How to test good the fish oil any time, in factory

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Testing and analyzing is one of the fundamental aspects of any industry involving food resources or beverages. The analyses can be performed at different stages and work for the best as possible yield and quality of the final product. Sometimes it is right the final product that need to be analyzed and checked. The following article is about efficient analysis of fish oil.

Fish oil: the first matter

Fish oil has been produced since 19th century for leather tanning, for the production of soap, glycerol and other non-food products, lately for the production of fish oil supplements as well. Other uses can be human food such as in margarine and shortenings or for medical and industrial purposes. Fish oil is rich in healthy free fatty acids and new findings has led to an increased usage of fish oil as a food supplement and to a develop of this market.

The industry of fish oil and fish meal uses the so-called industrial fish as first matter. It is all the fish that is not used for the fresh market because it cannot be used for direct human consumption. Infact it is too small or break down or turn rancid too quickly for economic storage and subsequent heading, gutting, cleaning and processing. This kind of fish, small and oily, are the main part of the catch.

Here below are some examples of industrial fish:

- Gadoids (the cod-like fishes)
- Clupeids (the herrings)
- Scombroids (the mackerels)
- Elasmobranchs (the sharks and the rays)
- Salmonoids (the salmons and other related fish)
- Crustaceans (small crustaceans, the carapaces and shells)

A wide variety of fish species is so used for the production of fish oil and meal in different countries. Fish meal is the product used for animal feeding.

The production of fish oil and meal

The same production flow produces both fish oil and fish meal. The two products are different but strictly connected. To understand it, it is necessary to consider that the components of the industrial fish are: a solid part (fat-free dry matter), oil and water. The table shows the composition of the material at each stage of its flow through the process and is based on the assumption that the raw fish contain 70 % water, 18 % solids and 12 % fat. The composition of the intermediate products in this example is as follows:

	WATER	SOLID	FAT
MATERIAL	%	%	%
Raw fish	70	18	12
Press Cake	53	443	
Press liquor	78	6	16
Dilute stickwater	95	5	<1
Conc. stickwater	65	33	2
Fish meal	9	85	6

Fish oil and fish meal process is focused on separating these three fractions from each other. Reducing fish to oil and meal can be done in a number of ways, but some processing steps are common to all possible methods. You cannot prescind from:

Heating, which coagulates the protein, ruptures the fat depots and liberates oil and physic-chemically bound water;

Pressing / Centrifugation, which removes a large fraction of the liquids from the mass;

Separation of the liquid into oil and water (stickwater);

Evaporation of the water into a concentrate (fish solubles);

Drying of the solid material plus added solubles, which removes sufficient water from the wet material to form a stable meal;

Grinding the dried material to the desired particle size.

Fish oil production

We underline here some important aspects in reducing fish to oil.

High temperature. It is an important prerequisite for efficient separation of the three components. The best performance of the plant would be obtained at the highest possible temperature which, at atmospheric pressure, would be l00 °C. Some experiments, however, have shown that the walls of the fat cells are broken down before the temperature reaches 50 °C. The oil is then free, and theoretically it should be possible to separate it from the solid material.

Separation of the fat component. The press and the pre-strainer transform the fish in a liquor consisting of water and varying amounts of oil and dry matter. The oil content is related to the proportion of oil in the fish. The separation of the three fractions of the press liquor, sludge, oil and water, is based on their different specific gravities. If press liquor is left for some time in a tank, it will settle out in three layers: sludge at the bottom, water in between and oil at the top. Plants adopts centrifugation for this operation that can be accomplished so in seconds and in efficient way.

Oil polishing. Once the oil is extracted it needs a final refining that is made in special separators. This step is done at the factory before the oil is pumped into storage. Polishing is facilitated by using hot water, which extracts impurities from the oil and thus ensures stability during storage.

Storage. Fish oil produced needs to be stored for sale and some precautions are taken for what it may concerns residual water, temperature, contamination by sludge and water. It is crucial at this moment the analytical phase, the mainstay for the quality control and shelf life of the oil. The varieties of fish from which the oil is extracted influence times and temperature of preservation. That is chemical analysis can help to know the acceptability tolerance for the fish oil stored and to choose which temperature assure its best and longer preservation. For example shad oils have a high oxidative deterioration while garfish oil shows a greater stability against oxidation. These differences can be checked thanks to a quick and reliable analytical system.

Fish oil parameters and methods

Since the beginning of the fish oil production process the oxidation parameter must be kept under control. Systematic sampling and analysis are normal and provide important information to make the best choices during the whole process.

The analysis that can help the fish oil industry to manage a high performance quality check are:

Peroxide value. To establish primary oxidation product levels. These compounds, with others resulting from further decomposition, are responsible for the rancid flavours that develop.

p-Anisidine value. To establish secondary oxidation product levels, for the same reasons of PV. Nevertheless the AV is more indicative of quality state.

Free Fatty Acids. Is still the most reliable parameter for oil quality and yield assessment.

A number of chemical, physical and sensory methods have been developed for the assessment of quality. The analytical work is made difficult by some aspects:

- The nature of the unsaturated fatty acids;
- The need to store at low temperatures in an inert atmosphere the oil before analysis;
- The tendency of the saturated oil fractions to precipitate during cold season in large storage vessels, then the need to mix the oil before sampling.

Moreover the test methods employed by the user of fish oil for hardening purposes are often divided into two groups, the first being applied on receipt of a consignment to check the fundamental parameters and the second, more detailed, examination as soon as possible thereafter, but in any case before the oil is used in the refinery. The

purpose of this second examination is to determine refining procedures.

Fish oil industry cannot prescind from the information a good and rapid analysis can provide: it assures a quality standard production and product optimization. Performing these analyses in the plants with the reference methods can be very problematic since they need an equipped chemical laboratory, skilled staff and a long and delicate procedure that requires time, specific facilities and human resources.

Fish oil analysis with CDR FoodLab® inside the plant

What can test the fish oil in a quick and reliable way without involving a chemical laboratory, inside or outside the factory?

CDR FoodLab® system can analyze Peroxide value, p-Anisidine value, Free Fatty Acids and soaps on fish oil in a rapid and straight forward way. Thanks to the optimized methods and to the technology applied to a colorimetric principle, the analysis can be performed in few minutes and the results are immediately disposable, facilitating a proper conservation of the oil and the decision making inside the plant about the different batches.

Here is a short list of the CDR FoodLab® system advantages:

- Analyses are very quick and rely on an analysis method that is reference method compliant
- Analysis can be performed any time inside the plant, in great quantities
- CDR FoodLab® consent time saving and drastic cutback of analysis costs
- The simplicity and rapidity of the analysis method allow everyone to perform the tests with the analyzer
- CDR FoodLab® uses prefilled cuvettes and reagents that does not require an equipped chemical laboratory

References:

- FAO, Fishery Industry Division, “The production of fish meal and oil” FAO Fish. Tech. Pap. (142) Rev. 1: 63p
- CDR FoodLab® analysis system for fats and oils