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# Press Release

A-ENG-16004-2 Backgrounder | February 02, 2016

## Analytical technologies and their use in the clinical world

**140 pages, free of charge Application Handbook "Clinical"**

As a world leader in analytical instrumentation, Shimadzu has been providing clinical applications since years. Chromatography, mass spectrometry, spectroscopy and life sciences instruments support earlier detection of diseases, to discover better treatments in order to achieve a healthier and safer life. They are part of the Application Handbook "Clinical" which covers 47 real life applications related to hot topics such as Vitamin D, steroids, immunosuppressants, catecholamines and amino acids analysis. The book is free of charge and can be downloaded (17 MB): www.shimadzu.eu/clinical

This is a quick overview of the analytical technologies and their use in the clinical world:

**Chromatography**

- Chromatographic separation in gas phase for analysis of volatile and semi volatile components is in use in the clinical field since many years. Gas chromatography is a key technique for quantitative analysis of alcohol in blood.

- HPLC and UHPLC systems are able to quantitatively analyze substances in blood, serum, plasma and urine containing multiple compounds by separating and detecting target substances. Shimadzu offers a wide variety of application-specific systems such as automated sample pretreatment systems for amino acid analysis or on-line sample trapping for quantification of drugs or metabolites.

- Gas chromatography-mass spectrometry (GC-MS) is a hyphenated technique combining the separating power of GC with the detection power of MS to identify different substances within a sample. Mass spectrometry is a wide-ranging analytical technique which involves the production, subsequent separation and identification

of charged species according to their mass to charge (m/z) ratio. It is well known for analysis of drug abuse.

- Liquid chromatography-mass spectrometry (LC-MS) is an analytical chemistry technique that combines the physical separation capabilities of LC with the mass analysis capabilities of MS, bringing together very high sensitivity and high selectivity. Its application is oriented towards the separation, general detection and potential identification of compounds of particular masses in the presence of other chemicals (e.g. complex mixtures like blood, serum, plasma or urine). Its use is spreading in the clinical field (research and routine) as a replacement of immunoassays thanks to the capability of multiplexing analysis and reduced risk of cross-reaction in immunoassays.

**Spectroscopy**

- AAS quantitates concentrations of elements in a vapor, when a ground state atom absorbs light energy of a specific wavelength and is elevated to an excited state. The amount of light energy absorbed at this wavelength is increased when the number of atoms of the selected element in the light path increases. The relationship between the amount of light absorbed and the concentration of the element present in known standard solutions can be used to determine unknown sample concentrations by measuring the amount of light they absorb.
- XRF allows analysis of element composition of samples in a wide variety of applications. This technique provides nondestructive and fast measurements of liquid and solid samples and is best suited for analyzing the elemental range from sodium/carbon to uranium, thereby covering the majority of the metallic elements.
- Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) is the measurement of light emitted by all elements present in a sample introduced into an ICP source. The emission intensities measured are then compared with the intensities of standard samples of known concentration in order to obtain the elemental concentrations in the unknown samples. The argon plasma is generated by an RF field and ionized argon gas. The advantage of the plasma compared to other energy

sources is the high temperature of 10,000 °K, enabling complete atomization of the elements in a sample while minimizing interferences.

- UV-NIR: Analysis of metals, ions, colors and molecules. The ultraviolet and visible range of the light spectrum is sensitive to determination of color and carbon hydrogen bonding. Color reactions, DNA and protein methods are easily applied at low concentrations.
- FTIR: Quantification and identification of substances. Infrared spectroscopy can analyze all materials which react with heat. The physical vibration correlating to this heat serves as an identification tool for each material.
- RF: Quantitative and qualitative analysis of substances. Fluorescence spectroscopy provides low detection limits for the determination of chemo- and bio-luminescences and fluorescences from diverse substances. Furthermore, this analytical method enables detection of selective DNA or a cocktail of markers in tissue analysis. Fluorescence spectroscopy can also be applied for kinetics as well as overview scans in high speed 3D-technique.

**Life Sciences**

- The MALDI-TOF (Matrix Assisted Laser Desorption Ionization - Time of Flight) technology offers multiple options for profiling of proteins. This enables identification of contamination, differentiation of bacteria, fungi, yeasts and much more. MALDI-TOF is now widely used in microbiology for bacteria identification. It is a robust and easy technology that fits in routine labs for quick control.

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