

ICP-MS at Shannon ABC

Since being introduced in the 1980's, Inductively Coupled Plasma Mass Spectrometry has become one of the most important techniques for elemental analysis. It surpasses rival techniques in terms of its low detection limits, high degree of selectivity and the fact that it can determine most of the elements in the periodic table.



At the heart of the ICP-MS instrument is the torch, where Inductively Coupled Plasma (ICP) atomises and ionises the sample at extremely high temperatures. These ions are then sorted according to mass and charge by the Mass Spectrometer (MS) part of the instrument. It is the coupling of these two unique instruments that gives ICP-MS its exceptional qualities in terms of detection, sensitivity and accuracy. The Inductively Coupled Plasma minimises interferences by offering exceptional ionisation, while modern mass spectrometers such as the quadrupole allow superb resolution.

ICP-MS has applications across a number of industries from pharmaceutical to food and environmental as it has now become the benchmark standard method for elemental determination in most sectors.

Examples of use of ICP-MS:

- **Heavy metal analysis in soil and water**
Heavy metals of relevance to soil and water are predominantly those that may have negative impacts on health and include mercury, cadmium, arsenic, chromium, thallium and lead. When these heavy metals are present in soil or water they can bioaccumulate and make their way into the food chain. In addition to impacts on the environment, human health impacts from heavy metals in the food chain can include anemia, insomnia, neuromuscular change, respiratory failure and kidney and brain damage. In this context, reliable and sensitive measurement of heavy metal content is essential.
- **Mineral analysis in food and drink products**
ICP-MS is an excellent to determine key nutritional markers of food and drink products. Minerals such as calcium, phosphorus, magnesium, sodium, potassium and chloride are needed in quite high amounts and those such as iron, zinc, iodine, selenium and copper are required in lower amounts. The Food Safety Authority of Ireland and European Food Safety

Authority of Ireland have defined regulations that companies can follow to determine whether their products are high in specific minerals which can then be communicated through on pack or other marketing materials. In addition to nutritional claims, health claims can be made on food and drink products provided that they comply with specifications defined by the EFSA. ICP-MS can be an excellent way for companies to determine if they can make nutritional or health claims on their food or drink products.

- **Quality control in pharmaceutical analysis**
Purity of pharmaceutical products is essential, particularly of parenteral products intended for injection. Heavy metal contamination could potentially come from a variety of sources including water, reaction vessels and ingredients. ICP-MS is a very user friendly method of analysis and can be automated and operated remotely. The sensitivity of ICP-MS is ideally suited for the pharmaceutical sector, due to the impact that very low levels of contaminants could have in these kinds of products.
- **Biomass screening**
The Bioeconomy encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, biobased products as well as bioenergy. Bioeconomy value chains integrate the latest breakthroughs in clean technology, biotechnology and genetic engineering to extract and produce high value products from agricultural, forestry, marine and waste biomass. Biomass is a general term usually used to describe natural materials for use in industrial processes; it can also refer to by-products from bioresource based processes. A well-defined and screened biomass supply chain is an essential cornerstone to a functioning bioeconomy. An ICP-MS can be used to screen biomass material to determine mineral and heavy metal content; this is important in terms of defining potential uses for the biomass.

If you think that an ICP-MS may be able to help your company, please contact Patrick Quille, Lecturer in Department of Biological and Pharmaceutical Sciences (Patrick.quille@staff.ittralee.ie) or Tim Yeomans, Shannon ABC Centre Manager (tim.yeomans@staff.ittralee.ie).