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# LA-ICP-MS

## LASER ABLATION- INDUCTIVELY COUPLED PLASMA- MASS SPECTROMETRY

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Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is an analytical technique used to detect and measure elements present in trace quantities from biological fluids, down to a detection limit of sub-parts per million (ppm). This technique was discovered in 1980 and was first introduced in the market in the year 1983. In the past decade, there has been a gradually increasing shift in laboratories towards using ICP-MS instead of older technologies like ICP AES (Inductively Coupled Plasma-Atomic Emission Spectroscopy) and flame atomic absorption. The biggest advantage ICP-MS has over the other technologies is its multi-element capability, which allows the measurement of multiple elements in a single analysis. Combined with its short analysis time and simple sample preparation, it is highly unlikely that the steady shift of technologies would cease.

However, ICP-MS can only be performed on fluids after it undergoes sample preparation. Therefore, variants of this technology have emerged that support the spectroscopic analysis of solid samples directly. Laser Ablation ICP-MS is the most powerful of these variants.

Laser ablation is a process by which layers are removed from a solid surface using a laser beam for ultimate precision. When a continuous wave or pulsed laser light is focused onto a material, its electronic subsystem and molecular lattice begin to absorb the energy, causing atoms to dissociate from one another. These atoms subsequently ablate, either evaporating, sublimating, or converting directly into the plasma. These particles are then transported to the plasma torch. The plasma in the ICP ionizes these particles, generating ions, which are then extracted through the interface region and into a set of electrostatic lenses called ion optics. The ion optics focus and guide the ion beam into the quadrupole mass analyser. The mass analyser separates ions according to their mass-charge ratio, and these ions are measured at the detector. Laser Ablation ICP-MS can provide element

compositions in a sample with a detection limit close to parts-per-billion (ppb).

LA-ICP-MS is an elemental and isotopic microanalytical technique that has found a place in several scientific fields, including Forensic Science. It can chemically characterize physical evidence associated with a crime event, a location, contact between objects, or contact between objects and a person(s). The main forensic application of this technology is the analysis of glass and paint samples. However, applications to other samples like documents (ink and paper), fiber, and gems have also been reported.

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