

MINISTRY OF HEALTH OF UKRAINE
BOGOMOLETS NATIONAL MEDICAL UNIVERSITY

**GUIDELINES
to the lectures**

Discipline of choice "Toxicological and forensic chemistry"

Field of knowledge 22 Health care

Specialty 226 "Pharmacy, industrial pharmacy"

Specialization 226.01 "Pharmacy"

Form of study Full-time

Department of medicinal chemistry and toxicology

Approved at the meeting of the department on "30" August 2024, protocol No. 14

Head of the Department of medicinal chemistry and toxicology

Doctor of Medicine, Professor

Nizhenkovska I.V.

Considered and approved:

on the meeting of cycle methodical commission of specialty 226 "Pharmacy, industrial pharmacy" dated August 30, 2024, protocol No. 1

Topic N1.

A group of poisonous substances that are isolated from biological material by extracting the studied objects with water (mineral acids, alkalis and their salts).

Type of lecture: traditional (informational)

Competencies:

integral: the ability to solve tasks of a research and/or innovative nature in the field of pharmacy and in the field of industrial production of medicinal products.

general:

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Knowledge and understanding of the subject area; understanding of professional activity.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to evaluate and ensure the quality of the work performed.

GC06. Ability to work in a team.

GC09. Ability to use information and communication technologies

GC10. Ability to make decisions and act in accordance with the principle of inadmissibility of corruption and any other manifestations of dishonesty.

professionals:

PC02. Ability to collect, interpret and apply data necessary for professional activity, research and implementation of innovative projects in the field of pharmacy.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

PC04. Ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments in the field of pharmacy to specialists and non-specialists, in particular to people who are studying.

Purpose: to form the systematized foundations of scientific knowledge regarding the group of poisonous substances that are isolated from biological material by extracting the studied objects with water (mineral acids, alkalis and their salts), their use in medical and pharmaceutical practices, methods of their isolation from the objects of research, ways of biotransformation, symptoms of poisoning, methods of qualitative detection and quantitative determination of poisonous substances and their metabolites in human biological fluids and cadaveric material, provision of pre-hospital first aid for poison intoxication; to provide an approximate basis for further assimilation of educational material in practical classes.

Lecture equipment: laptop, multimedia projector, blackboard.

Tasks of the lecture:

the student should know

representatives of the group of poisonous substances and peculiarities of their chemical

structure;

- ways of entering the human body and ways of removal from the body;
- ways of biotransformation of poisonous substances and methods of first aid in case of poisoning;
- methods of isolation and purification of extracts;
- methods of qualitative detection of poisonous substances and their metabolites using chemical and physicochemical methods;
- methods of quantitative determination of poisonous substances and their metabolites using chemical and physicochemical methods;

Plan of the Lecture

The name the stage of the lecture	Content of the stages	Educational goal of the stage	Time
Introduction	Announcement of the topic of the lecture, plan of the lecture, definition of the purpose of the lecture, a description of the problems proposed to be considered during the lecture, a brief description of the literature.	Activation of the previously acquired scientific knowledge of students in other disciplines and laying the scientific basis for assimilating the lecture material.	10 min
Main part	<p>1. Elective discipline "Toxicological and forensic chemistry". Purpose and task: to reveal the content and purpose and tasks of the elective discipline.</p> <p>2. A group of poisonous substances that are isolated from biological material by extracting the studied objects with water (mineral acids, alkalis and their salts): to familiarize with the use of the representatives of the group of poisonous substances in medicine and pharmacy, to reveal the metabolic pathways and methods of isolation; to familiarize with the methods of analysis of poisonous substances and their metabolites.</p> <p>3. Ways of entry of poisons into the human body and ways of their removal from the body. Methods of pre-hospital first aid in case of poisoning: to emphasize the main techniques for pre-hospital first aid in case of poisoning, to list the main ways of entry of poisonous substances into the body and ways of removal.</p>	<p>To acquire knowledge about the scientific basis of chemical and toxicological analysis; to reveal the purpose and tasks, objects and methods of research.</p> <p>To acquire knowledge about the group of poisonous substances that are isolated from biological material by extracting the studied objects with water (mineral acids, alkalis and their salts), methods of their isolation and analysis, taking into account the peculiarities of the chemical structure and physicochemical parameters.</p> <p>Get acquainted with the ways of entry of poisonous substances and ways of their removal from the body, the strategy and tactics of first aid in case of poisoning.</p>	65 min
Final part	Generalization in short formulations of the main content of the lecture, logically concluding it as a completed work; direction of further independent work of students; laying the scientific basis for the following	Learning the actual material of the lecture, the main theoretical provisions with the help of logical nodes - the key questions of the lecture.	15 min

Recommended literature:

Basic

1. Welchinska E.V. Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook: K.: PE Lopatina O.O., ISBN 978-617-7533-02-2, 2017. — p. 320-334.
<http://ir.librarynmu.com/handle/123456789/9123>
2. Materials of Lecturers. The department of medicinal chemistry and toxicology of pharmaceutical faculty of Bogomolets NMU. <https://www.youtube.com/@user-yj2fn5mz3x/>

Auxiliary

1. Jarrad R. Wagner, [An Introduction to Interdisciplinary Toxicology](#). Chapter 32 in From molecules to man. 445-459, 2020. <https://doi.org/10.1016/B978-0-12-813602-7.00032-6>
2. The European Monitoring Centre for Drugs and Drug Addiction-EMCDDA (2022) European drug report—trends and developments. p 60.
https://www.emcdda.europa.eu/publications/edr/trends-developments/2022_en.
Accessed 15 Apr 2023
3. Pieprzyca E, Skowronek R, Czekaj P (2022) Toxicological analysis of intoxications with synthetic cathinones. *J Anal Toxicol* 46(7):705-711.
<https://doi.org/10.1093/jat/bkab102>.

Informational resources

1. European Pharmacopoeia online - pheur.edqm.eu
2. The British Pharmacopoeia 2021 - www.pharmacopoeia.com
3. The British Pharmacopoeia 2020. London.2020: I-1298.
www.webofpharma.com
4. Pharmacopoea USP. www.usp.org.
5. Website of the Department of Medicinal Chemistry and Toxicology of O.O. Bogomolets <http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-farmatsevticheskoj-byologicheskoj-y-toksykologicheskoj-hymyy/>
6. Distance learning platform LIKAR_NMU <https://likar.nmu.kiev.ua/>
7. Official website of the Ministry of Health of Ukraine
<https://moz.gov.ua/>
8. International Journal of Medical Toxicology and Forensic Medicine (IJMTFM). <https://journals.sbmu.ac.ir/ijmtfm>
9. Journal of Synthetic Organic Chemistry, Japan.
<http://www.ssocj.jp/indexenglish>.
10. Journal of Organic Chemistry, USA. <https://doi.org/10.1021/acs.joc.0c02255>.

Questions for student self-preparation for the lecture:

1. The purpose and tasks of the optional discipline "Toxicological and Forensic Chemistry".
2. Objects of chemical and toxicological analysis.
3. Characteristics of the group of poisonous substances that are isolated from biological material by extracting the studied objects with water (mineral acids, alkalis and their salts - sulfuric acid, nitric acid, sodium hydroxide, potassium hydroxide, nitrates, nitrites, etc.): the main representatives of the group of poisonous substances, their use in medicine and pharmacy.
4. Toxicological characteristics of a group of poisonous substances.
5. The main ways of metabolism of poisonous substances, which are isolated from biological material by extraction of the studied objects with water.
6. Methods of isolating poisonous substances - mineral acids, alkalis and their salts.
7. Methods of analysis of poisonous substances and their metabolites (isolated from biological material by extraction of the studied objects with water).
8. Methods of pre-hospital first aid for intoxications.

The methodical development was made by:

head of the department of medicinal chemistry and toxicology, DM, professor Nizhenkovska I.V., professor of department, doctor of pharm. sc. Welchinska O.V.

Topic N2. A group of poisonous substances that are isolated from biological material by distillation with water vapor (volatile substances).

Type of lecture: traditional (informational)

Competencies:

integral: the ability to solve tasks of a research and/or innovative nature in the field of pharmacy and in the field of industrial production of medicinal products.

general:

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Knowledge and understanding of the subject area; understanding of professional activity.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to evaluate and ensure the quality of the work performed.

GC06. Ability to work in a team.

GC09. Ability to use information and communication technologies

GC10. Ability to make decisions and act in accordance with the principle of inadmissibility of corruption and any other manifestations of dishonesty.

professionals:

PC02. Ability to collect, interpret and apply data necessary for professional activity, research and implementation of innovative projects in the field of pharmacy.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

PC04. Ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments in the field of pharmacy to specialists and non-specialists, in particular to people who are studying.

Purpose: to form systematized bases of scientific knowledge regarding the group of poisonous substances that are isolated from biological material by distillation ("volatile" poisons), their use in medical and pharmaceutical practices, methods of their isolation from research objects, ways of biotransformation, symptoms of poisoning, methods of qualitative detection and quantitative determination of poisonous substances and their metabolites in human biological fluids and cadaveric material, provision of pre-hospital first aid for poison intoxication; to provide an approximate basis for further assimilation of educational material in practical classes.

Lecture equipment: laptop, multimedia projector, blackboard.

Tasks of the lecture:

the student should know

representatives of the group of poisonous substances and peculiarities of their chemical structure ("volatile" poisons);

- ways of entering the human body and ways of removal from the body;
- ways of biotransformation of poisonous substances and methods of first aid in case of poisoning;
- methods of isolation and purification of extracts;
- methods of qualitative detection of poisonous substances and their metabolites using chemical and physical-chemical methods;
- methods of quantitative determination of poisonous substances and their metabolites using chemical and physical-chemical methods;

Plan of the Lecture

The name the stage of the lecture	Content of the stages	Educational goal of the stage	Time
Introduction	Announcement of the topic of the lecture, of the lecture, definition of the purpose of the lecture, a brief description of the problems proposed to be considered during the lecture, a brief description of the literature.	Activation of the previously acquired scientific knowledge of students from other disciplines and laying the scientific basis for assimilating lecture material.	10 min
Main part	<p>1. A group of poisonous substances that are isolated from biological material by steam distillation ("volatile" poisons): the representatives, features of their chemical structure, use in medical and pharmaceutical practices.</p> <p>2. Features of isolation from research objects and methods of analysis of poisonous substances that are isolated from biological material by distillation with water vapor ("volatile" poisons): to reveal the pathways of metabolism and methods of isolation, to familiarize with the method of analysis of poisonous substances and metabolites.</p> <p>3. Ways of entry of poisons into the human body and ways of their removal from the body. Methods of pre-hospital first aid in case of poisoning: to emphasize the main techniques for pre-hospital first aid in case of poisoning. list the main ways of entry of poisonous substances into the body and ways of removal.</p>	<p>To acquire knowledge about the peculiarities of chemical and toxicological analysis of research objects in case of poisoning "volatile" poisons.</p> <p>To acquire knowledge about the general features of "volatile" poisons, methods of isolation and analysis, taking into account the peculiarities of their chemical structure and physicochemical parameters.</p> <p>Get acquainted with the ways of entry of poisonous substances and ways of their removal from the body, their removal from the body, strategy and tactics of first aid in case of poisoning.</p>	65 min
Final part	Generalization in short formulations of the	Learning the actual material of	15

	ideas of the lecture, logically concluding it complete work; direction of further independent work of students; laying the scientific basis for the following lectures.	lecture, the main theoretical provisions with the help of logical nodes main questions of the lecture.	min
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Recommended literature:

Basic

1. Welchinska E.V. Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook: K.: PE Lopatina O.O., ISBN 978-617-7533-02-2, 2017. — p. 33-85.
<http://ir.librarynmu.com/handle/123456789/9123>
2. Materials of Lecturers. The department of medicinal chemistry and toxicology of pharmaceutical faculty of Bogomolets NMU. <https://www.youtube.com/@user-yj2fn5mz3x/>

Auxiliary

1. Jarrad R. Wagner, [An Introduction to Interdisciplinary Toxicology](#). Chapter 32 in From molecules to man. 445-459, 2020. <https://doi.org/10.1016/B978-0-12-813602-7.00032-6>
2. The European Monitoring Centre for Drugs and Drug Addiction-EMCDDA (2022) European drug report—trends and developments. p 60.
https://www.emcdda.europa.eu/publications/edr/trends-developments/2022_en.
Accessed 15 Apr 2023
3. Pieprzyca E, Skowronek R, Czekaj P (2022) Toxicological analysis of intoxications with synthetic cathinones. J Anal Toxicol 46(7):705-711.
<https://doi.org/10.1093/jat/bkab102>.

Informational resources

1. European Pharmacopoeia online - pheur.edqm.eu
2. The British Pharmacopoeia 2021 - www.pharmacopoeia.com
3. The British Pharmacopoeia 2020. London.2020: I-1298. www.webofpharma.com
4. Pharmacopoeia USP. www.usp.org.
5. Website of the Department of Medicinal Chemistry and Toxicology of O.O. Bogomolets <http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-farmatsevticheskoy-byologicheskoy-y-toksykologicheskoy-hymyy/>
6. Distance learning platform LIKAR_NMU <https://likar.nmu.kiev.ua/>
7. Official website of the Ministry of Health of Ukraine <https://moz.gov.ua/>
8. International Journal of Medical Toxicology and Forensic Medicine (IJMTFM). <https://journals.sbm.ac.ir/ijmtfm>
9. Journal of Synthetic Organic Chemistry, Japan. <http://www.ssocj.jp/indexenglish>.
10. Journal of Organic Chemistry, USA. <https://doi.org/10.1021/acs.joc.0c02255>.

Questions for student self-preparation for the lecture:

1. Characteristics of the group of poisonous substances that are isolated from biological material by distillation with steam ("volatile" poisons - cyanides, alcohols, aldehydes, ketones, alkyl halides, carboxylic acids, benzene and its derivatives): the main representatives of the group of poisonous substances, their use in medicine and pharmacy.
2. Objects of chemical and toxicological analysis in poisoning with "volatile" poisons.
3. The main ways of metabolism of poisonous substances that are isolated from biological material by steam distillation.
4. Toxicological characteristics of a group of poisonous substances.
5. Methods of isolation of "volatile" poisonous substances.
6. Methods of analysis of "volatile" poisonous substances and their metabolites.
7. Methods of pre-hospital first aid for intoxications.

The methodical development was made by:

head of the department of medicinal chemistry and toxicology, DM, professor Nizhenkovska I.V., professor of department, doctor of pharm. sc. Welchinska O.V.

Topic N3. A group of poisonous substances that are isolated from biological material by mineralization (metallic poisons). Chemical and toxicological aspects of extreme situations.

Type of lecture: traditional (informational)

Competencies:

integral: the ability to solve tasks of a research and/or innovative nature in the field of pharmacy and in the field of industrial production of medicinal products.

general:

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Knowledge and understanding of the subject area; understanding of professional activity.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to evaluate and ensure the quality of the work performed.

GC06. Ability to work in a team.

GC09. Ability to use information and communication technologies

GC10. Ability to make decisions and act in accordance with the principle of inadmissibility of corruption and any other manifestations of dishonesty.

professionals:

PC02. Ability to collect, interpret and apply data necessary for professional activity, research and implementation of innovative projects in the field of pharmacy.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

PC04. Ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments in the field of pharmacy to specialists and non-specialists, in particular to people who are studying.

Purpose: to form systematized bases of scientific knowledge regarding the group of poisonous substances that are isolated from biological material by mineralization ("metallic" poisons), their use in medical and pharmaceutical practices, methods of their isolation from research objects, ways of biotransformation, symptoms of poisoning, methods of qualitative detection and quantitative determination of poisonous substances and their metabolites in human biological fluids and cadaveric material, provision of pre-hospital first aid for poison intoxication; to provide an approximate basis for further assimilation of educational material in practical classes.

Lecture equipment: laptop, multimedia projector, blackboard.

Tasks of the lecture:

the student should know

- representatives of the group of poisonous substances and peculiarities of their chemical structure ("metallic" poisons);

- ways of entering the human body and ways of removal from the body;
- ways of biotransformation of poisonous substances and methods of first aid in case of poisoning;
- methods of isolation and purification of mineralizates;
- methods of qualitative detection of poisonous substances and their metabolites using chemical and physical-chemical methods;
- methods of quantitative determination of poisonous substances and their metabolites using chemical and physical-chemical methods;

Plan of the Lecture

The name the stage of the lecture	Content of the stages	Educational goal of the stage	Time
Introduction	Announcement of the topic of the lecture, of the lecture, definition of the purpose of lecture, a brief description of the problems proposed to be considered during lecture, a brief description of the literature.	Activation of the previously acquired scientific knowledge of students in other disciplines and laying scientific basis for assimilating lecture material.	10 min
Main part	<p>1. A group of poisonous substances that isolated from biological material mineralization ("metallic" poisons): the representatives, features of their chemical structure, use in medical and pharmaceutical practices.</p> <p>2. Features of isolation from research objects and methods of analysis of poisonous substances that are isolated from biological material by mineralization ("metallic" poisons) to reveal the main pathways of metabolism methods of isolation, to familiarize with methods of analysis of poisonous substances and their metabolites.</p> <p>3. Ways of entry of poisons into the human body and ways of their removal from the body. Military poisons (metal-containing poisons). Methods of pre-hospital first aid in case of poisoning: to emphasize the main techniques for pre-hospital first aid in case of poisoning list the main ways of entry of poisonous substances into the body and ways of removal.</p>	<p>To acquire knowledge about peculiarities of chemical toxicological analysis of research objects in poisoning with "metallic" poisons.</p> <p>To acquire knowledge about the general features of "metallic" poisons, methods of isolation and analysis, taking account the peculiarities of chemical structure physicochemical parameters.</p> <p>Get acquainted with the ways of entry of poisonous substances and ways of their removal from the body, strategy and tactics of first aid in case of poisoning.</p>	65 min
Final part	Generalization in short formulations of the	Learning the actual material of	15

	ideas of the lecture, logically concluding it complete work; direction of further independent work of students; laying the scientific basis for the following lectures.	lecture, the main theoretical provisions with the help of logical nodes and main questions of the lecture.	min
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Recommended literature:

Basic

1. Welchinska E.V. Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook: K.: PE Lopatina O.O., ISBN 978-617-7533-02-2, 2017. — p. 85-128.
<http://ir.librarynmu.com/handle/123456789/9123>
2. Materials of Lecturers. The department of medicinal chemistry and toxicology of pharmaceutical faculty of Bogomolets NMU. <https://www.youtube.com/@user-yj2fn5mz3x/>

Auxiliary

1. Jarrad R. Wagner, [An Introduction to Interdisciplinary Toxicology](#). Chapter 32 in From molecules to man. 445-459, 2020. <https://doi.org/10.1016/B978-0-12-813602-7.00032-6>
2. The European Monitoring Centre for Drugs and Drug Addiction-EMCDDA (2022) European drug report—trends and developments. p 60.
https://www.emcdda.europa.eu/publications/edr/trends-developments/2022_en.
Accessed 15 Apr 2023
3. Pieprzyca E, Skowronek R, Czekaj P (2022) Toxicological analysis of intoxications with synthetic cathinones. J Anal Toxicol 46(7):705-711.
<https://doi.org/10.1093/jat/bkab102>.

Informational resources

1. European Pharmacopoeia online - pheur.edqm.eu
2. The British Pharmacopoeia 2021 - www.pharmacopoeia.com
3. The British Pharmacopoeia 2020. London.2020: I-1298.
www.webofpharma.com
4. Pharmacopoea USP. www.usp.org.
5. Website of the Department of Medicinal Chemistry and Toxicology of O.O. Bogomolets <http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-farmatsevticheskoy-byologicheskoy-y-toksykologicheskoy-hymyy/>
6. Distance learning platform LIKAR_NMU <https://likar.nmu.kiev.ua/>
7. Official website of the Ministry of Health of Ukraine <https://moz.gov.ua/>
8. International Journal of Medical Toxicology and Forensic Medicine (IJMTFM). <https://journals.sbm.u.ac.ir/ijmtfm>
9. Journal of Synthetic Organic Chemistry, Japan.
<http://www.ssocj.jp/indexenglish>.
10. Journal of Organic Chemistry, USA. <https://doi.org/10.1021/acs.joc.0c02255>.

Questions for student self-preparation for the lecture:

1. Characteristics of a group of poisonous substances that are isolated from biological material by mineralization ("metallic" poisons - compounds of Barium, Bismuth, Mercury, Arsenic, Cadmium, Lead, Argentum, Zinc, Antimony, Chromium, Manganese, Thallium, etc.; metal-containing combat poisonous substances): the main representatives of the group of poisonous substances, their use in medicine and pharmacy.
2. Objects of chemical and toxicological analysis in cases of poisoning with "metallic" poisons.
3. The main ways of metabolism of poisonous substances that are isolated from biological material by mineralization.
4. Toxicological characteristics of a group of poisonous substances.
5. Methods of isolating "metallic" poisonous substances.
6. Methods of analysis of "metallic" poisonous substances and their metabolites.
7. Methods of pre-hospital first aid for intoxications.

The methodical development was made by:

head of the department of medicinal chemistry and toxicology, DM, professor Nizhenkovska I.V., professor of department, doctor of pharm. sc. Welchinska O.V.

Topic N4. A group of poisonous substances released by polar solvents ("medical poisons"). Toxicological characteristics and peculiarities of chemical-toxicological analysis of drugs of acidic and slightly alkaline nature.

Type of lecture: traditional (informational)

Competencies:

integral: the ability to solve tasks of a research and/or innovative nature in the field of pharmacy and in the field of industrial production of medicinal products.

general:

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Knowledge and understanding of the subject area; understanding of professional activity.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to evaluate and ensure the quality of the work performed.

GC06. Ability to work in a team.

GC09. Ability to use information and communication technologies

GC10. Ability to make decisions and act in accordance with the principle of inadmissibility of corruption and any other manifestations of dishonesty.

professionals:

PC02. Ability to collect, interpret and apply data necessary for professional activity, research and implementation of innovative projects in the field of pharmacy.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

PC04. Ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments in the field of pharmacy to specialists and non-specialists, in particular to people who are studying.

Purpose: to form systematized bases of scientific knowledge regarding the group of poisonous substances that are isolated from biological material with polar solvents ("medical" poisons), their use in medical and pharmaceutical practices, methods of their isolation from research objects, ways of biotransformation, symptoms of poisoning, methods of qualitative detection and quantitative determination of poisonous substances and their metabolites in human biological fluids and cadaveric material, provision of pre-hospital first aid for poison intoxication; to provide an approximate basis for further assimilation of educational material in practical classes.

Lecture equipment: laptop, multimedia projector, blackboard.

Tasks of the lecture:

the student should know

representatives of the group of poisonous substances and peculiarities of their chemical structure ("medical" poisons);

- ways of entering the human body and ways of removal from the body;
- ways of biotransformation of poisonous substances and methods of first aid in case of poisoning;
- methods of isolation and purification of extracts;
- methods of qualitative detection of poisonous substances and their metabolites using chemical and physical-chemical methods;
- methods of quantitative determination of poisonous substances and their metabolites using chemical and physical-chemical methods;

Plan of the Lecture

The name the stage of the lecture	Content of the stages	Educational goal of the stage	Time
Introduction	Announcement of the topic of the lecture, of the lecture, definition of the purpose of the lecture, a brief description of the problems proposed to be considered during the lecture, a brief description of the literature.	Activation of the previously acquired scientific knowledge of students from other disciplines and laying the scientific basis for assimilating lecture material.	10 min
Main part	<p>1. A group of poisonous substances that are isolated from biological material with the use of solvents ("medical" poisons): the names of their representatives, features of their chemical structure, use in medical and pharmaceutical practices.</p> <p>2. Features of isolation from research objects and methods of analysis of "medical" poisons to reveal the main pathways of metabolism of "medical" poisons, methods of isolation, to familiarize with the methods of analysis of poisonous substances and their metabolites.</p> <p>3. Ways of entry of poisons into the human body and ways of their removal from the body. Methods of pre-hospital first aid in case of poisoning: to emphasize the main techniques for pre-hospital first aid in case of poisoning, list the main ways of entry of poisonous substances into the body and ways of their removal.</p>	<p>To acquire knowledge about the peculiarities of chemical and toxicological analysis of research objects in case of poisoning by "medical" poisons.</p> <p>To acquire knowledge about the general features of "medical" poisons, methods of isolation and analysis, taking into account the peculiarities of their chemical structure and physicochemical parameters.</p> <p>Get acquainted with the ways of entry of poisonous substances and ways of their removal from the body, strategy and tactics of first aid in case of poisoning.</p>	65 min
Final part	Generalization in short formulations of the main ideas of the lecture, logically concluding it as a complete work; direction of further independent work of students; laying the scientific basis	Learning the actual material of the lecture, the main theoretical provisions with the help of logical nodes - main questions of the lecture.	15 min

the following lectures.		
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Recommended literature:

Basic

1. Welchinska E.V. Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook: K.: PE Lopatina O.O., ISBN 978-617-7533-02-2, 2017. — p. 128-293.
<http://ir.librarynmu.com/handle/123456789/9123>
2. Materials of Lecturers. The department of medicinal chemistry and toxicology of pharmaceutical faculty of Bogomolets NMU. <https://www.youtube.com/@user-yj2fn5mz3x/>

Auxiliary

1. Jarrad R. Wagner, [An Introduction to Interdisciplinary Toxicology](#). Chapter 32 in From molecules to man. 445-459, 2020. <https://doi.org/10.1016/B978-0-12-813602-7.00032-6>
2. The European Monitoring Centre for Drugs and Drug Addiction-EMCDDA (2022) European drug report—trends and developments. p 60.
https://www.emcdda.europa.eu/publications/edr/trends-developments/2022_en.
Accessed 15 Apr 2023
3. Pieprzyca E, Skowronek R, Czekaj P (2022) Toxicological analysis of intoxications with synthetic cathinones. J Anal Toxicol 46(7):705-711.
<https://doi.org/10.1093/jat/bkab102>.

Informational resources

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2. The British Pharmacopoeia 2021 - www.pharmacopoeia.com
3. The British Pharmacopoeia 2020. London.2020: I-1298. www.webofpharma.com
4. Pharmacopoea USP. www.usp.org.
5. Website of the Department of Medicinal Chemistry and Toxicology of O.O. Bogomolets <http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-farmatsevticheskoy-byologicheskoy-y-toksykologicheskoy-hymyy/>
6. Distance learning platform LIKAR_NMU <https://likar.nmu.kiev.ua/>
7. Official website of the Ministry of Health of Ukraine <https://moz.gov.ua/>
8. International Journal of Medical Toxicology and Forensic Medicine (IJMTFM). <https://journals.sbm.ac.ir/ijmtfm>
9. Journal of Synthetic Organic Chemistry, Japan. <http://www.ssocj.jp/indexenglish>.
10. Journal of Organic Chemistry, USA. <https://doi.org/10.1021/acs.joc.0c02255>.

Questions for student self-preparation for the lecture:

1. Characteristics of a group of poisonous substances that are isolated from

biological material with polar solvents ("medical" poisons - derivatives of barbituric acid, salicylic acid, pyrazolone, para-aminophenol, phenylglutarimide, alkaloids (derivatives of pyridine, piperidine, tropane, quinoline, quinolizidine, isoquinoline, pyrrolidine, etc.), synthetic derivatives of phenothiazine, 1,4-benzodiazepine, morphine, oxypiperidine, etc.): the main representatives of the group of poisonous substances, their use in medicine and pharmacy.

2. Objects of chemical and toxicological analysis in cases of poisoning with "medical" poisons.

3. The main ways of metabolism of poisonous substances that are isolated from biological material with polar solvents ("medical" poisons).

4. Toxicological characteristics of a group of poisonous substances.

5. Methods of isolation of "medical" poisonous substances.

6. Methods of analysis of "medical" poisonous substances and their metabolites.

7. Methods of pre-hospital first aid for intoxications.

The methodical development was made by:

head of the department of medicinal chemistry and toxicology, DM, professor Nizhenkovska I.V., professor of department, doctor of pharm. sc. Welchinska O.V.

Topic N5. Poisons of natural origin (poisons of plants, mushrooms, animals and insects). Toxicological characteristics and features of chemical-toxicological analysis.

Type of lecture: traditional (informational)

Competencies:

integral: the ability to solve tasks of a research and/or innovative nature in the field of pharmacy and in the field of industrial production of medicinal products.

general:

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Knowledge and understanding of the subject area; understanding of professional activity.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to evaluate and ensure the quality of the work performed.

GC06. Ability to work in a team.

GC09. Ability to use information and communication technologies

GC10. Ability to make decisions and act in accordance with the principle of inadmissibility of corruption and any other manifestations of dishonesty.

professionals:

PC02. Ability to collect, interpret and apply data necessary for professional activity, research and implementation of innovative projects in the field of pharmacy.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

PC04. Ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments in the field of pharmacy to specialists and non-specialists, in particular to people who are studying.

Purpose: to form systematized bases of scientific knowledge regarding the group of poisonous substances that are isolated from biological material with solvents (poisons of natural origin - plant, mushroom, animal and insect poisons), their use in medical and pharmaceutical practices, methods of their isolation from research objects, ways biotransformation, symptoms of poisoning, methods of qualitative detection and quantitative determination of poisonous substances and their metabolites in human biological fluids and cadaveric material, provision of pre-hospital first aid for poison intoxication; to provide an approximate basis for further assimilation of educational material in practical classes.

Lecture equipment: laptop, multimedia projector, blackboard.

Tasks of the lecture:

the student should know

□ representatives of the group of poisonous substances and peculiarities of their chemical structure (poisons of natural origin - plant, mushroom, animal and insect poisons);

- ways of entering the human body and ways of removal from the body;
- ways of biotransformation of poisonous substances and methods of first aid in case of poisoning;
- methods of isolation and purification of extracts;
- methods of qualitative detection of poisonous substances and their metabolites using chemical and physical-chemical methods;
- methods of quantitative determination of poisonous substances and their metabolites using chemical and physical-chemical methods;

Plan of the Lecture

The name the stage of the lecture	Content of the stages	Educational goal of the stage	Time
Introduction	Announcement of the topic of the lecture, of the lecture, definition of the purpose of lecture, a brief description of the problems proposed to be considered during lecture, a brief description of the literature.	Activation of the previously acquired scientific knowledge of students from other disciplines and laying scientific basis for assimilating lecture material.	10 min
Main part	<p>1. A group of poisonous substances - poisons of natural origin - poisons of plants, mushrooms, animals and insects that are isolated from biological material with solvents: the representatives, features of their chemical structure, use in medical and pharmaceutical practices.</p> <p>2. Features of isolation from research objects and methods of analysis of poisons of natural origin - poisons of plants, mushrooms, animals and insects: reveal the main pathways of metabolism and methods of isolation. Familiarize with the methods of analysis of poisonous substances and their metabolites.</p> <p>3. Ways of entry of poisons into the human body and ways of their removal from the body. Methods of pre-hospital first aid in case of poisoning: to emphasize the main techniques for pre-hospital first aid in case of poisoning. List the main ways of entry of poisonous substances into the body and ways of removal.</p>	<p>To acquire knowledge about the peculiarities of chemical and toxicological analysis of research objects in case of poisoning by poisons of natural origin - poisons of plants, mushrooms, animals and insects.</p> <p>To acquire knowledge about the general features and methods of analysis of poisons of natural origin - poisons of plants, mushrooms, animals and insects, methods of their isolation and analysis, taking into account the peculiarities of the chemical structure and physicochemical parameters.</p> <p>Get acquainted with the ways of entry of poisonous substances and ways of their removal from the body, strategy and tactics of first aid in case of poisoning.</p>	65 min
Final part	Generalization in short formulations of the	Learning the actual material of	15

	ideas of the lecture, logically concluding it with the help of logical nodes complete work; direction of further independent work of students; laying the scientific basis for the following lectures.	lecture, the main theoretical provisions and main questions of the lecture.	min
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Recommended literature:

Basic

1. Welchinska E.V. Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook: K.: PE Lopatina O.O., ISBN 978-617-7533-02-2, 2017. — p. 217-256.
<http://ir.librarynmu.com/handle/123456789/9123>
2. Materials of Lecturers. The department of medicinal chemistry and toxicology of pharmaceutical faculty of Bogomolets NMU. <https://www.youtube.com/@user-yj2fn5mz3x/>

Auxiliary

1. Jarrad R. Wagner, [An Introduction to Interdisciplinary Toxicology](#). Chapter 32 in From molecules to man. 445-459, 2020. <https://doi.org/10.1016/B978-0-12-813602-7.00032-6>
2. The European Monitoring Centre for Drugs and Drug Addiction-EMCDDA (2022) European drug report—trends and developments. p 60.
https://www.emcdda.europa.eu/publications/edr/trends-developments/2022_en.
[Accessed 15 Apr 2023](#)
3. Pieprzyca E, Skowronek R, Czekaj P (2022) Toxicological analysis of intoxications with synthetic cathinones. J Anal Toxicol 46(7):705-711.
<https://doi.org/10.1093/jat/bkab102>.
4. Islam MB, Islam MI, Nath N, Emran TB, Rahman MR, Sharma R, Matin MM. Recent Advances in Pyridine Scaffold: Focus on Chemistry, Synthesis, and Antibacterial Activities. Biomed Res Int. 2023 May 18; 2023: 9967591. [doi: 10.1155/2023/9967591](https://doi.org/10.1155/2023/9967591). PMID: 37250749; PMCID: PMC10212683.

Informational resources

1. European Pharmacopoeia online - pheur.edqm.eu
2. The British Pharmacopoeia 2021 - www.pharmacopoeia.com
3. The British Pharmacopoeia 2020. London.2020: I-1298.
www.webofpharma.com
4. Pharmacopoea USP. www.usp.org.
5. Website of the Department of Medicinal Chemistry and Toxicology of O.O. Bogomolets
<http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-farmatsevticheskoj-byologicheskoy-y-toksykologicheskoy-hymyy/>
6. Distance learning platform LIKAR_NMU <https://likar.nmu.kiev.ua/>
7. Official website of the Ministry of Health of Ukraine <https://moz.gov.ua/>

8. International Journal of Medical Toxicology and Forensic Medicine (IJMTFM). <https://journals.sbmu.ac.ir/ijmtfm>
9. Journal of Synthetic Organic Chemistry, Japan. <http://www.ssocj.jp/indexenglish>.
10. Journal of Organic Chemistry, USA. <https://doi.org/10.1021/acs.joc.0c02255>.

Questions for student self-preparation for the lecture:

1. Characteristics of the group of poisonous substances that are isolated from biological material with solvents (poisons of natural origin - poisons of plants, mushrooms, animals and insects - alkaloids, zootoxins (tetrodotoxin, batrachotoxin, bufotoxins, pumiliotoxins, etc.), etc.): the main representatives of the group of poisonous substances, their use in medicine and pharmacy.
2. Objects of chemical and toxicological analysis in case of poisoning by poisons of natural origin.
3. The main ways of metabolism of poisonous substances of natural origin.
4. Toxicological characteristics of the group of poisons of natural origin - poisons of mushrooms, plants, insects, and zootoxins.
5. Methods of isolation of poisonous substances of natural origin.
6. Methods of analysis of poisons of natural origin and their metabolites.
7. Methods of pre-hospital first aid for intoxications.

The methodical development was made by:

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