

**Nisin**

Niprosin © is a nisin preparation with activity standardized at  $1 \times 10^6$ /gram. Nisin is a polypeptide produced by the lactic acid bacterium *Lactococcus lactis*, which contains 34 amino acids. It is a natural antimicrobial agent and used as a natural food preservative.

Nisin possesses anti-microbial activity against a wide range of Gram-positive bacteria, particularly those that produce spores. It inhibits certain strains of the food pathogen, such as *Clostridium botulinum*, *Staphylococcus aureus*, *Streptococcus haemolyticus*, *Listeria monocytogenes*, *Bacillus stearothermophilus*, *Bacillus subtilis* and some others.

Nisin is effective in products across a wide range of pH levels (3.5 - 8.0). It is used as a food preservative in a number of thermal processed foods, particularly in dairy products, canned foods, plant protein foods, juice, beer & related product, cured meat and processing of fermentation products. At normal levels of use, it does not affect the colour, odour or flavour of the finished product.

**Is it safe?**

Nisin was awarded the Generally Regarded as Safe (GRAS) designation in the U.S. Federal Register of April, 1988 and is approved as a natural food preservative in the United States. It is also approved as a natural food preservative by more than 40 other countries as well as with the Food and Agriculture Organization/World Health Organization and the European Union.

**Bacterial Sensitivity to Nisin**

Nisin possesses anti-microbial activity against a wide range of Gram-positive bacteria, particularly those that produce spores. It inhibits certain strains of the food pathogen, such as:

Alicyclobacillus SPP,	<i>Listeria monocytogenes</i>
<i>Bacillus</i> SPP,	<i>Micrococcus</i> SPP
<i>Clostridium</i> SPP,	<i>Pediococcus</i> SPP
<i>Desulfotomaculus</i> SPP,	<i>Staphylococcus aureus</i> ,
<i>Enterococcus</i> SPP	<i>Streptococcus haemolyticus</i> ,
<i>Lactobacillus</i> SPP	<i>Sporolactobacillus</i> SPP
<i>Leuconostoc</i> SPP	

**Product Specification**

It conforms to all major international specifications, including the FAO/WHO specification for nisin concentrate, and the FDA specification for nisin preparations; 21 CFR Section 184.1538.

**Packaging and Storage**

The product with Nisin activity 1000IU minimum per mg is packed in 500 grams canister. It has a shelf life of two years from the date when it is manufactured when it stored in the original container at ambient dry conditions, away from direct sunlight.

**Product Stability**

Nisin is a polypeptide and is most stable in acid conditions. Nisin is soluble in aqueous environments. Some loss of activity is expected when nisin is used in heat-processed foods.

**Direction for use**

Nisin is soluble in aqueous environments and most stable in acid conditions. It has been used in a wide variety of food products alone or in combination with other preservatives. Directly (or made into suspend solution first with boiled water) put it into food and stir well.  
General dose of use:50mg/kg-200mg/kg.

In the U.S., nisin is used to inhibit outgrowth of Clostridium botulinum spores (the cause of botulism) and toxin formation in pasteurized process cheese spreads with fruits, vegetables or meats at levels not exceeding good manufacturing practice. Current good manufacturing practice in this case is the quantity of the ingredient that delivers a maximum of 250 p.p.m. of nisin in the finished product.

At normal levels of use, it does not affect the colour, odour or flavour of the finished product. All ingredients conform to food grade specifications.

**Why Nisin?**

- 1). A natural preservative
- 2). Extend shelf life
- 3). Cost saving for food processors and distributor
  - Reduce the temperature of the heat processing
  - Shorten the time of the heat processing.
  - Protect against temperature abuse of chilled products during storage and distribution.
  - In certain cases use ambient instead of chilled condition for storage and distribution.

## Nisin – A Natural Preservatives

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4). Ensure Food Safety

Nisin is effective in controlling of pathogenic/food poisoning organisms such as *Listeria*, *Bacillus cereus* and *Clostridium botulinum* as part of an overall safe processing system.

5). Improve Food Quality

### Applications of Nisin as a Food Preservative

Food Applications <sup>1</sup>	Typical Targets <sup>1</sup>	Level of Nisin <sup>1</sup> (mg/Kg or mg/L)	Level(mg/Kg ) of Niprosin <sup>®</sup>
Processed cheese	<i>Clostridium</i> spp. <i>Bacillus</i> spp.	5–15	200–600
Pasteurised milk and milk products	<i>Clostridium</i> spp. <i>Bacillus</i> spp.	0.25–10.0	10–400
Pasteurised chilled soups	<i>B. cereus</i> <i>C. pasteurianum</i>	2.5–6.25	100–200
Crumpets	<i>B. cereus</i>	4–6.25	150–250
Canned foods (high acid)	<i>C. botulinum</i> and <i>thermosaccharolyticum</i>	2.5–5.0	100–200
Ricotta cheese	<i>Listeria monocytogenes</i>	2.5–5.0	100–200
Continental type cooked sausage	Lactic acid bacteria, <i>Brochothrix thermosphacta</i> , <i>L. monocytogenes</i>	5–25	200–1000
Dipping sauces	Lactic acid bacteria	1.25–6.25	50–250
Salad dressings	Lactic acid bacteria	1.25–5	50–200
Beer: pitching yeast wash	Lactic acid bacteria, eg. <i>Lactobacillus</i> , <i>Pediococcus</i>	25.0–37.5	1000–1500
post fermentation		0.25–1.25	10–50
Processed Meat <sup>2</sup>		200IU/g	200

<sup>1</sup> : J. Delves-Broughton , *Nisin as a Food Preservative*, *Food Australia* 57 (12) - December, 2005 pp 525-527.

<sup>2</sup> : Hurst, A. (1981), *Nisin*, *Adv. Appl. Microbiol.* 27, 85-123.

Nisin preparation contains 2.5% nisin. To convert the nisin level into the nisin preparation level, multiply 40 with the nisin level.

Nisin preparation contains 1x10<sup>6</sup> IU/G. . To convert the IU level into the nisin preparation level, divide the IU by 1x10<sup>6</sup> IU to arrive the needed grams of Niprosin<sup>®</sup>.

## Nisin – A Natural Preservatives

### Application of Nisin in Mashed Potatoes

Heat-resistant spore-forming bacteria such as *Bacillus* and *Clostridium* can survive and grow in cooked potato products. This situation represents both a public health problem and an economic problem.

The natural food preservative nisin is used in heat-treated foods to prevent the growth of such bacteria. The shelf life of the mashed potatoes at 25°C was extended by at least 58 days with the addition 6.25 µg of nisin per g<sup>i</sup>.

Application of “6.25 µg of nisin per g” means application of 250 ppm of Niprosin® in finished mashed potatoes, or 0.025% in the mashed potatoes.

Nisin was also shown to be effective in ready-to-eat potato puree<sup>ii</sup>

It was emphasized that the preservative and the ingredients must be well mixed to ensure good nisin efficacy. Nisin remained at effective levels after pasteurization, and good retention was observed throughout the shelf life of the mashed potatoes.

### Application of Nisin in Dehydrated Mashed Potatoes

Dehydrated potato contains *Bacillus cereus* spores at less than 10<sup>3</sup> CFU g<sup>-1</sup> at a prevalences of 10 to 40% that are able to survive drying of the raw vegetable and may represent a significant inoculum in the reconstituted (rehydrated) product where conditions favor germination of, and outgrowth from, spores<sup>iii</sup>.

Holding rehydrated mashed potato alone, or as part of another product (e.g., potato-topped pie), at temperatures above 10°C and below 60°C may allow growth of vegetative *B. cereus*. Levels exceeding 10<sup>4</sup> CFU g<sup>-1</sup> are considered hazardous to human health

Nisin is used in canned peas, carrots, peppers, potatoes, mushrooms, okra, baby sweet corn, and asparagus.

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<sup>i</sup> Thomas, Linda V, et al, 2002, Effective Use of Nisin To Control *Bacillus* and *Clostridium* Spoilage of a Pasteurized Mashed Potato Product, [Journal of Food Protection®](#), Number 10, October 2002, pp. 1527-1673 , pp. 1580-1585(6),

<sup>ii</sup> Rajkovic, A., et al, Antimicrobial effect of nisin and carvacrol and competition between *Bacillus cereus* and *Bacillus circulans* in vacuum-packed potato puree, [Food Microbiology](#), Volume 22, Issues 2 - 3, April - June 2005, Pages 189 - 197.

<sup>iii</sup> King, Nicola J, et al, Presence and Significance of *Bacillus cereus* in Dehydrated Potato Products, [Journal of Food Protection®](#), Number 2, February 2007, pp. 279-520 , pp. 514-520(7).