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DISCIPLINE “PHYSICAL-CHEMICAL ANALYSIS IN THE DEVELOPMENT OF MEDICINES” – AN OPTIONAL COMPONENT OF THE EDUCATIONAL PROGRAM “PHARMACY”

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Analytical chemistry methods play an extremely important role in pharmaceutical analysis, including in the process of identifying new potential biologically active compounds and their pharmaceutical properties [1-4]. Therefore, the educational program “Pharmacy” provides for the study of the discipline “Physical-chemical analysis in the development of medicines” for various forms of student education – full-time and part-time domestic students and students of foreign citizens of Bogomolets National Medical University.

Discipline “Physical-chemical analysis in the development of medicines” (elective course) belongs to the disciplines of the cycle of professionally-oriented training of the second (master’s) level of higher education, field of knowledge – 22 “Health Care”, specialty 226 “Pharmacy, Industrial Pharmacy”. The discipline is based on the general laws of physical and chemical sciences, studies methods of analysis of the structure and properties of drugs and biologically active compounds at the stage of drug development using an arsenal of physical and chemical methods. The discipline is part of the study of drugs of medicines, understanding their action and principles of creation, taking into account the principle of integrity of the pharmaceutical industry and based on a holistic concept – “from idea to medicines”.

Scope of the discipline: total number of hours – 90, of which lectures – 10 hours, practical classes – 10 hours, seminars – 10 hours, self-dependent work of students – 60 hours; the number of ECTS credits is 3.0. Semester: VI. Weekly hours for full-time education: classrooms – 3.0 and student’s self-dependent work – 6.0.

This course was introduced for the first time in the 2017/2018 academic year. Students of various forms of education took this discipline almost every academic year. Over the course of several years, we have optimized the course program taking into account the conditions of study during the period of global emergency due to COVID-19 and state of war in Ukraine, and currently the following content of the discipline is offered.

The subject of study of the discipline is physic-chemical methods of analysis in the study of the structure and properties of drugs and biologically active compounds at the stage of search / creation of new medicines. That is why the necessary prerequisites are

the disciplines: “General and inorganic chemistry”, “Analytical chemistry”, “Organic chemistry”, “Physical and colloid chemistry”, that students study during I-V semesters.

The aim of the course “Physical-chemical analysis in the development of medicines” is to study the physico-chemical methods of analysis of the structure and properties of drugs and biologically active compounds at the stage of medicines search.

The studying of course includes the following topics:

Topic 1. Basic stages of medicine development, mechanisms of action of drugs and biologically active compounds.

Topic 2. Characteristics and properties of medicines and drug-like compounds. Physico-chemical parameters.

Topic 3. High performance liquid chromatography (HPLC): principle, application.

Topic 4. HPLC analysis of lipophilicity and binding of small molecules to proteins and phospholipids.

Topic 5. Methods for characterizing protein-ligand interaction (isothermal titration calorimetry, surface plasmon resonance).

Topic 6. Approaches to studying the permeability of small molecules in drug development.

Topic 7. Nuclear Magnetic Resonance Spectroscopy in the Search for New Medicines and Drug Research.

Topic 8. Mass spectrometry in the search for new medicines and drug development.

Topic 9. Near-infrared spectroscopy methods in drug design. Crystallographic methods.

Topic 10. Thermal analysis methods and calorimetric methods for solid form analysis.

Learning outcomes for the course:

1) students should know the main stages of pharmaceutical drugs developments; basic properties of substances evaluated at the stages of medicines design; basic theoretical foundations of physico-chemical methods of analysis (chromatographic, spectroscopic, mass spectrometric, etc.);

2) students should be able to interpret the results of physico-chemical analysis of drugs and biologically active compounds in medicines; to use industry standards, methodological guidelines when implementing methods of quality control of substances and medicines; to use physical, physico-chemical methods in quality control of medicinal products and search for new biologically active compounds;

In our opinion, such a course program promotes the acquisition of competencies:

– formation of knowledge and skills, practical skills in the field of drug analysis and biologically active compounds in the development of pharmaceutical drugs;

– interpretation of the results of the physical and chemical analysis of medicines and biologically active compounds;

– assessment of specific properties of compounds when searching for new medicines, which is confirmed by the results of students' studies of the current academic year.

References:

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