

Analytic Chemistry and Instrumental Analysis

Monica Butnariu

Professor, Habilitated doctor, chemist, Chemistry and Biochemistry Discipline, Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" Timisoara, Romania.

***Corresponding author:** Butnariu M, Professor, Habilitated Doctor, Chemist, Chemistry and Biochemistry Discipline, Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" Timisoara, 300645, Calea Aradului 119, Timisoara, Romania, Tel: 004-0256-277464; Fax: 004-0256-200296; E-mail: monicabutnariu@yahoo.com

Received Date: 22nd February 2018

Accepted Date: 26th February 2018

Published Date: 4th March 2018

Citation: Butnariu M (2018) Analytic Chemistry and Instrumental Analysis. Enliven: Bio Anal Techniques 5(e1): 00e1.

Copyright: © 2018 Monica Butnariu This is an Open Access article published and distributed under the terms of the Creative Commons Attribution License, that permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Industrialisation and diversification of the domains of economic-industrial activity and activities from farming and animal breeding domains are offering great services to society, and in same time these activities are leading advanced pollution of ambient environment. There are frequent advanced pollution in case of air with dust and toxic gases (that are producing acid rains), of soil water and of food, all these facts having negative effects on human's health. As an example, indigenous dairy products (especially milk powder) are polluted with important amounts of nitrates, which are self-transformed in nitrites under action of some bacteria, nitrite being well known for its very high carcinogen potential [1]. In this way concern for air purity of air, water, soil, food and for normal living conditions providing is natural. The monitoring of environmental factors is realised with chemical and instrumental analytic methods using automate apparatus with remarkable objectivity and accuracy, with great efficiency, especially because results are analysed with help of computers and expensive and less accessible accessories [2].

From this cause is remarkable a accentuated trend for use of chemical methods that are offering immediate and enough precise pieces of information. The analytic methods are occupying an important place in activity of didactic and industrial laboratories and of research institutes. Analytic chemistry has as studying objects chemical analysis methods, these methods that can be defined as an ensemble of principles and proceeds that allow identification and eventually dosing of components from a sample. The exigencies of present development of instrumental analytic chemistry necessitate multilateral and deep knowledge of phenomena that are on base of analysis methods and right understanding of factors that are determining realisation in proper conditions of chemical analysis [3].

The Analytic Chemistry and instrumental Analysis are dedicated to a selective evaluation of pieces of information of special analytical and instrumental chemistry starting from general considerations concerning use with maximal efficiency of analytic methods from perfection of their evolution and perfection. Thus, here we insist on general and particular fundamental aspects concerning theoretical and practical principles of analysis methods [4].

The chemical analysis, after Professor Hans Malissa (Vienna, Austria), is one of most efficient and pragmatic ways in truth theory, chemical determinations illustrating or demonstrating truth, being in this way key of truth. Every analysis can be considered a new step to find or verify truth, because there are obtained new pieces of information with objective character, these pieces of information being concretized in mathematic relationships resulted from measurements of mass, concentration, optical density, conductivity that are based on physical and chemical laws.

"Measure what you can measure and do measurable what you cannot measure in that certain moment" was saying Galileo Galilei three centuries ago. Analysing a sample through results that are obtained there is produced a decrease of our ignorance, analysis representing richest source of information. The purpose of analytic chemistry is to determinate qualitative and quantitative composition and structure of different chemical systems (substance, mixture, solution). All these pieces of information are obtained practically through an ensemble of investigation methods that are in fact chemical analysis. If chemical analysis of a system is establishing its composition only after nature of its components then it is named qualitative chemical analysis; if there is determined content of every main, secondary or in print component of chemical system then chemical analysis is named quantitative [5].

Analytic chemistry studies and elaborates theoretical bases of methods of qualitative and quantitative analyses, and of separation of components of system and is interpreting analysis result. In every analysis of a chemical system qualitative analysis is preceding quantitative analysis. The quantitative analysis is using:

1. Chemical methods as are gravimetric and volumetric methods both having on their background chemical reactions and being characterised with direct and simple analytic functions, in their mathematical expression entering specific and measurable parameters as are mass of precipitate or of residue from its calcification in gravimetric determinations, volume of

titrating solution in titrimetric determinations and volume of a certain gas in gas–volumetric measurements. The correspondence between measured parameter (specific for method) and determined component concentration or quantity is established directly without calibrating. For this reason, these methods are named also independent or absolute.

2. The instrumental methods (physical and physicochemical methods) where chemical reactions can have an important role as an example in calorimetric, potentiometric, conductometric etc. determinations, or they can miss as is case of refractometric, polarimetric, magnetic etc. determinations. They are using different measuring and registration instruments. In instrumental methods used analytic functions are more complex. They comprise specific parameters of method that are depending a lot by working conditions. The correspondence between physical and physicochemical property measured (P) and proportion or concentration of a compound in a system isn't established directly as in case of chemical analysis methods, they are determined using a calibration curve [6].

The quantitative analysis chemical methods are characterized also after size (mass) of analysed sample. In this way we are distinguishing macro scale analysis method when mass of analysed sample is few decigrams (0.1 g), semi–micro scale analysis method that is analysing samples of few centigrams (10^{-2}), micro scale analysis method that is analysing sample of few milligrams (10^{-3}), ultra–micro scale analysis method for samples of few micrograms ($1\mu\text{g} = 10^{-6}$ g), sub–micro (nanogram) analysis method with samples of 10^{-9} g, and sub–ultra–micro pictogram analysis method for samples of few 10^{-12} g [7].

Other characteristic of a quantitative analysis method is relative proportion of components from analysed chemical system. Thus, components present in more than 1% are named main components and others comprised in proportions between 1 % and 0.001 % are named secondary components. The main and secondary compounds together constitute macro–components. The components present in less than 0.01 % are named micro–components or prints. There is tide dependence among content of components from an analysed chemical system, average size of an analysed sample and selected analysis method. For example, determination of secondary compounds or of prints from an average sample at macro scale (10^{-1} g order) there can be used instrumental methods without a former concentration of analysed components [8].

The chemical methods (gravimetric and titrimetric) from ensemble of quantitative analysis methods are corresponding to macro scale determinations while instrumental methods are used for quantitative determinations starting with semi–micro scale. The possibility to realise analyses on small and very small samples is one of advantages of instrumental methods in comparison with chemical methods. Both chemical and instrumental analysis methods have a series of limitation, every of them having advantages and disadvantages. Because of that many times they are using coupling of chemical methods with instrumental methods, they being completed reciprocal. For application of analytic methods is very important to be appreciated difference between accuracy and precision, because accuracy is measuring approaching of result to real value, meanwhile precision is measuring reproducibility of results when analyses is repeated for same sample [9].

The chemical methods have next advantages:

1. The necessary equipment is very expensive;
2. The methods are based on absolute measurements;
3. Procedures are simple and precise.

The chemical methods have next disadvantages:

1. The precision decrease with decrease of sample amount;
2. The realisation of an analysis is realised in a enough long time period;
3. They aren't flexible;
4. They are pollutant for environment;
5. Sometimes they aren't specific.

The instrumental methods have next advantages:

1. The determination is very fast;
2. Can be analysed complex samples;
3. Can be used small samples;
4. Have increased sensitivity;
5. The obtained results are certain.

The instrumental methods have next disadvantages:

1. The initial cost and costs for maintaining equipments are very high;
2. There is necessary an initial or continuous calibration of apparatus;
3. The concentration interval is limited;
4. Necessitate human resources with special training;
5. The sensitivity and precision depends by apparatus.

The chemical and instrumental methods can complete one on each other to obtain superior tools for solving of different chemical problems [10].

The quantitative analytic chemistry is that part of analytic chemistry that is working with identification of elements' nature and of elements' groups that are forming a chemical substance.

The qualitative analysis has as purpose setting of elements' nature that is entering in composition of some substances or substance mixtures. This fact can be realised using analysed sample or after it's passing into solution. Before starting analysis is necessary to do some samples whose results can indicate approximate nature of analysed substance (salt, metal, oxide, alloy, complex mixture, natural compounds or synthetic compounds), modality to bring into solution of its components and presence of some ions in sample. The qualitative identifications can be done using some methods, but before those there can be done some preliminary trials. The qualitative analyse represents a complex experimental and theoretic activity having as purpose characterisation and identification of unknown substances for one is executing analysis. In case of new substances are extra necessary next things:

1. Quantitative analysis (elemental and functional);
2. Determining adequate spectres [11].

The analysis can be done only on pure compounds. In case of substances mixtures there must to be effectuated first separation and purification of component substances. The detection points are lowered to values that are allowing analyses of substance prints, for concentrations measured in ng/L once with technical progresses. The most important criteria for any analysis are to choose most adequate method or instrumental or chemical procedure for that given case. The precision of an analysis method comprises accuracy, repeatability, sensitivity and its detection limit. Statistic calculus methods allow intervention on systematic errors. The expression of results must to be formulated to be used easy and interpretable.

References

1. Butnariu M (2011) *Biochimie vegetala* [Plant Biochemistry], Eurobit Publishing Timisoara RO.
2. Butnariu M (2011) *Environnement Biochemical Cooperation for prognosis of natural water and soil pollution in the Hungarian and Romanian crossborder region to shun catastrophe*, Eurobit Publishing Timisoara RO.
3. Butnariu M (2007) *Notiuni teoretice si practice de biochimie vegetala* [Theoretical and practical notions of plant biochemistry], Mirton Publishing Timisoara RO.
4. Butnariu M (2007) *Chimie analitica si analiza instrumentala-notiuni teoretice si practice* [Analytical chemistry and instrumental analysis-theoretical and practical notions], Mirton Publishing Timisoara RO.
5. Butnariu M (2006) *Chimie generala* [General chemistry], Mirton Publishing Timisoara RO, Colectia Paideia.
6. Butnariu M, Goian M (2005). *Metalele grele din solurile Banatului si biomonitorizarea lor* [Heavy metals from the Banat soils and their biomonitoring], Orizonturi Universitare Publishing Timisoara RO.
7. Butnariu M (2005) *Chimie analitica si instrumentala* [Analytical and instrumental chemistry], Orizonturi Universitare Publishing Timisoara RO.
8. Ianculov I, Butnariu. M (2000) *Ghid practic de chimie fizica si coloidala* [Practical Guide to Chemistry-Physical and Colloidal]. Publishing Eurostampa Timisoara.
9. Butnariu M (2000) *Metode de analiza a poluantilor organici* [Methods for the analysis of organic pollutants], Solness Publishing Timisoara RO.
10. Ianculov I, Butnariu M (2000) *Chimia mediului partea a II-a Chimie organica* [Environmental Chemistry Part II-Organic Chemistry], Eurostampa Publishing Timisoara RO.
11. Butnariu M (2008) *Antioxidantii din sursele naturale. Legumele-surse de compusi bioactivi cu activitate antioxidanta* [Antioxidants from natural sources. Vegetable sources of bioactive compounds with antioxidant activity]. In *Alimentatia functionala cu componente bioactive naturale in sindromul metabolic* [Functional nutrition with natural bioactive component sin metabolic syndrome], Dragan S, Gergen I, Socaciu C (eds) Eurostampa Publishing Timisoara RO.

Submit your manuscript at

<http://enlivenarchive.org/submit-manuscript.php>

New initiative of Enliven Archive

Apart from providing HTML, PDF versions; we also provide **video version** and deposit the videos in about 15 freely accessible social network sites that promote videos which in turn will aid in rapid circulation of articles published with us.