EUfishmeal input to the BREF SA TWG

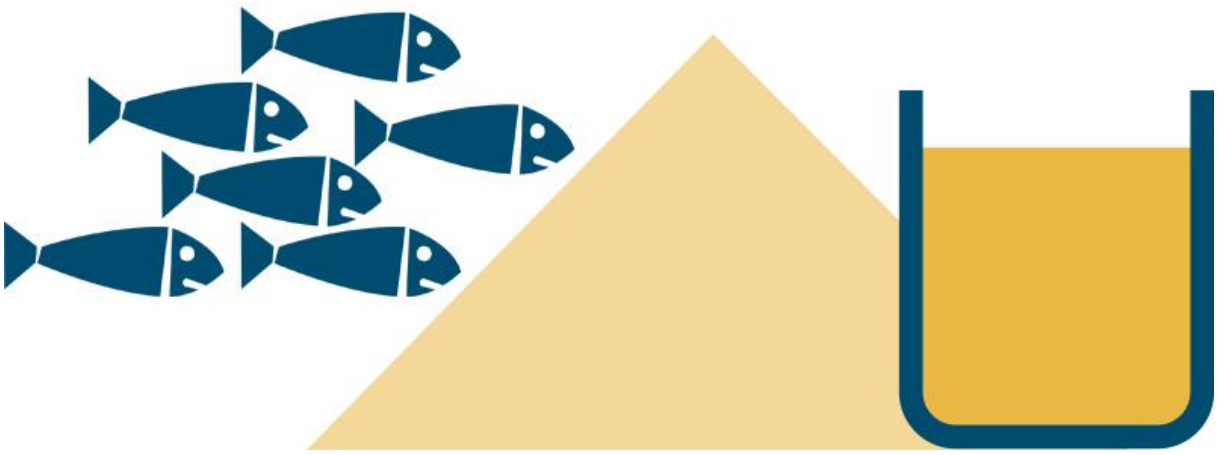


Table of contents

This report is prepared by the EUfishmeal Technical Working Group on the revision of the IED directive and the BREF-document on Slaughterhouses and animal by-products (SA BREF), on behalf of EUfishmeal.

The report consists of input from the national subgroups in Denmark, UK, Ireland, Iceland, Norway and Germany.

The report serves the purpose of giving the TWG in Seville a detailed view of the fishmeal and fish oil production processes in Europe as well as the environmental impact of the production, in order to address challenges and opportunities in revision of the SA BREF.

1 Introduction

EUfishmeal represents the European fishmeal (FM) and fish oil (FO) producers in Denmark, the Faroe Islands, Germany, Iceland, Ireland, Norway, Spain, France and United Kingdom. Based on a sustainable utilization of natural resources we provide the input for a growing global aquaculture sector and help feed the world healthy protein-rich fish products.

In the future, as the industry develops, it intends to produce also for direct human consumption and is currently working on approval to achieve this objective. The products also have the potential to reduce greenhouse gases from agriculture through its inherent digestible protein properties and feed conversion efficiency ratios, as the carbon footprint of fish is significantly lower than the land-based food industry.

With members from all major FM and FO producing countries of the European continent, EUfishmeal represent:

- +600,000 tons of produce
- An export value of +1000 million €/year
- An intake of 2 million tons of raw material (fish and trimmings)
- +3000 direct jobs in coastal areas
- Numerous jobs in the fishing sector and ancillary support sector
- Is an essential element of the primary and secondary human consumption fish processing industries

On a global level in 2017, Europe is producing 16% of the world´s fishmeal and 23% of the world´s fish oil.

Fishmeal and fish oil are fish-based marine proteins and oils provide a balanced amount of all essential amino acids, minerals, phospholipids and omega-3 fatty acids (DHA and EPA).
The production of FM and FO is based on fresh landings of small, oily, short-lived fish species such as Blue Whiting, Capelin, Sand Eel, Norway Pout and Sprat which are subject to international quotas. Furthermore, a significant amount of the raw material is by-products (trimmings) from the human consumption fish processing industry. For example, the filleting industry only utilizes between 40 % - 60 % of a herring or a mackerel and the remaining part of the raw material is, to the extent that's possible, transported to FM and FO factories and thereby a full utilization of the natural resources is secured. Several of the FM and FO factories in Europe are producing only from trimmings, while the rest are producing both from fresh landings and trimmings. It is important to note that the industry provides a vital environmentally efficient and regulated treatment solution for a by-product of the fish processing industry that otherwise would be a waste product that would be difficult and expensive to treat and dispose of.

The raw materials used in the production of FM and FO go through a process, that consist of boiling, separation, evaporation, drying, cooling and grinding. The conditions and production processes of FM and FO differ fundamentally from both the rest of the fish processing industry and the production processes in slaughterhouses and other animal by-product installations. FM and FO production are a much more complicated process than e.g. the filleting industry. Therefore, the environmental conditions and the

technologies used are different from those other industries included in the *Reference document on Best Available Techniques in the Slaughterhouses and Animal By-products Industries*.

In the following sections, we will go through each step of the FM and FO production focusing on the environmental impact in each step. The descriptions of the production processes will not only be on a general level, as we will also seek to provide information on how the FM and FO production differs throughout Europe and how this affects the environmental performance across the industry.

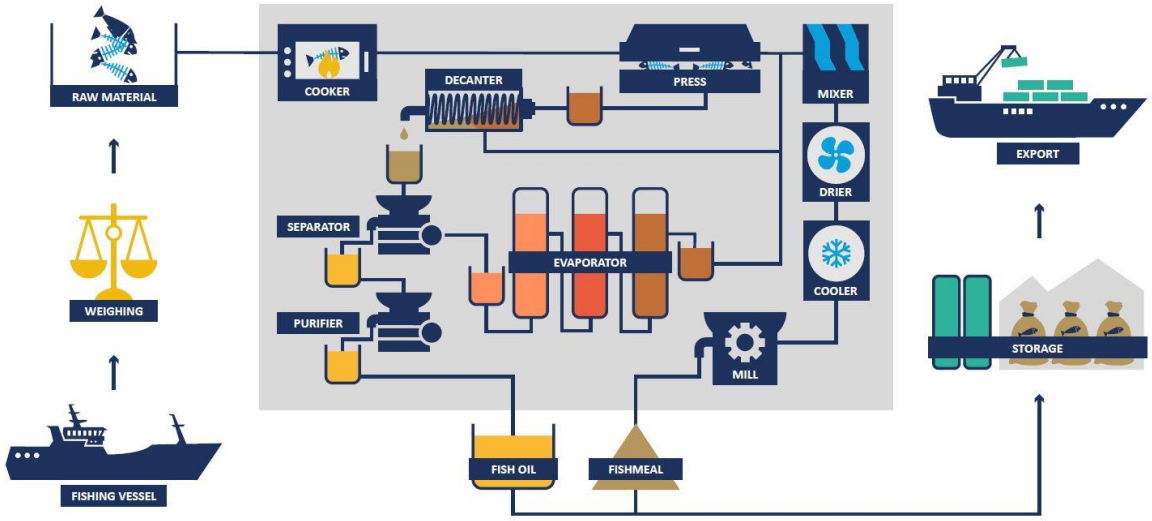
After going through the production process, this report will give an insight in the industry's emission conditions and finally, the report includes the EUfishmeal recommendations to the BREF SA revision process.

- There are 29 factories in Europe where >90 % operate the whole year
- 15 have one production line only.
- All factories in Europe receive trimmings
- 8 factories have trimmings as their main supply (> 50%)
- 4 of those are running on trimmings only.
- 10 factories get the raw material delivered from both fishing vessels and trucks and 9 from vessels only.

NC Consult (2017)

2 General process and production description

The raw material is basically composed of three major fractions: solids (fat-free dry matter), oil and water. During the production process, these three fractions are separated from each other. The processing of the raw material into meal and oil takes place in fully automatic closed systems from beginning to final product(s).



2.1 Raw material and intake

The raw materials delivered to FM and FO factories are composed of direct landings from fishing vessels, trimmings/by-product from fish processing industry and trimmings/by-product from the aquaculture industry. To optimize the quality of the final product, most of the fish supplied directly from fishing vessels is maintained in a chilled condition from the time it is caught until it is offloaded from the vessel. The parameter used to measure the freshness of the raw material is total volatile nitrogen (TVN). TVN is used as a quality parameter and process control and used in the contract with the supplier, as it relates to the quality of the end-product. Hence there is an industry driven financial incentive to keep TVN-levels low as possible.

A feature of the trimmings/by-product raw material is the remoteness of locations from which the material originates, which can make maintaining the quality of the raw material difficult as it is delivered to the plant in smaller consignments.

Raw material intake differs a little all over Europe as it depends on how the raw material arrives. It can be both by screw conveyers, lamella pumps, tipped from containers, bins, skips, bulkers or trucks or by pumping with water directly from the vessels. Common for all factories is, that raw material is unloaded into enclosed hoppers or tanks.

2.2 Cooking

After the raw material is unloaded and stored in a buffer silo, the raw material is fed into a cooker. The raw material is heated to 90-95 ^{o}C, which sterilizes the fish, coagulates the proteins and disrupts the cell membranes, to facilitate the separation of the soluble and the oil from the dry matter. The cooking temperature is controlled automatically to ensure correct cooking. This is done according to the veterinary approval.

2.3 Press & Decanting

The cooked raw material is fed to either a screw press, a 2 phase or 3 phase decanter, where much of the liquid is squeezed out to produce a liquid phase, a solid phase, and if there is a 3 phase decanter, there is an oil phase.
Strainers are used before pressing to make optimal working conditions for the presses.. Efficient pressing gives low fat levels in the product. It is best practise within the industry that vapours from the pressing process are extracted for odour treatment.

2.4 Separator

The press water is separated further in a decanter. The press water contains most of the oil from the fish and dissolved proteins, salts and fine particles. The liquid from the decanter is sent to separators, where the oil is removed and subsequently stored for export.

A Two-step separation is used for fish oil extraction. 1) Extraction of oil from soluble fraction by means of separator; 2) polishing of extracted fish oil by means of second separator. All solids separated by this process are recovered.

2.5 Evaporator

The liquid that remains after the removal of the oil, is the stickwater. This is fed to evaporators, where it is concentrated before being blended with the presscake during the drying stage. The stickwater contains both dissolved and undissolved proteins, residual oil, minerals, and vitamins. To concentrate the stickwater and achieve a high concentration of dry matter, large quantities of water are removed by evaporation, which requires energy and the resultant condensate has to be discharged.

The industry currently uses various devices for evaporation and having an evaporator significantly reduces the environmental impacts of waste water to the receiving environment.

2.6 Dryer

The purpose of the drying process is to convert the wet mixture of presscake, decanter sludge and concentrated stickwater into a dry fish meal. In practice, this means drying to a moisture content below 12%, which generally may be considered low enough to inhibit microbial activity. This drying is done by heating the material to a temperature where the rate of evaporation of the water is considered satisfactory in order to avoid reduction of quality, especially of the protein.

The table below shows the diversity of the typical drying processes used throughout the industry:

Country	No of Factories	Indirect steam drying	Vacuum drying	Hot air drying	Spray drying
Denmark	3	3	1	1	
France	2	1			
Germany	1	1			
Iceland	11	3	1	7	
Ireland	1	1			
Norway	6	6	1	4	
Spain	1	1			
United Kingdom	3	3			
Faroes Islands	1	1		1	

As seen in the table, some factories may use more than one drying process. Good practise applied to the drying process involve sealing of equipment to avoid uncontrolled excess air ingress, control/removal of vapour steam and maintaining equipment under vacuum.

2.6.1 Cooling

After drying the fishmeal is cooled. The fishmeal is cooled by air. Air for cooling is treated to reduce odour.

2.7 Grinder/Milling

The fishmeal is ground to a specific particle size using hammer mills. After the milling, the meal is stored for export either as meal or pelletized.
Air from the grinding/milling are treated to reduce odour.

2.8 Oil purification

To comply with undesirable substances, the oil producing factories may pass the oil through a carbon-filter press.

2.9 Scrubbing tower

The scrubbing tower collects air and surplus vapour from the dryers and the heat exchanger and air suction vapour from the processing plant.

3 Emission conditions

The fishmeal industry itself provides an essential overall integrated emission level reduction for the fish processing industry. There are however discharges from the fishmeal process itself which require monitoring and control according to the various receiving environments.
The FM and FO industry is specialized. Several factors can influence pollution impacts from the industry including the type of raw material being processed, factory design and the recipient environment.
The 29 FM and FO factories in Europe are designed in different ways, and even though the production processes described above can seem similar, many technical differences exist among the factories and therefore rigid and inflexible emission levels is likely to result in significant commercial disadvantage for the producers of FM and FO in Europe.

Below we will go through some of the most important emission conditions, that arise from the production of FM and FO.

3.1 Emission to air from Combustion Sources

During 2016, EUfishmeal conducted an internal benchmark report between the European FM and FO factories. Included in this benchmark was also an examination of national regulation on emission levels. On emissions to air, the report showed differences in regulation between countries and even differences between the regulation within countries. The reason for this is because of the fuel used for combustion diversity and modelling of the receiving environments involved.

The table below shows the fuel types in use throughout the industry:

Country	No of Factories	Oil	Gas	Electricity	LPG	Coal	External power
Denmark	3		3			1	
France	2						2
Germany	1		1				
Iceland	11	6		5			
Ireland	1	1					
Norway	6	4	3		1		
Spain	1	1					
UK	3	1	2				
Faroese Islands	1	1					

The FM and FO factories are powered in different ways throughout Europe and many can use energy from more than one source (not showed for all factories).

Outlets to air come from odour abatement and from boilers for steam production. In some countries the use of natural gas as an alternative fuel supply is not an option as there is no natural gas supply available. Where fuel is used it is normally low sulphur (<1%) fuel oil. Electricity generation in Iceland is advantageous partly due to the unique geothermal environment of Iceland.

3.2 Emission to water

FM and FO factories generate waste water from several processes utilized in the production process which together with the water content extracted from the raw material and sea water used in scrubbing and cooling produces the total waste water discharge.

Fresh water is used in the boiling process, in the separators and to clean machinery and tanks through the cleaning-in-place (CIP) method. However, a number of factories use condensates as rinsing water for CIP. Sea water is used for cooling of waste water from the evaporators and other installations which require cooling. Sea water is by far the biggest part of water consumption. However local conditions mean that a few factories do not have access to seawater.

Every factory is working with minimizing the consumption of water, which is recommended in the BREF SA (BAT-conclusion 5.1.4.1). Furthermore, many actions have already been taken on treatment of waste water, including prevention of water stagnation (BAT-conclusion 5.1.5.1), screening of solids (BAT-conclusion 5.1.5.2), removal of fat from waste water (BAT-conclusion 5.1.5.3) and regular conduct of laboratory analysis of the effluent composition (BAT-conclusion 5.1.5.13).

In some factories sea water is used for cooling, scrubbing and condensing to liquid within the fishmeal production process and is also generally used directly for cooling excess air from meal cooling.

Biological or further treatment is not currently applied on site by any European factories due to its own unsuitability.

As the outlet from FM and FO production to sea is mainly nutrients the impact on the environment depends very much on local recipient conditions. The EU regulation on surrounding waters should be considered when deciding on emission levels set for individual factories and optimally the receiving environment should be modelled to determine assimilative capacity on a case by case examination.

Irrespectively of available treatment facilities all receiving environments are regulated by the EU and local standards and regulation.

3.3 Odour

Malodorous air is produced during the various stages of the production process. Odour from FM and FO factories can create significant levels of complaint from affected individuals and regulators hence odour minimisation is an essential requirement within the industry. Today, it is a BAT-conclusion (5.1.1.21) to

audit odour. It is also a BAT-conclusion (5.3.3.3) to incinerate malodours air with heat recovery. Both conclusions are broadly complied with already.

The industry uses a wide range of odour emissions minimisation techniques, which includes the use scrubbing and filtration systems. Management of factory air that comes in contact with the product at the various stages of the production process contributes an effective methodology in controlling odours.

3.4 Noise

Noise limits are not given as emission levels from the factory but as emission levels at noise sensitive locations, so performance is hard to compare among factories. Noise regulation is laid out in national or local legislation and is included in permits and licences issued by Regulatory Authorities.

4 Overlapping with other BREFs

The LCP and MCP BREF (Large and Medium Combustion Plants) have already been revised and does unfortunately contain possible overlaps with the SA BREF for FM and FO factories (depending on MW-output) regarding the following:

- BAT 1 on environmental management systems
- BAT 3 on monitoring emissions to air and water, especially O_2 values
- BAT 5 on controlling fuels

EUfishmeal recommends avoiding overlapping by including all relevant BATs from other BREFs to the FM and FO section in the SA BREF, and thus by way of derogation to the conclusions from the LCP, MCP and FDM BREF.

5 New techniques

It is essential, that the SA BREF revision doesn't block for new emerging techniques and processing-developments that could be better and/or more affordable. It could for example be new cleaning techniques for waste water or odour.

6 EUfishmeal recommendations

EUfishmeal has a number of clear recommendations for the revision of the BREF SA.

EUfishmeal recommends, that FM and FO should have its own and separate section in the BREF-document. It will be beneficial to separate the FM and FO sector from slaughterhouses and other by-product industries such as meat and bone meal production. This will also help prevent the FM and FO industry from being covered by irrelevant BAT-conclusions suitable for other industries, but which may not have been fully considered as to the appropriateness, feasibility or if technically possible for the fishmeal industry.

EUfishmeal recommends, that all BAT-conclusions, requirements, and recommendations relevant for the production of FM and FO will apply to the manufacturing of all marine proteins and oils and to both land- and sea-based production units.

EUfishmeal recommends that the BREF should only include the most significant environmental parameters in the different subsectors. This will help to ensure a greater focus on the parameters that have the biggest influence on the environmental protection. Furthermore, it will ensure a more targeted and accurate BREF, which may also be expected to facilitate proceedings for both companies and authorities. Additionally, the industry is characterized by a varying production during the year and from year to year. Hence EUfishmeal recommends that the BAT AELs should be listed in intervals or production-size specific which reflect the diversity of the companies and as well as the production and allow the companies to be flexible and innovative.

EUfishmeal recommends, that BAT-AEL's should not contradict with local regulation. Even though the production process is broadly similar across the EU, each factory has individually designed production processes which makes each factory unique. Therefore, the BREF SA-revision needs to consider that the technologies used must be adapted to local conditions and that one or more units of process equipment cannot always simply be substituted with other standard equipment.

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