SEAFOOD SERVICES AUSTRALIA

Beche de mer
Konowata Product Development

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CONTENTS

97/409 Beche de Mer - Konowata Product Development

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Objectives

1. Trial and perfect the process involved to produce konowata
2. Document the procedure and operating conditions in the konowata process
3. Conduct sensory evaluation trials on market acceptability of prototypes
4. Publish a konowata case study report that could stimulate beche de mer industry members to investigate other product opportunities.

NON TECHNICAL SUMMARY

Commercial fishing for beche-de-mer, or sea cucumbers has been carried out in Australian waters since the early 1800's. Species of commercial interest have included: the sandfish, black teatfish, prickly redfish and the lollyfish. Of these, the sandfish is the most common commercial species and is found on inner reef flats, and in bays and estuaries along the coastline. They are bottom dwellers that feed on sediment while moving slowly across the seabed and they often spend part of the day buried in the silty sand. Harvesting is carried out by collecting the animals from shallow water at low tide or by diving in deeper water providing visibility is good.

Traditionally, fishermen have harvested sea cucumbers for processing into dried product. This product is then exported to Asian countries for consumption. Recently, research has focussed on developing value-added products from sea cucumbers. One such product is konowata. This is a traditional Japanese product that results from fermenting the intestinal tract of beche-de-mer. It is highly prized by the Japanese who pay up to A$100 for a 60 gram bottle of the best quality product.

Approval to collect beche de mer from Moreton Bay for the purposes of the research project was obtained from the Queensland Fisheries Management Authority (QFMA). The Centre's team conducted trials that evaluated and optimised the handling of live animals, the holding of animals (purging), evisceration to obtain the raw material, the handling of the intestines and the salting/fermentation process. The study also included evaluation of microbial, chemical and sensory characteristics of raw material and finished product. A comparison of experimental konowata with current imported product was also undertaken and market feedback obtained from Japanese buyers and specialists in konowata.
A video and manual were produced to demonstrate the main principles of collection and processing.

A number of protocols critical to the production of quality end product were developed from this study. These include:

> on-board handling of live animals
> purging of animals prior to processing
> good manufacturing practice during processing.

Specific results from this study are as follows:

- Following capture, care needs to be taken to minimise stress to animals during on-board handling and transportation to purging cages. Failure to do this may result in self-evisceration or mortality of animals. Good handling practice should include:
  > keeping animals out of direct sunlight,
  > keeping them cool by layering in bins with moist bags separating each layer,
  > minimise holding time out of water to 3-4 hours.
- Recovery of clean intestines varied between seasons as did the size and condition of animals.
- Salting rates between 8-9% gave a finished product of acceptable 'saltiness".
- The addition of commercially available enzyme did increase proteolysis but caused undesirable quality changes (darkening of colour) of the final product.
- The addition of acetic acid (vinegar) to assist in breaking down intestinal material during fermentation did not appear to improve product texture.
- The rate of fermentation is temperature dependent and influenced by the microflora, enzyme addition rates and salting rate. Fermentation carried out between 10°C and 20°C produced final product without any colour or flavour defects.
- Comparison of konowata produced from frozen salted and frozen unsalted intestines indicated the former treatment as having the most potential for producing a quality end product similar to that derived from fresh intestine.
- Microbial tests on raw and finished intestines indicated a low level of microflora, when compared with other fermented food products.
- Pilot trials to confirm trial methods on a commercial scale indicated that handling large quantities of animals for salting, draining and fermenting presented no problems, although the evisceration and cleaning processes are the most labour intensive activities.

It is essential that the gutting, cleaning and processing operations be carried out according to good manufacturing process including:
> a high level of personal hygiene must be practised to ensure contamination from spoilage and pathogenic bacteria does not occur,
> all work and equipment surfaces should be smooth, free of cracks, non-porous and non-absorbent and
> all equipment used in these operations must be properly cleaned and sanitised prior to use.

- Preliminary sensory assessment of prototype konowata from Japanese experts indicated that a product of marketable quality was achievable. An issue is the sourcing of raw material from a different species to that utilised in Japan.

The research project "Beche de mer Konowata Product Development" was funded by the National Seafood Centre and undertaken by the Centre for Food Technology. To summarise, results demonstrate that with proper management of live animals and by maintaining good manufacturing practices it is possible to prepare konowata from the sandfish species, *Holothuria scabra*, that is not dissimilar in quality from that being processed in Japan from local species.

KEYWORDS: Beche de mer, konowata, *Holothuria scabra*, fermentation

BACKGROUND

This project follows the recommendation from a previous funded project for developing value added products. The initial funded project assisted with the development of the beche de mer industry. This assistance resulted in the publication of a technical manual ('Food Processing Concepts for the Australian Beche de Mer Industry', Rich, B 1995, QDPI), that has gained international recognition. Included in the publication was reference to highly valued products such as konowata.

The fermented beche de mer intestine or konowata is a traditional Japanese product. Although described in the literature as a fermented product, the levels of micro organisms in good quality product are low and would be insufficient to cause proteolysis. It is probable that this breakdown of intestinal material occurs through the action of both enzymes as well as micro organisms. Its origins are in the Northern Prefectures of Japan where Holothurians (sea cucumbers) are fished during the winter months. The optimal time of harvesting is January / February which is also the coldest period, as at this time the intestines are said to be thin and of superior quality. (*pers. comm.* Mr.Kera of the Tokyo fish markets).

Konowata is consumed mainly by the older generation and is considered a delicacy. After fermentation it is bottled and frozen. The frozen konowata is thawed immediately prior to consumption and is eaten in several ways, usually as an entrée or an hors d'oeuvre. In the latter case, it may be consumed as is, or spread over warm rice or crackers. As an entrée it is recommended that it be eaten with warm rice topped with raw quail eggs.

The product is currently manufactured in Japan and has a well-established market. Ocean Quest Pty Ltd has been in contact with manufacturers who have expressed interest in an Australian product. Relationship development was established during the project with the aim of establishing market entry. However, marketing arrangements are at the discretion of Ocean Quest Pty Ltd.

Currently, no use is being made of the sea cucumber intestines. Internal organs (40-42% of wet weight) consist of intestine, gonads, respiratory tree and gonads. Of this 20% is useable intestine but this contains sand. Cleaned intestines account for 2.4% of wet weight. As the industry in Queensland is capped at a total allowable catch of 500 tonne per annum, this amounts to around 12 tonnes of potentially useable raw material.

This project work was based on a local sandfish (*Holothuria scabra*) taken from Moreton Bay in Queensland. It was chosen for its potential as an aquaculture species and its similarities to the main species fished in Japan (*Stichopus japonicus*).

NEED

The beche de mer industry is a small industry of limited resources with only a small number of species being targeted for collection. This compounds the problem of maintaining a viable and sustainable industry. As the majority of processing involves the production of traditional dried product, the Australian industry is vulnerable to market fluctuations in the international market.

If the Australian beche de mer industry is to be sustainable the raw materials available to it need to be fully utilised. If the individual processing establishments are to be viable, facility use needs to be maximised and returns increased.

This project provides a basis for further development of the industry. Initial market assessment indicates a demand for such a project and interest has been expressed by overseas contacts from a marketing perspective.

PROJECT OBJECTIVES

> Trial and perfect the process involved to produce konowata
> Document the procedure and operating conditions in the konowata process
> Conduct sensory evaluation trials on market acceptability of prototypes
> Publish a konowata case study report that could stimulate beche de mer industry members to investigate other product opportunities.

METHODS

Literature searches
AUSEAS was commissioned and completed a literature search on information pertaining to the processing of konowata. (Appendix 6) The search did not provide any information on konowata of practical value. The library service at the Centre for Food Technology conducted an additional Internet search for information on the processing of konowata. Again the search provided very limited information (relating to the biology of beche de mer and aquaculture, but not processing).

Marketing
Information relating to the physical and chemical characteristics of konowata was obtained from an Australian based Japanese food importer (Jan Pacific Pty Ltd). This importer is currently importing konowata under the brand name Ooshi Marine Products. The Japanese label on the product was translated and information about consuming the product was obtained.

A Japanese seafood specialist in Tokyo, Mrs Hiromi Ishikawa, was contacted for information pertaining to the processing of konowata. Mrs Ishikawa was able to obtain some information from a specialist company, Kangyoka Tosui (Mr Kera and Mr Ishii, 1.275, 5-2-1, Tsukiji, Chuoku Tokyo, Japan, Fax 0011 81 3 3541 6239), that provided information on the raw material requirements, time of harvesting and general methods of processing konowata.

There may be an opportunity for import replacement if there is an issue with konowata made from Australian species, and further market research may identify whether there is potential. Additional frozen samples have been supplied to Mr Lee Dexter, Ocean Quest Pty Ltd for further market feedback.

Trials

A series of trials were completed during the course of the project to:

> determine methods of obtaining good quality clean intestinal material;
> optimise the fermentation process;
> scale-up to simulate commercial production.

Cleaning trials

The beche-de-mer of commercial interest are bottom feeders and use tentacles to gather sediment into the mouth. The ingested sediment passes slowly along the gut and the contained micro biota is digested and the castings are discharged through the anus. Because of this feeding habit, the intestinal tract is usually tightly packed with sandy sediment.

Industry practice should be to eviscerate animals at sea following collection. Evisceration is carried out using a sharp blade to make a 2-3 cm cut along the lower abdomen to the anus. The internal organs are then removed through this incision. Gut is disposed of and the eviscerated animals are packed for transportation to processing plants. A series of trials was carried out to determine whether the intestinal material collected at sea could be cleaned at the processing plant.

Methods investigated were:

> stripping the intestines by hand;
> flushing the intestines with water by insertion of a capillary tube;
> agitating in water using a magnetic stirrer;
> tumbling intestines in a rotating drum;
> agitating by using aerated water;
> agitating in mesh trays immersed in water;
> purging live animals by holding in sea water tanks at the processing plant;
> purging live animals held at sea in purpose built cages.

In all trials (except purging trials) both frozen and fresh intestinal material was used.

Fermentation trials

Initial trials were conducted using the only method described in the literature (Green Mottet, M (1976) "The Fishery Biology and Market Preparation of Sea Cucumbers" Technical Report No 22, State of Washington, Department of Fisheries USA. The method is as follows:

1. The intestines are squeezed out by hand, without causing breakage.
2. They are then washed in clean salt water and drained.
3. The viscera are then salted using 10-15% salt by weight to raw viscera.
4. One third of this salt is added first to the draining viscera (the salt increases the amount of water being extracted).
5. Following further draining the remainder of the salt is added.
6. The mixture is stirred frequently for 5½ hours.
7. When dripping ceases, the mixture is placed into a barrel and covered with a lid.
8. The mixture is then only stirred occasionally for approximately 1 week while fermentation occurs.
9. At the completion of fermentation, the konowata is packed into small (65 g) glass bottles.

Later trials were conducted to evaluate variations to this method and their effect on product quality.

These variables included:

> salting levels;
> enzyme additions;
> fermentation temperature;
> length of fermentation;
> acetic acid addition;
> using previously cleaned and frozen raw material;
> using previously cleaned, salted and frozen raw material.

Commercial scale-up

The final trials for the project involved the collection of target quantities of animals (50-100 kg wet weight) to test the laboratory scale system of processing at a commercial level. These quantities yielded fermentation batch sizes of about 1-1.5 kg. The trials were also designed to ensure a supply of product to enable assessment by potential end users.

Microbiological testing

All samples submitted for microbiological testing consisted of about 10 g of intestine that was sub sampled from the total batch intended for fermentation. The method prescribed in Australian Standard 1766.2.1 - 1991 was used to determine the standard plate count.

Chemical testing

Samples submitted for chemical analysis were sub sampled from the total batch used for fermentation. The method used to analyse salt level was that prescribed in AOAC 935.47 1990. pH was determined by the method detailed in Australian Standard 2300.1.6 1990.

Sensory assessment

Samples of konowata evaluated at end of fermentation and following storage were evaluated at both CFT and by buyers in Japan (see Appendix 4 for sensory form). It is recommended that samples be provided to Jan Pacific Pty Ltd for further evaluation.

RESULTS AND DISCUSSION

Cleaning trials

Initial trials using both fresh and frozen intestines and a variety of methods previously described, were unsuccessful. Not only was compacted sediment difficult to remove from the intestine but damage to the intestinal wall also occurred and this resulted in breakage of material.

Trials involving purging of live animals in sea water for a minimum of 24 hours resulted in the cleanest intestinal material. Of the two methods trialed, holding in sea pens would be the most efficient system for fishermen as it involves minimal capital outlay (compared to salt water tanks at the processing plant) and would fit into operations based around a mothership.

Hence the current industry practice of cleaning intestines on board small vessels during collection trips would not be feasible. This may inhibit uptake by industry of the intestine collection unless there is a change to harvesting and cleaning protocols. The options of farming and milking of animals may be an option (Reference, The Beche de Mer Association Newsletter)

Care needs to be taken after collection to minimise stress to animals otherwise they may self-eviscerate or die. Good handling practice includes:

> keeping animals out of direct sunlight;
> keeping them cool by layering in bins with moist hessian bags separating layers;
> minimising holding time out of the water to no longer than 5 hours (2-3 hrs).

Floating pens or cages used for purging animals should be constructed from non-corrosive materials such as plastic pipe and mesh. Mesh size should be such that animals cannot escape but intestinal contents wash away freely.

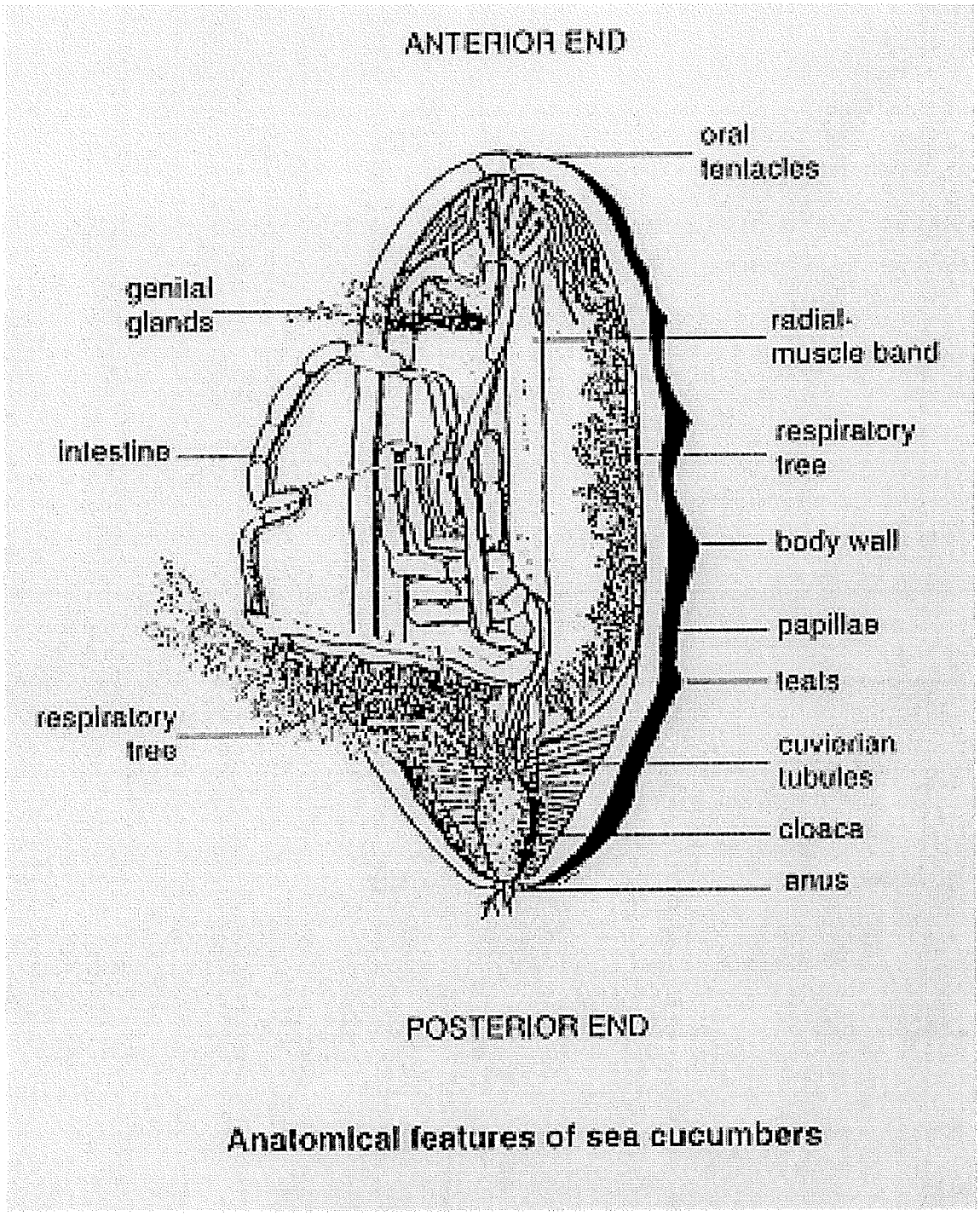
Cage design is not critical but stocking density must be controlled to minimise mortality rates. This is particularly important if holding times extend beyond 24 hours. Ideally, the number of animals should be such that only one layer forms across the bottom of the cage.

To increase cage capacity, layers of mesh could be stretched across the cage to form a number of levels within the cage.

Animals held in cages at sea were butchered at sea and those held in tanks at the CFT pilot plant were butchered in the plant.

The *rete mirabile,* respiratory tree and gonads are separated from the intestinal tract by gently pulling with the fingers or may be cut away using a thin sharp blade (see Figure 1).

Figure 1



Anatomical features of sea cucumbers

Purging animals does not guarantee intestines completely free of sediment. Final cleaning is carried out by floating the intestine in cool fresh seawater and hand stripping any remaining material from the length of the intestine with thumb and forefinger. It is important to change this water on a regular basis (½ hourly) to minimise bacterial contamination and redepositing sand on intestines.

Care must be taken during stripping to avoid breaking the fragile intestine as long intestines are highly valued by Japanese consumers. Once clean, the intestines are stored in fresh seawater held at refrigeration temperature till salted.

Recovery of clean intestines varied between seasons as did the size and condition of animals. During the summer months, cleaned intestine yield was 2.4% of total weight whereas in winter it was 1.1% of total weight (see Table 1). There was also a noticeable difference in the thickness of the intestinal wall that was much thinner in winter.

Table 1 The weight ranges and mean weights of the sandfish before and after evisceration

	Intestine before cleaning (grams)	Eviscerated weights (grams)	Total weights (grams)	Cleaned intestine (grams)
Range	6-165	207-492	231-601	3-16.5
Mean	**63.4**	**324.3**	**387.7**	**9.3**

Fermentation trials

The process of fermentation used for initial trials was that described by Green Mottet.

Samples from these trials were stored frozen. They were examined with the assistance of Mrs Hiromi Ishikawa and compared with an imported product (Ooshi Marine Products)

Salting levels

Although konowata is categorised as a 'fermented' product, it is probably more classically a preserved product. Salting plays a number of roles in the process. Firstly it accelerates the removal of moisture and secondly it limits the numbers of bacteria capable of growing during the 'fermentation' phase. Initial trial batches salted at 12% (mid range) were found to be too salty. A number of trials were then designed to yield a salt level in the finished product similar to imported commercial sample (7.5%). Besides the quantity of salt applied to raw material, the following factors will also influence the level of salt in the final product.

> quality of raw material;
> mixing of salt/intestines;
> mesh size of draining sieves;
> length of draining time.

Salting rates within the range of 8-9% gave finished product of acceptable 'saltiness'.

Salt should be fine grade (such as Cheetham 'crown vacuum salt, dairy or cheese salt') and comply with Standard J2 of the Australian Food Standards Code 1998.

Table 2 Salt content of commercially produced Konowata and trial batches

Sample	Salt added g/100 g	Product salt level g/100 g
Commercial	-	7.5 g
Trial 10	8.0	7.3 g
Trial 11	7.0	6.2 g
Trial 12	9.0	8.1 g
Trial 14	8.0	7.7 g

Addition of enzymes

The addition of a commercially available enzyme was considered in an attempt to gain increased proteolysis in the product. A protease, 'Flavourzyme®', (DSM Food Specialities) was used at 0.05% to increase the breakdown of product. This enzyme did increase proteolysis and reduce fermentation time (4 days at 20°C) but caused darkening of colour in finished product.

Table 3 Fermentation times - traditional vs enzyme treated

Sample	Enzyme addition	Temperature time	Fermentation time	Comments
Trial 3a	no	20°C	5 days	Light colour sweet, proteolysis
Trial 3b	yes	20°C	4 days	Dark colour off-odour
Trial 4a	no	25°C	7 days	Light colour clean odour
Trial 4b	yes	25°C	3 days	Dark patches off odour

Fermentation temperature/time

The method of Green Mottet did not detail fermentation temperature. Furthermore, microbiological analysis of commercial samples suggested that the breakdown of intestinal material was not caused solely from microbial activity as there were insufficient numbers present. From this evidence, it was assumed that material breakdown results from a combination of micro-organisms and enzymes. Both these systems are temperature dependent so a range of temperatures was trialed for effectiveness. These were:

> 10°C
> 20°C
> 25°C
> 30°C

Trial batches were held at these temperatures until a qualitative end point based on texture, odour and flavour was reached. Based on commercial samples, the pH at the completion of fermentation should fall within the range 5.4 - 5.7. Experimental batches for all treatments fell within the range 5.4 - 5.9. Once product was deemed to possess the desirable level of proteolysis it was bottled and frozen. The results of these trials showed:

> Temperatures >20°C fermented at a faster rate than product held at 20°C or lower;
> Temperatures >20°C were prone to develop 'off' flavours and colour defects;
> These colour and flavour defects were often associated with high total bacterial counts;
> Fermentation at 10°C and 20°C produced no colour or flavour defects.
> Breakdown of product at 10°C was slower than other treatments;
> The time of fermentation varied within a temperature treatment and is probably further influenced by microflora, enzyme levels and salting rate.

Table 4 Results of temperature/time treatments of fermentation

Treatment	Range (days)
10°C	7-12
20°C	7-10
25°C	5-8
30°C	2-4

Addition of acetic acid

Trials were conducted to test the ability of acetic acid (vinegar) to help in breaking down intestinal material during fermentation.

Two percent of vinegar (w/w) was added to the batch following salting and draining, and prior to fermentation. No improvement in product texture was observed.

Fermentation using cleaned and frozen raw material

A series of trials were conducted to compare *frozen unsalted intestines, frozen salted intestines and fresh intestines.*

These trials were completed to explore the possibilities of seasonal processing or future export of frozen intestine to Japanese processors.

The *frozen unsalted intestines* were thawed, salted and prepared for fermentation. Water loss was low (6-7%), compared to the fresh product (control) which lost 33% of weight in liquid. This meant the frozen product contained too much liquid (was too "sloppy" in appearance) compared to the fresh product. There needs to be a reduction in moisture, otherwise water activity will be high and the product too liquid. Too much liquid is an undesirable quality in fermented konowata. The frozen product also fermented at a slower rate and resulted in a darker coloured product.

Salting and draining raw material prior to freezing yielded a product similar to using fresh material although the colour was slightly darker than the fresh control samples.

Of the two freezing treatments, salting, draining and freezing raw material showed the most potential in terms of producing a final product similar to that derived from fresh raw material.

Microbiological quality of trial batches

Tests were carried out for total bacterial count on both raw and finished product. Examples of typical results are shown in Table 5.

Table 5 Microbiological results of raw and fermented product

Sample	Total bacterial count per gram
Fresh intestine	<1 000
Frozen intestine	3 000
Trial 12 fermented intestine	38 000
Trial 13 fermented intestine	<1 000
Trial 14 fermented intestine	19 000
Trial 15 fermented intestine	<1 000
Commercial product	1 000

Results indicate that compared to other fermented food products, the levels of micro organisms are quite low and would tend to suggest that they alone are not responsible for proteolysis of intestinal material.

Commercial scale-up

Four trials were carried out using larger numbers of animals to evaluate the workability of methods developed at laboratory scale level.

Animals were purged for 24 hours in cages at sea and were either eviscerated at sea or in the CFT pilot plant. Final cleaning of the gut was done in the pilot plant. To produce good quality product, it is critical to use good manufacturing practice (GMP). Elements of GMP must include:

> A high level of personal hygiene to minimise contamination from spoilage and pathogenic bacteria.
> All equipment used for processing must be properly cleaned and sanitised; and
> All work and equipment surfaces should be smooth, free of cracks, non-porous and non absorbent.

Treatments used for these trials included:

> traditional fermentation;
> enzyme (Flavourzyme®) addition;
> acetic acid addition;
> enzyme and acetic acid addition.

All batches were divided in half, following salting, draining and ingredient addition. One batch was then fermented at 20°C and the remainder at 10°C. Following completion of fermentation, product was bottled and frozen.

Depending on the size of the catch each trial utilised 1-1.5 kg of raw material.

The evisceration and cleaning process are the most labour intensive activities in the whole process. A good operator could handle around 50-60 animals per hour, yielding about 2.0–3.0 kg of cleaned intestine per operator per day.

There were no problems experienced in handling larger quantities of intestine for salting, draining or fermenting.

Sensory assessment

In house sensory assessments were conducted after each trial
Samples of the konowata were taken to Japan by Hiromi Ishikawa for evaluation by Japanese experts on konawata. Feedback is attached in Appendix .5

Table 6 shows the results of the sensory assessment for odour, appearance, colour, and flavour. Trial samples were compared against a commercially produced product imported from Japan.

Initial results were mixed and the samples were deemed unacceptable for the market although feedback towards a konowata product was positive. The samples resubmitted and described in table 6 below indicate that these samples are more acceptable.

Table 6 Sensory assessment of samples produced from processing trials

Trial samples	Odour	Colour	Taste	Appearance
Imported Japanese product	Strong sweet weedy odour	Okra / yellow with some green	Salty non descriptive flavour	Thin, liquid like, the individual intestines appear transparent and full of liquid.
1	Moderate fishy odour	Light cream, tan	N/a	Little change from start of fermentation.
2a	Moderate fishy odour	Yellow / tan with some darkening in places.	N/a	Becoming slightly more liquefied intestines still thick.
2b	Strong, sweet fishy odour	Yellow / tan with some darkening in places.	N/a	Becoming more liquefied but still intestines quite thick and not transparent.
3a	Fishy odour	Dark tan, slightly brownish.	Very salty	Intestines slightly thicker than STD.
3b	Strong fishy odour	Darker colour (tan).	V. Salty Similar to 4.	Similar breakdown to STD, colour and odour different.
4a	Sweet fishy odour	Lighter then 3a & 3b Tan / mustard.	V. Salty, texture close to STD	Some breakdown but not as much as STD.
4b	Fishy / neutral odour	Similar to 4a slightly darker	V. Salty. Walls thickish	Insufficient fermentation, walls still thick.
5	Strong fishy to slightly weedy odour	Tan to mustard, colour lighter then std, no yellow green colours	N/a	Product has broken down too far and is too liquefied. Intestines have thinned considerably.

Notes: Trial 1 - no enzyme treatment, stored at 27°C for 7 days
Trial 2a/2b stored at 21°C - no enzyme and enzyme treatment respectively
Trial 3b - enzyme treatment
Trial 4a - no enzyme treatment; 4b - enzyme treatment - stored at 30°C for 5 days
Trial 5 held at 30°C for 5 days.

BENEFITS

The current situation is that all the internal organs are discarded.

The beche de mer industry will benefit if the processing establishments diversify in the products being produced. Ocean Quest Pty Ltd will benefit by being able to offer a value added product and increase commercial returns. Given a successful outcome with konowata, Ocean Quest Pty Ltd have indicated their interest in future contributions to the development of the industry.

The project will contribute to increasing the level of highly processed export products. For example, the market for traditional dried Beche de mer on the export market is $Aus30-70/kg. Konowata is expected to command $Aus500+/kg.
Currently, the beche de mer fishing industry relies on the export of dried product and is vulnerable to price slumps and returns are variable. By comparison, konowata can command premium prices for the best quality product.

By adopting the results of this work, the industry would benefit by improving returns, utilising a waste material and reducing the pressure on beche de mer populations that would help in sustaining the fishery.

FURTHER DEVELOPMENT

Findings from this project were used to establish protocols for the collection, holding, transporting and processing of product. Feedback from Japanese experts verified that konowata developed from this work was of marketable quality. However, the product is not considered to be the equivalent quality of the leading brands.

The unknown nature of an Australian brand of the traditional konowata may be a problem. Additionally, there is a problem in duplicating the accepted konowata texture and this is most likely related to the sourcing of raw material from a different species to that used in Japan.

The market for konowata is dominated by Japan. It is a traditional product and market penetration by a new manufacturer, particularly a foreign manufacturer, would be difficult without help from a joint venture partner. Opportunities may exist to establish a joint venture with a Japanese partner to further develop the Australian konowata or to supply frozen raw material to allow processing to take place in Japan.

Commercial manufacture would ideally suit processors currently drying beche de mer and in particular those equipped with facilities to hold live animals for purging. Alternatively, processors could receive fresh intestines or salted and frozen intestines for further processing. (This latter arrangement is less ideal).

Investment in equipment would be minimal. However, the process of cleaning the intestine is labour intensive with a skilled operator handling about 400-450 animals per day.

A further progression in utilisation of waste is the production of dried roe that could be carried out in conjunction with konowata processing. Although a seasonal product, there has been interest in this product from Japanese buyers. Returns are believed to be greater than konowata but market size is not known. Potential for development of a konoko (fermented beche de mer roe) project met with a positive response from members present at the recent AGM (November 1998, Cairns) for the Beche de mer Association to support a project as a group.

CONCLUSION

This project was carried out to develop a procedure to manufacture konowata of acceptable quality. It aimed to use waste material (intestines) derived from the commercial sandfish *(Holothuria scabra)* fishery.

Protocols for collection, cleaning, processing and storage were developed through a series of trials. The outcomes from these trials follow.

Collecting and handling live animals

Following capture, care needs to be taken to minimise stress to animals during on-board handling and transportation to purging cages. Failure to do this may result in self-evisceration or mortality of animals. Good handling practice should include:

> keeping animals out of direct sunlight;
> keeping them cool by layering in bins with moist hessian bags separating each layer;
> minimising holding time out of water to a maximum of 5 hours; and
> gentle and minimal handling

Holding live animals (purging)

After capture, animals are held in purging cages for at least 24 hours to remove sand from their intestines. Stocking density must be carefully controlled to minimise mortality rates. Ideally, the number of animals should be such that only one layer forms across the bottom of the cage. To increase cage capacity, layers of mesh could be stretched across the cage to form a number of levels within the cage.

Evisceration

Following purging, the animals are eviscerated by making a 2-3 cm cut on the underside of the posterior end. The internal organs are squeezed out into cool clean seawater and the respiratory organs, gonads and connective tissue are separated from the intestine. Care should be taken not to break the intestine as long intestines are highly valued by the Japanese consumers. Once separated, the intestine is further washed in clean cool seawater to remove any traces of sand. This water should be changed regularly to minimise build-up of bacterial levels.

Salting/fermentation

After a series of trials to determine the effect of manufacturing variables on product quality, the following procedure produced best quality product.

> The washed intestines are drained in a sieve.
> The drained intestines are salted using 8-9% salt by weight. Initially, only one-third of this salt is added and this is stirred in well to ensure even blending. This salting causes a further expulsion of moisture from the viscera.
> Once most of this initial moisture is expelled (about 1 hour later), the remainder of the salt is added and the mixture stirred to ensure even mixing.
> The salted viscera are then stirred frequently for the next 4.5 hours.
> Dripping should have ceased after 5.5 hours. The mixture is then transferred to a lidded fermentation vessel (stainless steel, glass or food grade plastic) and held at 20°C for 7-10 days. It is also possible to freeze the salted viscera and hold frozen

until fermentation is desired. There is however some darkening in the colour of the end product when this modified process is practised.

> At the completion of fermentation, product is packed into small glass jars, labelled and frozen.

As a guide to potential processors of konowata, a processing manual and video have been completed. These detail the process from collection of animals to packaging and storage of the finished product.

Presentation to the Beche de Mer Association

A presentation on the potential for new products from beche de mer was given in Cairns at the Annual General Meeting of the Beche de Mer Association in November 1998. A discussion about the potential for the further work into the potential for konoko (fermented beche de mer roe) was initiated

Production of a video and manual for the industry

A video was also obtained from Japan that contained a small segment on the method used to clean the intestine in the initial stage of producing konowata. A manual was written to accompany the video to provide explanatory notes for the video (Appendix 7).

REFERENCES

Rich, B. R., *Food Processing Concepts for the Australian Beche-de-mer Industry,* Qld Dept. Prim. Ind., 1995.

Green Mottet, M., *The Fishery Biology and Market Preparation of Sea Cucumbers,* Technical Report NO 22, State of Washington, Dept. of Fisheries, USA, 1976

South Pacific Commission, Handbook No 18 (rev ed), *Sea Cucumbers and Beche-de-mer of the Tropical Pacific - A Handbook for Fishers,* Stredder Print Ltd, Auckland, New Zealand, 1994

APPENDIX 1: PROJECT STAFF

The principal investigator would like to thank the following people for their invaluable contribution to this project:

Craig Winkel	Senior Food Technologist Centre for Food Technology (Now with De Bretts Seafoods, Mooloolaba)
Gary Dennien	Senior Food Consultant Centre for Food Technology
Chris Gore	Assistant Senior Laboratory Technician Centre for Food Technology

APPENDIX 2: INGREDIENT SUPPLIER AND SPECIFICATION

Supplier of Flavourzyme®

DSM Food Specialities
Contact: John McGann
P O Box 83
Moorebank NSW 1875
Ph 02 9601 2288

Product Sheet
Enzyme Business

Page 1:3
B 717g-GB

Flavourzyme™

Application

Flavourzyme is a fungal protease/peptidase complex developed for hydrolysis of proteins under neutral or slightly acidic conditions. Flavourzyme can be used for debittering of bitter protein hydrolysates at low degrees of hydrolysis and for extensive hydrolysis of proteins resulting in taste development.
For debittering, Flavourzyme can be used at dosages of 5-10 LAPU/g protein. For extensive hydrolysis, dosages of 10-50 LAPU/g protein are recommended.
The optimal dosages must be determined in each individual case. For further information on the use of Flavourzyme, please see the leaflet "Extensive Hydrolysis of Proteins with Flavourzyme" (B 829), which is available on request.

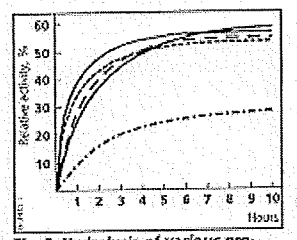


Fig. 3. Hydrolysis of various proteins with Flavourzyme.

Description

Flavourzyme is produced by fermentation of a selected strain of *Aspergillus oryzae* and contains both endoprotease and exopeptidase activities.
The optimal pH for the enzyme complex is in the range of 5.0-7.0. The optimal pH for the exopeptidase is approx. 7.0, as determined by application trials. The optimal pH for debittering is also approx. 7.0.
The optimal temperature for the enzyme complex as well as for the exopeptidase is around 50°C.

Novo Nordisk

Page 2

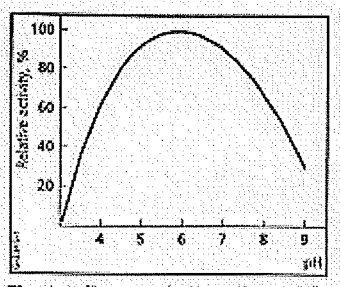


Fig. 1. Influence of pH on the activity of Flavourzyme.
Substrate: 8% soy protein isolate
Enzyme conc.: 33 LAPU/g protein
Temperature: 50°C
Method: TNBS

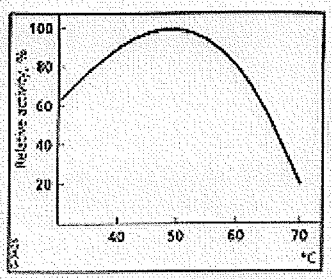


Fig. 2. Influence of temperature on the activity of Flavourzyme.
Substrate: 8% soy protein isolate
Enzyme conc.: 33 LAPU/g protein
pH: 7.0
Method: TNBS

Specifications

Flavourzyme is available as:
Flavourzyme 1000 L is a liquid formulation.

Flavourzyme 500 MG is a brown, free-flowing, non-dusting microgranulate, granulated on NaCl.

Flavourzyme 500 MG as well as Flavourzyme 1000 L are readily soluble in water.

Activity

Flavourzyme 500 MG has a declared activity of 500 LAPU/g whereas Flavourzyme 1000 L have a declared activity of 1,000 LAPU/g. One LAPU (Leucine Aminopeptidase Unit) is the amount of enzyme which hydrolyzes 1 mmole of L-leucine-p-nitroanilide per minute in Novo Nordisk's analytical method AF 298/1, which is available on request. The product complies with FAO/WHO JECFA and FCC recommended specifications for food grade enzymes, supplemented with maximum limits of 5 x 10^4/g for total viable count. The product is GRAS.

Inactivation

When using Flavourzyme for production of protein hydrolysates, the safety in use for the consumer is documented only if the production includes processing steps in which Flavourzyme is removed and/or inactivated.
Flavourzyme can be inactivated in 5 minutes at 85°C (or 5 seconds at 120°C) or higher when the pH is 4, and in 5 minutes at 85°C or higher when the pH is 7.
However, the inactivation is very much dependent on the substrate (substrate concentration, pH, etc.). Thus, the documentation for efficient elimination of Flavourzyme must be based on actual analysis for detection of residual activity.
A method (A-06468) for detection of residual protease activity in protein hydrolysate is available upon request.

Novo Nordisk

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Handling

The product is non-flammable and safe when used according to directions. Proteolytic enzymes may irritate skin and eyes and enzyme dust or enzyme-containing aerosol may cause sensitization when inhaled. Observe standard handling precautions to avoid direct contact with the product or inhalation of dust from the dried product. In case of accidental spillage and contact with the skin or eyes, rinse promptly with water.
A separate leaflet, "How to handle powder/granulated Novo Nordisk enzymes – safely" (B 143), is available on request.

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B 717g-GB

Storage

Flavourzyme 500 MG should be kept cool and dry.
Flavourzyme 1000 L must be kept at a temperature of max. 5°C.

Packing

Flavourzyme 500 MG is available in 40-kg fibre drums.
Flavourzyme 1000 L is available in 25-kg jerry cans.

Enzyme Business

Novo Nordisk A/S
Novo Allé
2880 Bagsværd
Denmark

Tel. +45 4444 8888
Fax +45 4444 1021
Telex 37560

Laws, regulations and third party rights may prevent customers from importing, processing, applying and/or reselling certain products in a given manner. It is the responsibility of the customers that their specific use of products from Novo Nordisk does not infringe relevant laws and regulations and, furthermore, does not infringe patents or other third party rights.

The contents of this document are subject to change without further notice.

B 717g-GB 200 June 1998 HPC © Novo Nordisk A/S.

Novo Nordisk

APPENDIX 3: FINISHED PRODUCT

Standard

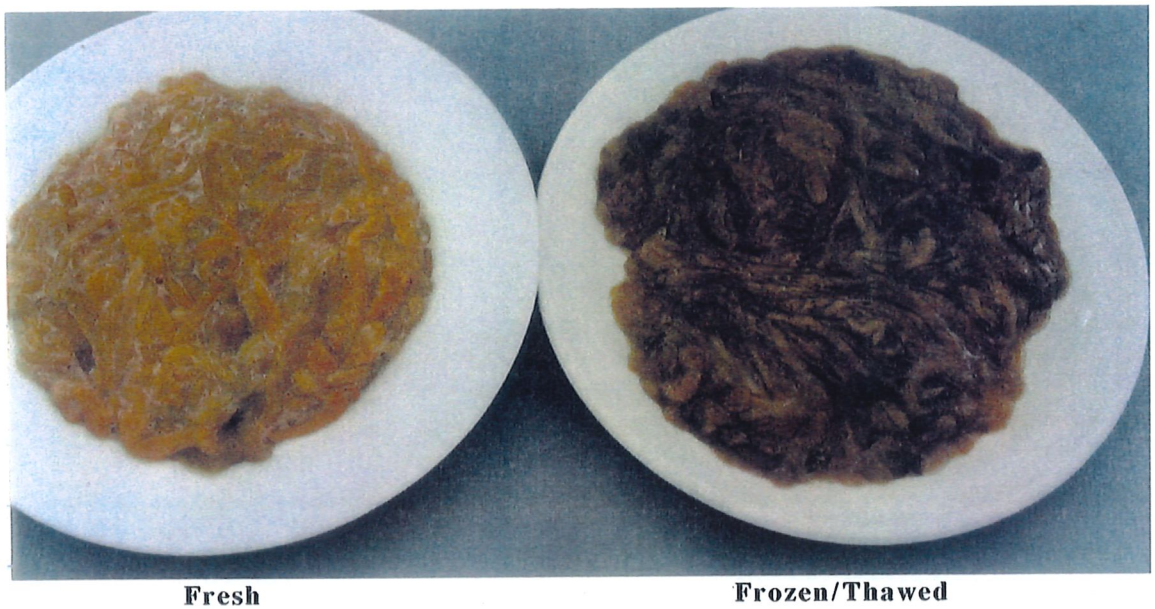
Trial 10a

Trial 10b

Trial 10c

Trial 10d

Pre fermenting



Fresh **Frozen/Thawed**

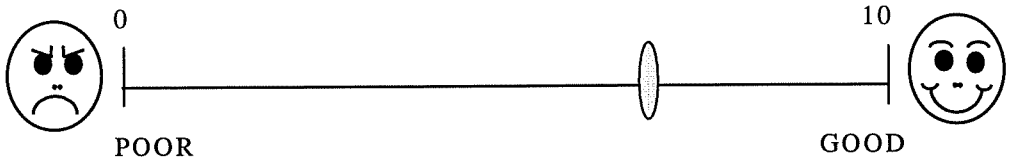
APPENDIX 4: SENSORY ASSESSMENT SHEET

KONOWATA SENSORY EVALUATION

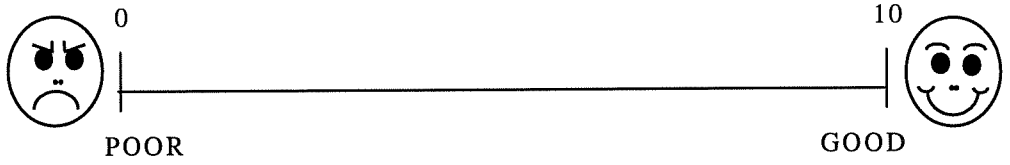
Each page represents a single sample
Please mark the level of acceptance on each graph corresponding to each characteristic.

Sample Number

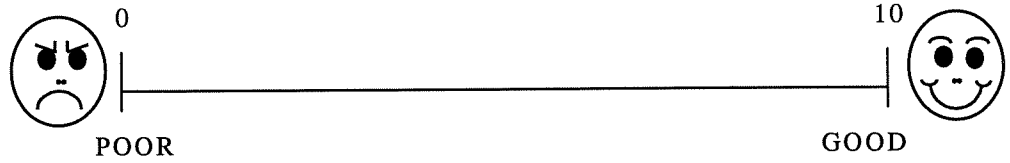
Example



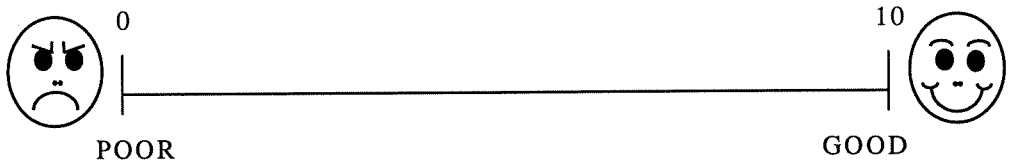
Odour



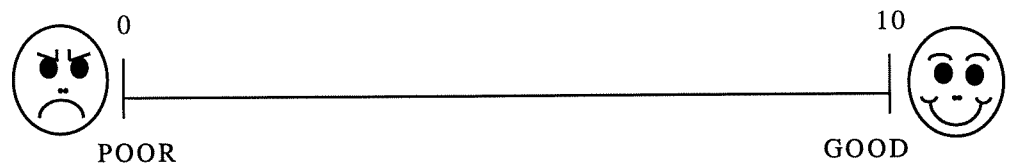
Colour



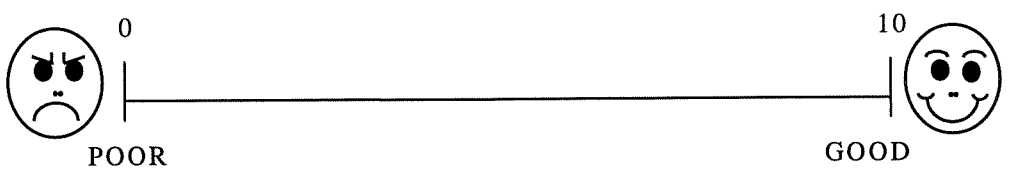
Texture



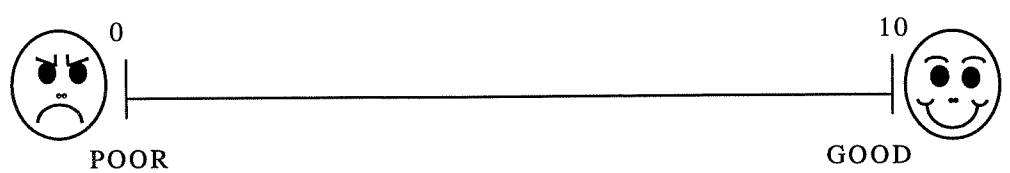
Saltiness



Flavour



Intestine Thickness

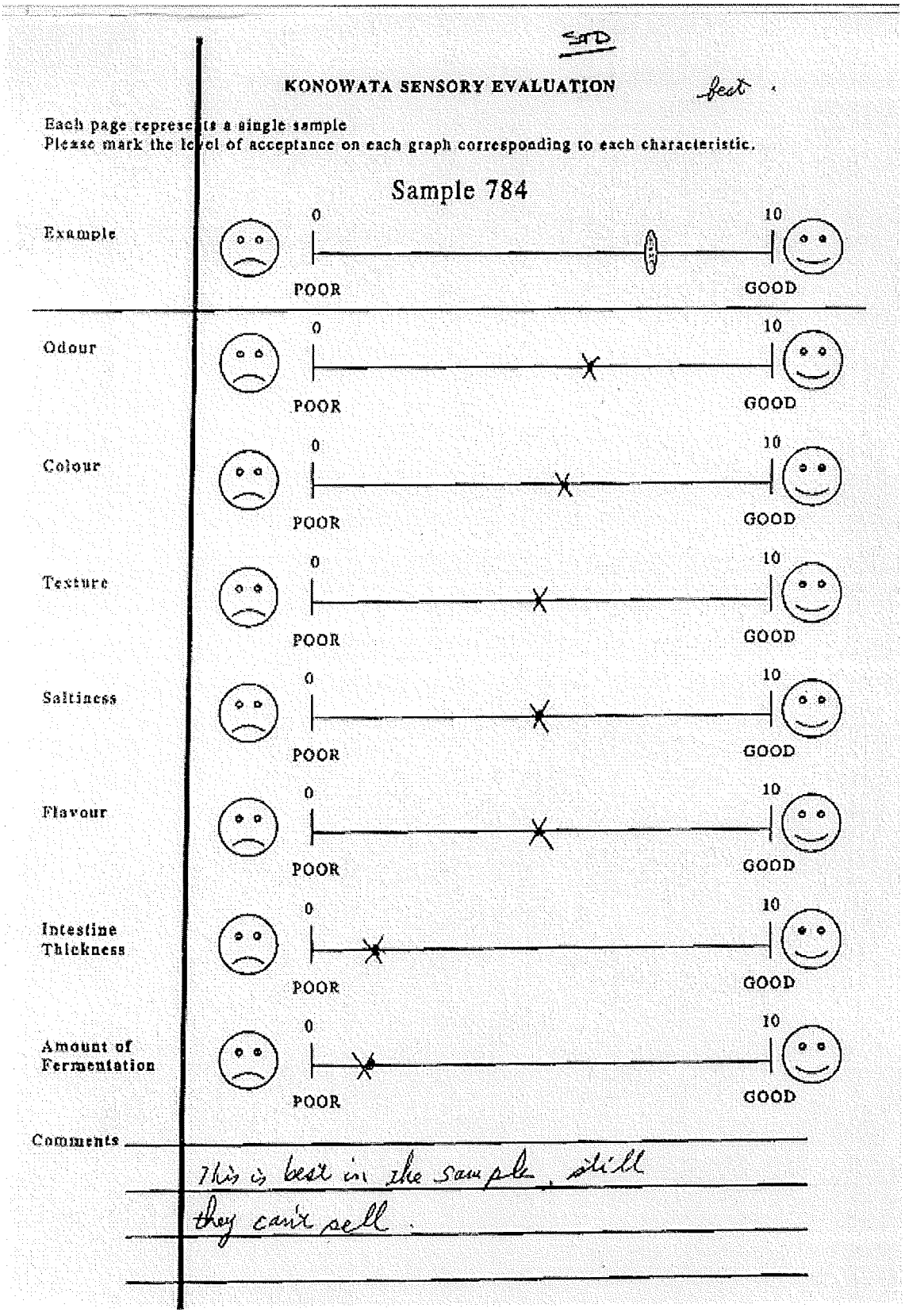


Amount of Fermentation

Comments

APPENDIX 5: SENSORY COMMENTS

Standard Sample – considered the best



KONOWATA SENSORY EVALUATION

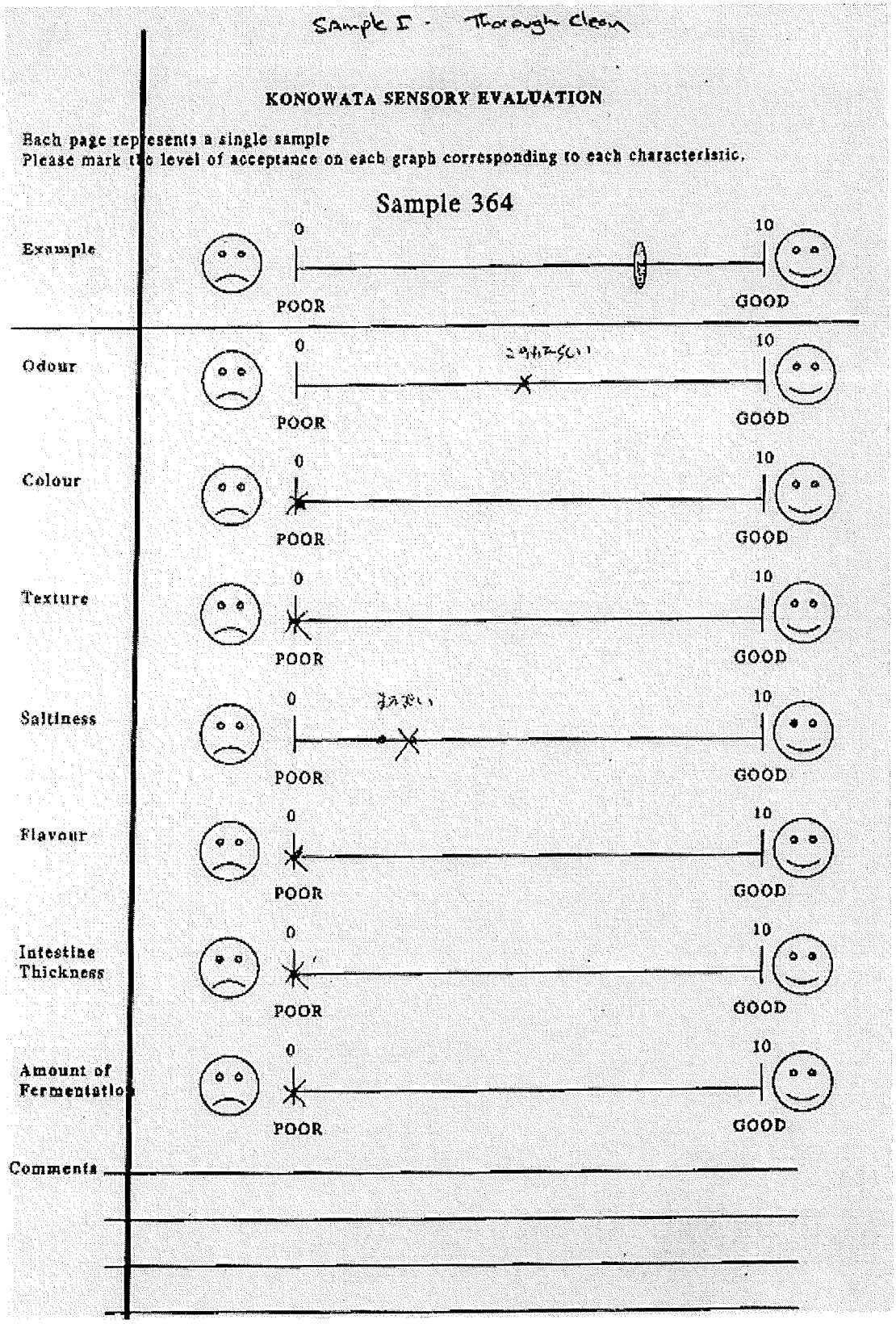
Each page represents a single sample
Please mark the level of acceptance on each graph corresponding to each characteristic.

Sample 784

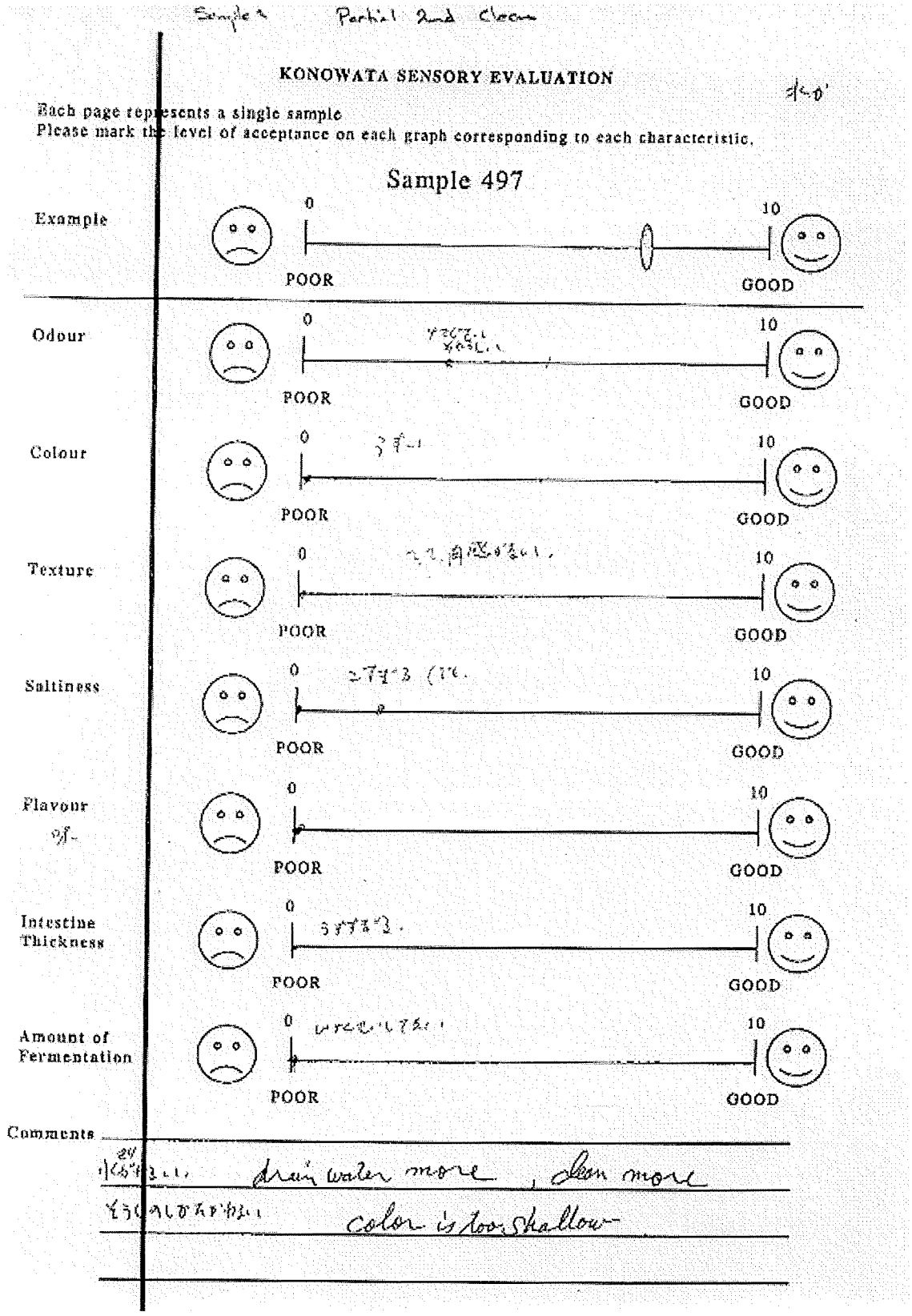
	0	10
Example	POOR	GOOD
Odour	POOR	GOOD
Colour	POOR	GOOD
Texture	POOR	GOOD
Saltiness	POOR	GOOD
Flavour	POOR	GOOD
Intestine Thickness	POOR	GOOD
Amount of Fermentation	POOR	GOOD

Comments: This is best in the sample, still they can sell.

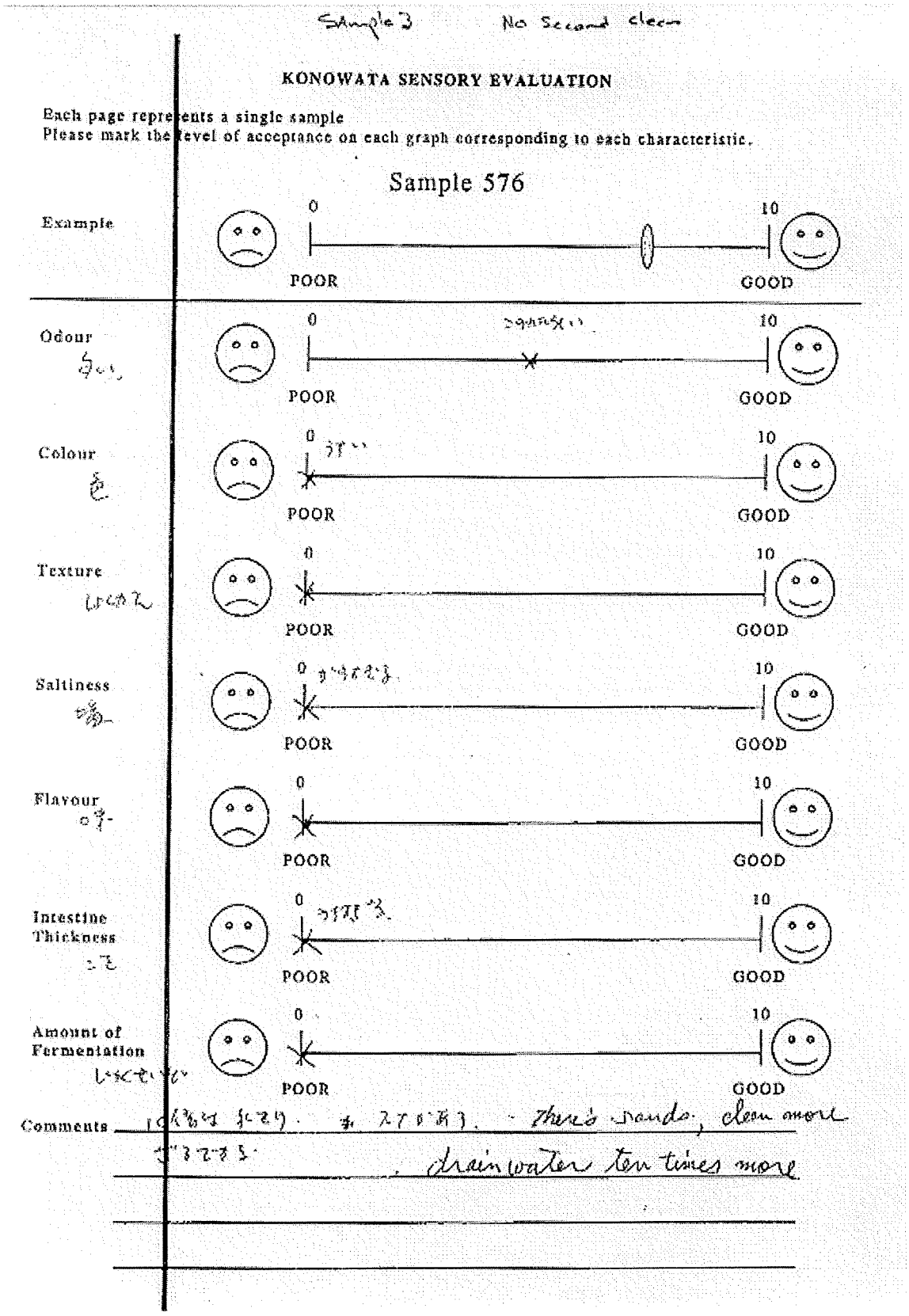
Sample 1 – Thorough clean of intestines



Sample 2 – Partial second clean of intestines



Sample 3 - No second clean of intestines



APPENDIX 6: LITERATURE SEARCH

Cambridge Scientific Abstracts
Database: ASFA: Aquatic Sciences and Fisheries Abstracts
Query: KW=(ferment*) and KW=(viscera*)

Record 1 of 20

TI: Title: Biotransformation of fish waste into a stable feed ingredient
AU: Author: Faid, M; Zouiten, A; Elmarrakchi, A; Achkari-Begdouri, A
AF: Author Affiliation: Hassan II Inst. Agron. and Veterinary Med., PO Box 6202, Rabat-Instituts, Rabat, Morocco
SO: Source: Food Chemistry [FOOD CHEM.], vol. 60, no. 1, pp. 13-18, Sep 1997
IS: ISSN: 0308-8146
AB: Abstract: Chopped pilchard wastes, including viscera, heads and tails, were mixed with 25% molasses and inoculated with a starter culture composed of Saccharomyces sp. and Lactobacillus plantarum. The silage was incubated at 22 degree C. Changes in nutritional quality and biochemical properties (pH, dry matter, ash, total and volatile nitrogen, lipids and trimethylamine) were monitored during a fermentation period of 15 days. Microbiological determinations were also carried out, including standard plate count, coliforms, Clostridium, lipolytic and proteolytic microorganisms. Results indicated that the pH decreased considerably and remained constant at 4.2 and 4.5 in the two trials. The total nitrogen decreased while the non-protein nitrogen and total volatile nitrogen increased significantly. Almost the same pattern in the two trials was observed. The trimethylamine decreased or remained constant at low levels depending on the initial value. The microbiological characteristics showed a rapid decrease of coliform and Clostridium counts to reach a low level after 5-7 days. Lipolytic and proteolytic microorganisms decreased notably during the fermentation and reached a minimum after 8 days and 5 days, respectively, in the two trials.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1997
PD: Publication Date: 19970900
PT: Publication Type: Journal Article
DE: Descriptors: Fish wastes; Waste utilization; Fermented products; Feed; feeds; Lactobacillus plantarum; Clostridium; Bacteria; Saccharomyces
ID: Identifiers: Bacteria
ER: Environmental Regime: Marine; Freshwater
TR: ASFA Input Center Number: CS9806904
CL: Classification: Q1 01626 Food technology; O 5040 Processing, Products and Marketing; Q4 27470 Food Products
UD: Update: 199804
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts; ASFA Marine Biotechnology Abstracts
AN: Accession Number: 4268048

Record 2 of 20

TI: Title: Quality analysis of viscera of Alaska pollack treated on vessel for raw materials of Changran-Jeotgal
AU: Author: Lee, W-D; Chang, D-S; Koh, B-H; Lee, M-S; Jeong, E-T
AF: Author Affiliation: Research Center of Hansung Enterprise Co., Ltd, Kyong-Nam 621-200, Korea
SO: Source: J. Korean Fish. Soc., vol. 30, no. 2, pp. 271-276, 1997

IS: ISSN: 0374-8111
AB: Abstract: A study was carried out to determine the ratio of stomach and intestine to viscera gathered on catching vessels, the critical level of VBN content as a freshness quality of viscera of Alaskan pollack (Theragra chalcogramma) for raw materials of Changran-jeotgal. It also examined the changes of VBN values, pH and viable cell counts during the fermentation. Then sensory evaluation of the fermented products, Changran-jeotgal, was done according to the freshness of raw materials used. The ratio of stomach and intestine to the gathered viscera on the vessel was about 72%, while that of round state of Alaska pollack was about 18%. There was no significant relationship in VBN content between fish muscle and viscera. It suggests that VBN content is not a reasonable freshness criteria in viscera but in fish muscle. However, if the VBN content is used as a freshness criteria of viscera for raw materials of Changran-jeotgal, less than 70mg% of VBN value could be recommended. According to the experimental results, the product yields and sensory evaluation scores were no good not only for economical evaluation but also for consumption.
LA: Language: English
SL: Summary Language: English; Korean
PY: Publication Year: 1997
PD: Publication Date: 19970000
PT: Publication Type: Journal Article; Numerical data
DE: Descriptors: Food fish; Quality control; Taste tests; Processed fishery products; Theragra chalcogramma
TR: ASFA Input Center Number: FA9800578
CL: Classification: Q1 01627 Food quality and standards
UD: Update: 199806
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 4312526

Record 3 of 20

TI: Title: Studies on the utilization of wastes from fish processing. 1. Characteristics of lactic acid bacteria for preparing skipjack tuna viscera silage
AU: Author: Yoon, H-D; Lee, D-S; Ji, C-I; Suh, S-B
AF: Author Affiliation: Sanitation & Processing Research Division, National Fisheries Research and Development Agency, Pusan 619-900, Korea
SO: Source: J. Korean Fish. Soc., vol. 30, no. 1, pp. 1-7, 1997
IS: ISSN: 0374-8111
AB: Abstract: In order to utilize fish by-products from the skipjack tuna (Katsuwonus pelamis) canning manufactures, Lactobacillus bulgaricus KCTC 3188 and L. plantarum KCTC 1048 were used as a starter culture for the preparation of fermented fish silage with skipjack tuna viscera. The optimum temperature and pH on bacterial growth and lactic acid production of L. bulgaricus and L. plantarum in MRS broth were 35 degree C and around pH 6.0, respectively. The optimum concentrations of the carbohydrate sources added to the broths were 7% for dextrose and 10% for molasses on the basis of total weights of skipjack tuna viscera. The pH of acid treated skipjack tuna viscera silage (ASS) slightly increased from 4.0 to 4.5, while that of fermented skipjack tuna viscera silages by the use of lactic acid bacteria (ESS) was significantly declined from 5.9 to about 4.0 after 42 days of storage at 35 degree C. Though the content of volatile basic nitrogen (VBN) in ASS was lower than those of FSS after 42 days of storage at 35 degree C, VBN content in silages slightly increased from an initial value of 62-65 mg/100 g to final value of 113-15 mg/100 g over 42 days. The silage fermented by L. plantarum reached a maximum concentration of amino nitrogen and showed 81% of hydrolysis degree after 4 days of storage at 35°C
LA: Language: Korean
SL: Summary Language: English; Korean
PY: Publication Year: 1997

PD: Publication Date: 19970000
PT: Publication Type: Journal Article; Numerical data
DE: Descriptors: Processing fishery products; Waste utilization; Fish wastes; Canned products; Fish silage; Katsuwonus pelamis
TR: ASFA Input Center Number: FA9800585
CL: Classification: Q1 01623 Processing methods, instruments and factories
UD: Update: 199806
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 4312533

Record 4 of 20

TI: Title: Studies on the utilization of wastes from fish processing. 2. Changes of chemical properties of skipjack tuna viscera silage during storage by processing method
AU: Author: Yoon, H-D; Lee, D-S; Suh, S-B
AF: Author Affiliation: Sanitation & Processing Research Division, National Fisheries Research and Development Agency, Pusan 619-900, Korea
SO: Source: J. Korean Fish. Soc., vol. 30, no. 1, pp. 8-15, 1997
IS: ISSN: 0374-8111
AB: Abstract: For an effective use of fish by-products from the skipjack tuna (Katsuwonus pelamis) canning manufactures, the changes of chemical properties of skipjack tuna viscera silage by the processing method during storage were investigated. The acid treated skipjack tuna viscera silage (ASS) were higher in the contents of moisture, lipid, protein and mineral but lower in the contents of carbohydrate and polyunsaturated fatty acids than those of fermented skipjack tuna viscera silage (FSS) by L. bulgaricus, KCTC 3188 and L. plantarum KCTC 1048. Especially, the contents of total n-3 fatty acids in FSS increased remarkably during storage. The dominant amino acids in ASS and FSS were glutamic acid (Glu), aspartic acid (Asp), leucine (Leu), glycine (Gly), and alanine (Ala). The contents of tryptophan (Trp) decreased by 30% in ASS and 5% in FSS in comparision with that of raw skipjack tuna viscera after 42 days of storage. The concentration of vitamin 8, and 82 in FSS increased gradually during storage but the concentration of vitamin B2 in ASS decreased. In organoleptic evaluation, ASS gave a grayish brown color and a fishy odor. On the other hand, FSS had reddish brown color and sour taste by the production of lactic acid during storage.
LA: Language: Korean
SL: Summary Language: English; Korean
PY: Publication Year: 1997
PD: Publication Date: 19970000
PT: Publication Type: Journal Article; Numerical data
DE: Descriptors: Processing fishery products; Canned products; Fish wastes; Waste utilization; Fish silage; Fermented products; Katsuwonus pelamis
TR: ASFA Input Center Number: FA9800586
CL: Classification: Q1 01623 Processing methods, instruments and factories
UD: Update: 199806
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 4312534

Record 5 of 20

TI: Title: Autolysis and rancidity development in tropical freshwater fish viscera during fermentation
AU: Author: Ahmed, J; Mahendrakar, NS
AF: Author Affiliation: Meat, Fish and Poultry Technology, Central Food Technological Research Institute, Mysore 570 013, India

SO: Source: Bioresource Technology [Bioresour. Technol.], vol. 58, no. 3, pp.247-251, Dec 1996
IS: ISSN: 0960-8524
AB: Abstract: To develop an ensiling process to preserve the nutrients in fish viscera, the offal was homogenised with 10% (w/w) molasses. Propionic acid (0.5% v/w) was added as an antimycotic agent. NaCl (2% w/w) and ethoxyquin (0.02% w/w) were added to see the effect on autolytic changes and rancidity development, respectively. Fermentation was carried out under microaerophilic condition at 26 plus or minus 2 degree C. Total volatile nitrogen, non-protein nitrogen, alpha-amino nitrogen (autolytic changes) and free fatty-acid content increased ($P < 0.001$) rapidly during the first 4 days and then remained constant up to 8 days. Salt had no influence on autolysis. Peroxide value (PV) increased ($P < 0.001$) initially up to 3-4 days and then decreased. A rapid increase ($P < 0.001$) up to 2 days and small ($P < 0.05$) subsequent increase in iodine value (IV) were observed. Thiobarbituric acid (TBA) number increased linearly up to 8 days of fermentation period. Ethoxyquin was effective in controlling oxidative rancidity, as indicated by significantly ($P < 0.001$) lower PVs and TBA numbers and higher IVs.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1996
PD: Publication Date: 19961200
PT: Publication Type: Journal Article
DE: Descriptors: Seafood; Quality control; Biodegradation; Autolysis; Fermentation; Public health
TR: ASFA Input Center Number: CS9816728
CL: Classification: Q1 01627 Food quality and standards; Q5 01524 Public health, medicines, dangerous organisms
UD: Update: 199809
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality
AN: Accession Number: 4336092

Record 6 of 20

TI: Title: Changes in microbial population during fermentation of tropical freshwater fish viscera
AU: Author: Ahmed, J; Ramesh, BS; Mahendrakar, NS
AF: Author Affiliation: Dep. Anim. Prod. Technol., Cent. Food Technol. Res. Inst., Mysore 570013, India
SO: Source: J. APPL. BACTERIOL., vol. 80, no. 2, pp. 153-156, 1996
IS: ISSN: 0021-8847
AB: Abstract: Freshwater fish viscera (FV) was homogenized, mixed with 10% (w/w of Fv) molasses and 0, 2 or 4% salt and allowed to ferment at ambient temperature (26 plus or minus 2 degree C) under microaerophilic conditions. The results revealed a reduction in total viable count and the number of spores, coliforms, Escherichia coli, staphylococci and enterococci and an increase in yeasts and moulds and lactic acid bacteria during fermentation. Coliforms and E. coli were found to be absent after 6 d and enterococci on 8th day. The presence of salt resulted in a marginally lower number of all organisms except yeasts, moulds and lactic acid bacteria. Inclusion of either 0.5% propionic acid, 0.3% calcium propionate or 0.1% sorbic acid suppressed growth of yeasts and moulds with propionic acid being the most effective. The study indicated that a microbiologically stable product could be prepared by ensiling fish viscera with 10% molasses and 0.5% propionic acid.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1996

PT: Publication Type: Journal Article
DE: Descriptors: fermentation; viscera; freshwater environments; Pisces; molasses; propionic acid; Escherichia coli; waste utilization; preservation (fishery products); livestock food; new products; pollution control; process plants; microbiological analysis
TR: ASFA Input Center Number: CS9610312
CL: Classification: A 01015 Fermentation & related processes; W2 32580 Fermentation and process engineering; Q4 27170 Microorganisms (viruses, bacteria, fungi, protozoa); Q1 01621 General; Q5 01505 Prevention and control
SF: Subfile: Microbiology Abstracts A: Industrial & Applied Microbiology; Agricultural and Environmental Biotechnology Abstracts; ASFA Marine Biotechnology Abstracts; ASFA 1: Biological Sciences & Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality
AN: Accession Number: 3883899

Record 7 of 20

TI: Title: Utilisation of fermented fish and poultry offals in feed for common carp (Cyprinus carpio)
AU: Author: Jagannathe Rao, R; Mahendrakar, NS; Chakrabarty, NM; Raghavan, SL
AF: Author Affiliation: Animal Products Technology, CFTRI, Mysore-570013, India
SO: Source: Seafood export journal. Cochin [SEAFOOD EXPORT J.], vol. 27, no. 3, pp. 17-23, 1996
IS: ISSN: 0037-010X
AB: Abstract: Fermented silages from fish and poultry offals were incorporated in fish feed formulations replacing fish meal. Feeding of common carp (Cyprinus carpio) under cage culturing system was carried out in order to evaluate the nutritive quality of silages. The isonitrogenous and isocaloric feeds in the mash form were used initially up to 30 weeks followed by feeding with extruded feeds up to 51 weeks. No mortality was noticed during the entire feeding period. Gain in weight per fish was 116.2,118.3 and 98.8g when fed with diets containing fish viscera silage, poultry intestine silage and fish meal after 30 weeks and 232.6, 226.7 and 220.5g after 51 weeks respectively. The offal silages were nutritionally superior to fish meal. No marked dietary influence was observed on proximate composition of whole fish.
LA: Language: English
PY: Publication Year: 1996
PT: Publication Type: Journal Article
DE: Descriptors: feed preparation; Cyprinus carpio
TR: ASFA Input Center Number: DP9600600
CL: Classification: Q1 01582 Fish culture; Q3 01582 Fish culture
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; ASFA Aquaculture Abstracts
AN: Accession Number; 3983606

Record 8 of 20

TI: Title: Some properties of the crude proteases from fish for application in seafood fermentation industry
AU: Author: Lee, D-S; Heu, M-S; Kim, D-S; Pyeun, J-H
AF: Author Affiliation: Department of Food and Life Science, National Fisheries University of Pusan, Pusan 608 737, Korea
SO: Source: J. KOREAN FISH. SOC., vol. 29, no. 3, pp. 309-319, 1996
IS: ISSN: 0374-8111
AB: Abstract: Properties regarding the utilization of the crude proteases extracted from the muscle and viscera of fish (2 dark-fleshed fish, Engraulis japonica and Clupinodon punctatus; 2 white-fleshed fish, Lateolabrax japonicus and Pleuronichthys cornutus) were

studied. Proteolytic activity of the muscle protease was slightly inhibited with the increase of sodium chloride concentration and it was apparent against the yellowtail myofibrillar protein rather than casein substrate. Proteolytic activities of the seabass and sole visceral crude protease were inhibited to 50-60% by 25% sodium chloride, but those of anchovy and gizzard-shad viscera crude enzymes were not influenced by sodium chloride. The vacuum freeze-dried crude protease and glycerol-mixed crude protease of gizzard-shad and seabass muscles almost lost their activities on the 16th week of storage, while those from the viscera of the fish were relatively stable. Degradation of the yellowtail myofibrillar protein by the anchovy muscle and viscera crude proteases rapidly proceeded in the beginning of the reaction and the degraded products were mainly distributed in the range of 6 to 15 kDa electrophoretically.
LA: Language: Korean
SL: Summary Language: English; Korean
PY: Publication Year: 1996
PT: Publication Type: Journal Article
DE: Descriptors: food technology; processed fishery products; fermented products; Engraulis japonica; Clupinodon punctatus; Lateolabrax japonicus; Pleuronichthys cornutus
ID: Identifiers: proteases
TR: ASFA Input Center Number: FA9700786
CL: Classification: Q1 01626 Food technology; O 5040 Processing, Products and Marketing
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts
AN: Accession Number: 4087337

Record 9 of 20

TI: Title: Lactic acid fermentation of fish offal and chicken by-product with different starter cultures
AU: Author: Lassen, TM
AF: Author Affiliation: Dep. Anim. Sci. and Anim. Health, R. Vet. and Agric. Univ., Buelowsvej 13, DK-1870 Frederiksberg C., Denmark
SO: Source: AGRIC. SCI. FINL., vol. 4, no. 1, pp. 19-26, 1995
IS: ISSN: 0789-600X
AB: Abstract: Lactic acid fermentation was evaluated as a method to preserve fish and chicken by-products. Herring (Clupea harengus) by-products (viscera and heads) and chicken by-products (heads, viscera, feathers, feet and discarded whole chickens) were minced, mixed with 5% dextrose and inoculated with 10 super(8) colony forming units (cfu)/g of four different lactic acid bacteria cultures. The by-product was fermented at 25 degree C and evaluated for pH, % produced lactic acid, redox potential and odour during four weeks' storage. In herring offal, pH decreased from 6.8 to 4.2 in one week and stabilized at about 4.3. In the same time, 2.0% to 3.2% lactic acid was produced and concentrations stabilized from 2.5% to 4.0%. In chicken offal, pH decreased to a stable level of 4.4, and 3.2% lactic acid was produced after one week of fermentation. A negative and stable redox potential was achieved after one week of fermentation in both herring and chicken offal.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1995
PT: Publication Type: Journal Article
DE: Descriptors: processed fishery products; fish silage; fermentation; redox potential; marine fish; bacteria; Clupea harengus; fish storage; lactic acid bacteria; fermented food; feeds; fishery products; poultry
ER: Environmental Regime: Marine
TR: ASFA Input Center Number: CS9511373
CL: Classification: Q1 01623 Processing methods, instruments and factories; A 01018

Animal foods; Q4 27470 Food Products
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Microbiology Abstracts A: Industrial & Applied Microbiology; ASFA Marine Biotechnology Abstracts
AN: Accession Number: 3730985

Record 10 of 20

TI: Title: Volatile components in salt-fermented fish and shrimp pastes
AU: Author: Cha, YJ; Cadwallader, KR
AF: Author Affiliation: Dep. Food Sci. & Nutrition, Changwon Natl. Univ., Changwon 641-773, South Korea
SO: Source: Journal of Food Science [J. FOOD SCI.], vol. 60, no. 1, pp. 19-24, 1995
IS: ISSN: 0022-1147
AB: Abstract: Volatile compounds in salt-fermented anchovy, big-eyed herring, hair tail viscera, and shrimp pastes were compared by simultaneous steam distillation-solvent extraction/gas chromatography/mass spectrometry (SDE/GC/MS). A total of 155 volatile compounds were detected. Of these, 111 were positively identified consisting mainly of aldehydes, ketones, alcohols, esters, aromatics, nitrogen-, and sulfur-containing compounds. Lipid-derived components, such as aldehydes, alcohols, and esters, comprised the majority of volatile compounds from fish pastes, while heterocyclic nitrogen-containing compounds, such as pyrazines, were predominant in shrimp paste.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1995
PT: Publication Type: Journal Article
DE: Descriptors: volatile compounds; fish storage; quality assurance; processed fishery products; seafood; food technology
TR: ASFA Input Center Number: CS9605202
CL: Classification: Q1 01627 Food quality and standards
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 3855848

Record 11 of 20

TI: Title: Effect of different levels of molasses and salt on acid production and volume of fermenting mass during ensiling of tropical freshwater fish viscera
AU: Author: Ahmed, J; Mahendrakar, NS
AF: Author Affiliation: Cent. Food Technol. Res. Inst., Mysore-570 013, India
SO: Source: Journal of Food Science and Technology (Mysore) [J. FOOD SCI. TECHNOL. (MYSORE)], vol. 32, no. 2, pp. 115-118, 1995
IS: ISSN: 0022-1155
AB: Abstract: Viscera from freshwater fish, constituting 5-11% of body weight, consists of (%) water 67, proteins 10, ether extracts 14, and minerals 3. Process of ensiling fish viscera after mixing individually with different levels of molasses (7.5, 10.0 and 12.5%, w/w) with (2 and 4%, w/w) or without salt was studied under microaerophilic condition at ambient (26 plus or minus 2 degree C) temperature. Data revealed that the optimum level of molasses was 10% of fish viscera, acid production being inadequate with 7.5% molasses, while it did not improve, but resulted in lower rise in fermenting mass with the use of 12.5% molasses. Salt lowered the swelling of fermenting mass, the efficiency being higher with the use of 4% salt, in addition to significantly (p less than or equal to 0.001) reducing the rate of acid production during the first two days of fermentation. Subsequently, pHs of salted samples were markedly (p less than or equal to 0.001) lower than those of non-salted samples.
LA: Language: English
SL: Summary Language: English

PY: Publication Year: 1995
PT: Publication Type: Journal Article; Bibliography
DE: Descriptors: fermentation; fish silage; waste utilization; freshwater fish
ER: Environmental Regime: Freshwater
TR: ASFA Input Center Number: DP9500753
CL: Classification: Q1 01626 Food technology
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 3894743

Record 12 of 20

TI: Title: Effect of different levels of molasses and salt on acid production and volume of fermenting mass during ensiling of tropical freshwater fish viscera
AU: Author: Ahmed, J; Mahendrakar, NS*
AF: Author Affiliation: Anim. Prod. Technol. Dep., Cent. Food Technol. Res. Inst., Mysore-570 013, India
SO: Source: Journal of Food Science and Technology (Mysore) [J. FOOD SCI. TECHNOL. (MYSORE)], vol. 32, no. 2, pp. 115-118, 1995
IS: ISSN: 0022-1155
AB: Abstract: Viscera from freshwater fish, constituting 5-11% of body weight, consists of (%) water 67, proteins 10, ether extracts 14, and minerals 3. Process of ensiling fish viscera after mixing individually with different levels of molasses (7.5, 10.0 and 12.5%, w/w) with (2 and 4%, w/w) or without salt was studied under microaerophilic condition at ambient (26 plus or minus 2 degree C) temperature. Data revealed that the optimum level of molasses was 10% of fish viscera, acid production being inadequate with 7.5% molasses, while it did not improve, but resulted in lower rise in fermenting mass with the use of 12.5% molasses. Salt lowered the swelling of fermenting mass, the efficiency being higher with the use of 4% salt, in addition to significantly (p less than or equal to 0.001) reducing the rate of acid production during the first two days of fermentation. Subsequently, pHs of salted samples were markedly (p less than or equal to 0.001) lower than those of non-salted samples.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1995
PT: Publication Type: Journal Article
DE: Descriptors: fermentation; acidity; silage; feeds; molasses; sodium chloride; Pisces; processed fishery products; fish silage; acidification
TR: ASFA Input Center Number: CS9616951
CL: Classification: A 01017 Human foods; Q4 27470 Food Products; Q1 01623 Processing methods, instruments and factories
SF: Subfile: Microbiology Abstracts A: Industrial & Applied Microbiology; ASFA Marine Biotechnology Abstracts; ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 3931438

Record 13 of 20

TI: Title: Comparison of trypsin and chymotrypsin from the viscera of anchovy, Engraulis japonica
AU: Author: Heu, MS; Kim, HR; Pyeun, JH
AF: Author Affiliation: Dep. Food Sci. and Nutr., Tongyeong Natl. Fish. Coll., Kyeongnam 650-160, Korea
SO: Source: Comparative Biochemistry and Physiology, B [COMP. BIOCHEM. PHYSIOL., B], vol. 112B, no. 3, pp. 557-567, 1995
IS: ISSN: 0305-0491
AB: Abstract: The molecular weights of trypsin and chymotrypsin purified from

anchovy viscera were estimated to be 25.6 and 26.1 Kda, respectively, by SDS-PAGE. Both enzymes had their maximal activity at pH 9.0 and 45 degree C for casein and at pH 8.0 and 45 degree C for synthetic substrates. Trypsin hydrolyzed at the position of Arg super(22) and Lys super(29), and chymotrypsin did at the position of Phe super(1), Tyr super(16), Phe super(24), Phe super(25), and Tyr super(26) of insulin beta -chain. The K' sub(m) and k sub(cat) of trypsin were 50 mu M and 1.84 mu M super(-1) min super(-1) toward N-benzoyl-L-arginine-p-nitroanilide (BAPNA) and those of chymotrypsin were 89 mu M and 10.0 mu M super(-1)min super(-1) toward N-succinyl-(Ala) sub(2)-Pro-Phe-p-nitroanilide. The activation energy of trypsin and chymotrypsin were estimated to be 14 Kcal/mol toward N-benzoyl-L-arginine-p-nitroanilide and 6.5 Kcal/mol toward benzoyl-L-tyrosine ethyl ester.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1995
PT: Publication Type: Journal Article
DE: Descriptors: marine fish; commercial species; fish physiology; amino acids; enzymes; physicochemical properties; fermented products; Engraulis japonica
ID: Identifiers: trypsin; chymotrypsin
ER: Environmental Regime: Marine
TR: ASFA Input Center Number: CS9618251
CL: Classification: Q1 01622 Primary products; O 5040 Processing, Products and Marketing
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts
AN: Accession Number: 3940051

Record 14 of 20

TI: Title: Utilization of ascidian, Halocynthia roretzi. 4. Browning of ascidian meat, Halocynthia roretzi and its prevention
AU: Author: Lee, K-H; Cho, H-S; Kim, D-S; Hong, B-I; Park, C-S; Kim, M-G
AF: Author Affiliation: Dep. Food Sci. and Technol., Natl. Fish. Univ. Pusan, Pusan 608-737, Korea
SO: Source: Bulletin of the Korean Fisheries Society. Pusan [BULL. KOREAN FISH. SOC.], vol. 26, no. 3, pp. 214-220, 1993
IS: ISSN: 0374-8111
AB: Abstract: Browning of ascidian, Halocynthia roretzi, meat occurs very rapidly when skinned off or cut during processing and resulting in the quality loss of fresh frozen, dehydrated or fermented products. In this study, the causes of color development and prevention of browning were experimented. The browning of ascidian meat may be obtained enzymatically by a tyrosinase contained in meat and viscera which acted specifically on L-tyrosine as a substrate rather than on catechol. Activity of the enzyme in viscera was three times higher than in meat. The enzyme was inactivated by heating at 80 degree C for 3 minutes or 90 similar to 100 degree C for 1 minute and it was inhibited by 0.1 similar to 0.5mM solutions at ascorbic acid, sodium hydrogen sulfite, cystein, citric acid, cyanide; only sodium hydrogen sulfite treatment was effective to retard such a high content of enzyme as in case of viscera. In practical use for processing of ascidian meat, browning was retarded by dipping the viscera removed ascidian meat in 0.2M citric acid for 5 minutes or 0.2% sodium hydrogen sulfite solution for 1 minute resulting in sulfur dioxide residue less than 100 ppm.
LA: Language: Korean
SL: Summary Language: English
PY: Publication Year: 1993
PT: Publication Type: Journal Article
DE: Descriptors: processing fishery products; food technology; quality assurance; Halocynthia roretzi

ID: Identifiers: browning discoloration
ER: Environmental Regime: Marine
TR: ASFA Input Center Number: FA9400538
CL: Classification: Q1 01626 Food technology; O 5040 Processing, Products and Marketing
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts
AN: Accession Number: 3539889

Record 15 of 20

TI: Title: Preparation and nutrient analysis of lactic acid bacterial ensiled salmon viscera
AU: Author: Dong, FM; Fairgrieve, WT; Skonberg, DI; Rasco, BA
AF: Author Affiliation: Univ. Washington, Inst. Food Sci. and Technol., Sch. Fish., 3707 Brooklyn Ave. NE, Seattle, WA 98105, USA
SO: Source: Aquaculture, vol. 109, no. 3-4, pp. 351-366, 1993
IS: ISSN: 0044-8486
AB: Abstract: The objective of this study was to define a procedure for converting salmon viscera into a co-dried product that could eventually be the major protein ingredient in dry salmonid feeds. A lactic acid bacteria fermented silage, and for comparative purposes, a sulfuric acid silage were prepared from salmon viscera (Oncorhynchus nerka and Oncorhynchus gorbuscha). Both ensiled products were separately co-dried with poultry by-product meal in a final ratio of 1:1 (w/w) on a dry weight basis. Nitrogen levels of the co-dried products were 9 to 11%, sufficiently high to be the main protein source in dry feeds for salmonids. Methionine was the limiting amino acid in the co-dried products. Protein fractionation by size exclusion chromatography of samples obtained on the first and fourteenth day of ensilage showed that proteins were hydrolyzed to low molecular weight of proteins, peptides, and amino acids. The co-dried products had low numbers of aerobic bacteria and low water activity, which would enhance storage stability. Formation of high levels of thiobarbituric acid reactive substances in freeze-dried silage was inhibited by the addition of 0.025% (w/w) ethoxyquin to the silage prior to drying.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1993
PT: Publication Type: Journal Article
DE: Descriptors: fishery products; processing fishery products; fish wastes; fish silage; feed efficiency; fish meal; Oncorhynchus nerka; Oncorhynchus gorbuscha; proteins; fish culture; feeds; silage; lactic acid bacteria; fermentation; nutrients
ID: Identifiers: salmon viscera
TR: ASFA Input Center Number: CS9414183
CL: Classification: Q1 01582 Fish culture; Q1 01622 Primary products; Q3 01582 Fish culture; O 5060 Aquaculture; O 5040 Processing, Products and Marketing; A 01018 Animal foods; Q4 27470 Food Products
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; ASFA Aquaculture Abstracts; Oceanic Abstracts; Microbiology Abstracts A: Industrial & Applied Microbiology; ASFA Marine Biotechnology Abstracts
AN: Accession Number: 3588126

Record 16 of 20

TI: Title: Feeding studies on tilapia (Oreochromis sp.) using fish silage.
AU: Author: Lapie, LP; Bigueras-Benitez, CM
AF: Author Affiliation: Univ. Philippines in the Visayas, Coll. Fish., Miag-ao, Iloilo 5023, Philippines
CA: Corporate Author: FAO Indo-Pacific Fisheries Comm., Bangkok (Thailand)

CF: Conference 8. Sess. of the Indo-Pacific Fishery Commission Working Party on Fish Technology and Marketing, Yogjakarta (Indonesia), 24-27 Sep 1991
SO: Source: PAPERS PRESENTED AT THE EIGHTH SESSION OF THE INDO-PACIFIC FISHERY COMMISSION WORKING PARTY ON FISH TECHNOLOGY AND MARKETING, YOGJAKARTA, INDONESIA, 24-27 SEPTEMBER 1991., FAO, ROME (ITALY), 1992, pp. 165-177, FAO fisheries report. Rome [FAO FISH. REP.], no. 470 Suppl.
IS: ISSN: 0429-9337
IB: ISBN: 92-5-103257-2
PB: Publisher: FAO, ROME (ITALY)
NU: Other Numbers: FAO FIIU/R470 (Suppl.)
AB: Abstract: Fish silages were prepared from ground fish offals (heads, tails, fins, viscera and trimmings of Sardinella spp.) by addition of concentrated formic acid (98%) at an amount equivalent to 2.5, 3.0 and 3.5 v/w of the fish offal. The final product chosen for feed formulation was the sample with the lowest concentration of formic acid (2.5%) since the Analysis of Variance (ANOVA) indicated no significance difference in amino nitrogen content among the samples at 5% level. The efficiency of the diets formulated from fish meal and those from a combination of fish silage and fish meal were compared by determining the growth response in tilapia. The diets were isoproteinic. The results showed that Diet 1 (with fish meal) and Diet 2 (1:1 fish meal fish silage) were more efficient than Diet 3 (1:3 fish meal fish silage). The highest Protein Efficiency Ratio (PER) was obtained in tilapia fed with Diet 2.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1992
PT: Publication Type: Book Monograph; Conference; Numerical data
DE: Descriptors: processed fishery products; fermented products; fish silage; waste utilization; feed; Oreochromis; Sardinella
ER: Environmental Regime: Freshwater
CL: Classification: Q1 01624 Secondary products; Q1 01425 Nutrition and feeding habits; Q1 01425 Fish culture; Q3 01582 Fish culture
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; ASFA Aquaculture Abstracts
AN: Accession Number: 2958169

Record 17 of 20

TI: Title: Hydrolysis and fermentation of fishery by-products: Costs and benefits of some processing variables.
AU: Author: Goldhor, SH; Curren, RA; Solstad, O; Levin, RE; Nichols, D
AF: Author Affiliation: Goldhor and Assoc., Inc., 45 B Museum St., Cambridge, MA 02138, USA
CA: Corporate Author: Alaska Univ., Fairbanks (USA). Alaska Sea Grant Program
CF: Conference: Int. Conf. on Fish By-Products, Anchorage, AK (USA), 25-27 Apr 1990
ED: Editor: Keller, S (ed)
SO: Source: MAKING PROFITS OUT OF SEAFOOD WASTES: PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON FISH BY-PRODUCTS, ANCHORAGE, ALASKA, APRIL 25-27, 1990., 1990, pp. 203-208, ALASKA SEA GRANT REP.
NU: Other Numbers: AK-SG-90-07
AB: Abstract: Fish protein hydrolysis refers to a process in which fish are treated with protein digesting enzymes. The enzymes are from the viscera of the fish itself, or they are commercially purchased. In either case, the fish flesh is turned to liquid. Under ideal conditions, which would include heating and stirring, liquefaction can occur in as little as 10 to 15 minutes. There are two markets into which fish protein hydrolysate has been

accepted and in which it has earned a reputation as a high value product. In the United States, the major market is in early weaned pig feeds. The second market, which is rapidly increasing, is the aquaculture feed market. The aquaculture market can accept wet or concentrated product. Prices are varied, but are frequently higher than fish meal of a comparable protein level. Two problems that seem to affect the utilization of fishery wastes in Alaska are the high ash content of many of the waste streams, and the sensitivity of fish proteins to overheating and over-drying. Both of these problems lower the value of fishery products.
LA: Language: English
PY: Publication Year: 1990
PT: Publication Type: Report; Conference
DE: Descriptors: fish wastes; food technology; processed fishery products; fermented products; byproducts; marine resources; aquaculture; proteins; marketing; fishery economics; feeds; fishery products; fermented food; USA, Alaska; enzymes; animal wastes; Pisces; INE, USA, Alaska
ID: Identifiers: enzymolysis; fish protein hydrolysis
ER: Environmental Regime: Marine
CL: Classification: Q1 01626 Food technology; O 8050 CONFERENCES; Q4 27470 Food products; Q4 27480 Environmental applications/impact
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts; ASFA Marine Biotechnology Abstracts
AN: Accession Number: 2463870

Record 18 of 20

TI: Title: Processing and taste compounds of the fish sauce from skipjack scrap.
AU: Author: Lee, E-H; Lee, T-H; Kim, J-S; Ahn, C-B
AF: Author Affiliation: Dep. Food Sci. and Technol., Natl. Fish. Univ. Pusan, Nam-gu, Pusan 608-737, Korea
SO: Source: Bulletin of the Korean Fisheries Society. Pusan [BULL. KOREAN FISH. SOC.], vol. 22, no. 1, pp. 25-35, 1989
IS: ISSN: 0374-8111
AB: Abstract: To prepare a new type of fish sauce from skipjack (Katsuwonus pelamis) scrap, the effect of koji on sauce flavor, conditions of low salt fish sauce processing and the changes of taste compounds during its fermentation, was examined. To prepare the skipjack scrap sauce, chopped skipjack head paste was mixed with 6.6% skipjack viscera, 26.9% koji, 71% of 25% brine, 13.3% salt and 7.6% glucose, and fermented at 25 plus or minus 4 degree C for 90 days. The major taste compounds of the products were revealed free amino acids and non-volatile organic acids. The nucleotides and their related compounds, total creatinine, betaine, TAMO and sugar had an auxiliary role in taste of those products. Fishy odor in skipjack scrap sauce can be improved by adding koji. A low salt skipjack scrap sauce (9.12% of salt contents) can be prepared by the replacement of a part of salt with sorbitol, lactic acid and ethyl alcohol. Results of sensory evaluation and chemical experiments, indicate the skipjack scrap sauce products to be at least equal to the soy sauce sold on the market in quality.
LA: Language: Korean
SL: Summary Language: English
PY: Publication Year: 1989
PT: Publication Type: Journal Article; Numerical data
DE: Descriptors: Euthynnus pelamis; fermented products; taste tests; waste utilization
ID: Identifiers processed fishery products
ER: Environmental Regime: Marine
CL: Classification: Q1 01624 Secondary products; O 5040 PROCESSING, PRODUCTS, MARKETING
SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Oceanic Abstracts

AN: Accession Number: 2060465

Record 19 of 20

TI: Title: Quality improvement of salt-fermented sardine by beheading of raw fish.
AU: Author: Suh, SB; Yun, HY; Park, CK; Kim, SJ
SO: Source: Bulletin of National Fisheries Research and Development Agency (Korea). Yangsan [BULL. NATL. FISH. RES. DEV. AGENCY (KOREA).], no. 41, pp. 87-96, 1988
IS: ISSN: 1225-6358
NT: Notes: 25 ref.
AB: Abstract: This study was attempted to improve the quality of salt-fermented sardine, Sardinops melanosticta . The head portion which includes gall-bladder and some part of viscera of raw sardine was removed in contrast to whole fish being used to preparation of the ordinary fermented sardine. The fermentation of sardine with different salt content was carried out at room temperature for 150 days during summer season. The chemical changes such as general components, volatile base nitrogen (VBN), amino nitrogen (amino-N), extractive nitrogen Ex-N), free amino acids, histamine and color values in the hydrolysates of fermented sardine were analyzed as well as organoleptic evaluation during the fermentation of compare the quality between conventional and experimental methods.
LA: Language: Korean
SL: Summary Language: English; Korean
PY: Publication Year: 1988
PT: Publication Type: Journal Article
DE: Descriptors: processing fishery products; fermented products; organoleptic properties; Sardinops melanosticta
ID: Identifiers: gutting; beheaded sardines
CL: Classification: Q1 01624 Secondary products
SF: Subfile: ASFA 1: Biological Sciences & Living Resources
AN: Accession Number: 2023500

Record 20 of 20

TI: Title: Biological fermentation of fish waste for potential use in animal and poultry feeds.
AU: Author: Hassan, TE; Heath, JL
AF: Author Affiliation: Dep. Poult. Sci., Univ. Maryland, College Park, MD 20742, USA
SO: Source: AGRIC. WASTES., vol. 15, no. 1, pp. 1-15, 1986
AB: Abstract: Biological fermentation of whole fish, viscera and heads using Lactobacillus plantarum was evaluated and the minimum lactose necessary for a successful fermentation under pilot conditions was found to be 5%. Preheating the fish before fermentation decreased the amount of soluble nitrogen substances both before and after fermentation. The relationships between lactic acid bacteria growth, yeast and mold growth and pH indicated that it may be necessary to add and antimycotic agent to achieve and maintain sufficiently low pH values for successful fermentation and storage. Fermentation temperatures of 25 and 35 degree C and inoculum size of 10 super(3) organisms g super(-1) of fish produced successful fermentations.
LA: Language: English
SL: Summary Language: English
PY: Publication Year: 1986
PT: Publication Type: Journal Article
DE: Descriptors: fish wastes; livestock food; fermented products; fishery products; fermentation; feeds; fisheries; agricultural wastes; Lactobacillus plantarum
ID: Identifiers: production; animal husbandry
CL: Classification: Q1 01624 Secondary products; A 01018 Animal foods; W 30412 Food (including SCP); P 4000 WASTE MANAGEMENT

SF: Subfile: ASFA 1: Biological Sciences & Living Resources; Microbiology Abstracts A: Industrial & Applied Microbiology; Biotechnology Research Abstracts (through 1992); Pollution Abstracts
AN: Accession Number: 1329110

APPENDIX 7: VIDEO MANUAL

SEAFOOD SERVICES AUSTRALIA

KONOWATA MANUAL

PROJECT NO. 97/409

KONOWATA MANUAL July 1999

CONTENTS

CENTRE FOR FOOD TECHNOLOGY

KONOWATA MANUAL July 1999

Commercial fishing for beche-de-mer or sea cucumbers has been carried out in Australian waters since the early 1800's. Species of commercial interest have included:

- The Sandfish
- Black teatfish
- Prickly redfish and
- The Lollyfish

Of these, the sandfish is the most common commercial species and is found on inner reef flats, and in bays and estuaries along the coastline. They are bottom dwellers that feed on sediment while moving slowly across the seabed. They often spend part of the day buried in the silty sand.

Harvesting is carried out by collecting from shallow water at low tide or by diving in deeper water providing visibility is good.

Traditionally, fishermen have harvested sea cucumbers for processing into dried product. This product is then exported to Asian countries for consumption. Recently, research has focussed on developing value-added products from sea cucumbers. One such product is Konowata. Konowata is a traditional Japanese product that results from fermenting the intestinal tract of beche-de-mer. It is highly prized by the Japanese who pay up to A$100 for a 60-gram bottle of the best quality product.

Handling live animals

Following capture, care needs to be taken to minimise stress to animals during on-board handling and transportation to purging cages. Failure to do this may result in self-evisceration or mortality of animals. Good handling practice should include:

- keeping animals out of direct sunlight,
- keeping them cool by layering in bins with moist bags separating each layer,
- minimising holding time out of water to 3-4 hours.

Holding live animals (purging)

After capture, animals are held in purging cages for at least 24 hours to remove sand from their intestines. Cages should be constructed from non-corrosive material such as plastic pipe and mesh. Mesh size should be such that animals can't escape but intestinal contents wash away freely.

The design of cages is not critical but the stocking density must be carefully controlled to minimise mortality rates. This is particularly important if holding times extend beyond 24 hours. Ideally, the number of animals should be such that only one layer forms across the bottom of the cage. To increase cage capacity, layers of mesh could be stretched across the cage to form a number of levels within the cage.

Evisceration

Following purging, the animals are transported to the processing plant where they are eviscerated by making a 20-30 mm cut on the underside of the posterior end. The internal organs are squeezed out into cool clean seawater and the respiratory organs,

gonads and connective tissue are separated from the intestine. Care should be taken not to break the intestine as long intestines are highly valued by the Japanese consumers. Once separated, the intestine is further washed in clean cool seawater to remove any traces of sand. This water should be changed regularly to minimise build-up of bacterial levels.

Salting/fermentation

The process of preparing konowata is as follows.

- The washed intestines are drained in a sieve.
- The drained intestines are salted using 8-9% salt by weight. Initially, only one-third of this salt is added and this is stirred in well to ensure even blending. This salting causes a further expulsion of moisture from the viscera.
- Once most of this initial moisture is expelled (about 1 hour later), the remainder of the salt is added and the mixture stirred to ensure even mixing.
- The salted viscera are then stirred frequently for the next 4.5 hours.
- Dripping should have ceased after 5.5 hours. The mixture is then transferred to a lidded fermentation vessel (stainless steel, glass or food grade plastic) and held at 20°C for 7-10 days. It is also possible to freeze the salted viscera and hold frozen until fermentation is desired. There is however some darkening in the colour of the end product when this modified process is practised.
- At the completion of fermentation, product is packed into small glass jars, labelled and frozen.

Good Manufacturing Practice (GMP)

The gutting, cleaning and processing operations should be carried out using elements of GMP including:

- a high level of personal hygiene must be practised to ensure contamination from spoilage and pathogenic bacteria do not occur,
- all work and equipment surfaces should be smooth, free of cracks, non-porous and non-absorbent and
- all equipment used in these operations must be properly cleaned and sanitised prior to use.