

Substance overview: C60

REPORT

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THE ORIGIN OF FULLERENE

Introduction

Fullerenes are hollow molecules; they consist of five-membered and six-membered carbon rings. The pentagons in the molecules are surrounded by hexagons, obeying the "rule of isolated pentagons." Along with diamond and graphite, fullerenes are another allotropic form of carbon. The main representative of fullerenes is the C₆₀ molecule (the full name Buckminsterfullerene, which was given in honor of the architect Fuller, who used quasispheroidal hemispheres for his buildings, which have the same structure as fullerenes).

Fullerene is practically insoluble in water, acetone, ethanol, tetrahydrofuran and other polar solvents. The fact that fullerenes are hydrophobic makes it difficult to study their physiological and pharmacological properties.

The most important fundamental properties of fullerenes are their antioxidant activity, they are many times more effective than the antioxidants widely used in medicine, such as vitamins C and E, and due to bioavailability, the effective dosage is much lower.

It is a powerful antiviral and antifungal tool. As "radical trap", it can neutralize more than 20 free radicals with one molecule. It shows 100 times greater effectiveness than all other currently known antioxidants. Preliminary fullerene tests for toxicity did not reveal any adverse effects.

C-60 is a powerful antioxidant and has a strong antiviral effect.

Historical reference

History of discovery and use in medicine

Fullerenes are a group of molecules consisting only of carbon atoms that form a framework of 12 pentagons and several hexagons. The origin of the term "fullerene" is associated with the name of the American architect Richard Buckminster Fuller, who designed hemispherical architectural structures in the form of hexagons and pentagons. [1].

The history of the fullerene application in the treatment of various diseases began 4 centuries before their discovery, since the first official mention of shungite use, a carbon-containing (fullerene-containing) rock, named after the Karelian village Shunga, built on the shore of Lake Onega. Indeed, such a mention of the miraculous power of shungite dates back to the beginning of the 17th century and is associated with the name of Queen Marfa Ivanovna (the noblewoman Ksenia Romanova. Being in exile in the Tolvuiskey graveyard in Zaonezhie, the great "nun" was on the verge of death from a seizure that befell her. However, after the unexpected pardon granted to her by Boris Godunov, the local peasants showed the noblewoman the miraculous healing power of a "spring infused with black stone", with the waters of which they healed themselves for centuries.

"Life" water helped the noblewomen recover and give birth to a son. Seven children, whom she gave birth to in exile, died in infancy. But the newborn - Mikhail Fedorovich Romanov - became the founder of the royal dynasty, which ruled in Russia for more than 300 years. In memory of the noblewoman Ksenia, the miraculous spring was called "Tsareven Klyuch" or "The Royal Spring", which was soon forgotten, and only a few residents of nearby farms used its water.

The miracles of "life" water were remembered a century later. In 1714 when Peter I (Peter The Great) founded a smelter in this region. History recalls that one of the workers, suffered from a serious illness. In Revbolot, from where they brought ore for the plant, he found another spring, whose waters healed him in three days. Having learned of this, Peter ordered to investigate the spring, whose waters flowed through the shungite deposits.

Studies have shown that water has a "great power" against anemia, scurvy, dropsy, liver disease and many others. Healing water treated ordinary people for a variety of diseases, and all of them passed without a trace within 2-3 weeks.

Having experienced the miraculous water on himself, Peter gives the order to build a palace near the source and organize a resort, which became the first Russian resort called "Marcial waters". It is believed that the resort dedicated this name to the war god Mars, because the wounded and sick soldiers of Peter were treated in the waters. Having learned about the unique antiseptic properties of the stone, which endowed the water with great power, Peter ordered each of his soldiers to carry a piece of shungite (this name appeared later, in those days it was called a black slate stone) in camping backpacks. By putting pieces of stone into pots of water, the soldiers received fresh, disinfected water. [2].

In many historical documents, one can find references to the fact that the emperor even issued a special decree ordering soldiers to drink only water disinfected with shungite. These documents also indicate that during the Battle of Poltava, which coincided with the very hot summer of 1709, water sources bloomed, and the water from them was unsafe. Documented is the fact that in the Swedish army there were very frequent cases of gastric poisoning, from which the Swedish king himself suffered. At the same time, there were almost no stomach upsets in the Russian army. It is believed that shungite saved the army from mass ailment, which was used by the soldiers and the emperor himself.

In the years of 1717-1719, by the order of Peter I, Doctors R. Areskin and L. Blumentrost carried out the study of the "Marcial water" composition. They recognized the waters as useful for the treatment of a number of diseases. In consequence of this was the publication of decrees by Peter I on the discovery of "Marcial waters" and "Doctorate rules on how to do it". [3].

In the same years, the article "Authentic inquiries about the effect of the marcial Konchezer water" was published, which contains nine brief descriptions of the diseases with their outcomes after treatment with "Marcial waters".

In the twenties of the XVIII century, Peter I was repeatedly treated in the "Marcial waters". Palaces were built in the resort for the king and his family, which, however, quickly became desolate after the death of the emperor. The Marcial Waters resort also ceased to exist. [2].

After decades, in the middle of the XVIII century, Elizaveta Petrovna tried to revive the first Russian resort. However, the medical doctor Bugaev, who was sent to the Olonets region, returned to the empress with the conclusion that the water from local sources does not have any healing power. Historians claim that this study was, as they say now, "contracted," and the results were rigged in the interests of importers who at that time imported expensive mineral water from abroad. As a

result, the resort was suspended for more than a century and a half. Most of the buildings and palaces were demolished. And only in 1910, construction was resumed in honor of the 300th anniversary of the Romanov dynasty celebration.

The official decline of the resort did not affect the locals in any way. They continued to use the life-giving water. Periodically increasing the scientist's interest in them. So, in one of the works of the beginning of the last century, devoted to medicinal waters, muds and sea bathing in Russia and abroad, the waters of the Marcial deposit are described in detail and it is said that in many respects they significantly exceed the waters of the world-famous resorts Spa and Marienbad.

The resort received a new life in the 30s of the XX century thanks to the activities of S. A. Vishnevsky. He organized an expedition to study the "Marcial waters", the results of which confirmed their unique healing properties. However, at that time, the war prevented the restoration of the resort, and it only began in 1960, but for another 30 years, the nature of the therapeutic effect of shungite remained unknown. [2]

The development of organic chemistry has made it possible to answer this question. So, in the mid-1960s, David Jones constructed closed spheroidal cells from specially folded graphite layers. It was shown that as a defect embedded in the hexagonal lattice of ordinary graphite and leading to the formation of a complex curved surface, there may be a pentagon.

In the early 1970s, organic chemist E. Osawa suggested the existence of a hollow, highly symmetrical C₆₀ molecule with a truncated icosahedron structure similar to a soccer ball. A little later (1973), Russian scientists D. A. Bochvar and E. G. Halperin made the first theoretical quantum chemical calculations of such a molecule and proved its stability.

In 1985, a team of scientists: G. Kroto (England, University of Sussex), Heath, O'Brien, R.F. Curl and R. Smalley (USA, Rice University) managed to detect a fullerene molecule when studying the mass spectra of graphite vapors after laser irradiation of a solid sample. In 1990, by V. Kretschmer, D. Huffman and colleagues at the Institute of Nuclear Physics in Heidelberg (Germany), was first proposed a method for producing and isolating solid crystalline fullerene.

In 1991, a Japanese scientist Iijima, using a polar ion microscope, first observed various structures composed, like in the case of graphite, of six-membered carbon rings: nanotubes, cones, nanoparticles.

In 1992, natural fullerenes (C₆₀) were discovered in a natural carbon mineral - shungite. In 1997, R. E. Smalley, R. F. Curl, and G. Kroto received the Nobel Prize in chemistry for the study of C₆₀ molecules, which have the shape of a truncated icosahedron [4].

Now fullerenes are being intensively studied in laboratories of different countries, where they are trying to determine the conditions of their formation, structure, properties and possible applications.

C60 Production and Quality Control

Our selected methods for the synthesis and purification of fullerene exclude the use of solvents besides distilled water. Impurities can only be fullerene isomers different from the composition of

C60, while maintaining the integrity of the fullerene core. Fullerene C60 and isomers close to it (less than 0.1%) are non-toxic, respectively, the finished product is non-toxic.

We control all stages of the synthesis and analyze products from each batch.
Based on the studies, a declaration of conformity and a safety data sheet was issued.

Fullerenes and their derivatives (including fullerenol) have the following properties:

1. Not toxic, not immunogenic, not allergenic [5];
2. Increase cell membrane resistance to damaging factors [5];
3. Renders a positive effect on the antioxidant and energy systems of the body [5;6];
4. Possesses radioprotective properties due to the suppression of excessive levels of free radicals [5;7;8;9;10];
5. Possesses strong and long-term antihistamine and anti-allergic effects, that is, they are able to work as anti-inflammatory agents [11;12;13];
6. Increases adaptogenic body functions [11;12];
7. Renders a positive neuroprotective and nonspecific analgesic effect [14;15; 11.];
8. Possesses oncoprotective activity [5;16];
9. Possesses antiatherosclerotic and antihypertensive properties [17;18];
10. Possesses a wide range of antibacterial and antiviral activities [19;20;37;38];
11. Able to have an antispasmodic effect [7];
12. Possesses bronchodilator [21;22];
13. and nootropic activities [23;24.;25].

The properties of fullerenes are currently being studied by scientists worldwide in the fields of chemistry, physics, biology, medicine and other related specialties.

In Russia alone, studies of the fullerene properties are conducted daily in more than a hundred educational and scientific departments, such as:

FSBEI HE "Moscow State University"

FSBEI HE "St. Petersburg State University"

FSAEI HE First Moscow State Medical University named after Sechenov of the Ministry of Health of Russia (Sechenovskiy University)

Federal State Budgetary Educational Establishment of Higher Education "First St. Petersburg State Medical University named after Academician I.P. Pavlova " of the Ministry of Health of the Russian Federation

FSAEI of HE St. Petersburg State Electrotechnical University“ LETI “named after V. I. Ulyanova (Lenina)

Federal State Autonomous Educational Institution of Higher Education "National Research University ITMO"

Federal State Budget Educational Establishment of Higher Education "St. Petersburg State Technological Institute (Technical University)", in particular, at the Petrozavodsk State University at the Department of Hospital Therapy fullerenes are used in the treatment of rheumatological patients. During the course of infectious diseases, work is underway to assess their antibacterial effect, in the Department of Molecular Biology, Biological and Organic Chemistry and the Department of Solid-State Physics – oncoprotective activity of nanocomposites based on semiconductor compounds and fullerene phase.

The Clinic for Military Field Therapy of FSBEI HE "Kirov Military Medical Academy" of the Ministry of Defense of the Russian Federation and the State Unitary Enterprise TO Research Institute of New Medical Technologies (Tula) investigates the shielding effects of shungite (fullerene) from electromagnetic radiation.

Federal State Institution "The Federal Center for Heart, Blood and Endocrinology. V.A. Almazova »Rosmedtekhnologii (St. Petersburg) – Investigate the antiatherosclerotic, antihypertensive, antispasmodic properties of fullerenes and their ability to" extinguish "the excessive activity of lipid peroxidation that occurs on cell membranes.

About C60

1. The mechanism of effect on the body

Once in a living organism, water soluble fullerene C60 causes excess free radicals, in particular aggressive forms of oxygen (ROS) and the oxidation products of biomolecules, to self-destruct. However, it does not affect the minimum of free radicals, which is vital for the normal function of the body's biological systems. In other words, it regulates their number and thereby gives the body the opportunity to mobilize its own protective functions to counter various diseases and slow down the aging process.

2. Antioxidant and antiviral properties

A hundred times more effective than all known antioxidants.

It enhances the body's ability to neutralize free radicals, has the strongest antioxidant properties, hundreds of times higher than vitamins C and E. Naturally enhances the immune system and fills the human body with energy, rejuvenates the whole system.

It protects liver and brain cells from exposure to toxins, positively affects the function of hepatocytes, the restoration of protein, lipid, enzyme metabolism, improves metabolic and redox processes in the body, reduces inflammatory and fibrosing processes in the liver, and helps restore liver cells. It slows down the aging process of the human body by reducing the rate of cytoproliferative protein accumulation (an aging factor that causes changes in brain tissue, death of neurons, etc.) in human blood.

Eliminates the excess of free radicals in the foci of inflammation and fights their negative effects on the human body. It activates the body's own endogenous antioxidant systems and provides an increase in metabolic potential. Increases endurance, accelerates the recovery process after physical exertion and injuries. Helps the body to fight seasonal outbreaks of colds, viral, fungal diseases. It reduces the risk of serious diseases (neurodegenerative nature, heart attacks, strokes, the development of atherosclerosis, etc.). Fullerene derivatives prevent ischemia (poisoning due to lack of oxygen), which is caused by a sharp increase of ROS in energy depleted tissues. [26.]

Fullerene has a wide spectrum of antiviral activity against a number of pertinent influenza viruses, including the 2009 pandemic virus A(H1N1)v and avian influenza A(H5N1) virus, herpes, adeno- and PC viruses. At the same time, it features non-toxicity to cells of various tissue origin the fullerene molecule is optimal for the manifestation of antiviral activity. Moreover, it was fullerene C60 that showed a comparable, and in some cases even more pronounced virucidal effect compared to drugs such as Acyclovir and Arbidol.

Pharmaceuticals based on fullerenes can be used as new antiviral drugs that have good bioavailability, and due to the nonspecific mechanism of their action, do not cause the rapid emergence of virus strains resistant to it.

Based on the available data, in connection with the studied viruses and the COVID-19 coronavirus similarity of etiology, C60 is assumed to have a similar antiviral effect against the new coronavirus.

In vivo, experiments have shown that C60 fullerenes have antiproliferative properties (inhibit cell multiplication) and, due to their ability to attach free radicals, prevent the cytotoxic effects from the use of doxorubicin, which is used in cancer chemotherapy. [27, 28, 29, 30, 9, 31]

Even in very low doses, fullerenes exhibits a wide range of biological effects due to the structuring of water around itself and the formation of a fullerene-water cluster with unique antioxidant activity, can act as a catalyst for self-neutralization of superoxide radicals with the help of water molecules. [32]

NB: Further details about the mechanism and antioxidants

Antioxidants - oxidation inhibitors, natural or synthetic substances that can slow down oxidation. Considered mainly in the context of the organic compound oxidation. Antioxidants act in such a way that the process of uncontrolled, chain reaction of free radical formation, the process of lipid cell membrane oxidation is stopped. The action mechanism of the most common antioxidants consists in breaking the reaction chains: antioxidant molecules interact with active radicals to form low activity radicals.

Oxidation also slows down in the presence of substances that destroy hydroperoxides. In this case, the rate of free radical formation decreases. Even in a small amount (0.01-0.001%), antioxidants reduce the rate of oxidation, therefore, for some period of time (the period of inhibition, induction), oxidation products are not detected. The most famous antioxidants are: ascorbic acid (vitamin C), tocopherol (vitamin E), β -carotene (provitamin A) and lycopene (in tomatoes). They also include polyphenols: flavin and flavonoids (often found in vegetables), tannins (in cocoa, coffee, tea), anthocyanins (in red berries).

Among the antioxidants known to date, **fullerenes**, are the most powerful, although their mechanisms of action are fundamentally different than those of conventional antioxidants.

Authors [33.] propose the following mechanism:

Fullerenes acts even in extremely small doses, and its effect even after a single dose lasts a long time, since fullerene launches body's own forces to fight aging, diseases, etc. Although fullerene known to be excreted within 48 hours.

Fullerenes are superior in strength and quality to all other antioxidants. They have a different mechanism of action. If classical antioxidants are reducing agents that are consumed during the reaction, then fullerenes are catalysts for recombination, mutual destruction of free radicals.

So, fullerenes as antioxidants are hundreds of times more effective than vitamins C and E. The molecule of an ordinary antioxidant is single-use. Having met a free radical, it perishes, is modified, forming with it a harmless compound. One antioxidant molecule is used to neutralize one radical. But the fullerene molecule acts differently. Free radicals can not only attack neighboring biomolecules, but also connect with each other to recombine, forming a harmless product. But for this to happen, they must meet, which at low concentrations is unlikely.

The fullerene sphere has the ability to collect free radicals on its surface, which quite firmly "stick" to it, meet on its surface and recombine, connecting with each other, but the fullerene remains by itself. "Matchmaking" free radicals with each other, fullerene accelerates their recombination by hundreds of times.

Thus, fullerene works in exactly the same way as a catalytic converter of exhaust gases in a car; it "burns" free radicals on its surface without changing itself, and thereby purifies the internal environment of the body.

Therefore, even microdoses of fullerene are as effective as dozens of times larger doses of other antioxidants. [33.]

3. Pharmacodynamics

There are studies that show that the aqueous complexes of fullerene C60 absorb pathogenic strains and their toxins in infectious diseases, such as acute dysentery, salmonellosis, viral hepatitis, typhoid fever, leptospirosis, hemorrhagic fevers, ornithosis. By combining toxins of microbial and endogenous origin, the drug reduces the burden on detoxification and excretion organs, eliminates diarrhea in acute intestinal diseases (rotavirus gastroenteritis, cholera, staphylococcal enterotoxin poisoning).

In allergic conditions, the therapeutic effect of the fullerene is due to its ability to bind food allergens, histamine, serotonin, as well as circulating immune complexes and bacterial antigens, which leads to an increase in cellular and humoral immunity, an increase in the number of T lymphocytes, a decrease in eosinophils and a decrease in itching, swelling, and urticaria. It shortens the circulation time of specific antibodies and antigens of various viruses in the blood, reduces the general symptom severity of the disease.

NB: Further details about immune and allergies

Scientists introduced these modified fullerenes to the subjects in the so-called mast cells - connective tissue cells that play a large role in inflammatory processes in allergies. After that, the subjects were exposed to allergens. It turned out that the strength of the allergic reaction in subjects sharply decreased. The reason for this is a 50-fold decrease in the release of histamine (a substance that causes pathological reactions in allergies), as well as a weakening of the effects of three dozen other substances of a similar effect. According to Kepley, this is due to the binding of dissolved fullerenes to free radicals that occur during allergies.

Not so long ago, Japanese scientists reported that they found a drug against cancer based on fullerenes. At the same time, work in this direction is actively conducted in Russia. In particular, a group of scientists from Kazan and Chernogolovka report the synthesis of new derivatives of fullerenes with pharmacophore groups. The results of many studies open the prospect of using an aqueous solution of fullerene and its derivatives as the basis for new drugs for the treatment of allergic diseases, inflammatory and autoimmune pathologies.

4. Clinical and preclinical trials

Laboratory, preclinical and clinical trials of water-soluble fullerene (WSF) were conducted, hundreds of positive results were published.

Clinical trials of this substance in humans (in vivo) have not been carried out by us, due to the lack of need, since this substance is not a drug. However, preclinical and clinical trials in relation to an aqueous solution of fullerene were conducted under the supervision of G.V. Andrievsky, at the Institute of Physiologically Active Compounds, Kharkov. A number of studies were carried out and the effectiveness of using fullerene in the complex treatment of patients with peptic ulcer and patients with chronic hepatitis of toxic origin was evaluated. In the gastroenterological department of the Kharkiv Regional Clinical Hospital, which is the base of the Department of Internal Medicine No. 3 of KhNMU, 40 patients with peptic ulcer / chronic toxic hepatitis were examined. The control group consisted of 20 healthy people (for each study separately).

The results of the study showed that the biologically active additive – WSF, which passed the preclinical study, showed the absence of acute and subchronic toxicity when applied. [34, 35, 36].

The following effects were confirmed: WSF determines the intensity of cell membranes lipid peroxidation, stabilizes membranes, inhibits free radical oxidation, regulates metabolism, and increases the intensity of restoration processes in the liver.

A number of specific WSF activities in animal experiments were also identified, including anti-inflammatory, anti-ulcer, regenerative, membrane-stabilizing, adaptogenic, which served as the basis for developing a new therapeutic strategy when applying traditional therapy for peptic ulcer in combination with WSF.

There is also a number of scientific papers that describe all the effects on animals (antitumor, cardioprotective, radioprotective, etc.) [9,31], as well as a lot of reviews from biohacker enthusiasts (from all over the world) who have been voluntarily taking fullerene in various forms for several years.

In addition, 6 months supervised tests have been conducted on a control group of patients (volunteers) to identify certain effects from the ingestion of fullerene solution in various concentrations. A positive effect was achieved, namely, an increase in the body's working capacity, an improvement in memory, attention, an overall improvement in well-being, and an increase in the body's resistance to harmful environmental influences. Monitoring of the studied parameters is being carried out. Studying and justification of one or another effect is in progress, as well as the expected publications on this topic.

5. Recommendations

Our product is designed to combat aging factors and is recommended for daily use for prophylactic purposes, as well as symptomatic (see increased dosage) during an illness or stress.

Not a drug! Is meant for use as an additional part of combined therapy for the following diseases:

- Foodborne infection
- Dysentery, salmonellosis
- Viral diseases
- Enterocolitis, cholecystopancreatitis
- Dyspepsia, flatulence, the processes of decay, fermentation, hypersecretion of mucus, hydrochloric acid poisoning
 - Chemical compounds and medicines (including organophosphorus and organochlorine compounds, psychotropic drugs)
 - Poisoning with alkaloids, heavy metal salts
 - Burn disease in the stage of toxemia and septicotoxemia
 - Chronic renal failure
 - Chronic hepatitis, acute viral hepatitis, cirrhosis,
 - Allergic diathesis, atopic dermatitis, allergic gastroenteritis, toxicoderma
 - Alcohol withdrawal syndrome
 - Preparation for x-ray studies (to reduce gas formation)
 - Decongestant effect, improves microcirculation, normalizes metabolic processes; protects cell membranes and improves capillary function, restores blood microcirculation, normalizes metabolism at the cellular level; helps improve blood flow and reduces edema by reducing blood viscosity and vascular wall permeability. Contribute to the regeneration of cells of all body tissues, that is, cleansing of toxins, from which the cells could not get rid off earlier.
- Inflammation of the nasopharynx and respiratory system (as part of complex therapy). Has anti-inflammatory effects
 - Neuritis, arthrosis, neuralgia and osteochondrosis.
 - Problems with the digestive tract (normalizes the digestive tract)

6. Dosage and administration

C60 product is directly designed to combat aging and increase immunity, as well as for people working in harmful working conditions, conditions that are prone to stress, radiation, etc. (fullerene has radioprotective and anti-inflammatory properties)

Dosage

- For healthy people / athletes. Daily for preventive purposes.

Dosage (Standard):

2 drops per 10 kg of body weight. Similar doses for animals. Consume throughout the day.

- For people with chronic health problems:

Start with quarter of the dose, then increase to a standard dose within the next 5-10 days.

- Increased (symptomatic) dosage:

4 drops per 10 kg of body weight. The increased dosage should be taken in a course of no more than 10 days.

In connection with each person's individual reaction, an immune response may be observed. If there are any manifestations of an intolerance to the solution, we recommend that you stop taking it for a few days, and then start taking it gradually: take quarter the dose for the first days, and then move to full dose, in accordance with the instructions.

(with high / low blood pressure - a short-term increase in pressure is possible with subsequent normalization)

Children are advised to take fullerene only symptomatically.

Not recommended for pregnant.

Shake before use.

Contents

Ultra-pure C60 and MCT oil.

Storage

Recommended to store in a dark place at a 0-30 C. Away from the reach of children. Shake before use.

FDA Disclaimer: The statements made herein have not been evaluated by the Food and Drug Administration. The products and the information provided in this text are not intended to diagnose, treat, cure, or prevent any disease.

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