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III.2. The History and Methods of Squid Processing

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1. The history of squid processing

Squid fishing in Japan has existed since ancient times, so one must suppose that there is an equally long history of squid processing. The oldest process will be the very easy manufacture of surume (dried squid) which was being eaten as long ago as the Heian period (792 to 1192). In the Enkishiki, the imperial court record of that period (927) it is said to have been used for tribute, and, being preserved and dried, to have been used as raw material for cooking for banquets.

This historical record suggests that surume was the first squid product. During the Hojo period (1203 to 1333) the surume produced in the Hakodate region was a commercial article which was exported to China together with konbu (kelp, Laminaria), namako (bêche de mer, Stichopus) and dried awabi (abalone, Haliotis) from Nagasaki. It became a staple article

of maritime commerce all the way from Tsushima, Goto (Nagasaki), Fukuyama, Shimane, Ishikara and Sado (Niigata) to Oshima, Hiyama (Hokkaido) and Sanriku (Aomori, Iwate). In Hizen (Saga prefecture) the Matsumae family soaked the surume in seasonings and stretched it for presentation to the family of the shogun, and this can be considered as the first delicacy of the modern type.

It was not the only article of commerce. As the domestic demand gradually increased, surume came to be used for secondary processing, especially for tsukudani*. From the Meiji Restoration (1868) to the Taisho era (around 1920) there was increasing manufacture in the Kansai (Kyoto - Osaka) region of tsukudani from kizamisurume and araresurume (cut into small cubes).

Shiokara has been made since ancient times in the squid producing districts, and 300 years ago in the Kanbun era (1661 to 1672), Namekawa (Fukuyama prefecture) became famous for the manufacture of the kurotsukuri style of shiokara as preserved food for use during the winter season of no fishing. In the Genroku era (1688 to 1703) the process in which the body was minced and mixed with the squid ink was introduced and highly valued, and the akatsukuri style was also developed for use when the squid could not be dried because of rainy weather. Important quantities of akatsukuri were produced in the Hokkaido and Tohoku regions.

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* For Japanese food names not immediately explained, see the detailed descriptions given later in this article. Translator.

From the earliest times the production of the main item, surume, was often influenced by the occurrence of rainy or cloudy weather, and frequent use was made of the same process of preserving in salt as had from time immemorial been used for fish. The manufacture of salt dried squid was begun in the Niigata and Fukuyama districts in 1912, and about 1919 to 1920 it was extended to Ohata in Aomori prefecture. Since then Niigata and Nagano districts have been the principal producers of squid products, and around 1952 to 1953 the districts with most production were Hachinohe and Ohata.

Both our industry and our way of life changed greatly with the second world war. Large catches were continuously made after the latter half of 1945, and matters settled down to some stability after controls were lifted in 1950. The manufacture of squid products has become prosperous in Hakodate and Hachinohe.

There has been a remarkable expansion of the manufacture of squid products with the gradual introduction since 1955 of new methods and of mechanization with skin removing machines, cutting machines, vacuum packing machines and squid splitting machines. The manufacture of kunseiika (smoked squid) was begun in 1955 in Hakodate, which at that time was the principal producer, and in 1959 or 1960 squid sugatayaki began to be produced. The manufacture of seasoned split dried squid began around the secondary processing industry in Kansai in 1961

and when this rapidly became popular Hakodate and Hachinohe began to manufacture large quantities. From about 1972 "soft split squid" using raw squid as material has been manufactured, and this has acquired new status as it has satisfied popular taste for delicacies.

Though the liver obtained in the manufacture of surume was used for shiokara most of it was discarded. In 1925 Mr Kokichi OSHIMA in Hakodate originated the autolytic method of extracting oil. At that time it was manufactured as an oil containing aminoacids, but since about 1949 the protein has been used for fodder and is still being used for SP fodder. The oil extracted from squid is a dry oil which can be used as a substitute for linseed oil or tung oil and there has been increased production of this by-product of surume.

The decline of squid stocks has led to searches for squid abroad, and there is continued interest in the utilization of squid species which have not hitherto been used.

II. Squid products and processing methods

At the head of the list of squid products one must put surume. There are very many products resulting from the secondary processing of surume. These include shiokara, seasoned and canned squid, and one can say that squid accounts for more products than any other type of sea food. Table III.2.2. shows the various different methods of preparation.

Table III.2.1

Methods of utilization and preparation of squid

Squid meat

Dried products (see Section 1)

Surume Salt-dried surume, seasoned dried surume (daruma) squid tokkuri (bottle-shaped, etc.)

Reprocessed surume (see Section 2)

Noshisurume (dried and flattened)
Kizamisurume (minced) matsuba (shaped like pine leaves) unimusubi (mixed with sea urchin), Matsumae pickle, etc.

Smoked products (see Section 3)

Smoked squid

Processed as delicacies (see Section 4)

Ajitsukesakiika (cut up and seasoned), ika sugatayaki matsudakeika (mixed with the mushroom Armillaria matsudake), waika, etc.

Tsukudani products (see Section 5)

Noshisurume tsukudani (dried and flattened),
arare tsukudani (cut into cubes)

Shiokara products (see Section 6)

Squid shiokara (shirotsukuri, akatsukuri, kurotsukuri)

Pickled sea-foods (see Section 7)

Squid kasuzuke (in sake lees), squid suzuke (in vinegar), squid unizuke (with sea-urchin)

Canned products (see Section 8)

Canned in boiling water or with seasonings

Squid liver (see Section 9)

Liver oil, squid oil
Liver extract, SP fodder

1. Dried products

There are many products in which drying is the final process, and these include products in which the raw material is merely dried and those which are dried with seasoning.

1) Surume

For surume the body of the squid is cut open and it is dried, but there are several names depending on the species of squid and the method of preparation.

These include kensakisurume (made from kensakiika, Loligo bleekeri) budosurume (grape-shaped surume), otafukusurume (made from Koika, Sepia esculenta, by skinning the body and stretching it sideways into a round shape), and migakisurume (skinned and dried), but surume made from surumeika (Todarodes pacificus) as the raw material (also known as second grade surume), is that which is produced in greatest quantity. Most is produced on the Pacific side of Hokkaido, followed by Aomori Prefecture and Iwate Prefecture.

(1) Manufacture

(i) Cutting

A cut is made with a knife from the tip of the squid across the visceral cavity from the head to the end of the fin without ripping the viscera which are then removed from the body. The tentacles are held to the body and the centre of the head is split to remove the eyes and the beak.

(ii) Washing in water

A round scoop is inserted and the impurities are removed by rinsing well in clean water.

(iii) Drying

The usual method is that of hanging from ropes. Ropes are stretched at five or six levels between poles about two metres apart at the drying site, and the squid are dried by being folded with the abdominal cavity surface outward and hung on the ropes with the two long tentacles spread out to left and right and hanging to both sides of thebody. When the drying has progressed to four or five tenths, the body is removed from the ropes and the lower part of the head is placed on the rope. At the same time the tentacles on the rope are again pulled apart and when the drying reaches six to seven tenths, two squid are joined together by the long tentacles and hung from a rafter. They are stored in a shed before sunset, or, without being allowed to get exposed to the night dew, they are laid on a straw mat outside , and drying is continued next day. They are once again hung from rafters, and when about seven to eight tenths dry, they are gently removed, and the body, fins and tentacles are pulled apart, smoothed to remove wrinkles and shaped into triangles. Bundles of six squid are then dried on bamboo mats and piled in the evening on straw mats in the shed to steam overnight. Drying is continued next day, the drying being finished in about three days. Recently however, simple drying equipment

has been installed in many places in all fishing districts, and drying is done with heat, particularly in unseasonable weather. In many cases a drying shed of twenty square metres is used with a kerosene stove and a hot-air forced draft machine. As an example, the drying of water may require two to five hours at 25°C to 30°C followed by eight to ten hours at 5°C to 40°C*. The squids are then 5 to 6 tenths dry. After shaping the drying is finished with about forty hours at about 45°C. There are many types of equipment, and their efficiency is variable, but when they are used jointly with sun drying there is an improvement in quality.

(iv) Packing and storage

Packs of ten are made, the heads being joined together by the long tentacles of the outside surume. These packs are well dried, taken into the storage shed and wrapped in straw mats for storage. During long period storage they should be occasionally exposed to sun and air, and inspected for the development of mould.

(2) Yield

16% to 23%, with a product containing 18% to 22% water.

(3) Quality

When the raw material used is fresh and drying is done in a short time, the meat shows a pale amber or yellowish white colour, few of the suckers fall off, the

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* Sic, but ? 35°C to 40°C. Translator.

odour is good and a good quality is obtained. If the materials are less fresh, or if freshness is lowered by unseasonable weather during drying, the meat becomes hard and fragile and takes on a reddish tinge, it is "mure" (musty" and shows the marks of the ropes, and so becomes of low quality.

2. Salt dried surume

As with surume, this may be chopped, salted and dried.

(1) Manufacture

(i) Cutting

As for surume.

(ii) Washing in water

As for surume.

(iii) Salting

In the brine salting method generally used in clear weather the squid is soaked in salt water of Beaume 24^{o} for twenty to thirty minutes. In dry salting, about 7% to 8% of salt is sprinkled on the opened-up squid, rubbed well in and left for two hours. The surface is then washed and the squid is taken away for drying.

(iv) Drying

In clear weather the squid are spread out on straw mats and the drying is finished in one day. Drying to five tenths takes one to two days. When artificial drying machines are used the manufacture requires eleven hours at temperatures from a low of $30^{o}C$ to about $45^{o}C$.

(v) Packing, wrapping

Five or ten squid are tied together and placed in a polyethylene bag which is packed in corrugated cardboard.

(2) Yield

30% to 33% with a water content of 30% to 35%.

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2. Secondarily processed surume

1) Kizami surume (minced)

A great deal of surume is used in the minced state as the raw material for tsukudani.

(1) Manufacture

(i) Spraying and moistening

The day before it is to be minced the surume is assembled, laid out lengthwise in lines, sprayed with water to about 5% of its weight, and left for twelve to fourteen hours to dry off. The meat then becomes softened with a uniform water content.

(ii) Compression

The surume raw material is piled up in a wooden frame of a defined size and compressed.

(iii) Cutting

It is finely minced to pieces of 0.5 mm thickness by chopping machines with reciprocating or revolving blades.

(2) Yield

96 ~ 120 %

2) Noshisurume (stretched)

The surume is placed in a stretching machine and stretched. It then becomes flavored noshisurume, or it may be cut up into small rectangular pieces (tanzaku). It can be used for tsukudani, or, with sea-urchin sandwiched between the pieces which are cut narrow, becomes chinmihin.

(1) Manufacture

(i) Removal of tentacles, fins and skin

The tentacles, the fins and the skin are removed.

(ii) Spraying and steaming

As for kizami surume.

(iii) Searing

The material is seared with an open flame to the extent of blistering both sides in order to remove water and at the same time to warm it for easy stretching.

(iv) Stretching

The material is put into the stretching machine before it cools and stretched. After passing three times through the stretching machine, the original surume becomes three to five times longer.

(2) Yield

40%.

3. Smoked products (kunseihin)

1) Kunseiika (smoked squid)

The squid body meat is seasoned and smoked.

(1) Manufacture

(i) Preparation of the material

The raw squid material is removed from the pot, the viscera, the tentacles and the fins are removed, leaving only the body.

(ii) Hot water skinning

To remove the skin the body meat is put into a hot bath at about 60°C, agitated for 10 to 20 minutes and skinned.

(iii) Boiling and softening

After skinning, the squids are well washed with cool water and then heated for three to five minutes in hot water at 85°C to 90°C.

(iv) Seasoning and pickling

There is no uniformity in second stage seasoning in different places, but they may be soaked for twelve to fifteen hours in a mixture of which the main components are

Sugar	5 to 20%
Salt	3 to 5%
Sodium glutamate	0.2 to 1%

(v) Smoking and drying

Dry in air for twenty to thirty minutes and hang up to smoke for three to five hours at 70°C to 80°C.

(vi) Cutting up

Remove ash, etc., from the surface and cut into round slices about 1 to 2 mm thick.

(vii) Second stage seasoning

As percentages of the quantity of sliced meat, sprinkle with

Sugar	5 to 15%
Salt	2 to 5%
Sodium glutamate	0.5 to 1.2%
Potassium sorbate	0.1%

mix well and pickle for 10 hours.

(viii) Packaging

Dry the surface lightly until the water content is 30% to 50%, then cool well and pack in vacuum boxes.

(2) Yield

About 10% to 15% of the raw squid.

4. Chinmi seihin (Delicacies)

There are many types of products known as "taishu chinmi" (popular delicacies) which are made from seasoned minced squid. These include sugatayaki, waika and matsudakeika. There are also many highly developed techniques of manufacture.

1) Seasoned sakiika

This typical "popular delicacy" was originally

made from surume, but recently much has been made from "soft split squid", the production of which is becoming important. Special varieties in which the roasted colour and fragrance are developed are "ogonsaki" (golden) and the white-coloured specially small "shirasaki" (white).

(1) Manufacture (soft split squid)

(i) Treatment of raw material

The squid is cut open in the same way as for surume and the viscera, the tentacles and the fins are removed.

(ii) Hot water skinning

The body is put into a skinning machine with warm water at 55°C to 65°C for 10 to 20 minutes, agitated and skinned.

(iii) Seasoning and pickling

The skinned body is well mixed with the seasoning and pickled for four to six hours.

Example of the composition of the seasoning:-

White sugar	5 %
Salt	3 %
Sodium glutamate	0.3%
Saccharin	0.025%
Sodium succinate	0.1%
Potassium sorbate	0.07%

(iv) Drying

Seven to eight hours of drying at 35-40°C in artificial drying equipment to a water content of 40% to 42%.

(v) Shredding

The dried body meat is heated and lightly stretched, put into the shredding machine and shredded to about 5 mm.

(vi) Final seasoning

This varies somewhat according to the first seasoning, and use may also be made of powder mixes or of a pickling liquor.

An example of a mixed powder seasoning is

White sugar	3%
Salt	2%
Sodium glutamate	0.3%

Other materials as required.

(vii) Final drying

The surface is lightly dried till the water content is 27% to 30%.

(viii) Packaging

Cool and pack in small bags.

(2) Yield 10 - 13% of the original material p194

2) Squid sugatayaki

Seasoned squid, toasted under pressure in its original shape, has become, together with sakiika, one of the popular delicacies.

(1) Manufacture

(i) Treatment of raw material

Same as for sakiika.

(ii) Hot water skinning

Same as for sakiika except that the tentacles are skinned.

(iii) Seasoning and pickling

After skinning, soak for two to three minutes in hot water at 85°C, cool, and then pickle in the following seasoning overnight.

Example of composition of seasoning

White sugar	7%
Saccharin	0.01%
Salt	4%
Sodium glutamate	0.3%
Sodium succinate	0.1%

Other materials as required.

(iv) Drying

Dry to water content of 30% to 40% in a drying machine at 40°C to 50°C for three to four hours.

(v) Toasting under pressure

Sandwich between two iron plates and toast for 2 minutes under pressure. A final seasoning may then be given.

(vi) Shaping, packaging

The tentacles are laid on the body, the required quantity is taken and vacuum packed.

(2) Yield

20% to 25%.

5. Tsukudani products

1) Kizamisurume tsukudani

The raw material for this tsukudani is kizami surume made by further processing of surume.

(1) Manufacture

(i) Example of the preparation of the seasoning liquor

Starch syrup	25g
Sugar	22 kg
Salt	1 kg
Vegetable gelatin (agar agar)	50 g
Water	12.6 kg

Heat to dissolve and make 60 kg of seasoning liquor*.

(ii) Cooking (boiled down tsukudani)

Place 2.8 kg of this seasoning liquor in a pot, heat to boiling, put in 1.7 kg of kizamisurume, stir to prevent sticking to the bottom of the pot, boil for seven to ten minutes.

(iii) Cooling

Cool with an air blast to obtain 4 kg of the product.

(2) Yield

160% to 180% of the weight of the kizamisurume used.

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* Sic, but this doesn't add up. ? starch syrup 25 kg?

Translator.

6. Shiokara products

1) Shiokara (akatsukuri)

Squid shiokara is normally made by preserving sliced squid in salt, mixing with liver, and fermenting. According to the method of preparation there are "akatsukuri" (red), "shiratsukuri" (white) and "kurotsukuri" (black versions, but the red version is the most common and makes up most of the quantity produced. For shiratsukuri (white) only the skinned body is used for manufacture, though recently there are versions to which chopped seaweed (kelp, Laminaria) and fish eggs have been added. Kurotsukuri (black) is a special product in which the black gut (the ink sac) has been added, and it is known to have been produced from ancient times in Fukuyama Prefecture.

(1) Manufacture

(i) Cutting

The head and body of the raw squid are cut open and the body and the tentacles are separated in the same way as for making surume. The bone is removed from the body, the viscera, eyes and beak are removed from the head and the soft circular bony parts of the suckers are also removed.

(ii) Slicing

The body is cut by a slicing machine into strips 0.5 cm wide and 5 cm long, and the tentacles are cut up in the same way.

(iii) Pickling

10% to 20% by weight of salt is applied to the sliced meat and it is pickled for one to two days, or for several days. 10% to 20% of salt is also added to the previously minced liver and it is pickled.

(iv) Fermenting

The salt-pickled liver is added in the proportion of 8% to 20% to the salt-pickled meat strips, and it is stirred and fermented. It is well stirred two to three times daily and fermented for about 10 days.

(v) Miscellaneous

Malt (yeast), mirin (sweet sake) and other seasoning materials are often added.

(2) Yield

85% of the original squid.

7. Sea food tsukemono (Japanese pickles)

Squid pickled in various seasoning materials.

1) Squid kazusuke

Squid pickled in sake lees.

(1) Treatment of raw material

(i) Take out of the pot, cut up the tentacles as in the preparation of surume, remove eyes and beak.

(ii) Warm water skinning

Put the body and the tentacles in warm water at about 60°C, stir and skin.

(iii) Boiling

Put into salt water which is already boiling (7% salt), take it out when it floats, cool in a current of water and drain.

(iv) Kazusuke

Sprinkle a little salt on the tentacles, insert them into the body and pickle the squid meat in a suitable barrel together with 20% to 30% of the following seasoned sake lees.

Example of seasoned sake lees:-

Mix well together

Sake lees	2 kg
Sugar	50 g
Sweet sake (mirin)	200 cc
Sodium glutamate	10 g
Salt	10 g

8. Canned products

1) Canned flavoured squid

(1) Manufacture

(i) Treatment of raw material

Take out shell and crush the body in a roller type fish processing machine. Wash the body and tentacles with a shower.

(ii) Boiling and softening

Put the body and the tentacles into a continuously revolving boiling and softening machine for 13 to 15 minutes at about 90°C.

(iii) Skinning

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Place the boiled and softened body and tentacles into a skinning machine (revolving mesh type), and skin by friction while revolving. Wash the skinned meat with a shower.

(iv) Cooling

Cool while washing the meat in a flowing water fish washing machine.

(v) Tentacle packing

Remove the bone, the dirt, the eyes and the beak from the body, insert the tentacles into the body, and again wash the surface with a shower.

(vi) Meat packing

When a small can is used (diameter 77 mm, height 51 mm) 115 grams of solid and 42 to 45 cc of seasoning liquor are put in for a total content of 165 g. With a No. 4 can (diameter 77 mm, height 118.26 mm) 340 to 350 g of solids and 70 to 80 cc of seasoning liquor for a content weight of 420 g are used. An example of seasoning liquor is a mixture of:-

Soy sauce	1.8 litres
Sugar	1.8 kg
Water	1.8 litres

(vii) Sealing, sterilization

Seal the lid with a vacuum sealing and sterilizing machine, sterilize at 8 pounds pressure (112.7°C) for 60 minutes. Then cool in cold water, wash the can and finish the production.

9. Squid oil

Squid liver oil has been made by an autolytic method and by alkali treatment, but recently squid oil has mostly been made by extraction by boiling.

1) Equipment

The kettle used for boiling is normally a cylindrical horizontal iron kettle of two to four tons capacity, equipped

with a stirrer and heated by either steam or by direct heat. If heated by steam, the steam pipe is led to the bottom of the kettle, and if heated by open flame, stirring equipment which scrapes the bottom is installed to prevent sticking.

2) Manufacture

(1) Boiling and softening

The kettle is filled to about seven tenths with raw livers, high temperature steam is blown in, the stirring machine is gently revolved (about sixteen times per minute) and the livers are boiled and softened. The liver gradually dissolves, and when the boiling point is reached the steam pressure is lowered and boiling continues for 30 minutes.

When an open flame is used, the flame is increased to reach the boiling point and is then reduced to maintain boiling for 10 minutes. The flame is then extinguished, and the kettle continues to boil gently for about 20 minutes from the remaining heat.

(2) Separation of oil

This boiling liquid and the oil are put together into a centrifuge and the oil is separated and removed. If centrifuge separation is not used, the boiled liquid is allowed to stand for about one day and night, and the oil is taken off when it floats to the top.

(3) Yield of oil

The yield depends on the season at which the squid is taken but averages 12% of the weight of the liver.

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