

Chlorates Fact Sheet



Dairy for life

What are chlorates and how are they formed?

Chlorate is a degradation residue of chlorine-based products. In the dairy industry hypochlorite has been noted as a major influence on chlorate residue levels found in milk at farm, but can be formed by other chlorine products and is also a residue in Caustic (NaOH) resulting from the manufacturing process of Caustic (Chloralkali process).

Hypochlorite is used as a sanitizing agent or disinfectant to destroy pathogenic microorganisms in water and maintain Farm dairy plant hygiene.

Hypochlorite is a strong oxidiser, and self-oxidises to form chlorites. Chlorites are short lived and are quickly oxidised by further hypochlorite ions to chlorate (ClO₃⁻). Further oxidation to perchlorate (ClO₄⁻) occurs over time but at a slower rate than chlorate formation.

Because the formation, regulation, toxicology, and proactive management of chlorate and perchlorate within the dairy supply chain are so intertwined, perchlorate is also covered / reduced by limiting chlorates in the dairy chain.

This degradation process reduces the concentration of the hypochlorite ions in solution meaning there is less active hypochlorite remaining in solution as the amount of chlorate increases (i.e., the hypochlorite solution becomes less effective over time).

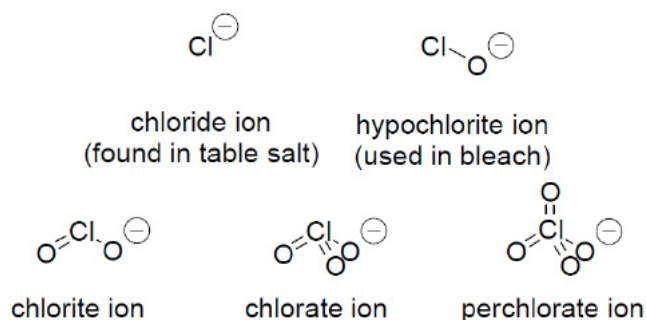
Why are chlorates a focus?

Due to regulatory changes within the European Union, chlorate (ClO₃⁻) has come into focus as a residue of interest in a growing number of NZ's dairy markets.

This is both from a market regulation and customer specification point of view.



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What impacts hypochlorite degradation to chlorate / perchlorate?

There are three main drivers for the speed of hypochlorite degradation. Those being time from manufacture, storage temperature, and concentration.

What is the toxicity, exposure and health risks associated with chlorates?

Acute Human Health Effects

Acute chlorate poisoning is rare in humans involving the ingestion of large quantities (150–200 g) of sodium chlorate. Hence not of relevance for the dairy industry.

Chronic Human Health Effects

When the EFSA (European Food Safety Authority) considered chlorate, they focussed on the inhibition of iodide transport (Thyroid function). A Tolerable Daily Intake (TDI) of 0.3 g/kg-bodyweight per day was established for perchlorate, and a TDI of 3 g/kg-bodyweight for chlorate.

Limits in drinking water

The WHO Guidelines for Drinking-water Quality (2017) have set a provisional guideline value of 0.7 mg/L.

In NZ a PMAV (Provisional Maximum Acceptable Value) of 0.8 mg/L is set with a proviso that disinfection must never be compromised.

Customer specifications

These are commercially sensitive but as chlorine-based products are used in water treatment, and as other food processes sanitise with chlorine-based products, then chlorates can come from several sources in food products when combined.

For example, for infant formula (IF) this is on a consumed basis, so customer specifications tend to build and account for impacts of water when making up the formula as well as other non-dairy food component added into the IF.

This means that the chlorate levels in a customer specification can be significantly lower than the regulatory limits.

What have Dairy companies in other countries done?

Chlorates are still a reasonably new residue of interest in the Dairy sector. However, there are cases in some countries where hypochlorite and other chlorine-based sanitiser has been banned from on-farm CIP – e.g., Ireland.

What are Fonterra's milk quality standards for Chlorates?

The Minor downgrade trigger level is ≥ 0.02 mg/kg.
The Major downgrade has a trigger of ≥ 0.1 mg/kg.

What are some key causes of chlorates on farm?

Based on farmer traceback the following are key trends occurring at a farm level:

- Most farmers spoken to added hypochlorite to their final wash
- Several farmers did not complete a final rinse after their acid wash
- Many farmers increased hypochlorite dosages in poor weather, both in the water supply and wash cycle
- Chlorine dosage rates were not typically measured well for both water and cleaning purposes
- Chlorine products were typically stored in 100/200L drums and expiry dates were not monitored, so some Chlorine stock had well passed the expiry date.

For further information please refer to the **Fonterra Chlorates in Milk FAQs factsheet**.