) connected to IVC system enters through a HEPA filter barrier 0.3 um ensures that sterility of the air and prevents the infectious agents. It also ensures that uniform circulation of air and relative humidity. All the cages and lids are autoclavable and can be sterilized timely bases.

APPLICATION

- This facility mainly ensures the animal welfare by providing safe ventilation without transmitting vibrations to the rack and sterile air
- HEPA Filter barrier prevents the entry of infectious agents
- Provides Hygienic environment within the cage

REFERENCE

Creamer, M. A. et al. “Implications of natural occlusion of ventilated racks on ammonia and sanitation practices”. *of the American Association for Laboratory Animal Science : JAALAS*, *53*(2), 174–179

Morris Water Maze

FUNDAMENTAL PRINCIPLE

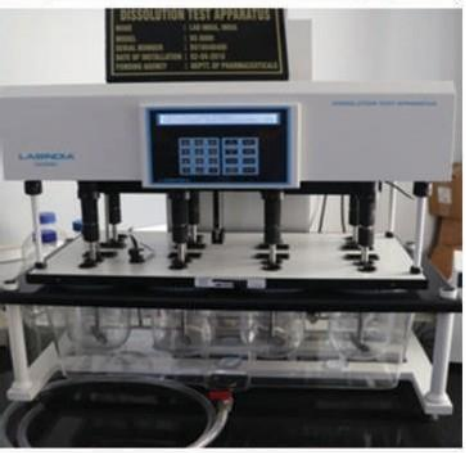
The Morris water tank has a diameter of 4ft ± 6 inches (mouse) and 6ft ± 6 inches (rat). The Morris Water Maze is one of the most widely used methods to assess spatial and learning memory. The Water Maze tank is filled with water and equipped with a platform which acts as a means of escape for animals. During testing, animals learn the location of the platform using spatial cues

APPLICATION

- To assess spatial and learning memory
- To screen drugs for Alzheimer's disease

REFERENCE

Vorhees C. V. et al. "Morris water maze: procedures for assessing spatial and related forms of learning and memory." *Nat Protoc*. 2006, 1(2):848-858.



NIPER GUWAHATI

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