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The Future of Biopreservatives

NISIN

NATAMYCIN

e-POLYLYSINE

NATAMYCIN HS

Anti-caking agents

NISIN

NISIN

NISIN

NATAMYCIN HS

e-POLYLYSINE

NATAMYCIN

Company Profile

Biozymes is a progressive biotech company that specializes in research, development, and application of Natural Bio preservatives for the food and personal care industry. Biozymes main products include Nisin, Natamycin, high soluble Natamycin and e-Polylysine. We work together with customers around the world, to eliminate or partly eliminate chemical preservatives with natural preservatives.

Main products

Nisin
Natamycin
***e*-Polylysine**
Natamycin HS (High Soluble)
Anti-caking agents

Nisin

Product Description

Nisin is a peptide, a natural fermentation product produced by Lactococcus lactis subsp. Lactis. It has an efficient anti-microbial activity.

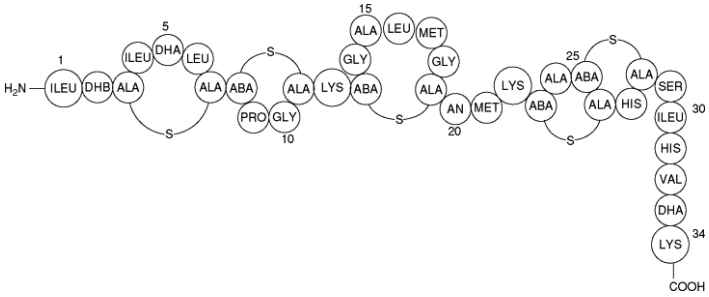
Molecular formula: $C_{141}H_{228}N_{41}O_{38}S_7$

Relative molecular weight: 3331 g/mol

INS code: 234

CAS No: 1414-45-5

Molecular Structure:



Key Benefits

- Inhibits the growth of a wide range of Gram-positive spoilage and pathogenic bacteria, and is particularly effective against some heat-resistant spore-forming bacteria such as Geo-bacillus stearothermophilus, Bacillus cereus, and Clostridium botulinum.
- Reduces thermal processing temperature time and minimizes nutrients loss. Improves food quality, safety and shelf life.
- It is cost-effective due to low usage level.
- It is hydrolyzed into amino acids by proteinases in the intestine after human consumption, and has no impact on natural microflora including probiotics in human body.

Microorganism	MIC (mg/kg/L)
Bacillus subtilis	5
Staphylococcus aureus	10
Listeria	10
Clostridium botulinum	30
Lactococcus and Lactobacillus	3

Indicative usage level to impede G (+) microorganism growth
MIC: Minimum inhibitory concentration

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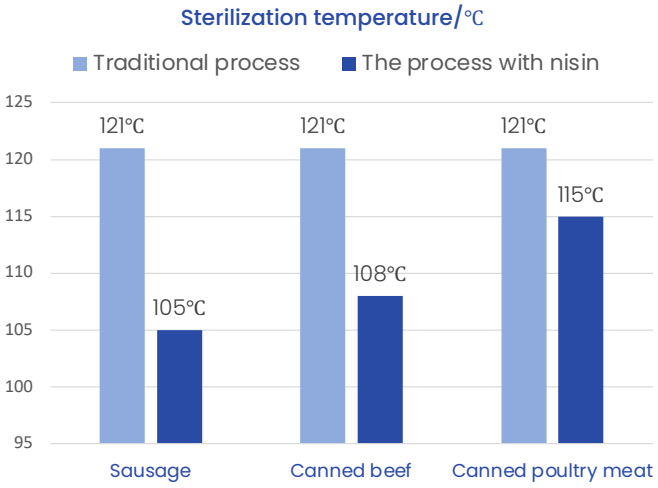
Application Examples

- Add 100-200 mg/kg nisin in sausage to extend shelf life
- Add 100-150 mg/kg nisin in canned meat to protect quality
- Add 40-60 mg/kg nisin in yoghurt to prevent post-fermentation acidification without affecting the regular fermentation
- Add 100-250 mg/kg nisin in dairy beverages to improve quality and safety and extend shelf life
- Add 50-100 mg/kg nisin in fruit juices to protect quality and shelf life



Application sample Nisin lower the sterilization temperature in food processing

Application standard

Nisin is a safe food preservation which has been widely accepted worldwide. Some countries have no legal limit on nisin usage while other countries have set the maximum usage levels permitted in different food products based on daily intake.

Food Applications	Indicative usage (mg/kg/L)
Milk and dairy products; Prepared meat product; Cooked meat; Cooked aquatic products	15 to 500
Multigrain sausage products; Wet fast noodles; Rice and flour sausage products; Egg products (Modified physical properties)	20 to 250
Canned edible mushroom and algae; Canned congee with mixed grains and beans; Soy sauce; Dips, sauces & dressings; Compound flavouring and condiments; Beverages (Exclude bottled drinking water)	20 to 200
Vinegar	12,5 to 150

About Biozymes and our Nisin

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. Biozymes always recommend to follow the local regulatory food safety authorities. Nisin (E 234) is an authorized food additive in the EU under Annex II of Regulation (EC) 1333/2008 for use in several food categories. Biozymes can supply customized products with different concentrations of nisin for both the food and personal care sector at customer's request, to meet specific needs.

Packaging and Storage

Packaging: From 10g/bag, up to 25kg/bag, as per costumer specification.
Storage: Store in cool and dry place. Keep it properly sealed and avoid direct sunlight. Shelf life is 2 years.

* Biozymes delivers natural food protection solutions. The company is dedicated to sharing technology development information and improving food safety and people's health and wellness.
For more information or technical assistance, please call **+45 41 81 44 36** or visit the company's website: **www.biozymes.dk**

Find us on our website at

Natamycin

Product Description

Natamycin is a natural antimycotic ingredient, a purified fermentation product from Streptomyces natalensis.

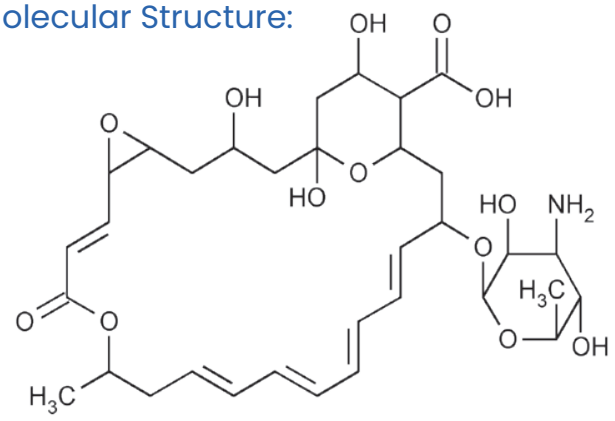
Molecular formula: $C_{33}H_{47}NO_{13}$

Relative molecular weight: 665.73 g/mol

INS code: 235

CAS No: 7681-93-8

Molecular Structure:

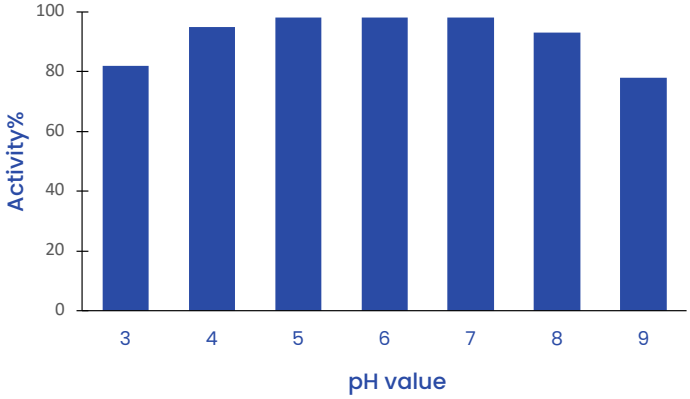


Key Benefits

- Natamycin is an antimycotic ingredient with a broad anti-fungal activity against various moulds and yeasts. It also inhibits the formation of fungal toxins. Natamycin does not inhibit the growth of bacteria therefore it does not affect the natural fermentation of yoghurt, cheese, raw ham, dry sausage, etc.
- The solubility of natamycin is very low in water and in most organic solvents. This low solubility makes it very suitable for use on the surfaces of food. Natamycin will stay on the surface of the food, where most moulds and yeasts may grow.
- Natamycin is effective at pH 3-9, making it suitable for acidic, neutral and alkaline foods.

Indicative usage level to inhibit the growth of fungi

Microorganism	MIC (mg/kg/L)
Aspergillus flavus	5
Aspergillus niger	2
Aspergillus oryzae	10
Penicillium	2.5
Candida albicans	2
Brettanomyces	1.5
Saccharomyces cerevisia	2.5



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Application Examples

- Spraying a natamycin solution of 300mg/L in an aqueous solution on the surface of the cake can protect it from the mould growth and extend its shelf life.
- Dipping the sausage in 300mg/L natamycin aqueous suspension can prevent it from mould growth and slime or sticky surface development.
- Adding 10-20mg/L of natamycin in wine, fruit and vegetable juices can prevent them from spoilage and extend their shelf life.
- Spraying natamycin suspension of 300mg/L in an aqueous solution on the surface of cheese can prevent the cheese from mould growth and extend its shelf life.

Application standard

Natamycin is an antimycotic product approved worldwide for use in foods as a bio-preservative. The regulation governing the use of Natamycin in food or feed may vary in different countries, local regulations concerning the status of this product should always be consulted.

Food Application	Indicative usage/(mg/kg/L)	Note
Cheese; Cake; Braised meat products; Smoked, roasted or grilled meat; Fried meat; Western ham (smoked, roasted or steamed ham); Sausage; Fermented meat products	300	10mg/kg Treat (spray or dip) the food surface with aqueous solution
Mayonnaise, salad sauce	200	Residual amounts≤10mg/kg
Fruit and vegetable juices (jam); Brewed wine	10-20mg/L	Residual amount<10mg/L

About Biozymes and our natamycin

Biozymes work with customers in application of implementing Natamycin, both in situ or at lab scale. We deliver Natamycin with both Lactose, Glycose or Sodium chloride or simply pure as per customers requirement.

Packaging and Storage

Product: Pure natamycin (USP(32)), 50% natamycin (formulation contains lactose, glucose or sodium chloride)
Packaging: 20g/bag to 25kg/bag as per customer demand.
Storage: Store in cool and dry place. Keep it properly sealed and avoid direct sunlight. Shelf life is 2 years.

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e-Polylysine

Product Description

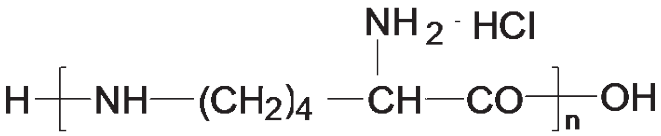
e-Polylysine is a L-lysine polymer which is produced by fermentation with Streptomyces diastatochromogenes and purified through ion exchange chromatography process. It can be used as a food preservative and in personal care products.

Molecular formula: $[C_6H_{12}N_2O{\cdot}HCl]_n{\cdot}H_2O$ n=25~35

Relative molecular weight: 4130~5776

CAS No: 728211-04-3

Chemical structure:



Key Benefits

- A natural food preservative with a broad antimicrobial spectrum. It can inhibit the growth of Gram(+) and Gram(-) bacteria, yeast mould and even virus.

Microorganism	MIC (mg/kg/L)
E.coli	40
Staphylococcus aureus	50
Bacillus subtilis	15
Streptococcusthermophilus	110
Lactobacillus bulgaricus	100
Lactobacillus plantarum	120
Saccharomyces cerevisiae	490
Pichia pastoris	40
Candida mycoderma	40
Rhizopus nigricans	90
Mucor mucedo	10

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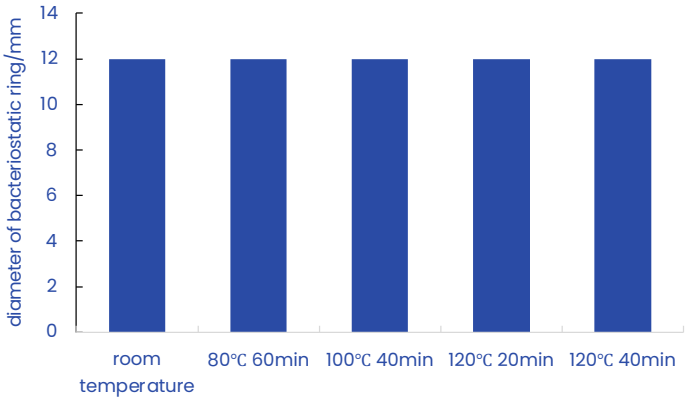
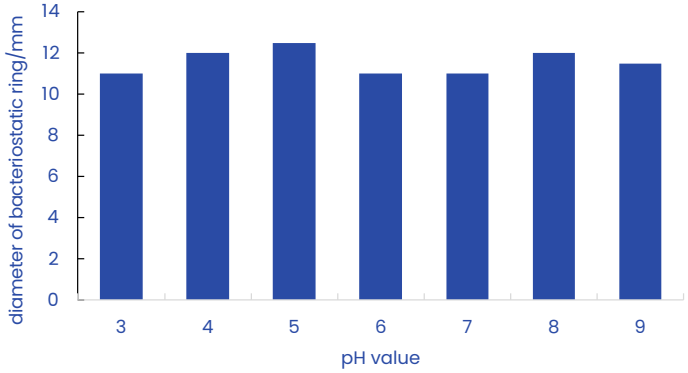
- Very good thermal stability

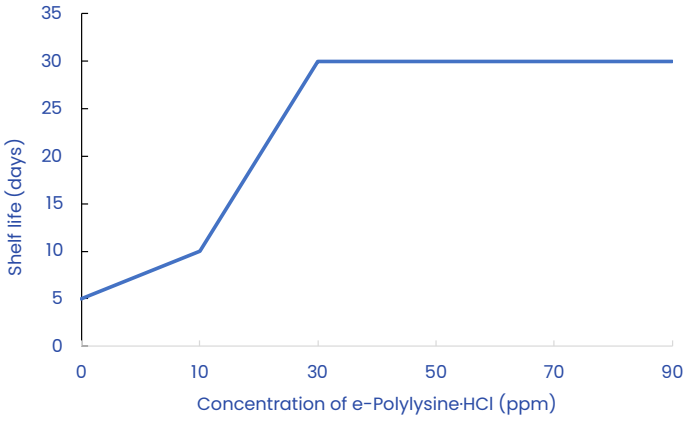


- Effective over a wide range of pH (3-9) and suitable for most foods



- Highly water soluble, colourless and tasteless, easy to use without affecting colour and flavour of the food products.
- Safe as the product can be decomposed into an essential amino acid L-lysine in the human intestine without any adverse health effect.

Example of *e*-Polylysine in corn juice



Application standard

e-Polylysine is defined as a natural food preservative. In the U.S, it received GRAS status from FDA. *e*-Polylysine has been widely used in food products. The regulation governing the use of *e*-Polylysine in food, feed and personal care may vary in different countries, local regulations concerning the status of this product should always be consulted.

Food Application	Indicative usage level (g/kg/L)
Beverage	0.20
Rice and rice products	0.25
Fruits, vegetables, beans, edible mushroom; Wheat flour and its products; Meat and meat products.	0.30
Cereal	0.40
Flavouring	0.50

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Natamycin HS

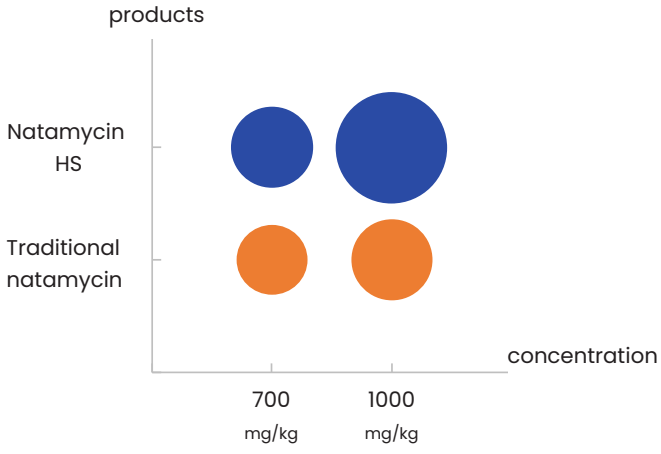
Product Description

Using encapsulation technology, Biozymes can offer a fast, highly soluble natamycin product. This product can be easily dissolved in water prior to use, or directly added into product formulation and it will be quickly dissolved and uniformly distributed in the product.

Key Benefits

- Improved in-use efficacy and efficiency for protection against yeasts and moulds compared to traditional natamycin.
- Highly water solubility, easy to use.
- Natamycin HS in water solution is more stable and there is no precipitation.
- Natamycin HS solution is clear, tasteless and does not affect the colour and flavour of food products.
- Traditional natamycin precipitates in water in very short time, while natamycin HS is soluble in water which ensures uniform distribution and complete coverage on surfaces of food products to achieve better protection.

Figure 1. Anti-fungal inhibition zones of traditional natamycin and Natamycin HS



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Anti-caking agents

Product Description

Anti-caking agents are substances added to food products, such as shredded cheese, to prevent them from clumping together and forming lumps. Natural antimicrobials, in this context, are ingredients that help inhibit the growth of microorganisms like bacteria, yeast and molds in the cheese, extending its shelf life.

Combining anti-caking agents with our natural antimicrobials it serves a dual purpose: maintaining the cheese's texture and preventing spoilage.

In summary, the combination of anti-caking agents and Biozymes natural antimicrobials in shredded cheese helps maintain its texture, extend its shelf life, and improve food safety. This allows manufacturers to provide consumers with a high-quality product that remains fresh and free from clumps.

Here's how this process typically works:

1. Anti-caking Agents: Anti-caking agents are substances that reduce the tendency of powdered or granulated materials, like shredded cheese, to clump together due to moisture absorption. Common natural anti-caking agents include substances like cellulose (often derived from plant sources), starches or rice flours. These agents create a barrier between cheese particles, preventing them from sticking together.

2. Natural Antimicrobials: Natural antimicrobials are ingredients that help inhibit the growth of microorganisms in food products. In the case of shredded cheese, natural antimicrobials may include ingredients like Biozymes natamycin. Natamycin help prevent the growth of spoilage microorganisms, extending the cheese's shelf life and maintaining its freshness.

By combining anti-caking agents and natural antimicrobials, shredded cheese manufacturers can achieve several benefits:

1. Texture Preservation: Anti-caking agents prevent the cheese particles from clumping together, ensuring that the shredded cheese remains free-flowing and easy to use. This helps maintain the desired texture and appearance of the product.

2. Extended Shelf Life: Natural antimicrobials inhibit the growth of spoilage microorganisms and molds, which can cause the cheese to spoil or develop off-flavors. This extends the cheese's shelf life and improves its overall quality.

3. Eliminate the use of Chemical Preservatives: The use of natural antimicrobials can eliminate the need for synthetic chemical preservatives in shredded cheese, making the product more appealing to consumers who prefer natural and clean-label products.

4. Food Safety: The inhibition of microorganisms also contributes to food safety by reducing the risk of foodborne illnesses associated with contaminated cheese.

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A leading aspiring company, engineering natural, safe and efficient protective ingredients for food, feed and personal care industries. Main products and service: Nisin series, Natamycin series, *e*-Polylysine series and anti-caking. Aiming for a green label food protective solution.

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