

## Let astaxanthin be thy medicine



Eiji Yamashita\*

Department of Research & Development, Medical Nutrition Division, AstaReal Co., Ltd., 2-6-3-12F, Shibakoen Minato-ku, Tokyo 105-0011, Japan

### ARTICLE INFO

#### Article history:

Received 29 April 2015  
 Received in revised form 3 September 2015  
 Accepted 3 September 2015  
 Available online 9 September 2015

#### Keywords:

Astaxanthin  
 Haematococcus  
 Add-on supplementation

### ABSTRACT

Astaxanthin is known as a “marine carotenoid” and occurs in a wide variety of living organisms such as salmon, shrimp, crab, and red snapper. Astaxanthin antioxidant activity has been reported to be more than 100 times greater than that of vitamin E against lipid peroxidation and approximately 550 times more potent than that of vitamin E for singlet oxygen quenching. Astaxanthin exhibits no pro-oxidant activity and its main site of action is on/in the cell membrane. To date, various important benefits suggested for human health include immunomodulation, anti-stress, anti-inflammation, LDL cholesterol oxidation suppression, enhanced skin health, improved semen quality, attenuation of eye fatigue, increased sports performance and endurance, limiting exercised-induced muscle damage, and the suppression of the development of lifestyle related diseases such as obesity, atherosclerosis, diabetes, hyperlipidemia and hypertension. Recently, there has been an explosive increase worldwide in both the research and demand for natural astaxanthin in human health applications. Japanese clinicians are especially using astaxanthin extracted from the microalgae, *Haematococcus pluvialis*, as add-on supplementation for patients who are unsatisfied with conventional medications or cannot take other medications due to serious symptoms. For example, in heart failure or overactive bladder patients, astaxanthin treatment enhances patient's daily activity levels and QOL. Other ongoing clinical trials and case studies are examining chronic diseases such as non-alcoholic steatohepatitis, diabetes, diabetic nephropathy and CVD, as well as infertility, atopic dermatitis, androgenetic alopecia, ulcerative colitis and sarcopenia. In the near future, astaxanthin's role may be stated as, “Let astaxanthin be thy medicine”.

© 2015 Elsevier B.V. All rights reserved.

### Contents

1. Introduction	115
1.1. Suspected basis of astaxanthin's bioactivity	116
1.2. Powerful antioxidant activity	116
1.3. Safe antioxidant activity	116
1.4. Superior position in the cell membrane	118
2. Health promotion effects of natural astaxanthin	118
2.1. Relief of eye fatigue	118
2.2. Skin aging defense (anti-photoaging)	118
2.3. Muscle resilience (enhancement of sports performance)	120
3. Safety in humans	121
4. Practical medical applications of natural astaxanthin	121
5. Conclusion	122
References	122

### 1. Introduction

Astaxanthin is widely and naturally distributed in marine organisms including crustaceans such as shrimp and crabs, and fish such as salmon and sea bream. In fact, astaxanthin is one of the oldest carotenoids originally isolated and identified from lobster,

\* Corresponding author.

**Table 1**  
Total singlet oxygen quenching rate constants.

Compound	Tested concentration (mM)	$k_T$ ( $10^9 M^{-1} s^{-1}$ )
Astaxanthin	0.01–15	5.4
Canthaxanthin	0.01–15	2.0
$\alpha$ -Carotene	0.01–15	0.93
$\beta$ -Carotene	0.01–15	1.1
$\beta$ -Cryptoxanthin	0.01–15	1.7
Fucoxanthin	0.01–15	0.97
Lycopene	0.01–15	3.4
Lutein	0.01–15	2.1
Zeaxanthin	0.01–15	3.4
L-Ascorbic acid	20–50,000	0.00089
$\alpha$ -Tocopherol	10–20,000	0.049
$\alpha$ -Lipoic acid	10–10,000	0.072
Ubiquinone-10	10–3000	0.0068
BHT	10–10,000	0.0040
Caffeic acid	10–10,000	0.0023
Curcumin I	10–10,000	0.0036
(-)-Epigallocatechin gallate	10–6000	0.0096
Gallic acid	10–10,000	0.0023
Pyrocatechol	10–10,000	0.0055
Pyrogallol	10–10,000	0.0055
Quercetin	10–10,000	0.0018
Resveratrol	10–10,000	0.0018
Sesamin	10–5000	0.0012
Capsaicin	10–10,000	0.0021
Probucol	10–10,000	0.00044
Edaravon	10–10,000	0.0067
Trolox	10–20,000	0.011

*Astacus gammarus* [1]. Astaxanthin was first commercially used for pigmentation in the aquaculture industry, which shows that humans have consumed astaxanthin for a long time. After the biological activity of the potent antioxidative property was first reported in 1991 [2], the use of astaxanthin as a food supplement started gaining acceptance. Recently, there has been an explosive increase worldwide in both the research and demand for natural astaxanthin in human health applications.

In this review, we examine the underlying basis for astaxanthin bioactivity and the health promotion effects of natural astaxanthin extracted from the microalgae, *Haematococcus pluvialis*. This review also examines the practical medical applications of natural

astaxanthin in cases and reports by clinicians using astaxanthin as an add-on supplement in patients who were unsatisfied with their conventional medications, or could not receive any medications due to the seriousness of their symptoms.

### 1.1. Suspected basis of astaxanthin's bioactivity

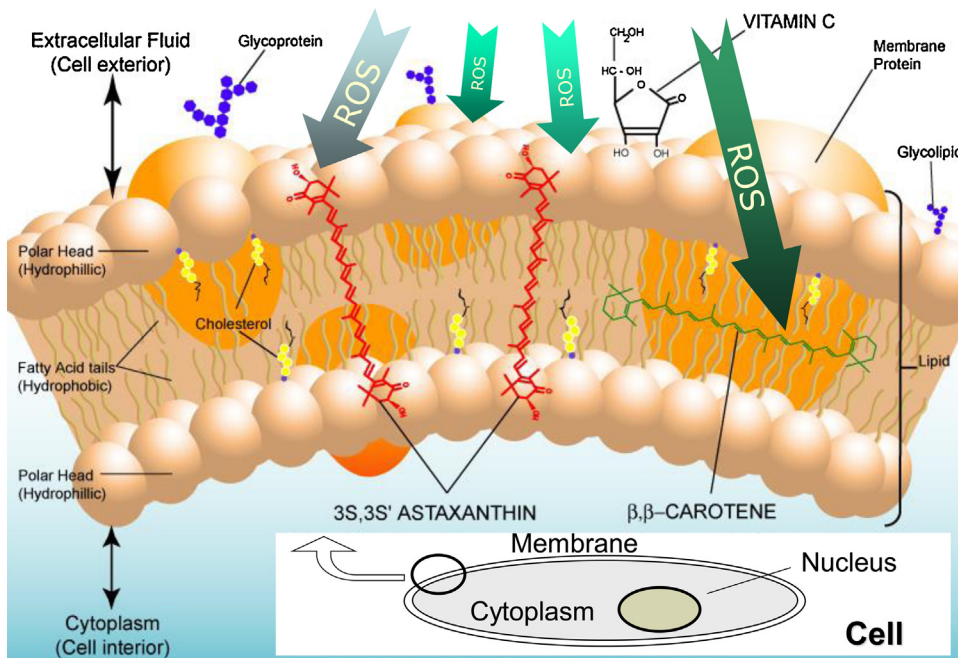
Astaxanthin is a totally unique antioxidant that possesses three simultaneous novel distinctions that include being a powerful antioxidant, safe antioxidant, and having a superior position within the cell membrane.

### 1.2. Powerful antioxidant activity

The inhibitory activity of astaxanthin on the peroxy radical mediated lipid peroxidation was more than 100 times greater than that of  $\alpha$ -tocopherol in the homogenate of rat mitochondria [2]. Among 27 common hydrophilic and lipophilic antioxidants such as polyphenols, tocopherols, carotenoids, ascorbic acid, coenzyme Q10 and  $\alpha$ -lipoic acid, astaxanthin has been shown to have the strongest singlet oxygen ( $^1O_2$ ) quenching activity when using the same test conditions. Table 1 shows the chemiluminescence detection system that was used for the direct  $^1O_2$  counting that utilized the thermodissociable endoperoxides of 1,4-dimethylnaphthalene as the  $^1O_2$  generator in DMF:  $CDCl_3$  (9:1) [3]. The hydroxyl radical scavenging ability of astaxanthin encapsulated in liposomes has also been shown to be more potent than that of  $\alpha$ -tocopherol [4].

### 1.3. Safe antioxidant activity

Martin et al. investigated 17 carotenoids and then divided them into three classes; (i) without significant antioxidative properties, (ii) anti- and pro-oxidants, and (iii) pure anti-oxidants. Astaxanthin was classified as a “pure anti-oxidant” as it did not possess any pro-oxidative properties similar to  $\beta$ -carotene and lycopene [5]. Non-polar carotenoids such as lycopene and  $\beta$ -carotene caused disorder of the membrane bilayer enriched with polyunsaturated fatty acids and showed a potent pro-oxidant effect (>85%



**Fig. 1.** Superior position in cell membrane.

Download English Version:

<https://daneshyari.com/en/article/2564408>

Download Persian Version:

<https://daneshyari.com/article/2564408>

[Daneshyari.com](https://daneshyari.com)