河南省创新型科技团队支持计划
河南省高等学校教学工程项目 资助

肉品科学英语材料选编

Meat Science English Compilation

马汉军 康壮丽 主编

科学出版社

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内 容 简 介

为使学生掌握有关肉品科学的英语词汇，熟悉相关内容英语表达方式，以便能顺利阅读英文版肉品科技读物，更大程度地丰富肉品专业知识，把握国内外肉品领域进展，特组织编写本书。

本书共分 13 章，涉及肉的基本结构与组成、动物屠宰及胴体分级、宰后肌肉变化、肉的贮藏、肉类加工基本原理、各类制品加工及质量控制等。内容编排上既考虑西式制品的加工原理与方法，又力求结合我国传统肉类制品加工的实际和特点，与国内相关著作的内容基本同步，符合学生的阅读习惯。在每章最后整理列出了专业术语与词汇，以供学生学习和查阅。

本书适合从事肉制品加工的科研人员、食品企业管理人员阅读，也可作为高等院校食品科学专业教师、学生的参考用书。

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《肉品科学英语材料选编》
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Preface

China is the largest meat producing country in the world, the gross output of meat in 2015 reaches 862.5 million tons, approximately accounts for 24% of the meat gross output of the world. The meat processing industry is also the largest food industry in China, its total output value accounts for over 12% of the total output value of food industry. With the development of Chinese economy and the continuously raise of people's living standard, the meat processing industry will have a wider development prospect.

According to statistics, there are over 300 universities which have set up the major of food in China at present, and Meat Science and Technology is one important course of this major. An increasing number of universities have started to adopt bilingual education, however there isn't any dedicated reference book which covers the principle and technology of Chinese and western style meat-packing. Therefore, we composed this book in order to facilitate the bilingual education and to enable the students to grasp the English vocabulary of Meat Science and Technology, be familiar with the English expressions of the relevant contents, read Meat Science and Technology books with ease, enrich the meat expertise, and hold the domestic and overseas progress in the realm of meat.

This book contains 13 chapters, which refer to the basic structure and composition of meat, the animal slaughter and carcass classification, the muscle variation after slaughter, the storage of meat, the basic principle of meat-packing, all sorts of product processing and quality control, etc. For the content arrangement, we have not only considered the process principle and methods of western product, but also attempted to combine the fact and characteristics of the Chinese traditional meat product process, besides, the content of this book are almost consistent with the domestic relevant literatures, which accords with the reading habit of the students. The terminologies and vocabularies are provided at the end of each chapter, which can be learned or checked by the students. This book can be used as the reference book of the meat courses, or can be referred by the researchers of meat.

Contents

Chapter 1 Introduction

1.1 Meat and Muscle

The bulk of the meat consumed in the United Kingdom is derived from sheep, cattle and pigs, rabbit and hare, generally, which is considered separately along with poultry. In some European countries (and elsewhere), however, the flesh of the horse, goat and deer is also regularly consumed, and various other mammalian species are eaten in different parts of the world according to their availability or because of local custom. Thus, for example, the seal and polar bear are important in the diet of the Inuit, and the giraffe, rhinoceros, hippopotamus and elephant in that of certain tribes of Central Africa are important, too; the kangaroo is eaten by the Australian aborigines; dogs and cats are included in the meats eaten in Southeast Asia; the camel provides food in the desert areas where it is prevalent and the whale has done so in Norway and Japan. Indeed human flesh was still being consumed by cannibals in remote areas until only recently past decades.

Very considerable variability in the eating and keeping quality of meat has always been apparent to the consumers, it has been further emphasized in the last few years by the development of prepackaging methods of display and sale. The view that the variability in the properties of meat might, rationally, reflect systematic differences in the composition and condition of the muscular tissue of which the post-mortem aspect is recognized. An understanding of meat should be based on an appreciation of the fact that muscles are developed and differentiated for definite physiological purposes in response to various intrinsic and extrinsic stimuli.

1.2 History of Chinese Meat Processing

In China, meat consumption and production, particularly for traditional meat products, has developed over more than 3000 years. *Yi Jing*, a popular Chinese book written around 2800 years ago during the Zhou Dynasty (1046BC-256BC), described various processing methods including sun-drying and salt-curing of meat products. In volumes 7, 8 and 9 of an agricultural book *Qi Min Yao Shu* of the Northern Wei Dynasty (386-557), the source of meat food, meat processing and storage was

discussed in detail. Technology for meat processing was largely integrated and developed between North and South of China during the Song (960-1279), the Liao (916-1125), the Jin (1115-1234) and the Yuan (1206-1368) Dynasties because of the need for communication between the different races. During the Ming (1368-1644) and the Qing Dynasties (1616-1911), meat processing and cooking technologies were greatly enhanced resulting in the formation of local traditional meat products right across China.

During the period of 1917 to 1949, western equipment and processing technologies were introduced to a number of large cities in China including Shanghai, Tianjin, Qingdao and Harbin. The introduction and utilization of this equipment for grinding, smoking and sausage stuffing led to the appearance of small to medium size slaughtering houses and meat processing plants. This was the beginning of the meat processing industry in China, while at the same time, most meat products were still being produced by family and small workshops. Following this period research began on meat hygiene and experts were trained in the area of meat processing and quarantine inspection. However, the meat available in markets was very limited during this period due to the poor economy and the low amount of output. This was particularly the case in rural areas, where people could only consume meat and meat products during special festivals. Economic reform in the latter part of the 1980s largely changed the meat industry in China, leading to the accelerated growth of fresh meat and the rapid development of meat processing. In 1990, the total meat output of China was 30.42 million tons (Mt.) which was the largest in the world while the meat consumption per capita (37.5 kg) reached the average level of the world in 1994.

Since the 1990s, China's meat industry has experienced a key period for development and transition. During these ten years, China imported more than 700 production lines for slaughtering and processing of meat. Most of the state-owned plants for meat products were made integrated or disappeared with the fast growing private meat processing enterprises in China. From 2000 to 2007, the number of enterprises involved in slaughtering and processing deceased from 35 000 to 23 000, but at the same time, those remaining companies became much larger-scale enterprises. The capacity for slaughtering and meat processing by the large enterprises developed rapidly during this period. For example, the number of pigs slaughtered in Shuanghui Group during the period 2000 to 2006 increased 340% while the Yurun Food Group increased their pig slaughter capacity by 670%. In 2007, the top 3 meat enterprises (Shuanghui Group, Yurun Food Group and Jinluo Group) in China slaughtered more

than 50 million heads of pigs accounting for 8% of total pigs slaughtered. The top 50 meat enterprises in China presently account for 1.61% of total above-scale three enterprises (annual sales more than RMB 500 million) while their total assets have a share of 72.5% and their profit has a share of 84.6% of all meat enterprises in China. The meat processing enterprises are mainly located in the provinces that have high production of livestock and poultry. The assets, sale and profit of the meat industry in Shandong, Henan, Sichuan, Jiangsu, Liaoning and Inner Mongolia have developed quickly which has driven the rapid improvement of the meat industry in China (Han, 2011). Given the enhanced concern for food safety and the move to modern meat processing operations, the meat product industry is expected to experience further integration (Wang & Xia, 1999).

The size of meat processing enterprises has been increasing which leads to increased levels of intensification and modernization. In 2009, the total number of above-scale enterprises in slaughtering and meat processing was 3696, which included 1985 in slaughtering, 1620 in meat processing and 91 in canned meat factories. The total assets of these enterprises are RMB 225.6 billion with a turn over of RMB 516.7 billion and a net profit of RMB 20.6 billion. The number of employees involved in slaughtering and meat processing reached 1.05 million, while 70 million farmers were involved in animal production and husbandry. The meat industry continues to play a key role in increasing the income of farmers and improving the economy of rural areas in China.

In recent years, the further processing rate for raw meat has been gradually increased in China (Figure 1-1). In 2002, only 7.2% of raw meat was further processed into meat products while it doubled to 14.7% by 2009. Currently, China has more than

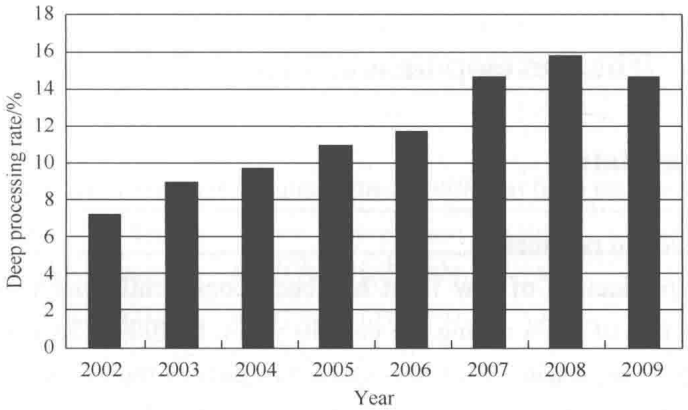

Figure 1-1 Deep processing rate of raw meat during 2002-2009 in China

500 types of meat products including both Chinese style (45%) and western style (55%). Among the western style meat products, 40% are high-temperature treated products while the low-temperature products account for 60% of the market. Ready-to-eat meat products currently have a low market share although their numbers are developing rapidly, particularly with high quality fermented meat products (Meng et al., 2011).

1.3 Classification of Chinese Meat Products

Chinese meat products can be divided into the following 10 categories (Table 1-1).

Table 1-1 Categories of meat products in China

Categories	Products
Sausages	Chinese-style sausage, fermented sausage, smoked and cooked sausage, fresh sausage products
Hams	Dry-cured ham, smoked and cooked ham, pressed hams
Cured products	Cured meat, bacon, sauce seal meat, air dried meat
Sauce pickled products	Boiled streaky pork, sauced meat, steamed salted pork in win
Smoked and roasted products	Smoked meat, roasted meat
Dried meat products	Jerky, dried meat, dried meat floss
Deed fried products	Hanging paste fried meat, pan-fried meat
Prepared meat products	Prepared fresh meat products, prepared frozen meat products
Canned meat products	Canned meat, retort pouch
Miscellaneous products	Meat loaf, meat jelly

1.4 The Development of Meat Industry in China

1.4.1 Present status

1) Production of raw meat

The total production of raw meat has been consistently rising in China at an annual average rate of 5.8% during the past 30 years. In 2009, China was the world's largest producer of meat with 78.21 Mt. which was 28% of the world's total production. Of this raw meat in China, the production of pork, poultry, beef and mutton was 49.88 Mt., 16.44 Mt., 6.43 Mt. and 3.87 Mt. respectively. The output of pork and mutton far

exceeded the production of poultry and beef (Table 1-2).

Table1-2 Meat production in China and the world in 2009

Production	China/Mt.	World/Mt.	Proportion/%	Ranking in the world
Pork	4 987.9	10 606.9	47.0	1
Mutton	386.7	1 304.8	29.6	1
Poultry	1 643.8	9 130.8	18.0	2
Beef	642.5	6 514.6	9.9	3

Sources: FAOSTAT: *China Statistical Yearbook 2010*.

As the production of raw meat has increased, the proportion of the different meat species has changed (Table 1-3). One of the significant changes was the drop of pork output from 79.08% of total meat in 1978 to just 63.93% in 2009. However, pork still has a dominant position in the total meat structure but its share of total meat production is still declining. The ratio of beef, mutton and chicken increased from 2.52%, 2.89% and 13.80% in 1978 to 8.31%, 5.08% and 22.68% in 2009, respectively. It is noteworthy that the meat consumption pattern was different in urban and rural areas in China as a result of differences in income level, education, meat availability and tradition. In urban households, 57% of meat consumption was pork and 13% was beef and mutton while pork accounted for 71% and beef and mutton for 9% in rural households (Gong et al., 2011). In 2009, the annual per capita consumption of meat in China was 57.3 kg including 36.7 kg of pork, 12.0 kg of poultry, 4.8 kg of beef and 3.0 kg of mutton. Currently, the developmental philosophy of fresh meat in China is "stable development of the swine industry, active development of the poultry industry and fast development of the cattle and sheep industry"(Han, 2011). The main purpose of this policy is to improve the balance of consumption and the demand structure of meat consumption in China.

Table 1-3 The production and proportion of different fresh meat in China

Year	Pork	Beef	Mutton	Poultry meat	Chicken	Duck	Goose
1978	8.77 (79.08)	0.28 (2.52)	0.32 (2.89)	1.53 (13.80)	1.08	0.27	0.17
1979	10.87 (81.42)	0.32 (2.40)	0.38 (2.85)	1.59 (11.91)	1.11	0.29	0.18
1980	12.13 (82.01)	0.34 (2.30)	0.45 (3.04)	1.66 (11.22)	1.17	0.30	0.19
1981	12.67 (82.06)	0.35 (2.27)	0.48 (3.11)	1.73 (11.20)	1.22	0.31	0.19
1982	13.53 (82.30)	0.36 (2.19)	0.53 (3.22)	1.81 (11.01)	1.28	0.32	0.20

Continued

Year	Pork	Beef	Mutton	Poultry meat	Chicken	Duck	Goose
1983	14.01 (82.03)	0.40 (2.34)	0.55 (3.22)	1.90 (11.12)	1.36	0.33	0.21
1984	15.37 (82.72)	0.45 (2.42)	0.59 (3.18)	1.94 (10.44)	1.39	0.33	0.21
1985	17.57 (83.91)	0.51 (2.44)	0.59 (2.82)	2.02 (9.65)	1.45	0.34	0.21
1986	19.03 (83.14)	0.63 (2.75)	0.62 (2.71)	2.32 (10.14)	1.66	0.41	0.25
1987	19.49 (81.01)	0.84 (3.49)	0.72 (2.99)	2.69 (11.18)	1.93	0.47	0.29
1988	21.29 (79.71)	1.00 (3.74)	0.80 (3.00)	3.25 (12.17)	2.35	0.51	0.40
1989	22.35 (79.45)	1.12 (3.98)	0.96 (3.41)	3.37 (11.98)	2.42	0.53	0.41
1990	24.02 (78.96)	1.30 (4.27)	1.07 (3.52)	3.74 (12.29)	2.66	0.60	0.47
1991	25.82 (77.37)	1.58 (4.73)	1.18 (3.54)	4.48 (13.43)	3.17	0.67	0.64
1992	27.65 (75.94)	1.85 (5.08)	1.25 (3.43)	5.12 (14.06)	3.59	0.79	0.74
1993	29.84 (73.59)	2.37 (5.84)	1.37 (3.38)	6.41 (15.81)	4.57	0.98	0.85
1994	32.61 (72.90)	2.81 (6.28)	1.48 (3.31)	7.17 (16.03)	5.15	1.08	0.93
1995	33.40 (69.22)	3.60 (7.46)	1.75 (3.63)	8.67 (17.97)	6.06	1.28	1.33
1996	31.58 (68.89)	3.56 (7.77)	1.81 (3.82)	8.79 (19.18)	6.14	1.29	1.37
1997	35.96 (68.26)	4.41 (8.37)	2.13 (4.04)	10.22 (19.40)	7.24	1.46	1.51
1998	38.84 (67.85)	4.80 (8.39)	2.35 (4.11)	11.22 (19.60)	7.95	1.60	1.66
1999	40.06 (67.34)	5.05 (8.49)	2.51 (4.22)	11.70 (19.67)	8.17	1.81	1.72
2000	39.66 (65.95)	5.13 (8.53)	2.64 (4.39)	12.41 (20.64)	8.85	1.80	1.75
2001	40.52 (66.36)	5.09 (8.34)	2.72 (4.45)	12.43 (20.35)	8.86	1.80	1.75
2002	41.23 (66.14)	5.22 (8.37)	2.84 (4.56)	12.75 (20.45)	9.05	1.85	1.80
2003	42.39 (65.79)	5.43 (8.43)	3.09 (4.80)	13.22 (20.52)	9.26	1.95	1.85
2004	43.41 (65.68)	5.60 (8.47)	3.33 (5.04)	13.12 (19.85)	9.30	1.96	1.80
2005	45.55 (65.64)	5.68 (8.19)	3.50 (5.04)	14.36 (20.69)	10.30	2.11	1.91
2006	46.51 (65.61)	5.77 (8.14)	3.64 (5.13)	14.67 (20.69)	10.42	2.18	1.98
2007	42.88 (62.45)	6.13 (8.83)	3.83 (7.69)	15.52 (20.83)	10.86	2.35	2.23
2008	46.21 (63.48)	6.13 (8.42)	3.80 (5.22)	15.76 (22.88)	11.02	2.51	2.23
2009	49.88 (63.93)	6.43 (8.31)	3.87 (5.08)	16.44 (22.68)	11.44	2.66	2.33

Sources: FAOSTAT: *China Statistical Yearbook 2010*.

Notes: The unit in the brackets is %, while the unit out of the brackets is Mt.

2) Fresh meat consumption and the market

The trend in the pattern of fresh meat consumption in China has changed from hot-fresh meat to frozen meat and subsequently from frozen meat to chilled fresh meat. Currently, the largest markets for chilled fresh meat are in the large size cities. In Beijing and Shanghai, chilled fresh meat has a share of 30% while it only accounts for 10% in the mid-sized cities of China. In rural areas and in remote

cities, hot-fresh meat is still the predominant type sold, usually through farmer's markets (Hong, 2007). In these situations, the carcasses may remain in open air for several hours before they are sold. The meat pieces are usually directly cut from the whole carcass as determined by the consumer's requirements based on muscle, fat content and weight (Gong et al., 2011). Along with the establishment and the improvement of low-temperature supply chains, the sale marketing of fresh meat from middle and large size enterprises has been changing. In big cities, the market share of supermarkets, special meat stores and franchised meat stores is larger than that of the traditional farmer's market. However, the farmer's market is still the predominant seller of fresh meat in most parts of China. In European countries, the sale of meat in supermarkets and special stores accounts for 65%, meat chain stores for 25% while 10% is sold to hotels and restaurants. It is expected that the share of meat sold by supermarkets, special stores and chain stores will increase in parallel with the change of consumer's knowledge and the fast pace of urbanization in China (Liang et al., 2009).

3) Meat export and import

During the period of 2004-2007, the export of meat was steady being in the range of 800-900 thousand tons per annum which accounted for 4.0%-5.0% of the world's total meat export. For example, 1.2% of pork produced (535 thousand tons) in China was exported accounting for 8.9% of world pork export in 2007 including countries such as Kyrgyzstan, Vietnam and Singapore. In the same year, 358 thousand tons of poultry meat was exported accounting for 3.3% of poultry production in China. However, the import and export of fresh meat, particularly pork, has not been stable since the second half of 2007 due to the price fluctuation of fresh meat in China. In 2008, China imported 373 thousand tons of pork, an increase of 3.4% compared to the previous year. In June of 2008, the imported pork reached 60 thousand tons which broke the monthly record of pork import in China (Pan, 2010). In 2009, there was again an adequate domestic supply and China only imported 139 thousand tons of pork, a decrease of 63.8% compared to the previous year. At the same time, the pork price decreased by two folds in 2009 compared to that in 2008, leading to reduced pig rearing in 2009. In 2010, the pig supply was again short in the market resulting in increased import of 200 thousand tons which was 49% higher than 2009 (Wang, 2009a, 2009b). These facts indicate that the import and export of fresh meat in China were inconsistent, largely depending on the available amount of animals in China and the price of fresh meat.

1.4.2 Future

During recent decades China has become one of the fastest growing economies in the world. In coming years, the economy in China is expected to keep growing in the range of 5%-10% per annum. Increasing incomes and expenditures along with the urbanization and population growth in China are expected to increase the demand for meat and meat products in the near future (Meng et al., 2011). The major developmental goals in China for the meat sector by 2020 are:

(1) By 2020, the total meat production output will reach 95 Mt. with a value of RMB 1000 billion. The gross profit of meat enterprises is targeted to increase from RMB 20.5 billion in 2009 to RMB 40 billion in 2020. The per capita annual meat consumption is expected to reach 71 kg.

(2) Pork production will be maintained at a steady level while the amount of beef, mutton and poultry will be expanded. The expected output for pork, poultry, beef and mutton in 2020 are 51.32 Mt., 21.31 Mt., 8.62 Mt. and 5.43 Mt., respectively.

(3) By 2020, the proportion of hot fresh meat, chilled fresh meat and frozen meat will be 40%, 40% and 20% respectively in above county-level markets. The amount of processed meat is expected to reach 18 Mt. with the increase of per capita annual consumption by 0.9 kg.

(4) In large (1 million population) and mid-size (100 thousand to 1 million population) cities, all enterprises in meat businesses should have a full food safety traceability system.

(5) The number of slaughter houses will be reduced from 21 000 in 2010 to 3450 in 2020 by consolidation and integration. Half at the national level and 89% in developing regions of the manual and semi-mechanized meat production enterprises are expected to be eliminated.

However, the meat industry in China is facing tough problems including limited resources of animal feed, meat quality and safety. Food safety and meat quality are likely to be the focus of urban demand, while rural demand will be driven mainly by quantitative growth. The reduction in cultivatable land and the decreasing numbers of farmers will result in the inevitable decrease of resources for animal feed, posting a huge challenge on the sustainability of the animal production industry. For example, cropland is expected to decline from 135 million hectares in 2003 to 129 million hectares in 2030. This fact brings the question whether the production of meat and

animal feed in China will be adequate to keep pace with the increasing demand for meat in the near future. To improve the meat quality and safety, China has to extend their research and application of advanced technology in meat industry. The key technologies for China meat industry to be applied include PACCP (Palatability Assurance Critical Control Points), online-detection system, automatic grading system, vacuum chilling, non-thermal processing, active packaging and others. China needs to establish better standards and regulations or laws in the area of meat industry and adjust the functions of different departments of government in order to improve meat safety. In conclusion, China meat industry has been experiencing a transition period from traditional farmer style to intensification development. This fast transition provides both challenges and opportunities for meat research and industry in China and the global market.

Technical Terms

meat 肉，肉类
muscle 肌肉
mammalian species 哺乳动物
poultry 家禽
considerable 重要的
variability 可变性
prepackaging 预包装
muscular 肌肉的
physiological 生理学
traditional 传统的
meat processing 肉品加工
slaughtering 屠宰
category 分类
prepared meat products 预制肉类
fresh meat 鲜肉