CHLOROPHYLL PLANT BLOOD AND BENEFITS FOR THE HUMAN BODY

Tagauov Ersultan

PhD degree student, Al-Farabi Kazakh Nationa University, Kazakhstan, Almaty

Abdrasulova Zhanna

научный руководитель, PhD, Senior Lecturer, Al-Farabi Kazakh Nationa University, Kazakhstan, Almaty

ХЛОРОФИЛЛ КРОВЬ РАСТЕНИЙ И ПОЛЬЗА ДЛЯ ОРГАНИЗМА ЧЕЛОВЕКА

Тагауов Ерсултан Джанабаевич

докторант, Казахский Национальный университет имени аль-Фараби,

Казахстан, г. Алматы

Абдрасулова Жанна Тубекбаевна

PhD, старший преподаватель, Казахский Национальный университет имени Аль-Фараби, Казахстан, г. Алматы

Abstract. The article describes the contribution of scientists to the development of ideas about chlorophyll and its benefits for the human body and its use in medicine. Chlorophyll is concentrated solar energy. It has a stimulating effect on various organs and systems - the cardiovascular, pulmonary, gastrointestinal system, kidneys and others, which has become especially relevant in our time.

Аннотация. В статье написано вклад ученых в развитие представлений о хлорофилле и пользе для организма человека и применение в медицине. Хлорофилл является концентрированной солнечной энергией. Он оказывает стимулирующее влияние на различные органы и системы - сердечно-сосудистую, легочную, желудочно-кишечную систему, почки и другие что особенно стало актуально в наше время.

Keywords: Chlorophyll, ontogenesis, photosynthesis, dedoxification, hematopoiesis.

Introduction:

Ключевые слова: Хлорофилл, онтогенез, фотосинтез, дедоксикация, гемопоэза.

Chlorophyll is the main structural unit of photosynthetic light-collecting devices (antennas) of green plants, which are nanoscale supramolecular complexes containing up to several hundred pigments

in a protein environment. The main functions of chlorophyll are the absorption of light, the conversion of light energy into electronic energy and its transfer through van der Waals (dipole-dipole) interaction to neighboring molecules. Along the chlorophyll chain, electronic energy is transferred to the photosynthesis reaction center, where it is used for spatial charge separation and subsequent redox reactions. Chlorophylls are also part of the reaction centers of green plants, where they play the role of primary electron donors.

In plants, chlorophylls as part of antennas and reaction centers are located in photosynthetic membranes, where they are spatially fixed in certain places with the help of wick side chains and additional complexation between the Mg2+ ion and polypeptide chains of proteins.

The analogy between chlorophyll and hemoglobin can be demonstrated by their structure. The structure of both compounds has striking similarities, only the difference of the central metal atom - magnesium (Mg) in chlorophyll and iron (Fe) in hemoglobin (Figs. 1 and 2.). But only in hemoglobin - 4 iron atoms, and in chlorophyll - 4 magnesium atoms, there is no more difference. Related to this is the difference in color. Therefore, everything that is green (from plants) contains a large amount of chlorophyll. The obvious similarity between the two is thus considered responsible for the therapeutic effects shown in chlorophyll in conditions associated with hemoglobin deficiency.

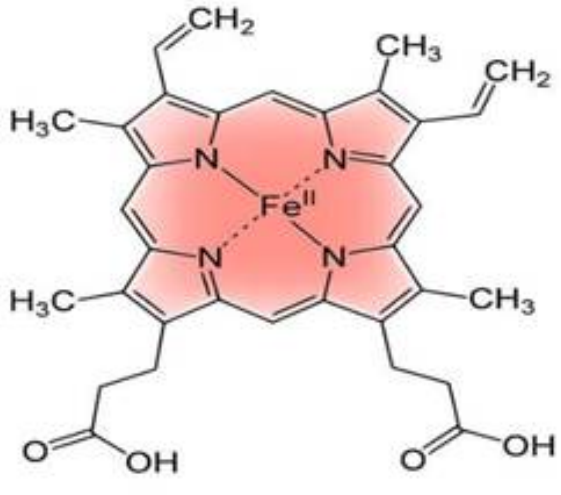

Figure 1. Hemoglobin formula

Figure 2. Chlorophyll formula

History of discovery

Back in 1771, the English naturalist Joseph Priestley discovered photosynthesis. Life on Earth is based on photosynthesis of plants: using the energy of the Sun, they provide animals and humans with food and oxygen. The chlorophyll molecule, having absorbed a quantum of light, triggers a complex mechanism of photophysical, photo- and biochemical and other processes (Fig. 3.)

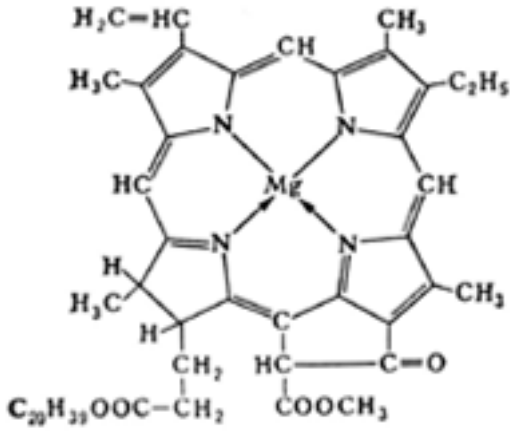

Figure 3. The structural formula of the chlorophyll molecule

The possibility of extracting green leaf pigments with alcohol was already known to the French scientist J. Senebier in 1782-1800 In 1817, French chemists P. Peltier and J. Covantou named a green alcohol solution of a mixture of plant pigments chlorophyll. Experimental evidence that light absorbed by chlorophyll leads to photosynthesis was obtained in parallel studies by the Russian scientist K.A. Timiryazev and the German scientist N. Muller in 1872-1876. This idea became generally accepted after the works of the German scientist Reinke (1884-1885). Many researchers have tried to find ways to purify green pigments and determine their chemical structure. In particular, the Russian botanist I.P. Borodin in 1882 described the production of a chlorophyll derivative - crystalline ethyl chlorophyllide under the action of ethanol on leaves. These studies were confirmed and continued by the Russian researcher N.A. Monteverde in 1893. The task of isolating pure green pigments was solved in 1906-1908 by the Russian scientist M.S. Tsvet using the chromatographic method developed by him. The color showed that the green pigment of plants is a mixture of two pigments, later called chlorophylls a and b.

The chemical structure of chlorophyll a was found out by German scientists R. Wilstetter, A. Stoll and H. Fischer. Fischer began work on the chemical synthesis of chlorophyll, and the complete synthesis of chlorophyll was performed by the American chemist R. Woodward in 1960.

The final stereochemical structure of chlorophyll was determined by the famous English organic chemist Ian Fleming, an article about this was published in the journal "Nature" in 1967. Now in any textbook on plant physiology you can find a "portrait" of this famous molecule. Although its true dimensions are extremely modest, the structural formula of chlorophyll takes up an entire page. The magnesium-porphyrin ring is an almost flat plate with a thickness of 0.42 nm and an area of

1 nm2 is the hydrophilic part of the molecule. The long aliphatic residue of phytol (2 nm), forming an angle with the porphyrin ring, is its hydrophobic pole, necessary for interaction with sites of membrane proteins and lipids.

Another Nobel Prize in Chemistry was awarded in 1988 "for establishing the three-dimensional structure of the photosynthetic reaction center of chlorophyll" to three German scientists - Hartmut Michael, Robert Huber and Johann Deisenhofer. Already as a postdoc in the laboratory of D. Osterhelt, H. Michel was engaged in the insoluble problem of membrane protein crystallization at that time. In 1970, D. Osterhelt discovered bacteriorhodopsin (a membrane photosensitive protein of halobacteria, similar in structure to mammalian rhodopsin) and the mechanism of its operation In 1978.

H. Michael accidentally noticed that bacteriorhodopsin placed in the freezer forms small glassy corpuscles. Using this observation, he spent a whole year trying to obtain its crystals, although at that time it was officially considered impossible to crystallize the membrane protein. When x . Michael eventually managed to obtain bacteriorhodopsin crystals, it turned out that they were irregular and unsuitable for X-ray diffraction studies. Tired of this work, the scientist decided to apply his techniques to isolate other membrane proteins. In 1971 he managed to obtain a good

crystal of the photosynthetic reaction center from the purple bacterium Rhodopseudomonas viridis. In 1972-1985, H. Michel, together with R. Huber and I. Deisenhofer, were able to obtain the exact structure of the bacterial reaction photosynthetic center.

Benefits for the body

Studies show that chlorophyll is very useful for humans

Chlorophyll is a unique natural supplement that enriches the body with the following substances:

magnesium;

vitamins A, K, E;

calcium;

iron;

potassium;

Improving blood composition The molecular structure of chlorophyll is similar to hemoglobin, an important element of blood. That is why the supplement is used to prevent anemia, relieve menstruation. The pigment restores red blood cells and increases their number. The blood is purified, tissues and organs stop experiencing oxygen deficiency.

Detoxification Due to the influx of fresh blood to the organs, the process of natural detox is started. Heavy metals and toxins are excreted from the body. The liver is cleansed and renewed. An important part of detox is starting the work of the intestine. Chlorophyll normalizes peristalsis, heals ulcers, eliminates putrefactive processes, maintains the balance of microflora.

Application in medicine

At the beginning of the 20th century, scientists discovered that blood hemoglobin has a similar structure to chlorophyll, only in the first case the protein structure is formed around an iron molecule, and in the second around magnesium. Chlorophyll began to be called the blood of green plants.

The first scientific data on chlorophyll were published in 1940 in the professional journal "American Surgical Journal" № 49. It was scientifically proven that chlorophyll accelerates the processes of tissue regeneration. But, unfortunately, it was a time of fascination with antibiotics and not only doctors, but also pharmaceutical companies gave them preference.

We must pay tribute to dentists from the state of Michigan (USA), who have been studying the effect of chlorophyll on the micro-ecology of the oral cavity for 2 decades. Dr. Robert Nara has developed a dental caries prevention program using toothpaste containing chlorophyll. The scientist correctly assumed that chlorophyll, participating in photosynthesis, is directly related to the production of oxygen. Oxygen is the strongest antibacterial agent. This has been proven once again in relation to the bacteria that cause caries.

But not only the local use of chlorophyll attracts medical scientists. In 1976, Israeli scientists conducted successful experiments on mice with an experimental model of acute pancreatitis, and various types of chlorophyll administration were used. Earlier, scientists from Japan proved the effectiveness of chlorophyll in infectious diseases.

But especially intriguing are the results of research conducted by scientists in Texas (USA) in 1979. According to the standard method, mice were vaccinated with a colon tumor. In mice fed food with chlorophyll extract, the tumor did not develop. This once again proves the old truth that eating greens and vegetables prevents the development of cancers, primarily of the intestine. Japanese scientists have studied about 60 species of plants and vegetables and proved that most of them have anti-carcinogenic properties. Moreover, heating and boiling deprives vegetables of these

properties.

Dr. Chiu-Nan Lai from Anderson Hospital believes that chlorophyll is the main anti-carcinogenic factor. And, of course, all plants rich in chlorophyll have antimutagenic properties - Brussels sprouts, broccoli, spinach, leafy lettuce, alfalfa, chlorella, spirulina, wheat and barley sprouts.

Fresh vegetables, extracts, ointments and toothpaste containing chlorophyll are the natural green pharmacy.

According to the American scientist K. Birsher, chlorophyll is concentrated solar energy. It has a stimulating effect on various organs and systems - cardiovascular, pulmonary, gastrointestinal system, kidneys, etc.

Conclusion

Chlorophyll is useful primarily because it has powerful antioxidant and anti-cancer properties. These substances support the immune system by forming strong molecular bonds with other substances that cause oxidative stress and diseases such as cancer.

The chlorophyll structure of both compounds has striking similarities, so the similarity between the two compounds may be the reason for the limited use of chlorophyll as a blood substitute in chronic anemia, tissue hypoxia, thalassemia and other hemolytic disorders.

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