GENERAL CHARACTERISTICS OF THE CONTENT AND METHODS OF STUDYING ORGANIC CHEMISTRY.

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The content of organic chemistry as an independent section of the chemistry course in higher education institutions began to take shape in the early years of the last century. The ideas of A.M.Butlerov about the chemical structure of substances penetrated into the chemistry course. In subsequent years, the department of organic chemistry developed and improved in connection with the development of science itself, chemical production, and the requirements that were put forward to the University at various stages of production.

1. Selection of classes of organic compounds for the study of organic chemistry.

Let's look at what scientific criteria underlie the selection of the content and the definition of the course structure. Clarifying this issue will show that the choice of classes of compounds, information about substances, general concepts and theoretical issues to study is not accidental, it is not determined by the personal tastes of certain compilers of the program, but has quite objective grounds. Organic chemistry studies a wide range of substances, estimated by the millions.

The number of synthesized compounds is currently increasing by several tens of thousands per month. It is no longer surprising that an organic chemist obtains hundreds of new substances during the period of his scientific activity. In the process of synthesis, well-known classes of organic compounds are not only supplemented with new substances, but substances of a fundamentally different structure also appear, new classes and new types of bonds are discovered. With such a variety of organic substances and a rapid increase in their number, while the structure becomes more complex, how can we find the basic material available in the course? Obviously, his selection should be subordinated to some leading scientific ideas.

The efforts of scientists are now largely focused on studying the chemical processes occurring in the cells of living organisms and forming the basis of the phenomena of life.: how do protein substances reproduce themselves from food elements; what is the mechanism of those subtle syntheses that are carried out in the body with the help of enzymes; what processes underlie the conversion of energy released during chemical reactions in the body into other forms of energy, such as mechanical energy, with an amazingly high efficiency. Well-known successes have already been achieved along this path, primarily in the study of proteins and nucleic acids, their matrix synthesis in the body, and the principle of transmission of hereditary traits.

The first chemical syntheses of protein substances and nucleic acids are being carried out. In connection with the successes in the study of the chemical foundations of life, the words acquire a deep meaning: "Here chemistry leads to organic life, and it has advanced far enough to guarantee that it alone will explain to us the dialectical transition to the organism." The leading cognitive task of organic chemistry now is to study biological phenomena in depth at the molecular level, to uncover the mechanisms of biochemical processes occurring in cells.

If organic chemistry studies the development of substances from hydrocarbons to the most complex compounds and is aimed at uncovering the biochemical foundations of life phenomena, then the course should reflect this process and lead students to understand the role of organic substances in the life of organisms. On this basis, it should obviously include information about the substances from which the body recreates itself in the process of exchange with the external environment, builds its complex material system.

These include proteins, fats, and carbohydrates. Studying the classification of compounds should lead to an understanding of these biologically important compounds. Given the abundance of classes, homological series, and their various derivatives, further selection must obviously be very strict. In fact, for example, among carboxylic acids we find marginal monobasic and polybasic fatty acids, acids with double and triple C-C bonds, hydroxyacids of various basicity and atomicity, aldehyde acids, keto acids, amino acids, aromatic monobasic and polybasic acids, aromatic hydroxyacids, amino acids, etc. Then there are numerous esters, amides, imines, hydrazides and azides, nitriles and isonitriles, etc.

Of such a variety, only those classes of compounds should be included in the training course, without studying which it is impossible to understand the structure and properties of proteins, fats and carbohydrates. Following this principle, we conclude that to study proteins, it is necessary to know amino acids as their structural elements; to understand the structure and properties of fats, it is necessary to know esters; to study carbohydrates, it is necessary to first study alcohols, aldehydes, ketones, by which they are characterized. Amino acids, in turn, can be approached only after studying amines and carboxylic acids, esters and fats - after familiarizing themselves with polyatomic alcohols, marginal and unsaturated acids. The study of all these classes of compounds ultimately requires knowledge of hydrocarbons. Along with these main classes, some other compounds will be presented in the course, such as esters, nitro, amino and imino compounds.

2. Selection of substances to characterize the main classes of compounds.

The phenomenon of homology helps to solve this problem. Since homologues are characterized by similarity of structure and chemical properties, there is no need to study many substances: based on acquaintance with several of them, one can get an idea of the homological series as a whole and about any other member of the series.

However, the principle of homology cannot be the only one in the selection of substances for study. Among them, it is impossible, for example, to build a study of fats, carbohydrates and proteins. Sometimes it is not advisable at all to isolate any individual substances (esters, proteins) from the class for study. The concept of limiting monobasic acids can also be given when considering the homological series as a whole. Different acids are used as examples.

After reviewing the general characteristics, a number of additional information will be required, obviously, formic and acetic acids, as well as representatives of higher acids - palmitic and stearic, which are part of fats.

Unsaturated acids should be considered in the same class of compounds to show the possibility of combining different types of C-C bonds with different functional groups and to prepare students for the study of fats.

It is advisable to introduce the concept of unsaturated acids using the example of acrylic, whose derivatives are widely used in the production of polymers (polyacrylic resin), and oleic acid, which is involved in the formation of fats.

Esters could be considered in connection with the study of the properties of acids as their derivatives. but since esters include fats, which are studied in detail in the course, it is advisable to consider them together with fats as a theoretical introduction. When selecting substances of the carbohydrate class, it is necessary to proceed from their biological significance.

From this point of view, starch and cellulose (fiber) should certainly be studied as important substances of organisms that simultaneously represent valuable raw materials for industry.

But understanding the structure and transformations of these carbohydrates requires familiarization with monosaccharides, primarily glucose, the links of which make up polysaccharide molecules and which is formed as a result of their hydrolytic cleavage in organisms.

The concept of amino acids is given in a generalized form, without involving information about specific substances. When selecting material on proteins, it is also impossible to single out substances that would be of particular interest in cognitive and practical terms for detailed study.

The methods of obtaining substances are selected as theoretically important and illustrative of modern industrial production.

For example, the production of amino acids by the interaction of ammonia with halogen derivatives of acids is mainly of theoretical interest, while enzymatic hydrolysis of proteins is considered as a practical method.

In the methodology of organic chemistry, it has been found that theoretical questions should be introduced into the course when there is a need to explain the accumulated facts in the coverage of subsequent material from a theoretical

perspective and when conditions are created for their conscious assimilation by students.

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