TRENDS IN EDUCATION IN ANALYTICAL CHEMISTRY

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Abstract - The paper introduce the concept of reliability in analytical chemistry for all the steps of the analytical process. The analytical information is a complex function of the reliabilities corresponding to the sampling, method, instrument and data-processing.

Key words reliability, sampling, method, instrument, data - processing

The aim of this paper is to introduce a lot of new concepts concerning chemical analysis as well as analytical chemistry.

Presently, it is necessary to change the old methods in teaching analytical chemistry. First of all, it is very important to assure the main place in the analytical process of the sampling.

In the introduction of a book dedicated to sampling the present author mentioned - " Sample is the LEITMOTIF of the analyst "-(1). In the same time, it is very important to know that " No analysis is better than the sample itself "(2). Beside concerning the methods of analysis, a lot of books were published, up to the present days only very few materials were dedicated in the literature to the sampling process. To improve the quality of teaching and education in analytical chemistry, the author of the present paper made a book mentioned above in which different problems concerning the sampling process were examined. The main role of this book concerning the philosophy of analytical chemistry is to introduce the idea that the sampling process is more general, and consists in collecting, preserving, processing - including separation techniques. It is very important to start the teaching in analytical chemistry by the sampling process, having in mind all the main steps of this process. The student must understand that the full analytical process is depending of the correctness of the sampling process. Here is imposed to introduce the concept of reliability in general and of reliability of the analytical information in special. We consider that the best definition for the reliability is -" Reliability is maintaining the quality in time "-. The reliability of the analytical information is a complex function:

$$R_{AI} = f(R_s, R_m, R_i, R_{dp}) \quad (1)$$

where the terms in paranthesis means the partial reliabilities concerning sampling, method, instrument and data-processing.

During teaching process of the analytical chemistry and chemical analysis is imposed to introduce to the students the notions of scientiometrics and chemometrics. These notions will be necessary to understand the triangle shown in Fig. 1 :

The logical order is marked by the arrows. To research, is practical impossible without a very serious ground of teaching. Analytical chemistry has a very large area and in these conditions it is imposed to have a large lot of knowledges on the sampling processes, on methods of analysis, instrumentation as well as automations and robotics. In some situations, we must utilize very old methods such fire assay in gold analysis, in other ways, we can utilize robots such in pharmaceutical or clinical analysis. We must have always in mind that -" Analytical chemistry is the science of characterizing matter "- using knowledges from different sciences. We mention here the octahedron of analytical chemistry (3,4), shown in Fig. 2:

Presently, we dispose of a lot of methods of analysis, all defined by the very simple formula:

$$P = f(C) \quad (2)$$

In this way, the best definition for the methods of characterizing matter is - Physical methods of analysis in analytical chemistry -. In this general formula we can include so called classical and modern methods of analysis.

The analytical process has three main steps in the ratio 40% : 20% : 40% :
 INPUT BLACK BOX OUTPUT

In this way, chemical analysis acts as a glue between science and technology.

The analytical process becomes more rapid and more reliable by connecting the apparatus with a computer:

METHOD - MAN - INSTRUMENT - COMPUTER CORRELATION

The most important role of the computers were played in the field of structural analysis making possible to obtain data in a very short period of time. Using transform techniques as well as pattern recognition, we can obtain a valuable information in due time about the different samples.

The student must know the main fields of application of analytical chemistry such as: biological sciences, clinical chemistry, criminalistics, environment, food, etc., as well as the main fields of development of this science such as: reactions, surface, automation-robotics, teleanalysis, etc.

The analyst of the 21st century will become a system analyst which must act with competence, flexibility in thought and adaptability to optimize the analytical process itself.

To characterize a complex sample, it is necessary to improve the reliability of the analytical information by using complementary methods with similar performances.

Finally, we must have in mind that the main three fields of chemical analysis in the present and in the near future are: environmental analysis, food analysis and clinical analysis.

To make analytical science, we must never forget that: " To research means to see what all people have seen and to think what nobody has thought "(5).

REFERENCES

1. G.E. Baiulescu, P. Dumitrescu and P.Gh. Zugrăvescu, Sampling, Ellis Horwood, Chichester, 1991.

2. G.E. Baiulescu, Sampling, in Collaborative Interlaboratory Studies in Chemical Analysis, H. Egan and T.S. West, Eds., Pergamon Press, Oxford, 1982.
3. G.E. Baiulescu, Analyst, 105, 1045 (1980).
4. G.E. Baiulescu and J.D.R. Thomas, Anal. Proceed., 26, 281 (1989).
5. A. Szent Györgyi, Bioenergetică, p.71, Ed. Stiintifică, Bucharest, 1962.