The use of nisin as a preservative in pasteurised liquid egg products

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Nisaplin® Natural Antimicrobial

- **Appearance:** Free flowing white powder
- **Composition:**
  - Nisin A 2.5%
  - Sodium Chloride 90%
  - Protein 4%
  - Carbohydrate 1.5%
  - Moisture 2%
- **Potency:** Standardised at $10^6$ IU/g by addition of salt
- **Certification:** Kosher pareve, halal
- **Shelf life:** 2 years at 4°C to 25°C
- **Toxicology:** Non toxic, no apparent antibiotic cross-resistance, degraded immediately during digestion
- **Process:** Produced by a sugar-based fermentation using *Lactococcus lactis*
- **Production:** Beaminster, UK
  - ISO 9001 for Quality
  - ISO 22000 for Food Safety
  - OHSAS 18001/ ISO 14001 for Safety and Environment

*International Unit*
Nisin A — The Only Codex approved Nisin

Nisin Z contains asparagine instead of histidine at position 27

ABU = Amino butyric acid
DHA = Dehydroalanine
ALA-S-ALA = Lanthionine
DHB = Dehydrobutyryl (β - Methyldehydroalanine)
ABU-S-ALA = β Methyl lanthionine
Nisaplin® — Dosage and Application Recommendations

- Recommended dosage: from 50 to 200 mg/kg (1.25 to 5 mg nisin/kg)
- Nisaplin works in a concentration dependent fashion
  - Increasing bacterial cell or spore loads will require higher nisin concentrations to achieve effective inhibition
- Nisaplin cannot be used to hide poor manufacturing practice
- Nisaplin added to a food system will naturally and slowly degrade during shelf life depending on the storage conditions and food type
- For a continued inhibitory or sporostatic effect, there must be sufficient Nisaplin remaining within the food system at the end of the required shelf life
Nisaplin®: mode of action against bacterial spores

Inhibition of pre-emergent swelling of spores

Germination  →  Swelling  →  Shedding of spore wall  →  Outgrowth of vegetative cell  →  Cell division
EU Directive 2010/69/EU based on EFSA

- Intended conditions of use: maximum limit at 6.25 mg/l
- The safety of nisin produced using a modified production process and extraction process based on fermentation of a sugar medium as a replacement for the traditionally milk-based medium.
- The additional use of nisin in pasteurised liquid eggs is not a safety concern and is justified from a technological point of view to:
  - extend the shelf life of the product
  - prevent the growth of food poisoning spore-forming species, like *Bacillus cereus*, which may survive from pasteurisation treatment.
- Development of antibiotic resistance should not be expected from the use of nisin in food.
Product Format and Shelf Life

- Fresh Typical Shelf Life
  - Whole eggs and yolks will keep for two to six days at 4.4°C.
  - Egg white only will keep for two to six days at 7.2°C.
  - Min 14 days shelf life
  - Extended – Min 56 days shelf life
  - Frozen – 12 month shelf life
- Target market for Nisaplin
  - Extended Shelf Life (ESL) whole eggs, egg whites or yolks
  - Egg powder for exports or process reasons
    (transportation before spray-drying)
Demonstration of Nisaplin® efficacy in Liquid Whole Egg

Shelf life at 8°C

Days until first spoilage monitored, i.e., cell count > 10⁶/g

Source: Danisco

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Alternative preservative solution: sorbate

- Sorbate can be added to liquid eggs at a level of 3000ppm
  - Not natural
  - Provides off-flavour
  - Requires pH adjustment in egg whites
## Benefits of Nisaplin®

<table>
<thead>
<tr>
<th>PAINS</th>
<th>GAINS</th>
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<tbody>
<tr>
<td>Food Safety</td>
<td>Nisin A is recognised as safe by EFSA/FAO/WHO, GRAS status in the US and recently authorised for use in pasteurised liquid eggs in the EU</td>
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<tr>
<td>Growth of heat resistant bacterial spores (including <em>Bacillus cereus</em>) after pasteurisation</td>
<td>Nisaplin® can prevent or delay the outgrowth of heat-resistant bacterial spores, including those of <em>Bacillus cereus</em></td>
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<tr>
<td>Growth of Gram positive bacteria during shelf life</td>
<td>Nisaplin® controls the growth of Gram positive bacteria such as <em>Listeria monocytogenes</em> or <em>Enterococcus faecalis</em></td>
</tr>
<tr>
<td>Protection of shelf life to increase distribution and export possibilities</td>
<td>Nisaplin® significantly improves the shelf life (+100% or more) even under moderate abuse storage conditions</td>
</tr>
<tr>
<td>Protection of natural positioning and brand image</td>
<td>Nisaplin® is vegetable-based and recognised as an effective natural protectant</td>
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Incorporation of Nisaplin® in Pasteurised Liquid Egg Process

**Nisaplin®**
- 50 to 200 mg/kg
- To be added gradually to avoid lumps
- Can be added 2 to 6 hours before processing

**Pasteurisation**
- pH 7.3 to 7.8
- 150 to 200 seconds at 64°C

**Aseptic packing**
Nisaplin® cannot compensate for poor hygiene conditions

Effect of Nisaplin® under poor hygiene conditions
- 200 mg/kg at 6°C -

Effect of Nisaplin® under good hygiene conditions
- 100 mg/kg at 8°C -

Source: Danisco
Nisaplin® — Do’s and dont’s

**What it does do…….**

- Controls heat-resistant bacteria in pasteurised, sterilised and UHT food products.
- Controls the growth of lactic acid spoilage bacteria
- Controls the growth of *Listeria monocytogenes*

**What it doesn’t do…….**

- It does NOT control yeast and moulds
- It does NOT control Gram-negative bacteria
  - *Usually destroyed by the processes used in manufacture of heat-treated foods*
- It does NOT cover up the use of poor quality raw materials, or poor hygiene
Now let’s get cracking!