

Method for Manufacturing Processed Foods

The invention relates to the manufacture of processed foods, particularly the incorporation of dietary supplements such as omega-3 fatty acids in to
5 processed seafoods.

In humans, polyunsaturated fatty acids (PUFAs) are important dietary components required for the proper development of the brain and vision in infants (Putnam JC et al., Am. J. Clin. Nutr. 54: 438, 1982), as well as being an aid to development of human intelligence (Patent no CN1130040, Xang Xuebin).
10 Additionally some of the PUFAs, e.g. omega-3 eicosapentaenoic acid (EPA) and docosapentaenoic acid (DHA) have been recognised as dietary components which are capable of assisting in the prevention of cardiovascular disease (Simpopoulous AP, Am. J. Clin. Nutr. 35: 106, 1991), such as arteriosclerosis, cerebral embolism and myocardial infarction (Patent no CN1108891, Dalian
15 Chemical Physics Inst). The nutritional importance of these essential fatty acids has been underscored by the fact that the governments of several Scandinavian countries and that of Canada have established daily recommended dietary intakes for omega-3 fatty acids (e.g. Health and Welfare Canada, 1991). The British Nutritional Foundation (Nicol WM, Food Safety Notebook, 3: 57, 1992) has
20 also published recommendations for dietary intake of these PUFAs. These recommendations fall in the range of 1.0 – 3.0 of omega-3 fatty acids per person per day for optimal nutrition. Children need about 1.0g while lactating mothers need about 0.3g omega-3 fatty acids per day. The needs of children and adults differ in the type of oil required; children require higher level of DHA while adults
25 need more EPA.

The generally recognised source of PUFAs is the flesh and oil of certain marine cold water finfish. A daily intake of 1.5g EPA for an adult would require a consumption of 225g fatty cold water fish everyday. In the United States, the mean daily per capita intake of fish is only 14g. In other countries the average
30 consumption of fish may be greater (for example 74g of fish per day in Singapore), however typically the type of fish consumed in countries such as Singapore is tropical fish, which are low in omega-3 fatty acids. In both of these examples the average consumption is much lower than the recommended intake.

Oils extracted from cold water fish (such as cod liver oil) are frequently consumed as supplements for PUFAs. However, the taste and odour associated with fish oil is considered objectionable by many people.

Polyunsaturated fatty acids have been previously incorporated in foods
5 such as infant formulae, baby food and milk (United States Patent 5,013,569, Century Laboratories Inc; European Patent EP093748, Nestle SA; United States Patent 5,397,591, Martek Biosciences Corporation; Patent no CN1108891, Dalian Chemical Physics Inst). However a number of disadvantages of the addition of
10 oils to these products have been identified. Firstly, the odour omitted by the oil may be unpleasant; secondly the oil is prone to oxidation causing it to turn rancid; thirdly, the oil may leak out of the product during cooking. Some attempts have been made to solve these problems, for example, to encapsulate the oil in a capsule (United States Patent 5,013,569) or in puffed starch (Patent no CN1130040, Xang Xuebin). Furthermore, mixing wet grain flour with the oil has
15 been used in an attempt to prevent oxidation of the oil (Japanese application no 07022490, Asahi Chem Ind Co Ltd).

Increasingly, consumers in industrialised countries are demanding ready-to-eat, highly processed food such as fast foods. The inclusion of nutritious additives would greatly benefit consumers who regularly eat such products. One
20 such food which is very popular with both adults and children is processed seafood products such as fish balls, fish cakes and sea sticks (surimi). Omega-3 fatty acid enriched processed seafoods would therefore serve as a desirable source of PUFAs. However, processed seafoods, like many other popular processed foods, are not inherently suitable for the incorporation of omega-3 oils
25 due to two of their key properties.

Free oil is generally immiscible with water because of its hydrophobic nature. Many foods are hydrophilic in nature, including, for example, the ingredients which make up processed seafoods. Generally, to overcome problems associated with immiscibility of hydrophobic liquids in hydrophilic
30 substances, vigorous mixing is employed. A very high level of agitation produces fine oil droplets as a suspension in the hydrophilic phase i.e. an oil-in-water emulsion, thereby increasing the surface area to volume ratio.

This method is not suitable for incorporation of oil in processed seafoods due to the second key characteristic of processed seafoods. During the manufacture of processed seafoods a thick seafood paste is formed. The high viscosity of this seafood paste means that it is not suitable for mixing using high agitation rates. The method of mixing which is typically employed for such a thick paste is slow mixing. To use this to incorporate oil in processed seafoods would result in poor mixing and therefore oxidation (rancidity) of exposed oil. Leakage of the oil during cooking is also a risk.

It is an object of the present invention to provide a method of manufacturing processed foods, particularly seafoods to incorporate oils such as omega-3 fatty acids. A further object is to provide a food product, particularly a processed seafood product, which is high in its content of desirable oils, particularly PUFAs.

Accordingly there is provided a method for incorporating PUFA oils into seafood to produce seafood preparations, including admixing at least one PUFA oil with said seafood, said at least one PUFA oil being adsorbed onto a solid carrier, or being in the form of a stable emulsion in a liquid carrier.

When a solid carrier is used leakage of oil is substantially prevented partly because of the adsorption of the oil on the carrier, and also because the use of a carrier allows dispersion of fine oil droplets, deeply embedded into the food. This prevents leakage of oil and deterioration by oxidation of the food during cooking. Likewise, when the oil is incorporated in the seafood as a stable emulsion in a liquid carrier, leakage of oil is substantially prevented.

This method is applied to seafood due to its hydrophilic and high viscosity characteristics and results in a product which is free of the odours and tastes commonly associated with PUFA oils. It has also been found that oils mixed into the food using a method according to the invention did not readily oxidize when incorporated in seafood, an unexpected additional advantage therefore being recognised. Leakage of the oil from the final product is also minimised.

Suitable solid carriers are carriers which are hydrophobic, ensuring the oil adequately adsorbs to the carrier. Mesh sizes of up to 20 USP are conveniently used, however smaller sizes have the advantage of a larger oil adsorbing surface area per carrier mass and produce finer droplets in the food. Consequently sizes

of less than 40 USP are preferable and particularly preferable is a size of less than 50 USP. A suitable such carrier is modified starch.

Suitable liquid carriers are those which when mixed with said PUFA oil result in a stable oil-in-water emulsion. One such carrier is water. Suitable
5 surfactants may be utilised to facilitate the formation of a stable emulsion.

In one preferred method of preparing a processed seafood product incorporating high levels of PUFA oils, an oil in water emulsion is formed utilising any acceptable food grade emulsifier. Preferably, ice cold water is utilised since this results in greater stability of the emulsion. The emulsion can then be mixed
10 into the seafood paste in a known manner.

An advantageous method of preparing the processed seafood utilising a solid carrier includes blending the solid carrier into a small volume of fish paste and combining the fish paste into the bulk of the fish. Alternatively, the fish paste can be incorporated into a glue and applied in between layers of fish sheets.

15 The method also may include the step of cooking the food, for example by steaming it.

A particularly advantageous PUFA oil is an omega-3 oil as these are known to be of high dietary value, particularly when obtained from fish. Particularly, it is known that adults require high levels of EPA and children high
20 levels of DHA, making these oils especially suitable. Different ratios of the different oils may be included in products directed at the different types of consumers.

Usefully, antioxidants can be mixed into the oil to assist in preventing spoilage of the oil. Vitamins A and E have dietary value in themselves, as well as
25 their value as an antioxidant, and therefore make also particularly suitable additives.

Other ingredients such as spices, vegetables or meats may also be added to the processed food.

In another aspect of the invention there is provided a processed seafood
30 made by made by admixing a PUFA oil with a seafood, said PUFA oil being adsorbed onto a solid carrier, or being in the form of a stable emulsion in a liquid carrier.

Suitable examples of a food prepared by this means are fish balls, fish cakes and sea sticks, due to their popularity as a food source, as well as previously described difficulties in incorporating and maintaining oils in this type of food.

- 5 The carriers identified hereinabove are favorably used in the preparation of this food.

It is desirable to include high levels of EPA and/or DHA to provide a food of high nutritional value for adults and children. The food may also desirably include other ingredients such as those identified hereinabove.

- 10 Advantageous additional steps in producing the food are also identified hereinabove.

Example

- A number of preparations of the food were made by preparing a range of oil mixtures containing various concentrations of EPA and DHA. These mixtures
15 provided a series of appropriate supplemental ratios of the two omega-3 fatty acids. In some of the mixtures, oil soluble antioxidants (either vitamin A and/or vitamin E) were included forming an oil composition. The oil composition was adsorbed on a modified starch solid carrier of a mesh size of less than 50 USP. Thus an oil-antioxidant-carrier complex was formed.

- 20 The oil-antioxidant-carrier complex was blended into a small volume of fish paste. Some of the omega-3 enriched fish paste was then mixed with a fish bulk to make fish balls and fish cakes. Some of the fish paste was incorporated into a glue, which was applied in between layers of fish sheets to make sea sticks (surimi).

- 25 While the foregoing example provides a preferred method of carrying out the method of the invention, a skilled person will recognise that various modifications and substitutions may be made without departing from the spirit and scope of the invention. Particularly the manufacture of processed seafood provides a convenient example of preparing a nutritionally enhanced and popular
30 food, however the method could be applied to a wide range a food types which the skilled person will readily recognise.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for incorporating PUFA oils into seafoods to produce seafood preparations which contain substantially enhanced levels of the oil, including admixing at least one PUFA oil with said seafood, said at least one PUFA oil being adsorbed onto a solid carrier, or being in the form of a stable emulsion in a liquid carrier.
2. A method according to claim 1 wherein oil particles or oil droplets have a diameter of less than 50 μm .
3. A method according to claim 1 or 2 wherein oil particles or oil droplets have a diameter of less than 100 μm .
4. A method according to any one of claims 1 to 3 wherein oil particles or oil droplets have a diameter of less than 200 μm .
5. A method according to claim 5 including blending the solid carrier into a small volume of fish paste and combining the fish paste into the bulk of the fish.
6. A method according to claims 5 or 6 including blending the solid carrier into a small volume of fish paste, incorporating the fish paste into a glue and applying the glue in between layers of fish sheets.
7. A method according to any one of claims 1 to 6 wherein the oil is an omega-3 oil.
8. A method according to claim 7 wherein the oil includes EPA and/or DHA.
9. A method according to any one of claims 1 to 8 wherein one or more antioxidants are added to the oil.

10. A processed seafood made by admixing a PUFA oil with a seafood, said PUFA oil being adsorbed onto a solid carrier, or being in the form of a stable emulsion in a liquid carrier.
11. A seafood according to claim 10 wherein the oil particles or oil droplets have a diameter of less than 50 μm .
12. A seafood according to claim 10 or 11 wherein the oil particles or oil droplets have a diameter of less than 100 μm .
13. A seafood according to any one of claims 10 to 12 wherein the oil particles or oil droplets have a diameter of less than 200 μm .
14. A seafood according to any one of claims 10 to 13 wherein the seafood is made according to the method of any one of claims 1 to 9.
15. A seafood according to any one of claims 10 to 14 including levels of EPA which are higher than the levels of DHA.
16. A seafood according to any one of claims 10 to 14 including levels of DHA which are higher than the levels of EPA.