

Food Application of Nisin

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ABSTRACT

Nisin is a bacteriocin produced by a group of Gram-positive bacteria that belongs to lactococcus and streptococcus species. Nisin is classified as a Type A (1) antibiotic that is synthesized from mRNA and the translated peptide contains several unusual amino-acids due to post-translational modification. Over the past few decades, nisin has been used widely as a food bio-preservative. Since then, many natural and genetically modified variants of nisin have been identified and studied for their unique antimicrobial properties. Nisin was described in 1928, commercially marketed in 1953, approved by WHO in 1969, FDA approved and generally regarded as a safe peptide with recognized potential for clinical use in 1988, as bio-preservative in 1990, bioengineered variants came into being in 2000 and finally its biomedical applications is current. Nisin has now been shown to have antimicrobial activity against both gram-positive and gram-negative disease-associated pathogens. Nisin has shown its potential use in a broad range of fields, including food, bio-preservation and bio-medical applications.

Keywords: NISIN, Bio-Preservative, Food, Applications

INTRODUCTION

The use of non-pathogenic microorganisms or their metabolites to improve microbiological safety and extend the shelf life of foods is defined as bio-preservation [1]. Bio-preservation refers to extended storage life and enhanced safety of foods using the natural microflora and (or) their antibacterial products. It can be defined as the extension of shelf life and food safety by the use of natural or controlled microbiota and/or their antimicrobial compounds [2]. One of the most common forms of food bio-preservation is fermentation, a process based on the growth of microorganisms in foods, whether natural or added. It employs the breakdown of complex compounds, production of acids and alcohols, synthesis of Vitamin-B₁₂, riboflavin and Vitamin - C precursor, ensures antifungal activity and improvement of organoleptic qualities such as, production of flavor and aroma compounds. In fish processing, bio preservation is achieved by adding antimicrobials or by increasing the acidity of the fish muscle [3]. Efforts have concentrated on identification and development of protective bacterial cultures with antimicrobial effects against known pathogens and spoilage organisms. Following compounds such as organic acids, bacteriocins, diacetyl and acetaldehyde, enzymes, CO₂, hydrogen peroxide etc are contributing to antimicrobial activity by Microbiota [4].

Bacteriocin: Nisin as bio-preservative in foods industry

Before bacteriocin can be applied in foods their cytolytic abilities should be assessed in detail. This is a very important issue since recently a cytolysin produced by *Enterococcus faecalis* was described that possesses both hemolytic and bacteriocin activities. Recombinant DNA technology is currently applied, to enhance production, to transfer bacteriocin genes to other species and for mutation and selection of bacteriocin variants with increased and/or broad activity spectra. Continued study of the physical and chemical properties, mode of action and structure-function relationships of bacteriocins is necessary if their potential in food preservation is to be exploited [5]. Further research into the synergistic reactions of these compounds and other natural preservatives, in combination with advanced technologies could result in replacement of chemical

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preservatives or could allow less severe processing (e.g. heat) treatments, while still maintaining adequate microbiological safety and quality in foods. Biological preservation approaches seem attractive as a safety parameter in foods with reduced contents of ingredients such as salt, sugar, fat and acid that usually serve as factors potentially inhibitory to microbial growth. It is expected that biological preservation methods may enjoy better consumer acceptance than their preservation counterparts that use traditional chemical preservatives. Bacteriocin-producing LAB has potential for the preservation of foods of plant origin, especially minimally processed vegetables, such as prepackaged mixed salads and fermented ones [6] observed a reduction in high initial bacterial loads of ready-to-use mixed salads on addition of bacteriocin-producing LAB. Furthermore, bacteriocin-producing starter cultures may be useful for fermentation of sauerkraut or olives to prevent the growth of spoilage organisms. Nisin is suitable for use in a wide range of foods liquid or solid, canned or packaged, chill or warm ambient storage and it is best added as an aqueous solution, usually to the liquid portion of a product during its processing. It can also be added as a powder, but in all cases, it is essential to ensure uniform dispersal throughout the food matrix. The level of nisin addition depends on the type of food, severity of heat process, storage conditions and the required shelf-life. Nisin is often used in acidic foods, but is effective in products across a wide range of pH values (3.5-08.0). It seems to be a very effective preservative in liquid egg, which generally has a pH of 7.3 to 7.8. It is used in a variety of products including pasteurized, flavored and long-life milks, aged and processed cheeses, and canned vegetables and soups. Nisin has been utilized to inhibit undesirable LAB in wine and beer [7]. Currently of interest is the use of nisin with novel preservation techniques such as ultra-high pressure or high hydrostatic pressure and pulsed electric field. Future approaches should consider the application of bacteriocins in combination with treatments enhancing their effectiveness in foods [8]. The antimicrobial efficiency of a bacteriocin may also be enhanced or broadened by using it in combination with other bacteriocins or other compounds including surfactants chelating agents or other metal completing compounds [9].

CONCLUSION

In recent years, nisin research has shown its potential use in a broad range of fields, including food bio-preservation and bio medical applications. Among different classes of lantibiotics, nisin is the most well-known and best studied lantibiotic.

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