

The Present Situation and Reformation Prospects of Meat Refrigerating Technology in China

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SUMMARY: The paper consists of two parts: the first part introduces the developing course of the basic equipment for meat refrigeration--freezers which have been developed from 22,000 tons capacity at the foundation of P.R.China to present 2,400,000 tons capacity, and describes in detail the types and distribution of the freezers for meat refrigeration, the daily animals slaughtering capacity, the situation of meat refrigeration, ice making and storage, freezing equipment and special transportation lines; the second part deals with the meat refrigerating technology in China according to the demands of consumers and markets for frozen meat and packets of frozen cut meat. In the end it describes the developmental tendency of meat refrigerating technology in the future.

INTRODUCTION: The basis of meat refrigerating industry was very weak in old China. There were only a few freezers in the whole country at the foundation of P.R.China, which totally have 22,000 tons capacity. Those freezers were mainly owned by English capitalists, which were used to freeze the cheap pork, beef, mutton and eggs bought from Chinese markets before they were sold in European markets. The freezers were distributed over Harbin, Dalian, Tanjin, Qindao, Nanjing and Shanghai.

The development of meat refrigerating industry is emphasized after the foundation of P.R.China. The original meat refrigerating enterprises have been extended and reconstructed. Afterwards, a group of meat processing enterprises and freezers have been newly built to meet the demands of domestic markets and foreign trade.

1. The present situation of meat refrigerating industry: With the development of production, meat refrigerating industry of China has been on the developmental road of independence. By the end of 1987, there have been 1,442 meat processing enterprises in state-operated commercial system in China, which employ 330,316 persons. Meat refrigerating factories (freezers) are distributed over big and medium-sized cities, as well as some coastal ports, which totally have 2,383,887 tons capacity. According to one shift (8 hours), the processing capacity is as follows: 570,000 pigs, 17,300 oxen, 177,600 sheep, 800,000 fowls, 800 tons of cut pork, 550 tons of meat products. Of the total capacity of freezers, low-temperature freezers account for 2,006,000 tons, high-temperature ones (about 0°C) account for 381,000 tons. The daily freezing capacity is 43,000 tons, daily cooling capacity is 6,500 tons, daily ice-making capacity is 3,300 tons. There are some 100 cold store boats whose charge capacity is 10,000 tons, and 4,900 cold storage vans. The details are listed in table 1.

a. The distribution of meat refrigerating enterprises. Meat enterprises in big and medium-sized cities (majority have refrigerating workshops) account for 38.3 percent of the total enterprises. There are 890 meat enterprises in county towns and down, which account for 61.7 per-

Table 1 The main producing capacity of refrigerating enterprises in commercial system in 1987

Items		Totality in China
number of enterprises		1,442
slaughtering capacity (number/shift)	number of pigs	572,848
	number of oxen	17,299
	number of sheep	177,625
	number of folks	800,000
cold storage capacity (tons)	brief figure	2,383,887
	low temperature	2,002,598
	high temperature	381,289
cooling capacity (tons/day)		6,452.3
freezing capacity (tons/day)		42,314.3
ice-making capacity (tons/day)		3,410.4
ice storage capacity (tons)		33,230
number of freezers		6,640
special railway line (kilometres)		194.19

cent. See table 2 for details.

Table 2 The freezer distribution of meat refrigerating enterprises in commercial system in 1987

In the whole country	number of enterprises		1,442
	cold storage capacity (tons)		2,383,887
In big and medium-sized cities	brief figure	number of enterprises	552
		cold storage capacity (tons)	1,876,690
	population \geq one million	number of enterprises	146
		cold storage capacity (tons)	994,078
	one million $>$ population $>$ half million	number of enterprises	99
		cold storage capacity (tons)	340,556
	population $<$ half million	number of enterprises	307
		cold storage capacity (tons)	592,056
In county towns and down	number of enterprises		890
	cold storage capacity (tons)		508,557

There are 797 meat enterprises in Jiangsu, Zhejiang, Anhui, Shandong, Hebei, Henan, Hunan, Hubei, Jiangxi, Sichuan, Shanxi, and Shaanxi provinces, which account for 55.3 percent of the total enterprises, there are 645 ones in the rest part of China, which account for 44.7 percent. There are 55 meat enterprises in Beijing, Shanghai and Tianjin, which account for 3.8 percent. The regional distribution of meat refrigerating enterprises is shown in table 3.

b. The scale of meat refrigerating enterprises. According to slaughtering scale of meat re-

refrigerating enterprises, there are 22 enterprises that actually have more than 300,000 slaughtering capacity in 1987, which account for 2.3% of the total enterprises(952). Among them, there are 4 enterprises(folk pressing ones) which have 1,000,000 slaughtering capacity and 6 enterprises (4 meat pressing ones, 2 folk pressing ones) whose slaughtering capacity is between 500,000 and 1,000,000, there are 12 ones whose slaughtering capacity is between 300,000 and 500,000. There are 930 enterprises that have less than 300,000 slaughtering capacity, which account for 97.3%. The scale of meat freezers is shown in table 4.

Table 3 The regional distribution of meat refrigerating enterprises in commercial system of China in 1987

regions	number of enterprises	percentage
North China	235	16.3
Northeast China	207	14.3
East China	370	25.7
Medium-south China	242	16.8
Southwest China	249	17.3
Northwest China	139	9.6
Totality	1,442	100

In the scale structure of enterprises, there are two obvious changes: one is that the number of enterprises which have more than 300,000 slaughtering capacity(per year) gradually reduces, and the number of those which have less than 300,000 slaughtering capacity(per year) increases one year after another. The tendency is the result of free management and multi-channel markets. The past collective slaughter is changed to scattering one which increases slaughtering capacity in many regions. The reformation of financial system is another reason. To increase financial income, the country enterprises transport half carcass meat instead of livestock into the cities; the other is that the number of the enterprises whose freezer capacity is more than 10,000 tons and less than 500 tons increases, and the total capacity grows. It is the result of completion and operation of a series of projects built at late 6th Five-Year Plan period(1980-1985). These projects which have more than 5,000 tons capacity each, are from the internal extension and reconstruction of old enterprises. More small-sized enterprises are built by local governments to expand management after it is free.

As shown above, driven by the reformation of national economic system, enterprises have quickened the adjustment of production construction, technological transformation and equipment importation to suit the new situation of multi-channel free management and further support production and consumption. The capacity of pressing cut meat, meat products, packets of meat products is increased, and technical competence is improved. As market system is in the embryonic stage at present, the central government still has to carry out the management policy of directive plans. State-operated commerce functions as stabilizing markets and commodity prices. Especially when meat is in the balance between production and consumption, meat refrigerating enterprises mainly process and store frozen half-carcass meat to solve the contradiction of unbalance. So enterprises keep relatively big slaughtering and refrigerating capacity at present. Now the problem in the new situation is that the capacity in big and medium-sized cities is more than the demands of city supply and exportation, but it can not be easily cut down in case of more sources of goods. In medium and small-sized cities, especially those county towns and down, the excessive capacity

Table 4 The scale classification of meat refrigerating enterprises in commercial system in 1987

In the whole country	number of enterprises	1,442
	cold storage capacity(tons)	2,383,887
capacity >10,000 tons	number of enterprises	54
	cold storage capacity(tons)	894,000
10,000 tons > capacity ≥ 5,000 tons	number of enterprises	77
	cold storage capacity(tons)	509,594
5,000 tons > capacity ≥ 3,000 tons	number of enterprises	47
	cold storage capacity(tons)	199,695
3,000 tons > capacity ≥ 1,000 tons	number of enterprises	227
	cold storage capacity(tons)	386,395
1,000 tons > capacity ≥ 500 tons	number of enterprises	220
	cold storage capacity(tons)	172,718
capacity < 500 tons	number of enterprises	815
	cold storage capacity(tons)	221,485

Notes: the data of table 1, 2, 3, 4 are quoted from the Almanac of Chinese Food Industry in 1987.

keeps growing, and does harm to both the improvement & control of the quality and comprehensive utilization of raw meat source, and causes repeated construction and waste of investment.

In recent years, the situation varies considerably in processing all kinds of frozen meat products: 1,760,000 tons frozen meat products are processed in 1985, increasing 44.4 %, 1,300,000 tons in 1986 and 1,040,000 tons in 1987 are processed. It shows a decline tendency. Thus the utilization ratio of freezer capacity is only about 45 %. In present circumstances of free management, enterprises are gradually changed from close production-storage types to open circulation types. They have launched a business of storage and management for the society, and users of the freezers grow. Management scope and variety are increased. Though enterprises process less half-carcase meat than before, the quantity of frozen goods keeps growing.

2. The developing trend of meat refrigerating technology in China

a. Rebuild freezers, add or enlarge cooling rooms, raise the production of chilled meat. There are cooling rooms in all the meat freezers in China built in 1950s. Butcher's meat is cooled from 38°C to a temperature between 0°C and 4°C before it is frozen in freezing rooms. But direct freezing technology is used in the freezers built after 1960, most of which do not have cooling rooms. And some of the original cooling rooms are changed into freezing rooms. Thus, butcher's meat has to be processed into frozen one after it is sent to the freezers. Although consumers do not like frozen meat, only frozen meat is sold in butcher's shops. If customers do not buy frozen meat, they have to eat butcher's meat. Scientific researches show that chilled meat (aged) is soft and juicy, and has a special flavour. The broth is transparent and fragrant, as well as digestible. The increasing acidity of the meat in aging period has disinfecting functions, but butcher's meat does not have above characters. So meat aging is of importance from the views of economics, veterinary sanitation and nutrition, and flavour.

When chilled meat is processed into frozen one, a large quantity of energy is used up. Production cost rises and nutrition materials are damaged. Conversely, when frozen meat is in thawing period, still much energy is consumed, and nutrition materials are lost again, thus the quality of frozen meat is much worse than that of chilled meat. For this reason, cooling rooms should be added or enlarged in refrigerating enterprises to meet the needs of consumers for chilled meat. In direct freezing technology, the heat load of a freezer is so big as to effect the freezer life. Certainly it is necessary to keep some freezing capacity in freezers. The butcher's meat, which can not be marketed for some time, may be frozen for long storage. Present refrigerating equipment can not process chilled meat, so it is a good way to add or extend cooling rooms to process both chilled and frozen meat.

b. Change the state of single variety-half carcase meat in meat supply, raise the production of cut meat.

For a long time, only half carcass meat is supplied in the markets around Chinese cities and country. The residents should work hard at the large skinny and bony pieces of meat which fat and lean, as well as positions are not separated. With the development of the time, both husband and wife of a family have to work. Such large pieces of meat can not meet the needs of broad consumers in such a hurry society. To counter the situation changes in the society, meat processing industry should process varieties of cut meat, such as shredded meat, meat stuffing, sliced meat, spareribs and some by-products, which are packed with packets (they can also be packed with large bags to meet the needs of public restaurants and canteens). The products are refrigerated ^{before} the residents buy and place them into refrigerators. So it is very convenient for the residents and much unnecessary housework has been reduced. On the other hand, meat processing enterprises can make full use of many by-products such as skin, bones etc. to increase public wealth and chances of employment, and also expand the scale of management. In a word, it is a favourable thing to society and people.

c. Strengthen the construction of cold chains to ensure the quality of frozen meat products. To ensure the quality of products, the frozen goods must be transported in low temperature in order that chilled meat and frozen packets of meat products are conveyed from the factories to meat wholesale departments, retail shops or other processing enterprises. The cold chains mainly mean short-distance transportation in the same city. Construction of small-sized freezers in wholesale and retail departments and cold storage trucks must be generally considered and arranged. Enterprises processing frozen meat products should deliver goods to the customers' in order to make full use of social manpower and materials resources.

d. Formulating integrative standards of frozen meat products does favour to processing, transportation and storage.

In the flourishing meat markets, there are many product quality standards, packing norms, transportation tools, storage conditions which cause confusion. It is very inconvenient for neither production and management, nor storage, transportation and marketing. At present, the country has not formulated integrative standards of frozen meat products. There are only standards made by every enterprise and locality. To counter the situation, the country should consider in a long run and formulate integrative standards of chilled and frozen meat, which contain sense norms, sanitation norms, packing marks, packing norms, testing methods, storage and transportation conditions for processing and managing enterprises to ensure the quality of products and supply the consumers with qualified frozen meat products.

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