Point of View

Trends in Environmental Analytical Chemistry

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Environmental Science is a broad science that studies the complex interactions among biota and humans with aquatic, terrestrial and atmospheric environments, as well as the effects caused by anthropogenic activities on these natural processes. It is an interdisciplinary science that involves chemistry, biology, engineering, medicine, government and others aiming to understand the changes that have occurred in the environment, from a small compartment to a global scenario responding to the challenges of the planet.

Environmental Chemistry studies the sources, reactions, transport and fates of chemical species in water, soil, air and living organisms. There is a strong relationship of this science with Analytical Chemistry. In fact, Environmental Chemistry studies in Brazil have developed strictly related to the Analytical Chemistry according to the Brazilian Chemical Society (SBQ) [1]. One of the major challenges of Environmental Chemistry is the identification and quantification of specific pollutants in the environment and for that, the development of analytical methods, tools for sampling and monitoring are needed to evaluate treatments and abatement options of contaminants or to monitor the presence of them in the environment.

During the last century, great attention was given to contaminants such as gases, metals and organic compounds in ppm or ppb levels. Classical analytical tools have been used along with instrumental analyses to measure these contaminants at such concentrations with high confidence and low cost. However, since the beginning of this century chemists have become deeply involved in the investigation of environmental problems related of the presence of contaminants in concentrations around parts per trillion or less. This is because the ecotoxicologists found that at such low concentrations several contaminants were able to cause adverse effects in the chronic exposed biota including humans.

Aware of these new research demands, analytical chemists have been working hard to develop new tools or to improve the sensitivity and detectability of the analytical instruments. In fact, there was a great improvement in analytical technologies for sampling, sample preparation and detection equipment. The challenge now is to concentrate the contaminants present at trace levels in the complex samples, remove the interferences present in the environmental matrices and transfer the target compounds to the appropriate solvent or environment to be determined by the appropriate analytical tool.

Considering for example, the current research involving emerging contaminants (such as pharmaceuticals and personal care products, pesticides, hormones, industrial compounds, disinfection by products, microplastics, nanomaterials and others) in water the aim of the environmental analytical chemistry is to develop and validate analytical methods able to identify and quantify target or un-known compounds (non target) with appropriated detectability to achieve the concentrations needed by the ecotoxicologists. Because the ecotoxicologists dilute the contaminants until they find no adverse effects, sometimes the safe concentrations are much lower than the ones analytical chemists can determine.

Chemists are responsible for measure the concentrations and the biologists are responsible for defining safe environmental concentrations for the several uses of the water and soil. Ecotoxicology in fact is the science where biologists and chemists become what we call ecotoxicologists. There is no ecotoxicologist that can survive without expanding their knowledge to outside his comfort zone, exploring new areas and learning how to solve problems in complex situations. The main objective of ecotoxicology is to do risk assessment of a desired scenario and for that exposure evaluation (performed by chemists) along with hazard evaluation (performed by biologists) are the key elements. In the environmental chemistry area some challenges are presented. To evaluate environmental exposure it is necessary to plan ahead and define a complete analytical method, considering since when, where, how many times and which kind of sampling is appropriate as well as define which is the best sample preparation protocol considering the physical-chemical proprieties of the contaminants of interest and the environmental compartment that will be studied, and of course, no less important, the instrumental tools that will be applied in the identification and quantification of the target compounds. Therefore, currently the ecotoxicological risk assessment is the key to minimize anthropogenic environmental impacts and environmental analytical chemistry is the key of this process.

1.Canela, M. C.; Fostier, A. H.; Grassi, M. T. *Quim. Nova*, **2017**, *40*, pp 634-642.