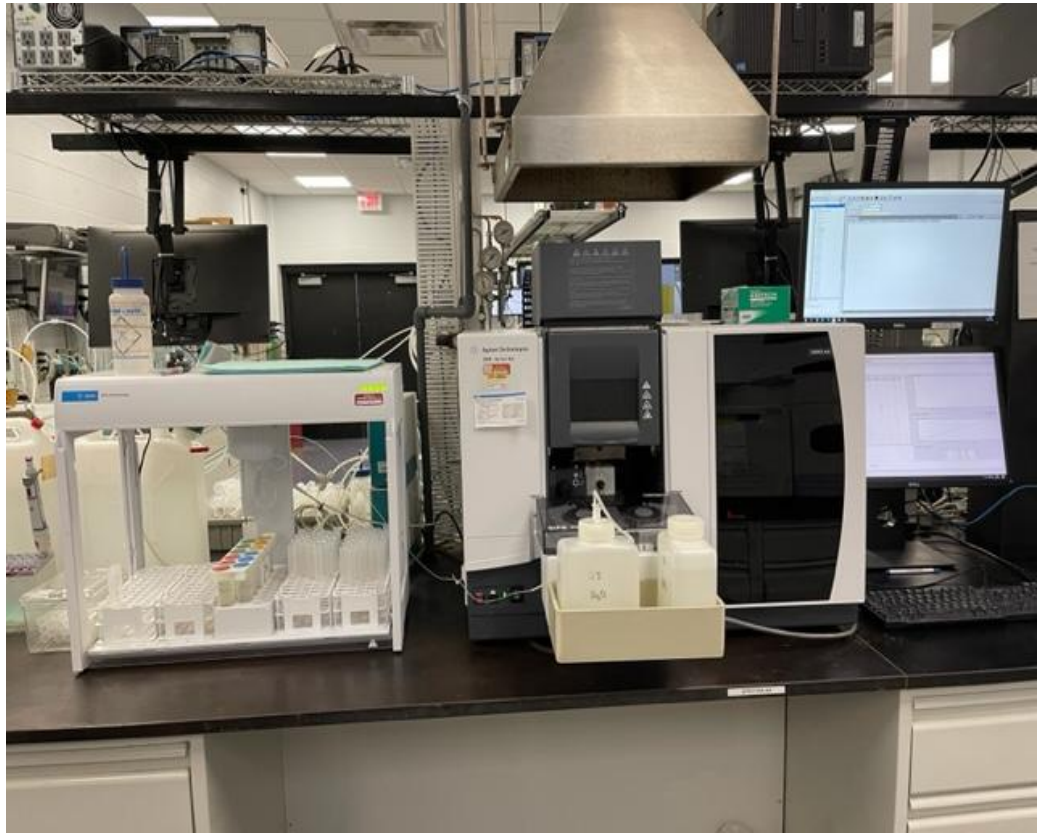
Chemlab Equipment Overview

Equipment I Routinely Use and Maintain for Sample Analysis

Atomic Absorption Spectrometer (AAS)

Manufacturer	Agilent
Model	240 FS
Application	Metals in wet processes



Atomic absorption spectrophotometry is a widely utilized technique for metal quantification across a diverse array of samples, capable of measuring both target and contaminant metals down to sub-microgram per milliliter concentrations.

Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES)

Manufacturer	Perkin Elmer
Model	DV 2100
Application	Metals in wet processes

ICP-OES serves to quantify metals in solutions, offering the benefits of simultaneous multi-element analysis, heightened sensitivity, and a broader analytical range compared to atomic absorption (AA) spectroscopy.

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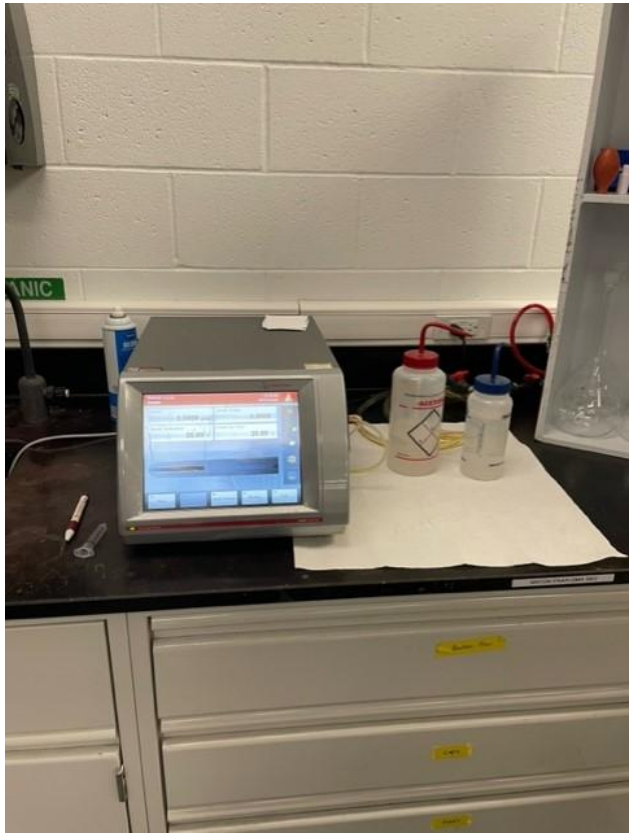
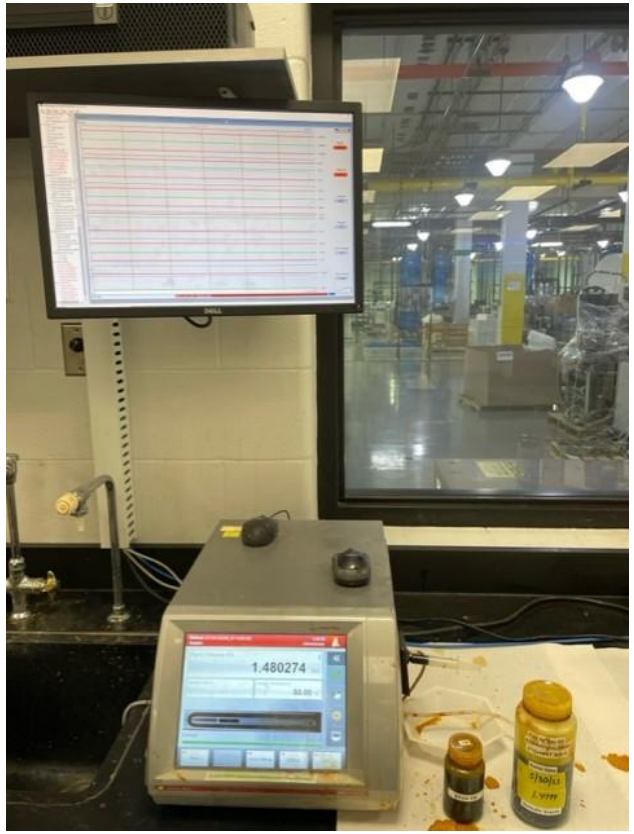
Density Meters

Manufacturer	Anton Paar
Model	DMA 4000 and DMA 4500
Application	Specific gravity in chemical processes



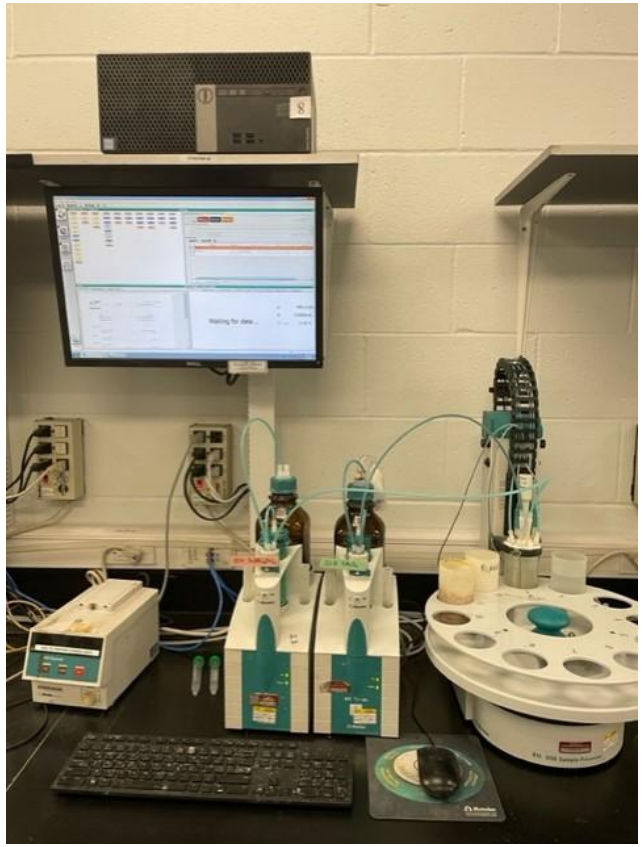


The DMA 4100 density meter boasts an accuracy of 0.00010 g/mL for density measurements and 0.02 °C for temperature readings.

In contrast, the DMA 4500 offers enhanced precision with an accuracy of 0.00005 g/mL for density and 0.01 °C for temperature..

Auto Titrators

Manufacturer	Metrohm
Model	Various 700, 800, and 900 series
Application	pH, redox, and ion specific titrations

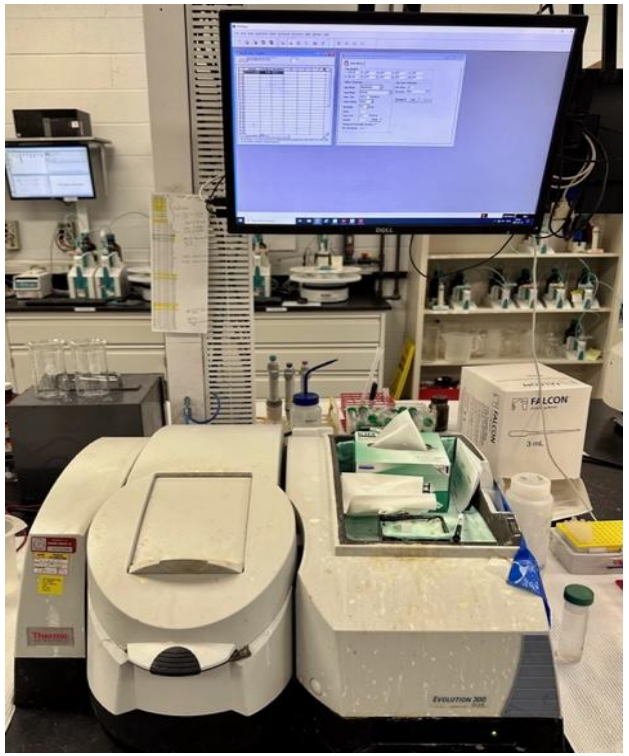


Autotitrators are employed to determine the concentrations within chemical processes by neutralizing or reacting a sample of unknown concentration with a known standard.

These systems automatically detect reaction endpoints and compute results. They allow for sequential processing of numerous samples with minimal manual intervention.

Ultraviolet-Visible Light Spectrophotometer (UV-Vis)

Manufacturer	Beckman and Thermo Fisher
Model	DU 640 and Evolution
Application	Chemical concentration analysis



UV-Vis spectroscopy is an analytical method that quantifies the absorption of light by a sample across various wavelengths.

This technique is utilized to ascertain the concentration of an absorbing substance within a broad concentration spectrum

Ion Chromatography (IC)

Manufacturer	Thermo Fisher
Model	Integrion
Application	Anion analysis

Ion chromatography is a high-performance liquid chromatography method that analyzes samples by separating and identifying ions or polar molecules. It is capable of measuring a diverse array of ion types across a wide concentration range.

Cyclic Voltametric Stripping (CVS)

Manufacturer	Metrohm
Model	Various 700 and 800 series
Application	Plating bath additives

Cyclic voltammetric stripping (CVS) serves as a monitoring tool for the concentrations of organic additives in plating baths. It determines concentration by cyclically plating and stripping a sample.

CVS assesses the behavior of the bath as a whole, rather than directly quantifying a specific analyte.

Viscometers

Manufacturer	Brookfield and Anton Paar
Model	DV II+ Pro and Visco QC 100
Application	Raw material viscosity

A viscometer is designed to measure the viscosity of materials within a range of 13 to 320 million centipoise (M cP), functioning by rotating a spindle at a controlled speed within the sample and quantifying the resistance as torque.

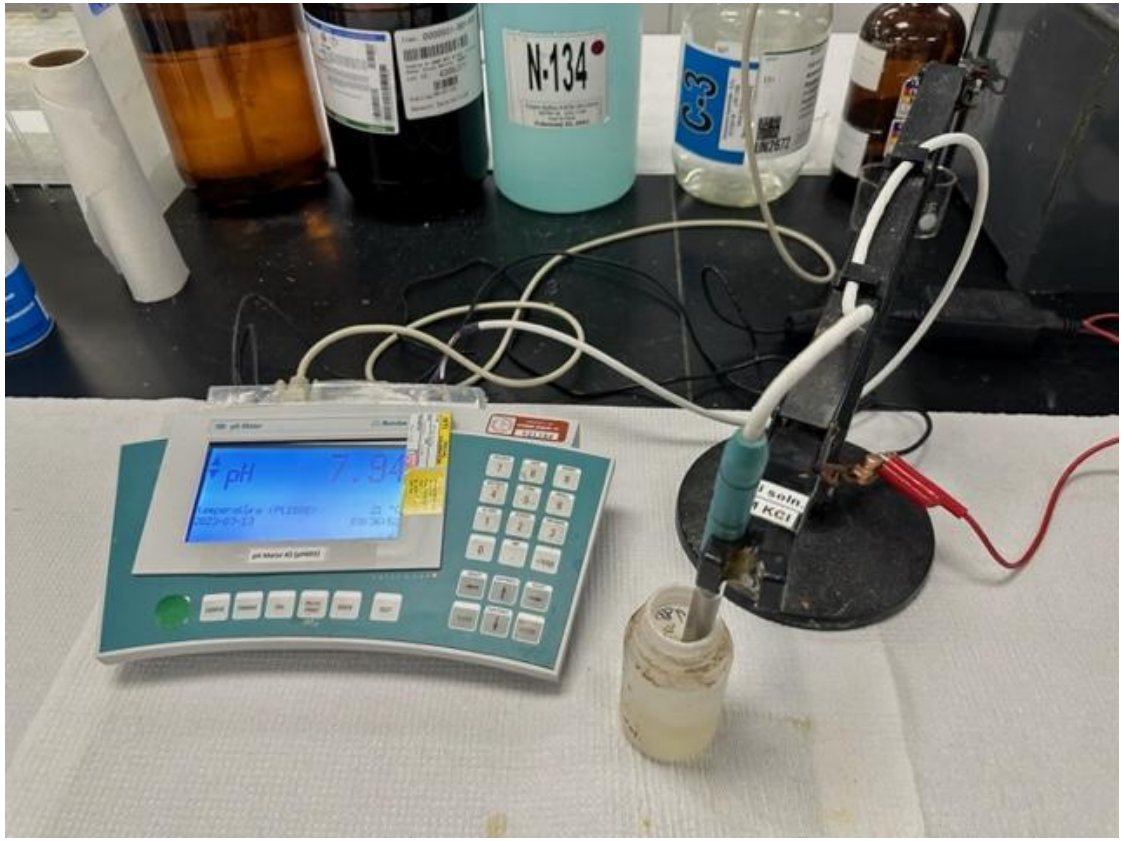
Centrifuge

Manufacturer	Thermo Fisher
Model	ST16 and CL2
Application	Sample prep

Centrifuges use centrifugal force, significantly exceeding gravitational force, to efficiently separate solids or precipitates from liquids. By rapidly spinning samples, they expedite the settling of denser materials to the bottom, enabling quick and effective preparation for analysis.

pH Meter

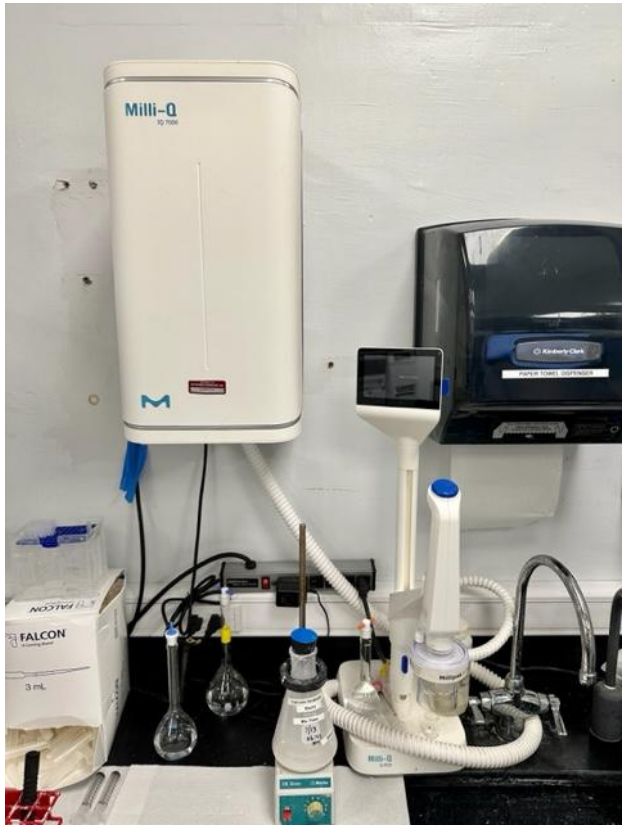
Manufacturer	Metrohm and Accumet Basic
Model	780 and AB-15
Application	pH measurement



pH meters function by measuring the voltage difference across a sensor, which correlates to the hydrogen ion (H+) concentration in a sample, thereby determining its pH.

Pure Water System

Manufacturer	Millipore
Model	Milli-Q IQ7000
Application	Reagent and sample prep



The pure water system employs an ion exchange resin to produce ultrapure water with a resistivity exceeding 18 MΩ·cm.

This high-resistivity water, crucial for minimizing contamination, is utilized in preparing solutions and samples for ion chromatography (IC) analysis, ensuring the accuracy and reliability of results.

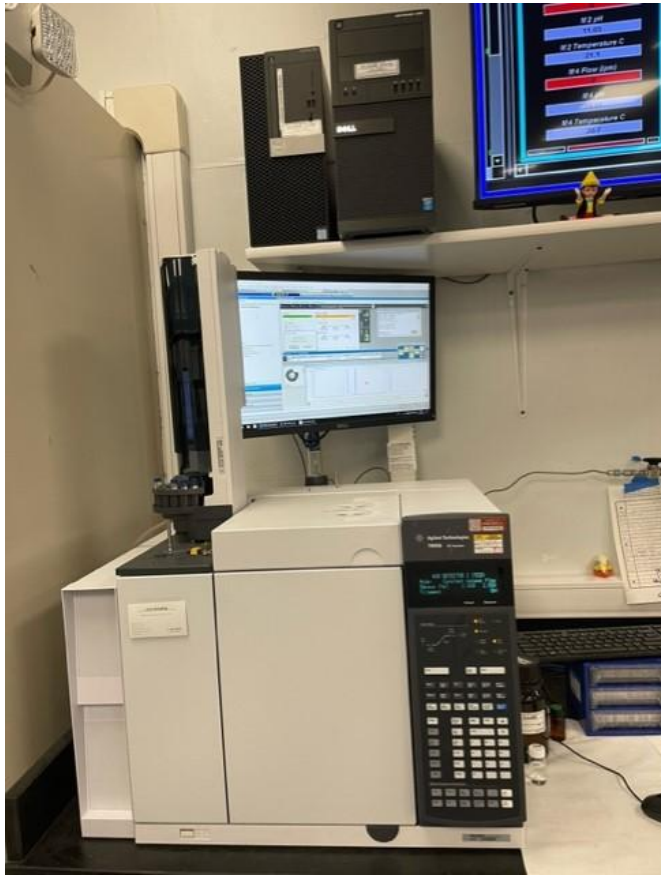
Fourier Transform Infrared Spectrometer (FTIR)

Manufacturer	Thermo Fisher
Model	Nicolet 6700 with Continuum Microscope
Application	Organic identification

Fourier Transform Infrared Spectroscopy (FTIR) analyzes the absorption of infrared radiation by sample molecules, converting it into a unique spectrum. Interpreting this spectrum involves comparing peaks to reference data to identify molecular structures and functional groups, enabling substance identification and chemical analysis.

Gas Chromatograph (GC)

Manufacturer	Agilent
Model	7890 with TCD detectors
Application	Solvent analysis



Gas Chromatography (GC) processes a sample by vaporizing it and passing it through a capillary column. As the components of the sample interact with the stationary phase inside the column, they separate based on their affinity and exit the column at different times. This separation allows for the quantitative measurement of individual components within the sample.

Gel Permeation Chromatography (GPC)

Manufacturer	Thermo Fisher
Model	1260 Infinity
Application	Polymer analysis

In Gel Permeation Chromatography (GPC), sample components separate based on their molecular size as they interact with a porous gel matrix. The eluted components are detected by a detector, generating a chromatogram. Interpreting the chromatogram involves analyzing peak retention times to determine molecular weight distribution and peak areas for quantification of component amounts.

Thermogravimetric Analysis (TGA)

Manufacturer	TA Instruments
Model	Discovery RCS90
Application	Polymer analysis

Thermogravimetric analysis (TGA) measures the mass of a sample over time as temperature varies, typically ramping from room temperature to around 1000°C. This provides insights into the sample's physical properties.

Differential Scanning Calorimetry (DSC)

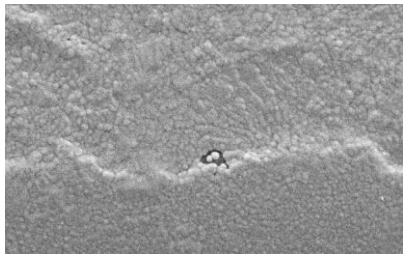
Manufacturer	TA Instruments
Model	Discovery
Application	Polymer analysis

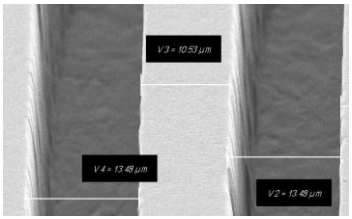
Differential scanning calorimetry (DSC) is a thermoanalytical technique that measures the difference in heat required to raise the temperature of a sample compared to a reference material, as temperature changes. It is commonly utilized for analyzing polymers and assessing oxidative stability.

Scanning Electron Microscope (SEM)

Manufacturer	Zeiss
Model	Supra 25
Application	Product troubleshooting

The Scanning Electron Microscope (SEM) utilizes a focused beam of electrons to scan the sample surface, producing high-resolution images. Detectors positioned near the sample surface capture signals generated by the electron beam-sample interaction, including secondary electrons, backscattered electrons, and characteristic X-rays. These signals are converted into electrical signals, processed by the SEM's electronics, and used to generate images and spectra. SEMs offer superior resolving power and depth of focus compared to optical microscopes, making them invaluable for product development, failure analysis, contamination detection, and various other applications.





Energy Dispersive X-Ray Spectroscopy (EDS)

Manufacturer	Oxford
Model	INCA
Application	Elemental identification

Energy Dispersive X-ray Spectroscopy (EDS), when coupled with a Scanning Electron Microscope (SEM), facilitates the analysis of materials' elemental composition. X-rays emitted from the sample upon interaction with the electron beam are captured by the EDS detector. These X-rays possess energies characteristic of the elements present, determined by the atomic structure of each element. By analyzing the energies of these characteristic peaks in the X-ray spectrum, EDS identifies the elements present and their relative abundance within the sample