Results of a feeding study concerning the carry over of toxaphene into laying hens and eggs

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Summary

There is a lot of data about the levels of toxaphene residues in fish and other marine organisms but almost nothing is known about a toxaphene burden of farmed animals, including their food products. Within a feeding study, in which laying hens got feeding stuff which was contaminated with technical toxaphene in some defined amounts, the carry over behaviour of toxaphene from the feeding stuff into the animal and from there into the egg was determined. Moreover half life times for the decline of toxaphene in some tissues could be calculated.

Introduction

Toxaphene belongs to the group of chlorinated pesticides. Beginning from the year 1947 up to its ban in the year 1982 in the USA about 500.000 tons were produced. In the former GDR further 50.000 tons were manufactured in the years from 1955 to 1990 (HEINISCH et al., 1994). Because of the ban of DDT in several countries toxaphene was used sometimes as a substitute. From the chemical point of view toxaphene is a mixture of a large number of chlorinated hydrocarbons, mainly from the substance class of the chlorinated bornanes. The number of single compounds (congeners) in this mixture is mentioned in the literature with more than 200 (SALEH et al.,1983). But recently 22 congeners were isolated from the technical mixture and their chemical structure was determined (HAINZL et al.;1995 and BURHENNE et al.,1993). With a commercially available standard mixture of these compounds a quantification of toxaphene residues based on the 22 congeners is now possible.

Material and methods

The feeding study was carried out with 89 laying hens. The toxaphene doses in the animals feed varied between 0.1 and 5 mg / kg feeding stuff. The first part of the study covered a range of 38 weeks. Samples of feces, eggs, liver, kidney, meat, fatty tissue and blood were investigated. For determining the half life times of the most important congeners in the hens the group with the highest toxaphene dose was fed in the second part of the study with uncontaminated feeding stuff for further 15 weeks.

Clean-up and analysis of samples

The lipids of the samples were extracted with hexane in a soxhlet apparatus. After removing the lipids by using a Florisil-column, the toxaphene congeners were determined with a gas chromatograph coupled to a high resolution mass spectrometer working in the EI-mode. For identification and quantification a standard mixture of 22 toxaphen congeners (Fig.1:1A) was used.

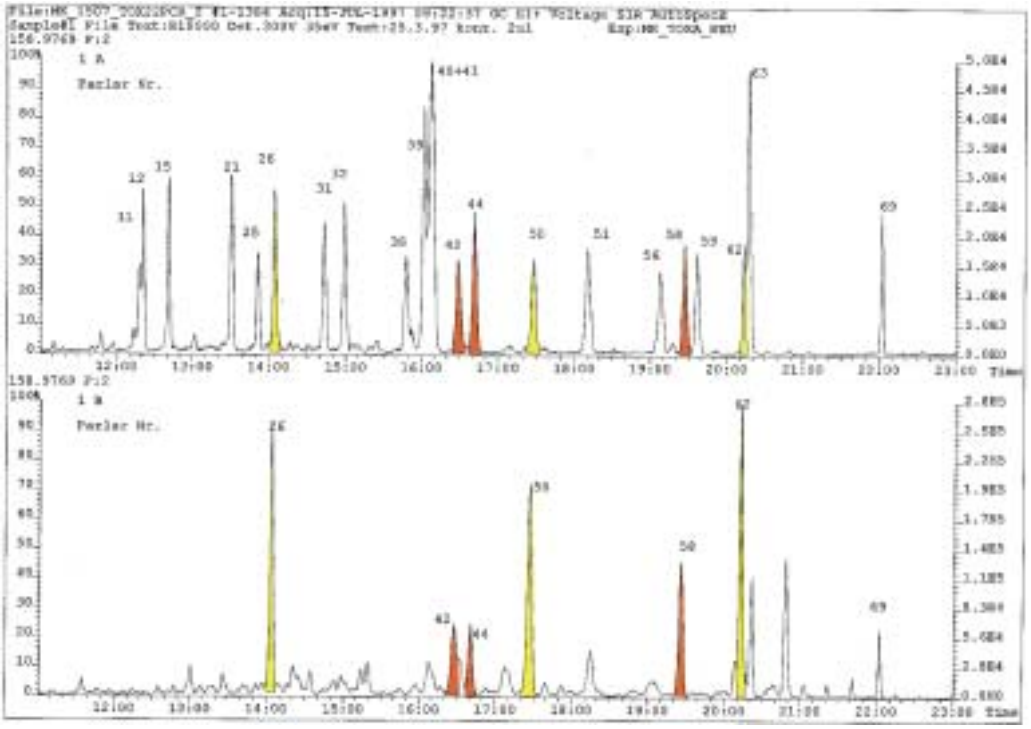

Fig 1: 1A: Chromatogram of the 22 congener toxaphen standard mixture
1B: Fatty tissue sample at the end of the withdrawal study

Results and discussion

Besides the congeners no. 26, 50 and 62 (numbers according to Parlar) which were regulated for fish in the German ‚Rückstandshöchstmengen-Verordnung' other congeners were investigated looking at their accumulation potential. As a result we found, that the congeners no. 42, 44 and 58 were also enriched in the hens tissues (Fig.1:1B Fatty tissue sample after the end of the withdrawal study). In liver and kidney the congeners no. 58 and 62 were less accumulated in relation to the congeners no. 26, 42, 44 and 50 than in fatty tissue and in yolk. Using the congener concentrations in the tissues and in the feed stuff carry over factors can be calculated. They vary for the above named congeners in fatty tissue in the range between 10 to 15, in liver and yolk between 0.9 and 1.7 and in other tissues they are clearly below 1. That means, that the investigated congeners were strongest accumulated in the fatty tissue of the hens. In the muscle meat they do not accumulate, to our present knowledge.

From the withdrawal study (KALTENECKER, SCHWIND et al.,1998) biological half life times (the time in which the concentration of a substance is reduced to half in the tissue because of the ongoing metabolism effects) can be calculated. To get a decline curve the tissue concentrations have to be drawn against a time axis. In Fig.2 this curve is plotted for the decline behaviour of the congeners no. 26, 50 and 62 in fatty tissue.

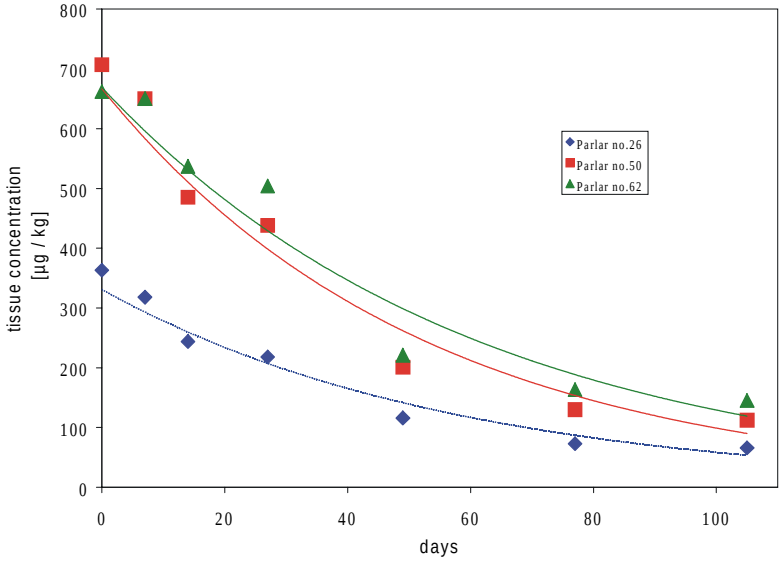

Fig. 2: Curve of the decline of the congeners 26, 50 and 62 in the fatty tissue of the hens

In table 1 half life times for fatty tissue and kidneys are shown.

Tab.1: Biological half life times in days

tissue	Parlar no.26	Parlar no.42	Parlar no.44	Parlar no.50	Parlar no.58	Parlar no.62
fatty tissue	40	25	35	36	36	42
meat	21	17	22	20	15	21
kidney	44	29	36	40	51	49

Moreover laying hens are able to reduce a considerable amount of the incorporated toxaphene by their eggs. Dependent on the congeners 22 % to 37 % of the totally uptaken congener quantity was eliminated with the yolk of the eggs.

Literature

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