INTERLABOR
BELP AG

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FACTSHEET

Phosphine contamination of food and feedstuffs

Introduction

Since the early days of grain cultivation, protecting the crop from pests such as mice, rats or various insects during storage has been an issue. The measures against these pests are manifold and solutions to this problem come from the most diverse fields of technology and science. Measures such as the construction of special grain silos or traps have been used for centuries, while modern means such as pesticides have only been applied since this and the last century. One category of these pesticides is the fumigants such as phosphine, also called hydrogen phosphide, which are effective but not entirely unproblematic in their application.

Phosphine as a pesticide and the problems associated with it

Phosphine is a potent gaseous neurotoxin and metabolic poison. It may be used in conventional grain where it is used as a storage protection agent. Here, phosphine is used as aluminum phosphide in the form of pellets, put directly in the grain or indirectly in bags or strips.

As the final report on the contamination of organic cereals with phosphine by FiBL (Bögli and Bickel 2018)[1] concludes, the problem with phosphine is that the fumigant added as a solid is never 100% converted into gaseous form. It remains in the grain as a residue, e.g. in the form of dust. These residues pose a problem inasmuch, in addition to possible maximum levels being exceeded, cross-contamination of organic cereals may occur, as organic goods are often used in addition to conventional goods in processing and storage facilities.

Swiss legislation with regard to phosphine

The residues of phosphine in foodstuffs are regulated for conventional samples in the *VPRH. The respective maximum values are set out in Annex 2 of the Ordinance as an excel table and were derived from Regulation (EU) No. 2019/1015. For organic products, the respective intervention value is regulated in the Ordinance on Organic Farming. Below you will find a table of the permitted maximum levels and intervention values with the respective sources.

**VPRH: Verordnung des EDI über die Höchstgehalte für Pestizidrückstände in oder auf Erzeugnissen pflanzlicher und tierischer Herkunft*

Table 1:

Legislation	Active substance description	Maximum content
Conventional samples according to the «Verordnung des EDI über die Höchstgehalte für Pestizidrückstände in oder auf Erzeugnissen pflanzlicher und tierischer Herkunft (VPRH)» Annex 2	Phospahne and phosphilde salts (sum of phosphane and phosphane generators, relevant phosphide salts Determination and expressed as phosphane)	Maximum content: 0.01-0.05 mg/kg (ppm) depending on the matrix
Directive on the Procedure for Residues in the Organic Sector of the Federal Office for Agriculture	Phosphine/ hydrogen phosphide	Intervention value: 0.001 mg/kg (ppm)

Analytical problems in the examination for phosphine

The problem with the analysis of phosphine is related to the low limits of determination, which have to be secured accordingly. For organic products, the intervention value for most pesticides is 0.01 mg/kg. Phosphine is an exception: in Switzerland the maximum level of phosphine for individual conventional foods is 0.01 mg/kg, while for organic products the intervention value is ten times lower at 0.001 mg/kg. As a consequence, most current pesticide screening methods are not sufficient to ensure the lower intervention value of 0.001 mg/kg for organic products in Switzerland. In order to be able to cover the corresponding measurement range, a specific method is required. Those are, however, only offered by very few service laboratories, as currently only Switzerland has set such low threshold values. Needless to say, such a low threshold poses a number of challenges.

Method of analysis at Interlabor Belp AG

During the analysis, the samples are worked up with acid to convert the phosphide salts into phosphine gas. The analysis is then carried out by headspace gas chromatography using a flame photometry detector. Due to phosphorus-selective filters in the detector, even the smallest amounts can be detected reliably. The measurement is always carried out as a double determination in order to ensure the result. In each case all of the compounds listed in the *VPRH are detected during the measurement.

Key data Phosphine analysis at Interlabor Belp AG

Interlabor offers the analysis of phosphine for various sample types as an independent laboratory under state of the art technology (ISO and GMP after successful validation only).

- Analysis quality: State of the art
- Sample quantity: approx. 20 g of a representative sample
- Processing time: standard 8-10 working days
- Analysis price for routine analysis: CHF 120.-

It would be a pleasure for us to advice you in a personal meeting.

References

1. *Bögli, S. Bickel, R. (2018). Kontamination von Biogetreide mit Phosphin/ Schlussbericht. https://www.fibl.org/de/themen/projektdatenbank/projektitem/project/1471?tx_projects_pi1%5B%40widget_0%5D%5BcurrentPage%5D=3&cHash=0fa69f6a434b02a65bfeafd31cbbeb35*

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