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Bacteriocins Based Strategies for Food Bio-Preservation

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Abstract

Maintaining of food safety and its quality is the major step to improve health of consumers. Consumption of bad quality foods, more synthetic additives led to various health problems like allergies, nausea, cancer, neural problems and even affects mental health of consumers and hence as an eco-friendly step, bacteriocins based strategies for food bio-preservation is gaining importance. These are possible by using lactic acid bacterial strains or by their metabolic antibacterial products like bacteriocins. These produced bacteriocins are commercially used in food industry as bio-preservatives.

Introduction

Many preservatives (Class I - sugar, salt, oil, *etc.* and Class II - Potassium metabisulphite, Sodium benzoate, Sorbic Acid, *etc.*) are used in extending the shelf life of food. Among them, the use of Class II preservatives is more compared to Class I because of their easy availability and comparatively more antimicrobial effectiveness. But we should see that they are synthetic in nature and have the capacity to become a health hazard, if used continuously and in more than the prescribed level. The only solution to avoid this is use of preservatives obtained from natural sources as there will be no such effects even if used in large quantity. Bio-preservation is one of suchapproachfor prolonging the shelf life of food materials by utilizing antimicrobials or controlled or natural microbiota. The term "bacteriocin" was first coined in 1953 to interpret colin produced by *Escherichia coli.* Moreover, to preserve the foods by means of bio-preservation method, quality of the lactic acid bacteria (LAB) and their bacteriocins, bacteriophages should be well maintained and these well-maintained LAB and their bacteriocins are capable of exerting the anti-microbial properties and imparts the products with good flavour and taste. Fermented products are also associated with some strains of lactic acid bacteria (LAB) which helps to preserve them for longer duration by imparting the anti-microbial actions. Various genera like *Leuconostoc, Lactobacillus, Lactococcus, Pediococcus, Streptococcus,* and *Enterococcus* are included in LAB category. Lactic acid, hydrogen peroxide, acetoin and other organic acids are some of the end products of LAB metabolism. Bacteriocins are substances which are low-molecular mass proteins or peptides which are synthesized ribosomally and exhibit the properties of bacteriostatic or bactericidal effects.

Apart from having broad antimicrobial spectrum and GRAS (Generally Recognized as Safe) status, the LAB also possesses important characteristics for its use as a bio-preservative agent in food like,

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• Good sensorial and organoleptic properties.

• Not active and nontoxic on eukaryotic cells and inactivated by digestive proteases.

• Bactericidal mode of action with pH and heat tolerance.

• Their genetic determinants are usually plasmid-encoded, facilitating genetic manipulation.

Methods of Applying Bacteriocins

Bacteriocins have been incorporated into different food items by:

• Direct soaking of food items into bacteriocin solution.

• Adsorption of bacteriocin on different surfaces such as polyester, polyethylene, polyvinyl chloride, ethylene vinyl acetate, polypropylene, acrylic *etc*. and edible cellulosic films.

• Preparation of bacteriocin containing antimicrobial casing.

• As one of the hurdles in hurdle technology strategies to reduce food borne disease.

Natural Occurrence of Bacteriocin Producers

• Lactic acid bacteria naturally occur on many foods (*e.g*. fruits and vegetables).

• Lactic acid bacteria isolated from cheese, milk, and meat samples inhibit *L. innocua* and *Pseudomonas fragi*.

• Lactic acid bacteria isolated from vegetables material generally inhibit *S. aureus*.

Mode of Action of LAB Bacteriocins

Potency of LAB bacteriocins as an antimicrobial property is exerted by various mechanisms. Growth and development of *Clostridium* spp. spores and most of gram-positive bacterial spore's activity is inhibited by the mode of action of Nisin which exhibits broad spectrum activity. Nisin acts on the target cell membrane of microorganisms by creating pore like structures which later lead by disruption of proton motive force and pH equilibrium leading to ATP hydrolysis and ion leakage from the disrupted cell structure and causes cell mortality. Various bacteriocins like subtilin, epidermin and also lacticin 3147 exhibits the same mode of action to cause the cell death.

Common Bacteriocins and Their Uses in Food Industry

• **Meat Industry:** Various bacteriocins like Enterocins A and B, Nisin and Pediocin PA-1 alone or in combination with MAP packaging, synthetic preservatives or high hydrostatic pressure is effective against *Listeria monocytogens.* Especially for meat and products of meat most suitable bacteriocin is Pediocin PA-1/AcH than Nisin (Costa *et al.,* 2019).

• **Fish Industry:** Microgard in combination with nisin is effective against *Listeria monocytogenes* in frozed thawed salmon and also in fresh chilled salmon (Heir *et al.,* 2020).

• **Dairy Industry:** Cheeses like camembert, Manchego and Ricotta can be kept safer from preventing infection by *Listeria monocytogenes* and *Clostridium botulinum* infection by using nisin bacteriocin. Enterocin AS-48 can be used against the infection of *S aureus, Bacillus cereus* in manchego cheese and milk (Medina and Nuñez, 2011).

• **Plantaricins:** Plantaricins are bacteriocins produced by *Lactobacillus plantarum*. These are effective against various bacterial genera like *Clostridia, Pediococcus, Propionobacteria* and including their natural competitor *Lactobacillus planatrum*.

Disadvantages of Using Bacteriocins

The hydrophobic nature, poor solubility and uneven distribution, impact on salt or other added ingredients in food and environment specific preservative action are the major drawbacks of using Bacteriocins as preservatives in foods.

Future Prospects

Bacteriocins are well accepted natural means of selective microbial inhibition. Potential towards improving and stability in productions of bacteriocins without any changes in its antimicrobial property and their possible applications in the diversified Indian food system should be the concern in upcoming times.

Conclusion

Bacteriocins obtained by LAB strains add into list of GRAS stated bio-preservatives. Due to increase in population of health-conscious society the demand for such bio-preservatives is also increasing in the market and people are ready to pay as long it is beneficial to health. So, the bacteriocins have a greater potential to become commercial bio-preservative in food industry.

References

Costa, R.J.D., Voloski, F.L., Mondadori, R.G., Duval, E.H., Fiorentini, A.M., 2019. Preservation of meat products with bacteriocins produced by lactic acid bacteria isolated from meat. *Journal of Food Quality* 2019, 1-12.

Heir, E., Solberg, L.E., Carlehog, M., Moen, B., Jensen, M.R., Holck, A.L., 2020. Improved control of *Listeria monocytogenes* during storage of raw salmon by treatment with the fermentate Verdad N6 and nisin. *International Journal of Food Microbiology* 336, 108-895.

Medina, M., Nunez, M., 2011. Applications of protective cultures, bacteriocins and bacteriophages in milk and dairy products. Protective Cultures, Antimicrobial Metabolites and Bacteriophages for Food and Beverage Biopreservation, p. 297.