

Application of Food-Grade Enzymes, Bacteriocins and Probiotics as Biological Food Preservatives

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Abstract

The demand of the consumers tends to be artificial additive-free, long foods of shelf-life, nutritious, ready-to-eat foods. The significance of the natural and food preservatives compounds is totally increased for the excessive use of the preservative compounds in the food rather than the synthetic compounds. The bacteriocins combine with the several modes of hurdle approach that can enhance the effects of the preservatives and reduce the resistance of the antimicrobial. The probiotic products enhance the health agents because they regulate inflammation inside the gastronomical tract, and it also has the functional effects that are immune. The bacteriocins are the antimicrobial compounds and they are considered biological preservatives or natural preservatives. These are having bacteriostatic effects and it shows the spectrum of the antimicrobial activity that is against the bacterial strains. The bacteriocins unlike the antibiotics are more specific and they can kill the pathogens by not causing any detrimental imbalances for hosting the microbiota. The safety of the Lb. plantarum runs through several beneficial claims in order to understand the related features of the probiotic. The effect of the usage of probiotics and essential oil is much lesser than that when used combined. This study is focused on the natural preservatives of the food grade enzymes, the main application of the bacteriocin in biological food preservatives and the use of the probiotics in the food preservatives.

Keywords

E. coli, Listeria, Lactobacillus casei, Lb. Plantarum, T. polium.

INTRODUCTION

Additive preservatives are a substance that is used for preventing the undesirable changes in food during transportation and the storage. The preservatives are totally divided in three groups, and they are antioxidants, antibrowning and antimicrobial agents.

The bacteriocin is the natural antimicrobials that consume through the fermented foods for millennia and it is focused on the renewed effects for identifying the novel bacteriocins and their microorganism. These are used as biological food preservatives and their applications. The role of the bacteriocins as the food bio preservatives is to gain credibility as the health modulators for regulating the microbiota and it is strongly linked with the wellbeing of the humans ([3]. 2020). The probiotics in food products are used for improving the nutritional value of biological products.

MICROORGANISMS AND THEIR METABOLITE FOOD-BASED PRESERVATIVES

Bacteria fabricate several compounds that are used for preventing the potential spoilage or the development of pathogenic microorganisms. The microorganisms found in food-grade enzymes form enormous numbers of several different substances that hamper the other microorganisms. The features of the bio preservation of the food-grade enzymes are totally different from the antimicrobial compound and also in the form of a compound that consists of protective cultures, purified compounds, and fermentates ([7]. 2021). The microbial cultures of the culture are used for the fermentation of the food for obtaining stable products. The cultures of the microbes are used for food production that is called the protective cultures. The protective culture enhances the sensory and nutritional characteristics, and it also provides safety and durability. The protective culture is having the potential for improving the safety of the microbial of the food. Therefore, this culture is regard as additional safety. Hence, the lactic acid bacteria (LAB) have the total capacity in inhibiting the growth of the microorganism and they are present in several food products. Moreover, for several years the LAB is used for the production of fermented foods for providing the texture of the food, flavour, and desired taste of the food ([11]. 2018). It is also used for preventing the growth and development of pathogenic organisms. The production of organic acid is a significant role in the culture of LAB in meat. The organic acid causes the reduction of the pH that inhibits the pathogenic bacteria and spoilage.





The bacteriophages are used as the biocontrol agents in the food, and it is used on seafood products for the bio preservation that is less documented than in the meat or dairy products. Moreover, the natural spices and the herbs are having the preservative activity that is depending on the nature, concentration, and type of the organism. The spices and the herbs contain the volatile chemicals, and these type of chemicals are taken out by several methods that are used in the production of the preservatives. However, it is seen that the plant extracts and the plant oils are used for the agents of preservation of food and agents of medical therapy.

BACTERIOCINS AS BIOLOGICAL FOOD PRESERVATIVES

The bacteriocins are having the optimum potential as the bio preservatives that are protected for utilisation, "have several minimal effects on the human microbiota, are effective against the food pathogens or the spoilage of the microorganisms and it is stable for the food matrix". It might require resistance to the heat, enzymes associated with food, and ph. The bacteriocins are added to the food in three several ways and they are i) preparation of the pure bacteriocin, ii) the bacteriocin containing the fermentates, and iii) the bacteriocin is producing the cultures. Nisin is the bacteriocin that is produced by some of the strains of the Lactococcus lactis ([8]. 2021). Nisin is mostly used as the bacteriocin as the natural preservatives and it was the first preservative that is used in cheese and several dairy products, poultry, kinds of seafood, meat and also in the beer and wine industry.



Figure 2: Bacteriocins in biological food products (Source: [8]. 2021)

The bacteriocin that contains the food-grade fermengates are commercially accessible and is mostly used in the food industries. The bacteriocin is producing the cultures that are used as the starter cultures that serve the dual purpose because they provide preservation and fermentation simultaneously. Moreover, they can contribute to food safety and the flavour of the food. The examples include the Bactoferm range that contains the sakacin and pediocin that produce strains and is used in making cured dry meat and the fermented sausages and also the protective cultures of HOLDBAC. Moreover, it contains a mix of the bacteriocin to produce a strain that is used in protecting seafood, dairy products, and meat from moulds, yeast and Listeria ([9]. 2019). In the current scenario, the novel bacteriocins that are potential as the food preservatives that include the plantaricyclin A, the circular bacteriocins that are produced by isolating the Lactobacillus Plantarum.

USE OF PROBIOTICS IN BIOLOGICAL FOOD PRODUCTS

A variety of fermented products like dried food are produced in several countries. The fermented dried and fresh milk product is produced widely in rural areas, and it consists of full fat and low-fat yogurt. Therefore, the probiotic products are used to enhance the health agents as they regulate down the inflammation inside the gastrointestinal tract and are immune to the functional effects ([10]. 2017). There are several species of LAB that are organized as probiotics that possess significant traits like the total production of the organic acids and the bacteriocins, adhesion of the host cells, and the resistance to heavy metals and antibiotics. The number of the native plasmid encodes these traits of probiotic that is sequenced from L. Plantarum. The context of growing interest in cosmetic products, functional foods, and emulsified products like lotions and dressings is proposed in delivering plant extracts and probiotics with biological properties. It is due to the daily consumption and the application of the skin respectively ([5]. 2019).



(Source: [5]. 2019)

Despite these positive effects, the emulsified products that are containing the water are too much prone to microbial growth. The safety regarding the synthetic preservatives stimulates the total development of the antimicrobial ingredients for the food preservation or for the cosmetic products. Moreover, besides the direct addition for the antimicrobial biomolecules, total addition of the bioprotective bacteria like the LAB and the plant extracts in



the process of food preservation and cosmetic emulsions. The applications of the principles of difficult technology, selection of LAB, the antimicrobial metabolites in several phases of the process of emulsion, extracts of the plants on the stability in the process of emulsion, and the effect of the LAB for tackling the total process. The other function which requires to be underlined is the capabilities of the Lb. Plantarum for the production of potent and diverse bacteriocins, that are the peptides of antimicrobial with the possible applications of the agents antibiotic complimentary and food preservatives. Moreover, all the characteristics that are designed Lb. plantarum as an authentic model of the agents of biological and academic research with promising applications ([6]. 2020). Hence, it is significantly better to take the advantage of the synergistic effect of the probiotic and the essential oil together.

DISCUSSION

According to figure 1, the addition of the T. polium EO in several different concentrations in different samples significantly increases the count of L. casei during the time of storage that is 20 days ([12]. 2021). Moreover, the effect of combining the probiotics and the extraction of the medical plant might be the new and latest approach for their complementary effects of antimicrobial and practically it has no side effects.



Figure 4: Survival of the Lactobacillus casei after the storage of 20 days at 4 degrees C (Source: [12]. 2021)

The figure shows that there are three samples that are the sample B contains the probiotic kick with no EO added, sample E contains probiotic kishk with 75 mg/l EO and sample F contains the probiotic kishk with 150 mg/l EO. Moreover, it is observed that several strains are having different sensitivity for the essential oils (EO). There are several studies showing the stability of the LAB against the EO when compared with the other pathogens. The essential oils may maximize the development and growth of other organisms ([2], 2019). The kishk contains the probiotic bacteria that is without the essential oils that is having the lowest total count of L. casei. The T. polium has several;

effects on essential oils on the viability of L. casei that are significantly different in the concentrations of 150 mg/l and 75 mg/l.

The antibiotics that are used in the animal husbandry are for treating the injections, improving the food efficiency, and prevention the disease ([1]. 2018). Antibiotics are used for the production of global food to meet the demands growing for animal protein and surpass the consumption by humans. The bacteriocins are the type of antibiotics that kill the pathogens by not causing any detrimental imbalances to the microbiota. This research will provide more evidence that the production of the microbiota provides positive subtle changes at the lower levels of taxonomic. Moreover, it maintains the desirable gut of the microbiota and they are much more beneficial for the host.

This research also presents the natural preservation of the animal, plant, and the microbial origin and also their uses in the products of the seafood for maintaining their quality ([4]. 2018). Several biological preservatives of the food grade enzymes are used for several types of food, and it also concerns the total safety of all the preservatives that have never decreased.

CONCLUSION

From the above research, it is to conclude that, the natural preservatives encourage the food industries and food researchers for finding more natural and effective food products. Moreover, for finding the natural preservative for the food grade enzyme, the active ingredients are to be correctly identified and determine the food protective effects. These food grade enzymes can protect the human body from various type of infection that may create a negative impact on the health condition of the human, and they are the significant contributors to the prevention of the healthy food loss and nutrition. The bacteriocins are versatile antimicrobials with potential and use as the antibiotic alternatives, bio preservatives, gut modulators of promoting health and promoters of animal growth. The incorporation of increase consumption of antibiotics, in the production of food and medicines, has been recognized as the main cause of the disruption of the microbiome and the selection for the transfer and accumulation of the registering genes within the population of microbial of the human gut. The research also confirms that the essential oils of T. polium and the probiotic fermentation reduced the population of E. coli during the time of storage. The complex effect of the essential oils of T. polium and the probiotic is much stronger than by using them as an individual application.

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