

Are Most Fish Oil Products Synthetic?

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

February 22, 2023

STORY AT-A-GLANCE

- › A chemical process leaves many fish oil supplements lacking in actual EPA and DHA omega-3s
- › Trans-esterification transforms most fish oil into a synthetic product that's far removed from the natural fish oil you'd get when eating sardines or other fatty fish
- › A class-action lawsuit filed against The Bountiful Company and its subsidiary Nature's Bounty alleges consumers are being misled, as the supplements contain "not a single milligram" of the omega-3 fats found in fish
- › In fish, DHA and EPA occur in the form of triglycerides, which are the most bioavailable; in most fish oil supplements, the omega-3 fats are in ethyl ester form
- › Ideally, consume omega-3 fats by eating fatty, cold-water fish such as wild-caught Alaskan salmon, sardines, anchovies, mackerel and herring; if you choose to use a supplement, krill oil provides a superior alternative to fish oil

Reading medical journals and following the mass media, it's easy to get the idea that fish oil is something any sensible person should use. It's rare to see anything suggesting that it could be dangerous.

The omega-3 fats, including those with long chains found in fish oils, are said to make babies more intelligent, to be necessary for good vision, and to prevent cancer, heart disease, obesity, arthritis, depression, epilepsy, psychosis, dementia, ulcers, eczema and dry skin.

Certain fish oil supplements contain "not a single milligram" of the omega-3 fats found in fish, according to a class-action lawsuit filed against The Bountiful Company and its subsidiary Nature's Bounty.¹ As a result, people consuming these supplements in the hopes of gaining omega-3's many beneficial effects may be being misled.

Wild-caught salmon, sardines and certain other fish are an excellent source of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), two omega-3 fats known for their role in brain health, heart health and more. It's been shown, for instance, that eating fatty fish two to three times a week reduces the risk of heart disease and stroke.²

However, because most Americans do not consume much seafood, many rely on fish oil supplements instead. But Nature's Bounty fish oil contains no EPA or DHA, the suit alleges.³

Are Consumers Wasting Billions on Synthetic Fish Oil?

Fish oil is among the most popular supplements in the U.S. Globally, the fish oil market was valued at \$1.9 billion in 2019, with estimates suggesting this will rise to \$2.8 billion by 2027.⁴ Many of these dollars may be wasted, however, due to a chemical process that leaves many fish oil supplements lacking in actual EPA and DHA. According to the suit, which was filed in September 2021:⁵

"Defendants manufacture, label and sell a Product which they claim to be 1400 mg. of Fish Oil containing of 647 mg. of Eicosapentaenoic Acid ("EPA") and 253 mg. of Docosahexaenoic Acid ("DHA")—the essential omega-3 fatty acids that naturally occur in fish ...

They also proudly claim that the contents are USP verified, which, among other things, assures consumers that the Product "contains the ingredients listed on the label, in the declared potency and amounts" ... Contrary to what is represented on the label, however, this Product is not fish oil, nor does it contain a single milligram of EPA or DHA."

Most Fish Oil Supplements Contain Omega-3 Ethyl Esters

The issue with most fish oil supplements is the chemical process used – trans-esterification – which transforms the oil into a synthetic product that's far removed from the oil you'd get when eating sardines or other fatty fish. The suit explains:⁶

"What was once a low-grade oil derived from fish offal, has been subjected to a chemical process by which its molecular structure and constituent parts have been substantially transformed and irrevocably altered into a synthesized product that does not otherwise exist in fish, or nature.

Through this chemical process, known as trans-esterification, an industrial solvent is introduced into the fish oil in order to break its natural triglyceride bonds and cleave the glycerol backbone from fatty acid molecules.

Thereafter, ethanol is introduced to which the newly freed fatty acids bond to form fatty acid ethyl esters. Fish oil is stripped of hundreds of its constituent sub ingredients, and the Omega-3s, which include DHA and EPA, are converted into ethyl esters.

Critically, these newly formed Omega-3s are different molecules than the Omega-3s which exist naturally in fish oil. The new chemical by-products are universally recognized by their common or usual name – Fatty Acid Ethyl Esters ("FAEE")."

Dietary supplement labels should use the product's common name in order to inform consumers of what they're purchasing. But fish oil is trans-esterified, it becomes FAEE, the lawsuit alleges, and therefore can no longer be called fish oil on labels.

"To do so, as NBI [Nature's Bounty Inc] has done, is false, misleading, deceptive, unlawful and perpetrates an actionable fraud on the consuming public," according to the suit, which added, "Defendants falsely represented the fundamental nature of their product, and as a result of this false and misleading labeling, were able to sell these

products to tens of thousands of unsuspecting consumers throughout New York and the United States."⁷

Synthetic 'Fish Oil' 'Found Nowhere in Any Fish Ever'

Nature's Bounty and The Bountiful Company filed a motion to dismiss the lawsuit in February 2022. They denied that labeling their fatty acid ethyl esters "fish oil" was misleading and also suggested their label complies with federal law. In January 2023, U.S. Magistrate Judge Anne Shields recommended granting the motion to dismiss, writing:⁸

"If it has not already been made clear, the court states clearly here that there is nothing false about labeling the product as fish oil. Describing the product this way denotes nothing more than a statement of fact that the OM3's [omega-3 fats] therein are derived from fish oil. It says nothing about the process by which crude fish oil makes its way to the OM3's found in each capsule.

Plaintiffs do not, and cannot, argue that other supplements containing OM3'S derived from fish oil are properly named only if they are derived via a different process. All such products get their OM3's from fish oil. To suggest that molecular differences between such products make a difference to a reasonable consumer is plainly implausible."

The plaintiffs' attorneys, Michael Braun and Mai Kats, pushed back, urging the district court judge overseeing the lawsuit to not take Shields' recommendation, stating:⁹

"In short, under Second Circuit precedent, plaintiffs are entitled to proceed with their claim that when purchasing defendants' product, they read the label and believed the product to be comprised of authentic fish oil – that is, oil 1) derived from pressing fresh fish and 2) containing both DHA and EPA.

Additionally, plaintiffs are entitled to show, through discovery and expert testimony, that reasonable consumers attribute a higher value to the marketed product – a clean product – than to the product they received, which is a lab-

created, artificial concoction, comprised of intensely and chemically-processed fish waste (offal) that lacks both DHA and EPA and consists instead of unnatural ethyl ester compounds found nowhere in any fish ever."

Ethyl Ester Versus Triglyceride Forms of Omega-3 Fat

While the judge suggested a "reasonable consumer" won't care whether their omega-3 fats are in ethyl ester form, I'd suggest most will absolutely care – if they're informed about the difference. In fish, DHA and EPA occur in the form of triglycerides,¹⁰ which are the most bioavailable.

A triglyceride consists of a three-carbon molecule that forms a "backbone" for the fatty acids to latch onto. Each carbon molecule is linked to a fatty acid, so in total, a triglyceride is composed of three carbons bonded to three fatty acids. In most commercial fish oil supplements, however, the DHA and EPA are delivered in the form of ethyl esters.

Ethyl esters are essentially a synthetic substrate, created through the micro distillation process of crude fish oil, in which ethanol and/or industrial alcohol is added. This mix is heat distilled in a vacuum chamber, resulting in a concentrated omega-3 ethyl ester condensate.

Not only does this molecular distillation process remove vital resolvins and protectins that are important in reducing inflammation, but it also concentrates the EPA and DHA. You can tell the concentration of these two fats in any given supplement by looking at the label. In fish, the oil consists of 20% to 30% EPA and DHA, whereas purified fish oil concentrate typically contains between 60% and 85% EPA and DHA.¹¹

Most corporations produce ethyl ester fish oil because it's far less expensive to produce than the triglyceride form. Ethyl esters are also easier to work with during processing, as they have a higher boiling point, which becomes important when the oils are heated and purified of environmental pollutants.

Ethyl Esters Are the Least Bioavailable Form

The problem with ethyl esters is they're the least bioavailable form of omega-3. Manufacturers could convert them back into the triglyceride form by detaching the ethyl alcohol molecule and reattaching a glycerol molecule in a process known as re-esterification,¹² but most don't because it's so costly.

This is unfortunate, as your body metabolizes the triglyceride and ethyl ester forms differently, and this is when the issues arise. Since the glycerol backbone is missing in the ethyl ester form, the EPA and DHA will scavenge for available triglycerides or steal a glycerol molecule from somewhere.

One way or another, the fatty acids need to be converted back into triglyceride form or your gut epithelium will not be able to process them. When the ethyl ester form of EPA or DHA ends up stealing glycerol molecules, the molecule that lost its glycerol will then go searching for a replacement, creating a negative domino effect. Further, the fatty acids cannot be transported through your blood unless they're in triglyceride form.

On the other hand, when you consume omega-3s in triglyceride form, the fatty acids are first separated from the glycerol backbone. All of the individual parts are then absorbed by gut epithelial cells, where they're reattached to form triglyceride.

When you consume ethyl esters, they must be processed in your liver. There, the ethanol backbone is separated from the free fatty acids, and your body must then reattach the free fatty acids to glycerol to form triglyceride. Your liver must also process the ethyl alcohol, which may release free radicals and cause oxidative stress – the opposite of what you're trying to achieve when you consume fish oil.

Synthetic Fish Oil May Cause More Harm Than Good

Many are aware of the fact that omega-3s are also PUFAs just like omega-6s that are so dangerous when consumed in excess quantities. But most don't know that omega-3 fats are actually ten times more perishable than omega-6 fats and far more susceptible to

oxidative damage. Fish oils are also generally much more immunosuppressive than omega-6 seed oils.

This is important to know because of all of the processing that occurs in processed fish oil. Invariably these highly perishable fats will be damaged and cause far more harm than good. I personally would never take processed fish oil in the ethyl ester form and strongly encourage you to seriously reconsider your choice if you are taking them.

Even if you were able to get unoxidized ethyl ester fish oils, absorption is also an issue. Free fatty acids of fish oil have an absorption rate of at least 95%. EPA in its natural triglyceride form had a 69% absorption rate in one study, while ethyl ester forms absorbed only about 20%.¹³

Importantly, unstable molecules are also more prone to oxidative damage and thus rancidity, which means consuming synthetic fish oil could potentially cause more harm than good. As explained by Douglas MacKay, N.D., senior vice president of scientific and regulatory affairs for the Council for Responsible Nutrition:¹⁴

"The potential negative health effects of consuming rancid fish oils have not been fully elucidated. However, it has been shown that oxidized by-products of polyunsaturated fatty acids, including DHA, are elevated in patients with neurodegenerative conditions.

The triglyceride structure is the natural "resting" state for lipid molecules. The inherent structure of three fatty acids attached to one glycerol backbone provides protection to the double bonds in the long-chain PUFAs from being exposed to free radicals.

An ethyl ester fatty acid, on the other hand, exists as a single strand, and is exposed on all sides to free radicals. Although there is little data that directly compares the stability of EE [ethyl ester] fish oils to TG [triglyceride] fish oils, such basic biochemistry suggests the superior stability of TG fish oils both inside a capsule or liquid as well as within the body."

The Best Way to Get Your Omega-3s

Ideally, it is best to get your omega-3 fats from whole-food forms. This includes wild-caught Alaskan salmon, sardines, anchovies, mackerel and herring. If you choose to use a supplement, krill oil provides a superior alternative to fish oil.

Krill oil contains less EPA and DHA per gram of supplement than fish oil does. However, krill oil is more bioavailable as the EPA and DHA are bound in a phospholipid form, allowing you to take lower doses while still reaping similar results.

Sources and References

- ¹ [ClassAction.org September 30, 2021](#)
- ² [Class Action Complaint, Filed September 24, 2021, Page 1](#)
- ^{3, 4, 5} [Class Action Complaint, Filed September 24, 2021, Page 2](#)
- ⁶ [Class Action Complaint, Filed September 24, 2021, Pages 2-3](#)
- ⁷ [Class Action Complaint, Filed September 24, 2021, Page 3](#)
- ^{8, 9} [Natural Products Insider February 3, 2023](#)
- ^{10, 11, 12, 14} [A Comparison of Synthetic Ethyl Ester Form Fish Oil vs. Natural Triglyceride Form \(PDF\), What Are Triglycerides and Ethyl Esters?](#)
- ¹³ [Biochem Biophys Res Commun. 1988 Apr 15;152\(1\):328-35](#)