



LEADING THE OMEGA-3 FUTURE

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POWERED BY TRANSBIODIESEL





Leading the Omega-3 future

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- ❑ Cutting-edge proprietary **enzymatic technology** for the production of **concentrated Omega- 3 (>60%)** with:
  - ❑ Advanced nutritional potential
  - ❑ Unique, **high-potency EPA + DHA combinations**, designed for specific functions such as brain and heart support
  - ❑ Predetermined ratio of DHA and EPA in the form of **mono-, di- and tri-glycerides**, ethyl esters, **phospholipids** and **glycolipids**
  - ❑ **Higher bioavailability**
- ❑ Our revolutionary biocatalysts **OmegaZyme ET™** and **TransZyme ET™** :
  - ❑ Enable smart engineering and restructuring of lipids
  - ❑ Increase processes efficiency
  - ❑ Significantly **lower production costs**

## General: Health benefits offered by the consumption of EPA/DHA

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- ❑ Reducing LDL-cholesterol, blood pressure and coronary heart diseases such as heart attacks and strokes
- ❑ Improving body functions including blood clotting, fertility, muscle activity, digestion and cell division & growth
- ❑ Infants: DHA promotes brain, nerve and eye development.

# The Omega-3 PUFA market is segmented

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**Type:** Docosahexaenoic acid (DHA), Eicosapentaenoic acid (EPA) and Alpha Linolenic acid (ALA)

**Application:**

- ☐ Dietary supplements
- ☐ Functional food & beverages
- ☐ Pharmaceuticals
- ☐ Infant formula
- ☐ Others.

**Source:** Marine and plant

- ☐ Marine source is further segmented into fish oil, algal oil, krill oil, and others.
- ☐ Plant source is further segmented into flax and chia seeds oils, and others.

## High concentrates source is estimated to be a major revenue contributor in omega-3 ingredients market

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- ❑ A new sub-category (end of 2015): Ultra-high concentrates with EPA and DHA concentrations of up to 90%. These ultra-high concentrates are nearing pharmaceutical levels—without being called drugs.
- ❑ In October 2015, DSM launched a new line of high concentrate of DHA and EPA products sourced from fish oil and a high concentrate of DHA from algal oil. The products contain 85% omega-3 to support cardiovascular and cognitive health.
- ❑ In June 2015, Croda introduced IncroOmega DHA, which is ideal for cognitive health and has certification of EFSA (European Food Safety Authority).
- ❑ Last November, Nordic Naturals launched Omega ONE, an ultra-high concentrate with 80% EPA+DHA (with 90% or more of that in the absorbable triglyceride form).

## Conventional technologies for omega-3 concentrates

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- ❑ Winterization of fish/algal oils to reach up to 30% in average of omega-3 PUFA
- ❑ Transesterification of fish/algal oils to produce fatty acid ethyl esters (FAEEs) which are subsequently:
  1. Subjected to fractional distillation to produce FAEEs with different ratios of EPA/DHA up to 70% in sum
  2. Supercritical carbon dioxide fractionation/column chromatography to reach 50-90% omega-3 concentrates
  3. Urea complexation to reach 60-90% omega-3 concentrates
- ❑ Reverse transesterification catalyzed by strong alkaline bases (Sodium/Potassium hydroxide/methoxide) to produce r-TAGs with EPA/DHA in the range of 50-90%

## Omega-3 PUFA challenges

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- ☐ Pill size is too big and difficult to swallow
- ☐ Fishy burp and taste can make for an unpleasant consumer experience
- ☐ Products aren't potent enough
- ☐ Too few specialized products are available to meet specific health needs and perceived value
- ☐ Bio-availability
- ☐ Stability
- ☐ **Methods of production**
- ☐ Exposure to high temperatures, low recovery yields and generating large amounts of wastes in production processes

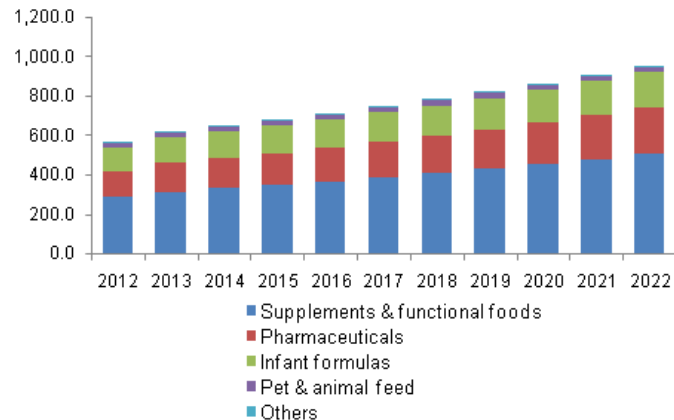
# Market size and growth

With the increasing health-consciousness among the consumers and multi-benefits of Omega-3 PUFA, the demand for Omega-3 PUFA is expected to enhance the market growth from 2015 to 2020.

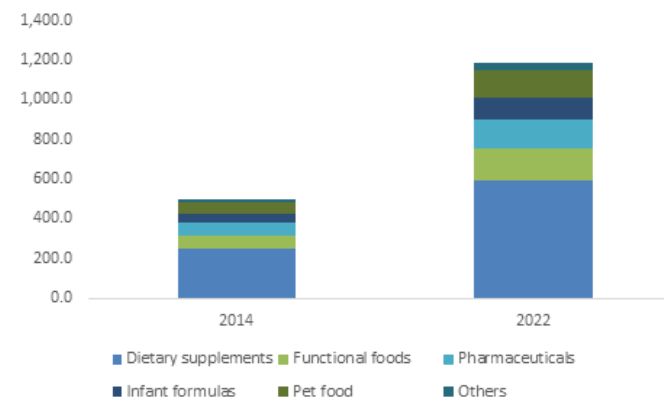
Global omega-3 market size was USD 1.82 billion in 2014 and is expected to witness substantial growth over the forecast period owing to increasing demand for functional foods in various countries including India, China, U.S., Japan, Australia, Germany, and Italy.

According to Global Market Insights, Inc., “Omega-3 ingredients market size is estimated to grow at a CAGR of 11% over the period of 2015-2022.” The omega-3 ingredients market share is anticipated to surpass USD 3 billion by 2022.

**North America Omega-3 market revenue, by application, 2012 - 2022 (USD Million)**



**Europe EPA/DHA ingredients (Omega-3) market revenue, by application, 2014 & 2022 (USD Million)**



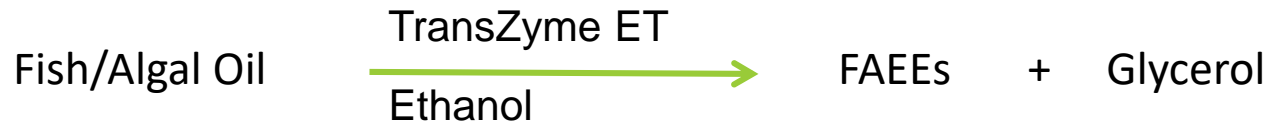


# Our proprietary Enzymes

TransBiodiesel has developed two new immobilized enzymes for the enrichment of **omega-3 fatty acids** in fish/algal oils for the food supplements/nutraceutical industries:

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1. **TransZyme ET with different selectivity towards saturated/unsaturated fatty acids/fatty acyl groups** for the preparation of fatty acid alkyl esters of fish/algal oils



***FAEEs** – Fatty acid ethyl esters enriched with up to 70% EPA and DHA.*

2. **OmegaZyme ET with different selectivity towards saturated/unsaturated fatty acids/fatty acyl groups** for the preparation of enriched **omega-3 fatty acids in the form of glycerides**



***Glycerides** enriched with 50-70% EPA and DHA in the form of glycerides.*

## TransBiodiesel's proprietary enzymatic technology

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TransBiodiesel's technology platform, consisting of two elements:

- ❑ Modification and adaptation of enzymes (lipases) for use in solvent-free systems
- ❑ Immobilization of modified enzymes for industrial applications, which is achieved by binding the enzymes to specific carriers

TransBiodiesel's technology overcomes the major drawbacks of enzyme-based catalysts of Omega-3 products:

- ❑ High cost of the enzymes
  - ❑ Low efficiencies
  - ❑ Low long-term stability
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- ❑ The modified immobilized enzymes developed by TransBiodiesel can be used in multiple batch and in continuous processes
  - ❑ They are highly active in solvent-free systems
  - ❑ TransBiodiesel's biocatalysts are capable of catalyzing the esterification/transesterification/interesterification reactions simultaneously, which allows them to be used for the production of mono-, di- and tri-glycerides, ethyl esters, glycolipids and phospholipids



# HighOmega

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- ❖ Ultra-pure, high-potency EPA and DHA >> 60%
  - ❖ Tailored solutions with advanced nutritional potential
  - ❖ HighOmega technology can create unique EPA + DHA combinations, designed for specific health benefits such as brain and heart support
  - ❖ Produced using enzymatic reactions, lipid- engineering independent of raw material variations
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- ❑ Smaller, easier to swallow pills
  - ❑ Reduced costs for encapsulation, transport, and display of finished supplements



# Competition

Company name	Trademark	High+ Ultra high concentrates	Enzymatic	Production Cost	Ethyl esters	Mono- , di--, & tri- glycerides	Phospholipids/ Glycolipids	Source
TransBiodeiesel	HighOmega	50-80%	+	low	+	+	+	Fish/ algal
DSM Nutritional Products	<i>MEG-3</i> <sup>®</sup>	> 85%	-	high	+	+	-	Fish/ algal
BASF Human Nutrition	Lovaza	>85%	-	high	+	+	-	Fish
Croda International PLC (U.K.)	Incromega DHA OmeRx™.	70% min	-	high	+	-	-	Fish
Polaris, france	Omegavie <sup>®</sup>	30-80%	+	high	+	+	-	Fish/alga
GC-Reiber Norway	VivoMega	75-90%	+	high	+	-	-	Fish
Arctic Nutrition	Romega <sup>®</sup>	50-80%	-	high	+	-	+	Fish
Organic Technologies	AlaskOmega <sup>®</sup>	50-80	-	high	+	-	-	Fish

# COMPANY PROFILE

TransBiodiesel produces immobilized enzyme-based catalysts for the production of fatty acid alkyl esters using high-acid oils feedstocks of potential application for:

1. The 2<sup>nd</sup> and 3<sup>rd</sup> generation biodiesel fuel complying with the specs.
2. The enrichment of omega-3 fatty acids in the form of fatty acid alkyl esters and in the form of glycerides.

Our biocatalysts are environment-friendly, enable the catalysis of esterification and transesterification of oil feedstocks, with different selectivity to the various fatty acids, while lowering significantly the total production costs of production.



**TransZyme A/ TransZyme ET/ OmegaZyme**

**FOUNDED IN 2007 BY DR. SOBHI BASHEER**

**DEVELOPED THE WORLD'S ONLY IMMOBILIZED  
ENZYME-BASED CATALYST FOR THE INDUSTRIAL  
SCALE PRODUCTION OF BIODIESEL**

**7 PATENTS & PROPRIETARY KNOW-HOW**

**EU ENTREPRENEUR OF THE YEAR 2014**

**STATE OF ISRAEL - 2010 START-UP OF THE  
YEAR**

**2015: ESTABLISHED FIRST JV IN LIMA / PERU  
FOR THE PRODUCTION OF BIODIESEL**

## CONTACT DETAILS

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