Bundesverband Naturkost Naturwaren

Fact Sheet

Phosphonic acid, potassium phosphonate (potassium salt of phosphonic acid), fosetyl-aluminium

Summary of current knowledge, May 2017

1. Introduction

Since autumn 2013, phosphonic acid has been repeatedly detected in conventionally and organically grown fruit and vegetables, ever since a number of state and private laboratories established the analytical methods. The suspected origins are primarily the use of potassium phosphonate (approved in organic farming until 30 October 2013, see *Legal Classification*) or fosetyl-Al (trade name "Aliette"), given that the actual active substance in both cases is phosphonic acid (see next section for details). Potassium phosphonate can be a declared or undeclared component of (foliar) fertilizers or plant strengtheners that were authorized in organic farming in certain EU countries. In the case of permanent crops, these (allowed) applications can still result in positive detections also a long time afterwards due to retention of phosphonic acid in wood.

2. What is potassium phosphonate? What is phosphonic acid? What do either of these have to do with fosetyl aluminium?

Potassium phosphonate is the potassium salt of phosphonic acid (KH_2PO_3, also obsolete phosphorous acid). Potassium phosphonate is an inorganic phosphonate, for which it was formerly named potassium phosphite (now obsolete, but having the advantage that this term facilitates the distinction from organic phosphonates, to which potassium phosphonate does not belong). Potassium phosphonate, or rather the actually active substance phosphonic acid, is an agent that has a systemic effect against fungal diseases, in particular against downy mildew. Potassium phosphonate has a natural substance character. Organic phosphonates (to which potassium phosphate **does not belong**, see above) occur in all life forms.

Degradation of the fungicide fosetyl-aluminium (chemical formula: $(C_2H_6PO_3)_3$ Al), which is **not authorized for organic farming**, also is a possible source of phosphonic acid via the intermediate fosetyl ($C_2H_6PO_3$ H, where three "individual groups" of fosetyl arise from one fosetyl-Al since aluminium is trivalent). For this reason, the residue definition of fosetyl-Al pursuant to regulation (EC) No. 396/2005 is: Fosetyl-Al (sum of fosetyl and phosphonic acid and their salts, expressed as fosetyl).

This often causes confusion since a sum of fosetyl-Al is given in laboratory reports although no fosetyl-aluminium or fosetyl was detected, rather in most cases only phosphonic acid on its own. Of course, the BNN guideline value applies to fosetyl-Al as to any other pesticide that is prohibited in organic agriculture.

Koordinationsstelle der BNN-Monitorings, Michaelkirchstraße 17-18, D-10179 Berlin
koordination@n-bnn.de, www.bnn-monitoring.de

3. Potassium phosphonate in organic farming

Potassium phosphonate was used in Germany (a product called “Frutogard”) as a way to minimize dependency on copper in organic wine growing. Applying potassium phosphonate on leaves triggers resistance mechanisms. This promotes natural resistance and hardening of vines and other plants against fungal deseases and especially peronospora (“downy mildew”). This application of potassium phosphonate was authorized until 30 September 2013 for organic operations in many EU States (e.g. Germany, Greece, Austria, Spain, Czech Republic, and Hungary). Apart from its use in organic wine growing, other uses also were common, like in particular for **organic vegetable farming (e.g. for cucumbers and tomatoes), organic pomes and organic citrus fruits.** However, the positive detections are not restricted to above mentioned crops. With the classification as a plant protection product in April 2013, which came into effect in October of the same year (see next section), any future use of the substance for organic farming requires (re-)authorization. Unauthorized use of fosetyl-Al in organic farming is unlikely, since potassium phosphonate comes at much lower cost for similar effectiveness.

4. Legal classification

Until 30 September 2013, there were still plant strengtheners and fertilizers containing the active substance potassium phosphonate that were allowed to be used in organic farming in Germany and other EU States. As of 1 October 2013, potassium phosphonate has been authorized as a pesticide in the EU and therefore may no longer be used in plant strengtheners or in fertilizers. Grace periods led to legal applications also after this date. Potassium phosphonate could only be used in organic farming again, if it was listed in the EU Organic Regulation (Annex II = List of Authorized Plant Protection Products). **Use of potassium phosphonate in organic farming is not allowed in any EU Member State at present!** The *Bund Ökologische Lebensmittelwirtschaft*, BÖLW (German umbrella organisation for organic food and farming) calls for potassium phosphonate to be added to the list – rightly, in BNN’s opinion. In BÖLW’s opinion, this should be limited to wine growing, and up to the end of flowering in order to minimize residues. According to BNN’s information, the southern European countries are not urging for authorization of potassium phosphonate. In non-EU-countries equivalent standards could authorise the use of potassium phosphonate in organic farming, even though no such a case is known to the BNN-monitoring.

The maxium residue level of fosetyl-Al (see 1.) including the metabolite phosphonic acid is 100 mg/kg for wine and table grapes, and only 2 mg/kg for several other produce. At first, several MRLs were raised temporarily through regulation (EU) No. 991/2014 until the end of 2015. Currently transition values are still in place for several types of nuts until first of March 2019 (regulation (EU) No. 2016/75), furthermore several MRLs were increased permanently in the meantime (cf. regulation (EU) No. 2016/1003).

Koordinationsstelle der BNN-Monitorings, Michaelkirchstraße 17-18, D-10179 Berlin
koordination@n-bnn.de, www.bnn-monitoring.de

5. Toxicology

Potassium phosphonate and phosphonic acid are hardly toxic, hence the EFSA has specified no acute reference dose for potassium phosphonate ("ArfD: Not relevant"). The acceptable daily intake (ADI) is 3.90 mg/kg body weight per day.

6. Analytical methods

The laboratories apply limits of quantification (LOQ) for phosphonic acid ranging from 0.01 mg/kg up to 0.05 mg/kg depending on the type of food matrix. Analysis is done by aqueous and/or methanol extraction and subsequent measurement by LC-MS/MS (ESI, in negative-ionisation mode). Fosetyl and phosphonic acid cannot be mistaken, since chromatographic separation takes place. However, the analytical method of course cannot reveal the "origin" of the phosphonic acid. Phosphonic acid and fosetyl cannot be analysed using so-called multi-methods.

7. Positive detections and their origins

Generally, residues of pesticides must be kept as close to minimum as possible. According to the experience gained so far positive detections of phosphonic acid can be attributed to use of potassium phosphonate (or alternatively fosetyl-Al). However, in the case of permanent crops in particular, applications of the active substance could date back further and thus took place place at a time, when its use in organic farming was still authorized.

Apart from the use of potassium phosphonate, the Julius Kühn Institut (JKI) and others consider contaminations in phosphorus fertilizers a possible source, although in the experts' opinions, this does not apply to the soft ground rock phosphate authorized for organic farming. In phosphate-deficient situations, phosphonate can potentially be taken up from the soil and assimilated. The rumour that potassium phosphonate could be naturally present in algal products is probably based on the – at best ambiguous – declaration of the ingredients of the plant strengthener Frutogard, which also contains brown alga extract. The potassium phosphonate declared, however, is added, which also tallies with the fact that, in the scope of the BÖLW assessment of the "natural substance character", no potassium phosphonate could be found in nature, or only as an intermediate that is very rapidly converted.

Furthermore, there is an **undeclared additive in inputs approved for organic farming,** for example in the products "Alginure"(Tilco Biochemie GmbH), "Organihum Fosnatur", "Tec-Fhos" (Grupo Agrotecnologia) and "Myelfos" (AISA). Whether these products have now been labelled otherwise and/or the operators/growers have been informed thereof is unknown to us.

8. Evaluating positive detections of phosphonic acid

BNN recommends the following assessment:

If levels above 0.05 mg/kg of phosphonic acid are detected, the inputs such as plant strengtheners or fertilizers, should be checked in any case. However, also detections of lower concentrations must be reduced in the medium-term and scrutinized. If no fosetyl itself is detected, then there is no

Koordinationsstelle der BNN-Monitorings, Michaelkirchstraße 17-18, D-10179 Berlin
koordination@n-bnn.de, www.bnn-monitoring.de

reasonable cause to suspect that the phosphonic acid detected is a result of unauthorized use of fosetyl-Al. Until 01 October 2013, uses of potassium phosphonate as a plant strengthener or in fertilizers was authorized in organic farming in many EU countries. Such uses can result in the presence of phosphonic acid residues for some time after its application, especially in the case of permanent crops. Equivalent standards in non-EU countries might continue to make provisions for authorizations of potassium phosphonate in organic farming. In these cases, there is no contradiction with the regulations on organic farming, and the BNN reference value is still deemed to be complied with. For evaluating residues that can be traced back to the use of products containing undeclared potassium phosphonate as an active substance, the competent control body/authority is responsible for evaluating the organic quality of the product(s). In the opinion of BNN, the organic foods concerned should still be marketable with an organic farming label.

9. Further recommendations and notes on investigating origins

It is recommendable, in the context of self-control, to assess which, if any, product should be tested for the presence of phosphonic acid. We strongly advise conducting a critical examination of the inputs, especially when investigating the origins of unexpectedly detected phosphonic acid. We welcome all information on other farm inputs containing phosphonic acid (see *Positive detections and their origins*). A product data sheet and analysis of an original container would be ideal for its addition to the above mentioned list. Also, we highly appreciate any documented advice on further routes of entry of phosphonic acid in order to update this factsheet when necessary. We call upon all concerned to take positive detections of potassium phosphonate seriously and to investigate and, if necessary, remedy the causes. At the same time, we urge for judicious action, so as not to make wrongful accusations about goods produced in compliance with organic farming regulations. Due to the retention of phosphonic acid in wood and potentially in soil, and given the likelihood of other inputs containing undeclared phosphonic acid, this will in all probability remain a relevant issue for some time to come.

Sources

Wikipedia article on phosphonic acid: http://en.wikipedia.org/wiki/Phosphonic_acid

The BÖLW, with the support of Ecovin, has put together an information sheet on potassium phosphonate:
http://www.boelw.de/uploads/media/pdf/Themen/Pflanzengesundheit/BOELW_Info_Weinbau_Kaliumphosphonat_131001.pdf

Expert opinion: Kann Kalium-Phosphonat als mineralisch, natürlich vorkommend angesehen werden?
http://www.boelw.de/uploads/media/pdf/Themen/Pflanzengesundheit/Phosphit-Gutachten_BOELW_2012.pdf

Koordinationsstelle der BNN-Monitorings, Michaelkirchstraße 17-18, D-10179 Berlin
koordination@n-bnn.de, www.bnn-monitoring.de

Reports from the Julius Kühn-Institut: 14th expert discussion: “Pflanzenschutz im Ökologischen Landbau –Probleme und Lösungsansätze”: Phosphonate, Berlin-Dahlem, 09 November 2010 http://pub.jki.bund.de/index.php/BerichteJKI/article/view/1436/1735

Conclusion on the peer review of the pesticide risk assessment of the active substance potassium phosphonates http://www.efsa.europa.eu/de/efsajournal/doc/2963.pdf

Final Review report for the active substance potassium phosphonates. Finalized in the Standing Committee on the Food Chain and Animal Health at its meeting on 15 March 2013 in view of the approval of potassium phosphonates as active substance in accordance with Regulation (EC) No 1107/2009.

Expert consultation:

Dr. Markus Kelderer, head of Fruit-Growing, Responsible Organic Farming department, Laimburg Research Centre for Agriculture and Forestry (South Tyrol)

Dr. Uwe Hofmann (Dipl. Oenologe), prelate, ECO-CONSULT, International Consultancy of Organic Viticulture

Dr. Günter Lach, Lach & Bruns Partnerschaft – Consulting Chemists, scientific advisory board of BNN

Koordinationsstelle der BNN-Monitorings, Michaelkirchstraße 17-18, D-10179 Berlin
koordination@n-bnn.de, www.bnn-monitoring.de