

Analytical Research Laboratory
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Virginia-Maryland
College of **Veterinary Medicine**

Trace elemental analysis of almost any sample matrix by ICP-MS

Our lab utilizes an Agilent 7900 inductively coupled plasma – mass spectrometry (ICP-MS) instrument for trace quantitative determination of almost every element between lithium and uranium on the periodic table. It is capable of simultaneously analyzing for any number of elements by their respective molecular masses. With this system, we are typically able to quantify 100 parts per trillion (ppt) or less in solution.

In combination with our Anton Parr Multiwave GO microwave digestion system we can easily handle digestions for trace level analysis of higher volatility elements such as mercury and selenium. We are also capable of safely handling and using both hydrofluoric acid (HF) and perchloric acid (HClO₄) for especially difficult to digest elements such as silicon, aluminum, and titanium. Almost any type of leachable or digestible sample matrix can be analyzed for trace elements using these systems.

Example ICP-MS projects performed by our lab:

- Routine screenings of biologically relevant trace metals in animal blood and tissues (17 elements)
- Titanium analysis in rat tissues containing titanium oxide nanoparticles as a cancer drug delivery system
- Gadolinium and cerium analysis of animal tissues containing metallofullerene cages for MRI contrast agents
- Multiple rare earth element analyses of silicates, clays, coal, and coal ash (30+ elements including uranium)
- Zirconium analysis in animal tissues containing metal organic framework (MOF) particles used for cancer drug delivery
- Residual metals in polymer digests
- If your samples can be digested or extracted, we can most likely analyze it!

Trace analysis of low volatility organic molecules by UPLC-MS/MS

We have also recently acquired a Waters Xevo TQD ultra high pressure liquid chromatography – tandem mass spectrometry (UPLC-MS/MS) instrument that is used for chromatographic separation and trace quantitation of organic molecules by molecular mass. This is the instrument of choice when it comes to targeted quantitative analysis of low volatility organic molecules, particularly when low detection limits are required. With this system, we are typically able to quantify 100 parts per trillion (ppt) or less in solution.

Pharmacokinetic (PK) drug studies are most commonly performed in our lab using this instrument. The system is also capable of unknown compound identification by molecular mass, though it is less commonly used in our lab for this purpose.

Example UPLC-MS/MS projects performed by our lab:

- Quantitative pharmacokinetic studies of fentanyl, altrenogest, telmisartan, pioglitazone, LY294002, and several short chain peptides in various animal tissues
- Anticoagulants screening and quantification (9 different anticoagulants in same analysis)
- Polymer side chain deconvolution analysis
- Short chain peptide identifications
- If you know what organic molecule(s) you're interested in, we can most likely quantify it for you!

Trace analysis of volatile to semi-volatile organic molecules by GC-MS

The lab also has an Agilent 6890 gas chromatography – mass spectrometry (GC-MS) instrument for chromatographic separation and identification/quantitation of organic molecules by molecular mass. This is used almost exclusively for analysis of volatile to semi-volatile organic molecules that would not be easily detected by the UPLC-MS/MS. This GC-MS system can also be used for pharmacokinetic studies but with higher detection limits than that of the other system since it doesn't have a tandem mass spectrometer. Identification of unknown molecules within samples can be easily performed using both software library searching and manual interpretation of spectra. Typical quantitation limits for this system are around 10 to 100 parts per billion (ppb). This system is also capable of using a flame ionization detector (FID) for rare instances where mass spec detection may not be the best option.

Example GC-MS projects performed by our lab:

- Screening of sample extracts for qualitative identification of unknown sample components
- Semi-quantitative analysis of extracted and leached samples using a wide variety of organic solvents
- Glycols screening to identify and quantify propylene glycol, ethylene glycol, and glycolic acid in biological fluids
- Comparative analysis of multiple oil and water samples to identify differences between additives and/or contaminations in the samples
- Quantitative analysis of residual solvents, additives, or contaminants in commercial plastic products
- Residual monomer and dimer analysis for polymer batch quality control testing
- If your sample has volatile to semi-volatile components of interest, we can most likely analyze for them!

Analysis of low volatility organic molecules by HPLC-UV/FLD

The lab also has two Agilent 1100 high performance liquid chromatography with ultraviolet or fluorescence detection (HPLC-UV/FLD) systems that are used for chromatographic separation and quantitation of organic molecules with unique ultraviolet chromophores or fluorescent fluorophores. Though these systems aren't as sensitive or selective as the UPLC-MS/MS system, they are still of use particularly in instances where certain compounds aren't easily ionized by the other systems. Typical quantitation limits for the UV detector are typically around 100 parts per billion (ppb) to 1 part per million (ppm). FLD quantitation limits are usually lower than that of UV, with concentrations of around 10 to 100 ppb able to be quantified.

Example HPLC-UV/FLD projects performed by our lab:

- Quantitative pharmacokinetic studies with higher concentration analytes such as those that would be administered to a larger animal
- Anticoagulant screening and quantification
- Quantitative polymer additives analysis

Example Project Costs

Students, staff, faculty, and most associates of Virginia Tech receive an internal rate for analysis.

Pricing can be negotiable based on the difficulty of analysis, the number of samples, and any authorships/acknowledgements of the lab in reputable scientific literary publications.

Please note that the values below do not include the cost of relevant standards needed for a specific analysis. In these instances, we can order the required standards and bill them to you at our cost, which is typically cheaper than buying it yourself.

Analysis Type	Internal Rate	External Rate
ICP-MS with digestion	\$60/sample	\$97/sample
ICP-MS without digestion	\$31/sample	\$50/sample
UPLC-MS/MS assay	\$50/sample	\$81/sample
GC-MS assay	\$56/sample	\$90/sample
Method Development	\$29/hour	\$47/hour

Please feel free to send any questions, project work requests, or additional correspondence to the contact information listed at the top of the first page.