

## Some Clever Techniques in the Processing of Traditional Fish Products

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### Introduction

“New things, nice-looking things and convenient things are good”. This seems to be the trend of the world today. However, I think food should be an exception to this trend, because food contains all the essential materials for building up our body and for keeping our health. There’s no substitute for food. In this sense, I wish traditional food will be more highly commended for its merits. The essential characteristics of traditional food may be summarised by following three points:

#### 1. Exhaustive utilization of materials

This means that each piece of raw material is processed as an undivided whole, and it results in not only nutritive and flavour-rich products but also with little waste.

#### 2. Regional character

This results from the manner of processing, and the characteristics of the product are varied according to the climate and the native tastes in the region.

#### 3. Clever processing

This is due to the ingenuity of our ancestors in selecting the most appropriate processing procedures.

Now, I would like to talk about the third point, that is the technical interest in traditional foods, by the following five examples of traditional fish products in Japan and Southeast Asia.

### Clever Technique for Preserving *Umami* Taste (Good Flavour) of Dried Fish

In Japanese-style cooking, soup stock made from dried fish and dried *kombu* is usually used. The dried fish used for the stock is usually made from dark-meat fish, like anchovy, sardine, mackerel or bonito, and among these species anchovy and sardine are the most popular.

Now, for drying anchovy or sardine three kinds of drying methods have been carried out in

Japan. One is “direct drying method” (drying without any previous treatment), the second is “drying after being boiled” and the third is “drying after being salted”. But only one of those three methods has been applied to the fish for soup stock. The method of “drying after being salted” is of no use in this case, because the product is too salty.

Then, which of the other two methods is used? Anyone would think that the “direct drying” method must be used, because the method of “drying after being boiled” would result in a big loss of the water soluble components of *umami* taste of the meat during boiling. Actually, the “boiled and dried” anchovy and sardine have been used for soup stock since ancient times. There are two kinds of dried anchovy on your table. Please try to taste the difference between them.

The reason why the boiled and dried anchovy has a more intense *umami* taste than the directly dried one is explained as follows:

As is well known, the *umami* taste of fish meat is due to the *umami* multiplying effect of inosine mono-phosphate (IMP) and glutamic acid. When either disappears, the *umami* taste decreases to one-fifth or less of the original taste intensity. In the case of the directly dried anchovy, the IMP in the raw fish is gradually decomposed by phosphatase to inosine during and after drying and almost disappears by the time it is placed in the market. So, the directly dried anchovy has little *umami* taste, although the glutamic acid remains as it was.

On the other hand, in the case of the boiled-dried anchovy, some parts of IMP as well as glutamic acid are lost in water during boiling, but those remaining in the fish body do not decompose any more, because IMP-phosphatase has been destroyed during boiling. So, the boiled-dried anchovy keeps an intense *umami* taste for ever. I think “drying after being boiled” is the technique “sacrificing a little to have a lot”.

### Triple Effects of Intermittent Dry-Roasting Method in *Katsuo-Bushi*

Let’s suppose that there is a quarter split of a bonito 10 - 15 cm thick. Will it be possible to completely dry to 15% moisture? The answer should be “no”. Even if the outer layer of the fillet could be

successfully dried, the inner part must remain as it was by any modern drying machine.

However, a very clever technique for drying

such a big fillet has been handed down from our ancestors in Japan. It is the "intermittent dry-roasting" treatment in the processing of dried bonito and it is shown in Fig. 1.

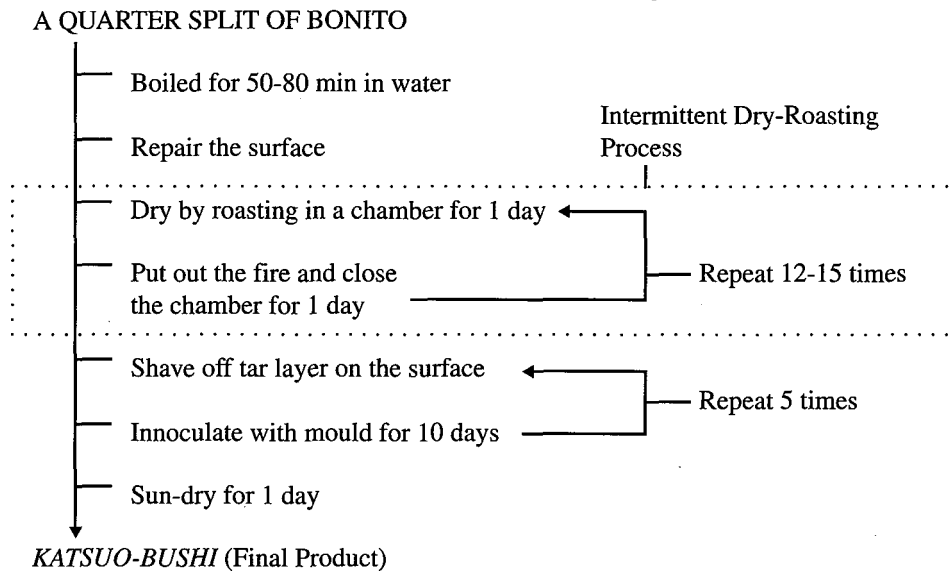


Fig 1. Procedure for Drying Bonito Fillet to make *Katsuo-bushi*.

The fillet is first boiled in water for about 60 min. After the surface cracked during boiling is repaired, the fillet is placed on a rack side by side and roasted over burning wood in a drying chamber.

During initial roasting, the surface of the fillet dries up to make a skin, and the evaporation is then completely interrupted. The fire is put out and the drying chamber is tightly closed up, leaving the fillet inside. During keeping for one day, the moisture is evenly distributed in the fillet by diffusion of the water from the inside to the surface. Then, the chamber is opened and the fire is started again. As the roasting process and the breaking-off process are repeated about fifteen times, the fillet is dehydrated little by little and finally dries up to a deep black bonito stick of 16-17% moisture. After the tar layer on the surface is scrapped off, the stick is further dried down to 15%

moisture by repeating an alternating moulding process and a sun-drying process. The dried bonito thus produced is called *katsuo-bushi*.

This intermittent dry-roasting method, which made it possible to completely dry such a big bonito fillet, is known to give two more wonderful effects to the finished product. One is a smell improving effect. Fishy smell is replaced with a nice smell characteristic of dried bonito. The other one is an oxidation-preventing effect to the lipids in the fillet. Both effects are known to be due to the smoke components, especially phenol derivatives which permeated into the fillet.

From these wonderful merits, the intermittent dry-roasting method is considered to be the technique of "killing three birds with one stone".

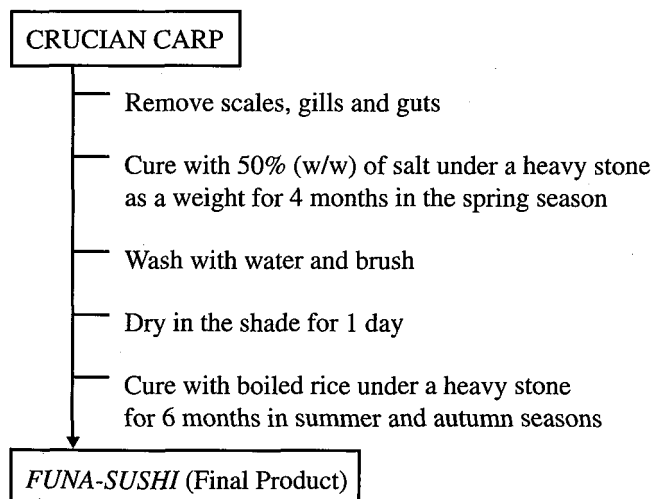


Fig 2. Procedure for Making *Funasushi*, fermented *sushi* with Crucian Carp.

### Method for Desalting Fish by Using Boiled Rice

When fish are preserved by salting during the hot summer season in Japan, 30-50% (at least 30%) of salt should be added to prevent spoilage. Such a salted fish is then too salty to eat. So it is necessary to desalt the fish. But when soaked in water, the fish body absorbs water and simultaneously loses its good flavour.

The ancient people devised a clever method for desalting by using boiled rice. The method has been applied to crucian carp around Lake Biwa since the 8th century. The product is called *funa* (crucian carp)-*sushi*, or fermented *sushi* of crucian carp. The procedure is shown in Fig. 2.

Crucian carp are first removed of their scales, gills and viscera, leaving the ovary only and cured in a bucket with 50% salt by weight of fish, weighted down by a stone for 4 months from March to July. In the beginning of summer when the temperature suddenly raises to 30°C or more, the salted fish is taken out from the bucket, washed with running water, dried in the shadow for one day and then cooked rice is stuffed into its gill cleft and abdominal cavity. Then, the rice-filled fish are put back into the bucket, with cooked rice in layers between the fish. The fish are covered with a lid and a heavy stone is put on top as a weight.

While curing with cooked rice, salt in the fish body gradually diffuses in the rice and its concentration ultimately goes down to 2%. Simultaneously, the boiled rice ferments and produces organic acids, most of which is lactic acid. The acids permeate the fish body and lowers the pH to 4-5. Due to the simultaneous exchanges of salt and acids between the fish body and the boiled rice, the shelf-life of the fish can be maintained in spite of the

lowered salt concentration. Changes in the chemical components of crucian carp meat before and during curing are shown in Table 1. After curing with boiled rice for more than five months, the fish becomes good

Table 1. Changes in the Composition of Crucian Carp Meat in the Curing Process of *Funa-Sushi* (%).

	Raw Fish (June 1)	After Cured with Salt for 50 days (July 20)	After Cured with Boiled Rice for 107 days (November 4)
Moisture	80.45	53.31	63.89
Total Nitrogen	2.04	4.56	4.01
Crude Protein	16.49	28.48	25.09
Crude Fat	1.70	3.78	4.50
Ash	1.27	14.31	4.53
NaCl	-	11.34	2.27
Total Acid	0.0123	0.0407	1.48
Lactic Acid	0.008	0.025	1.10

According to Kuroda (1972)

to eat together with skin and bone.

This clever desalting technique was devised in the olden times when rice vinegar had not yet been produced.

### Method of Drying Fish in Sauce

Drying and salting are two major techniques for preserving fish since ancient times. Both are based on the principle that the growth of micro-organisms is repressed by lowering water activity.

The third method based on the same principle was devised for preserving small-sized fish in a fishing village in Japan about 300 years ago. The method is very simple. Fish are only boiled down with a sauce. Table 2 shows an example of the composition of the sauce: soy sauce, Japanese rice wine, Japanese cooking rice wine, sugar and some spices are mixed

Table 2. An Example of the Sauce for *Tsukuda-ni* of Sand Eel.

(To 2 kg Sand Eel)

<i>Shoyu</i> , Soy Sauce .....	450 ml
<i>Sake</i> , Japanese Rice Wine .....	100 ml
<i>Mirin</i> , Japanese Cooking Rice Wine .....	100 ml
Sugar .....	450 g
Thick Malt Syrup .....	60 g
Race Ginger cut into fine stripes .....	150 g

together.

While boiling down, germs are killed and water in the fish body is drawn out into the sauce by osmotic action, and salt, sugar and other hydrophilic substances in the sauce simultaneously permeate the fish body. As a result, the raw fish becomes dried

and the water activity of the system drops to 0.6-0.7. The finished product can be at room temperature even in the summer season in Japan.

This simple and clever technique for drying fish in sauce has many advantages, including

- (1) No need for space.
- (2) The process is not influenced by the weather.
- (3) Large-scale equipment is not necessary. Only a pot or pan is needed.
- (4) Products are delicious and eatable as they are.

The finished product is called *tsukuda-ni* after the name of the fishing village, where this method was invented.

### Special Leaching Technique in *Yu-Wan*, Chinese-Style Fish Balls

Two kinds of fish jelly products are being produced in Asia. One is *kamaboko* in Japan, and the other is *yu-wan*, so called fish balls in south China and Southeast Asian countries. Both are practically the same in respect of the processing principle and the texture of the products, but somewhat different from each other in their processing.

Fig. 3 shows the processes for making *kamaboko* and *yu-wan*. In the case of *kamaboko*, chopped fish meat, that is the raw material, is first leached with 3-5 times the volume of water several times, and then the leached meat is ground with about 2% salt to make meat sol. In the case of *yu-wan* the chopped meat is first of all ground with salt and the meat sol produced is immediately shaped into balls and then soaked in water.

The leaching process in *kamaboko* is done to remove fish smell as well as meat colour. For fish

as food material, its fishy smell is the weakest point together with its rapid post-mortem deterioration. So, the idea that the smell should be removed from the raw meat before grinding with salt seems to be quite natural.

In contrast to that, the soaking treatment in *yu-wan* is primarily a device for keeping raw fish balls from sticking together. But I think this process undoubtedly functions as a means of leaching for raw fish balls. The idea that the fishy smell and the meat colour should be removed not from the raw meat but from the meat sol is really unique and wonderful, because this idea makes it possible to produce fish gel of good quality without using iced water even in the tropics.

If there was no ice, we cannot make *kamaboko* in such a hot climate, because myosin in the chopped meat would have been considerably denatured by heat during the leaching and dewatering processes. In the case of *yu-wan*, myosin has already been solubilized to a sticky sol prior to denaturation. After having been formed into balls and put in water, *yu-wan* of good quality are ours.

After all, *yu-wan* could be produced without ice even in the open air in the tropics. I think *yu-wan* is produced by such a clever leaching process similar to raw fish balls. It seems quite natural that it is considered to have been born in the hot Fuchou district, Fujian, south China.

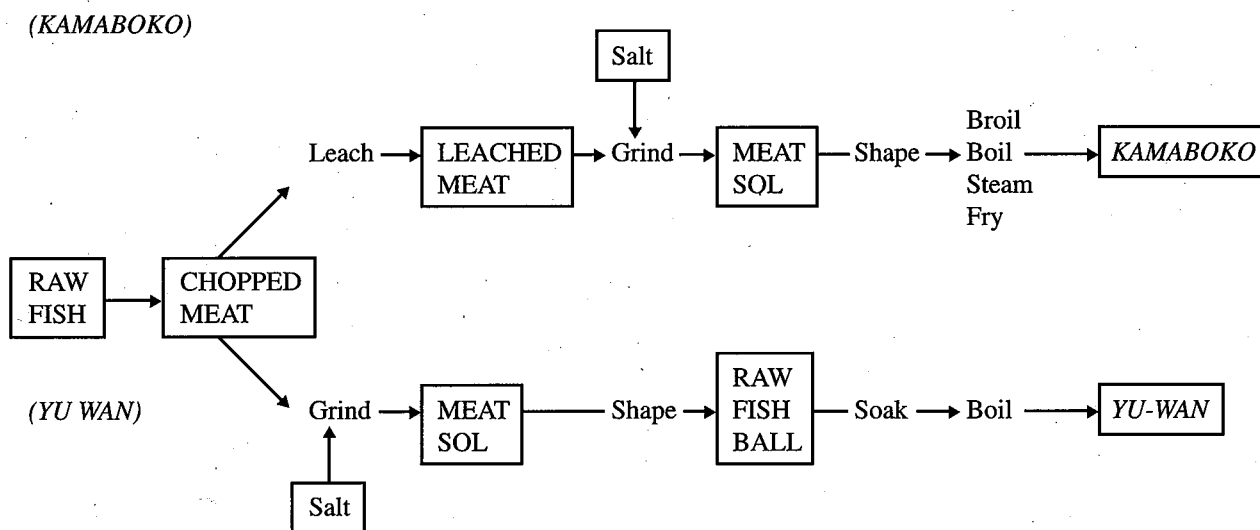


Fig. 3. Procedures for Making *Kamaboko* and *Yu-wan*.

### Conclusion

Most traditional foods were made by the natives, in a specified district or a country, according to the available food sources and the climate conditions. Therefore, those foods prove their merits only in their native region and cannot be easily transferred to other regions with a different climate.

I hope that various kinds of traditional fish products from Southeast Asian countries will be taken up more often as the subject of your research work, and that the fruits of your work will be used not only for the quality improvement of the product concerned, but also for the development of new fish-utilizing technology in the region.