Spectrum Journal of Innovation, Reforms and Development
Volume 22, December, 2023 | ISSN (E): 2751-1731
Website: www.sjird.journalspark.org

WHAT ARE COMPLEXONS? APPLICATION OF COMPLEXONES IN MEDICINE

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Abstract
This article discusses complexons, the composition and role of complexons in medicine. Studying the processes of interaction of metals with ligands, which are features of the properties of complexones, is the key to the search for new drugs. Complexones are an important antidote for heavy metal poisoning.

Keywords: Complexon, antidote, EDTA, chelate, chelation therapy, ligand, biocomplex, biometal, homeostasis, heavy metals.

Introduction

COMPLEXONES, organic compounds containing **N, S** or **P** atoms capable of coordination, as well as carboxyl, phosphonic and other acid groups and forming internally stable complex compounds with metal cations - chelates. The term “Complexon” was introduced in 1945 by the Swiss chemist G. Schwarzenbach to designate aminopolycarboxylic acids exhibiting the properties of polydentate ligands.

The simplest representative of complexons is the amino acid glycine, H2NCH2COOH. In the glycine molecule, the amino group -NH2 is separated from the carboxyl group -COOH by a single methylene group -CH2. When the carboxyl group is deprotonated, the glycine ion can act as a bidentate ligand and form chelate complexes with metal ions.

Complexones are colorless crystalline substances, usually soluble in water, aqueous solutions of alkalis and acids, insoluble in ethanol and other organic solvents; dissociate in the range of pH values **2–14**. In aqueous solutions with cations of transition **D**- and **F**-elements, alkaline earth and some alkali metals, complexones form stable intra-complex compounds - complexonates (mono- and polynuclear, medium, acidic, hydroxocomplexonates, etc.). Complexonates contain several chelate cycles, which causes high stability of such compounds. chelates, chelate compounds (from lat. chela - claw), also intra-complex or cyclic complex compounds - organometallic complex compounds, formed by the interaction of metal ions with polydentate (that is, having several donor centers) ligands. **Chelates** contain a central ion (particle) - a complexing agent and ligands coordinated around it. The internal sphere of the chelate consists of cyclic groups, including

the complexing agent. The body continuously develops and destruction of biocomplexes from biometal cations (iron, copper, zinc, cobalt) and bioligands (porphyrins, amino acids, polypeptides). Metabolism with the environment maintains the concentration of the substance at a certain level, ensuring the state of metal-ligand homeostasis.

The distribution of a particular metal cation between bioligands in biomedia is determined both by the strength of the formed complexes and by the concentrations of these ligands. Each of the biometal cations is characterized by its own set of metal-ligand equilibrium reactions. The intake, metabolism, accumulation and release of metal cations (and, in general, any microelements) are regulated by a special system of microelement homeostasis. In total, there are thousands of pathological phenomena - microelementoses associated with certain metal excess or metal deficiency conditions. Disturbance of metal-ligand homeostasis is possible for various reasons: due to a deficiency or excess of biometal cations, due to the intake of toxic metal cations, due to the entry or formation of foreign ligands.

To maintain metal-ligand homeostasis and remove toxic metal ions from the body, complexons - polyaminopolycarboxylic acids - are increasingly being used. In medicine, a special direction has emerged associated with the use of complexones to regulate the metal-ligand balance - chelation therapy.

Chelation therapy is a procedure for treating mercury, lead and other types of heavy metal poisoning. A chelating agent is introduced into the body, which binds to metals, deactivates them and removes them through the urinary system.

Heavy metals cause abnormalities in intracellular functions and inflammation. This inflammation damages the cells and blood vessels themselves. As a result, we have decreased function of the heart, memory, liver, thyroid gland, parathyroid glands, etc. In addition, the immune system and brain function are suppressed.

Removing these harmful heavy metals from the body will speed up the recovery of the heart and blood vessels, improve liver and kidney function, increase blood flow to the brain and much more.

Ethylenediaminetetraacetic acid, **EDTA** (from the English EDTA), complexon **II** - an organic compound, a tetrabasic carboxylic acid with the chemical formula (HOOCCH2)2N(CH2)2N(CH2COOH)2, white fine-crystalline powder, slightly soluble in water, insoluble in most organic solvents, soluble in alkalis, forms ethylenediaminetetraacetate salts with metal cations. Prepared by condensation of ethylenediamine with monochloroacetic acid. The compound was first synthesized in 1935 by Ferdinand Münz, who prepared the compound from ethylenediamine and chloroacetic acid.

EDTA is used in the form of disodium salt dihydrate (Complexon **III**, Trilon B, Na2-EDTA) - in the textile, leather, paper, paint and varnish industries, in the production of metals, rubber, in color cinematography, for water softening. In analytical chemistry, EDTA allows the determination of more than 60 elements. In medicine, EDTA is used to remove radioactive and toxic metals from the body, for blood preservation, in case of overdose of cardiac glycosides, etc. In toxicology, cobalt salts of EDTA are used as an antidote for

poisoning with hydrocyanic acid or cyanogen chloride. In dentistry, it is used for endodontic treatment of tooth canals; it demineralizes and softens surface dentin. In pharmaceutical technologies, EDTA is used to enhance the permeability of drugs through mucous membranes.

THE USE OF COMPLEXONES AND COMPLEXONS IN MEDICINE

The complexions occupy an important place in the development of medicinal and diagnostic tools. Their ability to penetrate cell membranes, manifest the functions of biocatalysts, imitate the functions of certain enzymes, etc., has been established. On the basis of complexones, mineral metabolism regulators, bactericidal and antiviral drugs, anti-allergenic substances, diagnostic preparations, etc. were made. A simple list of drugs used would make a solid list. One can call, for example, a xydiphon - dikalydinatriium salt of OEDF. This drug has passed clinical trials and is approved for use in the treatment of urolithic disease, salt deposition, kidney disease, smooth muscle spasms, etc. The chelating agent can be administered intravenously, intramuscularly or orally, depending on the agent and type of poisoning. The German Environment Agency (Umweltbundesamt) included **DMSA** and **DMPS** in the list of two of the most useful and safest available chelating agents.

chelator	Used in
dimercaprole (British anti-lewisite; **BAL**)	acute arsenic poisoning acute mercury poisoning lead poisoning (in addition to EDTA poisoning) lewisite (for which it was developed as an antidote)
dimercaptosuccinic acid (**DMSA**)	lead poisoning arsenic poisoning mercury poisoning
Dimercaptopropanesulfonate (DMPS)	severe acute arsenic poisoning severe acute mercury poisoning
penicillamine	Mostly: copper toxicity Sometimes additional therapy for: gold toxicity arsenic poisoning lead poisoning rheumatoid arthritis
Ethylenediaminetetraacetic acid (disodium calcium versenate) ($CaNa_2$ - E DTA)	lead poisoning
Deferoxamine, Deferasirox and Deferiprone	acute iron poisoning iron overload

Benefits of Chelation

Rejuvenation of the heart and cardiovascular system

Chelation therapy has been widely used by alternative practitioners since the **1950s** to treat heart disease. Chelating agents interact with calcium accumulated in the arteries, which

helps clear plaque from the blood vessels, reduce scar tissue, increase blood flow to the heart, and lower blood pressure. It also helps reduce inflammation and prevent damage to blood vessels.

Prevent neuro-degeneration

There are many studies that demonstrate that increased deposits of iron and toxic heavy metals contribute to neurological degeneration and diseases such as Alzheimer's disease, Parkinson's disease and multiple sclerosis. Chelation therapy has been researched and used to treat and reduce the risk of neurological disorders. The idea is that the chelator reopens clogged blood vessels in the body and brain. Chelation therapy can also help improve memory and mental clarity in older adults.

Reduce pain and inflammation

Ethylenediaminetetraacetic acid (EDTA), which is used as a chelating agent, is also an antioxidant. It can repair damage from free radicals and toxins; this helps reduce inflammation and pain. EDTA is used as a maintenance treatment for many age-related diseases, including autoimmune chronic inflammatory diseases such as osteoarthritis and rheumatoid arthritis.

The chemistry of complexones is undergoing a period of intensive development. The processes of accumulating information about the composition, structure and properties of complexonates, the conditions of their existence, and real and potential areas of their practical use are proceeding at a high pace. The study of the unique properties of complexons is far from complete, and new major discoveries are still ahead.

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