UDC 378

CREATION OF AN ELECTIVE COURSE FOR PHARMACISTS AS AN ELEMENT OF STEM EDUCATION

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Abstract: The structure and systematization of the elective course as an element of STEM - pharmaceutical education, which is introduced into the educational process of pharmaceutical students, is highlighted. It is noted that an effective form of innovative activity of STEM education is the implementation of individual research work by pharmacy students, which is used in the process of studying the program material.

Keywords: STEM - education, scientific work, special course by choice.

Interdisciplinary integration is a priority direction in the development of pharmaceutical education. In particular, the disciplines that exist on the border of sciences complement and systematize the theoretical knowledge of future pharmacists, creating a basis for further study of special subjects. Physico-chemical analysis in the creation of drugs is an optional course in the system of higher pharmaceutical education, introduced into the educational process for students - pharmacists of the 3rd year of specialty 226 "Pharmacy, industrial pharmacy".

The material is structured and systematized according to the methods of qualitative and quantitative analysis (titrimetry, gravimetry, modern chemical, physical and physico-chemical); methods based on the properties of true solutions (ebullition and cryoscopy), sols (stalagmometry), high-molecular compounds (viscometry); thermodynamic and kinetic indicators of medicinal substances. The discipline is integrated with:1. inorganic chemistry - the relationship between the size of atoms and

ions, the features of the electronic configuration and the position in the periodic system of biogenic elements with their biological activity and toxicity is considered;

2. biological chemistry - such biological processes as respiration, photosynthesis, transmission of nerve impulses, metabolic transformations, muscle contraction, as well as protection against toxic and mutagenic effects take place with the participation of biogenic elements. The structure and functions of metalloproteins, the types of interaction of metal ions with proteins, nucleic acids, carbohydrates, and lipids depend on the physical and chemical parameters of metals; 3. pharmaceutical chemistry - determination of the relationship "structure - pharmacological effect", justification of the use of biologically active substances based on inorganic, coordination and organometallic compounds in pharmacy: medicines, biomaterials;

4. toxicological and forensic chemistry - determination of the relationship between the toxicity of elements and their compounds and their electronic structure; a detailed examination of the mechanisms of toxicity of exogenous compounds of metals - xenobiotics; creating approaches to detoxification and finding detoxifying agents in accordance with modern requirements. The Department of Biochemistry and Medicinal Chemistry of the Dnipro State Medical University has developed an educational and methodological complex of the discipline "Physico-chemical analysis in the creation of drugs" in Ukrainian, English, and French for full-time and part-time forms of education.

The complex includes a work program, a teaching-methodical manual [1, p.200], multimedia lectures, methodological instructions for self-training and conducting practical classes, methodological instructions for independent extracurricular work. Therefore, the implementation of the optional course "Physico-chemical analysis in the creation of medicines" allows to concentrate and deepen the knowledge of higher education students, to develop modern forms of theoretical thinking for use in future practical activities.

In the context of the above, we consider the implementation of individual research work of pharmacology students, which is used in the process of studying program material, to be an effective form of innovative activity of STEM education in higher

education. For example, the goal of the research work of students in chemical disciplines was work on the determination of calcium and magnesium ions in such pharmacopoeial drugs as calcium chloride and magnesium sulfate [2, p. 28].

The next research of pharmacy students is devoted to the improvement of the method of complexometry of the content of magnesium and calcium in the leaves of nettle dicotyledons using pyrocatechin violet and acid chrome dark blue indicators. The optimal conditions for the extraction of calcium and magnesium by the method of complexometry from the studied raw materials are not substantiated in the literature

As is known, mineral substances as components of the metabolism of medicinal plants supplement and enhance their therapeutic effect on the body [3, p.235]. Of particular interest is calcium, which is involved in the transmission of nerve impulses, ensures the balance between the processes of excitation and inhibition in the cerebral cortex, plays a major role in regulating the contractility of skeletal and cardiac muscles, affects the acid-base balance of the body, ensures the activity of a number of enzymes, etc. Medicinal plants, in which macro- and microelements are in a bio-absorbable form, can be effective for normalizing the mineral balance [4, p.205].

Dicotyledonous nettle leaves are an official plant material, included in the State Register of Medicinal Products of Ukraine [5, p.332]. The main use of raw materials and preparations based on it is as a hemostatic agent. This pharmacological effect is mainly attributed to fat-soluble vitamins of group K [6, p. 359] contained in nettle leaves. However, it is also known that nettle contains a significant amount of calcium oxalate [4, p. 330]. Vitamin K in the liver promotes the synthesis of specific proteins and enzymes of the blood coagulation system, and calcium in the plasma participates in the processes of their activation.

The hemostatic effect of nettle is based on the synergism of action, as a result of which it is widely used in practical medicine, despite the range of synthetic drugs presented.

In order to determine the completeness of the extraction of calcium and magnesium from the leaves of St. Nettle, the influence of the size of the raw material particles, the ratio of the raw material and the extractant, the optimal time and the extraction frequency were studied. It was found that magnesium is best extracted when nettle

leaves are crushed to less than 0.2 mm. At the same time, the largest amount of calcium in extraction is observed when using raw materials with a particle size of 0.5 to 2.0 mm. Purified water is the best extractant for calcium release.

When using diluted hydrochloric acid, the output of magnesium from medicinal rolin compound (LRS) increases. This is due to intensive destruction of chlorophylls in an acidic environment. At the same time, the output of calcium decreases more than seven times. As antagonists inside a living cell, calcium and magnesium compete in the co-extraction process.

The optimal extractant for the simultaneous extraction of these trace elements is purified water at a ratio of raw materials with a particle size of 0.5 - 1.0 mm and extractant of 1:50. The optimal extraction time, according to experimental data, was 60 minutes.

A further increase in time, as well as the extraction frequency, is impractical, as it does not lead to an increase in the yield of LRS microelements. The next stage of the work will be related to the comparison of the obtained data with the results of the determination of calcium and magnesium in the leaves of nettle dicotyledons in the works of other authors.

Therefore, the optimal conditions for the extraction of calcium and magnesium from the leaves of nettle and their determination in the listed medicinal substances (calcium chloride and magnesium sulfate) were selected. The results indicate the perspective of including the definition of these quality indicators in modern regulatory documentation.

Список літератури

1. Methodical manual on analytical chemistry for preparation for «KROK 1.Pharmacy»/ Hanna Maslak , Lyudmila Khmelnikova. Дніпро. 2023.200 с.

2. Крилкіна А.І. Впровадження методів аналізу при визначенні йонів кальцію в фармакопейних препаратах у викладанні дисципліни «Аналітична хімія» /А.І. Крилкіна, Л.І. Хмельникова//Матеріали XXI Всеукраїнської конференції молодих вчених та студентівз актуальних питань сучасної хімії.Дніпро.2023.С.28-30.

3. Ніжник Г.П. Фармацевтична хімія: підручник. Київ : Медицина, 2010. – 352 с.
4. Державна Фармакопея України. Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». − 1-е вид. − Доповнення 3. Харків : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2009. – 280 с.
5. Державна Фармакопея України. Державне підприємство «Науково-експертний фармакопейний центр». 1-е вид. Доповнення 2. Харків : Державне підприємство «Науковоекспертний фармакопейний центр», 2008. – 548 с.
6. Медична хімія: Підр. для вузів / В.О. Калібабчук, Л.І. Грищенко, В.І. Галинська та ін.; Під ред. В.О. Калібабчук. – К. : Інтермед, 2006 – 460с.