Meeting report

EU aims for comprehensive analysis of emerging pollutants

Report on Chemical Analysis of Emerging Pollutants, 1st Thematic Workshop of EU Project NORMAN, held 27–28 November 2006 at Maó, Menorca, Spain

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1. Organization

The workshop on Chemical Analysis of Emerging Pollutants was the first of three thematic workshops of the European Union (EU) NORMAN Project ''Network of reference laboratories and related organizations for monitoring and bio-monitoring of emerging environmental pollutants''. This co-ordination action is funded under the 6th EU Framework Programme and will develop and implement a methodology within a network of reference laboratories and related organizations (including standardization bodies) to enable and improve EU capabilities for monitoring emerging pollutants, thereby ensuring the production of data that are valid, comparable and fit for purpose across the EU.

The Workshop was attended by 74 participants from 14 countries (see Fig. 1, a photograph taken at the Institut Menorqui d'Estudis, Maó, Menorca). With 20 keynote lectures and 22 poster presentations, it was structured in six sessions:

(i) EU research on emerging contaminants;
(ii) Polar pesticides and related compounds;
(iii) Pharmaceuticals and personal care products;
(iv) Halogenated emerging contaminants;
(v) Other emerging contaminants; and,
(vi) Degradation and bioavailablity of emerging contaminants in the environment.

2. Objective and topics

The main objective of the workshop was to evaluate practical aspects of the usefulness of chemical analytical methods and techniques for determining a variety of organic and inorganic emerging contaminants in different environmental matrices (e.g., water, soil/sediment and air). The following practical aspects and state-of-the-art applications were discussed in the course of the workshop:

- advances in analysis of halogenated emerging contaminants (e.g., brominated flame retardants, polychlorinated paraffins and pefluorinated organic surfactants);
- challenges and opportunities of new hybrid LC-MS systems (QqTOF and QqLIT) in the analysis of pharmaceuticals and polar pesticides;
- automated multidimensional GC and on-line solid-phase extraction methods for pesticides; and,
- analytical methods for a broad range of contaminants (e.g., fuel oxygenates, organophosphorus flame retardants, bacteria, organometallic compounds, and emerging inorganic pollutants).

The workshop brought a comprehensive picture of advanced analytical technology applied in the environmental area, giving an overview of the latest developments and applications in this topic.

3. Summary of key points

- Great progress is being made in analytical determination of emerging contaminants, but less is known about their fate (biotic and abiotic processes). Analytical tools are available to study biodegradation at trace levels and this option should be exploited

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Figure 1. Workshop participants.

more, leading to a better understanding of the fate and the behavior of emerging contaminants in the environment.

- Due to the high purchase prices and the running costs of LC-MS^2 instrumentation, there is a need for low-cost, on-site instrumentation for routine European laboratories to perform water-monitoring campaigns on emerging contaminants. Such devices, with competitive prices in the market, should also be easy to use and their performances should be validated using Standard Operational Procedures (SOPs). We expect that such devices will be used for the determination of new, emerging contaminants identified in the revision of the priority list of the Water Framework Directive (WFD).
- Regarding chemical analysis, the main drawback of the conventional analytical approach is target-compound monitoring, which is often insufficient to assess the environmental relevance of emerging contaminants. An integrated approach, combining analytical chemistry (applying techniques that are able to identify unknown compounds, metabolites or transformation products) and biology (effect monitoring), seems to be a more appropriate way to tackle the complex problem of environmental contamination. However, the real challenge is to decide on the significance of the chemical data. Increased sensitivity in MS, as a result of more efficient ionization techniques and better detectors, has allowed detection of virtually any contaminant at a very low level (ng/L or even below). Consequently, a number of new, previously ignored or unrecognized contaminants have bean brought under scrutiny; however, discussion on the real risks posed is still open.
- Water cycle and emerging contaminants should include all the compartments, especially groundwater and leaching of emerging contaminants through the soil and groundwater. Attention should be paid to the distribution of emerging contaminants between groundwater and surface water in certain parts of the river (e.g., the alluvial plains) and to the quality and environmental impact of such waters in their possible use as drinking water, since many aquifers are used as a source for water supply.
- Bioavailability (metal speciation, organic pollutants) is the key parameter to elucidate routes and pathways of contaminants from source (suspended particles, sediment) to targets (organisms,

populations, ecosystems), which implies highly complex processes with a multitude of interactions between the abiotic environment and the different parts of the biocenosis (different organisms from bacteria to fish). The workshop discussed the influence of dissolved organic matter and black carbon as quantitative abiotic environmental parameters on the bioavailability of contaminants.
- There is a gap between our current knowledge of toxic effects of emerging contaminants on organisms derived from laboratory studies (both in vitro and in vivo) and exposure routes and the real effects occurring in nature on different structural and functional levels (organisms, populations, ecosystems). As a result, we need further information about the proportion of contaminants really causing adverse effects in the biocenosis and that also implies more study of the abiotic processes, such as transport and sorption.
- Modeling of emerging contaminants (e.g., pharmaceuticals) should learn from other polar pollutants that have been studied considerably in river basins, including groundwater studies (e.g., polar pesticides). Modeling should address all relevant scales starting from micro-scale watershed interactions, the transport of dissolved species of pollutants as well as suspended matter in soil and groundwater systems on the catchment-area and river-basin scale. The use of integrative modeling will help to improve river-basin management of emerging contaminants.

Finally, following the workshop, we expect regular scientific papers submitted to be published, after the usual refereeing procedure, in ***Journal of Chromatography A***.