

## Original Paper

# Development Status and Business Solution of Ultra-high Pressure Food

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### Abstract

*Ultra-high pressure food processing technology refers to the technology of sterilizing food under thousands of atmospheric pressure without destroying the properties of food raw materials. Japan is a world leader in HPP technology. Significant achievements have been made in experimental equipment, production equipment, processing, sterilization and preservation of ultra-high pressure technology. Almost all natural, safe and healthy HPP food jams and fruit juices have been commercialized. Germany, the United States, France, the United Kingdom and other countries are also unwilling to fall behind, they are scrambling to carry out research on ultra-high voltage technology and have achieved industrialization results.*

*China's research on food ultra-high pressure technology started late. After nearly ten years of technical digestion and research, the research results have been achieved in stages, but there is still a large gap compared with developed countries. This article outlines the application of HPP technology in food processing, briefly analyzes the development of HPP food technology in China today, and establishes a cold chain supply chain model to identify problems and propose certain countermeasures, with a view to addressing HPP technology in food and chemicals industry.*

### Keywords

*Food, ultra-high pressure technology, cold chain, supply chain*

## 1. Raise Research Questions

With the continuous development of the agricultural product processing industry and the continuous updating of people's consumption concepts, the importance of preservation of agricultural products, especially green preservation, has become increasingly prominent. Various fresheners, fresh-keeping films, fresh-keeping equipment and new technologies came into being, greatly improving the quality of

agricultural products, reducing the losses of agricultural products, increasing the production efficiency of agricultural products, and promoting the development of agricultural products processing. However, green fresh-keeping materials, fresh-keeping equipment and fresh-keeping technology are still relatively scarce, and there is still a big gap between people's requirements for green consumption. Therefore, in order to obtain healthy, hygienic, and durable technical methods, people have been exploring and researching for a long time. The key to preservation technology is to inhibit microbial activity and even kill microorganisms. The birth of ultra-high pressure technology has brought unlimited possibilities for freshness preservation. Due to the pure physical method and cold sterilization, the original flavor, color and nutrition of the food are hardly changed, so it has attracted the attention and attention of all countries, especially developed countries.

For a long time, the processing methods of food and fruit juice products in China have been mainly heat sterilization or canning. The emergence of ultra-high pressure food processing technology is catering to people's demand for high-quality, high-nutrition food, and has also triggered a new era for the food industry revolution. What follows is that the localization of equipment and the corresponding cold chain logistics design research have become bottlenecks in the application of ultra-high pressure technology. Such bottlenecks will increase the entry barriers for food companies to develop ultra-high pressure foods, and solving bottlenecks can help food companies improve their core competitiveness. The application of the cold chain supply chain will also be upgraded from traditional warehousing to a comprehensive one-stop solution covering the entire value chain. This article will use the cold chain supply chain model to find the influencing factors, so as to fill the gaps in the application management of the cold chain supply chain of ultra-high pressure food technology. At the same time, it will play an important role in improving the competitiveness of products and services of domestic and foreign food manufacturers.

## 2. Literature Review

In order to discuss the dilemmas and problems encountered in the application of ultra-high pressure technology, study the influencing factors of the application value chain of ultra-high pressure food technology, and put forward specific suggestions from the aspects of application chain management of cold chain supply of ultra-high pressure food technology, this section will combine The existing cold chain supply chain theory is connected with the current actual situation of the development of ultra-high pressure food technology, and provides a theoretical basis for the development problems and solutions of the application of ultra-high pressure food technology, and puts forward hypotheses on this basis.

Basak and Ramaswamy (1998) studied the effect of high pressure processing on the firmness of different types of vegetables and fruits, and pointed out that hardness and firmness are also key indicators for measuring ultra-high pressure processed fruits and vegetables. The solution of cold chain logistics after high pressure treatment has a great impact on the quality and texture of fruit and

vegetable foods. To understand these dynamic changes and influencing factors, a corresponding cold chain temperature and humidity control is designed to evaluate the quality of high pressure processed fruit and vegetable foods. And texture, the dependent and independent variables in the supply chain model can be established. Ahmed (2005) proposed that food packaging should be adapted to food processing technology. Ultra-high pressure processed foods require flexible packaging, and can't be packed in tin can glass products. Flexible packaging suitable for ultra-high pressure food processing includes polyethylene (PE), polypropylene (PP), ethylene vinyl alcohol copolymer (EVOH) or composite PE / polyamide (PA), EVOH / PE, PP / EVOH / PP, PMPE And other packaging materials. At the same time, the packaging materials must be suitable for the temperature and humidity requirements of cold chain transportation to prevent the flexible packaging from breaking.

According to Matser (2008), after the fruits and vegetables are processed by ultra-high pressure, the color does not change during storage. After one or two months of storage, the color is still acceptable. Therefore, by studying the high-pressure treatment of different processes, storage and cold-chain logistics transportation of fruit and vegetable food pigments and some factors that affect the mechanism have important significance for high-pressure treatment of fruit and vegetable foods. The cold chain solution can make fruit and vegetable products not only maintain flavor but also maintain color through temperature and humidity control, which is of great significance for the off-season storage and sales of vegetables. However, there is no satisfactory answer on how to achieve the freshness-preserving effect of food after ultra-high pressure processing through a reasonable cold chain design. Xiao (2006) and others mentioned the calculation of fresh produce for long-distance transportation based on the CIF price. This type of fresh food is highly perishable, and during the long-distance transportation and sales process, it faces the risk of reducing the freshness of some products; and the freshness of products directly affects the final market demand. Therefore, considering the characteristics of long-distance transportation of ultra-high pressure food, how to manage cold storage inventory, guide and control demand through appropriate strategies, achieve effective matching of food supply and demand, overcome hidden dangers of food safety, and increase profits. A challenge commonly faced by upstream and downstream companies in the food supply chain.

Based on the existing literature research, it can be found that the research on the development of ultrahigh-pressure technology is relatively mature and involves many factors. The literature research on the development strategy of existing ultra-high pressure foods mainly focuses on the physical and chemical properties of the ultra-high pressure foods, such as color and aroma and shelf life Some of the current status and problems are explained, and the impact of the cold chain logistics model on the development of ultra-high pressure food technology has not been comprehensively and systematically studied. Therefore, this research will attempt to analyze the development strategy of ultra-high pressure food technology from the perspective of application management of the cold chain supply chain. Based on the actual cold chain data in the production and logistics supply chain process of food companies, an analysis and investigation will be conducted to understand the current situation. The development of

China's ultra-high pressure food technology, so as to provide logistics solutions for ultra-high pressure food, will play an important role in improving the core competitiveness of Chinese agricultural products companies.

### 3. Research Method

Guided by theories such as economics, this research uses behavioral research, case studies in field research, design empirical research, laboratory research, and analysis of second-hand data to establish a supply chain model through causality theory to find change factors. The technical route includes the research methods and key control points in this project. First put forward research questions, then establish the hypotheses of the research questions through literature reading, and verify the accuracy of the hypotheses based on the collection and analysis of experimental data and secondary data. The experimental method is based on the actual cold chain data and simulated laboratory data in the production and logistics supply chain of the food company, which guarantees the validity of the data. At the same time, according to the type of ultra-high pressure food produced by the enterprise, a questionnaire survey was determined to understand the relationship between customer satisfaction and cold chain solutions. Since the research sample is the carrier of the cold chain supply chain and the food produced by ultra-high pressure, the key technology involves the application of ultra-high pressure sterilization technology in food production and storage. The key is the advanced level of domestic ultra-high pressure equipment. At the same time, cold chain equipment and design solutions are also key technologies in this project.

### 4. Development Status of Ultra-high Pressure Food

For a long time, the main processing methods of Chinese fruit, vegetable and fruit juice products are heat sterilization or storage in a pot. The fatal disadvantage of using these methods is that heat treatment not only sterilizes, but also changes the taste, flavor and other characteristics of the food. More importantly, the nutrients and vitamins in the food are destroyed and lost a lot. With the development of science and technology, people have researched and developed a variety of new food processing and storage methods. Food high-pressure processing technology is considered the most promising processing method. The emergence of ultra-high pressure food processing technology has satisfied people's demand for high-quality nutritious food, and has also triggered a new revolution in the food industry. What follows is that the localization of equipment and the corresponding cold chain logistics design research have become bottlenecks in the application of ultra-high pressure technology. Such bottlenecks will increase the entry barriers for food companies to develop ultra-high pressure foods, and solving bottlenecks can help food companies improve their core competitiveness.

Color, taste, and texture are important quality characteristics of vegetables, fruits, meat, and seafood. They are also the main factors affecting the sensory quality of food and the acceptance of the food by customers. People use various processing methods, which not only increase the appetite and

palatability of vegetables, fruits, meat and seafood, but also extend their shelf life. Because the high-pressure processing method has a small effect on the covalent bonds of food, so that its impact on the nutrition and texture of the food is minimized, the high-pressure processing is a valuable choice for traditional food processing and preservation methods. However, there is no satisfactory answer on how to achieve the freshness-preserving effect of food after ultra-high pressure processing through a reasonable cold chain design.

## **5. Problems with HPP Food**

### *5.1 Technical Obstacles*

Foreign developed countries, such as the United States, Japan, and the European Union, have invested a lot of money in systematic research on high-pressure processing technology and equipments for many years, but there is still no mature theory and technology on cold-chain logistics solutions for ultra-high-pressure processing food. At the same time, the research on cold chain logistics solutions for ultra-high pressure processed foods is a very complex system engineering. Its content includes the intersection of management, operations research, mechanical materials and food science. To complete this research, multi-disciplinary experts are required to form a collaborative research team. In addition, China's research on high-pressure sterilization equipment is doctrine, and it is still in the research stage. Different food material systems have different sensitivities to high-pressure sterilization technology. Specific research on cold chain logistics of different material systems is required, so the research workload is large. These are the main technical obstacles that this topic faces in the research.

### *5.2 Incomplete Cold Chain Logistics Infrastructure*

Most domestic cold chain logistics companies have problems with outdated equipment and untimely technology updates. The temperature and humidity of refrigerated trucks lack professional maintenance personnel, and they still rely on manual settings and maintenance and guarantee of subsequent facilities and equipment. From output to consumers, the most important thing is to maintain freshness and quality. The above-mentioned infrastructure problems will have a greater impact on the transportation process of ultra-high pressure food, and it is difficult to achieve fresh and high-quality food for consumption Hands.

### *5.3 Weak Brand Awareness among HPP Food Companies*

Domestic ultra-high pressure food companies have not standardized the names, packaging and logos of ultra-high pressure foods, promoted market awareness and recognition of product brands, increased the value of ultra-high pressure foods, guaranteed product quality, and improved corporate management, etc. Food sales and other favorable aspects are not well understood, and the strategic awareness of establishing a corporate brand has not yet been established. The main consumer bodies facing domestic ultra-high pressure food companies are mainly the domestic market. Domestic consumers have low awareness and awareness of the brand of ultra-high pressure food. Therefore more consumer testing will be done to improve HPP foods products awareness.

#### *5.4 Enterprises Lack Cold Chain Logistics Management Talents*

At present, most domestic ultra-high-voltage companies employ general managers to carry out cold-chain logistics business. Such personnel are familiar with traditional product logistics business. They have little knowledge of ultra-high-pressure cold-chain logistics business and are still in the exploration stage. Business operation processes are slow. In addition, due to their familiarity with the business, these management business personnel are more inclined to focus on the traditional logistics model that they are good at. Due to the lack of talents in the cold chain logistics of ultra-high pressure food, it is more difficult to find target customers in the domestic market development, and it is more difficult to expand the market. On order to solve the constraint, it is better for the enterprises, universities and research organization to set up the strategic alliance.

### **6. Strategic Recommendations for HPP Foods**

#### *6.1 Establishing a Collaborative Mechanism for Ultra-high Voltage R & D, Production and Logistics*

First, set up a multi-disciplinary expert research team and rationalize the division of labor according to their respective advantages and foundations. Second, focus on “HPP food cold chain supply chain research as the core” to carry out key research to break through obstacles and provide applications for HPP food. Guarantee; choose a representative typical fruit and vegetable food material system, and carry out a systematic study of cold chain logistics for its respective material system characteristics. For example, choose pomegranate juice from Xinjiang, Sichuan pickled pepper claws, ultra-high pressure rice and vegetables.

#### *6.2 Improve the Comprehensive Capabilities of Cold Chain Logistics Companies*

There are a large number of ultra-high pressure food companies in China, and there is a great demand for cold chain storage, transportation and distribution. Domestic third-party cold-chain logistics enterprises should make full use of the development space, continuously introduce large-scale foreign cold-chain logistics enterprises, and actively promote the development of the cold-chain logistics industry. The high management level, low transportation loss and high information level of logistics companies can both reduce the cost of ultra-high pressure food companies and improve the quality of ultra-high pressure food.

#### *6.3 Adopt an Omni-channel Retail Model*

The all-retail model is considered to be a new business format that can break the traditional online and offline models, while the fresh sales and consumption model is the category that best meets the development of the new retail model. Whether it's online delivery or offline dine-in, what's sold is no longer simply a commodity but a service. The core of its role is convenience. This convenience will promote changes in people's lifestyle. If the vitality of this model is guaranteed, it will make the scene of ultra-high pressure food consumption no longer limited to farmers' markets and supermarket chains. Providing goods and services also provides a way of life. The composite of business brings the coverage of the scene. The multi-channel sales positioning is restaurant + supermarket + distribution.

The theme of food is around the experience, which almost covers most of the consumption habits.

#### 6.4 Improve Talent Team Building

The development of ultra-high pressure food requires various talents such as ultra-high pressure food research and development, cold chain logistics, and a single professional has a limited role in the development of ultra-high pressure food. Enterprises should, in accordance with the enterprise development strategy, regulate their own development needs through various channels and methods, determine the types of talents needed, and cultivate comprehensive professional talents. HPP food companies should introduce professional cold chain management talents to better adapt to the current changes in logistics methods, promote the changes and upgrades of enterprise logistics methods, and bring broader space for enterprise development.

### 7. Conclusion

In this paper, by combing the development status of ultra-high pressure foods, applying a supply chain model to study the innovation of cold chain management methods from the relationship between independent variables and dependent variables of influence factors, and combining the practical results during a visit to the production base of ultra-high pressure products, we found the current Problems with cold chain logistics for HPP foods. The contribution of this research is to achieve the integration of HPP technology and the business model.

The survey found that the current high-pressure food industry has high technical barriers, imperfect cold-chain logistics infrastructure, weak brand awareness of ultra-high-pressure food companies, and lack of cold-chain logistics management talents. Therefore, ultra-high-pressure food companies need to increase investment in research and development, establish a coordination mechanism for ultra-high-pressure R & D, production and logistics, improve the comprehensive capabilities of cold-chain logistics enterprises, achieve large-scale management and transportation, improve customer experience, and adopt modern science such as multi-channel marketing. Marketing methods, while promoting ultra-high pressure food, continue to increase the consumer awareness of Chinese ultra-high pressure food.

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