

May 23, 2018

Today I want to talk about essential oils, hydrophobic molecules and how we understand them in our processes and application of them. The two molecules we will address are astaxanthin and CBD. This is a story of why they are both interesting, and why they are perhaps compelling in combination:

Astaxanthin is a very powerful anti-oxidant, several hundred to thousands of times more powerful and longer lasting than most others. It has an Oxygen Radical Absorption Capacity (ORAC) index of 2.8 million. However, it does not much like water, it likes oil. It is hydrophobic, and it is a lipophile. Most all of the astaxanthin on the market that is useful is extracted from an alga called *Haematococcus pluvialis*, (HP) an algal cell that at maturity is about 50 microns in diameter.

In its natural life cycle, it goes through a kind of hibernation and in preparation for this hibernation the chlorophyll in the chloroplasts is liberated and travels to the stored starches and sugars made during the green phase and converts it all to astaxanthin. Being in a water-based environment, as these molecules are formed they “encyst” themselves. This also protects during hibernation from being digested. Think about it as a bunch of pairs of treble hooks connected by a short string mixed up in a knot. So when we get the astaxanthin to the cell plasma and other plasma membranes it does great long term good. But how to get it there? What we are taking was designed by nature to be indigestible, we need to fix that!

Our technology solves this problem by bypassing Super Critical Carbon Dioxide (SCCO) with a unique process that untangles these treble hooks and pairing a hydrophobic molecule with a hydrophilic molecule. This is our delivery system.

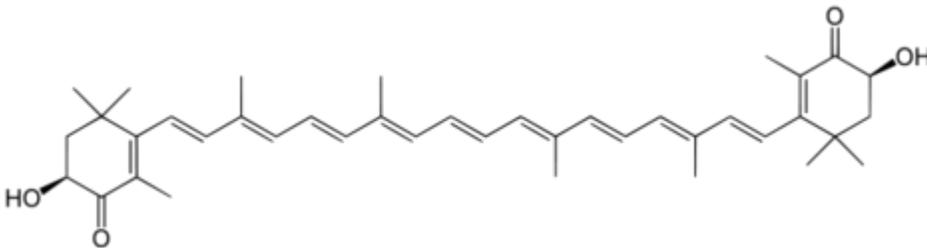
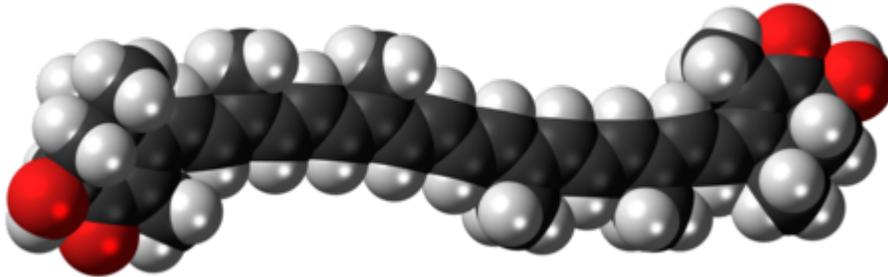
The digestive system, the digestive membranes, the stomach the intestines, and the blood system are all water based. So getting a hydrophobic molecule to the plasma membranes is a trick mastered by nature and now by us.

Once the astaxanthin is in the plasma membrane, because every other carbon bond is a double, called conjugated, it is an excellent funnel for taking reactive oxidative species out of the cell and getting them to the outside, where molecules like vitamin C can carry

them out through elimination. Vitamin C is water soluble and eliminated about every six hours.

Astaxanthin: $C_{40}H_{52}O_4$ Molar Mass: 596.84 grams/mole

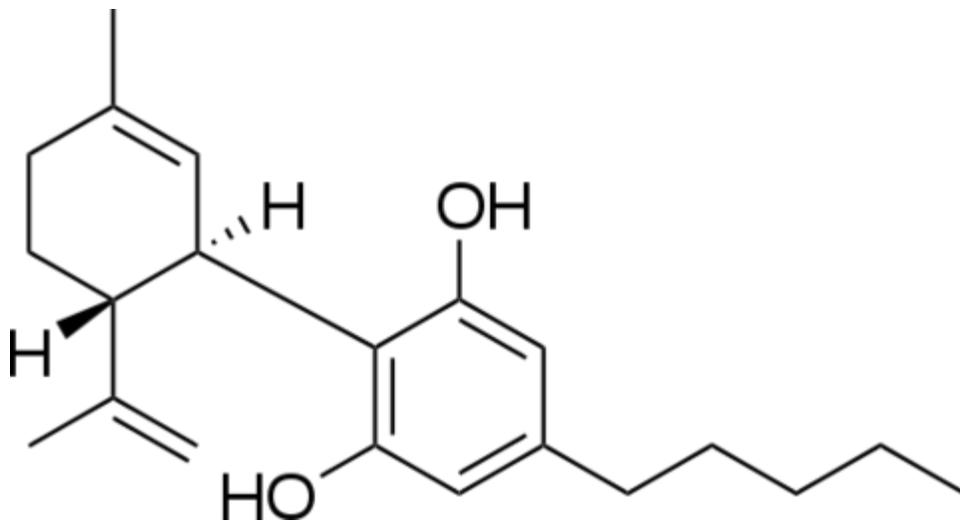
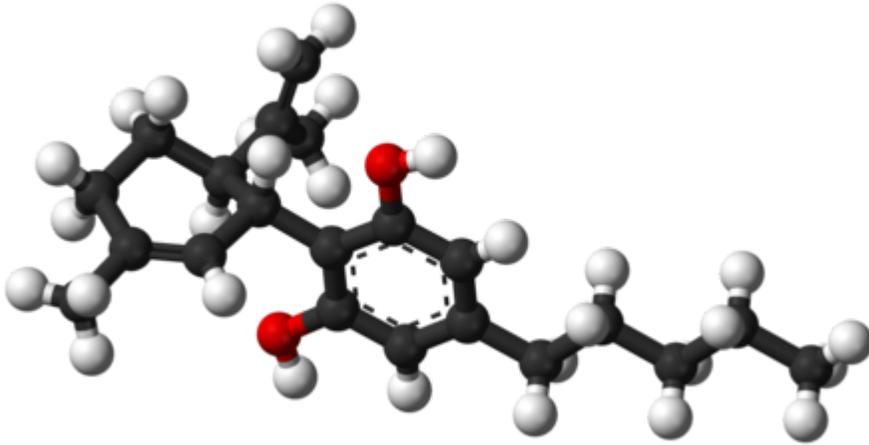
Astaxanthin is a colorful, lipid-soluble pigment. This color is due to the extended chain of conjugated (alternating double and single) double bonds at the center of the compound. This chain of conjugated double bonds is also responsible for the antioxidant function of astaxanthin (as well as other carotenoids) as it results in a region of decentralized electrons that can be donated to reduce a reactive oxidizing molecule. It is highly hydrophobic and highly soluble in oils, lipids and alcohols. For instance it is what gives wild salmon its color.



Astaxanthin had been in our diet throughout our evolution till about 20,000 years ago, when we started industrializing food production. So till then it was always there assuring that our cells and organs were not damaged by excessive oxidative stress. In our evolutionary diet we got small but constant amounts of highly bio available astaxanthin from the flesh of the animals and foods we consumed.

Because it is not so much in our diet anymore, we need to supplement. But in this case we are supplementing with a food from HP which by evolutionary design was made to be indigestible! SN's breakthrough is an economical process to make an astaxanthin from HP which is highly bio available, making it a helpful supplement.

Cannabidiol $C_{21}H_{30}O_2$ Molar Mass: 314.4636 grams/mole

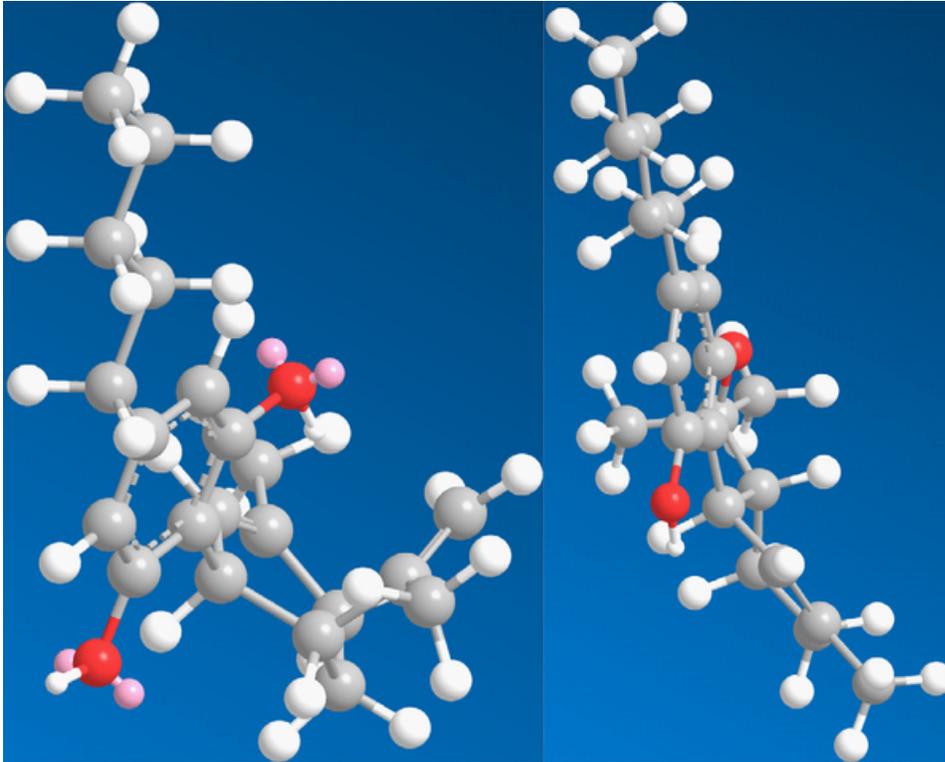


CBD is, like astaxanthin, hydrophobic. However, unlike astaxanthin, animals make it. We humans make it. When a system starts with “ENDO” that means it is made internally. Thus we have the “endocannabinoid system” (ECB) where we make CBD internally. As we explained earlier, CBD is now understood to be a powerful factor in the eicosanoid system, a major regulatory set of systems important to our health. It

enhances or even enables Arachidonic acid release from phospholipids which is the beginning of the process for making eicosanoids. All these processes are very sensitive to oxidative stress. So a weak antioxidant function in the cells will impair these processes. There are two ways to fix this: improve the antioxidant function with astaxanthin and add more CBD as a supplement. In this case we need to understand more about CBD and how to make it bioavailable and how to make our systems more efficient. We believe that SN and SNCE Labs process do this in the most optimal way.

In her paper, *Cannabidiol (CBD) and its analogs: a review of their effects on inflammation*, Sumner Burstein teaches us as follows:

Although there is considerable structural overlap between CBD and THC (Fig. 1), the conformational structures shown in Figure 1A differ significantly. Whereas THC exists in an essentially planar conformation, CBD adopts a conformation in which the two rings are more or less at right angles to each other (Fig. 1). A result of this is the observation that CBD does not bind to or activate the CB1 receptor an action that THC is capable of doing. This in turn leads to a complete lack of psychoactivity by CBD unlike THC, which is the psychoactive principle of Cannabis.



CBD

Figure 1

THC

SNCE Labs extracts essential oils from *Cannabis sativa*. We are focused on “Industrial Hemp”, which has very little THC and lots of CBD. As a result, our extraction efficiency at 99% allows us to extract most all the oils. For instance, in our typical extraction we extract all the chlorophyll. Our broad-spectrum green CBD oil has a lot of chlorophyll. Chlorophyll is an excellent carrier to bring CBD molecules to the plasma membrane.

My conclusions today:

1. There is a strong interdependence between the antioxidant function in our cellular functions and the operation most all operations in our biology and especially of the endocannabinoid system and the eicosanoid systems.

2. A strong antioxidant function will enhance biological operations and especially the endocannabinoid and eicosanoid systems. A strong reactive oxidative species function will badly impair them.
3. Astaxanthin is among the best antioxidant species we can find and was part of our evolutionary diet. But if we take it as a supplement, we need to assure that it is bioavailable. It is hydrophobic and when it is extracted from HP it must be molecularly separated from the cyst.
4. CBD is not psychoactive because it cannot bind with the THC receptors, it having a right angle between the two rings whereas THC is nearly planar. The THC receptors require a planar coupling.
5. However, CBD has been found to be a very powerful initiator of Arachidonic acid release, which is necessary for the instant formation and use of eicosanoids, which are a major regulatory system in our cellular health and which are made after Arachidonic acid release from Omega 3 and Omega 6 fatty acids.
6. A combination of DHA rich Omega 3, CBD and astaxanthin in a highly bioavailable form would be a very interesting supplement for humans and animals both. More to follow!