

## Product Focus - New Age of Possibilities: Mass Spectrometry Instrumentation

Mass Spectrometry (MS) is an analytical method enabling professionals to determine the elemental composition of chemical substances through measuring the mass to charge ratio of charged particles. Due to its high-efficiency and continuous development, it has become one of the most powerful, versatile and sensitive measurement technologies available today. It is commonly used for both routine and research purposes in biotechnology, pharmaceutical, clinical and environmental applications. The recent advances and increasing sophistication of mass spectrometry products expand its capabilities further, providing higher sensitivity, lower costs and increasing sample throughput.

### Instrumentation

New developments in mass spectrometry instrumentation are primarily focused on increasing the speed, sensitivity and throughput of analyses. **PerkinElmer** has recently announced **Flexar SQ 300 MS** - a fast, accurate and robust detector which is interfaced with the proven Flexar LC platform to quickly identify and quantify compounds across a wide range of applications. This high performance LC/MS system incorporates super-soft ionization allowing analysts to acquire information on a wide range of molecular structures. Moreover, the efficient and reliable ionization of compounds in both positive and negative modes also enables the effective analysis of a broad range of analytes particularly for the pharmaceutical and chemical industries. Incorporating a patented multi-stage ion path, Flexar SQ 300 MS allows multi-residue analysis with best-in-class limits of detection sensitivity for food and environmental testing applications. Additionally, front-end Collision Induced Dissociation (CID) technology enables fragmentation for further confidence in results. A significant breakthrough in functionality is the snap-in-probe design. The probes can be specific to a user, application or sample type, helping to minimize the risk of cross-contamination and instrument downtime.

**Agilent Technologies, Inc.** introduced the **240 Ion Trap MS**, offering a sub-picogram detection limit in full scan mode, providing reliable quantitation and identification over a wide range of concentrations. The instrument also features MS/MS and MS<sup>n</sup> capabilities which reduce matrix influences and provide detailed structural data. EI, CI and MS/MS can be performed in the same run, providing extremely high selectivity for complex matrix analyses. Applications include environmental analysis, materials testing, food quality and safety measurement and a wide range of research and routine analyses performed in government and academic laboratories.

**ALMSCO International's** bench-top time-of-flight (TOF) mass spectrometer, **BenchTOF-dx** offers superior full-scan sensitivity at typical GC-quad SIM levels. This mass spectrometer combines speed and resolution with uncompromised spectral quality even at trace concentrations. The novel technology enables

analysts to screen for both known and unknown compounds at much lower levels with a high degree of definition and clarity. While alternative techniques offer such a high level of sensitivity they provide too much detail about the identity of the compounds, making it difficult to characterize them at very low levels, the BenchTOF-dx screens samples at trace levels while maintaining sensitivity, speed of analyses and selectivity. BenchTOF-dx readily integrates with existing gas chromatographs (GCs) and associated data handling / control packages, enabling analysts to screen samples for trace target compounds at much lower levels on a routine basis and with a negligible learning curve.

### Sample Preparation

Effective sample prep prior to MS is essential to minimize matrix effects and obtain accurate data so scientists and researchers can make the right decisions. One of the main challenges associated with mass spectrometry is automated, efficient and cost-effective sample preparation and optimization. Meticulous sample preparation requires techniques such as dilution, filtering, solid phase extraction, liquid-liquid extraction or protein precipitation which can be highly time-consuming. The latest sample preparation solutions streamline this process, providing significant time savings as well as increasing throughput and accuracy of results.

**Thermo Scientific** Transcend system combines the power of automated online sample preparation and multiplexing to increase the efficiency of a mass spectrometry workflow. The Transcend system is optimized to increase productivity, enhance efficiency and boost throughput to the instrument – without compromising data quality or sensitivity. The unique Thermo Scientific multiplexing technology brings the productivity of up to four separate, parallel LC systems to a single mass spectrometer. Proprietary Thermo Scientific TurboFlow technology is an automated, online technique that helps reduce sample preparation by up to 95%.

Trypsin is the favoured enzyme for in-gel protein digestion prior to mass spectrometry analysis. However an inherent limitation of trypsin is the size of the peptides that it generates. For



Perkin Elmer's Flexar SQ 300 MS allows multi-residue analysis with high limits of detection sensitivity for food and environmental applications

most organisms > 50% of tryptic peptides are less than 6 amino acids, too small for mass spectrometry based sequencing. To address this issue, **Promega** has launched an expanded family of proteases. These include **ProteaseMAX Surfactant**, which improves the speed and quality of trypsin protein digests, and a range of other proteases including Chymotrypsin, Endoproteinase Lys-C and Asp-N, which can be used in combination with trypsin for enhanced protein sequence coverage to improve protein identification.

### Accessories

Optical filters with reliable and repeatable transmittance characteristics are essential for high performance in gas-sensing applications including spectroscopy and mass spectrometry.

**Deposition Sciences, Inc.** has recently introduced advanced **Infrared Narrow**

### Material compiled by The Scott Partnership



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**Bandpass (IR NBP) Filters** for industrial, medical and biological sciences instrumentation. The improved narrow bandpass optical filters offer high spectral performance, with accurate center wavelength placement and good temperature stability which makes the infrared NBPs ideal for spectroscopic applications such as advanced gas-sensing. The NBP filters' IR spectral range enables the user to detect a particular gas and to identify the concentration levels of gases such as CO<sub>2</sub>, CH<sub>4</sub>, HOx and more. The absorption of infrared radiation at wavelengths between 2.0 – 20.0 microns provides a definitive signature of the bending, stretching and or twisting of the atomic bonds in a particular gas molecule. DSI's IR narrow bandpass filters allow discretization of the spectra through a gas sample at multiple detection wavelengths, inside and/or outside the absorption band of interest.

Also making strides in accessories for mass spectrometry is **ESI Source Solutions**. Its **Active Background Ion Reduction Device (ABIRD)** for nanospray ESI/LC-MS/MSMS isolates a mass spectrometer from interferences due to variable laboratory air composition. The key feature of the product is the enhancement of signal to noise ratios in the full mass range of a mass spectrometer, allowing the instrument to observe extremely low level signals which could potentially go undetected. This is an inexpensive

#### Companies featured in this product focus include:

**AB Sciex**  
**Agilent Technologies**  
**Deposition Sciences, Inc.**  
**ESI Source Solutions**  
**GeneBio**  
**PerkinElmer, Inc.**  
**Promega**  
**Saw Instruments GmbH**  
**Thermo Fisher Scientific, Inc.**

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GeneBio's Smile MS is a unique software platform for the identification and analysis of small molecules using mass spectrometry

and reliable way of enhancing the sensitivity of a mass spectrometry method.

**SAW Instruments GmbH** introduced **sam5** biosensor instrument, a unique tool for advanced real-time biomolecular interaction and kinetic studies. The sam5 is a peerless biosensor utilising Surface Acoustic Wave (SAW) technology for the label-free detection of real-time binding and structural events. Combined directly with ESI-MS, it enables direct connection of protein-ligand (K<sub>d</sub>) analysis with subsequent quantification and structural characterisation by mass spectrometry. Biosensors have previously only been connected to a mass spectrometer indirectly in a MALDI-TOF format where crystallized sample spots are analyzed. This new SAW-ESI-MS set-up is unique, as the first that directly connects liquid flow from the SAW biosensor directly into the ESI-MS via a standard desalting interface – an approach impossible with other available biosensors. This method enables direct quantitative determinations of protein-ligand complexes by SAW-yielded dissociation constants (K<sub>d</sub>) from low nanomolar to sub-micromolar sample concentrations.

#### Software

New developments in mass spectrometry software have been designed to increase productivity by reducing method development time from hours to minutes and enabling rapid



ALMSCO International's BenchTOF-dx offers superior full-scan sensitivity at typical GC-quad SIM levels

and easy data review and reporting.

**GeneBio's Smile MS** is a unique software platform for the identification and analysis of small molecules using mass spectrometry. It provides advanced library searching capabilities for rapid routine analyses using a powerful and innovative algorithm delivering highest level of confidence from both low and high mass accuracy data. Smile MS is designed to identify analytes from mass spectrometry spectra of fragmented molecules via a spectral library search approach and can be used for both targeted and untargeted screening methods. This new solution, marketed with **AB SCIEX's** mass spectrometers enable in-depth, intuitive evaluation of results for use in food testing, pharmaceutical research, clinical research, environmental testing and biomedical research.



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