

Fucoxanthin from microalgae

FucoRexTM

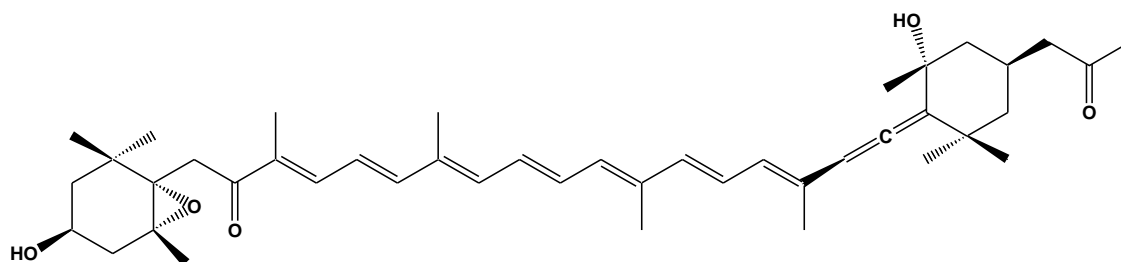
Dietary Ingredient for Prevention of
Metabolic Syndrome, Antioxidation
and Beauty enhancement

■ FucoRexTM-5

(Oil included 5% fucoxanthin, Food Grade)

■ FucoRexTM-1

(Oil included 1% fucoxanthin, Food Grade)



Fucoxanthin

Fucoxanthin from microalgae
FucoRex™
 Dietary Ingredient for Prevention of Metabolic
 Syndrome and Beauty Enhancement

1. Introduction

Fucoxanthin (Fig. 1) is carotenoid that is included brown algae (luminaria, seaweed and so on). It has an excellent dietary effect that is enhance Uncoupling protein-1 (UCP1) activity in visceral fat.

Oryza oil and fat chemical co., ltd. has been sold fucoxanthin products since launched fucoxanthin product extracted and purified from brown algae in 2008. This time, we launched “FucoRex™” that is fucoxanthin product extracted and purified from microalgae (*Phaeodactylum tricornutum*).

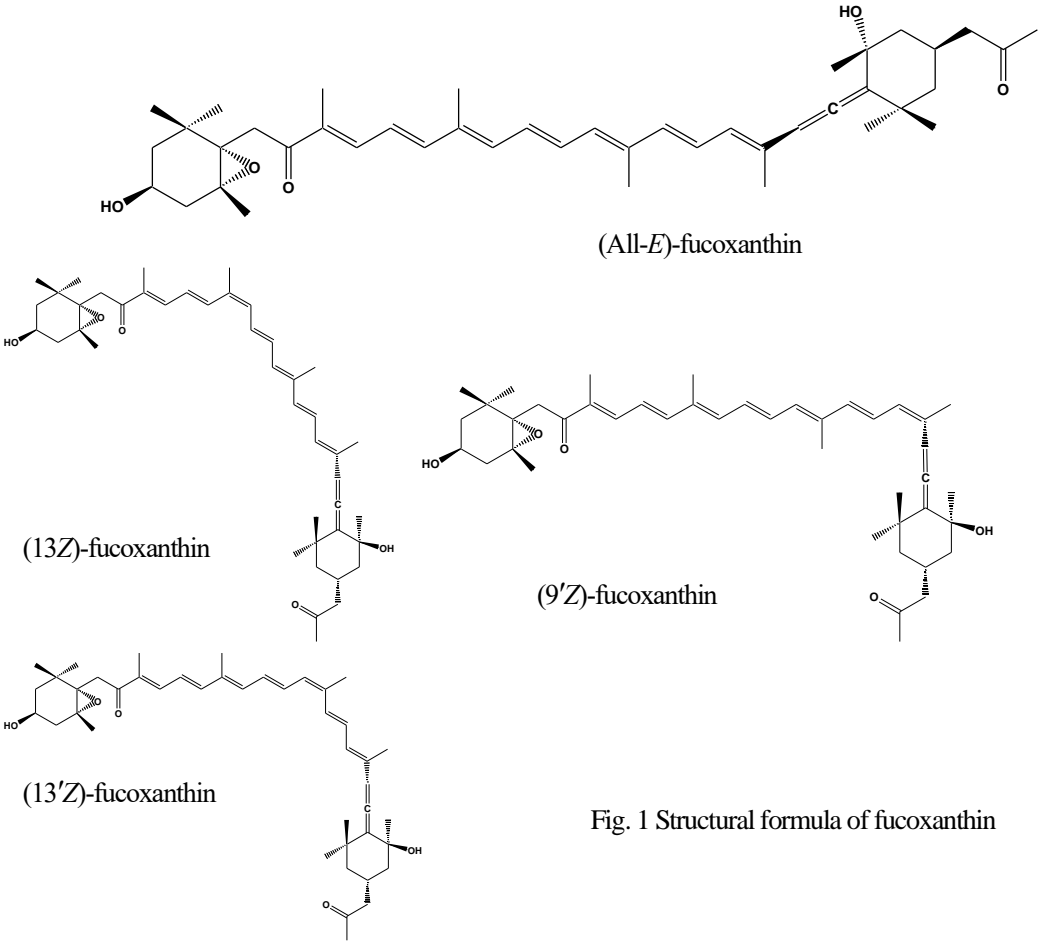


Fig. 1 Structural formula of fucoxanthin

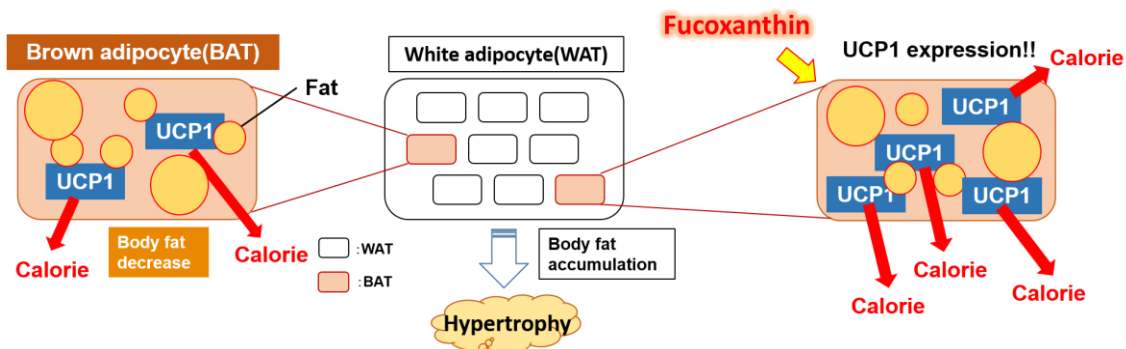


Fig. 2 Anti-obesity mechanisms of fucoxanthin

2. About microalgae

Microalgae (it is also called phytoplankton) algae propagated mainly in the ocean. Currently, about 10 thousand species of microalgae grow in seawater and freshwater¹⁾. Microalgae changed carbon dioxide to oxygen in the primeval atmosphere by photosynthesis. It is said to have played a part in building the present atmospheric composition. Then, microalgae is the bottom of the food chain, zooplankton eats microalgae and fish eats zooplankton. Microalgae plays an important role not only to make the present atmosphere but also to support living organisms on the earth as part of the food chain. Recently, the high lipid (oil) production ability of microalgae has been focused, and it is expected to use biomass as raw material. It is known that the oil production ability of microalgae is 500 times or more of grain-related biomass raw material like corn. And there is no competition for land and water quality resources with food crops. For these reasons, microalgae is rapidly studied as a third biomass next to edible-related biomass like corn (first biomass), and non-edible-related biomass like vegetation (second biomass).

Oryza Oil & Fat Chemical Co. Ltd. has been focused that *Phaeodactylum tricornerutum* of microalgae has a high content of fucoxanthin. We developed the production of fucoxanthin using our own manufacturing method, and launched FucoRex™. *P. tricornerutum*, a raw material, is a biomass material (FucoVital™) that is cultured and supplied by Algatechnology Inc. of Israel through its unique high technology and many years of research and development. There is no problem of water pollution and pesticides etc., and little influence of environmental change because microalgae is cultured in a closed system. So, it is an important characteristic that microalgae can be supplied stably and sustainably. Furthermore, microalgae has 50 times the fucoxanthin content compared with brown algae, and we can do product development at a lower cost.

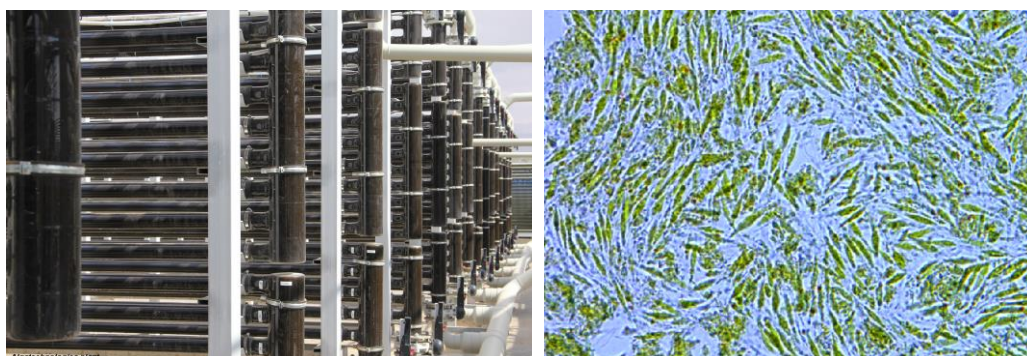


Fig 3. left : Microalgae culture equipment (Algatechnology Inc.)

right : Photomicrograph of *P. tricornerutum*

1) 井上勲, 藻類 30 億年の自然史 藻類から見る生物進化・地球・環境 第 2 版 東海大学出版会

3. Functionality of fucoxanthin

Please show our catalog “Fucoxanthin” and “clinical study of fucoxanthin” that have detail data about anti-obesity and beauty effect of fucoxanthin.

4. Product stability of FucoRex™

(1) Heat stability

FucoRex™-5 was showed less than 10% reduction in content when it was heating for 1 hour at 80°C. When you use FucoRex™-5, we recommend to process at lower 100°C.

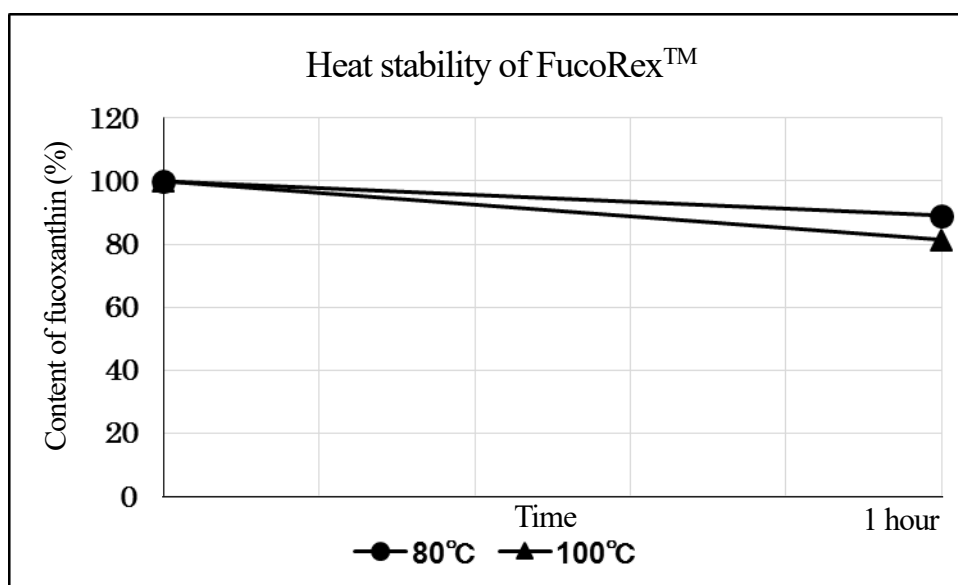


Fig 4. Heat stability of FucoRex™-5 (% of control)

5. Recommend dosage of FucoRex™

For the result of our human clinical test (collaborative trial with external CRO), we recommend 3 mg as fucoxanthin per day, that is 60 mg / day for FucoRex™-5 (oil solution) and 300 mg / day for FucoRex™-1 (oil solution).

6. Safety profile of FucoRex™

(1) Acute toxicity (LD₅₀)

Acute toxicity of microalgae extract included fucoxanthin was conducted according to the guidelines for single-dose toxicity tests for pharmaceutical products where microalgae extract (content of fucoxanthin is 22.4%) of 1000 mg / kg was orally given to mice (ICR, 6-week old). And the mice were observed for 14 days. No abnormalities and fatal event observed at 1000mg/kg. No abnormalities of organs observed under

macroscopic examination upon autopsy. Thus, LD50 of microalgae extract included fucoxanthin is deduced to be > 1000 mg / kg.

(2) Mutagenicity (Ames test)

Ames test was conducted to evaluate the mutagenicity of microalgae extract (content of fucoxanthin is 22.4%) using *Salmonella typhimurium* TA100, TA1535, TA98, TA1537 and *Escherichia coli* WP2 *uvrA*. At concentration 19.5 – 5000 µg / plate, no mutagenicity was observed.

7. Commercial Applications

	Applications	Claims	Examples
Foods	Prevention of metabolic syndrome, anti-obesity, diet, anti-diabetes, anti-cancer, skin care • skin whitening	1) Anti-metabolic syndrome 2) Anti-obesity, diet 3) Anti-diabetes 4) Skin care • skin whitening 5) Anti-cancer	Beverages, hard & soft capsules, tablets, candies, chewing gums, chocolates, wafers, jellies, etc

8. Package

FucoRex™-5, 1 (Oil)

1kg, 5kg Interior : Tin can
 Exterior : Cardboard
 Others : Fill with nitrogen gas, store below 5°C

9. Storage

The product is vacuum-packed or nitrogen-filled. Store the product sealed in a cool, dark place (5°C or below). Avoid high temperature and humidity. Once the package is open, remove air or fill nitrogen and use the product up as soon as possible.

10. Expression

FucoRex™-5, 1

Expression : Triglyceride, Glycerin Ester of Fatty Acid, Micro Algae Extract, Natural Tocopherol

*Please refer to your nation's laws and regulations.

Product Standard

Product Name

FucoRex™-5

Food grade

This product is oily liquid extracted with ethanol from micro algae (*Phaeodactylum tricornutum*) and then purified. It contains minimum of 5.0 % fucoxanthin.

<u>Appearance</u>	Reddish brown viscous liquid with light unique smell.												
<u>Fucoxanthin</u>	Min. 5.0 % (HPLC)												
<u>Purity Test</u>													
<u>(1) Heavy Metals (as Pb)</u>	Max. 20 ppm (Sodium Sulfide Colorimetric Method)												
<u>(2) Arsenic (as As₂O₃)</u>	Max. 2 ppm (Standard Methods of Analysis in Food Safety Regulation, The Third Method, Apparatus B)												
<u>Standard Plate Counts</u>	Max. 1×10 ³ cfu/g (Analysis for Hygienic Chemists)												
<u>Moulds and Yeasts</u>	Max. 1×10 ² cfu/g (Analysis for Hygienic Chemists)												
<u>Coliforms</u>	Negative (Analysis for Hygienic Chemists)												
<u>Composition</u>													
	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Ingredient</u></th> <th style="text-align: right;"><u>Content</u></th> </tr> </thead> <tbody> <tr> <td>Triglyceride</td> <td style="text-align: right;">76.0%</td> </tr> <tr> <td>Glycerin Ester of Fatty Acid</td> <td style="text-align: right;">12.0%</td> </tr> <tr> <td>Micro Algae Extract</td> <td style="text-align: right;">11.0%</td> </tr> <tr> <td><u>Natural Tocopherols</u></td> <td style="text-align: right;"><u>1.0%</u></td> </tr> <tr> <td>Total</td> <td style="text-align: right;">100.0%</td> </tr> </tbody> </table>	<u>Ingredient</u>	<u>Content</u>	Triglyceride	76.0%	Glycerin Ester of Fatty Acid	12.0%	Micro Algae Extract	11.0%	<u>Natural Tocopherols</u>	<u>1.0%</u>	Total	100.0%
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Total	100.0%												
<u>Expiry date</u>	2 years from date of manufacturing.												
<u>Storage</u>	Store it at a cool (below 5°C), dry place. Filled with nitrogen. Keep it away from high temperature, high moisture and sunlight, and store it in a closed container.												

Product Standard

Product Name

FucoRex™-1

Food grade

This product is oily liquid extracted with ethanol from micro algae (*Phaeodactylum tricornutum*) and then purified. It contains minimum of 1.0 % fucoxanthin.

<u>Appearance</u>	Reddish brown viscous liquid with light unique smell.
<u>Fucoxanthin</u>	Min. 1.0 % (HPLC)
<u>Purity Test</u>	
<u>(1) Heavy Metals (as Pb)</u>	Max. 20 ppm (Sodium Sulfide Colorimetric Method)
<u>(2) Arsenic (as As₂O₃)</u>	Max. 2 ppm (Standard Methods of Analysis in Food Safety Regulation, The Third Method, Apparatus B)
<u>Standard Plate Counts</u>	Max. 1×10 ³ cfu/g (Analysis for Hygienic Chemists)
<u>Moulds and Yeasts</u>	Max. 1×10 ² cfu/g (Analysis for Hygienic Chemists)
<u>Coliforms</u>	Negative (Analysis for Hygienic Chemists)

<u>Composition</u>	<u>Ingredient</u>	<u>Content</u>
	Triglyceride	94.4%
	Glycerin Ester of Fatty Acid	2.4%
	Micro Algae Extract	2.2%
	Natural Tocopherols	1.0%
	Total	100.0%

Expiry date 2 years from date of manufacturing.

Storage Store it at a cool (below 5°C), dry place. Filled with nitrogen. Keep it away from high temperature, high moisture and sunlight, and store it in a closed container.

ORYZA OIL & FAT CHEMICAL CO., LTD. striving for the development of the new functional food materials to promote health and general well-being.

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ORYZA OIL & FAT CHEMICAL CO., LTD.