

NRP Endocrine Disruptors

Final Summary

Original project title Integrative mass flow model for endocrine disruptors in Switzerland
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Modelling massflows and concentrations of nonylphenol polyethoxylates and its metabolites

A massflow model for nonylphenol polyethoxylates and its endocrine active degradation products was developed for Switzerland and the region Greifensee & Glatt valley. The modular model serves as a screening tool, as well as a realistic prognostic tool to predict environmental concentrations in a real geographic landscape situation.

Research questions

In connection with trace chemicals in the environment adverse health effects were observed occasionally, such as endocrine effects on fish. For the risk assessment of such chemicals realistic prognostic models to assess local environmental concentrations are necessary.

The objective of the project was to develop such a prognostic model for the well studied nonylphenol polyethoxylates. It was aimed to implement the model as a screening tool with the general regional scenario Switzerland and as a realistic model representing the local scenario Greifensee & Glatt valley.

Results

Based on chemical properties and the quantity and the application characteristics the model predicts massflows on a regional or local level, which result in predicted environmental concentrations in surface water and groundwater. These concentrations can be interpreted as averaged levels in the regional scenario Switzerland and as realistic levels with geographical resolution in the local scenario Greifensee & Glatt. Due to its hierarchical structure the model processes and visualizes massflows on all detail levels (e.g. region, political community, sewage treatment plant,

activated sludge reactor, biodegradation process). In addition to nonylphenol ethoxylates the model also considers all relevant metabolites (e.g. nonylphenol).

The model was validated with field data from the Swiss Institute of Aquatic Science and Technology (Eawag). Based on the amount of nonylphenol ethoxylates used the situation Switzerland and the region Greifensee & Glatt valley could be assessed for the time before 1984 (before the ban from household products), for 1999 (before the ban from household products), and for 2006 (after the prohibition of using sewage sludge on agricultural land).

The current version of the model is especially suitable for chemicals, which mainly are emitted by the water pathway (personal care products, pharmaceuticals, detergents, etc.). Thus it is a valuable tool in support of the risk assessment of chemicals according to the new Swiss chemical law and contributes to the assessment of risk reduction measures, such as use restrictions and technical measures in sewage treatment plants.

Perspectives

Due to its modular approach the model can be further developed to include other chemicals and processes. By including more chemicals it could be extended in order to assess the risks caused by a sum of chemicals. This is especially important for the risk assessment of chemicals with very low dose-response relationship, i.e. when adverse toxicological effects on humans and the environment have to be expected at very low concentrations, such as for endocrine disruptors.