

## **β-carotene and all about (Molecular Formula (C<sub>40</sub>H<sub>56</sub>))**

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### **ABSTRACT:**

*A plant pigment that is an isomer of carotene, important in the diet as a precursor of vitamin A. Red, brownish-red or purple-violet crystals or crystalline powder (color varies according to extraction solvent used and conditions of crystallization). Beta carotene is found in carrots, Herbs and spices – chili powder, oregano, Paprika, Parsley, Margarines, Onions, Peas, Peppers, Plums, Pumpkin, Spinach, Squash, Sweet potatoes. The human body converts beta-carotene into vitamin A (retinol). Beta-carotene is a precursor of vitamin A. We need vitamin A for the health of the skin and mucous membranes, our immune system and for good health and eyesight. Vitamin A can be derived from the food we eat, for example, through beta carotene or as a supplement. Some studies have suggested that those who consume at least four daily servings of beta carotene rich fruits and or vegetables have a lower risk of developing cancer or heart disease. If you follow a healthy diet rich in beta carotene you do not need supplements. Advantages as well as disadvantages of "beta-carotene". Our Research includes what effect "beta-carotene" has on Humans. Our Research is on basis of experimental evidences (of course we've not done it on animals). We've done this research in order to have a clear vision regarding 'BETA-CAROTENE'. β-Carotene belongs to a group of more than 600 compounds, jointly called as carotenoids. It has numerous biological functions in the human body and as man cannot synthesize any of them, it is necessary to provide these precious compounds with food or pharmaceutical products. Rising, therefore, market demand stimulates the development of its diverse production methods. Originally β-carotene was recovered from plants by physicochemical extraction and mainly from carrots. Nowadays β-carotene is mainly produced through chemical synthesis. But quite recently biotechnology makes a great approach toward β-carotene production as bioactive compounds of natural origin reveal higher Bio-accessibility and higher consumer trust on market.*

**Keywords:** abdominal ,angioplasty ,antioxidant, apricot ,asbestos, Beta carotene, bronchitis , cantaloupe ,carcinoma , carotenoids, cervical, Chromatography ,chronic, colon, diarrhea, dietary, degeneration, dunaliella , erythropoietic protoporphyria , isoprene, leukemia, leukoplakia , lipophilic , mono oxygenase melanoma ,multivitamin, macular ,peppers, pigment ,pyrophosphate ,placebo, prostate , , pulmonary, salina , selenium , squash ,tumor, terpenoid, thyroid osteoarthritis.

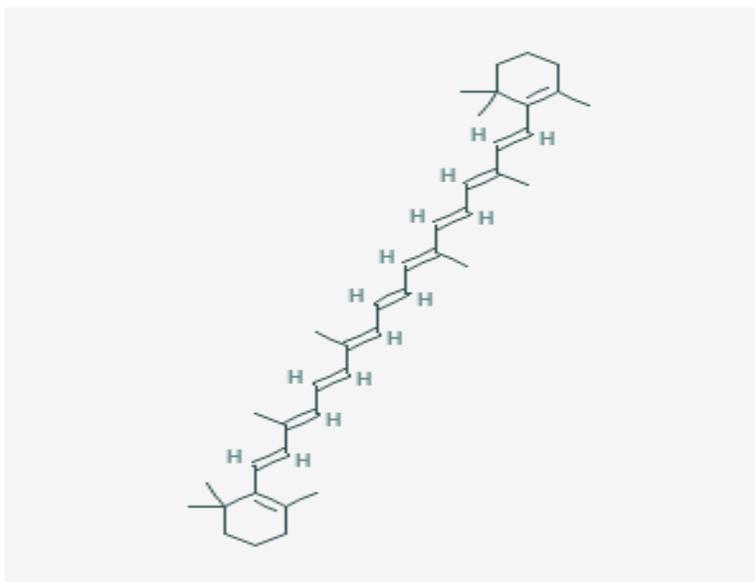
### I. INTRODUCTION:

$\beta$ -Carotene is an organic, strongly colored red-orange pigment abundant in plants and fruits. It is a member of the carotenes, which are terpenoids (isoprenoids), synthesized biochemically from eight isoprene units and therefore have 40 carbon atoms. Among the carotenes,  $\beta$ -carotene is distinguished by having beta-rings at both ends of the molecule.  $\beta$ -Carotene is biosynthesized from geranylgeranyl pyrophosphate.  $\beta$ -Carotene is the most common form of carotene in plants. When used as a food coloring, it has the E number E160a. The structure was deduced by Karrer et al. in 1930. In nature,  $\beta$ -carotene is a precursor (inactive form) to vitamin A via the action of beta-carotene 15,15'-monooxygenase. Isolation of  $\beta$ -carotene from fruits abundant in carotenoids is commonly done using column chromatography. It can also be extracted from the beta-carotene rich algae. The separation of  $\beta$ -carotene from the mixture of other carotenoids is based on the polarity of a compound.  $\beta$ -Carotene is a non-polar compound, so it is separated with a non-polar solvent such as hexane. Being highly conjugated, it is deeply colored, and as a hydrocarbon lacking functional groups, it is very lipophilic.

### II. PHYSICAL PROPERTIES:

- BETA CAROTENE appears Red-purple in color.
- The boiling point is in range 633-677 °C due to double bond conjugation and resonance.
- Melting point being in the range of 180-182 °C.
- The density of this is 0.941 g/cm<sup>3</sup>. IUPAC NAME- "beta, beta-carotene".
- Molar mass of this is 536.87 g/mol. Molecular formula is C<sub>40</sub>H<sub>56</sub>.
- Insoluble in water as Vitamin A is also insoluble in water.
- Solubility in di-chloro-methane is 4.51 g /kg at 20 °C. It is also soluble in CS<sub>2</sub>, Benzene, CHCl<sub>3</sub>.

### III. STRUCTURE OF BETA CAROTENE :



It consists of 11 double bonds in conjugation and absorbs in lower energy blue and green portions of the spectrum and appears as orange and red.

#### IV IMPORTANCE AND USES :

Beta carotene is an antioxidant. Beta carotene, like all carotenoids, is an antioxidant. An antioxidant is a substance that prevents the oxidation of other molecules; it protects the body from free radicals. Free radicals harm cells through oxidation. Eventually, the damage caused by free radicals can cause numerous chronic illnesses. Some studies have suggested that those who consume at least four servings of beta-carotene daily in fruits and / or vegetables have a lower risk of developing cancer or heart disease. Some studies have suggested that those who consume at least four daily servings of beta carotene rich fruits and/or vegetables have a lower risk of developing cancer or heart disease. Beta carotene may slow down cognitive decline.

Men who have been consuming beta carotene supplements for 15 or more years are considerably less likely to experience cognitive decline than other males, researchers from Harvard Medical School reported in Archives of Internal Medicine (November 2007 issue). Oxidative stress may be the be a key factor in cognitive decline, the researchers explained. Studies have shown that antioxidant enhancements may help prevent the weakening of cognition. Their study, which involved 4052 men, compared those with beta-carotene supplements for an average of 18 years with others who received placebo. In the short term, they found no difference in the risk of cognitive decline between the two groups of men, but in the long run it became clear that beta-carotene supplements made a noticeable difference. The researchers highlighted that there may have been other factors which contributed to the slower decline in cognitive abilities among the men in the beta carotene group. Beta carotene keeps lungs hale and hearty as people age. Treating sun sensitivity in people who have a form of inherited blood disorder called "erythropoietic protoporphyria." Consuming beta-carotene by mouth can decrease sensitivity to the sun in people with Erythropoietic protoporphyria

- Age-related macular degeneration also known as AMD is an eye disease . Intake of beta carotene via mouth along with vitamin C, vitamin E, and zinc daily, seems to help avert vision loss and worsening of AMD in people with advanced AMD. Taking beta-carotene plus antioxidants but without zinc does not seem to improve advanced AMD. There are not sufficient evidence to know prove that beta-carotene along with other antioxidants works for people with less advanced macular disease. There is contradictory evidence about whether beta-carotene supplements can help reduce the risk of developing AMD.
- Breast cancer. Consuming more fruits and vegetable that contain beta-carotene seems to decrease the risk of breast cancer in pre-menopausal women who are at great risk of getting breast cancer, counting those with a family history and those who use alcohol disproportionately.
- Prevention of COPD (chronic obstructive pulmonary disease,) a lung disease .Increase in intake of beta-carotene in the diet appears to help prevent bronchitis and difficulty breathing in smokers with COPD, but beta-carotene supplements do not.
- Asthma attacks activated by exercise. Intake of beta-carotene by mouth seems to reduce asthma attacks that are triggered by exercise.
- White patches on the tongue and mouth are called oral leukoplakia. Consumption of beta-carotene by mouth for up to 12 months seems to reduce signs of oral leukoplakia.
- Osteoarthritis. Beta-carotene intake by mouth may prevent osteoarthritis from getting worse, but it does not seem to prevent osteoarthritis.
- Ovarian cancer. Consuming food rich in carotenoids, including beta-carotene, lessens the threat of ovarian cancer in women after menopause.
- Physical performance. Eating a diet that include a higher amount of beta-carotene seems to improve physical performance and muscle strength in older people.
- Preventing complications post-childbirth. Intake of beta-carotene by mouth before, during, and after pregnancy seems to reduce the commonness of diarrhea and fever post-childbirth.
- Pregnancy-related difficulties. Beta-carotene consumption by mouth seems to reduce the risk of pregnancy-related death, pregnancy-related night blindness, and post-childbirth diarrhea and fever in underfed (malnourished) women.

- Sunburn. Intake of beta-carotene by mouth may decrease sunburn in people sensitive to the sun. However, consumption of beta-carotene is unlikely to have much effect on sunburn risk in most people. Beta-carotene does not seem to reduce the risk of skin cancer or other skin disorders related with sun exposure.

#### IV. SIDE EFFECTS :

- Beta-carotene is **LIKELY SAFE** in adults and children when taken by mouth in suitable amounts for certain specific medical conditions. However, beta-carotene supplements are inadvisable for general use.
- Consumption of beta carotene by mouth when taken long-term is possibly unsafe. A doses of beta carotene can change color of skin to orange or yellow.
- There is developing concern that taking high doses of antioxidant supplements such as beta-carotene might do more damage than good. Some research shows that taking high doses of beta-carotene supplements might increase the chance of death from all causes, increase the risk of certain cancers, and possibly other serious side effects. Along with this, there is also concern that consuming large amounts of a multivitamin plus a separate beta-carotene supplement enhances the chance of developing advanced prostate cancer in men.
- Special Precautions & Warnings: Pregnancy and breast-feeding: Beta-carotene is **LIKELY SAFE** when taken by mouth in suitable amounts. However, high prescriptions of beta-carotene supplements are not recommended for general use during pregnancy and breast-feeding.
- Smoking: In people who smoke, beta-carotene supplements might lead to intensification for the risk of colon, lung, and prostate cancer. Avoid consumption of beta-carotene supplements if you smoke.
- Asbestos exposure: Beta carotene supplements may increase the risk of cancer in people who have been exposed to asbestos. If you have been exposed to asbestos then avoid taking beta carotene supplements.
- Angioplasty, a heart procedure. There is certain concern that when antioxidant vitamins, including beta-carotene, are used together they might have harmful effects after angioplasty. They can interfere with healing. Don't use beta-carotene and other antioxidant vitamins before or after angioplasty without the recommendation of your healthcare provider.

#### V. INEFFECTIVE AGAINST :

- Preventing abdominal aortic aneurysm, or the enlargement of a large vessel running through the abdomen .Evidence suggests that consuming beta-carotene by mouth for about 5.8 years does not reduce the occurrence of abdominal aortic aneurysm in male smokers.
- Cancer: Beta-carotene does not seem to prevent or decrease death from uterine cancer, cervical cancer, thyroid cancer, bladder cancer, skin cancers (melanoma, basal cell carcinoma, squamous cell carcinoma), brain cancer, and blood cancer (leukemia). However, some research recommends a combination of beta-carotene with vitamin C, vitamin E, selenium, and zinc might lower cancer rates in men, but not women. Researchers speculate that men have lower intake of dietary antioxidants and therefore might benefit more from supplements.
- Heart disease : A Science Advisory from the American Heart Association states that the evidence does not clarify use of antioxidants such as beta-carotene for reducing the risk of heart disease. Evidence also shows that beta-carotene in combination with vitamin C and E does not decrease heart disease risk.
- Colon cancer : Research shows that taking beta-carotene by mouth, alone or with vitamins C and E, selenium, and calcium carbonate, does not prevent risk of colon tumor growth. In some people who have had colon tumors removed, taking beta-carotene supplements seems to reduce the risk of recurrence. However, in people that smoke cigarettes and drink alcohol, taking beta-carotene supplements increases the risk of new tumors. It is

not clear if dietary beta-carotene reduces the risk of colon cancer.

- Lung cancer : Consumption of beta-carotene actually seems to increase the risk of lung cancer in people who smoke (especially those smoking more than 20 cigarettes per day), former smokers, people exposed to asbestos, and those who consume alcohol (one or more drinks per day) in addition to smoking. However, beta-carotene from food does not appear to have this adverse effect. Also, taking supplements containing beta-carotene, vitamin E, and selenium for about 5 years does not reduce the risk of death in people previously diagnosed with lung cancer.
- Prostate cancer : Intake of beta-carotene supplements does not prevent prostate cancer in most men. In fact, there is some concern that beta-carotene supplements might actually rise the risk of prostate cancer in some men. There is evidence that men who take a multivitamin daily along with a separate beta-carotene supplement have an amplified risk of developing advanced prostate cancer. Also, men who smoke and take beta-carotene supplements have in increased risk of developing prostate cancer.

#### VI. Methodology/Experimental Materials/Theory:

Main Source to obtain Beta Carotene are Carrots.

Other Sources Being Sweet potatoes, Dark leafy greens, such as kale and spinach, romaine lettuce, Squash, red and yellow peppers, apricots, Cantaloupe. Beta carotene is an antioxidant that converts to vitamin A and plays a very important role in health. It's responsible for the red, yellow, and orange coloration of some fruits and veggies.

#### VII. Synthesis/Algorithm/Design/Method :

Take carrot extract carotene from carrot roots, crush well in a mixture and extract in ethanol & filter to remove solid mass then concentrate the solution. Thick mass extracted in pet. Ether & concentrated by rotary evaporation to get orange colored carotene in the flask.

Carotene can be obtained from carrot roots by alcoholic extraction or extraction with petroleum ether.

#### VIII. Results and Discussions :

Found the effect of BETA CAROTENE on Humans. Some Myths related to that as earlier Research said it's actually good, but it's not that helpful until consumed to a certain extent. It does damage Humans who smoke. Well evidences till now suggest it's actually not bad, but no good either.

#### IX. Future Scope :

BETA CAROTENE using Chromatography and Spectroscopy, We can make a synthetic enzyme or vitamin which can be used instead of BETA CAROTENE to perform the same activity and which will be less dangerous or not toxic at all.

Controlled consumption of beta carotene is not harmful or fatal.

#### X. Conclusion :

Earlier we used to believe that BETA CAROTENE is dangerous, actually it's not instead VITAMIN A is dangerous. Too much consumption of BETA CAROTENE is dangerous for people who SMOKE. Because our body converts BETA CAROTENE in VITAMIN A as required/needed. But still it's harmful. The Consumption amount of BETA CAROTENE is Adults and teenagers: 6 to 15 milligrams (mg) of beta-carotene (the equivalent of 10,000 to 25,000 Units of vitamin A activity) per day. Children: 3 to 6 mg of beta-carotene (the equivalent of 5,000 to 10,000 Units of

vitamin A activity) per day. This Debate is still unsolved like many because we can't directly say that it's good or bad as this as 2 sides like many.

#### **XI. Acknowledgment :**

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