



## "Bacteriocins: A Natural Weapon Against Microbial Spoilage in Food Systems"

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### ABSTRACT:-

Food preservation is crucial in the food industry to maintain the texture, color, and taste of food products without spoilage. Chemical preservatives, such as sodium benzoate, sulfur dioxide, calcium benzoate, and potassium nitrate, have been used for years but have been linked to adverse effects like asthma attacks, carcinogenic properties, and neurological damage. As consumers shift towards natural, unprocessed foods, bio-preservatives like bacteriocins from different microorganisms are being considered. Bacteriocins are generally recognized as safe antimicrobial substances by the FDA and can be applied to food and products through direct incorporation, food packing, or purified form. In the food and dairy industry, bacteriocins like Nisin are used in cheese, yogurt, and milk to increase shelf life. As consumers become more aware of the health hazards associated with chemical preservatives, there is a demand for eco-friendly and sustainable food products.

### INTRODUCTION:

Food preservation is an important process in the food industry as it helps maintain the texture, color, and taste of food products by increasing their shelf life without spoilage. The main objective is to minimize the growth of microorganisms such as bacteria, yeast, and molds, which can cause spoilage and make the food unsuitable for consumption. Other factors such as oxidation, temperature, and light also contribute to food spoilage.

The increased use of chemical preservatives in food products has raised concerns about their potential effects on long-term human health. These chemical preservatives can alter the internal properties of food, and long-term consumption of such chemically preserved foods may lead to toxic effects on the human body. As a result, the new approach towards the use of natural (Bacteria, plants, etc.), chemical-free, and healthy products not only improves the overall

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quality of food but also extends the shelf life of the food products. Bacteriocins, which are antimicrobial peptides derived from bacteria, tend to be the best alternative for food preservation. This can prevent food spoilage and growth of pathogenic microorganisms. Unlike chemical preservatives, bacteriocins are safer for consumption and do not cause adverse effects on human health. This is because they are inactivated by digestive enzymes in the gastrointestinal tract, ensuring that they do not cause any harmful effects on the human body. Therefore, the utilization of bacteriocins was found to be a natural and safe method for increasing the shelf life of food products.

## THE NEED FOR NATURAL PRESERVATIVE

Different types of chemical preservatives have been utilized for many years, among them most commonly used is Sodium benzoate, which can be found in carbonated drinks, pickles, and sauces. Sulfur dioxide is commonly used in dried fruits and potato products. Calcium benzoate is present in low-sugar products, cereals, and meat products, and Potassium nitrate, is used in cured meats and canned meat products. However, these preservatives must be associated with a range of adverse effects, including asthma attacks, carcinogenic

properties, neurological damage, gastric irritation, nausea, and diarrhea.

In recent years, people have significantly shifted towards natural, unprocessed foods over highly processed alternatives. This shift can be due to an increase in awareness about potential health hazards associated with chemical additives commonly found in processed foods. As a result, consumers are seeking out clean-label products to reduce the artificial chemicals, flavorings, and colorants. Furthermore, this shift in people's preferences shows an awareness of environmental sustainability.

Consumers are becoming more conscious about the impact of food production on the environment and thus prefer eco-friendly and sustainable food production methods. Natural preservatives provide significant benefits when compared to chemical preservatives since they are non-toxic in nature and have a variety of nutritional benefits.

As consumers moved away from chemical preservatives, natural methods of preserving foods and food products gained more attention. Bio-preservatives are one such method, where an antimicrobial substance like Bacteriocins from different microorganisms is used to inhibit the growth of spoilage organisms, thereby increasing the shelf life of food and food products.

## BACTERIOCIN AND ITS FOOD INDUSTRY APPLICATION

Bacteriocins are generally considered to be the proteins or peptides derived from bacteria that prevent another related or unrelated microorganism. These are generally recognized as safe (GRAS) antimicrobial substances by the United States, Food and Drug Administration (FDA). There are different ways the bacteriocins can be applied to food and food products through direct incorporation into food, food packing, or by the purified form of bacteriocins.

### FOOD AND DAIRY INDUSTRY

Research has shown that Bacteriocins, such as Nisin, are used in cheese, yogurt, and milk which is effective in increasing the shelf life of dairy products by preventing the growth of food pathogens, such as *Listeria monocytogenes*. Nisin is known for inhibiting Gram-positive bacteria and is commonly used in various dairy products. Pediocins are used on soft cheeses and other dairy products, and they are even more effective than nisin against certain food-borne pathogens, including *Listeria monocytogenes* and *Staphylococcus aureus*. Additionally, they can inhibit Gram-negative organisms like *Pseudomonas* and *Escherichia coli*, making them valuable for maintaining food safety in dairy products.

### POULTRY AND MEAT PRODUCTS

Nisin is effective against various spoilage bacteria and pathogens, allowing for reduced dependence on conventional preservatives like nitrites in poultry and meat products. This can also be used in combination with other preservative methods. Certain bacteriocins have been shown to maintain the original color of meat samples during storage and inhibit the growth of spoilage microorganisms, especially *Listeria monocytogenes*, *Salmonella typhimurium*, and *Pseudomonas fluorescens* which can lead to deterioration of meat quality thereby increasing the shelf life of meat products, which gains consumer attention and increases the market value of meat products.

### SAFETY AND REGULATION

The bacteriocins, a natural preservative produced by bacteria and considered to be safest for human intestinal microflora, are non-toxic and inactivated by digestive enzymes. These can allow food manufacturers to use them without needing additional approvals, making them a reliable and trusted option as a natural preservative.

### CONCLUSION

Bacteriocins represent a promising substance in food preservation, combining safety effectiveness, and a natural compound in origin. Their antimicrobial activity ensures food is free from pathogenic bacteria without any adverse effects on human health, with the

approval of GRAS from the FDA. Bacteriocins are not only trusted but also increasing in demand for their clean, and natural substances. These are the best alternatives to chemical preservatives. Their sustained use and further research hold great potential for enhancing food safety and quality on a global scale.

