

CHLORATES, PERCHLORATES AND RESIDUES FROM WATER TREATMENT

OTHER CONTAMINANTS IN FOOD | CHAPTER 3



TWO ANIONS, DIFFERENT ORIGINS

Chlorate (ClO_3^-) and perchlorate (ClO_4^-) are distinct chemical contaminants, although both can, at certain doses, interfere with iodide transport in the thyroid gland. They are not synonymous with free chlorine, chlorides or ordinary dietary salts. Interpreting a result requires knowing which compound was measured, in which food and by which method.

Chlorate may originate from water treated with chlorine-based disinfectants or from contact with sanitised surfaces and equipment. Perchlorate can have natural and human-derived sources; it can reach crops through water and soil and accumulate in certain plant tissues. Their chemical similarity does not justify assuming they come from the same source of contamination.

CHLORATES AND PERCHLORATES

Two anions with different primary pathways

1

CHLORATE · ClO_3^-

Processing water

May originate from water treated with chlorine-based disinfectants

2

PERCHLORATE · ClO_4^-

Water and soil

May be taken up by certain crops

3

COMMON FEATURE

Iodide transport

At sufficient doses, they can interfere with thyroid iodide uptake

4

PREVENTION

Dual protection

Microbiological safety and reduced chemical residues

DIFFERENT SOURCES → DIFFERENT PREVENTION

HOW CAN THEY ENTER FOOD?

For chlorate, important factors include water used for washing, processing or preparing food, management of disinfection systems and contact times. Hygiene treatments essential for controlling microorganisms should not be demonised: the challenge is to maintain microbiological safety while minimising avoidable chemical residues.

Perchlorate can be taken up through plant roots and may be of particular relevance in leafy vegetables, herbs and some other crops. Its distribution depends on availability in water and soil, crop species, environmental conditions and agricultural practices. The concentration in a food product cannot be inferred from the field's geographical location alone.

WHAT RISKS HAVE BEEN ASSESSED?

The thyroid uses iodine to synthesise hormones essential for metabolism and development. Chlorate and perchlorate can inhibit iodide uptake, with particular concern where iodine intake is insufficient and among sensitive groups such as children and pregnant women. Risk assessment is not equivalent to simply detecting the substance: it requires concentration, quantity consumed, frequency and the circumstances of the exposed population.

EFSA has separately assessed exposure to chlorate and perchlorate. An analytical result below the limit of quantification means that the laboratory could not quantify the substance above a specified threshold; it does not demonstrate absolute absence.

THE EUROPEAN REGULATORY FRAMEWORK

For perchlorate, Regulation (EU) 2023/915 sets maximum levels for specific food categories, including certain vegetables, teas, herbal infusions and foods for young children. There is no single value applicable indiscriminately to every food.

For chlorate, the framework for maximum levels in plant products is linked to pesticide-residue legislation, particularly Regulation (EC) No 396/2005 and subsequent measures on chlorate limits. This difference in regulatory classification does not alter the need to assess exposure according to the contaminant's actual origin and occurrence.

FROM MEASUREMENT TO PREVENTION

Ion chromatography coupled with mass spectrometry, or equivalent validated methods, can determine these substances at low concentrations. Samples must represent the batch, and the laboratory must clearly specify units, uncertainty and the limit of quantification.

Possible measures include checking water quality, managing disinfectant solutions, rinsing where required by procedures, selecting agricultural water sources and monitoring vulnerable products. The correct conclusion is not to abandon disinfection but to reconcile microbiological with chemical protection.

SCIENTIFIC AND REGULATORY REFERENCES

- EFSA (2015), Chlorate in food: public-health risks [↗ Source](#)
- EFSA (2015), Perchlorate in fruit and vegetables [↗ Source](#)
- Regulation (EU) 2023/915, maximum levels for certain contaminants [↗ Source](#)
- Regulation (EC) No 396/2005, pesticide residues [↗ Source](#)