Yarmouk University

Faculty of Pharmacy

Pharmacy Research Lab

The Pharmacy Research Lab contains many research devices that faculty members at the Faculty of Pharmacy use in their scientific research.

Name of the device: Dynamic light scattering (DLS) and zeta potential

Contact person: Dr. Yazan Akkam/ yazan.a@yu.edu.jo

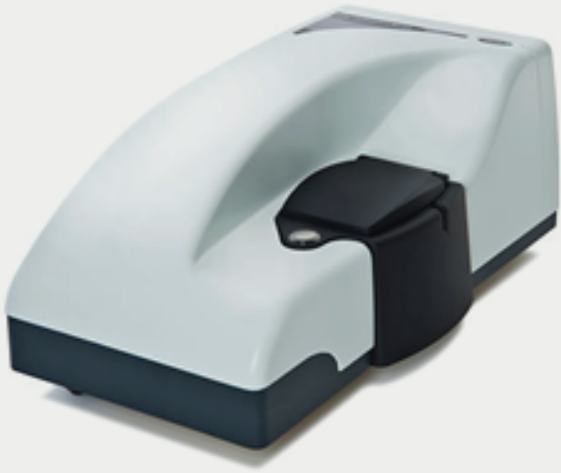
Description:

Dynamic Light Scattering (DLS) measures the fluctuations in scattered light caused by Brownian motion of particles in suspension. From these fluctuations, DLS determines the size distribution of particles in the range of nanometers to submicrons. This technique is particularly useful for analyzing the size of nanoparticles, proteins, and polymers in solution, providing valuable insights into their stability, aggregation behavior, and interactions.

Zeta Potential measures the electrokinetic potential of particles in suspension, which indicates their surface charge. This property is crucial for understanding the stability of colloidal dispersions because particles with higher absolute zeta potentials generally repel each other more strongly, thereby preventing aggregation. Zeta potential measurements are used to optimize formulations in industries such as pharmaceuticals, cosmetics, and food, where colloidal stability is critical.

Uses:

An essential tool in the field of colloidal and nanoparticle characterization.



Name of the device: 96 well plate reader, SYNERGY-HTX

Contact person: Dr. Yazan Akkam/ yazan.a@yu.edu.jo

Description:

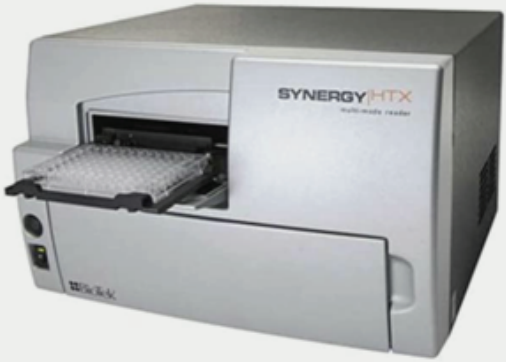
Absorbance measurements quantify the amount of light absorbed by a sample at a specific wavelength, providing information about the concentration of a substance or the extent of a reaction. This is useful for studying enzyme kinetics, protein quantification, and nucleic acid analysis.

Fluorescence measurements detect the emission of light at longer wavelengths after excitation with a specific wavelength of light. This technique is employed to quantify fluorescently labeled molecules, monitor cellular processes, and assess protein-protein interactions.

Luminescence measurements detect light emitted due to chemical reactions such as ATP production, luciferase activity, or reporter gene expression. This sensitive technique is pivotal in assays requiring high sensitivity and minimal background noise.

Uses:

The reader is capable of measuring absorbance, fluorescence, and luminescence which is an instrument widely used in medical, biological, and chemical research. Mainly is use in drug discovery, molecular biology assays, and clinical diagnostics. The 96-well format enables simultaneous measurement of multiple samples, enhancing efficiency and throughput in research and industrial laboratories.



Name of the device: High-Performance Liquid Chromatography (HPLC), Shimadzu

Contact person: Dr. Mohammad Obeid Ayasrah/ m.obeid@yu.edu.jo

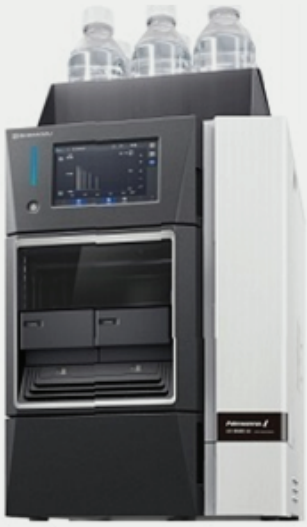
Description:

Separation using High-Performance Liquid Chromatography is based on the affinity of the different compounds within the analyte to the mobile phase (eluent) and the stationary phase. The specific intermolecular interactions between the molecules of a component of the sample and the packing material result, in effect, in these molecules being taken up transitorily onto the stationary phase.

The greater the interaction with the stationary phase compared with the mobile phase, the longer the time spent interacting with the stationary phase, the longer the time spent on the column, and the longer the retention time (Rt) for that component. The power of the technique comes from the wide range of mobile and stationary phases that may be used to fine-tune separations

Uses:

High-Performance Liquid Chromatography (HPLC) is an analytical technique used to identify the components in a mixture and separate mixtures of very similar compounds.



Name of the device: Differential Scanning Calorimetry (DSC), Melter Toledo

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Dr. Hadeyyah Mashaqbeh

Description:

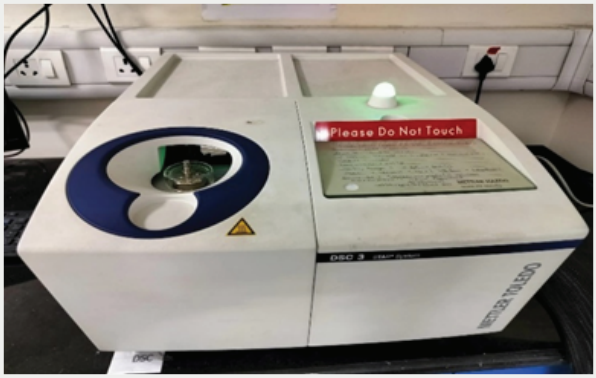
DSC is a thermal analysis apparatus measuring how physical properties of a sample change, along with temperature against time. the device is a thermal analysis instrument that determines the temperature and heat flow associated with material transitions as a function of time and temperature. During a change in temperature, DSC measures a heat quantity, which is radiated or absorbed excessively by the sample on the basis of a temperature difference between the sample and the reference material.

Based on the mechanism of operation, DSCs can be classified into two types: heat-flux DSCs and power-compensated DSCs. In a heat flux DSC, the sample material, enclosed in a pan, and an empty reference pan are placed on a thermoelectric disk surrounded by a furnace. The furnace is heated at a linear heating rate, and the heat is transferred to the sample and reference pan through the thermoelectric disk. However, owing to the heat capacity (Cp) of the sample, there would be a temperature difference between the sample and reference pans, which is measured by area thermocouples, and the consequent heat flow is determined by the thermal equivalent of Ohm's law.

In a power-compensated DSC, the sample and reference pans are placed in separate furnaces heated by separate heaters. The sample and reference are maintained at the same temperature, and the difference in thermal power required to maintain them at the same temperature is measured and plotted as a function of temperature or time.

Uses:

DSC detects endothermic and exothermic transitions like the determination of transformation temperatures and enthalpy of solids and liquids as a function of temperature.



Lyophilizer (freeze dryer), BIOBASE

Contact person: Dr. Hadeyyah Mashaqbeh/ h.mashaqbeh@yu.edu.jo
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Description:

Lyophilizers work by freezing the material, then reducing the pressure and adding heat to allow the frozen water in the material to sublimate.

freeze dryer Lyophilizer occurs in three different stages, with the freezing phase being the first and most critical. The principle of freeze dryer Lyophilizeris relatively easy; however, it needs to be done with utmost care in order to achieve the perfect result. The three phases of freeze dryer lyophilizer are as follows

1. Pretreatment freezing

the first and most critical being the freezing phase. Proper lyophilization can reduce drying times by 30%.

2. Primary drying

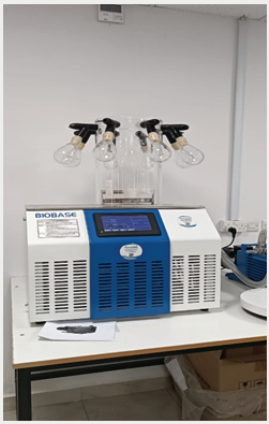
About 95% of the water in the material is removed in this phase.

3. Secondary drying

By raising the temperature higher than in the primary drying phase, the bonds are broken between the material and the water molecules.

Uses:

is a water removal process typically used to preserve perishable materials, to extend shelf life or make the material more convenient for transport.



Atomic absorption spectrometry (AAS), SHIMADZU ASC-7000

Contact person: Dr. Mohammad Zaitoun/ m.zaitoun@yu.edu.jo
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Description:

Atomic absorption spectrometry (AAS) detects elements in either liquid or solid samples through the application of characteristic wavelengths of electromagnetic radiation from a light source. Individual elements will absorb wavelengths differently, and these absorbances are measured against standards. In effect, AAS takes advantage of the different radiation wavelengths that are absorbed by different atoms.

in AAS, analytes are first atomized so that their characteristic wavelengths are emitted and recorded. Then, during excitation, electrons move up one energy level in their respective atoms when those atoms absorb a specific energy. This energy corresponds to a specific wavelength that is characteristic of the element. Depending on the light wavelength and its intensity, specific elements can be detected and their concentrations measured

Uses:

to determine the presence of a particular substance in a sample and, in many cases, to quantify the amount of the substance present.