**ICP-MS (Inductively Coupled Plasma - Mass Spectrometer)**

A picture containing text, home appliance, design, indoor

Description automatically generated

***ICP-MS PlasmaQuant MS Elite, Analytik Jena, Germany***

<https://www.analytik-jena.com/products/chemical-analysis/elemental-analysis/icp-ms/plasmaquant-ms-series/>

**Background**

ICP-MS represents a pinnacle in modern analytical instrumentation, offering unparalleled sensitivity, selectivity, and versatility. It combines the capabilities of an Inductively Coupled Plasma (ICP) ion source with the resolving power of Mass Spectrometry (MS), enabling the simultaneous analysis of multiple elements across a wide range of sample types.

At its core, ICP-MS operates by introducing a sample into a high-temperature plasma, where it is atomized, ionized, and subsequently introduced into the mass spectrometer. The mass spectrometer then separates and measures the ions based on their mass-to-charge ratio, providing valuable insights into the elemental composition of the sample.

A picture containing text, screenshot, diagram, line

Description automatically generated

*Fig. 1. The fundamental principles of atomic emission and mass spectroscopy*

The advantages of ICP-MS are numerous. It boasts remarkable sensitivity, capable of detecting elements at trace levels, often in the parts per trillion or lower range. This level of sensitivity is crucial in various fields, including environmental monitoring, geochemistry, pharmaceutical analysis, and materials science.

ICP-MS also offers exceptional versatility, accommodating a wide range of sample matrices such as liquids, solids, and gases. Whether you are analyzing environmental samples, biological tissues, geological materials, or complex industrial samples, ICP-MS provides the analytical power to meet your specific needs.

A picture containing text, screenshot, design

Description automatically generated

*Fig. 2. The scheme of quadrupole ICP-MS instrument (by Analytik Jena)*

In addition to elemental quantification, ICP-MS enables isotopic analysis, allowing researchers to investigate isotopic ratios, elemental speciation, and trace metal fingerprinting. This capability finds applications in fields such as archaeology, forensics, and geochronology, among others.

**Notes for our clients**

In general, the primary distinction between ICP-OES and ICP-MS lies in their sensitivity, with mass spectrometry detection offering superior performance. While both instruments are used for determining the total elemental content in acidic solutions, ICP-MS typically exhibits lower instrument limits of quantitation (LOQ) compared to ICP-OES. However, it is important to note that ICP-MS often requires higher sample dilution, which can partially compromise its superior sensitivity.

Furthermore, these two techniques encounter different types of interferences, making the quantification of certain elements challenging for one technique while relatively straightforward for the other. For instance, the reliable determination of phosphorus (P) and sulfur (S) using ICP-OES is relatively uncomplicated due to the characteristic emission lines of these elements in the UV spectral range.

On the other hand, the analysis of P and S using ICP-MS can be problematic due to their low ionization efficiencies and susceptibility to interferences, resulting in inaccurate quantification. Additionally, sulfur and phosphorus can form polyatomic species and exhibit isotopic interferences, further complicating their analysis with ICP-MS.

To address these challenges, our laboratory operates both techniques and selects the most suitable method for each element. We have compiled a table (Table 1) below, showcasing the approximate instrument LOQ values for the specific list of elements routinely analyzed using ICP-MS. If you are interested in an element not included in this list, please contact us for further clarification (vasiliyr@savion.huji.ac.il).

When sending samples for analysis using ICP-MS, please ensure that you fill out the **submission form** provided, following the instructions outlined on **the ICP-OES instrument page.** Please refer to the **"FAQ"** page for detailed information on the sample submission process.

At our laboratory, we strive to provide accurate and reliable elemental analysis by leveraging the strengths of ICP-OES and ICP-MS. By employing the most appropriate technique for each element, we ensure high-quality results for a wide range of samples. If you have any questions or require further information, please do not hesitate to contact us via vasiliyr@savion.huji.ac.il.

*Table 1. Instrument Limits of Quantification (LOQ) for ICP-MS Analysis (µg/L)*

A picture containing text, screenshot, number, font

Description automatically generated