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STEM EDUCATION – AN EFFECTIVE APPROACH TO THE IMPLEMENTATION OF EDUCATIONAL AND RESEARCH WORK OF PHARMACIST STUDENTS INTO THE EDUCATIONAL PROCESS

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Abstract: The introduction of research work on chemistry of pharmacist students into the educational process of chemical disciplines increases the motivation of students to study chemical disciplines, making learning more interesting and meaningful, contributes to improving the quality of students' knowledge.

Keywords: STEM education, research work of pharmacist students

We consider the implementation of individual work of an educational or educational-research nature, which is used in the process of studying program material, to be an effective form of innovative activity of STEM education in higher education [1,c.2]. It is obvious that such types of work form students' skills of independent creative activity with elements of scientific research, require familiarization with a sufficiently wide range of literature, and the use of computer technology [2,c.4].

For example, the goal of the educational and research work of pharmacist students was a review of the literature related to the issues of the connection of nitrates and nitrites: with human diseases, their biological role and application in pharmacy and medicine; their metabolism in the human body; socio-ecological problems; environmental consequences of the distribution of nitrates; natural and anthropogenic sources, etc. Regarding human diseases, we draw your attention to the fact that according to statistics of the World Health Organization (WHO), 3.5 million people die worldwide due to nitrate poisoning in water. Persons. The vast

majority of them (about 90%) are children under the age of five [3,c.28]. Researchers from the USA, Germany, and Czechoslovakia found that nitrates and nitrites cause methemoglobinemia and stomach cancer in humans, which negatively affect the nervous and cardiovascular systems, and the development of embryos[4,c.5]. Methemoglobinemia is oxygen starvation (hypoxia) caused by the transition of blood hemoglobin into methemoglobin, which cannot carry oxygen. Methemoglobin is formed during the destruction of nitrites in the blood. When the content of methemoglobin in the blood is about 15%, lethargy and drowsiness appear, when the content is more than 50%, death occurs, similar to death from the soul. In Colombia, a direct relationship between frequent stomach cancer, atrophic gastritis and a high nitrate content in the water of wells and the blood of residents was found [5,c.8].. In different Chile and Hungary, a relationship was found between the amount of nitrogen amendments applied and the mortality from stomach cancer [6,c.20]. In England, in the city of Worksop, doctors believe that the high incidence of cancer is caused by a large amount of nitrates in drinking water - 90 mg per liter. The control group (404 people) used water with a nitrate content of up to 5 mg/l. The second group (390 people) - With a content of 90 mg/l. The third group (326 people). With a content from 288 to 480 mg/l. It was found that in children who drink water with a high content of nitrates, there is a tendency to increase height and weight while decreasing the circumference of the chest, the muscle strength of the arms and the vital capacity of the lungs. Children, like plants, gained weight rapidly. Identified violations of ratios indicate the disharmony of children's physical development. Long-term nitrate intoxication should be considered the cause of these disorders. Assessment of the physical development of 5-year-old boys showed that drinking water with a high nitrate content causes a slight increase in growth and impaired physical development in them. At the age of 6, the number of children with impaired and poor physical development is increasing. In girls, these processes proceed less noticeably: only at the age of 6, a tendency to weight gain with impaired physical development was noted. With the growth of chemotherapy, the incidence of tuberculosis increases, especially in the age group of 7-14 years. These are mainly

pulmonary forms of the disease. Adults get sick less than children. Of the diseases of the respiratory system, chronic bronchitis prevails, and of the blood circulation system, arterial hypertension, and the younger the examinees, the higher the incidence rate.

When consuming products with a high content of nitrates, not only nitrates enter the human body, but also their metabolites: nitrites and nitrosocompounds [7,c.25].. It has not yet been possible to make an exact balance of the intake and consumption of nitrates in the body. The fact is that nitrates enter the body not only from the outside, but are also formed in it. Back in 1861 Tartu University scientist Wilffins discovered that even with a nitrate-free diet, nitrates are excreted from the body in the urine.

Thus, in case of acute poisoning, nitrates cause methemoglobinemia of varying severity in humans, up to death; with chronic poisoning - stomach cancer, changes in the functions of the central nervous system and heart activity. Children, especially in the first year of life, are most sensitive to excess nitrates in water and food.

When introducing information into the educational process in chemical disciplines (inorganic, analytical, pharmaceutical chemistry) regarding the biological role and application of nitrogen-containing compounds in pharmacy and medicine, we draw attention to the fact that nitrates are divided into metal nitrates — salts of nitric acid and organic nitrates — nitrate derivatives acids with the general formula R-ONO2 [8,c.12].. Organic nitrates are part of all plants and animal organisms. Both metal nitrates (mostly sodium nitrate) and organic nitrates are used in pharmacy. Sodium nitrate as a vasodilator (with the effect of lowering blood pressure).

Organic nitrates (methyl nitrate, ethyl nitrate, amyl nitrate, nitroglycerin, cellulose nitrates, etc.) are part of drugs that have a vasodilating and antispasmodic effect (nitroglycerin, Sustak, etc.

When considering nitrates as a socio-ecological problem, attention was drawn to the fact, that excessive amounts of nitrates cause abnormal functioning of natural ecosystems and living organisms, the biological value of products decreases and the negative impact on humans and animals increases. The formation and accumulation of nitrates in soil and water becomes an environmental factor that determines not

only plant nutrition, metabolism and productivity, but also the quality of crops, water and air. The content of nitrates in excessive quantities impairs the biological quality of plant products and creates a potential danger to human and animal health. Essential in solving the nitrate problem is to identify sources of nitrate contamination, eliminate them and introduce constant strict control at all stages of production, processing, storage and consumption of food products. The main sources of nitrates in undisturbed and agricultural landscapes are soil organic matter, the mineralization of which ensures the constant formation of nitrates. The dynamics of nitrates in terrestrial ecosystems is in a certain way connected with the small biological nitrogen cycle, that is, the role of soil nitrogen in the pollution of natural waters with nitrates and in the accumulation by plants is very significant The main sources of nitrates in undisturbed and agricultural landscapes are soil organic matter, the mineralization of which ensures the constant formation of nitrates. The dynamics of nitrates in terrestrial ecosystems is in a certain way connected with the small biological nitrogen cycle, that is, the role of soil nitrogen in the pollution of natural waters with nitrates and in the accumulation by plants is very significant Nitrogen fertilizers are mainly produced in the form of concentrates, with urea and ammonium nitrate occupying the largest place in their range. The predominant use of ammonium and amide forms of nitrogen fertilizers in agriculture does not reduce the risk of significant losses of nitrogen from the soil due to the rapid nitrophification of ammonium nitrogen. When consuming products with a high content of nitrates, not only nitrates enter the human body, but also their metabolites: nitrites and nitrosocompounds. It has not yet been possible to make an exact balance of the intake and consumption of nitrates in the body. The thing is that nitrates both enter the body from the outside and are formed in it. Back in 1861 at the University of Tartu, Wilffins discovered that even with a nitrate-free diet, nitrates are excreted from the body in the urine. The main cause of all negative consequences is not so much nitrates as their metabolites — nitrites. Nitrites, interacting with hemoglobin, form methemoglobin, which cannot carry oxygen. As a result, the oxygen capacity

of the blood decreases and hypoxia (oxygen starvation) develops. 1 mg of sodium nitrite is enough to form 2000 mg of methemoglobin.

In a normal state, a person's blood contains about 2% of methemoglobin. If the methemoglobin content increases to 30%, symptoms of acute poisoning appear (shortness of breath, tachycardia, cyanosis, weakness, headache), death may occur at 50% methemoglobin The concentration of methemoglobin in the blood is regulated by methemoglobin reductase, which restores methemoglobin to hemoglobin. Methemoglobinreductase begins to be produced in humans only from the age of three months, therefore children up to a year, and especially up to three months, are defenseless against nitrates. In the literature devoted to the chemistry of nitrates, there is no report on the release of nitrites from the human body. N.I. Opopol believes that the main part of them goes to the formation of methemoglobin. It has been proven that even with high concentrations of nitrates in the blood (2215 mg/kg), the methemoglobin content is only 2.1-4.5%, which is much less than dangerous concentrations. The content of meghemoglobin increases to dangerous values only when nitrites enter the blood. Nitrates are reduced to nitrites by various microorganisms that mainly inhabit the intestines. The degree of nitrate recovery, as in the case of product storage, depends on the same factors: the amount of nitrates in the products and the living conditions of microorganisms. A slightly alkaline and neutral environment is favorable for the development of intestinal microflora. People with reduced stomach acidity are most sensitive to nitrates. Over the last 10-15 years, more than E-1000 cases of nitrate-nitrite methemoglobinemia have been described, of which 100 ended in death. In healthy people, mild forms of poisoning were observed when the nitrate content in water or food exceeded 80-100 mg/l.

The distribution of nitrates is closely related to the type of plant.

Thus, nitrates are practically absent in the grain of cereal crops and are mainly concentrated in the stems and leaves. Green crops accumulate large amounts of nitrates, usually in stems and leaf petioles. The leaf blade of green crops contains 4-10 times less nitrates than the stems.

The high content of nitrates in stems and petioles is caused by the fact that they are the site of transport of nitrates to other plant organs, where they are assimilated into organic nitrogen compounds. The ability of tissue to accumulate nitrates is associated with a whole complex of factors, both internal and external. The greatest number of them is located at the bottom of the leaf, the minimum is at its top.

Nitrate accumulation varies depending on the type of plant organ. For example, in potato tubers, a low level of nitrates was found in the tuber pulp, while in the peel and core their content increased by 1.1-1.3 times. The core, tip and top of the table beet differ from the rest of its parts in their increased content of nitrates. Therefore, it is necessary to cut off the upper and lower parts of the root crop for table beets.

Thus, when storing potatoes in a warehouse with enhanced ventilation, 85% was preserved after 3 months. and after 6 months - 30% of nitrates from the initial level. In carrot root vegetables there are 70 and 44%, respectively. Optimal storage conditions (temperature and humidity) ensured a reduction the level of nitrates in vegetable products after 8 months by 50%. Thus, the degree of reduction in the amount of nitrates during storage depends on the type of product, their initial content, storage modes and other conditions.

Depending on the method of further cooking, the amount of nitrates decreases differently. When potatoes are boiled in water, the level of nitrate nitrogen drops by 40-80%. for a couple - by 30-70%. when frying in vegetable oil - by 15%, in deep frying - by 60%.

By pre-soaking potatoes in a 1% solution of potassium chloride and 1% ascorbic acid and then deep-frying them, the level of nitrates drops by 90%.

As a rule, a small amount of nitrates enters the human body with products of animal origin. Nevertheless, the accumulation of nitrate nitrogen in them is apparently due, on the one hand, to the use of animal feed with high levels of nitrates, and on the other hand, their entry into products during technological processing. The normal amount of nitrates in the muscles of ruminant animals is 0.5-1.0 mg/100 g in the blood - 2-3 mg,

The nitrate content is low in fish and fresh frozen foods. During fish processing (hot smoking), some of the nitrates turn into nitrides.

Thus, the introduction of research work on chemistry of pharmacist students into the educational process of chemical disciplines increases the motivation of students to study chemical disciplines, making learning more interesting and meaningful, contributes to improving the quality of students' knowledge**.**

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