8. CONCLUSIONS

A good water quality is fundamental for the maintenance of ecosystem biodiversity and therefore for the sustainable development of humans, for water supply and recreational purposes. Toxicants are addressed by the WFD in the assessment of the chemical status, through the comparison of the measured concentrations to the Environmental Quality Standards (EQS). Standard (“classical”) monitoring based on spot sampling and chemical analysis can be helpful but presents severe limitations. Spot water sampling therefore provides only a “snapshot” of the situation at the set time of sampling and fails to provide information in the bioavailability of pollutants in water and sediments. This is of major concern, because toxicants have been identified as one of the main driving forces of the deterioration of aquatic systems (Brunberg and Blomqvist, 2001).

In this context a possible successful implementation of the WFD relies on a number of factors including a series of emerging tools to implement monitoring. Many of the emerging tools and techniques that have been developed in recent years provide suitable alternatives for low cost and more representative monitoring respect to the standard procedures. Among these emerging tools ecological monitoring, biomarkers and toxicity tests have been identified particularly useful in providing a more realistic assessment of impacts and exposure of aquatic organisms to specific or mixture of contaminants in the water. They can provide additional information on temporal and spatial variability of pollutants, biological/toxicological effects, accounting for contaminant bioavailability, as well as early detection of pollution events.

The presented work aimed to provide an overview the value of of ecotoxicity tests both as a tool for the specific evaluation of potential effect of single pollutants (well-known pollutants such as chromium and DDE and also new potential pollutants such as zosteric acid used as antifoulant) on target aquatic organisms and as emerging monitoring tool to reach the FWD objectives.

Ecotoxicology has emerged as the applied science that addresses the central issues of contaminants in the biosphere. Thus in the 21st century, ecotoxicology needs to evolve, moving away from traditional toxicology approaches that are still in use by most regulatory agencies, and encompass integrative tools and models to evaluate the risk posed by existing and new contaminants as part of their registration, potential use, and application. Major
challenges in this young science include the following: (1) the integration of causal explanations and knowledge arising at different levels of biological organization into a coherent whole; (2) integration of scientific, technical, and practical goals of ecotoxicologists; and (3) consideration of ecotoxicological issues at increasingly wider spatial and longer temporal scales.

On the basis of what emerged most recently in literature and on what mentioned in the present work, chemical characterization by itself does not provide specific biological information about potential hazards to organisms. Traditional ecotoxicological approaches that utilize individual endpoints are still valid tools to understand the fate of pollutants (their migration, transformation, sedimentation, and interactions) in the environment (aquatic environment in particular) and their impact on individuals, populations, communities, and ecosystems. By truly integrating monitoring strategies, involving chemical analyses, a set of ecotoxicological tools, the study of population/community responses in the same water body and, preferably, time of the year, a more holistic picture can be obtained.

Priority issue for a successful inclusion of emerging techniques in water monitoring programs is to improve communication between scientists and policy-makers, and to optimise the coordination between scientific development outputs and policy-research needs (Quevauviller et al 2005)

However, there is little doubt that the combination of these technologies, together with associated ecological monitoring, should enable the representative assessment of the health of an ecosystem, as required by the WFD. Strategic monitoring using all these tools in appropriate way could provide the representative information necessary for monitoring activity to fulfil the requirements of the WFD.

The protection of aquatic environments is often focused only on water compartment but more attention has to be posed to the sediment environment which is an essential, integral and dynamic part of water environments.

Though the WFD does not specifically deal with sediment, it is clear that there is a strong link between sediment quality evaluation and achieving of this WFD objective.

Furthermore the use of bioassays and sediment analysis to evaluate sediment quality is significant for assessing water quality, confirming the urgent need to correct current gaps in the WFD on water quality analysis. Bioassays and biomonitoring are two key tools for evaluating the chemical and ecological states of water, sediment and biota.
Results obtained from the present studies reinforced the significance of including these tools in water quality analysis, as already highlighted by the recommendations in some Member States legislation (e.g. French, Spanish, Nederlands).

The matter of port pollution even in freshwater environments is of concern still under discussion and evaluation. It is well-known that there is an urgent need to improve environmental data monitoring techniques in marine harbours in order to understand the environmental impacts of port activities (Darbra et al. 2009). It seems that even freshwater port sediment also could be affected from heavy micropollutants.

According to the European Water Framework Directive (WFD), these water bodies are classified as heavily modified water bodies (HMWB) because they continuously suffer from severe physical and chemical modifications due to anthropogenic activities. Ecotoxicological sediment tests should be therefore recommended within the WFD adopting a standardized classification system for sediments according to their degree of chemical contamination.

The importance of an integrative evaluation of the aquatic ecosystem (water and sediments) is crucial, giving a comprehensive analysis of the environmental quality of the water bodies; this represents the implementation of remediation strategies for the modified water bodies to obtain a good ecological potential and a good chemical status as proposed in the WFD. Ecotoxicological approach results as a useful tool both in laboratory test on known chemicals to better understand their effect on target organisms and their behaviour in water or sediments and in a more holistic approach as new monitoring tools to support the chemical monitoring to assess the status of water ecosystems (water and sediments).
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