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The application of lactic acid bacteria in fresh-keeping of aquatic products

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ABSTRACT. *This paper is mainly about: The application of lactic acid bacteria in fresh-keeping of aquatic products. Through analysis we found that Lactobacillus mainly produces bacteriostatic substances through competition and metabolism to keep fresh aquatic products and Lactic acid bacteria can consume the nutrients needed by harmful bacteria to inhibit their growth and reproduction. At the same time, lactic acid bacteria can also compete for oxygen to form the dominant bacteria group and inhibit the growth of fungal microorganisms. Screening more and better strains of lactic acid bacteria that can form hydrogen peroxide and bacteriocins or compete with some spoilage microorganisms for nutrients and ecological niche has potential commercial application value as biological protective agents for aquatic products.*

KEYWORDS: *Lactic acid bacteria; Fresh-keeping; Aquatic products*

1. Introduction

The main cause of deterioration of aquatic products is the growth and reproduction of microorganisms,such as putrefaction bacteria or pathogenic bacteria.Putrefaction bacteria mainly include putrefaction Siva, Psychrotrophic pseudomonas spp., Escherichia coli, Photobacterium phosphorescent bacteria, etc.Pathogenic bacteria mainly include Pathogenic vibrio, Aeromonas, Staphylococcus aureus, Escherichia coli, Listeria monocytogenes, Bacillus cereus, Salmonella, etc. Therefore, the fresh-keeping of aquatic products is mainly to control the growth and reproduction of microorganisms in the products. At present, Aquatic product preservation technology mainly include physical method, chemical method and biological method.

Physical fresh-keeping methods include low temperature, air conditioning, ultra-high pressure and radiation, it has high technical requirements and may cause serious consequences.Chemical fresh-keeping methods include adding preservatives, fungicides, and antioxidants, it not onlyeasy residual chemicals and affect people's health, but also promote bacteria to develop resistance.

Biological fresh-keeping method is a non-destructive fresh-keeping technology that USES natural microorganisms or antimicrobial metabolites from plants, animals

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and microorganisms to inhibit putrefying microorganisms and pathogenic bacteria, and has the characteristics of safety and efficiency, less influence on nutrition and sensory characteristics of aquatic products.Biological fresh-keeping method includes enzyme preservation method and microbial preservation method. Microorganisms that can be used in fresh-keeping of aquatic products mainly include lactic acid bacteria and pseudomonas fluorescein.

Lactic acid bacteria is a general term for gram-positive bacteria without spores which can ferment sugars and whose main product is lactic acid. The lactic acid bacteria found in at least 18 genera, a total of more than 200 species.The major lactic acid bacteria used for fresh-keeping aquatic products are Carnobacterium spp. and Enterococcus spp.. They are both found in fish.

Lactic acid bacteria bio-protective agent is natural biological agent which mainly composed of lactic acid bacteria or their metabolites,it has the advantages of high safety and wide range of action.

2. Thefresh-keepingprincipleoflactic acid bacteria

Lactic acid bacteria mainly produces bacteriostatic substances through competition and metabolism to keep fresh aquatic products.Lactic acid bacteria can consume the nutrients needed by harmful bacteria to inhibit their growth and reproduction. At the same time, lactic acid bacteria can also compete for oxygen to form the dominant bacteria group and inhibit the growth of fungal microorganisms. Lactic acid bacteria can produce a variety of bacteriostatic substances in the metabolic process, such as lactic acid, fatty acid, carbon dioxide, diacetyl, peroxide,bacteriocins and nisin etc. They can inhibitthe growth of putrefying and pathogenic bacteriasuch as Escherichia coli, Salmonella, Listeria and so on, so as to prevent the deterioration of aquatic products.

Lactic acid can reduce the pH value of aquatic products, thus changing the growth environment of harmful microorganisms.Undissociated lactic acid can penetrate the cell membrane of harmful microorganisms and reduce the intracellular pH value.Lactic acid can also interfere with metabolic pathways of harmful microorganisms, such as oxidative phosphorylation.

Carbon dioxide can react with the cell membrane of harmful microorganisms, and also lowers the pH inside and outside of their cells,thereby inhibiting microbial growth.

Diacetyl can react with arginine-binding proteinsto inhibit the growth of harmful microorganisms.

Peroxide can oxidize membrane phospholipids and cellular proteins of harmful microorganisms,thus has a bacteriostatic action.

Nisin is a protein complex that ACTS as an antibiotic and inhibits the growth of homologous or heterogeneous microorganisms.

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Bacteriocins are metabolites that have antagonistic effects on homologous or similar species.Bacteriocins have no pathogenic characteristics and no drug resistance, so they have great application value in biological preservation.

The lactic acid bacteria were cultured protectively, it competes with harmful microorganisms in aquatic products, and inhibit harmful microorganisms reproduction and growth, thus the aquatic products can remain fresh.Different from traditional fermentation, the protective culture of lactic acid bacteria does not change the original taste of aquatic products.

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Not all strains of lactic acid bacteria have bacteriostatic activity, and not all strains of lactic acid bacteria with bacteriostatic activity can be used as biopreservative of lactic acid bacteria.Lactic acid bacteria, which can be used as biological preservative, must have the following characteristics: firstly, good antibacterial activity and effective control of harmful microorganisms in aquatic products;Second, add to aquatic products, to meet safety standards;Third, through protective culture, it can not affect the taste and other quality of aquatic products.Therefore, although a large number of lactic acid bacteria strains with bacteriostatic activity have been found, and the number of bacteriocin-producing strains is increasing, few strains can be applied in the preservation of aquatic products.

Different lactic acid bacteria have different inhibitory effects on different harmful microorganisms in different aquatic products. So,different fresh-keeping of aquatic products need to develop different lactic acid bacteriaantistaling agent.For example,Lact. piscium CNCMI-4031 can inhibit the growth and reproduction of b. mosphacta in MAP packed shrimp. Lysozyme and Nisin were consistent with fresh mussel meat and could control the total number of bacteria and volatile salt nitrogen.Nisin combined with sodium lactate inhibited the growth of listeria monocytogenes in smoked rainbow trout.

According to the different treatment methods of aquatic products, the application of lactic acid bacteria preservation can be divided into two categories: one is fresh-keeping of frozen aquatic, the other isfresh-keeping of fresh aquatic products.

2.1 The application of lactic acid bacteria in fresh-keeping of frozen aquatic products

At present, the main application of lactic acid bacteria for biological protection of frozen aquatic products is frozen smoked salmon, and the main control pathogen is listeria monocytogenes.There are many lactic acid bacteria that have been found to inhibit listeria monocytogenes.

Lactic acid bacteria as biological preservatives have strong competitiveness. The lactic acid bacteria used to keep frozen smoked salmon fresh mainly come from the

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intestines of salmon, and the main way to keep fresh is through bacteriocins or bacteriocin-like substance. For example,CarnobacteriummaltaromaticumA9b, Carno bacteriumpiscicola V1, Carnobacteriumdivergens V41, Carnobacteriumpiscicola V1, Carnobacteriumdivergens M35 and Enterococcusfaecium ET05 have a good inhibitory effect on Listeria monocytogenes by bacteriocins; Carnobacteriumdivergens V41and Carnobacteriumpiscicola SF668 have a good inhibitory effect on Listeria innocua by bacteriocin-like substance.

In addition, in fresh-keeping of frozen surimi, Carnobacteriummaltaromaticum CS526 has a good inhibitory effect on Listeria innocua by bacteriocins. In fresh-keeping of MAP frozen salmon, Leuconostocgelidum EU2247 has good inhibitory effect on Listeria monocytogenes and Clostriumsporogenes. In fresh-keeping of VP frozen smoked salmon, Lactobacillussakei Lb790 has a good inhibitory effect on Listeria monocytogenes.

2.2 The application of lactic acid bacteria in fresh-keeping of fresh aquatic products

Robertson et al. isolated a strain of Carnobacterium spp. from Atlantic salmon and found that it has significant inhibitory effect on Vibrio spp. and Yersinia ruckeri.According to Vijayabaskaret al., Lactic acid bacteria have a good inhibitory effect on the Aeromonas hydrophila in Oreochromis mossambicus.

Beatriz et al. studied the bio-preservation of Lactobacillus curvatus BCS35 and Enterococcus faecium BNM58 for fresh fish, These two kinds of lactic acid bacteria are bacteriocinogenic and separated from fish and fish products, They were inoculated into fresh merluccius and lepidorhombusboscii, and were protected culture. The results showed, they all have antibacterial activities againstseveral kinds of spoilage organisms and pathogenic bacteria such as Listeria spp..For some control batches, their cell-free culture supernatants and the lyophilized bacteriocin preparation were added to the food ingredients, the other control batches were not treated in this way.The results showed, bacterial counts were significantly higher than treated control batches, both for merluccius and lepidorhombusboscii.

Mounaet al. studied one hundred sixty psychrotrophic lactic acid bacteriaisolated from wild and aquacultured fresh fish, and founded that most strains are antimicrobial by antibacterial test. The majority of strains can reduce the number of pathogenic bacteria(includingAspergillus flavus, Escherichia coli, Pseudomonas aeruginosa, Listeria monocytogenes, Staphylococcus aureus and Salmonella arizonae) and Gram-negative bacteria (Aeromonas hydrophila , Photobacterium damselae, Pseudomonas fluorescens and Pseudomonas putida) in fresh fish.Among them, 39 strains showed significant antibacterial activity.

In addition, in fresh-keeping of atlantic salmon, the strainsofCarnobacterium spp.have a good inhibitory effect on Aeromonas salmonicida, Vibrio spp. and Yersinia ruckeri. In fresh-keeping of fresh salmon fillet, lactobacilluspiscium CNCMI-4031has a good inhibitory effect on B.thermosphacta and Listeriamonocytogenes. In fresh-keeping of bass and sea carp,the strainsofEnterococcus spp. and Lactobacillus lactis USC-39

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have a good inhibitory effect on Listeriamonocytogenes by bacteriocins II. In fresh-keeping of turbot fish, Enterococcus faecium USC-46 and Enterococcussmundtii USC-51 have a good inhibitory effect on Listeriamonocytogenes and Staphylococcal aureus by bacteriocins;Lactobacillusacidophilus CECT903 has a good inhibitory effect on Vibriopelagius by organic acids. In fresh-keeping of tilapia, the strains of Bacillus spp. have a good inhibitory effect on Aeromonas hydrophila by bacteriocins. In fresh-keeping of Japanese catfish,Lactobacillus lactis has a good inhibitory effect on Aeromonas spp. by Hydrogen peroxide.

3. Conclusions and prospects

With the increasing demands of consumers on food safety and quality, the demand for fresh aquatic products is also increasing.However, pathogenic bacteria and other safety problems in aquatic products have brought great impact to the aquatic product market.Combined with consumers' acceptance level and the actual characteristics of aquatic products, lactic acid bacteria were cultured and prepared into biological preservatives.

Using lactic acid bacteria as biological preservative for aquatic products has a great application prospect. At present, lactic acid bacteria biological preservative mainly adopts soaking method and spraying method. The main obstacles of this technology are the adhesion of lactic acid bacteria on aquatic products and the cross reaction between bacteria and seafood surface materials.

Many strains of Carnibacterium spp. and Enterococcus spp. were used in fresh-keeping of various aquatic products,its biological effects mainly depend on bacteriocins, organic acids and hydrogen peroxide, etc.There are relatively few researches on other metabolites of lactic acid bacteria, such as carbon dioxide, cyclic peptide, diacetyl and other active substances in the field of aquatic product preservation. At the same time, screening more and better strains of lactic acid bacteria that can form hydrogen peroxide and bacteriocins or compete with some spoilage microorganisms for nutrients and ecological niche has potential commercial application value as biological protective agents for aquatic products.

Alfred North Whitehead, for the rest of his life,whether as a British mathematician, educator, or as a well-known philosopher, logician.His theories have influenced and guided the practice of different disciplines with their academic achievements.Whitehead received a good education from childhood and taught at the university after graduation.However, he is not confined to a specific field of study, but has a wide range of interests.He has dabbled in various disciplines and made remarkable achievements.He has made great achievements in many disciplines and he is a really master figure.Whitehead wrote many books in his life, and his works covered many fields and had a great influence on these fields.The so-called situation makes heroes.At the beginning of the 20th century, the largest scientific revolution in Western science took place in history.As a result, some scientific circles and philosophers took place the Copernican Revolution in their thoughts, and gradually began to study the process philosophy based on

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process-relationship.Process philosophy can also be called organic philosophy or organism philosophy.The thought of process in this paper is embodied in Whitehead's masterpiece Process and Reality.The general characteristics of process philosophy are process and relationship.Whitehead's process philosophy holds that the world can not be reduced to material entity or spiritual entity in essence, but a dynamic process, a process of continuous generation.Not only the world is like this, but also everything in the world is like this.All existence will become reality and process.Whitehead's process philosophy has subverted the traditional philosophy characterized by static entity and structure in the West, which has occupied an absolute position in modern times, by means of criticism, and at the same time, it has continued the views of organic connection and endless growth in the eastern and western philosophies by means of inheritance and development.The internal motive force of process philosophy is the way to study the change of human experience and the fundamental nature of things in the dynamic universe.As a revolutionary change in the history of Western philosophy, we believe that we will be able to find a new cosmology and world outlook from Whitehead's process philosophy, which is different from other philosophical schools.

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