

# X-CELL Analytical



## Oils and Fats Analysis



**St. Francis Xavier University**  
Analytical Services Lab



### *Equipment Specification Brochure*

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# Oils and Fats Analysis

(Food Sciences)

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	2
Dry powders measurement	2
Surface tension	3, 15
Interfacial tension	3, 15
Density	3, 4
Percentage of acidity	5, 7
p-Anisidine value	5
Peroxide value	5, 7
Concentration of soaps	5, 7
Oxidation stability of oils and fats	6
Water content determinations	7, 8
Rheological fluid properties	9, 10
Percentage of oil and water	13
Molecular structure analysis	14
Heat measurement	16, 17, 19
Flash point	18
Chromatography	21

# Equipment Information

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## 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  $\mu\text{m}$
- Size range for Zeta potential : 5nm to 10  $\mu\text{m}$
- Size range for molecular weight : 1000 to  $2 \times 10^7$  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)

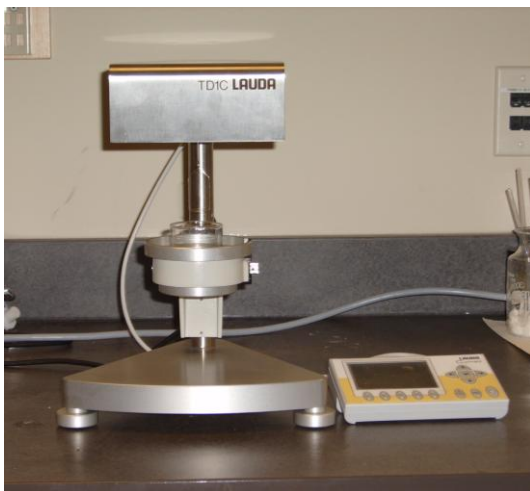
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## Malvern Mastersizer 2000

- **Particle size analyzer**
- **Measures emulsions, suspensions and dry powders**
- Measures materials from 0.02  $\mu\text{m}$  to 2000 $\mu\text{m}$
- 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

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### 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
  - $< 300 \text{ mN/m}$  (ring) ;  $< 999 \text{ mN/m}$  (plate)
  - Resolution  $\pm 0.1 \text{ mN/m}$
- Density Measurement
  - $< 2000 \text{ g/l}$
  - Resolution  $\pm 1 \text{ g/l}$
- Weight Measurement
  - $< 5000 \text{ mg}$
- Resolution  $\pm 1 \text{ mg}$

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### Density Meter (DMA 5000)

- Measuring range: 0 to  $3 \text{ g/cm}^3$
  - Accuracy
    - Density:  $0.000005 \text{ g/cm}^3$
    - Temperature:  $0.01 \text{ }^\circ\text{C}$
  - Measuring Temperature:  $0^\circ\text{C}$  to  $90^\circ\text{C}$  ( $32$  to  $194 \text{ }^\circ\text{F}$ )
  - 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.

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## 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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## 743 Rancimat

- For the determination of the **oxidation stability** of oils and fats, also referred to as Oil Stability Index (OSI).
- 8 sample positions, 2 separate heating blocks and a software solution for controlling methods, samples and data
- **Applications:**
  - Vegetable fats/oils: soy, sunflower, corn, canola, coconut, peanut, palm, etc
  - Animal fats/oils: butter, fish oil, lard, etc.
  - Fat- or oil-containing products:
    - Direct measurements: margarine
    - After fat extraction: cereals, biscuits, cookies, nuts, bacon, sausages, meat, etc.
  - Antioxidant research
  - Oxidative stability of biodiesel and FAME (fatty acid methyl ester)
- Oxidation stability of light heating oil with Cu catalyst

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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 Titrande

- **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: -200 $\mu$ A- +200 $\mu$ A
- Resolution:
  - Voltage: 0.1mV
  - pH value: 0.001pH
  - Current: 0.01uA
  - Temperature: 0.1 $^{\circ}$ C
- Measuring Accuracy:
  - Voltage:  $\pm$  0.2mV
  - pH value:  $\pm$  0.003pH
  - Temperature:  $\pm$  0.2 $^{\circ}$ C
- With 801Stirrer: Magnetic stirrer for use with the titrande.
  - 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<sup>-1</sup>

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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<sup>-1</sup>): 0.01-1700  
Shear Stress Range(dynes/cm<sup>2</sup>): 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<sup>-1</sup>) - 1-1022  
Viscosity Range - 0-300 centipoise at 300 rpm

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### OFITE Retort

- 50mL Retort with Digital Temperature Controller, 115V
- Measures the **percentage of oil and water, and estimates both suspended and dissolved solids** contained in a sample of water-based or oil-based muds and cuttings.

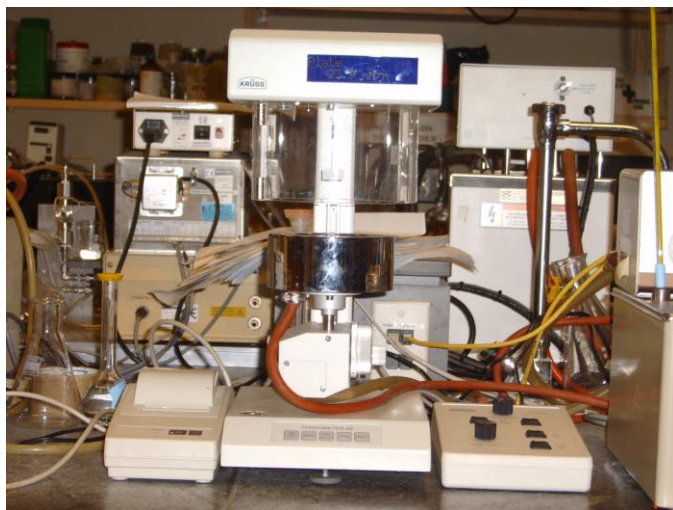
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### Bruker NMR 400

- 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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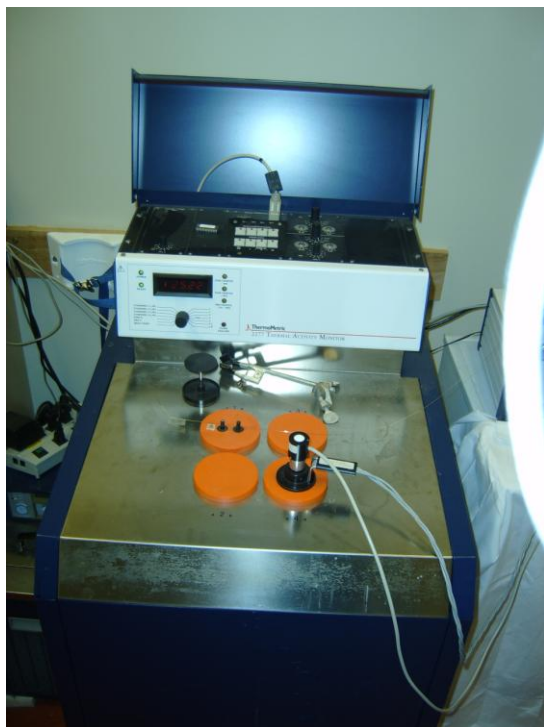


### Kruss Tensiometer K9

- **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<sup>3</sup>
- Resolution: 1 kg/m<sup>3</sup>
- Measuring rate: 2 readings/sec
- Weighing range: 50g
- Temperature range: -10 to 100°C
- Display resolution: 0.1°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  $\pm 2 \times 10^{-4}^{\circ}\text{C}$  within the working range of  $5\text{-}80^{\circ}\text{C}$ .
- 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:  $0.1\mu\text{cal}$
- Baseline stability:  $\pm 0.02\mu\text{cal}/\text{sec}/\text{hr}$
- Precision buret:  $25\text{-}250\mu\text{L}$
- Delivery precision:  $\pm 0.01\mu\text{L}$
- Temperature range:  $0\text{ to }110^{\circ}\text{C}$
- Bath stability:  $\pm 0.0005^{\circ}\text{C}$

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### K16200 Pensky-Martens Closed Cup Flash Tester

- Determines **flash points** of a wide range of products by a closed cup method with two option speed stirring of the sample.
- Used in shipping and safety regulations for detection of contamination by volatile and flammable materials in fuel oils and lubricating oils, and for characterization of hazardous waste samples.
- Electrically heated model with a 750W nickel-chromium heater with stepless variable control for accurate, repeatable temperature rate of rise settings per specifications.

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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 ( $\Delta H$ ) data are obtainable for almost any liquid-liquid or solid-liquid chemical system.
- Temperature resolution:  $2\mu\text{C}$
- Temperature noise level:  $\pm 30\mu\text{C}$
- Temperature Stability:  $\pm 100\mu\text{C}/24\text{hr}$
- Minimum Detectable Heat: 1 mcal (4mJ)
- Precision Buret: 0.1 to 10mL
- Temperature range: 0-100 °C
- Bath temperature stability:  $\pm 0.0005\text{ }^{\circ}\text{C}$

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## Hewlett Packard 5890 Series II Gas Chromatograph

- SRI Peak Simple **Chromatography** Data System Model 333
- Column Oven:
  - Operating range: 4°C above ambient to 450°C
  - Setpoint entry: 1°C for temperatures, 0.1°C for program rates
  - Programming: rates 0.1 to 70°C per min, 650 minutes maximum run time, three ramps with initial/ final holds
- Thermal conductivity detector (TCD):
  - Range to 400°C
- Flame ionization detector(FID):
  - Range to 450°C
  - Grounded jet and current limited design for operator safety
  - Push-button flame ignition
- Inlet systems:
  - 5890 PI (Packed Inlet)
  - 5890 Split/ Splitless Inlet with EPC (Series II with #039 only)
  - 5890 Series II dual injectors (split/ splitless or packed) dual FID/TCD detectors
- Primary applications: analysis of herbicides, pesticides, biodiesels, many organic reaction products.