

ODESSA NATIONAL MEDICAL UNIVERSITY
Department of General and Clinical Pharmacology and Pharmacognosy

METHODOLOGICAL DEVELOPMENT
Course: "Pharmacognosy"

practical lesson for students on the topic:
"Triterpenoids. Steroids. Saponins. General characteristics. Methods of qualitative and quantitative determination. LR and raw materials containing triterpenoids and triterpene saponins. Types of licorice, bitter chestnut, horsetail, orthosiphon stamen, ginseng, Manchurian aralia, woolly astragalus.

Course: 3rd Faculty: medico-pharmaceutical

**Approved on methodical
meeting of the department
"30" August 2024
Protocol № 1
Head department
MD, prof. JV Rozhkovsky**



Odessa - 2024

1. The topic of the lesson: "Triterpenoids. Steroids. Saponins. General characteristics. Methods of qualitative and quantitative determination. LR and raw materials containing triterpenoids and triterpene saponins. Types of licorice, bitter chestnut, horsetail, orthosiphon stamen, ginseng, Manchurian aralia, woolly astragalus » - 8 hours.

2. Relevance of the topic.

Saponins are natural glycosides that form colloidal solutions and stable foam when shaken with water and cause hemolysis of the blood. According to the structure of aglycone (sapogenin), they are divided into steroid and triterpene. Saponins have a wide range of biological activity. They enhance the secretory activity of the glands, which causes their expectorant effect, have diuretic, anti-inflammatory, antimicrobial, hypercholesterolemic and adaptogenic effects. Knowledge of the rules of collection, drying and storage and the ability to determine the identity and quality of raw materials containing saponins will be used in the practice of pharmacists.

3. Objectives of the lesson:

3.1. General goals: to study medicinal plants containing saponins and to perform work on macro- and microscopic analysis of raw materials on this topic.

3.2. Educational goals: formation of a professionally significant substructure of personality with relevant aspects of deontological, ecological, legal, psychological, patriotic, professional responsibility.

3.3. Specific goals:

- **Know** (level of assimilation according to Bezpalk - II):

1. Definition of "saponins".

2. Distribution of saponins in the plant world and resources of the studied raw materials.

3. Terms and methods of LRS collection.

4. Measures for the protection and rational use of wild medicinal plants containing saponins.

5. Latin and Russian names of LRS, producing plants and families of all objects of the researched topic.

6. Morphological characteristics of plants, their habitats (cultivation areas), places of growth.

7. External signs of the studied types of medicinal raw materials.

8. Possible impurities in raw materials (licorice roots, horsetail grass, astragalus grass) and their main differences.

9. The main anatomical diagnostic features of horsetail grass, licorice root.

10. Chemical composition, uses and medical use of LRS and drugs containing saponins.

Based on theoretical knowledge of the topic and practical work:

- **Master the techniques (be able)** (level of assimilation according to Bezpalk - III):

- Recognize the external features of the plant (*Dioscorea niponskaya*, sweet naked and Ural, cyanosis blue, astragalus woolly, tempting tall, Manchurian aralia, ginseng, horsetail) and distinguish them from possible impurities.

- To determine the identity of raw materials by external features, anatomical structure, histochemical reactions.

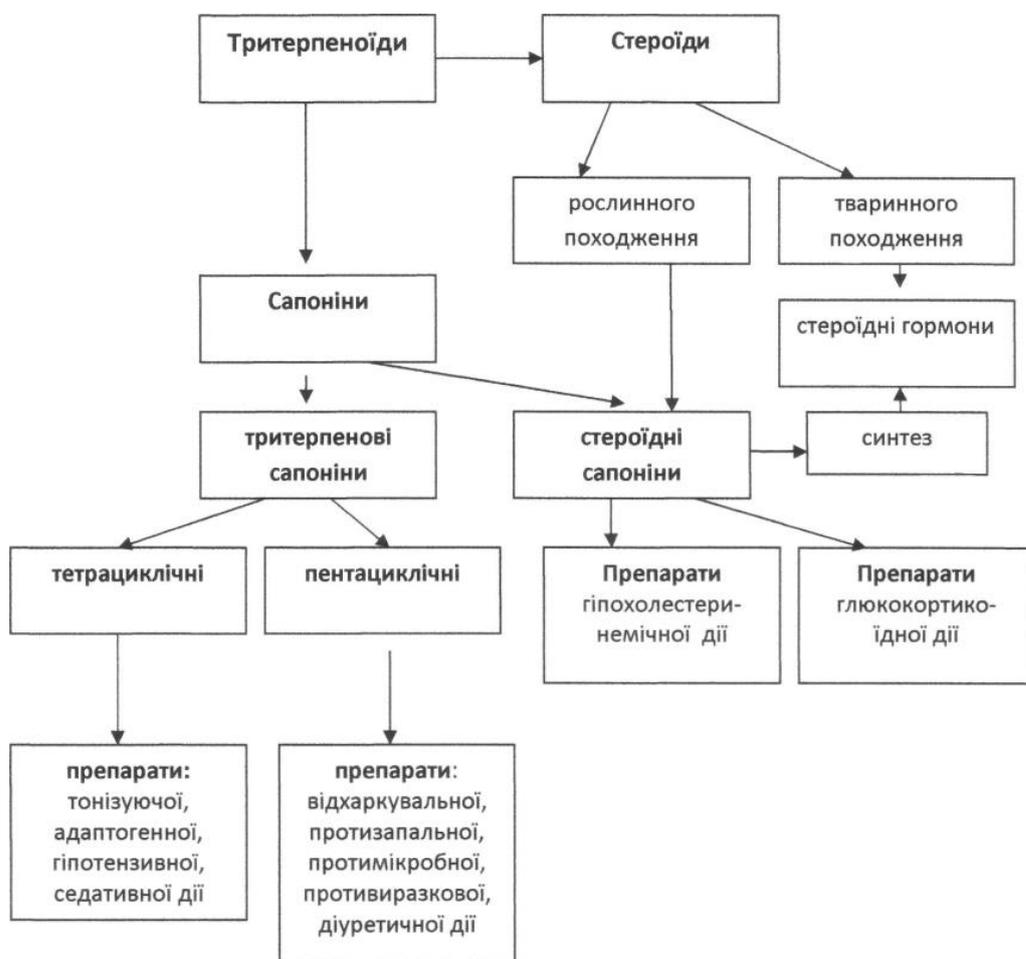
4. Interdisciplinary integration

№ p.p.	discipline	know	be able
1	2	3	4
1.	Previous disciplines: 1. Botany	Characteristic features of the families of the studied plants. Morphology of stem, bark, leaves, flower, fruit, root and rhizome. Anatomical structure of the leaf, bark, fruit, root, rhizome.	Use a microscope, prepare surface preparations and cross-sections.
	2. Organic	Physical and chemical properties	Carry out qualitative

	<p>chemistry</p> <p>3. Analytical chemistry</p>	<p>of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles.</p> <p>Methods of acid-base titration (neutralization) and permanganometry</p>	<p>reactions; purification of organic compounds.</p> <p>Work with analytical scales, measuring vessels, photoelectrocolorimeter, use methods of chromatography on paper and in a thin layer of sorbent.</p>
2.	<p>The following disciplines:</p> <p>1. Physical and colloid chemistry</p> <p>2. Pharmacy technology of drugs</p> <p>3. Industrial technology of medicines</p>	<p>Solubility of solids and liquids in liquids. Distillation. Raoul's law. Konovalov's law. Vapor pressure and composition over mutually insoluble liquids. Buffer solutions. Polarography. Potentiometric titration. Adsorption. Ion exchange adsorption. Chromatography: paper, column, in a thin layer of sorbent, gel chromatography.</p> <p>Methods of measuring mass and volume. Preparation of powders or liquid drugs for internal and external use. Analysis of prepared liquid drugs using a burette system.</p> <p>Conditions of industrial preparation of medicines. Principles of organization of pharmaceutical production of various dosage forms: liquid, solid, soft, injectable solutions, etc. Machines, devices, equipment for the production of medicines.</p> <p>Pharmacodynamics and</p>	

	<p>4. Clinical pharmacology</p> <p>5. Pharmaceutical chemistry</p> <p>6. Organization and economics of pharmacy</p> <p>7. Management and marketing in pharmacy</p>	<p>pharmacokinetics of drugs. The pattern of action of drugs on the human body and its corresponding reactions. Basic principles of treatment in terms of drug selection, evaluation of their effectiveness and safety.</p> <p>Methods of qualitative and quantitative study of drugs.</p> <p>Pharmaceutical service management. Storage of medicines. Control and analytical service, organization of its work. Accounting for inventory and cash. Economic analysis of the pharmacy.</p> <p>Management and entrepreneurship. Organization as an object of management. Connecting processes in management. Human Resource Management Pharmaceutical Marketing Management. Pharmaceutical market research. International marketing.</p>	
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5. Content of the topic (text or thesis), graphological structure of the lesson.



6. Plan and organizational structure of the lesson.

№.№ р.р.	The main stages of the lesson, their functions and content.	Learning objectives in the levels of mastery.	Means of training and control.	Materials on methodical forensuring the visibility of the lesson, control the knowledge of those who teachis.	Term (in minutes or in%) of the total class time.
1	2	3	4	5	6
1	<i>Preparatory stage</i> Organization of classes Setting learning goals Homework check	II	Oral interview on the topic	Methodical works for students, album	1% 2% 25%
2	<i>The main stage</i> Conducting a practical lesson	III	Herbariums of medicinal plants, LRS, reagents		50%
3	<i>The final stage</i> Testing and assessment of practical skills	II- III	Herbariums of medicinal	Methodical works for	5%

	Checking the final level of knowledge	II- III	plants, LRS, reagents	students, album	15%
	Providing homework with a reference to the literature			Tests and situational tasks	3%

7. Materials on methodological support of the lesson

7.1. Control materials for the preparatory stage of the lesson: questions, tasks, tests.

Tests:

1. Licorice root contains saponins. Which method of analysis allows you to detect the level of saponins:

- A. foam number
- B. acid number
- B. ethereal number
- G. iodine value
- D. the number of saponification

2. To identify the raw material, an aqueous decoction of licorice roots was placed in a test tube with a ground stopper and shaken for 1 minute. Observed the formation of a stable column of foam, which indicates the presence of raw materials:

- A. saponins
- B. tanidov
- B. alkaloids
- G. flavonoids
- D. coumarins

3. Herbal preparation "glycerin" is used as an anti-asthmatic agent. The herbal source of this remedy is:

- A. root licorice naked

- B. root cyanosis blue
- V. root althaea medicinal
- G.roots of delusion high
- D. leaf of marshmallow

4. In the identification of medicinal plant raw materials pharmacist-analyst prepared water extracts and intensively shook the test tube, thus forming a stable and a lot of foam. What biologically active substances are present in raw materials.

- A. saponins
- B. tannins
- B. alkaloids
- G. anthracene derivatives
- E. fatty oil

5. On the basis of licorice roots produce various dosage forms - tablets, powders, syrups, fees, but not developed dosage form - injectable solution. Licorice roots exhibit hemolytic properties inherent in the active substances:

- A. saponins
- B. alkaloids
- B. essential oils
- G. iridoids
- D. polysaccharides

6. Rhizomes with cyanosis roots contain saponins. Which method of analysis can detect the level of saponins?

- A. foam number
- B. acid number
- V.ether number
- G. iodine number
- D. number of saponification

7. To determine the authenticity of the raw material, the aqueous extract of rhizomes with cyanosis roots was placed in a test tube and shaken. Observed the formation of a stable column of foam, indicating the presence of:

- A. saponins
- B. flavonoids
- V. Kumarinov
- Г.хромонов
- Д.ксантонов

8. To determine the authenticity of the root of the Manchurian aralia conducted color reactions. During the reaction Lafon observed blue-green okra-Shivani, and during the Salkivsky reaction there is a change in the color from yellow to red, which indicates the presence of:

- A. saponins
- B. tannins
- V. Kumarinov
- G. flavonoids
- D. anthracene derivatives

9. The rhizome of *Dioscorea nipon* contains saponins. Which method of analysis can detect the level of saponins?

- A. foam number
- B. acid number
- V. ether number
- G. iodine number
- D. number of saponification

10. From the rhizomes of which plants containing the amount of water-soluble steroid saponins, get the drug diosponin:

- A. rhizome with roots of *Dioscorea*

- B. rhizome with male fern roots
- V. rhizome of delusion
- G. rhizome of azalea
- D. rhizome of valerian

Question:

1. Definition of "saponins".
2. Distribution of saponins in the plant world and resources of the studied raw materials.
3. Terms and methods of LRS collection.
4. Measures for the protection and rational use of wild medicinal plants containing saponins.
5. Latin and Russian names of ARS, which produce plants and families of all objects of the research topic.
6. Morphological characteristics of plants, their habitats (cultivation areas), places of growth.
7. External signs of the studied types of medicinal raw materials.
8. Possible impurities in raw materials (licorice roots, horsetail grass, astragalus grass) and their main differences.
9. The main anatomical diagnostic features of horsetail grass, licorice root.
10. Chemical composition, uses and medical use of ARS and drugs containing saponins.
11. The value of the work of domestic and foreign scientists to study saponins.
12. What is licorice root?
13. What producing plants are included in GF XI as sources of licorice root?
14. What varieties of licorice root are allowed GF XI for medical use?
15. What parts of the underground organs of licorice are used as medicinal raw materials?
16. On what external sign and organoleptic test the authenticity of raw licorice is quickly determined?

17. What is the importance of microscopic analysis of licorice root bast; than it is characteristic?
18. What mechanical elements are found in licorice root?
19. What are the characteristics of the leading vessels of licorice root?
20. What is the result of a microchemical reaction to woody elements in licorice root?
21. What is the raw material of cyanosis blue, what are its morphological data?
22. What is the type of structure of the root of cyanosis (cross-sectional micropreparation), its diagnostic features?
23. What is the raw material of horsetail; what are its features from other species of horsetails?
24. Why is ginseng root called "root man"?
25. What anatomical features are important in determining the authenticity of ginseng root?
26. What are the external signs of the root of Manchurian aralia?
27. Which producing plants are sources of raw materials for Dioscorius?
28. What is characteristic of the morphological characteristics of the raw materials of Dioscorius?
29. What is a foaming reaction?
30. How to conduct a foaming reaction with raw cyanosis, what are its results?
31. What are the methods of discovery of saponins in medicinal raw materials?
32. What is a "foam number" or "saponin index"?

72. Materials of methodical maintenance of the main stage of employment: professional algorithms, orientation maps for formation of practical abilities and skills, educational tasks.

The list of educational practical tasks that must be performed during the practical laboratory lesson:

Task 1. To study licorice and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of licorice, Ural, Korzhinsky and possible impurities - bristle licorice and smelly licorice (Macedonian) on herbarium specimens (Scheme № 1). Write the Latin and Russian names of raw materials, plants and families, give synonyms.

Scheme № 1

DEFINITIONS OF PRODUCING PLANTS According to external signs

- Life form (herbaceous plant, shrub, tree).
- Type of underground organs (root, rhizome, tuber, etc.).
- The structure of the stem (shape, nature of branching, pubescence, diameter, etc.).
- Sheet placement (alternate, opposite, whorled).
- Leaves (simple or complex, the shape of the leaf blade or leaves, edge, veining, color, size).
- Flowers (single or inflorescence, flower structure, color, size, etc.). Fruit (type, shape, color, size).
- Bark (in woody species), (color, presence, shape and color of lenticles, spines, etc.).

2. Describe the appearance of licorice root on the example of a sample of raw materials

Scheme № 2

ANALYSIS OF RAW MATERIALS "UNDERGROUND ORGANS" By external signs

- Commodity type of raw material (unharvested, cut, cleaned or uncleaned from the plug, etc.).
- Type of underground organs (roots, rhizomes with roots, rhizomes, tubers, bulbs, etc.).
- Shape (cylindrical, conical, lumpy, twice curved, etc.).
- Dimensions.
- Surface (smooth or wrinkled, the presence of longitudinal or transverse folds, scars from leaves, stems, traces of lateral roots, etc.).
- Color on the outside, at the break.
- The nature of the fracture (granular, fibrous, smooth, rolling, bristles, etc.).

- The presence of the core.
- Type of structure of the conductive system (beam, beamless).
- Odor when scraping or wetting with water.
- Taste (in non-toxic objects).

3. Prepare a micropreparation of licorice root powder, study it at low and high magnification (scheme № 3).

Scheme № 3

Microscopic analysis of RAW MATERIALS "UNDERGROUND ORGANS"

- Structure: primary, secondary; (Beam, beamless type).
- Integumentary tissue (plug, epidermis).
- Elements of xylem, phloem (histological composition, location).
- The shape and structure of the core rays.
- The main parenchyma (dense, loose, aerenchyma, etc.).
- Vessels, milk vessels, secretory passages, etc.
- Crystalline inclusions.
- Spare nutrients (starch, inulin).

Draw and mark diagnostic signs:

- bast fibers with crystal-bearing equipment;
- sharp of barrel-shaped and reticular vessels;
- cells of the parenchyma with starch.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of GF X, Article 573.

Task 2. To study horsetail and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of horsetail and possible impurities - horsetail of forest, meadow, river and swamp on herbarium specimens (see Scheme №1). Write the Latin and Russian names of raw materials, plants and families.

2. Describe the appearance of horsetail grass on the example of a sample of raw materials (scheme № 4).

Scheme № 4

ANALYSIS OF RAW MATERIALS "GRASS" On external signs

- "Commodity type" of raw materials (unharvested, cut, threshed)
- Stem structure (shape, branching, pubescence, color, size, specific features).
- The nature of the leaf arrangement (alternate, opposite, whorled).
- Leaves.
- The location of the flowers on the stem.
- Flowers.
- Fruits and seeds.
- Sizes of stems, leaves, flowers.
- Coloring.
- Запах when rubbing.
- Taste (in non-toxic objects).

3. Prepare a micropreparation of horsetail branch from the surface and study it at low and high magnification (scheme № 5).

Scheme № 5

Microscopic analysis of RAW MATERIALS "GOODS"

- Structure (dorsiventral, isolateral).
- Mesophile (nature of palisade and spongy tissues).
- Inclusions are crystalline (single crystals, crystal-bearing gasket, friends, Rafida, crystal sand, cystolites); secretory (containers, milk vessels, canals).
- The epidermis of the upper and lower sides of the sheet (the shape and contour of the cells: c-diametrical, rectangular, tortuous;
- Type of trichomes: hairs, glands.
- Cuticle: thin, thick, straight, folded, "warted".

Draw and mark diagnostic signs:

- Cells of the epidermis of the grooves are long, rounded serrated, elongated along the axis of the branches;
- Epidermal cells of the ribs are elongated, erect, arranged in several rows and form at the junction of the narrow ends of the protrusions in the form of inclined, obstructed teeth;

- stomata with radiant folds are located in the grooves in three rows.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of GF XI, Article 50.

Task 3. To study cyanosis blue and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. Examine the appearance of cyanosis on the herbarium sample (see Scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.

2. Describe the appearance of the rhizome with cyanosis roots on the example of a sample of raw materials (see Scheme № 2).

3. Prepare a cross-section of the root, draw a general scheme of its structure and study the micropreparation at low and high magnification (scheme № 3).

Draw and mark diagnostic signs:

- The epidermis is two-layered, rarely single-layered, consisting of round cells with thin obrobkovevshey shells;

- Parenchymal cells of the primary cortex are large with unevenly thickened membranes, tangentially elongated;

- Endoderm clearly expressed;

- Parenchymal cells of the secondary cortex smaller than the cells of the primary cortex;

- Leading elements of the bast are small;

- Cambial area is narrow, barely noticeable;

- Vessels of different diameters, located without special order;

- Small starch grains and drops of fatty oil in the parenchyma.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of GF XI, Article 74

Task 4. To study astragalus woolly-flowered and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of astragalus woolly-flowered and possible impurities - astragalus fluffy-flowered by herbarium pattern. Write the Latin and Russian names of raw materials, plants and families.
2. Describe the appearance of astragalus woolly grass on the example of a sample of raw materials (see Scheme № 4).
3. Prepare a micropreparation of the leaf from the surface and study it at low and high magnification (see Scheme № 5).

Draw and mark diagnostic signs:

- Cells of the epidermis of the upper side of the leaf are polygonal, in places with clear-shaped thickenings;
 - Cells of the lower epidermis with slightly tortuous walls;
 - stomata on both sides of the sheet, surrounded by 3-4 cells of the epidermis;
 - Hairs two-celled, with a short basal and long (terminal) with a large tuberos surface;
 - Cells of the epidermis around the hairs - are radiant in the form of a rosette.
4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of FS 42-533-73.

Task 5. To study *Dioscorea nipon* and to carry out the analysis of raw materials on AND (section: external signs).

1. Examine the appearance of *Dioscorius* of Nippon on a herbarium specimen (See Scheme №1). Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the appearance of rhizomes with roots of *Dioscorus nipon* on the example of a sample of raw materials (see Scheme № 2).
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of FS 42-1521-80.

Task 6. To study the temptation high and to carry out the analysis of raw materials on AND (section: external signs).

1. Examine the appearance of the lure high on the herbarium specimen (see Scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the appearance of rhizomes and roots of temptation high on the example of a sample of raw materials (see Scheme № 2).
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of FS 42-314-72.

Task 7. To study Manchurian aralia and to carry out the analysis of raw materials on AND (section: external signs).

1. Examine the appearance of Manchurian aralia by herbarium pattern (see Scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the appearance of the roots of Manchurian aralia on the example of a sample of raw materials (see Scheme № 2).
3. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF XI, Article 65.

Task 8. To study ginseng and to carry out the analysis of raw materials on AND (section: external signs).

1. Examine the appearance of ginseng on a herbarium sample (see Scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the appearance of ginseng root on the example of a sample of raw materials (see Scheme № 2).
3. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF XI, Article 66.

Instructional materials for mastering professional skills, abilities:

Methods of work performance, stages of performance:

- a) get the necessary ARS
- b) to study and describe the appearance of the obtained ARS, to draw ARS
- d) to study the anatomical and diagnostic features of roots and rhizomes

- e) to study the anatomical and diagnostic features of fruits and leaves
- f) record the observations in a laboratory journal

7.3. Control materials for the final stage of the lesson: tasks, tasks, tests, etc.

Tests:

1. At cardiovascular diseases drugs "diosponin" and "Polisponin" are used. The presence of which group of biologically active substances is due biological activity of these drugs:

- A. saponins
- B. thioglycosides
- B. cardiosteroids
- G. sesquiterpenes
- D. cyanogenic glycosides

2. What biologically active substances contained in ginseng, licorice, horsetail, cyanosis, have the ability to cause hemolysis of the blood.

- A. saponins
- B. flavonoids
- V. coumarins
- G. chromones
- D. xanthoni

3. The method of identification of which biologically active substances in plant raw materials is to determine the "hemolytic" index.

- A. saponins
- B. cardiosteroids
- V. iridoids
- G. alkaloids
- D. flavonoids

4. Which group of BAS forms a stable precipitate with cholesterol, which allows you to use this method to quantify cholesterol. it

- A. saponins
- B. flavonoids
- V. coumarins
- G. chromones
- D. xanthoni

5. To determine the authenticity of the herb *Astragalus woolly-flowered* conducted color reactions. During the Lafon reaction, a blue-green color is observed, and during the Salkivsky reaction, the color changes from yellow to red. Positive color reactions by Lafon and Salkivsky indicate the presence in the raw material:

- A. saponins
- B. tannins
- V. Kumarinov
- G. flavonoids
- D. anthracene derivatives

6. The root of Manchurian aralia contains saponins. Which method of analysis can detect the level of saponins?

- A. foam number
- B. acid number
- V. ether number
- G. iodine number
- D. number of saponification

7. To identify the raw material, an aqueous decoction of the rhizome of cyanosis was placed in a test tube with a ground stopper and shaken for 1 minute. The formation of a stable column of foam is observed, which indicates the presence of:

- A. saponins

- B. tanidov
- V. alkaloids
- G. flavonoids
- D. Kumarinov

8. Which of these groups of natural compounds, by chemical structure are glycosides, has a surface, hemolytic activity and toxicity to cold-blooded.

- A. saponins
- B. tannins
- V. coumarins
- G. flavonoids
- D. chromones

8. Literature

Basic literature

1. Фармакогнозія: підручник (I—III р. а.) / І.А. Бобкова, Л.В. Варлахова. – 3-є видання Всеукраїнське спеціалізоване видавництво «Медицина» 2018, 504с.
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3. Навчальний посібник з дисципліни «Фармакогнозія» / Я. В. Рожковський, Б. В. Приступа, І. А. Бойко, Н. В. Герасимюк, В. В. Черногорюк -: Методична розробка кафедри фармакогнозії ОНМедУ. – Одеса: ОНМедУ, 2019 – 51 с.
4. Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1500 с.

Additional literature:

- 1 Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
2. Практикум з ідентифікації лікарської рослинної сировини: навч. посіб. / [В. М. Ковальов, С. М. Марчишин, О. П. Хворост та ін.] ; за ред. В. М. Ковальова, С. М. Марчишин. – Тернопіль: ТДМУ, 2014. – 250 с.

10. The topic of the next lesson:

Cardioglycosides. Methods of qualitative and quantitative determination. LR and raw materials that contain cardioglycosides (cardiac glycosides). Foxglove purple, foxglove woolly, foxglove large-flowered, species of strophanthus, mustard, lily of the valley, jaundice.

Methodical recommendations were made by  *associate professor Boyko IA*

(Signature)