Environment Agency

Evidence

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Bioaccumulation of chemicals in fish: investigating the relationship between depuration rate constant and fish lipid content in laboratory studies

This report considers three aspects of a new approach to analysing how chemicals build up in fish (bioaccumulation). Specifically these are: the relationship between fish lipid content and the rate at which chemical levels fall after exposure (so-called depuration); which rate best represents the depuration; and experimental uncertainty in key study parameters. This work follows on from two earlier Environment Agency reports: *Estimation of fish bioconcentration factor (BCF) from depuration data*, and *Depuration rate constant: growth correction and use as an indicator of bioaccumulation potential*.

Bioaccumulation is an important piece of information in assessing the risk of chemicals and for regulatory regimes such as the EU chemicals regulation REACH (the Registration, Evaluation and Authorisation of Chemicals). When alternative non-test means of getting information on bioaccumulation potential are not viable, fish are generally used as the key indicator for bioaccumulation in laboratory studies. Studies investigate how a chemical is taken up into fish in an exposure phase, and how the chemical is lost from the fish when exposure is ceased (depuration). Our understanding of the effect of different processes in such tests is constantly evolving and so we need to update the way in which we interpret the information that is measured.

A new laboratory method for measuring bioaccumulation in fish has been proposed. This is recommended for poorly water-soluble chemicals that cannot be tested by exposure via water (which is the method that has been used until now).

The new method involves exposing fish to the test chemical via the diet. This route of exposure means that the study results in a dietary biomagnification factor (BMF) – the ratio of the concentration of the chemical in the fish's body to the concentration in the food. The existing laboratory method results in a bioconcentration factor (BCF; the ratio of the chemical concentration in the fish to the chemical concentration in water). The two measures of bioaccumulation potential, BCF and BMF, are not directly comparable.

This difference in bioaccumulation measure is important because in several regulatory regimes the criteria for a chemical being categorised as bioaccumulative (B) or very bioaccumulative (vB) are based on BCF and not BMF. In addition, risk assessment requires a BCF (and in some cases also a BMF) to estimate concentrations in prey for the investigation of risks from secondary poisoning.

BMFs obtained from the new dietary study could be used to demonstrate qualitatively that a chemical is not taken up (and so is unlikely to meet the regulatory criteria for Bioaccumulative (B) or very Bioaccumulative (vB) under the REACH legislation), or in other cases indicate that a chemical would be likely to meet the B or vB criteria. However, as many of the chemicals that will be tested with the new method are likely to be B or vB candidates, it is an advantage to be able to quantitatively estimate a BCF from the data generated in the dietary study for comparison with regulatory criteria. This report provides new science focussed on this area and will therefore aid the assessment of B or vB.

This report provides new science for the interpretation of bioaccumulation studies; this will aid the assessment of B or vB.

Title: Investigation of the dependence of depuration rate constant on lipid content of fish

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