Trends in the use of marine by products
The experience in France

VIGO September 10th, 2018

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PROCIDYS is a French consulting and research company in food processing with sound and recognized expertise in marine products projects: 50% in France and 50% abroad.

Area of Expertise:
- New product and concept development, New process development
- Improvement of existing process (efficiency, quality and yield)
- Identification of the most suitable technologies
- Engineering assistance: Selection of the Industrial equipment, and support to startup
- Process performance expertise, training to the new process
- Energy balance evaluation

Expertise in food processing:
- Enzymatic process, hydrolysis, bioconversion..
- Evaporation, concentration Membrane technologies (microfiltration, UF),
- Centrifugation, filtration
- Drying (spray dryer, fluidized bed dryer, discs dryer),
- Cooking, heat transfer
- Grinding, crushing, micronisation, sieving.
- Physical and chemical treatment
Fish by-products resources in EUROPE

- UK: 200,000T
- Norway: 600,000T
- France: 150,000T
- Spain: 250,000T
- Benelux: 100,000T

**TOTAL EUROPE**

1,500,000T

Source: IFFO 2016

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Fish by products resources in FRANCE

- Boulogne sur mer: 60000T
- Bretagne Nord: 20000T
- Lorient/Concarneau: 35000T
- Normandy: 15000T
- Sud Ouest: 15000T
- Mediterrannée: 5000T

TOTAL FRANCE: 150000T

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What are the different ways to valorize the fish by-products in France?

1/ Fishmeal and fish oil

2/ Fish protein Concentrate (fish hydrolysate)

3/ Fish Silage

4/ Direct use in petfood industry
What are the different ways to valorize the fish by-products in France?

5/ Fish mince or pulpe

6/ Fish aromatic extract

7/ Marine ingredients for nutraceutical, health food and food

8/ Marine ingredients for cosmetic
What are the different ways to valorize the fish by-products in France?

### Fish Raw material

- **Fishmeal**: 55000 Tons
- **Hydrolysate**: 36000 Tons
- **pulpe**: 16000 Tons
- **petfood**: 40000 Tons
- **food ingredient**: 3000 Tons

### finished product

- **Fishmeal**: 11000 Tons
- **Hydrolysate**: 6000 Tons
- **pulpe**: 10000 Tons
- **petfood**: 40000 Tons
- **food ingredient**: 300 Tons

**TOTAL**

- **Fish Raw material**: 150000 Tons
- **finished product**: 67300 Tons
What are the different ways to valorize the fish by-products in France?
1/ Fish meal and fish oil
French producers apply the usual fishmeal process

**Trends are** quality control and certification (BRC, HACCP, GMP+, ISO 22000) sustainable management of marine resources, traceability
1/ Fish meal and fish oil

- Very well known process (few new technical developments)
- Large demand for aquaculture
- Very good price for the last five years
- Best solution for a very large quantity of raw material
- In France standard quality: protein 65% and Fat 12%

**BUT**

- For French producers the regulation is clear but hard to comply with (Dioxin, PCP, heavy metals)
- Profitability and added value for fishmeal is better now but still low
- Investments for a plant are very high — Any new project
- The image in France is bad due to low added value, smell and industrial fisheries
1/ Fish meal and fish oil

➢ 2 mains producers of Fishmeal and fishoil in FRANCE:

➢ BIOCEVAL in Concarneau (SARIA Group)
   - Collect XXXXXX T of Raw material
   - Produces XXXXXXX Tons of fishmeal
   - and XXXXX Tons of fishoil
   - For animal feed
1/ Fish meal and fish oil

➢ 2 mains producers of Fishmeal and fishoil in FRANCE:

➢ COPALIS in Boulogne sur Mer

- Collect XXXXX T of Raw material
- Produce XXXX T of fishmeal
- and XXXX Tof fishoil
- For animal feed
2/ Fish Protein Hydrolysate (FPH)
2/ Fish Protein Hydrolysate (FPH)

French producers apply the usual hydrolysate process with different type of enzymes and specific know how of the hydrolysis.
2/ Fish Protein Hydrolysate (FPH)

- High quality products requiring high quality raw material
- In France standard quality: protein 75 to 85% and Fat 10%
- Profitability and added value for FPH are better than fishmeal
- New markets for FPH: aquaculture, petfood, piglets, fertilizers

**But**

- In vivo tests are required to show the efficiency of the hydrolysates and peptides (Peptides properties, stimulation of growth and health properties)
- Investments for a plant are very high
- The process and market are complex

**Trends are:**

- Quality control and certification (BRC, HACCP, GMP+, ISO 22000)
- Sustainable management of marine resources, traceability
- Better nutritional efficiency of the peptides
- Large range of peptides and hydrolysates adapted to each market
- Improvement of the process (hydrolysis, energy, waste treatment...)

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New developments for fish functional hydrolysates:
For aquaculture

- Many in vitro and in vivo tests have been developed to show these functional properties:
  - Improve Survival rate
  - Decreasing of Malformation
  - Average weight gain, conversion rate (FCR) and specific growth rate
  - Improvement of digestibility and reduction of pollution
  - Natural source of anti-microbial peptides and immune response
  - Palatability
New developments for fish functional hydrolysates: For petfood

- Many in vitro and in vivo tests have been developed to show these functional properties:
  - **Coating**
  - Increase the *palatability* of feedstuff.
  - Improve the protein efficiency ratio (PER)
  - Indirect effects on *stress*
  - *Immuno stimulating* and *Hyppoallergenic* effect
3 mains producers of Fish Hydrolysate in France:

- **COPALIS** in Boulogne sur Mer (North of France)
  - Produce XXXX Tons of fish hydrolysate
  - and XXXXX T tons of fish oil
  - For animal feed

- **AQUATIV** in Vannes (Brittany)
  - Produce XXXX Tons of marine hydrolysate in the world
  - For animal feed (aquaculture and petfood)

- **NUTRIFISH** in Cherbourg in Vannes (Normandy)
  - Produce XXXXX Tons of marine hydrolysate
  - For animal feed (petfood)
  - For Food
3/ Fish Silage

- Local application for animal feeds and fertilizers
- Good solution for small amount of fish raw material
- Solution for the treatment of viscera and by-product on board
- Very simple process: natural hydrolysis at acid pH

Few projects in France
Some projects in the French Islands

Trends are: application as fertilizers
4/ Direct use in petfood industry

- Very easy solution
- Good price

25% of the fish raw material is used in petfood in FRANCE

**Trends** are quality control and certification (BRC, HACCP, GMP+, ISO 22000) sustainable management of marine resources, traceability Marketing in relation with fish species: salmon, tuna, sardine
Fish by products: Human Food and others applications for human

- **Human Food and nutraceuticals**
  - Fish mince/pulpe, surimi
  - Marine aromatic extracts
  - Marine Ingrédients for health food and food supplements
  - Fish oils rich in omega 3

- **Cosmetics**
  - Topic Texturants
  - Actives Ingrédients
Several filleting and fish processing plant in France produce fish pulp for:

- food
- petfood
- Surimi

10 to 15 000 tons of fish pulp are produced in France per year

Mainly from:

- Salmon, Cod and saithe, other white fish, Tuna

Main producers in FRANCE:

- Atlantic petfood, Activ International, Nutrifish, Valofish, Seanov, Comapeche (Surimi), Seacreative, Marine Harvest
The suppliers have improved the performance of the separators.
New development

To produce Surimi base with fish waste

Fish raw material
Grinding

Mince production
with separator

Washing of the pulp

Refining
mixing

Deodorization

Decantation
Centrifuge

Cold extrusion

Surimi Base

Bones and skin

Water

wastes

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some companies in FRANCE produce fish and marine aromatic extracts

- By gentle enzymatic hydrolysis
- By fish drying in food conditions
- By cooking

Trends
- Necessity to have a range of several products
- The better raw material is crustaceous rather than fish.
- The demand of the market is growing slowly: sauce, soup, terrine…
- Reproducibility and quality
- Certification and naturality
Main producers and suppliers of fish aromatic extract in FRANCE

- Mane Group
- Diana Natural Symrise
- Copalis
- Setalg
- Centraliaa
- Activ International
- Nutrifish
- Colin Ingredients
- Nactis Flavours
- Abyss ingredients
7/ Marine ingredients for nutraceutical, health food and food

- Skin
- Gelatin
- Collagen
- Hydrolysed Collagen
- Elastin
- Flesh
- Proteins
- Peptids
- Oils
- Gut and soft Roe
- Peptids
- Oils
- DNA
- Enzymes
- Cartilage, Bones
- Glycosaminoglycans
- Minerals

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7/ Marine ingredients for nutraceutical, health food and food

- **BONES STRENGTHENING**
  - Mineral extracts, marine cartilage powder, shark cartilage powder

- **JOINTS**
  - Chondroitine sulfate, glucosamine
  - Soluble cartilage extracts
  - Hydrolysed collagen

- **CARDIOVASCULAR**
  - Peptides, fish oils

- **RELAXATION**
  - Peptides, fish oils

- **WEIGHT CONTROL**
  - Peptide with low GI, fish oils

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7/ Marine ingredients for nutraceutic, health food and food

- Benefit of the marine source:
  - The nutritional benefit of seafood products is recognised
  - Excellent source of easily digestible proteins

- Profitability and added value can be good but the possible turnover per product is low.

- The market is growing for health food extracted from fish.

- Good image (natural product) but animal origin and risk of fish smell.
7/ Marine ingredients for nutraceutic, health food and food

But

➢ Necessity to have a range of several products

➢ High cost of R and D to develop the product and to prove the nutritional efficiency (clinical study).

➢ The regulation is very strict: EFSA and AFSA are very strict to accept the claims of health ingredients

➢ The Yield (final product/Raw material) are very low (10 to 50% of the dry matter of the fish can be extracted as marine ingredient).

➢ The extraction process is complex and requires many equipment.

➢ The process provides a lot of residue or by products and pollution
Many marine ingredients are produced in France and included in finished products.
7/ Marine ingredients for nutraceutical, health food and food

- Fish skin

**PROCESS**
- Pre treatment
- Extraction
- Enzymatic treatment
- Purification
- Deodorization
- Spray drying

**Native collagen, Gelatine, Hydrolysed collagen**

- Benefits Your Joints
- Skin, Hair, Nails and Tissue Growth
7/ Marine ingredients for nutraceutical, health food and food

- **Gelatine, Hydrolysed collagen**

  - **Rousselot**: They have developed PEPTAN, marine hydrolyzed collagen for the pharmaceutical, food, dietary supplements and cosmetic markets.

  - **Weishardt**: Weishardt Group, 4th largest producer of gelatin in the world, offers a large range of fish gelatine for pharmaceutical, edible or technical applications.

  Naticol® is therefore a hydrolysed collagen

- **Copalis, Nuwen, Abyss**
7/ Marine ingredients for nutraceutical, health food and food

Mucopolysaccharids (chondroitin sulfate) can be extracted from fish cartilage (skate, shark) for joint health and arthrosis.

Marine cartilage: Some producers in France

- COPALIS ([www.copalis.com](http://www.copalis.com))
- ABYSS Ingredients

Many users for joint and bone health formulation
7/ Marine ingredients for nutraceutical, health food and food

*In vitro* screening tests of bioactive properties of fish peptides

- SECRETAGOGUES
  - Gastrin and CCK-like peptides

- ANTI-CANCER

- ANTIBACTERIAL

- CALCITROPEIC
  - Calcitonin-like peptides

- ANTI - ACE (hypotensive)

- ANTIOXIDANT

- OBESITY, DIABETES, CARIES, MIGRAINE (CGRP-like peptides), OTHERS ....
Marine ingredients for animal

➢ **Immunostimulation**
Pet-Food (dog, cat, fish, …)
Feed, Aquaculture (including invertebrates) – antibiotics substitution by immunostimulants hydrolysates riches en PAM

➢ **Tissue repair**
Pet-food: Pet food: positive effect on osteoarthritis gelatin hydrolyzate for dog

➢ **Trophicity/ intestinal well being**
Importance of free AA and peptides: important implications for nutrient absorption (Walrand et Cynober, 2001)

➢ **Anti-stress activity**
Fish peptide: Procalm®: dog, cat, horse,
7/ Marine ingredients for nutraceutical, health food and food

**FISH Peptides**: several producers in France

- **COPALIS** Procalm, Protizen, Nutripeptin, Protimune
- **DIELEN** Molval
- **Abyss Ingredients**
- **Laboratoire Le Stum**
- **Nutrifish**
- **Comapeche** Slimpro to improve digestion
- **Aquativ Diana**: antioxydant, palatibility
- **Rousselot** Peptan
- **Grand Ocean**, Biothalassol, Yalacta, Valorimer, Yslab, Pierre Fabre
7/ Marine ingredients for nutraceutical, health food and food

- Peptide for weight loss
- Djform Peptistress
- Anti stress peptide
- Fish peptides
- For joint and bone health
- Combats oxydative stress

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Fish proteins and fish peptides

Functional properties of fish proteins and fish peptides

- Foaming
- Gelation
- Solubility
- Water holding
- Emulsification
Alkylglycerols are activators of the immune system. They stimulate and modulate the production of white blood cells and red blood cells as well as platelets.

**Omega 3:**
Memory stimulation
NEUROTONE MAX is a nutritional supplement based omega 3, ginseng, zinc, vitamins B and C.

**Fish oil**

**Alkylglycerols** are activators of the immune system. They stimulate and modulate the production of white blood cells and red blood cells as well as platelets.

stimulation of immunity
anti bacterial, anti fungal and anti viral effects
FISH OIL: Some french companies are leader

- **POLARIS** ([www.polaris.fr](http://www.polaris.fr))
  POLARIS offers a range of marine oil rich in Omega 3s: Salmon oil, Nordic Shrimp oil, shark liver oil, cod liver oil, tuna oil

- **OLVEA fish oil for Winterisation Europe** ([www.olvea.com](http://www.olvea.com))
  They process (refining and winterisation) and commercialise fish oils for:
  - Human consumption, Pharmaceutical industry, Petfood, Animal feed, Technical use

- **Daudruy van Cauwenberghe at Dunkerque** ([www.daudruy.fr](http://www.daudruy.fr))
  They are one of main suppliers of fish oil in Europe for fish oil.

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FISH OIL: Some French companies are leader

➢ SEANOVA: Fish oil for feed and food, EPAX, encapsulation
➢ COPALIS: Fish oil for feed and food
➢ BIOCEVAL Saria: Fish oil for feed
➢ SOPHIM: Producer of squalene extracted from shark liver oil
➢ Nutrifish: Fish oil (salmon and others) for feed and food
➢ Phosphotech: Fish oil for feed and food
8/ Marine ingredients for cosmetics

➢ Moisturizing actives:
  - Marine Native Collagen
  - Marine Hydrolysed Collagen

➢ Anti-ageing, anti-wrinkles:
  - Marine Elastin
  - Chondroitine sulfate

➢ Cells restructurating:
  - Marine Peptide
  - Muccopolysacharides extract
  - cartilage extract

➢ Firmness and Elasticity
  - Marine Peptide
  - Collagen Gel

➢ Hair and Nails:
  - Hydrolysed Marine Keratine
8/ Marine ingredients for cosmetics

Some french producers of marine ingredients for cosmetics

- **JAVENECH**: specialist in DNA, collagen, Protamine (extracted from fish roe)
- **COPALIS** Marine Peptide, elastin, Native collagen, Muccopolysacharids extracts
- **EPHYLA**: chitosan
- **SOPHIM** squalene
- **SETALG** minerals

Some cosmetic companies use these marine ingredients: Thalgo, Daniel Jouvance, laboratoire Ponroy, Biothalassol, Science et mer, Goemar
Thank you for your attention!

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