

Zeaxanthin

Zeaxanthin is one of the most common carotenoid alcohols found in nature. It is important in the xanthophyll cycle. Synthesized in plants and some micro-organisms, it is the pigment that gives paprika (made from bell peppers), corn, saffron, wolfberries, and many other plants and microbes their characteristic color.^{[1][2]}

The name (pronounced *zee-uh-zan'-thin*) is derived from *Zea mays* (common yellow maize corn, in which zeaxanthin provides the primary yellow pigment), plus *xanthos*, the Greek word for "yellow" (see xanthophyll).

Xanthophylls such as zeaxanthin are found in highest quantity in the leaves of most green plants, where they act to modulate light energy and perhaps serve as a non-photochemical quenching agent to deal with triplet chlorophyll (an excited form of chlorophyll) which is overproduced at high light levels during photosynthesis.

Animals derive zeaxanthin from a plant diet.^[2] Zeaxanthin is one of the two primary xanthophyll carotenoids contained within the retina of the eye. Zeaxanthin supplements are typically taken on the supposition of supporting eye health. Although there are no reported side effects from taking zeaxanthin supplements, the actual health effects of zeaxanthin and lutein are not proven,^{[3][4][5]} and, as of 2018, there is no regulatory approval in the European Union or the United States for health claims about products that contain zeaxanthin.

As a food additive, zeaxanthin is a food dye with E number E161h.

Contents

Isomers and macular uptake

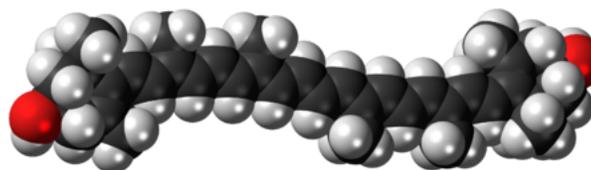
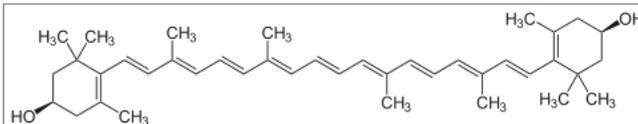
Relationship with diseases of the eye

Natural occurrence

Safety

References

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Names

IUPAC name

4-[18-(4-hydroxy-2,6,6-trimethyl-1-cyclohexenyl)-3,7,12,16-tetramethyl-octadeca-1,3,5,7,9,11,13,15,17-nonaenyl]-3,5,5-trimethyl-cyclohex-3-en-1-ol

Other names

β,β-carotene-3,3'-diol

Identifiers

CAS Number

144-68-3 (<http://www.commonchemistry.org/ChemicalDetail.aspx?ref=144-68-3>) ✓

3D model (JSmol)

Interactive image (<https://chemapps.stolaf.edu/jmol/jmol.php?model=CC1%3DC%28C%28C%5BC%40%40H%5D%28C1%29O%29%28C%29C%29%2FC%3DC%2FC%28%3DC%2FC%3DC%2FC%28%3DC%2FC%3DC%2FC%3DC%28%2FC%3DC%2FC%2%3DC%28C%5BC%40H%5D%28CC2%28C%29C%29O%29C%29%5CC%29%2FC%29%2FC>)

ChEBI

CHEBI:27547 (<https://www.ebi.ac.uk/chebi/searchId.do?c>)

the other, research does not separate effects of one from the other.^{[11][12]}

Except where otherwise noted, data are given for materials in their standard state (at 25 °C [77 °F], 100 kPa).

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- Three subsequent meta-analyses of dietary lutein and zeaxanthin concluded that these carotenoids lower the risk of progression from early stage AMD to late stage AMD.^{[13][14][15]}
- A 2017 Cochrane review of 19 studies from several countries, however, concluded that dietary supplements containing zeaxanthin and lutein have little to no influence on the progression of AMD.^[16] In general, there remains insufficient evidence to assess the effectiveness of dietary or supplemental zeaxanthin or lutein in treatment or prevention of early AMD.^{[2][11][16]}

As for cataracts, two meta-analyses confirm a correlation between high serum concentrations of lutein and zeaxanthin and a decrease in the risk of nuclear cataract, but not cortical or subcapsular cataract. The reports did not separate a zeaxanthin effect from a lutein effect.^{[17][18]} The AREDS2 trial enrolled subjects at risk for progression to advanced age-related macular degeneration. Overall, the group getting lutein (10 mg) and zeaxanthin (2 mg) did not reduce the need for cataract surgery.^[19] Any benefit is more likely to be apparent in subpopulations of individuals exposed to high oxidative stress, such as heavy smokers, alcoholics or those with low dietary intake of carotenoid-rich foods.^[20]

In 2005, the US Food and Drug Administration rejected a *Qualified Health Claims* application by Xangold, citing insufficient evidence supporting the use of a lutein- and zeaxanthin-containing supplement in prevention of AMD.^[21] Dietary supplement companies in the U.S. are allowed to sell lutein and lutein plus zeaxanthin products using *Structure:Function language*, such as "Helps maintain eye health", as long as the FDA disclaimer statement ("These statements have not been evaluated...") is on the label. In Europe, as recently as 2014, the European Food Safety Authority reviewed and rejected claims that lutein or lutein plus zeaxanthin improved vision.^[22]

Natural occurrence

Zeaxanthin is the pigment that gives paprika (made from bell peppers), corn, saffron, wolfberries, and many other plants their characteristic color.^[2] Spirulina is also a rich source and can serve as a dietary supplement.^[23] Zeaxanthin breaks down to form picrocrocin and safranal, which are responsible for the taste and aroma of saffron.^[24]

Foods containing the highest amounts of lutein and zeaxanthin are dark green leaf vegetables, such as kale, spinach, turnip greens, collard greens, romaine lettuce, watercress, Swiss chard and mustard greens.^{[2][25]}

Safety

An acceptable daily intake level for zeaxanthin was proposed as 0.75 mg/kg of body weight/day, or 53 mg/day for a 70 kg adult.^[26] In humans, an intake of 20 mg/day for up to six months had no adverse effects.^[26] As of 2016, neither the U.S. Food and Drug Administration nor the European Food Safety Authority had set a Tolerable Upper Intake Level (UL) for lutein or zeaxanthin.

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 - In their evaluation of the safety of synthetic zeaxanthin as a Novel Food, the EFSA NDA Scientific Panel [37] applied a 200-fold safety factor to this NOAEL to define an ADI of 0.75 mg/kg bw/day, or 53 mg/day for a 70 kg adult.
 - Formulated zeaxanthin was not mutagenic or clastogenic in a series of in vitro and in vivo tests for genotoxicity.
 - Information from human intervention studies also supports that an intake higher than 2 mg/day is safe, and an intake level of 20 mg/day for up to 6 months was without adverse effect."

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