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Editorial

Where Does the Measurement Process Begin and End in Analytical Chemistry?

Elcio Cruz de Oliveira
Technical Consultant at Petrobras Transporte S.A. – TRANSPETRO
Rio de Janeiro, RJ, Brazil, elciooliveira@petrobras.com.br
Professor of the Postgraduate Program in Metrology, Metrology for Quality and Innovation at the Pontifical Catholic University of Rio de Janeiro,
Rio de Janeiro, RJ, Brazil, elciooliveira@puc-rio.br

Analytical Chemistry can be afforded different descriptions in relation to four distinct time periods: the time period prior to the existence of microcomputers, up to the 1970s; the time period encompassing the early stages of the use of microcomputers in the 1980s; during the exponential growth of microcomputers in the 1990s; and finally, the current century, with passive and active applications. As time progressed, classical Chemistry has detrimentally lost ground to instrumental analysis. Compared to the first time I entered a laboratory, it is now a fascinating new reality! In light of this paradigm shift, I have noticed that some chemists suppose that the measurement process begins when a technician inserts a sample into an instrument, and that the process ends when the result is issued.

This supposition is understandable when the current literature, itself, offers two distinctions: measurement processes and measuring equipment. Indeed, chemical measurement processes can be divided into discrete steps: identification and definition of the measurand (first conceptual step); sampling (start of the experiment's measurement process); use of reference materials and certified reference materials; sample preparation; qualified labor and instrumental measurement system; and, critical analysis of the result. The last step includes uncertainty measurement against specifications or statutory limits, and, the end of the measurement process.

From my point of view, sampling and sample preparation are the particularities that most distinguish the chemical measurement process from the physical one. However, since the sampling process is not always recognized as a critical step, inexperienced professionals perform it carelessly; despite the fact that this step may significantly interfere with the analytical result. It has been convenient to assert the sampling target as a representative sample of the population, but not to describe and express the relevance of the sample. Considering the measurement uncertainty as a quality parameter, depending on the matrix and the analyte,the sampling uncertainty is dominant in comparison to the analytical uncertainty. Studies of environmental systems (e.g., soil, water, air, waste, etc.) are better examples for ratifying this assumption. In these matrices, the spatial and/or temporal heterogeneity of the analyte in the sampling target can be very relevant.

Analytical chemists must get out of their comfort zones, shed light on the sampling process and better understand the entire measurement process. I suppose that it is already clear where the measurement process begins and ends! I conclude with my own proposal for a definition of the measurement process in Analytical Chemistry: ensure a survey of all input quantities that contribute significantly to the quantification of the analyte, thus guaranteeing that the analyzed sample represents perfectly the properties of interest in the parent population; it could be useful in the case of a situation in dispute.