Deriving Quality Standards for biota under the Water Framework Directive

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Abstract

The establishment of Quality Standards (QS) for biota is part of the EU strategy to achieve the protection objectives of the Water Framework Directive (WFD, Art. 16, Directive 2000/60/EC). The current methodology to derive QS for biota considers data on secondary poisoning of predators and humans and a concentration in water is calculated as overall QS rather than the corresponding body burden in prey. However, concern was raised that for bioaccumulating subtstances the current methodology would leave several issues unresolved and that specific quality standards should be developed for biota suitable for direct assessment and monitoring. A group of experts was therefore mandated to update this methodology.

The group's work focused on three main topics: (1) assessment of risk of secondary poisoning for pelagic organisms for which the suitability of the critical body burden methodology is investigated, (2) development of refined bioaccumulation and food web models under consideration of the most recent published data's and state of the art of scientific knowledge, and (3) identification of suitable indicator organisms for biomonitoring taking account of existing practices in EU member states and animal welfare. The new refined approach to set QS for biota will be included in a Technical Guidance Document which is intended to provide guidance on QS setting in the context of the WFD at both EU and national level.

Keywords: Quality Standards, Biota, Secondary poisoning, Models, Monitoring

Introduction

The establishment of Quality Standards (QS) in surface water, sediment or biota for the Priority Substances (PS) posing a significant risk to, or via, the aquatic environment is part of the EU strategy to achieve the protection objectives of the Water Framework Directive (WFD, Art. 16, Directive 2000/60/EC). The current methodology to derive QS for biota considers data on secondary poisoning of predators and humans. A concentration in water is calculated as overall QS rather than the corresponding body burden in prey in order to avoid animal monitoring. Hence, only for 3 substances on the first list of 33 PS a body burden based QS_{biota} has been proposed. However, concern was raised that, with regard to bioaccumulating substances, the current methodology would leave several issues unresolved and that specific quality standards should be developed for biota suitable for direct assessment and monitoring. A group of experts was therefore mandated to update this methodology.

Approach

Task of the expert group on biota QS for organic pollutants is to first identify and prioritize the methodological issues to be addressed based on the Fraunhofer report (Lepper, 2005) taking account of the comments raised on the current approach e.g. by the CSTEE (2004) and then to develop a refined methodology to set QS for biota. The revised methodology will need to be consistent with the approaches to risk assessment for new and existing substances (E.C., 2003) and to chemical safety assessment under REACH. The protection objectives of the QS_{biota} cover freshwater (inland waters) and marine (transitional, coastal and territorial) ecosystems and the groups potentially at risk from secondary poisoning as shown in Fig.1.
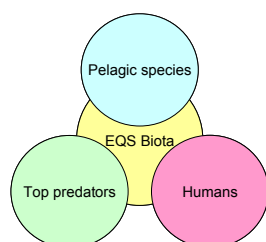

Fig.1_ Protection objectives covered by a QSbiota

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Three main topics were identified for further work: (1) assessment of risk of secondary poisoning for pelagic organisms, (2) development of refined bioaccumulation and food web models, and (3) identification of suitable organisms for monitoring.

Results and Discussions

Assessment of risk of secondary poisoning in pelagic species

The current methodology to set QS for the protection of pelagic species considers exposure via water but a concerns were raised that food exposure might be more relevant for bioaccumulating substances especially for the species on top of the food web. In order to take the food route in consideration, in quality standard setting, the suitability of the critical body burdens (CBB) methodology is being investigated. The concept of CBB method is reasonably well-established, particularly with respect to acute effects of chemicals acting via narcotic mode of action. However the possibility to use it in standard setting should comprise the scientific underpinning of the principles, but also pinpoint the applicability of the concept in environmental policy. Therefore knowledge of the basic principles behind standard setting and risk assessment (e.g. the application of assessment factors or Species-Sensitivity Distribution curves and the selection of the most critical endpoint) is a prerequisite. A critical evaluation of some studies in which the concept has been used will be part of the project in order to illustrate the basics.

Development of refined bioaccumulation and food web models

A recent review of scientific literature and database sources regarding bioconcentration (BC) and bioaccumulation (BA) factors of organic chemicals for aquatic species indicated that about 45% of these values are subject to at least one major source of uncertainty and that measurement errors generally result in an underestimation of the potential to accumulate (Arnot and Gobas, 2006). For accumulating substances, biomagnification may occur up the food web, putting at risk especially predators at the higher levels. Suitable BC, BA and food web models for the purpose of QS setting need therefore to be identified or, if necessary, developed in order to permit prediction of pollutant concentrations in organisms along different food web levels in a site-specific way. Several works have been recently published describing the main BA and BC factors databases and bioaccumulation models. For example, the UK Environment Agency presented models suitable for setting quality standards for the aquatic environment and the human food but indicated as well the need of further development and assessment of these models e.g. validation against EU datasets and a wide range of chemical types (Brooke and Crookes, 2007).

Identification of suitable organisms for monitoring

After identification of the group of organisms being most sensitive against adverse effects of accumulation (pelagic species, top predators or humans), suitable indicator organisms for monitoring in freshwater and marine water need to be identified. In choosing appropriate indicator organisms, the spatial distribution in Europe and the metabolism of the species in question are important criteria, and animal welfare need to be accounted for as well. A review of national biomonitoring practices, existing guidance and relevant EU directives will be performed in order to identify the most suitable organisms for monitoring of bioaccumulating substances. Any suggestions of indicator organisms will need to be in line with the monitoring strategy developed under the Chemical Monitoring Activity.

Deliverables

The group of experts on biota QS for organic pollutants is part of the Expert Group on Environmental Quality Standard (EG-EQS). The refined QS setting methodology developed by this group will be included in a Technical Guidance Document (TGD) which is intended to assist the EU Member States in deriving QS at national level on the basis of an agreed methodological framework and the European Commission to set QS data sheets for the new priority substances.

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