X-CELL Analytical

Pharmaceutical Systems Analysis

St. Francis Xavier University
Analytical Services Lab

Equipment Specification Brochure

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Pharmaceutical Systems Analysis

Variables Measured	Equipment Number
Particle Size Analysis	1, 2
Zeta potential measurement	1
Molecular Weight	1
Protein Melting Point	1
pH	1
Concentration	1
Emulsion measurement	2
Suspensions measurement	2
Dry powders measurement	2
Surface tension	3, 15
Interfacial tension	3, 15
Density	3, 4
Percentage of acidity	5, 7
Water content determinations	7, 8
Rheological fluid properties	9, 10
X-ray diffraction analysis	11
Molecular structure analysis	14
Heat measurement	16, 17, 19

Equipment Information

1

Malvern Zetasizer Nano ZS

• The Zetasizer Nano ZS can perform a combination of three of the most important parameters for the colloid and polymer chemist, **particle size analysis** (Dynamic Light Scattering (DLS)), **zeta potential measurement** (Laser Doppler Electrophoresis), and **molecular weight measurement** (Static Light Scattering (SLS)).

• Size range : 0.6nm to 6 µm

• Size range for Zeta potential : 5nm to 10 µm

• Size range for molecular weight : 1000 to $2x10^7$ Daltons

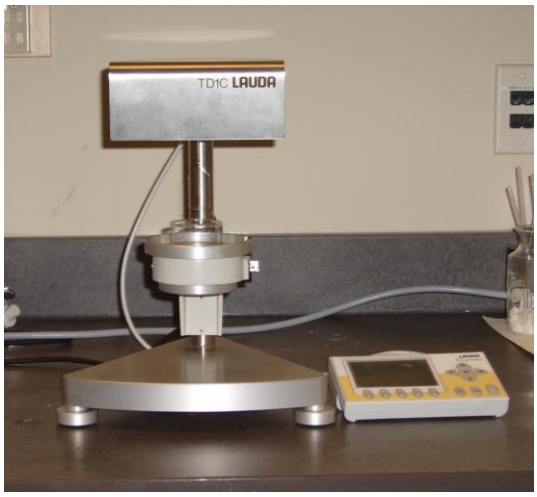
• Instrument options**:** Narrow band filter (improves the signal for samples that fluoresce at the wavelength of the laser fitted); Universal 'Dip' cell (used to provide repeatable measurements of non-aqueous samples such as solvents); MPT – 2 Autotitrator (used to perform pH, additive, and dilution titrations)

2

Malvern Mastersizer 2000

- **Particle size analyzer**
- **Measures emulsions, suspensions and dry powders**
- Measures materials from 0.02 µm to 2000µm
- Measurement principle: Mie scattering
- **Hydro 2000S (For wet dispersions)**
  - Typical applications include pharmaceuticals, chemicals, food stuffs and emulsions
  - Capacity 50-120 mL
  - **Maximum size of particles up** to 6000 microns dependent on particle shape and density
- **Scirocco 2000 (For dry dispersions)**
  - Typical applications include pharmaceuticals, cement, metal powders, minerals, powder coatings, chemicals and dry ingredients
  - Control of dispersive air pressure to 0.02 bar over a range of 0 – 4 bar
- **Maximum size of particles up** to 2000 microns dependent on particle shape and size

3



Lauda TD 1 C Surface Tensiometer

• **Measurement type** : **surface and interfacial tension, density, weight**
• Simple selection of measuring methods according to Du Noüy-ring, Wilhelmy-plate, or density measurement
• Measurements surface and interfacial tension
  - < 300 mN/m (ring) ; < 999 mN/m (plate)
  - Resolution ± 0.1 mN/m
• Density Measurement
  - < 2000 g/l
  - Resolution ±1 g/l
• Weight Measurement
  - <5000 mg
• Resolution ±1 mg

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Density Meter (DMA 5000)

• Measuring range: 0 to 3g/cm^3
• Accuracy
  - Density: 0.000005g/cm^3
  - Temperature: 0.01 ^{o}C
• Measuring Temperature: 0^{o}C to 90^{o}C (32 to 194 ^{o}F)
• Pressure range: 0 to 10 bar (0 to 145 psi)
• Minimum amount of sample: 1 mL
Applications**:** Fine chemicals, Biodiesel, Bioethanol, Sea water, Crude oil, Fuel, Lubricants, Coatings, Beer and wort, Juice, Soft drinks, Spirits, and Wine.

5

FoodLabFat

• Measures the **percentage of acidity**, the **amount of peroxides**, the **concentration of p-Anisidine** (AnV) and **soaps** in seed oils, dry fruit, essential oils, butter, cream, and edible fats and oils.
• 6 channel photometer designed to heat the samples at a temperature of 37°C.
• Environmental operating specifications: the system and its components can be used in environments with a temperature ranging from 15°C to 35°C and a relative humidity from 20% to 90% , non condensing.
• Photometric range: 0.0-2.3 Abs

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787 KF Titrino

• With 703 Ti Stand
• Contains the four most important **titration methods**:
  - Titer determination with water or water standard
  - Titer determination with sodium tartrate
  - Blank determination
  - Karl Fischer titration- KFT
• Direct **water content determinations** in
  - Liquids
  - Solids
  - Gases
  - Viscous materials
• Range of water contents: 100 ppm-100%
• Range of start volume: 0-99.99mL

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808 Titrando

• **Titrator** with built-in buret drive, one or two galvanically separated measuring interfaces with one high-impedance and one polarizable measuring input, measuring input for temperature sensor.

• Measuring ranges**:**
- Potentiometric : -2000mV- +2000mV
- pH: -20.00- +20.00
- Amperometric: -2000mV- +2000mV
- Voltametric: -200µA- +200µA

• Resolution**:**
- Voltage: 0.1mV
- pH value: 0.001pH
- Current: 0.01uA
- Temperature: 0.1°C

• Measuring Accuracy**:**
- Voltage: ± 0.2mV
- pH value: ± 0.003pH
- Temperature: ± 0.2°C

• With 801Stirrer: Magnetic stirrer for use with the titrando.
- Applications:
  - Determining the **water content** in biodiesel by Karl Fischer titration.
  - Titration analyses of biofuels
  - Automated Karl Fischer titration for liquid samples

• Maximum speed: 1700-1900 min^{-1}

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OFITE Model 900 Viscometer

• Sometimes referred to as a V-G meter or a **rheometer**, is used to **measure fluid flow properties**.

• Analysis of food grade materials, suspensions, solutions, polymer systems

• Analyzes drilling fluids and completion fluids.

• Shear Rate Range (sec^{-1}): 0.01-1700
Shear Stress Range($dynes/cm^2$): 0-1700

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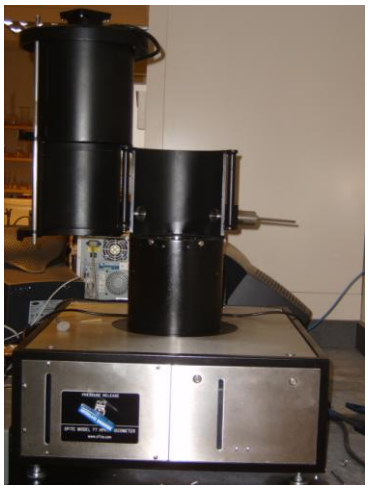

OFITE HTHP Viscometer

• This fully-automated system accurately determines the **rheological properties** of completion fluids and drilling fluids in terms of shear stress, shear rate, time, and temperature at pressures up to 20,000 psi and temperatures up to 450°F.
• Motor Speeds (rpm) - Variable speed range 10-600
• Shear Rate Range (sec^{-1}) - 1-1022
Viscosity Range - 0-300 centipoise at 300 rpm

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PANalytical X-ray Diffractometer

• The X'Pert PRO MPD is a multi-purpose X-ray diffraction system.
• Complete X-ray powder diffractometer for the analysis of: pharmaceutical substances, engineered components, coatings, clay minerals, glass, polymer foils, metals, chemicals, and zeolites, forensics.
• Routine autosampling phase analysis, microdiffraction (small spot size analysis), variable temperature and humidity experiments and insitu measurements of phase changes related from a reaction chamber.
• **Enclosed Console and X-ray tubes**
• **Goniometer System**
15 Position Autoloader and Spinner

14

Bruker NMR 400

- Magnet: Bruker Ultrashield 400 MHz/54mm
- Outstanding field homogeneity with excellent resolution and non-spinning lineshape
- Multinuclear capability – suitable for liquid systems.
- Transport properties – diffusion measurements in liquid systems.
- **Analyzes the structure of many chemical molecules**, primarily organic compounds.
- Central field: 9.40 Tesla
- Coil inductance: 34.5 Henry
- Magnetic energy: 28 kJoule
- Magnetic center from top flange: 762nm
- System: Bruker Avance II

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Kruss Tensiometer K9

- **Measures surface tension and interfacial tension** using ring and plate method
- Can also be used for measuring at controlled temperatures
- Measuring range (SFT/IFT): 1-999 mN/m
- Resolution: 0.1 mN/m
- Measuring range (Density): 1-2200 kg/m^3
- Resolution: 1 kg/m^3
- Measuring rate: 2 readings/sec
- Weighing range: 50g
- Temperature range: -10 to 100^{o}C
- Display resolution: 0.1^{o}C

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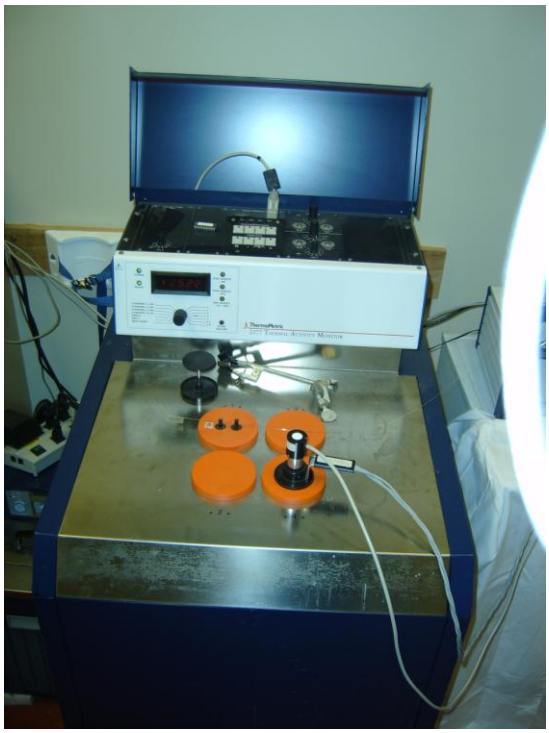

2277 Thermal Activity Monitor

• Free-standing multichannel **microcalorimeter**.
• Measurement of the heat effects associated with many chemical and physical processes
  - Ligand binding thermodynamics;
  - Phase morphology;
  - Enthalpies of solution with batch adapter system.
• Heat sink is formed by a closed 25 liter thermostated water bath, maintained to ± 2 x 10^{-4}°C within the working range of 5-80°C.
• Has a 6120 Lund Syringe Pump

With Accessory: Thermometric 2250- series Micro Reaction System

• For Titration, Perfusion and Controlled Relative humidity (Rh) Perfusion.

With Accessory: Precision Solution Calorimeter

• Semi-adiabatic (isoperibol) calorimeter
Heat resolution of 1-4 mJ in a 100ml reaction vessel

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Isothermal Titration Calorimeter (ITC)

• **Measures the heat produced** when two solutions are mixed.
• Uses a "twin" heat flow design for maximum sensitivity.
  - Ligand binding thermodynamics;
  - Phase morphology;
  - Enthalpies of solution with batch adapter system.
• The thermoelectric device (TED) detectors have a sensitivity of approximately 1 nanowatt / nanovolt.
• The ITC can measure heat flow rates of from 1 nanowatt to 250 microwatts.
• Minimum detectable heat: 0.1µcal
• Baseline stability: ±0.02µcal/sec/hr
• Precision buret: 25-250µL
• Delivery precision: ±0.01µL
• Temperature range: 0 to 110°C
Bath stability: ±0.0005°C

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Isoperibol Solution Calorimeter (ISC)

• Measures **heats of solution or heats of reaction** taking place in solution or at liquid-solid interfaces.
• Suitable for batch, incremental titration, or continuous titration experiments. Both analytical (concentration) and thermodynamic (ΔH) data are obtainable for almost any liquid-liquid or solid-liquid chemical system.

- Temperature resolution: 2μ°C
- Temperature noise level: ±30μ°C
- Temperature Stability: ±100μ°C/24hr
- Minimum Detectable Heat: 1 mcal (4mJ)
- Precision Buret: 0.1 to 10mL
- Temperature range: 0-100 °C
- Bath temperature stability: ±0.0005 °C