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## **AGILENT TECHNOLOGIES TECHNICAL SOLUTIONS AS AN EFFECTIVE TOOL FOR DETERMINATION AND MONITORING OF FOODSTUFF PARAMETERS**



*A brief overview of some product lines manufactured by Agilent Technologies (California, USA) and possible areas of their application are given. The equipment is designed to meet the individual needs and peculiarities of different industries. The Agilent Technologies solutions are widely used in the field of agriculture and food production.*

*Key words: Agilent Technologies, analytical equipment, foodstuff, and spectrometry.*

While discussing the crucial tasks of food analysis, first of all, it is necessary to pay attention towards the basic objective which is the consumer protection. This requires not only professional knowledge of such disciplines as food processing technology, toxicology, physiology of digestion, and microbiology, but also of current legislative requirements and standards.

The development of different analytical methods was caused by several main factors: on the one hand, a variety of types and forms of analytes required the creation of versatile techniques and, on the other hand, the discoveries in medicine and toxicology stimulated the development of techniques allowing the users to carry out express analysis and to monitor the quality of large flow of material to be analyzed. The development of multistep physicochemical methods became relevant after the introduction of requirements for the content of toxic elements in foods. As a result, today, every analyst has at hand a sufficiently large arsenal of techniques, such as gas chromatography, high performance liquid chromatogra-

phy, atomic absorption spectroscopy or electrophoresis, which involve the use of properly selected detectors (such as MSD, electrochemical or some specialized spectral detectors).

A mandatory indicator of food quality control is content of heavy metals and toxic elements which adversely impact the human health, such as highly toxic lead, mercury, cadmium, and arsenic, which can accumulate in the human organism causing long-term adverse effects of mutagenic or carcinogenic (in case of arsenic and lead) character.

The monitoring of chemical and biological safety of imported and exported food is a quite difficult and complex task needing a responsible care. Previously, the analysis of metal content in foodstuff required the use of many various devices to cover the full range of necessary concentrations of elements and types of products to be analyzed. This approach was very inefficient in terms of time and costs of equipment and reagents. The ICP-MS 7700x mass spectrometer with inductively coupled plasma manufactured by *Agilent Technologies* is a handy tool for the identification and analysis of content of both the trace and the tangible metal concentrations using the method

of single collisions. This method is simple and allows the users to analyze a sufficiently large number of samples per unit of time and to identify a large list of indicators.

The main advantage of these spectrometers as compared with the atomic-absorption spectrometers with electro-thermal atomization is their versatility. All the elements of interest in the analyzed product are identified «simultaneously», without any additional equipment such as, for example, hydride console.

The **ICP-MS Agilent 7700x** mass spectrometer is designed for flow analysis and work with samples containing complex and fairly concentrated matrixes. The basic configuration of device includes the HMI (High Matrix Introduction) aerosol dilution system and the octopole reaction system of third generation (ORS3). The high-temperature plasma mode, inert interface and nine orders of dynamic range provide the perfect combination of reliability, sensitivity, and unique analytical capabilities (Fig. 1).

The 7700x devices are designed to fit maximum performance of laboratory flow analysis. They are adaptable, sufficient for more complex research analytical tasks, and surpass the competing devices: the standard 7700x package contains, among others, a spray chamber with temperature control, independent controls of microfluidizer and auxiliary gas supply, an ion focusing system with high transmittance, and a quadrupole with electrodes having a strict hyperbolic section. To further adapt the 7700x devices to more complex analytical tasks the auxiliary equipment (e.g., chromatograph interface blocks, organic solvent analysis blocks, etc.) has been proposed.

The analysis of pesticide content in foodstuffs is important for ensuring their safety. Currently, such research is conducted for tracking the pesticide distribution and verifying the suitability of agricultural raw materials. Insofar as pesticides are introduced during the entire period of plant growth in order to control their content it is necessary to carry out the screening measurement which requires a device suitable for flow analysis.



**Fig. 1.** Agilent 7700 mass spectrometer with inductively coupled plasma



**Fig. 2.** Agilent GC-MSD three-quadruple, series 7000V

**The three-quadruple detectors GC-MSD, series 7000V,** provide a superior sensitivity and selectivity of on-stream analysis. Moreover, they allow the researchers to achieve lower levels of detection and high speed performance of GC-MS-MS quantitative determination mode even under the strictest conditions of analysis of very contaminated samples. Sophisticated, easy to use, and innovative design of GC three-quadruple mass spectrometer provides a high performance in daily work. It is the best choice for laboratories striving after maximum sensitivity and maximum performance (Fig. 2).

Regardless of the purpose of analysis (to determine the origin of products, to control quality or safety of products) the task is very complex and multifaceted. Some elements could be contained



**Fig. 3.** Agilent 4100 MP-AES atomic emission spectrometer with microwave plasma



**Fig. 4.** Agilent Cary 630 FTIR spectrometer

only as traces, while others are permissible in higher concentrations.

Atomic spectroscopy is a proven tool for analysis of metal content in food. The preferred method is chosen on the basis of requirements for the list of elements, their concentrations, the amount and type of sample. A variety of methods allows the researchers to consider options for technical solutions with different amounts of consumables, gases, as well as the cost of maintenance and repair. One of the latest achievements in atomic emission spectral analysis is the use of microwave plasma for ionization of atoms in the sample.

The **Agilent 4100 MP-AES atomic emission spectrometer** is a safe, economical, and sensitive

tool (detection limit is less than  $1 \text{ bln}^{-1}$ ). It outperforms the flame atomic absorption spectrometers (AAS) and does not consume combustible gases. This is a true revolution in spectrometric techniques: the working environment of device is air (Fig. 3). The *Agilent 4100 MP AES* is a compact desktop atomic emission spectrometer with microwave-saturated plasma based on strong magnetic nitrogen plasma. The spectrometer is designed for elemental analysis using a solid-state CCD detector. It is designed for a large sample flow and has a rapid sequential element identification mode. Due to it the foodstuffs will always be safe and their quality will be excellent.

The device is ideal for the laboratories for which speed is a crucial factor, as well as for the small and medium-sized laboratories dealing with on-stream analysis («screening») which determines the content of nutrients, microelements, and trace amounts of toxic elements.

Authenticity is an integral part of the quality of foodstuffs (including milk and its derivatives). It is defined by a set of physical, chemical, and biological indicators whose absolute quantitative values and fluctuation limits are conditioned by the properties of raw materials and permissible treatment during the manufacture of finished foodstuffs. Faked food products are the foodstuffs and raw foods intentionally modified and (or) having hidden properties and quality the information on which is incomplete or misleading. Food identification is verification of compliance of foodstuffs with their declared name (type, class, category, grade, geographical origin) by studying their identity with authentic samples and/or descriptions published in the relevant documents and with information contained in the accompanying documents and consumer labels. This study is based on the use of analytical and organoleptic methods.

The **Cary 630 FTIR** spectrometer is a multifunctional instrument designed for a variety of analytical tasks. The spectrometer is used for carrying out the measurements in the near and the middle infrared region and is a tool for identification and quality control.

Small size, superior performance, flexibility, simplicity, and ease of operation make these devices suitable for the systematic exploitation in accordance with raised requirements for sustainability. The multiple attachments for samples make the devices easy to use and ensure a high quality of any analytical data. For example, the innovative design of attachments with an option of optical path choice (DialPath) provides the sensitivity comparable with that of optical cells. These specialized attachments ensure the best performance for the sample measurement (Fig. 4).

The intelligible interface helps to ensure reliable results due to minimization of the human factor. The *Agilent Cary 630* consists of spectrometer block and attachment for samples. The interface is configured for automatic recognition of attachments and automatic self-diagnostics that ensures consistent and correct measurement of samples. The *Agilent Cary 630* spectrometer has a sufficient sensitivity to quickly obtain the qualitative and quantitative results.

The state-of-the-art analytical equipment offered by *Agilent Technologies* applies to the entire chain of production, including input control, development of new products, quality control, and packaging. The company keeps abreast with the latest trends and challenges in the industry and is developing the systems and devices which meet all the existing advanced methods and requirements.

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ТЕХНІЧНІ РІШЕННЯ  
КОМПАНІЇ AGILENT TECHNOLOGIES  
ЯК ЕФЕКТИВНИЙ ІНСТРУМЕНТ  
ВИЗНАЧЕННЯ ТА МОНІТОРИНГУ  
ПАРАМЕТРІВ ХАРЧОВИХ ПРОДУКТІВ

Проведено короткий огляд деяких моделей приладів компанії *Agilent Technologies* і можливих областей їх застосування. Прилади виготовлені з урахуванням індивідуальних потреб та особливостей різних галузей промисловості. Дане обладнання досить широко застосовується при вирішенні завдань сільського господарства та виробництва харчових продуктів.

*Ключові слова:* *Agilent Technologies*, аналітичне обладнання, харчові продукти, спектроскопія.

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ТЕХНИЧЕСКИЕ РЕШЕНИЯ  
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КАК ЭФФЕКТИВНЫЙ ИНСТРУМЕНТ  
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ПАРАМЕТРОВ ПИЩЕВЫХ ПРОДУКТОВ

Сделан краткий обзор некоторых моделей приборов компании *Agilent Technologies* и возможных областей их применения. Приборы изготовлены с учетом индивидуальных потребностей и особенностей различных отраслей промышленности. Данное оборудование достаточно широко применяется при решении задач сельского хозяйства и производства продуктов питания.

*Ключевые слова:* *Agilent Technologies*, аналитическое оборудование, пищевые продукты, спектроскопия.

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