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Competition — Selected other papers

Analytical Chemistry – today's definition and interpretation

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Definition

Analytical Chemistry is a multidiscipline, comprising various fields of chemistry with special understanding of physics, mathematics, computer science, and engineering; it uses chemical, physicochemical, and physical or even biological methods for analytical signal production, followed by problem and matter-related signal processing and signal interpretation in order to provide reliable (quality assured) qualitative, quantitative and/or structural information about a sample.

Interpretation

Definitions are important when clarifying the destination of a science or profession and, of course, are needed to identify the role Analytical Chemists play in the general public [1]. Starting reflections about today's definition and interpretation of Analytical Chemistry some well-known definitions may be quoted: "Analytical Chemistry is a science of chemical characterisation and measurement" (H. A. Laitinen; 1982), "Analytical Chemistry is a science of signal production and interpretation" (E. Pungor, 1987), and "In the course of determination, chemical, physicochemical, and physical methods are used. All of these definitions have the same feature which is the dependence of signal on analyte concentration. The important task of Analytical Chemistry is therefore the discovery and implantation of this dependence into analytical procedures" (A. Lewenstam, J. Zytkow, 1987) [2].

These definitions seem to be similar, but they are not quite the same. Nevertheless, they give a brief description of the scientific situation in which Analytical Chemists are interacting with their "customers". But some further aspects should be regarded and some additions have to be made. First of all, it should be stressed that Analytical Chemistry is undoubtedly a multidiscipline, i.e. it is a specific discipline with its own paradigm [3]. In this respect, it is not surprising that nowadays Analytical Chemistry even makes use of biological methods.

The complexity of analytical problems today results more and more in questions about the structure of materials. Therefore this analytical task is of growing importance and has to be implemented into a definition of Analytical Chemistry. The question about structural information leads to the problem of signal interpretation as already defined by E. Pungor [4]. This part of an analytical task exceeds by far the mere step of signal processing, as e.g. by use of statistically based mathematics to solve (complex) analytical problems. Analytical signal processing and chemical signal interpretation are both the basis to produce chemical information by inference [4].

Analytical Chemistry has become essential for the technical, economical and ecological development and prosperity not only of industry but of mankind. Analytical systems today produce and supply most information for control and regulation systems in industry and public institutions [5] and are an essential part of quality control and quality assurance systems. This statement proves that Analytical Chemistry always shows a direct application to problems, and it is not "pure" research; in other words Analytical Chemistry is an applied science and is applied chemistry. But nevertheless, it represents a science with high intellectual demands and with its own philosophy [6]; it needs high qualified scientists for innumerable fields of research and "problem solving". Solving analytical problems may require, at the first stage, research work and the development of a new analytical method in order to provide the necessary data, and, further on, to supply data with the appropriate precision and accurary, and perhaps also as quickly and inexpensively as possible. Research work has often to be performed e.g. to improve detection limits, reduce the time for analysis or to deal with complex or unknown sample matrices.

Summarizing, Analytical Chemistry can be regarded as both science and art [7]. The prosperity and welfare of men nowadays depend on the state-of-the-art of Analytical Chemistry or of analytics, respectively.

The last point to be mentioned refers to the term "to provide reliable (i.e. quality assured) information" in the definition above. The reliability of analytical results and information has become one of the main questions in Analytical Chemistry and is of the greatest importance, especially regarding trace analysis in environmental tasks. In this respect Analytical Chemistry has to play its part in quality assurance. By application of GLP (Good Laboratory Practice) — rules which serve for data validation — and by introduction of quality assurance systems within analytical

laboratories, a great step of progress has been made to the credibility of analytical data and information.

Conclusion

Analytical Chemistry is the application of principles of analytical measurement to generate information about chemical systems or to solve chemical problems as well. That means that Analytical Chemistry, as defined above as a multidiscipline, is from a philosophical point of view an information science, and from an applied pragmatic point of view a problem solving science [8].

It must be stated that there is a steady increase of the importance of analytics, and that Analytical Chemistry is never finalized regarding e.g. problems on earth such as the nutrition problem, the exploration of new sources of energy and raw materials, the support of the introduction of new technologies and the development of medical care and, last but not least, the dispassionate control of the environment.

When speaking about "hi-fi" and "high-tech" as expressions of the highest level of technological development, the term "high-QA" for high-quality analytics or Analytical Chemistry can be used when characterizing the state-of-the-art and future developments in Analytical Chemistry [9].

These facts give the Analytical Chemist identity and demonstrate that he is not only a (poor) information gatherer but possesses, as the controlling conscience, a high responsibility to the general public because his results serve their direct interests.

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