

OMEGA-3 OIL



SINCE 1938

Most types of omega-3 fish oils from LYSI are categorised as food supplements. However, the company also offers fish oils to customers as APIs (active pharmaceutical ingredients). Pharmaceutical companies use APIs as the key ingredients in the manufacturing of medicines. LYSI API oils and relevant documents fulfil all requirements made by national regulatory bodies for the registration of medicines.

Omega-3 fish oil is a complex mixture of triacylglycerols (also called triglycerides), which is characterised with an exceptionally high level

of EPA and DHA, or with the approximate ratio 18/12. Omega-3 fish oil is commonly called 18/12 fish oil. It is a natural triglyceride oil, containing the highest level of the omega-3 fatty acids.

Omega-3 fish oil is extracted by physical means from fresh fish of the families *Engraulidae*, *Carangidae*, *Clupeidae*, *Osmeridae*, *Scombridae* and *Ammodytidae*. The principal species are Peruvian anchoveta (*Engraulis ringens*), European pilchard (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*).



LYSI imports crude oil from producers in Peru, Chile and Morocco for processing in the company's refinery in Reykjavik, Iceland. The oil from Peru and Chile is derived from fish caught in the Southeast Pacific Ocean (FAO fishing area 87), whereas the Moroccan oil is extracted from fish caught in the Eastern Central Atlantic Ocean (FAO fishing area 34).

The fishing stocks are under strict government control to ensure sustainability. All producers are certified under the Marine Trust programme and certified sustainable by Friend of the Sea (FOS).

LYSI is a major producer of omega-3 fish oil, exporting its fully refined fish oils to over 70 countries worldwide.



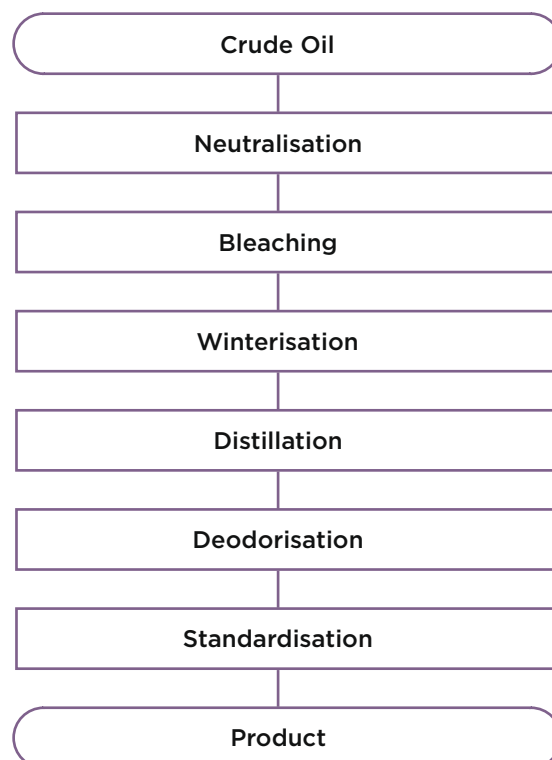
The Refining Process

Crude omega-3 fish oil is not suited for direct consumption and must be refined before use. The refining process removes unwanted components such as free fatty acids, pigments, contaminants and various other substances that can impart fishy flavour or off-flavour to the oil.

The refining process of omega-3 fish oil is comprised of 5 or 6 steps, as outlined below. Distillation (short-path) is not always called for.

It is imperative that the products we consume are clean and that they meet the most stringent international demands issued by health authorities. This is secured through elaborate and comprehensive production processes in the LYSI refinery. The equipment used for refining is custom-made, built on the extensive knowledge of fish oil refining obtained over the last 85 years. The key processes have been validated and approved.

The company is **FSSC 22000** and **GMP** certified. FSSC 22000 is a food safety scheme that is fully recognised by the Global Food Safety Initiative (GFSI) and GMP is a pharmaceutical standard.



Technical Aspects

The composition of omega-3 fish oil is defined in the European Pharmacopoeia and the USP.

Omega-3 fish oil from LYSI meets both pharmacopoeias. Vitamins, flavourings and antioxidants can be added in accordance with the needs of the individual customer.

Every batch of omega-3 fish oil produced at LYSI is analysed per specification. The batch is released by QC only when it meets the specification. A certificate of analysis is issued for every batch.

Our standard specification for omega-3 fish oil is shown in the table below.

Parameters	Specification
EPA (area %)	min. 18,0
EPA (mg/g as FFA)	min. 150
EPA (mg/g as TG)	min. 160
DHA (area %)	min. 12,0
DHA (mg/g as FFA)	min. 100
DHA (mg/g as TG)	min. 105
Total omega-3 fatty acids (area %)	min. 35
Total omega-3 fatty acids (mg/g as FFA)	min. 320
Total omega-3 fatty acids (mg/g as TG)	min. 330
Free fatty acids (%)	max. 0,25
Acid value (mg KOH/g)	max. 0,5
Unsaponifiable matter (%)	max. 1,5
Cold test; remains clear at 0°C (hours)	min. 3
Peroxide value (meq. O ₂ /kg)	max. 3,0
Anisidine value	max. 20,0
Oligomers (%)	max. 1,5



Properties of Omega-3 Fish Oil

As the name implies, omega-3 fish oil is an excellent source of the omega-3 fatty acids EPA and DHA. It is natural fish oil that has not been subjected to any chemical alterations, only refining. The oil may be taken orally as a liquid or in capsule form.

EPA and DHA acids are often considered essential due to their low conversion efficiency from alpha-linolenic acid. They have been extensively studied for the last three decades and their different effects on the body have been described.

Initial studies on the physiological effects of long-chain omega-3 fatty acids focused on the relationship between EPA and DHA and cardiovascular disease. The findings showed that both the acids reduced the risk of cardiovascular disease (Casula, et al., 2013) (de Oliveira Otto, et al., 2013) (Zock, et al., 2016).

A deficiency of omega-3 fatty acids has been implicated as a risk factor in mental disorders such as depression, schizophrenia and ADHD (McNamara, 2016) (Parletta, et al., 2016) (Königs & Kiliaan, 2016).

Omega-3 polyunsaturated fatty acids have been shown to contain anti-inflammatory properties. These acids play a role in arthritis and possibly other conditions associated with inflammation (Yates, et al., 2014) (Calder, 2015) (Khatib, et al., 2016).

A number of recommended intakes of EPA and DHA have been published. Health claims authorised by the EU give daily intakes from 250 mg to 3 g EPA+DHA, depending on the claim. For example, the beneficial effect to normal heart function is obtained with 250 mg of EPA and DHA, but the beneficial effect to maintenance of normal blood pressure is obtained with 3 g of EPA and DHA. In comparison LYSI omega-3 fish oil normally contains 270 mg EPA+DHA/g.

Product Groups

Fully refined omega-3 fish oil is produced to fulfil LYSI many different specifications. The specifications can be generic or they can be determined in agreement with customers in terms of individual requirements.

Other ingredients can be added, such as vitamins, antioxidants and flavourings. Mixed tocopherols are used as antioxidants.

All ingredients/additives must be non-GMO, non-irradiated and preferably, Halal-certified.

LYSI also offers various fish oil blends containing omega-3 fish oil. Again, the specifications can be generic or agreed to with customers. Omega-3 fish oil blends must contain at least 51% of omega-3 fish oil to legitimately bear the name Omega-3 fish oil, however, the oil is often used at a lower ratio.

The products are packed into steel drums, IBCs, tankcontainers or flexicontainers, all according to customer requirements.

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