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Research into the application of new technologies and materials in food processing

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Abstract: *These new technologies and materials play an important role in improving the shelf life and storage capacity of foods, and are an effective means to achieve the production of natural fresh foods, which are welcomed by food companies and will certainly promote the rapid development of natural fresh foods.*

Keywords: *food processing; new technologies; new materials; applications*

1. Introduction

The freshness and safety of food has always been a major concern for consumers. Traditional chemical preservative techniques have to a certain extent solved the problem of food preservation, but they also pose food safety risks. In recent years, as people become more ecologically conscious and their needs become more diversified, natural preserved foods have become a popular choice for consumers. The use of natural preservation techniques and materials to keep food fresher for longer periods of time is of great significance to the food industry.

Biological preservative technology can be used to inhibit the growth of microorganisms and achieve natural freshness.

2. New technologies in food processing

2.1 UHP processing technology and applications

UHP technology uses the high pressure generated by the UHP unit to destroy the cell membrane and internal structure of bacteria, moulds, yeast and other microorganisms to achieve sterilisation and disinfection. The UHP treatment of food products maintains the maximum freshness, nutrient content and original form. This technology is used for the sterilisation and storage of fruit and vegetable juices, bakery products, dairy products, seafood etc. It can extend the shelf life of food for 30-90 days without deterioration.[1]

2.2 Electric field pulse technology

The electric field pulsing technique uses short bursts of high intensity electric field pulses to destroy the integrity of microbial cell membranes for the purpose of sterilisation. Compared to heat treatment, this technology causes minimal damage to the food, effectively killing both resting and active microorganisms and extending shelf life. It is suitable for the sterilisation of heat sensitive foods such as fruit and vegetable juices, alcoholic beverages and dairy products.

2.3 Microwave technology

Microwave technology uses the electromagnetic field generated by microwaves to create a microthermal effect on water molecules and other charged ions to accelerate the heating process of food. This technology is fast and efficient and can be used for food baking, quick-freezing, thawing and sterilisation. It is particularly suitable for the processing of high moisture foods and can significantly reduce heating time and increase production efficiency.

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2.4 Ultrasound technology

Ultrasound technology uses high frequency mechanical vibration waves through air or liquid media to cause physical and chemical changes in food. It can be used to emulsify, extract, sterilise, accelerate chemical reactions and improve drying. Ultrasonic technology is an efficient and clean means of processing, as it causes minimal damage to the food and is easy to control. It is mainly used for the processing of liquid foods and dispersion systems.

2.5 Directional culture fermentation technology

Directional culture technology is used to control fermentation conditions to select specific functional strains of microorganisms for food fermentation production. It is commonly used in the fermentation of dairy products by lactic acid bacteria to produce fermented products with specific flavours and in the fermentation of brewer's yeast to produce beer with characteristic flavours. This technology allows the production of high quality fermented foods with consistent flavour.[2]

2.6 Membrane separation technology

Membrane separation technology uses semi-permeable membranes to separate substances according to their molecular weight or ionic nature. This technology is simple to operate and causes little damage to foodstuffs, and can be used for the concentration of fruit juices, the separation of yoghurt and the separation of soybean proteins. It is particularly suitable for the processing of heat-sensitive foods and foods with fragile textures.

2.7 High pressure preparation techniques

High-pressure preparation technology uses high pressure devices to alter the rate and equilibrium of chemical reactions in food products and to adjust the texture and properties of food products. It is commonly used for food dehydration, tenderisation, enzymatic denaturation, antioxidation, etc. It can be used to prepare fruit purees, cooked meat products and fermented foods. The technology is simple and efficient, and is a potential green food processing technology.

2.8 Electrically infiltrated flow technology

The electro-impregnation flow technology uses electric field forces to promote the migration of trace ions in food, accelerating the process of food permeation and diffusion. It can be used for food dehydration, tenderisation and enzymatic denaturation to maximise the retention of the original colour, aroma and flavour of the food. Simple, clean and efficient, it is an innovative food processing technology for a wide range of liquid and semi-solid food products.

3. New materials in food packaging

3.1 Active packaging materials

Active packaging materials contain oxygen adsorbents, carbon dioxide generators, moisture inhibitors and other active substances, which can actively improve the internal gas composition of the packaging, to extend the shelf life of food. For example, oxygen adsorbents can absorb oxygen inside the packaging to prevent food oxidation; carbon dioxide generators can generate carbon dioxide gas to inhibit the growth of bacteria. The application of active packaging materials can be used without modifying traditional packaging equipment, which is simple and easy to implement.[3]

3.2 High oxygen barrier materials

High oxygen barrier materials to PVDC, EVOH and other high barrier polymer materials made of plastic film, used to make high oxygen barrier packaging. These materials have a very low oxygen permeability coefficient and can effectively prevent the migration of oxygen through the packaging material to the food in the package, acting as a barrier to oxygen. They are used in food packaging where the oxygen content needs to be strictly controlled.

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3.3 Biodegradable plastics

Biodegradable plastics such as PLA, PHA and other plastics made from biological resources are completely biodegradable. The degradation process does not produce any harmful substances, which makes it more environmentally friendly. They can be used in disposable food packaging, which is conducive to the recycling and disposal of food packaging waste.

3.4 Intelligent trimming of plastics

Intelligent modification of plastics is in the traditional plastic base material added with antibacterial agents, fragrance additives, smooth additives and other substances, to give it antibacterial, adjust the smell of the packaging, improve the smoothness of the surface and other new functions. This new type of modified plastic can maintain the original packaging performance on the basis of the freshness of the packaging contents or use performance to meet different packaging needs. They are used in a variety of food and consumer goods packaging.

4. New technologies and materials in preserved food

4.1 MAP technology

MAP (Modified Atmosphere Packaging) technology uses different gas ratios, such as high nitrogen and low oxygen or high nitrogen and low oxygen and high carbon dioxide, to extend the shelf life of food products in a sealed package. MAP technology is commonly used in the packaging of perishable food products such as meat and aquatic products, which can extend the shelf life of food by 2-3 times.

The application of MAP technology requires the use of oxygen-proof bags made from high oxygen barrier packaging materials and gas packaging machines. The gas packaging machine is used to replace the gas inside the bag with the required composition and ratio before sealing the package, and then the food is sealed to achieve freshness and quality. This technology is simple and easy to use, with little impact on food quality, to achieve the purpose of natural preservation, favoured by food manufacturers.

4.2 Active packaging

Activated packaging uses oxygen adsorbents, carbon dioxide generators and other active substances added to packaging materials to actively regulate the gas composition of the package to achieve the purpose of preservation. For example, the use of oxygen adsorbents to absorb oxygen generated in the packaging, to inhibit the oxidation of food deterioration; the use of carbon dioxide generators to produce carbon dioxide gas, to inhibit the growth of bacteria, to extend the shelf life.

Compared to MAP technology, active packaging technology is simple and easy to implement using existing packaging equipment, reducing investment costs. It is mainly used to preserve the freshness of McDonald's food, baked goods and puffed foods. This natural and environmentally friendly method of preserving freshness is very popular with consumers.

4.3 Storage temperature control techniques

Storage temperature control technology refers to the use of insulation materials designed for transport packaging or storage containers, can actively control the storage temperature of food, to ensure that the food fresh. Commonly used insulation materials include polyurethane foam, calcium silicate, isothermal materials, etc.

Polyurethane, for example, has a pore structure and a low foam density, and has good thermal insulation properties. It can be used in food packaging or storage boxes, for example, to effectively control temperatures and enable cold chain transport and storage. This technology is widely used in the transport and storage of frozen food, live food and refrigerated food to ensure maximum freshness and safety.

4.4 Biopreservation techniques

Biopreservation technology uses natural antimicrobial substances such as lactic acid bacteria and proton chemical antimicrobial agents in food or food packaging to inhibit the growth and reproduction

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of microorganisms in food and to extend the shelf life of food.[4]

Commonly used biological preservatives include lactic acid bacteria, lactam and whey protein. For example, lactic acid bacteria can promote lactic acid fermentation and produce lactic acid to inhibit bacterial growth; lactams and other compounds can produce antibacterial effects and delay food spoilage. These natural biological preservatives can effectively inhibit a variety of food microorganisms such as Gram-positive and Gram-negative bacteria, and have the advantages of being natural, safe and broad-spectrum antibacterial.

Biopreservation is a simple and gentle process that does not affect the colour, aroma or taste of food and is highly sought after by consumers. It can be applied to a wide range of food products such as meat, bakery products and dairy products, and can extend the shelf life of food products by 1-2 times. This is a highly effective natural preservation technology with great potential for development.[5]

In summary, the application of new technologies and materials has led to an increasing variety of natural fresh food processing methods. MAP technology, active packaging, storage temperature control technology or biological preservative technology can be selected according to the characteristics of different foods to achieve precise temperature control and anti-bacterial preservation purposes, significantly improving the shelf life and storage and preservation capacity of food. These technologies are simple and easy to implement, and are favoured by food manufacturers, and will certainly promote the rapid development of the natural fresh food market.

5. Conclusions

The market for naturally preserved foods has great potential due to its high quality, safety and environmental protection, as well as its nutritional and health benefits. New technologies and materials provide more options for the sustainable preservation of food products, making it much less costly and difficult to manufacture naturally preserved food products. Food companies should increase the application of new technologies and materials in their product development and launch more high-quality natural fresh food products to meet people's needs. It is believed that in the near future, natural fresh food will become the mainstream of the food market.

References

[1] Wu Jing. Impact of new food processing technologies on food nutrition [J]. Journal of Food Safety, 2022(30):186-188+192. DOI:10.16043/j.cnki.cfs. 2022.30.019.
[2] Wang Yuqi. Research on the application of new technologies in food processing [J]. Food World, 2018(10):124-127.
[3] Huang Zhihao. Advanced technology in food processing [J]. Food Industry Science and Technology, 1987(04):50-54. doi:10.13386/j.issn1002-0306.1987.04.011.
[4] Zhou Xiuqin. New applications of biotechnology in food processing [J]. Science and Technology Today, 1993(07):27.
[5] Zhai Y, Cui L, Zhou X,et al. Estimation of nitrogen, phosphorus, and potassium contents in the leaves of different plants using laboratory-based visible and near-infrared reflectance spectroscopy: comparison of partial least-square regression and support vector machine regression meth[J]. International Journal for Remote Sensing, 2013, 34(7):2502-2518. DOI: 10.1080/014311 61.2012.746484.