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FRONTIERS IN TRACE ELEMENTAL ANALYSIS

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Trace elemental analysis of substances has been an integral part in many areas of science; Environmental, Geological, Biological, Human Health, Clinical, Forensic, *etc*.. For example, in order to confidently prove or disprove the suspected culprits of Chronic Kidney Disease of Unknown etiology (CKDU), such as Cd, As, *etc*., it is important to accurately monitor low concentrations of toxic elements in water, soil, body fluids *etc*.. Inductively Coupled Plasma Atomic Emission and Mass Spectrometry (ICP-ES & ICP-MS) are among the most versatile and powerful tools used for instrumental analysis of trace elements in the modern analytical laboratory.

Overall process of instrumental analysis involves three basic steps: (i) sample introduction (ii) signal measurement (iii) data collection and processing. In spite of recent advancement in instrumentation with ultra-high sensitivities and automation, final data quality and versatility of applications depend primarily on steps (i) and (iii),in the hand of the user. We will discuss novel developments in our laboratories in sample introduction (step-i), and a critical view of traditional calibration techniques (step-iii).

Traditional approach for sample introduction in atomic spectroscopic techniques is the aspiration of liquids as a fine aerosol into a flame, or plasma. However, majority of substances (*e.g*. geological material), occur in the solid form. Solid samples are required to be converted into solution via time consuming and often dangerous, digestion-procedures, which also lead to errors due to incomplete digestion, contamination and loss of analytes. We will outline our research in "*direct solid analysis"* to alleviate above problems and to obtain additional information. We will also discuss new developments in "*vapour generation*" to address such problems.

In many scientific measurement systems, instrument calibration is an integral part of measurement process where signal responses are correlated to standard concentrations. Commonly used normal least square calibration assumes equal uncertainties along the whole range of the calibration line. However, uncertainty of calibration points can vary depending on the concentration. Above topics will be targeted to the interests of a general scientific audience so that the concepts can also be applied to other areasthat usescientific measurements in general.