Science for Environment Policy
DG Environment News Alert Service
SPECIAL ISSUE
EUROPEAN COMMISSION

Special Issue 21 1 June 2010

Biology as important as chemistry in assessing toxic mixtures

Researchers have developed the first biology-based model to predict the sub-lethal effects of chemical mixtures on organisms. Sub-lethal effects do not cause death but can damage processes such as growth and reproduction. The model provided accurate predictions of the sub-lethal impacts of a chemical mixture on water fleas.

Currently the toxicity of chemical mixtures tends to be analysed using descriptive methods based on concentrations and properties of individual chemicals within the mixtures, for example, the methods of 'Concentration Addition' and 'Independent Addition'. Although these are useful as a first step in assessing toxicity, they do not consider the interaction of mixtures with biological processes or explain why the effects of mixtures can change over time.

The research was supported by the EU-funded NoMiracle[1] project. Compared with traditional methods, it adopted a more biology-based approach that considered the interaction of mixtures with several biological processes, such as feeding, maintenance and reproduction. This is known as an 'ecotoxicodynamic' approach. The researchers predicted the impacts of a simple mixture of two polycyclic aromatic hydrocarbons (PAHS), pyrene and fluoranthene, on the growth, reproduction and survival of water fleas (*Daphnia magna,* a commonly used species in toxicity research).

To test the model, the results were compared to experimental results from a 21-day partial life-cycle test. The test comprised measurements of the impacts of the PAH mixture with varying proportions of the two chemical compounds within the mixture. The model provided an accurate description of the impacts of the PAH mixture on growth and reproduction. It indicated that fluroanthene is slightly more toxic than pyrene within the mixture, and was consistent with the assumption that these compounds have the same mechanism of action.

The modelled data were very similar to the real data for growth and reproduction for all treatment. For survival, the general pattern was well described, but for comprising roughly equal levels of pyrene and fluroanthene, there was a notable mismatch between model and data. This could be due to a specific interaction between the two PAHs when mixed at these concentrations.

The results demonstrated the feasibility of using a biology-based approach to assess the patterns of toxicity for different types of impact over time. It also raised questions about the use of traditional measurements of toxicity, which would not have yielded useful information about the impacts on survival, growth and reproduction. Since it is the first of its kind, more data need to be analysed to increase confidence in the method.

1. NoMiracle was supported by the European Commission under the Sixth Framework Programme, under the theme 'Global Change and Ecosystems'. See: http://nomiracle.jrc.ec.europa.eu/default.aspx

Source: Jager, T., Vandenbrouck, T., Baas, J. *et al.* (2010). A biology-based approach for mixture toxicity of multiple endpoints over the life cycle. *Ecotoxicology.* 19:351-361.

Contact: tjalling@bio.vu.nl

Theme(s): Biodiversity, Chemicals, Risk assessment