

Introduction of HACCP in Kibun Foods Inc.

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Kibun Foods Inc. is a surimi-based product manufacturer in Japan. The market and technical trend of the surimi-based product in Japan are explained, and development of the circumstances of HACCP introduction in the present and future are described.

■ The Market of Surimi-based Products in Japan

The fish-based products are classified into surimi-based products, frozen foods, and other fish-based products. The total production of the fish-based products in 1998 was 6 million tonnes, in which surimi-based products shared 12% of the fish-based products (Fig 1). The surimi-based products are further classified into 5 categories: fried kamaboko, baked chikuwa, flavored kamaboko such as crab-leg type kamaboko, boiled kamaboko called "Hanpen", and other types. The profile of the surimi-based products market in Japan is shown in Fig 2. The production was 754,459 tonnes comprising of 33.5% fried kamaboko, 21.8% baked chikuwa, 16.6% kamaboko, 6.9% flavored kamaboko, and 5.6% boiled kamaboko, 8.3% fish sausage and fish loaf, 2.5% of other products.

■ Processing Technology of Surimi-based Products

The manufacturing process of surimi-based products from frozen surimi requires four steps. First, thawing of surimi; second, mixing surimi with salt; third, preheating; and fourth, heating.

The raw material of the surimi-based products are based on several fishes, such as thread-fin bream called "itoyori-dai" in Japanese, white croaker, lizard fish, walleye pollack and so on.

Mixing surimi with salt was believed to be the most important factor in the surimi-based production process in terms of quality. A stone mortar mixer, silent cutter and high-speed mixer have been used in the process. The demerit of these mixers was evident in the inconsistent quality of the final products. Because these mixers raised the temperature of the paste during the mixing process and required long standing time till the paste goes to the next heating process.

In order to solve these problems, we have developed a continuous kneader that could supply the raw material continuously and control the temperature of the product at low levels. It requires a short period

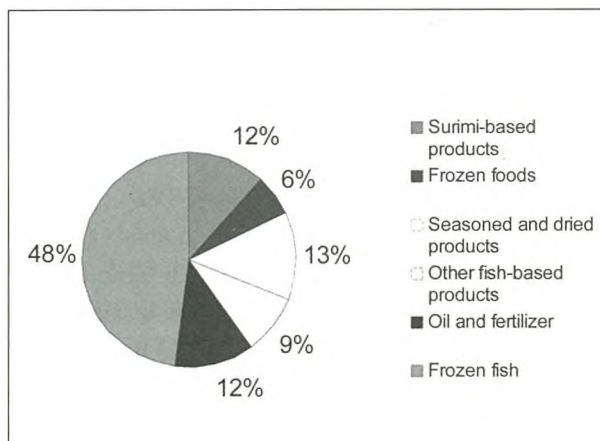


Fig. 1: Breakdown of Production of Fish-based Products in 1998

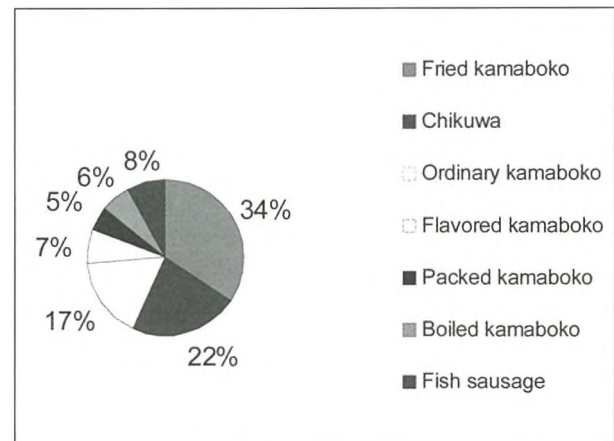


Fig. 2: Breakdown of Production of Surimi-based Products in 1998

of time without long standing time of salted fish paste. Under unsuitable operating condition, the denaturation of myofibrillar protein in the salted fish paste took place and the quality of the final products became clearly inferior under the effect of the rise in meat temperature.

In the heating process, the production technology which used joule heating was recently developed and applied to various kinds of surimi-based products wherein this heating method enables temperature of paste to rise in a short period of time.

The development of treatment machine and processing equipment of fish meat products was done effectively by studying the change in the myofibrillar protein of fish meat. The texture of food is largely influenced by myofibrillar protein. Therefore, the development of a new processing machine may be expected to progress from the same point of view.

■ Introducing HACCP into Kibun Foods Inc

In recent years, food hygiene and microbiological control has become the object of public interest in the food industry. HACCP, a new hygiene control system, was introduced to the world.

In Japan, massive food poisoning by *E. coli* O-157 in the summer of 1996 was of serious concern. This summer, the milk plant controlled by HACCP produced milk polluted by *Staphylococcus aureus*, resulting in over 15,000 people falling sick.

Table 1: Outbreak of Food Poisoning in Japan

Year	1996	1997	1998
Number of outbreaks	1,217	1,960	3,059
Number of patients	46,327	39,989	46,645
Number of death	15	8	9

Note:

Vibrio parahaemolyticus (850 outbreaks)

Salmonella (771 outbreaks)

Campylobacter

Pathogenic *Escherichia coli* (301 outbreaks)

Over 30 % of the total catch of marine products are traded in the world. It becomes well known in Europe and America that the marine products prevent the thrombosis in the brain and the blood vessels and the geriatric diseases such as cardiac infarction. The trading amount of the marine products increases

year by year. However, the difference of the food regulations of each country is dependent on the world food trading.

On the other hand, the changes of consumers' taste call for the refraining of food from heat treatments, lower salt concentration and softening, resulting in the increment of microbiological problems. Manufacturer must be more responsible for its products' safety by the indication of expiration periods, introducing PL regulation and amendments of food hygiene regulations. It becomes more and more important to introduce HACCP idea and control into manufacturing systems.

1. Outline of Kibun Foods Inc.

Company name:	Kibun Foods Inc.
Address:	7-14-13, Ginza, Chuo-ku Tokyo, Japan
President:	Masahito Hoashi
Started:	June, 1938
Establishment:	September, 1947
Business contents:	Manufactures and sale of total processed foods, mainly fish surimi products.
Commodities:	1. Kamaboko, Hanpen, Satsuma-age, Oden and the special dishes for the New Year Holidays. 2. Chilled Chinese dishes so called Gyoza and Shumai in Japan. 3. Tamago tofu made from egg and sweeteners.
Capital:	3,926 million Yen
Employee:	2,000 persons
Total sales:	74,600 million Yen
Branch and Business sections:	27 Branches and 4 business sections
Factories:	Located in Eniwa, Ishinomaki, Shiogama, Tokyo, Shirakawa, Funabashi, Yokohama, Shizuoka, Osaka, Kyoto, Hiroshima and Saga.
Group companies:	25 domestic companies and 16 overseas companies (in 10 foreign countries).

2. The progress of introducing HACCP into Kibun Foods Inc.

(a) EU

1991	Application of HACCP for the marine products was ordered
March 1995	Inspection by the observers from EU.
April 1995	The export of the marine products to EU was prohibited.
December 1995	8 companies and factories were authorized to export the marine products to EU.
January 1998	Tokyo Factory in Kibun Foods Inc. was authorized to export to EU.

(b) US

12 December 1997	HACCP for marine products was enforced.
January 1998	39 companies and factories were licensed to export to US. Tokyo Factory was authorized to export to US.

(c) Japan

May 1995	Amendment of Japan Food Hygiene regulations. Establishment of admission system for the food manufacturing by HACCP.
May 1996	Enforcement of the admission system of milk, milk products and meat products.
November 1997	Enforcement of the admission system of canned foods and surimi products.
July 1998	Application HACCP in Tokyo Factory.
August 1998	Inspection of Tokyo Factory by officers from the Ministry of Health and Welfare, Chiba Prefecture and Sakura City.
January 1999	Inspection of Tokyo Factory by officers from Ciba prefecture and Sakura City
April 1999	HACCP of Tokyo Factory was approved.
June 1999	ISO-9002 of Tokyo Factory was approved.

3. HACCP in Tokyo Factory

(a) Outline of Tokyo Factory

Company name:	Tokyo Factory, Kibun Foods Inc.
Address:	2-1-1, Yaguchishinmei Sakae-own, Inba-gun, Chiba Prefecture, Japan
Start construction:	June, 1996
Completion:	19 August 1997
Start production:	August 1997
Main Products:	Chikuwa, Satsume-age, Crab-leg analogue, Chinese dishes, Hanpen, Kamaboko, assorted Oden and Nabe-dane.
Grand Area:	46,392.78 m ²
Building area:	14,987.36 m ²
Total floor area:	19,806.69 m ²
Tree-planting area:	10,052 m ² 4,365 trees are planted.
Lawn area:	6,470 m ²
Factory size:	140m(L) x 100m (W) 1st floor: Production, Shipping and Transporting section. 2nd floor: Office, Welfare facilities and Utilities.
Number of Production lines:	16 lines for surimi products and 10 lines for other dishes

(b) Purpose of Tokyo Factory

1. Purpose for introducing HACCP into Tokyo Factory Idea of Quality and Hygiene in the supplying of safe food:

- (i) Improving the quality and hygiene system.
- (ii) Reducing the time between order and delivery.
- (iii) Cost reduction of production and transportation.

2. Hygiene facilities

- (i) Separate the movement of persons and materials.
- (ii) Factory area is divided into hygiene zones.
- (iii) Each hygiene zone separated by partitions.
- (iv) Production area has no windows and its atmospheric pressure is higher than outside.
- (v) Packing is carried out in the clean room.

- (vi) The ventilation, laying pipes and electric wiring are connected to the processing machine and are supplied vertically from the ceiling and floor pits.
 - (vii) The inside wall and ceiling are constructed of coldroom panels.
 - (viii) Air conditioning in all areas except heating (cooking) room.
 - (ix) The room temperature and the temperature of main facilities are monitored continuously.
 - (x) The room lights in the pre-processing rooms, mixing rooms and cooking room are coated with anti-scattering films.
- 3. Sanitary control
 - (i) Cocking, cooling and metal-detection processes are controlled by the central administration office.
 - (ii) Sanitary standard operation procedures are set up.
 - (iii) Sanitary education for employee is done.
 - (iv) Individual sanitary control such as uniform, shoes, hat, hand-washing method and air-shower to each zone is carried out.
 - (v) Raw materials are unpacked and then sent into factory.
 - (vi) Soaps and sterilizing agents are kept in exclusive cabinets.

Comparison of HACCP Standards in EU, US and Tokyo Factory

EU (Directive 91/493)	US (GMP, 21 CFR110)	Tokyo Factory
Facilities Dock shelters at entrances and exits of material rooms are necessary.	Dock shelter is preferred, but double doors are enough to prevent rising temperature and entry of rats and insects.	EU standard.
Unclean areas, semi-clean areas and clean areas are separated by individual partitions.	Prevention of cross-contamination by time difference, air flow, forming pipe lines and covering. Not necessary to separate by partitions.	EU standard.
The work overalls should not be in contact with personal clothes on the racks.	It is enough to wear clean and sanitary overalls during the working period. Practically, the dressing room must be neat and clean.	EU standard.
The wall should be constructed of non-porous material.	Painted wooden walls without gaps and easily washable is acceptable.	EU standard.
The movement of people and products do not cross each other.	Times difference, air flow and closed systems are available.	EU standard.
Regulation for fishing boats are prescribed.	Regulations are not prescribed for the fishing boats, the procedures of removing the head and guts and the freezing store on the boat.	
Sanitary regulations for market on the land are prescribed.	Market on the land is classified as processor, therefore it must pass the regulation of GMP and HACCP.	Only for exports.
Raw Materials Raw materials before and after unpacking and products before and after packing are separated by partitions.	Not necessary.	EU standard.

Comparison of HACCP Standards in EU, US and Tokyo Factory — continued

EU (Directive 91/493)	US (GMP-21 CFR 110)	Tokyo Factory
Raw materials and products should not be stored in the same coldroom.	It is possible to store raw materials and products in the same coldroom only if the distance between them is over 1m.	EU standard.
Administration Strict checking of water for use.	Water is sanitized and safe.	EU standard.
It is necessary to monitor the mercury by the authority.	Not necessary.	US standard.
GMP is carried out, but checking lists are not prescribed.	General sanitary checking are carried out in the 8 sanitation areas with records. The improvements must be reported.	US standard.
HACCP is carried out, but detailed regulations are not prescribed.	Detailed HACCP regulations and requirements are prescribed.	US standard.

■ Subjects in the Future and Problems of HACCP Introduction

1. Effects of introducing HACCP (see Table 2)
2. Subjects in the future
 - (a) Reduction of cost of HACCP

The costs of introducing and managing of HACCP is very expensive. However, these costs include the cost of GMP, which is the prerequisite of HACCP, which includes the costs of new or upgraded facilities. GMP requires the improvement of the manufacturing environment such as the individual storage place of the raw materials and packing materials, floor, drains and partitions between clean and non-clean areas. Most of cost is spent in this area. Also the purchase and running cost of

indicators by which the important administration points can be observed and monitored is needed.

From USDA's calculations in the case of small scale factory, the cost of HACCP with GMP improvements is a half of that without GMP. For example, the cost of improvement on the point of GMP and HACCP is almost 120 million dollars per year. On the other hand, the cost of HACCP itself is only 60 million dollar per year. The cost at the receiving place of materials, the administration cost, and the cost of the cleaning and sterilizing of the machines are very expensive.

(b) Verification

It is very important to verify that the HACCP plans are suitable with regards to food-safety, main critical control points, the setting of the critical limits, the

Table 2: Effects of HACCP on the Claims in Tokyo Factory and Others

Factory Name	Claim (%)	Physical Claims	Chemical Claims	Biological Claims
Tokyo Factory with HACCP	33	17	1	6
Yokohama Factory without HACCP	62	14	2	21
E Factory without HACCP	80	5	1	10

Comments:

1. First purpose is that the number of claims be reduced by 1/10 through HACCP. The number of claims actually decreased by 1/2 to 1/3. It is indicated that HACCP resulted in decrease of the biological claims and increase of the shelf-life.
2. Physical claims are mainly the contamination of wrapping films.
3. In Tokyo Factory, HACCP controls the products' quality and ISO manages the systematic quality.

evaluation of monitoring data, and the corrective methods. These verifications need the scientific knowledge and skill. After mastering HACCP, the suitable evaluations can be done.

(c) Applying HACCP for high-risk products

HACCP is introduced into the chilled foods, the vacuum packed foods, the cooked and chilled foods for preventing microbiological contamination. To increase the shelf life, new technical inventions such as packing with inactive gases are utilized in many new age foods. However the microbiological safety of these techniques is not verified yet. US and EU apply HACCP for the seafood industries which have high risks and in which people are interested about its healthy aspects.

(d) Introduction of HACCP in phases

The food industries are already making efforts to supply foods to consumers that are safe even before the introduction of HACCP. Fish decreases in freshness immediately and become easily contaminated by

microbes. Therefore, HACCP must be introduced and improved upon in phases.

(e) HACCP monitoring equipment

HACCP is based on the control and monitoring of critical control points in as close to real time as possible. Sensors and indicators with high sensitivity, high accuracy and high specificity are needed. In the future, the developments of biosensors and non-destructive monitoring equipment would be unavoidable.

(f) Protection of the companies' secrets

HACCP requires the recording of important critical control points and its data, which are the secrets of the company, such as machine name, layouts, flow diagrams, material used, recipe, pH, and cooking temperature and time. The protection not to leak such secrets is very important. The privacy of the data and know-how accumulated should be respected.