Research on Fresh Products for Fresh E-commerce

Qun Dai¹, Can Yang¹, Shujing Zhang¹ and Wanrong Zhang¹*
¹Transportation Logistics Engineering Department, Shandong Jiaotong University, Jinan, Shandong Province, China.
*1937145321@qq.com

Abstract. At present, opportunities and challenges coexist in the development of e-commerce industry, which develops rapidly, but there are also many problems. Among them, the offline cold chain logistics that puzzles fresh e-commerce has not been a good solution, the key reason is that there are too many uncontrollable factors of logistics distribution, storage and fresh, and lack of high quality cold storage to meet the needs of e-commerce. This paper analyzes a series of problems of cold storage from the aspects of temperature, space location, packaging design and distribution. Finally, we can solve these problems through temperature control technology, bar code technology and advanced cold chain technology.

1. Introduction
At present, the packaging of fresh e-commerce products is complex, cumbersome, numerous and costly, which is not conducive to resource conservation and environmental protection. Fresh e-commerce enterprises through big data statistics to define the most commonly used packaging size specifications for production, on the packaging installed RFID electronic labels, set up a specific website, enterprises, products, logistics, consumers for real-time connection. After the product arrives at the destination, the user can notify the e-commerce enterprise and the express delivery enterprise through the website to carry on the recycling to the fresh e-commerce product packaging. This not only reduces the waste of consumables, reduces the cost of enterprises, but also achieves the effect of green environmental protection[1]. At present, most of the logistics enterprises still focus on manual picking, with high labor intensity and low efficiency, picking speed is the main problem.

2. Analysis on the Problems in Transportation of Fresh Products

2.1. Analysis of Temperature Control Problems
Classification and sub-regional storage of fresh products according to special storage requirements of temperature and environment[2]. For fresh products e-commerce logistics warehouse, the general use of three-temperature warehouse. The three-temperature reservoir contains three temperate zones: normal temperature zone, refrigerated zone and frozen zone. each area has its own controllable temperature: room temperature is generally 12-18°C; freezer temperature is generally 0-5°C; freezer temperature is generally below-18°C. Below are the objects that can be stored at different temperatures, as shown in Table 1.
Table 1. Storage at different temperatures

| Temperature Range | Target Description |
|-------------------|--------------------|
| 20℃               | Low temperature storage and circulation of fruits and vegetables, low temperature storage of rice |
| 10℃~0℃            | Low temperature storage and circulation of fruits and vegetables, low temperature storage of rice |
| 0℃~5℃             | Processing and circulation of undercooled or slightly chilled foods |
| -10℃~18℃          | Frozen food frozen, generally frozen food storage |
| -23℃~30℃          | Frozen aquatic products, ice cream storage, circulation |
| -30℃~50℃          | Frozen food frozen tuna surimi food frozen storage |

The temperature difference between the highest temperature and the lowest temperature is large. Some products with strict environmental temperature requirements will be in an unsuitable living environment in a certain area. If the temperature can not meet the requirements of the product, it will lead to deterioration and direct loss. Therefore, to solve this problem, it is urgent to improve by adding a few more regions and classifying the temperature of each region more precisely, so that the temperature difference between the highest temperature and the lowest temperature in each region is smaller and more accurate. According to the classification of fresh products, it can be initially set up as ultra-low temperature storage, freezer, cold storage, air conditioning storage and pretreatment processing packaging area and other areas.

1) Ultra-low temperature storage: the storage temperature of ultra-low temperature storage is below 20℃, which can maximize the preservation period of goods, and make the speed of qualitative change of goods to the change. It mainly stores frozen seafood, frozen meat and frozen conditioning food and other foods stored longer.

2) Refrigerator: The storage temperature of the freezer is between -2℃~20℃, which can ensure that the food is in the best freshness and the best edible quality. It is generally used to store frozen livestock and smoked products.

3) Cold storage: the internal ambient temperature set in the cold storage is between -2℃~10℃, and the fresh products stored in the cold storage can maintain a very high nutritional value. It is mainly used to store fresh fish and eggs and other products with a short storage period.

4) Gas storage: in order to meet people's demand for cross-regional, anti-seasonal high-grade fruits, we need to use the characteristics of fruits and vegetables, specially set up gas storage and transportation. According to the physiological characteristics of fruits and vegetables, regulating the gas medium and setting a suitable low temperature environment, the physiological activities of fruits and vegetables are controlled.

5) Pretreatment processing zone: fresh cold chain logistics needs all logistics operation flow in low temperature environment, so in order to prevent cold chain logistics from breaking chain, it is necessary to place the pretreatment processing zone inside the fresh cold chain logistics warehouse. This can effectively control the quality of goods in the process of processing, easy to control temperature adjustment.

2.2. Analysis of packaging design problems

At present, the difficulty of the supply chain of fresh e-commerce products lies in the preservation function of transportation packaging, and the pain point of agricultural products e-commerce is to reach the "last kilometer" in the hands of customers, but the fact is that agricultural products through the origin of picking, precooling, grading, processing, packaging and storage and other links, to the transfer of logistics before the transfer of logistics transportation "the first kilometer" is crucial. According to the research and investigation, the decay rate in the process of logistics "first one kilometer" is more than 10%, and the loss of transportation and terminal consumption is more than 20%[3]. Therefore, fresh products in the process of transportation need to do a good job of product preservation, extended transport life, which needs to be developed in fresh packaging materials, in fresh packaging mainly
packaging seal, filler, foam box, ice bag and so on. Different packaging problems are needed to solve different products[4].

(1) Outer packaging and tape sealing problems: outer packaging tape to stick firmly to avoid moisture, upper and lower left and right corner part of the tape to be tight, to prevent the occurrence of theft, and packaging tape adhesive to be standardized and beautiful, strict implementation of packaging requirements, unified according to the standard packaging, packaging box specifications for 5 layers corrugated box. Fresh food to prevent pollution should be noted, so that distribution personnel as far as possible priority distribution.

(2) Filling problem: the inside can use waste newspaper as filling and anti-collision measures, waste newspaper here can also play a role in preventing the rupture of meat packaging with blood water, but also can play the role of water absorption, in case the outer packaging can not be blocked and contaminated to other express parts. But from the aesthetic point of view, the use of broken paper as a filling is the most appropriate.

(3) Foam box problem: the outer foam box should use the distribution bag as far as possible to re-wrap the solid plus tape sealing edge packaging, if the use of tape to seal the foam box, it is recommended to use-keeping bag plus tape cross packaging mode, low cost, good aesthetic. General foam box and outer box size, need to leave a slight buffer space, it is suggested that there is a gap between the foam box size and the outer box about 0.1-0.3 before and after, in order to facilitate the customer to take out the foam box.

(4) Ice bag problem: the ice bag inside the packing box can use ice bag and frozen bottled water, the ice bag is the best condition when the customer receives it. Although the cooling effect of mineral water is better, the weight is relatively large and inconvenient, and the area occupied is relatively large.

2.3. Analysis on Cross-contamination of Fresh Products
Fresh products are easy to cause cross-contamination, because fresh products have different attributes, smell and other easy to string together, such as meat products and ice cream in a reservoir area, ice cream will be affected by smell pollution and its value loss. In addition, human factors are also an important cause of fresh cross-contamination. If the staff carry microorganisms, germs into the cold storage, will increase the risk of fresh cross-contamination. There are four ways to address such problems:

(1) First of all, reasonable layout, according to the attributes of different commodities, reasonable zoning neatly placed, do a good job of marking, clear flow of people, logistics, water flow, airflow direction.

(2) To improve the hygiene requirements of employees, every time into the cold storage must be sterilized, to prevent the carrying of germs, microorganisms into the cold storage, staff should do to keep the warehouse environment clean and sanitary, the ground without water, dirt, clean walls, no sanitary dead corner, and regular daily elimination work, disinfection records.

(3) Strengthen the training of employees to prevent contamination of fresh products due to incorrect operation of employees.

(4) Carry on the uninterrupted temperature detection to the fresh-keeping goods, and record the data, arrange the special person to compare the different reactions of the critical state, deal with the products with bad freshness or odour in time, and avoid cross-contamination.

3. Analysis of Layout Problems in Warehouse

3.1. Problems to be considered in the construction of model cold storage
(1) Storage capacity: Mainly based on the storage of fresh products to calculate the maximum number, not only consider the volume of the product should also consider the aisle and spacing and so on.

(2) Warehouse location: When designing the cold storage, we should not only consider the entrance and exit, but also consider the layout of the workshop, packaging platform, sorting platform and drainage conditions, which are closely related to the location of the warehouse.

(3) Selection of Cold Storage Insulation Material: To be economical and practical, and to have good
thermal insulation performance, its choice must be adapted to local conditions.

(4) Selection of Refrigeration System in Cold Storage: It should be selected according to the advantages and disadvantages of each refrigeration system and storage product requirements, including the convenience of installation and management. In the cold storage refrigeration unit, the capacity and quantity of the refrigeration compressor equipment are configured according to the maximum load of the production scale and considering the refrigeration parameters.

3.2. Construction conditions of cold storage
(1) Warehouse covers an area of 10,000 square meters, 500 meters long, 200 meters wide, 9 meters high;
(2) It needs to be built on a certain highway, which has good performance such as drainage, as shown in figure 1.

![Figure 1. Warehouse location diagram](image-url)

3.3. Prioritization scheme
In the construction should be based on the company's business model, operation mode and other reasonable layout of the reservoir area, the goods can be easily carried out in operation link, which includes different temperature areas, channels, shelves and other locations, including picking areas, waiting areas, packing areas, storage areas and other safe, efficient and reasonable design.

The general plane of warehouse can generally be divided into storage operation area, auxiliary operation area and administrative living area.

3.4. Storage capacity determination
The volume of cold storage is mainly based on the maximum number of fresh products, the relevant data are as follows:
Tonnage calculation of cold storage: Tonnage of cold storage = contents of cold storage room × volumetric utilization coefficient of cold storage room × unit weight of food
Contents of cold storage rooms= Within the array, Length × width × height
Volume utilization factor for cold storage: 50 – 1000 m³ = 0.4
1001 – 2000 m³ = 0.5
2001 – 10000 m³ = 0.55
10001 – 15,000 m³ = 0.6
Food unit weight of cold storage:
Frozen meat = 0.40 t/c
Frozen fish = 0.47 t/c
Fresh fruits and vegetables = 0.23 t/c
Bone removal of meat or by-product = 0.6 t/c
Mechanism ice = 0.75 t/c
Boxed frozen poultry = 0.55 t/c

Calculation method of cold storage quantity:
The formula for calculating the maximum storage volume in storage operation is: effective content product = total content product × 0.9
Real maximum storage capacity of active cold storage: effective volume = total volume × 0.9
The maximum storage volume = total volume × (0.4 – 0.6) of which 0.4 – 0.6 is determined by the size of the warehouse and the storage material.

4. Analysis of Ammonia Refrigeration Technology
Now some modern logistics companies are using wind-cooled technology, this technology to adjust the temperature quickly, but freon and noise pollution, uneven temperature, easy to frost problem is
prominent. While ammonia may be more suitable as refrigeration technology than freon. And ammonia has strong irritating odor and has certain toxicity and flammability[5]. Once leaked, it will pollute the air, food, and irritate the eyes and respiratory organs. But ammonia may be better suited for refrigeration than freon. In terms of environmental protection, ammonia is an environmentally friendly refrigerant with good thermodynamic performance and no adverse effects on the atmosphere. And unlike freon, ammonia doesn't appear and plug even if its water content is below 2%, so refrigeration piping systems using ammonia refrigeration requires less drying[6].

Taking the 100 ton daily project as an example, the annual operating cost of ammonia system unification is 2.874 million yuan, and the annual cost of fluorine refrigeration system unification is 1.9546 million. The annual cost of fluorine refrigeration system is 919400, about 32%, less than that of ammonia refrigeration system.

In the case of equipment investment, the lower the overall equipment investment of ammonia refrigeration system is than that of fluorine system, and the difference between the maintenance cost of ammonia refrigeration system and fluorine refrigeration system is very small. So ammonia may be better suited for refrigeration than freon.

5. Conclusion
Fresh e-commerce warehouse is in the stage of rapid development, but there are also some shortcomings, the application of bar code technology to the picking link will save more time and labor. In the era of science and technology and intelligence, it is of great significance for the promotion of fresh e-commerce to improve the working details of each link of processing warehouse and distribution.

References
[1] Gao,K. (2018) A Study on Intelligent Design of Packaging of Fresh E-commerce Products. Hunan Packaging, 4.
[2] Song,Y. (2015) Fresh e-commerce to be developed Nuggets need to be careful and calm. IT Time, 32-33.
[3] Analysis on the Market Status and Development Trend of Fresh E-commerce Industry in China in 201. (2016) China Industrial Information Network.
[4] Zhang,X, Li,X.(2018) A Study on Standardization of Cold Chain Preservation Packaging in E-commerce. Standard Science, 0(8):102-105.
[5] HG20660. Classification of chemical medium toxicity hazards and explosion hazards in pressure vessels.
[6] Hu J, He Y, Zhang X, Li J, Wang R, Wu J. (2016) Application and Technology Status and Development Trend of Vortex Refrigeration Compressor. Refrigeration and air conditioning, (04):1-7.