ECOTOXICOLOGICAL METHODS FOR MONITORING THE EFFECTS OF MICROPOLLUTANTS IN WATERS

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In recent years there has been growing concern about emerging micropollutants found in treated and untreated waste-waters, surface and subsurface waters because of their potential environmental and health risk. Emerging contaminants can be pharmaceuticals and personal care products, pesticides, disinfection by-products, industrial additives and by-products etc. in the aquatic environment. These emerging substances are suspected of having secondary adverse effects, such as mutagenicity, carcinogenicity, reprotoxicity, and endocrine disrupting, immune-disrupting and allergizing effects. While more effective analytical methods are being developed for chemical monitoring of these contaminants, biological methods providing more complex results and capable of predicting and measuring chronic effects are still not available. Prior to conducting appropriate and feasible environmental risk assessments of emerging micropollutants, ecotoxicological methods with more sensitive end-points need to be developed.

In connection with this topic our research activity aimed at developing innovative, sensitive environmental toxicology tests. Historically, toxicological endpoints of standardized animal tests included survival, growth and reproduction. In this paper we examined on various testorganisms the effects of emerging contaminants such as ibuprofen, naproxen, ketoprofen, paracetamol, diclofenac, •-estradiol, ethinylestradiol, estriol, nicotine, caffeine, triclosane, bisphenol A and metazachlor focusing on common endpoints. We have also assessed the physiological responses (respiration, moving behaviour, heart rate) using novel procedures. To detect responses of animal testorganisms over a wide range of pollutant concentrations digital microscope camera observation and a computer aided evaluation system were used.

We have done/carried out comparative assessment of the newly developed and commonly used environmental toxicology tests. The problem-specific integrated methodology included: alga tests with three unicellular alga species (*Pseudokirchneriella, Scenedesmus, Chlorella), Tetrahymena pyriformis* (protozoon) reproduction and respiration test, *Lemna minor* reproduction inhibition test with the determination of chlorophyll content, *Heterocypris incongruens (*freshwater ostracode) lethality and movement test, and the *Daphnia magna* immobility and heart rate test.

The moving behaviour and heart rate of crustaceans were the most sensitive endpoints, with clear effects observed even at the ppb level of some pollutants (diclofenac, •-estradiol, nicotine, triclosane) revealing the sublethal stresses caused/produced by exposure to these emerging pollutants. These newly developed procedures with sub-lethal endpoints offered the possibility for easy and quick estimation of environmental toxicity. Furthermore an important conclusion of the research is that there is no universal toxicity test to detect the effect of all types of chemical substances; risk assessment requires a battery of bioassays.