The Subject And Ways Of Development Of Organic Chemistry. The Main Stages In The Development Of Organic Chemistry

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ABSTRACT

Organic chemistry is of exceptionally important scientific and practical importance. The object of her research is a huge number of compounds of synthetic and natural origin. Therefore, organic chemistry has become the largest and most important branch of modern chemistry. The article discusses about the subject and ways of development of organic chemistry. Furthermore, we will discuss the main stages in the development of organic chemistry.

Keywords: *Petrochemistry, raw materials, intensive development, polymer chemistry, iatrochemistry, alchemy, organic compounds.*

Organic chemistry is a science that studies carbon compounds - hydrocarbons and their derivatives, which can include almost all elements of the periodic system. The separation of organic chemistry into an independent scientific discipline is due to the large number and variety of carbon compounds, the presence of specific properties that distinguish them from compounds of other elements, and finally, their exceptional importance in human life.

Currently, more than 4.5 million organic compounds are known, while there are only about 700 thousand inorganic compounds.

The transformations of organic compounds are governed by the general laws of chemistry, as well as by specific laws that are characteristic only of organic compounds. Organic compounds are usually less stable than inorganic ones, oxidize (burn) more easily, the vast majority of them have only covalent bonds between atoms.

The special position of organic chemistry in the system of sciences is also due to the fact that it studies a more highly organized matter than inorganic chemistry, and is closely related to biology: organic substances appeared on Earth later than inorganic ones, they are carriers of vital activity.

Subject and ways of development of organic chemistry

The subject of organic chemistry is the study of methods for the preparation, composition, structure, and applications of the most important classes of organic compounds. For successful management of students' activities, it is necessary to establish feedback in order to obtain information about the quality of assimilation of the studied material by each student [3].

In ancient times, people had great life experience in obtaining and using a number of organic substances. They knew how to make alcoholic beverages by fermenting sugary substances (wine, beer), to prepare vinegar by souring wine. In India, sugar cane was used to make sugar. In ancient Rome, vegetable dyes were used - indigo, alizarin, "antique purple", obtained from certain types of snails. Many fragrant essential oils were known, which were used not only as incense, but also as disinfectants for preserving corpses in the form of mummies (in ancient Egypt). The Gauls (French) knew soap.

However, at that time people were dealing with mixtures of organic compounds. Pure substances began to be obtained much later.

In the Middle Ages, alchemists (alchemy comes from the Arabic alchemy, which goes back to the Greek chemia cheo - pour, pour), which indicated the connection of alchemy with the art of melting and casting metals, or from chemia - Egypt, which links alchemy with the place where it originated art.

The alchemists considered their main task to be the transformation of simple metals into precious ones (gold, silver) through the so-called "philosopher's stone", developed methods for purifying substances, which in a certain respect paved the way for emerging chemistry.

In 900, almost pure wine spirit was obtained by Arab alchemists. In the 18th century, a number of pure organic substances were already isolated.

In 1773, crystalline urea was isolated, followed by tartaric, citric, malic, gallic acid, and many other organic compounds.

At the beginning of the development of chemistry, researchers did not see the differences between organic and inorganic substances. However, later they began to notice that most of the substances obtained from the “dead” nature are various metals, salts, etc. have relatively little change. While the majority of substances obtained from organisms of plants and animals with relatively small impacts, undergo profound changes.

Different behavior and, as it was believed, different ways of formation of substances obtained from dead and living nature, formed the basis for the division of chemistry into organic and inorganic.

By the beginning of the 19th century, the initial idea of organic chemistry had already been formed, as a science that studies substances formed in animal and plant organisms.

The famous Swedish chemist Jakob Berzelius (1779-1848) can be called the founder of organic chemistry (1806).

He defined organic chemistry as "the chemistry of plant and animal substances or substances formed by waters under the influence of the life force." At that time, they did not yet possess methods for obtaining organic substances. From this, the opinion was created that special laws operate in living nature, controlled by "life force". What is "life force", no one could explain. It was considered only that it causes the formation of organic substances in organisms. This trend in chemistry was called VITALISM (lat. vitalis - vital). Vitalism, on the one hand, played a positive role, since it separated organic and inorganic matter, but on the other hand, it disarmed chemists, because preached that organic matter cannot be obtained from a lifeless force; synthesis was practically rejected. With the development of the natural sciences, the idealistic reactionary vitalistic trend began to be opposed to the materialistic ones.

Acting with various chemical reagents on organic substances of natural origin, chemists began to obtain numerous products that are no longer found in nature.

In 1824, the German physician and chemist Friedrich Wehler (a student of J. Berzelius) synthesized oxalic acid from cyanogen, and in 1833, urea (NH4OCN). In this case, the starting material was an inorganic salt - potassium cyanide, during the oxidation of which potassium cyanate is formed, the exchange decomposition of which with ammonium sulphate produces ammonium cyanate, which, upon nitration, turns into urea.

Wehler himself was well aware that the synthetic preparation of urea from inorganic matter dealt a severe blow to the idea of \u200b\u200bvitality, and he proudly wrote to his teacher Berzelius: “I must tell you that I can prepare urea without needing either a kidney or in a living organism in general ... "

In subsequent years, more complex organic substances were synthesized.

In 1854, the French chemist Marcelin Berthelot synthesized a number of organic substances, including fat. In 1861, Alexander Butlerov (the creator of the theory of the chemical structure of organic substances) synthesized a sugary substance. Thus, the vitalist current was dealt a final blow.

There was a need for organic chemistry to stand out in a special row, but now for completely different reasons:

Numerous organic compounds.

· Great practical importance of organic compounds. They are necessary for a person both in the form of food (proteins, fats, carbohydrates) and in the form of numerous household items (clothes, shoes).

The peculiarity of organic compounds. They are combustible, enter into various reactions and have isomerism (compounds that have the same composition, but a different structure). The essence of the phenomenon of isomerism was discovered by A. M. Butlerov, who showed that in isomeric substances the atoms are connected in a different order.

An important stage in the development of chemistry was the development of the theory of valency by Cooper and Kekule in 1857. This theory was based on the tetravalence of carbon and its ability to form chains. In the first volume of his work on organic chemistry, published in 1859, Kekule for the first time introduces a definition of the concept of "organic chemistry" close to the modern one - it is "the chemistry of carbon compounds", which is already reflected in the very title of this work, which translates as "Textbook of organic chemistry, or the chemistry of carbon compounds. In 1865, Kekule proposed the structural formula for benzene (C6H6), one of the most important discoveries in organic chemistry. In 1917, Lewis proposed to consider the chemical bond using electron pairs (An electron pair is a bound state of two interacting electrons.).

In 1931, Huckel applied quantum theory to explain the properties of alternative aromatic carbons, thereby founding a new direction in organic chemistry, quantum chemistry. In 1933, Ingold conducted a study of the kinetics of a substitution reaction at a saturated carbon atom, which led to a large-scale study of the kinetics of most types of organic reactions.

It is customary to present the history of organic chemistry in connection with the discoveries made in the field of the structure of organic compounds, but such a presentation is more connected with the history of chemistry in general. It is much more interesting to consider the history of organic chemistry from the standpoint of the material base, that is, the actual subject of study of organic chemistry.

At the dawn of organic chemistry, the subject of study was predominantly substances of biological origin. It is to this fact that organic chemistry owes its name. Scientific and technological progress did not stand still, and over time, the main material base of organic chemistry became coal tar, which is released during the production of coke by calcining coal. It was on the basis of the processing of coal tar that the main organic synthesis arose at the end of the 19th century. In the 50-60s of the last century, the main organic synthesis was transferred to a new base - oil. Thus, a new field of chemistry appeared - petrochemistry. The huge potential that was laid in the new raw materials caused a boom in organic chemistry and chemistry in general. The emergence and intensive development of such a field as polymer chemistry is due primarily to a new raw material base.

3. Main stages in the development of organic chemistry

The period of development until the XIV century, called spontaneous.

XV - XVII centuries - the beginning of development or, iatrochemistry, alchemy.

Century XVIII - XIX - the dominance of the theory of vitalism.

XIX - XX centuries - intensive development, scientific stage.

Spontaneous stage in the formation of the chemistry of organic compounds

This period implies the spontaneous generation of the concept of chemistry, the origins. And the origins go back to Ancient Rome and Egypt, in which very capable inhabitants learned to extract dyes for coloring objects and clothes from natural raw materials. Unusually agile inhabitants of different nationalities of the same time also learned how to get vinegar, make alcoholic beverages from sugar and starch-containing substances of plant origin. as such, the concept of "chemistry" did not exist, and the study of specific substances in order to clarify the properties and composition did not occur. Therefore, this period is called spontaneous. All discoveries were random, non-purposeful nature of everyday significance. This continued until the next century.

Period of iatrochemistry - a promising beginning of development

It was in the XVI-XVII centuries that direct ideas about chemistry as a science began to emerge. Thanks to the work of scientists of that time, some organic substances were obtained, the simplest devices for distillation and sublimation of substances were invented, special chemical utensils were used for grinding substances, separating natural products into ingredients. The main direction of work of that time was medicine. The desire to obtain the necessary medicines led to the fact that essential oils and other raw materials were extracted from plants. So, Karl Scheele obtained some organic acids from plant materials:

v apple;
v lemon;
v gallic;
v dairy;
v oxalic. It took the scientist 16 years to study plants and isolate these acids (from 1769 to 1785). This was the beginning of development, the foundations of organic chemistry were laid, which was directly defined and named later as a branch of chemistry. In the same period of the Middle Ages, G. F. Ruel isolated uric acid crystals from urea. Other chemists obtained succinic acid from amber, tartaric acid. The method of dry distillation of vegetable and animal raw materials, thanks to which acetic acid, diethyl ether, and wood alcohol is obtained, is in use.

This was the beginning of the intensive development of the organic chemical industry in the future. A large team of specialists with many years of experience in scientific research and practical work in the relevant fields was involved in writing the book [4].

Vis vitalis, or "Life Force"

XVIII - XIX centuries for organic chemistry are very twofold: on the one hand, there are a number of discoveries that are of grandiose significance. On the other hand, for a long time the growth and accumulation of the necessary knowledge and correct ideas is hampered by the dominant theory of vitalism.

A German scientist worked on cyanide compounds and in one of his experiments he managed to obtain crystals similar to uric acid. Thus was dealt the first blow to the vitalistic views. The history of the development of organic chemistry began to gain momentum.

Many different people were involved in creating the field of organics that we have today. Therefore, scientists of organic chemistry deserve attention. The end of the 19th and 20th centuries were the times of global discoveries in pharmaceuticals, the paint and varnish industry, and quantum chemistry. organic chemistry discovery scientific

Consider the discoveries that ensured the maximum value of organic chemistry:

1881 M. Konrad and M. Gudzeit synthesized anesthetics, veronal and salicylic acid.

In 1883, L. Knorr received antipyrine.

In 1884, F. Stoll received a pyramidon.

In 1869, the Hyatt brothers received the first artificial fiber.

1884 D. Eastman synthesized celluloid photographic film.

In 1890, copper-ammonia fiber was obtained by L. Depassy.

In 1891 Ch. Cross and his colleagues obtained viscose.

In 1897, F. Miescher and Buchner founded the theory of biological oxidation (cell-free fermentation and enzymes as biocatalysts were discovered).

1897 F. Miescher discovered nucleic acids.

III Beginning of the 20th century - new chemistry of organoelement compounds.

In 1917, Lewis discovered the electronic nature of the chemical bond in molecules.

1931 Hückel is the founder of quantum mechanisms in chemistry.

SH 1931-1933 Limus Pauling substantiates the theory of resonance, and later his employees reveal the essence of directions in chemical reactions.

In 1936, nylon was synthesized.

SH 1930-1940 A. E. Arbuzov gives rise to the development of organophosphorus compounds, which are the basis for the production of plastics, medicines and insecticides.

In 1960, Academician Nesmeyanov and his students create the first synthetic food in the laboratory.

SH 1963Du Vigne receives insulin, which is a huge step forward in medicine.
In 1968, the Indian H. G. Korana managed to obtain a simple gene, which helped in deciphering the genetic code.
Thus, the importance of organic chemistry in people's lives is simply colossal. Plastics, polymers, fibers, paint and varnish products, rubbers, rubbers, PVC materials, polypropylenes and polyethylenes and many other modern substances, without which life is simply not possible today, have gone a difficult way to their discovery. Hundreds of scientists contributed their many years of painstaking work to form a common history of the development of organic chemistry.

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