



# CCEDEP

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Environment and People Conference

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## Emerging Substances in Water, a New Challenge for Analysts

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**Abstract:** Thanks to the advancement in the analytics that enables detection of more substances at increasingly lower concentration, besides the already well-known substances, in the water also appear new classes of emerging contaminants. They include: Pharmaceuticals and Personal Care Products (PPCPs), this group of compounds includes human and veterinary drugs, as well as consumer products such as UV-sunscreens, musk fragrances (1,3). Musk fragrances are used in high quantities in cosmetic products. In 1996 about 5600 t of polycyclic musk fragrances (PMF) were used world-wide. PFOA/PFOS—Perfluorinated organics are uniquely stable molecules that are widely used in almost all industries. Endocrine disruptors (EDCs) which are synthetic chemicals that, even in small doses, can affect the endocrine system of living organisms (2). Algal toxins, flame retardants (phosphorus esters), etc. There are potentially thousands of such compounds. Approximately 3000 different pharmaceutical ingredients are used in the EU today, including painkillers, antibiotics, antidiabetics, beta-blockers, contraceptives, lipid regulators, antidepressants, antineoplastics, tranquilizers, impotence drugs and cytostatic agents. As these compounds are frequently transformed in the body, a combination of unchanged pharmaceuticals and metabolites is excreted by humans. These pharmaceuticals are discharged from private households and from hospitals and eventually reach municipal sewage treatment plants. In contrast to pharmaceuticals, personal care products, such as PMF, do not pass through the human body to a high extent. They enter the wastewater via their regular use during showering or bathing. In addition to parent polluting compounds appears significant number of metabolites formed in organisms or in the process of wastewater treatment (4).

Worldwide there are a 100000 "old chemicals" until 1981, 4000 "new chemicals" since 1981, 30000 chemicals > 1 t yr<sup>-1</sup>, 2900 chemicals > 100 t yr<sup>-1</sup> and 2600 chemicals > 1000 t yr<sup>-1</sup>. Application quantities in Germany: human-use pharmaceuticals (ca. 2800): about 6500 t yr<sup>-1</sup> corresponds to 78 g cap<sup>-1</sup> yr<sup>-1</sup>, veterinary pharmaceuticals: about 1000 t yr<sup>-1</sup>, pesticides (ca. 200) about 30000 t yr<sup>-1</sup> and surfactants: 188629 t yr<sup>-1</sup> (2.3 kg cap<sup>-1</sup> yr<sup>-1</sup>). Production quantities in Germany: personal care products: > 500000 t yr<sup>-1</sup> (> 6.1 kg cap<sup>-1</sup> yr<sup>-1</sup>), EDTA: 29560 t yr<sup>-1</sup>.(1)

Today's analyst have wide range of possibilities for solving the emerged environmental challenge, both for target and non-target compounds. Using gas (GC/MS/MS/TOF) and liquid chromatography, (LC/MS/MS) with mass detection methods it can be achieved significantly lower limit of detection (LODs) and limit of quantification (LOQs) (in femtograms range) for a wide range of contaminants, significantly shorten analysis time, boosted lab's productivity, meet stringent regulatory and directive requirements.

GC/MS/MS is specifically designed for sensitive measuring with confirmation, identification and quantification of non-polar contaminants the lowest levels of target compounds in difficult matrices such as sediment and wastewater.

LC/MS/MS is the best in the confirmation and quantification of the ultra-trace polar contaminants. Time of flight detector (TOF) provides full spectra and accurate mass for searching databases after the separation in gas or liquid chromatography.

Inorganic components can yield innovative solutions for emerging contaminants. Ranging from speciation of toxic elements like Cr(VI) to the herbicide, spectrophotometer

with inductively coupled plasma and mass detection (ICP-MS) gives the flexibility analyzing a wide range of elements.

These very complex and sensitive devices give useful results just when the staff knows fully and integrates principles operation. A new device in the laboratory is also a new challenge for analysts. To get the most out of expensive devices analyst should update their knowledge on a daily basis and follow the latest developments in analytics and technology as well as participate in seminars and workshops on topics related to analytical techniques.

Putting a device to work, setting methods, obtaining satisfactory sensitivity, are not simple processes that take a long time and require patience and persistence. Analysis of new emerging substances are particularly complicated task for a group of compounds that have very different in chemical properties of this means that a comprehensive analysis of emerging substances includes usage all of the above-mentioned analytical techniques.

**Keywords:** Emerging substances

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