IAFMM TECHNICAL REPORT

Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Hertfordshire EN6 3AR, U.K. Tel: (Potters Bar) 0707 42343/4/5

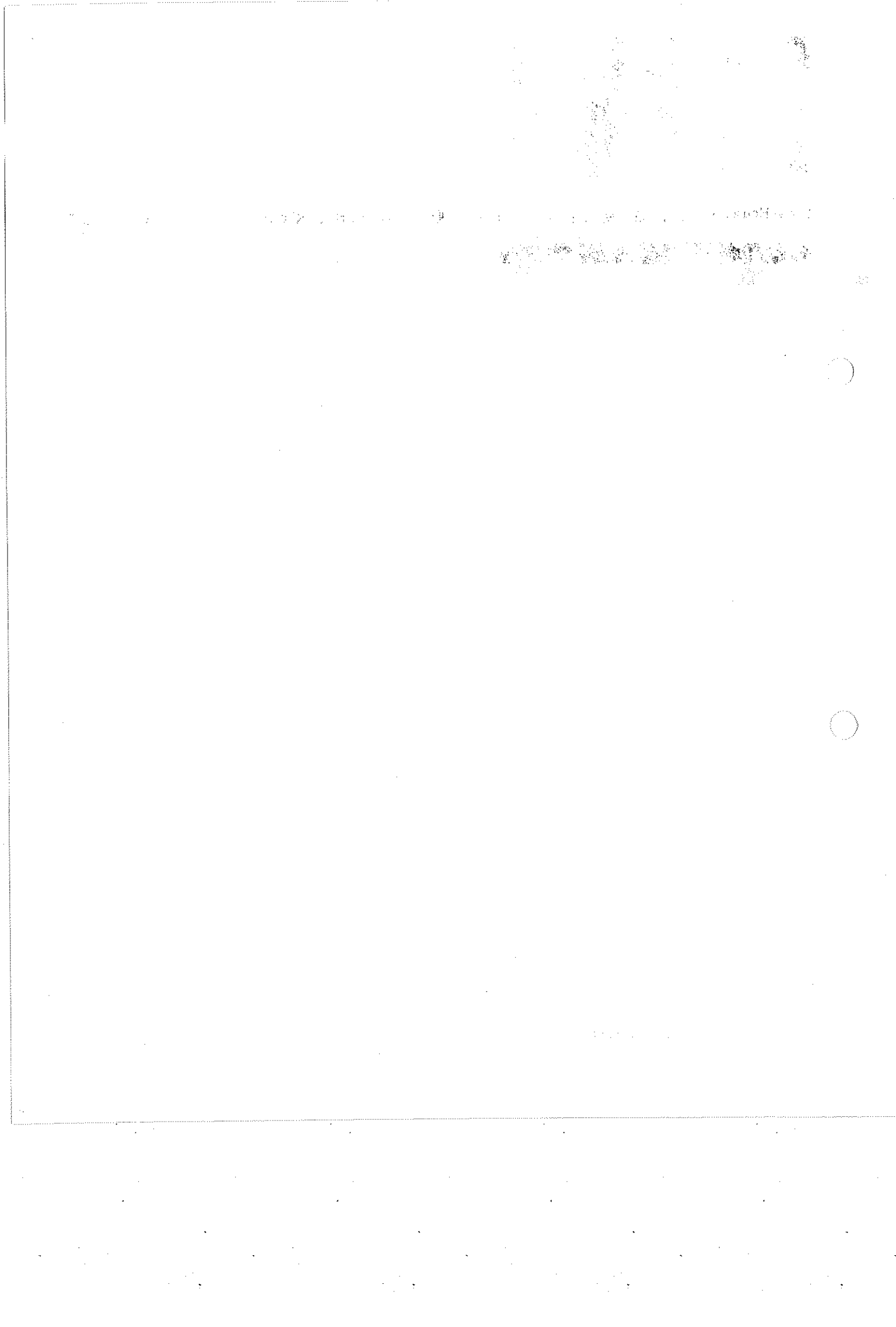
No 5 September 1985

ORGANOLEPTIC ENHANCEMENT OF COMMINUTED INDUSTRIAL FISH

by

G.M. DREOSTI

Scientific Consultant to I.A.F.M.M., "Phezulu", 63 Ocean View Drive, Green Point, Cape Province, South Africa.



ORGANOLEPTIC ENHANCEMENT OF COMMINUTED INDUSTRIAL FISH

TABLE OF CONTENTS

ABBREVIATIONS USED:

CPS = Cooked, Pressed and Salted
AO = Antioxidant
EQ = Ethoxyquin
MC = Moisture Content
TSS = Total Soluble Solids

SUMMARY

1. The preparation and marketing of attractively flavoured and coloured minces and pastes would seem to have sales advantages over supplying raw or cooked products with weak or unattractive odour and flavour and grey/brown colour.

2. The cooked, pressed and salted (C.P.S) minces and pastes offer many advantages over the raw products.

3. Examples are given of attractive final products that can be made from the minces and pastes. Flavour and colour ingredients that are common to a number of finished products are indicated, with the view to reducing the number of semi-processed minces and pastes necessary to cater for a wide range of finished commodities.

4. Efforts should, in the first instance, be concentrated on the preparation of flavoured minces and pastes which are suitable for the manufacture of sausages, products of similar type to fish fingers, and to Kamoboko - the latter items with flavours, colours and appearances of their own.

5. The possible use of the C.P.S. paste, instead of F.P.C. for enriching cereal products and for general enrichment purposes, needs investigation.

6. It is thought that the Fish Meal Industry and its Scientists should make samples of semi-processed minces and pastes and, indeed, of the finished products for purposes of negotiation with the Food Processing Industry. That industry should not be relied on entirely for experimenting with the use of fish minces and paste in their food products.

7. As the minces and pastes can be used directly in the kitchen it would seem possible also to market these semi-prepared products through food marketing agencies for direct kitchen use. In the latter case, it would seem to be wise to prepare recipe booklets for inclusion in the wholesale and retail packages sold directly to consumers.

8. The co-operation of the F.A.O. should be sought concerning the main food dishes for African, Asian and South American Countries in which the fish minces and pastes could find good use.

ZUSAMMENFASSUNG

1 Herstellung und Vertrieb von in Geschmack und Farbe ansprechenden Produkten aus gehacktem Fisch oder Fischpaste bieten beim Verkauf Vorteile gegenüber dem Angebot von rohen oder gekochten Produkten mit schwachem Geruch und grauer/brauner Farbe.

2 Die gekochten, abgepressten und gesalzenen (CPS) Breie oder Pasten bieten viele Vorteile gegenüber dem rohen Material.

3 Es werden Beispiele für ansprechende Produkte aus Brei oder Paste gebracht. Geruchs - und Geschmacksstoffe, die für eine Anzahl von Fertigprodukten üblich sind, werden empfohlen mit dem Ziel einer Verminderung der Zahl von Halbfabrikaten, die für ein umfangreiches Angbot von Fertigprodukten erforderlich sind.

4 Im Anfang empfiehlt sich eine Konzentration der Bemühungen auf die Produktion von aromatisiertem Brei oder Paste, die zur Herstellung von Wurst, Erzeugnissen ähnlich den Fischstäbchen und Kamoboko geeignet sind, letztere mit dem eigenen Geruch, Geschmack und Aussehen.

5 Die möglich erscheinende Verwendung von CPS Paste anstelle von FPC zur Anreicherung von Getreideprodukten oder allgemein zur Anreicherung von Lebensmitteln bedarf der Erforschung.

6 Wünschenswert ist, daß die Fischmehlindustrie bezw. ihre Wissenschaftler Proben sowohl von Halbfabrikaten aus Brei und Paste als auch von Fertigprodukten herstellen, um mit der Nahrungsmittelindustrie in Verbindung treten zu können. Diese Industrie sollte nicht allein auf eigene Versuche zur Verwendung von Fischbrei bezw. Paste in ihren Produkten angewiesen sein.

7 Da Brei und Paste direkt in der Küche verwendet werden können, scheint eine Vermarktung über die Großhandelsketten zur direkten Verwendung in der Küche möglich. In diesem Falle wäre die Herstellung von Rezeptbüchern und ihre Einlage in Großpackungen sowie in die direkt an den Verbraucher gehenden Kleinpackungen empfehlenswert.

8 Die Zusammenarbeit mit der FAO sollte in Hinblick auf die Hauptnahrungsmittel in den Ländern in Afrika, Asien und Südamerika gesucht werden, in denen Fischbrei und Fischpaste gute Verwendung finden können.

RESUMEN

1. La preparación y mercadeo de pastas y picadillos de pescado coloreados y aromatizados atractivamente pareciera tener ventajas de venta sobre el suministro de productos crudos o cocidos con olor y aroma débil y no atractivos y color pardo grisáceo.

2 Las pastas y picadillos cocidos, prensados y salados (CPS) ofrecen muchas ventajas sobre los productos cocidos.

3 Se dan ejemplos de los productos finales atractivos que pueden ser hechos con picadillos y pastas. Se recomiendan aromas y colorantes que son comunes a un número de productos terminados, con vistas a reducir el número de picadillos y pastas semiprocesados necesarios para cubrir un amplio rango de productos terminados.

4 En primera instancia los esfuerzos deben concentrarse en la preparación de picadillos y pastas aromatizados que sean utilizables en la fabricación de salchichas, embutidos o similares al tipo de dedos de pescado y o Kamoboto, los últimos item con aromas, colores y apariencia de la especie empleada.

5 Se necesita investigación para el uso posible de pastas CPS en lugar de FPC, para enriquecer productos de cereales y para propósitos de enriquecimiento general.

6 Se entiende que la industria de harina de pescado y sus científicos deberían hacer muestras de picadillos y pastas semiprocesadas y además de productos terminados con el propósito de negociación con la industria procesadora de alimentos. Esa industria no debería ser acreditada completamente en experimentar con el uso de picadillos de pescado en sus productos alimenticios.

7 Como los picadillos y pastas pueden ser usados directamente en la cocina, parecería posible también comercializar esos productos semi-preparados a través de agencias de mercado de alimentos para uso directo en la cocina. En el último caso, parecería conveniente preparar manuales de recetas para ser incluídas en los envases de comercialización al por mayor y menor, vendidos directamente a los consumidores.

8 La cooperación de FAO se debería contemplar en lo relacionado con los principales platos de alimentos para los países de Africa, Asia y Sud América, en las que los picadillos y pastas de pescado puedan encontrar un buen uso.

1. INTRODUCTION

Comminuted protein products have been used for many years in many countries. For instance, in Scandinavia more than 50% of the carcase weight of animals is apparently used in the form of mince; in Germany almost every city, town and village has its own type of delectable sausage or other meat fabrication from mince; and high usage also occurs in many other countries such as Canada, U.S.A. and the U.K.

Considerable, and increasing quantities of minced fish are also consumed in these and other countries, including Japan.

Comminuted fish products are thus used worldwide and form the basis of many food commodities.

The IAFMM is devoting attention to the possibility of converting much more industrial fish into food rather than feed products, and has established a special Committee for the manufacture of foods from industrial fish species, which devotes its full attention to the difficult problems involved. Active research is in progress in this field in several countries and industrial processes have been developed in Japan, Peru, U.S.A., Norway, South Africa and other countries.

The U.S.A. is becoming increasingly interested and taking a leading part in this work.

2. THE PRODUCTS

The present paper concerns the semi-processing of minces and pastes described in Technical Report No. 1. January 1983, of the International Association of Fish Meal Manufacturers entitled "Potential Food Products from Industrial Fish".

Briefly, the minces and pastes are produced by washing the fish and passing it through a coarse or fine deboner, depending on the size and nature of the fish in question, and then washing out the gut contents (which are soluble in these fishes) by counter-current procedure. The mince can be further washed in this manner for reducing volatile and soluble odour and flavour substances and to lighten the colour of the flesh.

2.1 Leaching

Although leaching losses are considerable, the spent wash-water is thick enough in solubles, e.g. 7% to 9% to justify the cost of centrifuging off the oil and concentrating the solubles in

mutiple effect evaporators to by-products for feed or fertilizer. The washed mince and pastes can be stored by freezing or salting, either raw or after cooking and pressing.

2.2. Bones

The head and bones retained by the deboner could presumably be used, after counter-current washing, for cooking to produce a concentrated fish soup stock, with the addition of the necessary herbs and spices.

After straining, the insoluble material would be diverted to the fish reduction plant.

2.3 Cooking and Pressing

Although cooking of these minces and pastes reduces their functional properties considerably the process opens up the prospect of great advantages. In this latter process the flesh can be cooked in a rotary cooker, just sufficiently for maximum oil removal by consequent pressing and, if necessary, heating of the presscake can be continued for a sufficient time to soften any residual bones.

The whole process fits better into existing fish reduction procedures than any other option and seems to have the greatest chance of economic success.

Both the press oil and the concentrated "stick-water" are recovered. The oil can be sold in the usual way and the concentrated stick-water can be used for human consumption as it is recovered from fish flesh in the absence of gut contents. Incidentally, organs including the gut are not removed from any of the products here described nor is there any nutritional reason for doing so as they have considerable nutritional value.

The cooked and pressed minces and pastes can be stored either by freezing or salting and, in this latter respect, the amount of salt needed is only half of that needed for salting the raw products.

The cooked, pressed and salted (C.P.S.) have the following advantages over the raw commodities:-

Considerably reduced oil content, salt content, storage and transport space and weight and thus cost.

An advantage of cooking, pressing and salting is that coarse mince can be made and any small bones passing through the deboner can be softened by further cooking.

C.P.S. products are not only much easier to store than the other minces and pastes, but also to handle and use, after storage and transport, for preparing the final products, and subsequent storage and transpsort. Freezing , thawing (for mixing) and re-freezing can be avoided altogether or, at any rate, freezing can be avoided for many final products. In the C.P.S. process the press liquor is drinkable or edible if used on solids or highly concentrated. It is not only the most convenient product for the Fish Meal Industry to make but also the most profitable, taking into account the recovery of press oil and edible extract, and the relatively low salt usage, as indicated in my Memorandum to the IAFMM in 1982. The profit obtainable from the manufacture of this mince is about 2½ times as high as for the manufacture of fish meal and oil, at the same "mark-up" as for fish meal and oil production, i.e. approximately 25% above the cost of manufacture and packaging. Even if C.P.S. products were marketed at 100% profit they could still easily compete with other protein commodities such as chicken and textured soya

2.4 Press Liquors

The so-called stick water derived from the press liquors during cooking and pressing of the mince can be concentrated in multiple effect evaporators just as ordinary stick-water, but the present material is suitable for human consumption as already stated, and can be used either for use in preparing a soup stock, with or without the addition of cooked and pressed paste, or for concentrating after centrifuging and pressure filtering to form a thick extract of about 80% soluble solids which can be flavoured by means of herbs to give a Bovril-like product. Such a product was made by me at F.I.R.I. many years ago from drainings during canning operations and was attractive and devoid of fishy taste or smell.

The wash water from the counter-current washing of the raw mince however contains gut contents and should not be used for edible purposes.

3 OXIDATION

Oxidation is one of the most important causes of quality loss (nutritional and organoleptic) and limited storage life. It gives rise to many unwanted changes in flavour, odour, colour and even texture. Oxidation proceeds much more rapidly in comminuted products than in the flesh they are made from and present great difficulty in storage, whether frozen or salted.

It is for this reason that the IAFMM requested a report entitled "Protection of Minced Oily Fish against Rancidity". This report is due for publication shortly. It is strongly recommended that antioxidant procedures be applied to any comminuted products made from industrial fish.

4 IMPROVEMENTS

The motive for presenting this paper is to stress the need for presenting these comminuted products in the most attractive manner to prospective users or consumers. Foods and food products are not usually bought because they are "good for health" but because they have an attractive flavour, odour and texture.

In fact, the Head of one of the largest International Food Organisations once impressed me with his stated experience that he could market food products better by claiming that they were good for the eyelashes or wrinkles than for health.

We should thus devote thought and experimentation to this subject of presentation of good protein.

As leaching losses are considerable in these processes, the residual odour and flavour are rather weak. After prolonged storage, there is always a danger that very slight rancidity may occur in spite of the protection afforded by antioxidants such as ethoxyquin (where permitted) or TBHQ and citric acid. The masking value of small, almost undetectable traces of curry, mustard, cinnamon, etc. should not be overlooked. Furthermore, it seems desirable to add sufficient herbs, spices, or other flavourings not merely to mask any slight odour or flavour of the mince or paste, but to impart thereto pleasing characteristics which are consistent with those expected by the consumer in the final product.

Many flavours which are undesirable or even revolting, are acceptable and even attractive when present in very minute

proportions in the final products. This is one of the reasons why the producer of fish minces and pastes should add flavourings which are consistent with final products intended.

Although we should not compete with the Food Industry we should, nevertheless, process our raw materials to the most presentable state that we can within our own experience with fish and our own connection with other sections of the Fishing Industry, with Agriculture, etc. Although we cannot add all the attractive components (e.g. crustacean, herbs, spices) that blend with the final products intended, because of the wide variety of final products in which our minces and pastes can be incorporated, we should, nevertheless, have knowledge of such components and of the final products; and we should give all possible assistance to the Food Industries.

Briefly, we should experiment with the (few) main products which seem to be the most attractive in our own circumstances, e.g. area, type of fish, type of Food Industry, status of the consumers, or requirements of official Agencies, and prepare a few semi-processed raw materials for those specific purposes, and even a few final products for demonstration in our negotiations - even though possible admitting that the final products might not measure up to those that may be possible with the semi-processed raw materials in question.

The present paper comprises a preliminary approach to this subject and is based largely on experience and estimates due to the lack of literature on the subject. It might be helpful if a fairly complete list of recipes could be drawn up of products that are made, or could be made, from these fish minces and pastes. This list could be added to by Members in the future and it could serve as a useful reference for producers in different countries. Recipes could be selected which would fit in with their factories, produce of their areas, facilities and plant available, food habits of intended marketing areas, and methods of preservation (freezing, canning, salting, drying and semi-preservation, e.g. chilling or preservatives).

4.1 Colour

Unfortunately, the colour of the flesh of pelagic fish is not as white as that of demersal fish, which is often highly desired by consumers . In the present process of removing gut contents the dark (nutritious) organs are left in the mince thus darkening the colour even more.

There is no known way of lightening the colour of pelagic fish flesh appreciably. A small amount of lightening is obtained by the thorough washing, but the use of hydrogen peroxide for slight further lightening is not desirable due to its detrimental effect on protein.

It would be better to add white flesh to the present minces or pastes, if light colour is desired.

4.2 Colouring

Titanium dioxide is a strong colourant and high levels could safely be used in foods as it is innocuous. It is permitted in flour and sugar confections up to 0.4% and in non-dairy creamers to the extent of 1%. It is often used in medicines. Owing to the considerable amounts of fish that may be eaten by certain users, however, it would probably be considered as an adulterant in minced fish products.

However, from discussions here with relevant senior Health Department Officials, it seems that 0, 1% to 0.2% may be permitted in pelagic fish mince if application is made for this in South Africa. Having added these small amounts to (mackerel) mince it was surprising to find the degree of whitening obtained. Incidentally, tapioca and other starch products (flour, etc) are added to some fish products for binding purposes. Tomato is so often used with fish that fish mince or paste containing tomato paste or sauce (ketchup) would be suitable for use in many final products.

4.3 Texture

The texture of the final product is far more important in, for instance, Japan where elasticity is prized than in the West where odour and flavour are more important, though the "feel" of the product in the mouth is not unimportant. Unfortunately, the flesh of industrial fish falls short in elastic and general functional properties of most demersal (white) fish. Moreover, fine milling does not improve the feel (texture) of the flesh. Also fish protein undergoes adverse changes in functional properties during frozen storage, salting and even more so during cooking - hence the addition of polyphosphates, etc. to white fish mince prior to freezing.

Fibre spinning of the fish flesh, e.g. by extrusion through fine orifices into a suitable medium and subsequent stretching or weaving is still in the experimental stage.

However, functional properties are less expensive to obtain from vegetable sources (lentils, peas, rice, etc) and it is suggested that such materials be added to the fish minces and pastes.

4.4. Flavourings

Minced fish and fish paste offer opportunities for preparing a large number of known and new products, for a wide range of consumers both in the East and West. Flavoured minces and pastes can be used for the preparation of many different products.

The following substances can be included in the final products made from fish mince, and could be added to the mince prior to storage and distribution to food manufacturers or users: minces made from crabs, lobsters, prawns, shrimps, salmon, tuna and smoked fish, anchovy sauce, pickles or curried fish, bacon, cheese, pulse meal, skim milk powder, potato, maize, wheat, oatmeal (AO), peas, barley, rice, tomato, carrot, onion, stable vegetable oil and fat (both of which would protect the residual fish oil in the mince) chillies, soya protein, Worcestershire sauce, lemon flavour, lemon rind and a great variety of herbs and spices such as parsley (which is used in a great variety of fish dishes), basil, cayenne pepper, celery seed, cumin seed, curry powder, fennel, mace, marjoram, mustard, paprika, rosemary (AO), saffron, sage (AO), tarragon, thyme, turmeric, garlic, mint, peppermint, bayleaf, coriander, nutmeg, capers, cloves, a local Peruvian seed called quinus, spices used in the East (e.g. in yusone and other minced products which are used in the Far East in large quantities and in special spiced minces used in Malaysia, etc), citric acid, acetic acid, red, black and white pepper, salt, sugar, polyphosphates and potassium sorbate.

4.5 C.P.S. additives

During my dehydration control days, onions were dehydrated after removal of the juice by pressing. The juice was concentrated at low temperature, under vacuum, and sold separately thus increasing profitability.

It may be possible to cook and press the flesh and salt the presscake of crab, lobster, prawn, etc. The minces could then be added to the C.P.S. mince made from pelagic fish and the concentrated press liquors marketed separately or added, after salting, to C.P.S. mince or paste made from pelagic fish. At any rate, if I had a laboratory at my disposal I would investigate this possibility.

5 SMOKING

Smoking of fish mince can be improved, and reduced in cost, by condensing the smoke in e.g. vegetable oil and introducing this to the mince instead of smoking the mince itself in smoke houses. Many years age we produced good smoked fish products by passing the smoke from the smoke generator through a spray of water which was recirculated continuously for saturating it with lighter components, while it condensed out the heavier tarry components; and then condensing the smoke that passed through the spray, e.g. in vegetable oil. In this way the full flavour of the smoke was retained while avoiding brown discolouration by tar components or soot on the fish. Carcinogens were also removed by the washing procedure. Small quantities of this "smoked oil" were added during pilchard canning.

The smoke washer also proved its value in the white fish smoking industry. An important further advantage was the elimination of the risk of fire in the smoke houses.

6 FINAL PRODUCTS

It may be of interest to look at examples of final products which could be prepared by Food Industries and by consumers with the view to selecting additives which are common to a number of final products for incorporation in fish minces and pastes. Each fish mince or paste manufacturer could limit his products to the few best suited to his markets and his particular local circumstances.

A distinction must be made between industrialised and sophisticated markets, markets in poorer areas and in the developing countries, and Government or International charitable food assistance programmes.

7 FOOD AID PROGRAMMES

For these, purposes, the fish material must be as low in overall cost as possible and only the salted products are worth considering. The cooked, pressed and salted minces and pastes have a great advantage over all other products in this respect. They are cheaper to produce and have advantages in transport weight and volume and in handling. In areas where charity feeding is necessary the taste of slight rancidity, if any is present, is often an advantage rather than a drawback, as these people are used to rancidity and like it - even when it is strong.

Nutritionally, any slight rancidity would be of no consequence. When used for protein enrichment of cereal products, however, bland pastes are required that are undetectable when added up to about 4% dry matter.

7.1 Enrichment

For the purpose of enriching wheat or other milled grain products the cooked, pressed and salted fish paste should be finely ground. Fish paste is not as neutral as extracted F.P.C., although the odour and flavour could be largely masked by adding a practically undetectable amount of e.g. curry powder. The water content of C.P.S. paste is so low that it would add a maximum of only 2% to that of the flour to which 4% of the paste is added, and the increase in salt content would be only about 0.7%. Foods usually are correctly salted at 1.5% to 1.8% of salt content. The fish protein added to the flour would be of similar order to that of 2% extracted F.P.C., which is sufficient to enhance the protein quality of the final product appreciably. As drying would be avoided there would be no "grittiness" problem.

An addition of 2% of F.P.C.type A to brown bread here was the most economic and efficient amount for this purpose. C.P.S. paste would be easier and cheaper to produce than F.P.C. type A, and it would be nutritionally superior for protein enrichment. Research is needed with the aim of using C.P.S. paste instead of F.P.C.(A) for cereal enrichment. The C.P.S. products could, in any case, be supplied to the needy direct for sprinkling on, or inclusion in, their cereal foods.

8 DEVELOPING AREAS

In most developing areas "fishiness" and even rancidity are acceptable and often even desirable.

For these areas also the products should be as low in cost as possible.

Cooked, pressed and salted minces and pastes are indicated for these markets also.

Whether additive is advisable and if so, which, depends on the exact area for which the product is intended. For instance, flavour requirements in Africa are undoubtedly difference to those in South America and these again different to Asia.

F.A.O. is in the best position to furnish such data for developing areas from their wide experience in this field. The information could prove useful to members, who could then develop specific minces for these areas. However, many of the ingredients, except the fish material, would probably by of local origin and therefore would, in many case, be provided by the consumers more cheaply than through the mince or paste.

However, with knowledge of local flavour and odour preferences we could at least give guidance as to the best manner of incorporation.

9 INDUSTRIALISED AREAS

High grade minces and pastes are required for sophisticated markets, and these must have an attractive appearance, odour and flavour that fits in well with the production of the desired final products. This market definitely calls for the blending of balances, pleasing, qualities into the minces and pastes even, if necessary,, at relatively high cost.

10 EAST

There are very wide variations in diets of difference areas and races, not only in organoleptic and nutritional qualities but in the degree of sophistication.

In South East Asia, large quantities of fermented products are consumed. The cooked, pressed and salted mince could perhaps be used for these products. Their usual composition is mince plus salt plus acid activated by microbial enzymes.

Salted and spiced fish (tilapia) is sundried in Malaysia and mixed with rice foods. It is not known whether industrial fish mince and, in particular, whether C.P.S. could be used for this purpose.

10.1 Surimi and Kamoboko

Kamoboko is a composite fish product in which well washed fish paste (Surimi) is used, which is bland and to which various substances are added such as sugars, monosodium glutamate, flavourings, carrots, onion, cheese, squid meat, potato, cereals, spices, etc. It is, therefore, a wide family of products made from Surimi. The best Surimi is made from white fish, but certain quantities of the fish paste are made from pelagic fish in conjunction with white fish and dairy products, or alone

together with vegetables and cereals to produce "composite" Kamoboko. A fish paste of lesser quality is called Itatsuki Kamoboko.

Large quantities of Kamoboko are consumed in Japan and thus, even though only inferior Surimi can be made from industrial fish, it would seem worth experimenting with the raw minces described here, or improved (but more expensive) minces made from light-coloured muscle only, for the production of Surimi type products for Kamoboko. Frozen raw mince would form the basis of such products, if necessary, with added functional vegetable proteins. The addition of carrots, onions, cheese and potato could result in a product in which the colour of the fish flesh is less pronounced.

Sausages also form a growing market and are discussed below.

11 WEST

There is great potential scope for the manufacture of innumerable products from fish minces and pastes. The following list of ready-to-eat fish products that are made, or can be made, by food industries and by consumers can be added to considerably. The additives are indicated which could be used by the fishing industry to enhance the odour, flavour, colour or texture of the pastes and minces. It is not suggested that the fishing industry should attempt to prepare a mass of difference minces and pastes. Each manufacturer could select two or three mixtures which would cover many of the products that are envisaged for his markets. In some cases, he may wish to reduce the number of additives in order to cover a wider field of final products with a specific mince or paste,or he may do so because the few additives are fully satisfactory.

The coarseness or the fineness of the mince or the paste could be decided upon in consultation with the food organisation showing interest in the product.

11.1 Fish Fingers or Fish Sticks

These are used in great quantities in the U.S.A., UK., South Africa and other countries. For instance in the U.K. about 30% of the fish consumed is in the form of fish fingers. Ten percent to 20% of the fish sticks are made entirely of mince and the rest of the fish stick contain about 20% of fish mince.

Perhaps the highest consumption of mince and paste in the West is used for the manufacture of fish fingers or fish sticks. Here again, white fish is generally used, but technically there seems to be no reason for not producing attractive fish fingers or sticks, either with the inclusion of some mince made from pelagic fish or made entirely from pelagic fish. Different fish fingers could be made by including vegetable and other additives- for instance, smoke, parsley, onion, cheese and either tomato or titanium oxide for colour.

These ingredients could be added to the minces.

Because of the importance of this market considerable research effort should be devoted to this product, both in the laboratory and in the market place. Flavour and colour additives are strongly indicated. The colour would be rather dark and the product might be regarded as inferior if the present fish sticks are merely imitated.

12 FISH SOUPS AND STEWS

A fish stock made from washed deboner solids (after straining) can be further strengthened by vacuum concentration and the incorporation of de-oiled, concentrated, press liquors obtained from the flesh in the manufacture of C.P.S. mince.

Common factors in different soups are onion, clove, bayleaf, celery and/or parsley and pepper.

The stock can be stored in the frozen state or it can be salted - not needing desalting before dilution for use. Cooked, pressed and salted mince or paste can also be added. Even after adding the necessary further salt to the stock for preservation, the soup made therefrom would have no more than about 1.8% of salt, i.e. just right for flavour after dilution of the mixture to 1/8th of its strength, which latter is a very thick and nutritious soup containing about 5% of fish solids, i.e. more than 20% of fish flesh. For the calculation the stock was taken as having 40% of fish solids and the cooked, pressed and salted fish also 40% of fish solids, and equal parts of each incorporated in the stock. The fish stock or soup could also contain vegetable fat, MSG, hydrolised vegetable protein, yeast extract, saffron, caramel, pepper, sugar, citric acid, starch, (flour, potato) and spices. Carrot and/or peas and/or green or red peppers could also be added to the fish soup. The stock could serve for many other fish soups, e.g:.

another soup (Bouillabasse), containing also other fishes and crustaceans, (e.g. crab, lobster) would contain olive oil or fat, onions, celery, cloves, garlic, lemon peel, lemon juice, saffron, bayleaf, lobster meat, shrimp; or;

an "easy" fish chowder (onions, bacon, salt, pepper, bayleaf) or so-called "Grandma's fish soup" (carrots, curry powder, lemon juice , sugar, bayleaf, onion) or a "light fish soup" (margarine, pepper) or "fish bisque" (parsley, onion, pepper, salt) or curried fish soup (curry, grated cheese, salt, pepper).

Curry dishes are improved by the (Eastern) addition of ginger, but Western Cookery Books make no mention of this.

Zuppadivongole (clam chowder) would contain, in addition, clams, olive oil, garlic, chopped anchovy, red wine, salt, pepper, oregano and parsley; or clams, onions, white wine, olive oil, leeds, garlic, celery, marjoram. For mussel soup one would also add olive oil, tomato sauce, ground red peppers, garlic, oregano, salt.

Some American Seafood Chowders seem to have thyme instead of parsley and a variety of other substance in addition to those mentioned above, e.g. chopped shellfish, in cream style with a lobster flavour or, alternatively, certain vegetables including green peppers.

Genovese fish stew also contains onions, celery, carrots, mushrooms, garlic, parsley, pine kernel nuts, vegetable oil, salt, pepper and white wine.

13 PATES, SPREADS, MOUSSES AND PUDDINGS

These commodities may have similar components. They may contain a single fish species (e.g. pilchard pate) or several species (anchovy spread) and the present pastes could find application in these products, e.g. together with salmon, tuna, lobster, etc. and added colouring and with flavourings which are normally used with these products, such as parsley, pepper, onion, olive oil, gelatine, garlic, mustard, milk, egg, tomato (sauce), salt, radishes, lemon juice, etc. Spreads may include products with a "sharper" taste than pates, such as paprike, smoke, red pepper, nitrite, etc.

Common factors would be peppers, parsley, onion, salt and oil and these could be incorporated in the pastes.

14 SAUCES

Immitation anchovy sauce could be made from fish paste with the addition of anchovy essence, or imitation lobster or shrimp sauce with anchovy essence, lemon juice or citric acid, cayenne pepper and ground lobster or shrimp meat, or oyster sauce with anchovy essence and lemon juice, onion, olives, Parmesan cheese, pepper and oil or vegetable fat. Sauces for pizzas filling or spaghetti (with garlic, anchovy, capers, etc) could also be made from these pastes.

Common factors are pepper, lemon, oyster essence,and these could be added to the pastes.

15 SAUSAGES

There is a large sausage market in most Countries and the potential for fish minces and pastes is great. A variety of savour mince sausages, and raw brown Vienna type and Frankfurter type (smoked) sausages can be made from the minces and pastes. Common ingredients again are pepper and parsley. An important advantage is that the skins of the sausages offer resistance to the ingress of oxygen and some skins act as a good barrier to oxygen right until the sausages are eaten. Vienna and Frankfurters of superior quality , and indistinguishable from the meat products, were made in my laboratory and their manufacture introduced to the fishing industry. The sausages were made of white fish flesh, but similar products could no doubt be made from industrial fish. Twelve percent or more of fat is added to many kinds of sausages, and the mixing in of stabilised fat with mince or paste would greatly assist in protecting the fish oil from rancidity during storage.

16 OTHER PRODUCTS

All the following products could be made from minces and pastes containing onion, parsley, pepper and celery:

fish salami, fish-soy cakes, cakes of fish and meat or cheese or mushroom or other vegetables, or plain fish cakes, crispies, croquettes, rissoles, pies, patties, fish portions, fish burgers, fish bites, sea-sticks, savoury fish balls, bobotie, fish-cream, hot fish chilli, fish and rice loaf, fish frikkadels, fish rosemary rice, fish fritters, fish breyani, fishermen's pie, fish murphies (with potato and cheese), puffed fish (self-raising flour), spicy fish casserole, fish and vegetable pie, fish filling for pancakes, fish and ham spread, sweetcorn fish pie, imitation clam balls, crab cakes, crab nuggets, crabsticks (15% crab), fish roly-poly filling, prawn shapes imitation tuna sandwich filling and many more.

Some products include prawns, crab, tuna, shrimp, e.g. 55% fish mince and 45% shrimp, vegetable oil and smoke flavour, any of which would also help to enhance the appearance and/or flavour of the minces and pastes.

Many of the products contain tomato paste or sauce which could also be used for masking the grey/brown colour of fish mince or paste used for these purposes. Other ingredients which could, for most final products, be added to the minces and pastes are capers, olives and finely milled Parmesan cheese. Many contain additives shown under soups and stews, e.g. saffron, turmeric, hot chilli, mustard, nutmeg, cayenne and pepper.

17 RECIPES

Numerous other tasty dishes can be made from fish minces and pastes in hotels and in official and industrial mass feeding kitchens and in homes. For these latter purposes, it would be helpful, and in the interest of our Industry, to prepare attractive booklets giving recipes of dishes that can be prepared from the minces and pastes. The recipes could be made available to marketing agencies for inclusion in wholesale or retail packages of the minces and pastes.

18 MEAT EXTENDER

For this purpose, the fish flavour and odour must be bland and undetectable, e.g. when used as a meat extender (15%) in hot dogs or in meat loaves, meat sausages, meat salami, meat rissoles, meat burgers and even, almost, in so-called beefish (one-third) products. For these kinds of products the cooked and pressed minces seem to have advantages insofar as any possible residual odour and flavour are concerned, and even more so if the products are recooked for softening the bones after cooking and pressing. At this stage, beef flavours, (extract) could be added to the fish material intended for these purposes.

For many of these products the basic flavoured mince or paste could contain pepper, onion, parsley, cloves or nutmeg and tomato (for colouring) and a trace of mustard.

REFERENCE

1 Potential Food Products from Industrial Fish - G M Dreosti and T J Billy - 1983

2 Protection of Minced Oily Against Rancidity - G M Dreosti - 1983

3 Study on Fish Waste - Jatte Nielsen, Denmark - 1980

4 Seafood Science and Technology in the U.S.A. National Sea Grant College Programme - David H Attaway - 1981

5 Fishery Products Report of Technical Conference on Fishery Products, Tokyo, edited by Rudolf Kreuzer, F.A.O. - 1974. Fishing News (Books) Limited.

6 The Technology of Fish Utilisation - International Symposium Husum edited by Rudolph Kreuzer, F.A.O. - 1964. Fishing News (Books) Ltd.

7 Third National Technical Seminar on Mechanical Recovery and Utilisation of Fish Flesh - Raleigh, North Carolina - 1980 edited by Roy E Martin.

8 Thirty International, American, English, German, Italian, Dutch and South African General and Fish Cookery Books.