Association of Ecological Food Producers (AöL) – Information for Members

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Chlorate / Perchlorate – Residues

AöL Information on chlorate and perchlorate residues in organic food

1. Problem/Starting point

In investigations, among others by the Chemisches und Veterinäruntersuchungsamt Stuttgart (CVUA Stuttgart) [1], residues of chlorate and perchlorate were found in various organic foods from different countries of origin.

Chlorate residues can get into food if chlorine-containing disinfectants and cleaning agents as well as chlorinated water are used. In addition, chlorate-containing plant protection products were used as herbicides in conventional agriculture in Germany until 1992 and in the EU until 2010. Chlorate falls within the scope of Regulation (EC) No 396/2005 on maximum residue levels of pesticides. In 2015, the European Food Safety Authority (EFSA) published a new toxicological assessment for chlorate residue in food. The acute reference dose (ARfD) was set at 0.036 mg/kg body weight.

Since that time, the Commission has defined maximum values for chlorate in food within the framework of the aforementioned Regulation [2]. These entered into force on 28 June 2020. There were no further transition periods.

Perchlorates are salts of perchloric acid. They are easily soluble in water and persistent in the environment. They can get into soils through sewage sludge, rainwater, flooding, artificial irrigation and fertilisers based on Chile saltpetre. This can especially affect glasshouse crops, as perchlorate may accumulate in the soil. [1]

Perchlorate is not an active ingredient in herbicides. Consequently, perchlorate indications fall under the legislation governing pollutants. In May 2020, a corresponding ruling on maximum levels was incorporated in Commission Regulation (EC) 1881/2006 [3]. This replaces the provisional reference values for certain foodstuff groups defined by the EU Commission in March and June 2015. From 1 July 2020, the maximum values summarised in the table on page 4 are applicable.

2. Toxicology

According to the German Federal Institute for Risk Assessment (BfR) and the European Food Safety Authority (EFSA), chlorate and perchlorate may inhibit iodine uptake in humans if they are ingested over long periods. However, a single ingestion does not have a significant effect on the iodine uptake.

In the case of chlorate, the short-term ingestion of higher amounts can lead to the formation of methaemoglobin and may cause damage to red blood cells. Taking this effect into account, EFSA has established an acute reference dose (ARfD) of 0.036 mg/kg body weight for chlorate, based on a clinical study. A tolerable daily intake (TDI) of 0.003 mg/kg body weight was established with regard to the risk of reduced iodine uptake from repeated chlorate ingestion. With that said, the BfR recommends a drinking water limit value of up to 0.07 mg chlorate per litre, which however may only be reached for a short time. In the long term, the concentrations should nevertheless be lower. [4.5]

According to EFSA calculations, especially younger population groups with high intakes and slight to moderate iodine deficiency are negatively affected by perchlorate. EFSA has set a TDI value of 0.0003 mg/kg body weight. According to EFSA, acute health risks from a single ingestion of perchlorate in food are unlikely, therefore no acute reference dose (ARfD) has been established. [6]

3. Pathways

Chlorate: A major cause is no longer the inadmissible use of chlorate-containing pesticides, but primarily the use of treated drinking and irrigation water in plant production. Drinking and process water can be treated for disinfection with approved biocides such as chlorine gas, hypochlorite or chlorine dioxide, which can cause chlorate. Chlorate has often been detected in frozen vegetables, fruit juices and salads/herbs. This can be caused by glazing frozen goods, diluting juice concentrates or washing herbs, salads, fruit and vegetables with chlorinated water. Chlorate can also be produced as a by-product when using chlorinated substances for cleaning or disinfection, and can thus be released into food as a cleaning agent residue. The use of chlorate-containing pesticides or biocides is no longer permitted in the EU. [4]

Chlorate is also formed in the atmosphere, analogous to perchlorate, and released through rain. Thus, natural contents are predominantly found in arid regions. Compared to perchlorate, however, it is degraded faster by microorganisms.

Perchlorate: Perchlorate is used in the metalworking industry, in paper finishing, as a dehydrating and oxidising agent as well as for explosives and fuels. It can get into soils through sewage sludge, to a lesser extent through rainwater, or through flooding. Perchlorate can also be formed by oxidative processes in the atmosphere and deposited in dust. In desert areas, perchlorates can accumulate in the soil. They can also find their way

into the soils through artificial irrigation and fertilisers based on Chile saltpetre. Chile saltpetre is not permitted as a fertiliser in organic farming. The use is very unlikely because of the poor availability and the very high costs. Modern N-fertilisers obtained by the Haber-Bosch process are considerably cheaper and cannot be analytically detected in the end product.

In some countries, perchlorate also occurs naturally in mineral deposits. Soils may be ubiquitously polluted by contaminated rain and irrigation water. Explosion grounds, military training grounds as well as metal processing and paper finishing sites may also be polluted.

4. Analytical aspects

Perchlorate and chlorate can be routinely analysed in food residue laboratories equipped for this purpose. Usually, the QuPPe method (Quick Polar Pesticides) is applied, in which both substances are simultaneously extracted from the homogenised sample and determined by LC-MS/MS. The limits of determination for both substances should not exceed 0.01 mg/kg.

5. Legal aspects

Chlorate: Chlorate-containing plant protection products were used as herbicides in conventional agriculture in Germany until 1992 and in the EU until 2008. Thus, chlorate falls within the scope of Regulation (EC) No 396/2005 on maximum residue levels of pesticides.

Since that time, the Commission has defined maximum values for chlorate in food within the framework of the aforementioned Regulation [2]. These entered into force on 28 June 2020. There were no further transition periods. In recognition of the different entry routes for chlorate in processed foodstuffs, the EU Commission has inserted a footnote in its draft for maximum values of chlorate in accordance to the effect that this must be taken into account in the assessment process. For example, if the chlorate content detected from the use of legally chlorinated drinking water or from permitted processing additives, the foodstuff can remain marketable even if those maximum values are exceeded. However, the footnote goes on to stipulate that the burden of evidence lies with the foodstuffs business and relates not only to the nature but also to the level of additional input of chlorate. There is still dispute about whether the Commission Regulation (EC) 396/2005 provides the required legal framework for a ruling of this kind. Furthermore, a level of legal uncertainty can still be anticipated in relation to the application of these regulations, in respect of foodstuff companies as well as of statutory food monitoring bodies.

If the specific limits for chlorate are also exceeded in a definitive manner, also including possible additional entries, the affected foodstuffs then cease to be marketable after this ruling enters into force. If the ARfD value is exceeded, a public recall of the affected batch of the food cannot be ruled out.

In relation to bio status, it can be assumed that products containing levels of chlorate in excess of 0.01 mg/kg can continue to be viewed as compliant provided that the addition of chlorate verifiably did not originate from the use of pesticides but instead from one of the aforementioned sources.

According to the German Environment Agency [7] in December 2019, a maximum chlorate value of 0.07 mg/L for permanent use of chlorine-containing agents and 0.2 mg/L for temporary dosing was set for drinking water treatment. If disinfection cannot otherwise be ensured, the amount of chlorine may be further increased for short-term emergencies, but the chlorate content should not exceed 0.7 mg/L.

Perchlorate: Perchlorate findings fall under the law on contaminants. In May 2020, a corresponding ruling on maximum levels was incorporated in Commission Regulation (EC) 1881/2006 [3]. This supersedes the provisional reference values defined by the EU Commission in March and June 2015 for certain food groups. From 1 July 2020, the maximum values summarised in the following table shall apply. This permits products that came onto the market legally before this date to continue to be marketed until their minimum sell-by date or expiration date. Products marketed from 1 July 2020 cease to be marketable if these maximum values are exceeded definitively.

Product	Maximum content of perchlorate [mg/kg]
Fruit and vegetables, with the exception of - *Cucurbitaceae* and cabbage - Leaf vegetables and fresh herbs	0.05 0.10 0.50
Tea *(Camellia sinensis)*, dried Herb and fruit teas, dried	0.75
Infant formula, follow-up formula, foods for special medical purposes for babies and infants as well as food for young children ([3])([4]) (*) Baby food ([3]) ([4]) Grain supplement ([3]) ([29])	0.01 0.02 0.01

(3) Foods listed in this category in accordance with the definition in Regulation (EU) No. 609/2013 of the European Parliament and Council of 12 June 2013 in relation to foods for babies and infants, food for special medical purposes and daily rations for weight-controlling nutrition and to supersede Council Directive 92/52/EEC, Directives 96/8/EC, 1999/21/EC, 2006/125/EC and 2006/141/EC by the Commission, Directive 2009/39/EC of the European Parliament and Council as well as Regulations (EC) No. 41/2009 and (EC) No. 953/2009 of the Commission (ABl. L 181 dated 29.6.2013, p.35).
(4) The maximum content relates to the ready-to-eat product (marketed as such or in the preparation indicated by the manufacturer).
(29) The maximum content relates to the commercially available product.
(*) In respect of baby food, this relates to milk-based drinks and equivalent protein-based products intended for babies. These products are not covered by the scope of Regulation (EU) No. 609/2013 (Commission report to the European Parliament and the Council on food intended for infants and young children (COM(2016) 169 final) (https://eur-lex.europa.eu/legal-content/DE/ TXT/PDF/?uri=CELEX:52016DC0169&qid=1559628885154&from=DE).“

6. Recommendation / Summary

Chlorate and perchlorate inputs should be avoided where technically possible. The application rate should be kept as low as possible, especially when treating and disinfecting drinking water with chlorine-containing agents. The type of chlorination also influences whether more or less chlorate is formed. If chlorinated water is used, e.g. by a municipal utility, the installation of a reverse osmosis system to remove the chlorate can be useful. If chlorine-containing cleaning agents and disinfectants are used during operation, it must be thoroughly rinsed with non-chlorinated water. Measures to minimise the chlorate content should not be at the expense of sufficient disinfection.

Furthermore, the contamination of foodstuffs with chlorate or perchlorate should be regularly investigated.

In relation to the aforementioned reversal in respect of the burden of evidence, the foodstuff companies would be well advised to retain all documentation relating to known chlorate contents that can provide insights into the possible input routes, or that demonstrate that no chlorate could be detected in those foodstuffs prior to processing. By way of example, these could show the chlorate levels and the volume of water or processing additive used, or also analysis results of previous stages of the processed foodstuff.

7. Literature and references

[1] *Ökomonitoring 2018 – Ergebnisse der Untersuchungen von Lebensmitteln aus ökologischem Landbau, Hrsg.* [Eco-monitoring 2018 - results of investigations into foodstuffs from ecological agricultural sources, publisher:] *Ministerium für Ländlichen Raum und Verbraucherschutz Baden-Württemberg; Redaktion durch CVUA Stuttgart* [Ministry for rural areas and consumer protection in Baden-Württemberg; editorial by CVUA Stuttgart]

[2] Regulation (EU) 2020/749 of the Commission dated 4 June 2020 on amendment of Appendix III of Regulation (EC) No. 395/2005 of the European Parliament and Council in relation to maximum levels of chlorate residues in or on defined products

[3] Directive (EU) 2020/685 of the Commission dated 20 May 2020 on the amendment of Commission Regulation (EC) No. 1881/2006 in relation to the maximum levels of chlorate content in certain foodstuffs]:

[4] *BFR - Der Eintrag von Chlorat in die Nahrungskette sollte reduziert werden, aktualisierte Stellungnahme Nr. 007/2018 des BfR vom 15. Februar 2018* [The entry of chlorate in the food chain should be reduced, updated opinion no. 007/2018 of the BfR dated 15 February 2018]

[5] Chlorate risk assessment. Joint EFSA -BfR document, agreed on 15 June 2015,

https://www.efsa.europa.eu/sites/default/files/assets/4135ax1.pdf

[6] *BFR - Der Eintrag von Perchlorat in die Nahrungskette sollte reduziert werden, aktualisierte Stellungnahme Nr. 006/2018 des BfR vom 15. Februar 2018* [BFR - The entry of perchlorate in the food chain should be reduced, updated opinion no. 006/2018 of the BfR dated 15 February 2018]

[7] *Umweltbundesamt, Bekanntmachung der Liste der Aufbereitungsstoffe und Desinfektionsverfahren gemäß § 11 der Trinkwasserverordnung – 21. Änderung (Stand Dez. 2019)* [German Environment Office, announcement of the list of preparatory substances and disinfection procedures in accordance with Section 11 of the drinking water regulation - 21st amendment (dated Dec 2019)]

AöL information

The Association of Ecological Food Producers [*Assoziation ökologischer Lebensmittelhersteller (AöL)*] is a consortium of more than 110 companies involved in the food business. Its European members generate annual bio-sales revenues in excess of four billion euro. Their work focuses on the representation of their interests at a political level and the promotion of dialogue and cooperation between its members.

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