

Risk assessment on the use of triclosan in cosmetics

III: Environmental effects of triclosan

The Norwegian Institute for Water Research (NIVA) has assisted the Norwegian Pollution Control Authority (SFT) with an evaluation of environmental effects of triclosan. This evaluation was used as basis for a classification proposal regarding environmental effects of triclosan within the framework of Directive 67/548/EEC. Environmental classification of chemicals depends on the chemical's toxicity, degradation properties (biodegradation) and potential for bioaccumulation. A summary of the environmental evaluation of triclosan follows.

Toxicity

Ecotoxicological studies demonstrate that triclosan has an acute toxicity to aquatic organisms at concentrations < 1 mg/l equivalent to the limit for classification R50 (*very toxic to aquatic organisms*). Reported data demonstrate LC₅₀ values in the range 0.26-0.54 mg/l for fish (Ciba 2002, Orvos et al. 2002). EC₅₀ values for acute toxicity to crustaceans have been found to be in the range 0.13 – 0.39 mg/l (Ciba 2002, Orvos et al. 2002).

Algae appear to be the most sensitive aquatic organism to triclosan. EC₅₀ values for inhibition of growth rate have been found in the range 1.4 – 19 µg/l. The lowest reported NOEC is 0.69 µg/l (Orvos et al. 2002).

Biodegradation

There are some uncertainties related to the biodegradation of triclosan in municipal wastewater treatment plants (WWTPs) and in the environment. Because of the antibacterial effects of triclosan, degradation according to standardised biodegradation tests (OECD Guideline 301) is not relevant. Based on this it is not documented that triclosan fulfil the criteria for ready biodegradability. However, removal of >98% triclosan has been demonstrated in biological WWTPs (Ciba 2002). This removal results partly from biodegradation and partly from adsorption to sludge (Federle et al. 2002). A reduction of triclosan levels has also been demonstrated downstream of discharges in rivers (Sabaliunas et al. 2003). This indicates a further degradation in the receiving water, where phototransformation plays a part in the removal (Tixier et al. 2002).

Documentation on the biodegradation in municipal treatment plants demonstrates that triclosan is not persistent, but it is still not certain if the biodegradation fulfil the criteria for classification R53 (*may cause long-term adverse effects in the environment*) or not.

Bioaccumulation

Triclosan has a log octanol/water partition coefficient (log KOW) of 4.76 (MITI 1992) which indicates a potential for bioaccumulation. Bioaccumulation in fish has been documented in several studies. Bioconcentration factors (BCF) in the range from 2500 to 8700 (Ciba 2002, Schettgen et al. 1999) have been reported. This exceeds the criteria for R53 classification (log POW > 3 and BCF >100).

Evaluation of environmental effects

To conclude, the evaluation demonstrates that triclosan fulfil the criteria for an environmental classification R 50, R 53. (Substances that are assigned R 50 shall also be assigned R 53 if they possess a potential for bioaccumulation **or** are not readily biodegraded according to the criteria above). Analytical data from environmental samples in several countries demonstrate concentration levels in rivers receiving municipal effluents in the range of (for example);

Switzerland 18-98 ng/l (Singer et al. 2002), Germany 30-90 ng/l (Wind et al. 2004), USA median: 40 ng/l, max. 2300 ng/l (Kolpin et al. 2002)). It is of course difficult to detect any *in situ* effects of this exposure, but a risk evaluation according to the "Technical Guidance Document" from the European Commission based on the available information on toxicity to aquatic organisms would probably show that the concentration levels found in rivers may exceed the PNEC (Predicted No Effect Concentration). A risk assessment carried out in USA has concluded that "... some very sensitive algal species could be impacted by triclosan discharges into some water bodies with small dilution factors during low flow conditions, whereas less sensitive species are not expected to be affected" (Reiss et al. 2002). The possibility that today's use of triclosan could cause environmental effects can therefore not be excluded.

In a Norwegian study triclosan was detected in sediment samples from waste disposal sites, sediment samples from Mjøsa, Vormå and Drammensfjorden and in fish and blue mussel from the same localities. The concentration levels of triclosan were in general very low. Water samples were not analysed. (Fjeld et al. 2004).

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