

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

METHODOLOGICAL DEVELOPMENT

Course: "Pharmacognosy"

practical lesson for students on the topic:

"Tannins. Methods of qualitative and quantitative determination. LR and LRS containing procyanidins and tannins. Sumac ordinary, bitter snake, species of alder, geranium, species of oak, foxglove, blueberries, bird cherry.

Course: 3rd Faculty: Medical and Pharmaceutical

**Approved on methodical
meeting of the department
"30" 08.2024**

Protocol № 1

Head department

MD, prof. JV Rozhkovsky



Odessa – 2024

1. The topic of the lesson: "Tannins. Methods of qualitative and quantitative determination. LR and LRS containing procyanidins and tannins. Common sumac, serpentine bitter, alder species, medicinal rootstock, oak species, erect foxglove, blueberry, common bird cherry. " - 12 hours.

2. Relevance of the topic:

Tannins are a significant group of polymeric phenolic compounds with different pharmacological activity: astringent, hemostatic, bactericidal, anti-inflammatory, disinfectant. Currently known about 30 drugs containing tannins used in enteritis, colitis, uterine and hemorrhoidal bleeding, gingivitis, stomatitis, as well as antidotes for poisoning by salts of heavy metals, alkaloids, glycosides.

Successful mastering of this topic will help the student in mastering other disciplines.

Knowledge of the rules of collection, drying, storage and the ability to determine the identity and good quality of raw materials containing tannins will be used in the practice of pharmacists.

3. Objectives of the lesson:

3.1. General goals: to study medicinal plants containing tannins and to perform work on macro- and microscopic analysis of medicinal raw materials (oak bark, sumac leaf, sumac leaf, rhizome of snake, rhizome and roots of rodovik, rhizomes of foxglove, alder fruit, cherry fruit, rhizome of bergamot) .

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

3.3. Specific goals:

-know (level of assimilation according to Bezpalk - II):

1. Definition of "tannins"
2. Morphological characteristics of plants containing tannins, their habitats (areas of cultivation), places of growth.
3. Terms, methods of collection and rules of storage of LRS containing tannins.
4. Possible impurities in raw materials and their main differences.
5. Chemical composition of the studied LRS.
6. Ways of using raw materials and its medical application.

Based on theoretical knowledge and laboratory work:

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

- Recognize the external features of the plant (oak, rock, sumac, bitter snake, geranium, bergamot, black alder, gray alder, foxglove, bird cherry, blueberry).
- Determine the identity and good quality of raw materials by external features, anatomical structure and qualitative reactions. Distinguish medicinal raw materials from possible impurities.

4. Interdisciplinary integration

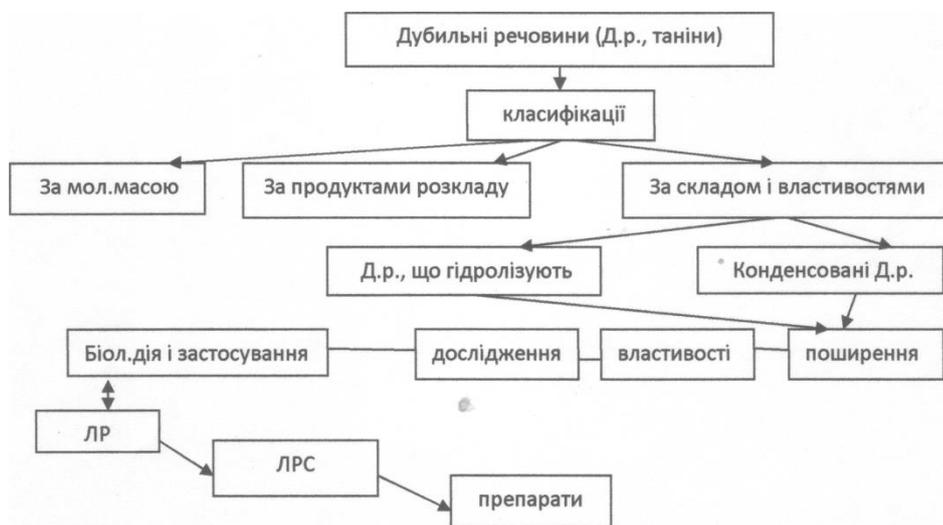
№	discipline	know	be able
p.p.			

1	2	3	4
1.	<p>Previous disciplines:</p> <p>1. Botany</p> <p>2. Organic chemistry</p> <p>3. Analytical chemistry</p>	<p>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.</p> <p>Physical and chemical properties of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles.</p> <p>Methods of acid-base titration (neutralization) and permanganometry</p>	<p>Use a microscope, prepare surface preparations and cross-sections.</p> <p>Carry out qualitative reactions; purification of organic compounds.</p> <p>Work with analytical scales, measuring vessels, photoelectro-colorimeter, 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>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</p>	

	<p>3. Industrial technology of medicines</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>various dosage forms: liquid, solid, soft, injectable solutions, etc. Machines, devices, equipment for the production of medicines.</p> <p>Pharmacodynamics and 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. The content of the topic (text or thesis), a graph of the logical structure of the lesson.

(See the text of the lecture).



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 Checking the final level of knowledge Providing homework with a reference to the literature	II- III II- III	Herbariums of medicinal plants, LRS, reagents	Methodical works for students, album Tests and situational tasks	5% 15% 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. To localize which substances in plant tissues, the reaction with a solution of potassium dichromate is used:

- A. Tannins
- B. saponins
- C. Essential oils
- D. Small
- E. mucus

2. Name substances that are derivatives of polyhydric phenols (Pyrogallol, pyrocatechin and floroglucin):

- A. Tannin materials
- V. Coumarins
- C. Vitamins
- D. Alkaloids
- E. Saponins

3. Name the plant sources of medical tannin:

- A. Leaves of sumac and sumac
- B. Birch leaves
- C. Nettle leaves
- D. Plantain leaves
- E. The leaves are pale

4. Tanninum in medical practice is used as:

- A. Astringent and hemostatic agent
- B. Anti-inflammatory and analgesic
- C. Antitumor and anti-radiation agent
- D. Antispasmodic
- E. Antifungal agent

5. One of the components of the drug "Tanalbin", which has a specific effect on the intestine is:

- A. Tanin
- V. Catechin
- S. Pyrocatechol
- D. Pyrogallol
- E. Floroglucin

6. Name the plant, an aqueous decoction of the bark of which gives a solution of iron-ammonium alum black and blue color:

- A. Oak

- V. Krushina
- S. Kalina
- D. Joster
- E. Cherry

7. Name the medicinal plant used as a strong astringent in the form of a decoction - Decoctum Bistortae, liquid extract - Extractum Bistortae fluidum and is part of the astringent gastric collection:

- A. Snake Highlander
- B. Bark of ragweed
- C. Licorice roots naked
- D. Alder fruit
- E. Viburnum bark

8. To determine the authenticity of the raw material to the decoction of the roots of the root of the profit, poured a few drops of a solution of ferroammonium alum. The appearance of black and blue color indicates the presence of raw materials:

- A. Tannins
- B. Vitamin C
- S. anthracene-derived
- D. Carotenoids
- E. coumarins

9. Which plant of the family Rosaceae is used as an astringent in gastrointestinal diseases and hemostatic in hemorrhoids, uterine bleeding:

- A. Medicinal blood bread
- V. Nettles
- S. Oak bark
- D. Highlander snake
- E. alder malt

10. Which of the organs of the foxglove is used as a LRS:

- A. Roots
- B. Letter
- S. Bulbs
- D. Seeds
- E. Flowers

Question:

1. Definition of "tannins".
2. Ukrainian and Latin names of medicinal plant raw materials, producing plants and families of each object.
3. Morphological characteristics of plants, their habitats (cultivation areas), places of growth.

4. Terms of collection, drying and storage of medicinal plant raw materials containing tannins.
5. Characteristics of external signs of the studied types of medicinal raw materials.
6. Possible impurities in raw materials (oak bark, blueberries) and their main differences.
7. Anatomical diagnosis of oak bark, rhizome of snake, rhizome and roots of rodovik.
8. The use of medicinal raw materials and drugs.

7.2. Materials of methodical support 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 lesson:

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

1. To study the appearance of pedunculate and rock oak on herbarium specimens (scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.

Scheme № 1.

DETERMINATION OF DERIVATIVE PLANT BY 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 lentils, spines, etc.).

1. Carry out a comparative macroscopic analysis of oak bark on the example of samples of raw materials and possible impurities - ash bark (scheme № 2). Write down the Latin and Russian names and the ash family.

Scheme № 2.

ANALYSIS OF RAW MATERIALS "CRUST" on external signs - Commodity type of raw materials. - Form (pieces tubular, grooved or flat, etc.). - Nature of an external surface (smooth, rough, etc.; existence and the form of lentils). - Color plugs, the shape of lentils. - Inner surface (smooth, longitudinally ribbed, etc.) - Color. - Fracture (smooth, rolling, granular, fibrous, bristly, etc.) - Dimensions (length, thickness) - Taste (for non-toxic objects) - Characteristic features

1. Prepare a cross section of oak bark. Study it at low and high magnification (scheme № 3).

Draw and mark diagnostic signs:

- Brown cortical layer of numerous cells - Mechanical belt consisting of alternating groups of bast fibers and stony cells (in too old bark this belt is absent) - Stony cells single and in groups - Parenchymal cells contain flobafen in the form of inclusions of any color; - Single-row core rays (rarely wider); - Bast fibers surrounded by crystal-bearing coating- Friends of calcium oxalate.

Scheme № 3

MICROSCOPIC ANALYSIS OF RAW MATERIALS "CRUST".

- The nature of the structure (primary, secondary) .- Periderm (structure, color) .- The main parenchyma (cell shape) .- Core rays (single-row, multi-row) .- Crystal inclusions (single crystals, friends, crystal-bearing coating) .- Mechanical elements (bast fibers, bast fibers with crystals-nasal coating, stony cells).

1. Prepare a micropreparation of oak bark powder and study it at low and high magnification. Draw and mark diagnostic signs:

- Bast fibers with crystal coating;
- Stony cells;
- Friends of calcium oxalate;
- Parenchymal cells containing flobafen.

2. Carry out a qualitative reaction.

- Wetting the inner surface of the bark with a drop of a solution of iron-ammonium alum turns black and blue color.

3. Note the compliance of the sample of raw materials to the requirements of GF-XI, Article 3.

Task 2. To study snake bitterness and to carry out the analysis of raw materials on AND (sections: external signs, qualitative reaction).

To study the appearance of the serpentine mountaineer (coil) according to the herbarium sample (scheme №1). Write the Latin and Russian names of raw materials that produce plants and families (specify synonyms), 1. Describe the appearance of the rhizome of the coil on the example of a sample of raw materials (scheme № 4).

Scheme № 4

ANALYSIS OF RAW MATERIALS "UNDERGROUND AUTHORITIES" BY EXTERNAL SIGNS

- Commodity type of raw material (unharvested, cut, cleaned or uncleaned, etc.) .- Type of underground organs (roots, rhizomes with roots, rhizomes, tubers, 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, bristly, etc.) .- The presence of the core.- The type of structure of the conductive system (beam, bundleless) .- The smell of scraping or wetting with water.- Taste of non-toxic objects).

1. Draw the appearance of the rhizome of the coil.2. Carry out a qualitative reaction.- Aqueous decoction of the rhizome (1:10) gives a solution of iron-ammonium alum

black and blue color (tannins) .3. Note the compliance of the sample of raw materials (by external features and qualitative reaction) to the requirements of GOST.

Task 3. Examine the medicinal product and analyze the raw materials on AND (sections: external signs, microscopy).

1. Examine the appearance of the generic drug 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 and root of the rootstock on the example of a sample of raw materials (see Scheme № 4) .3. Prepare a cross section of the root of the rodovik. Examine the micropreparation at low and high magnification (see Scheme № 3). Draw and mark diagnostic signs: - Multilayer plug consisting of small cells - Loose bark with large intercellular spaces - Cambium ring - Conductive elements of bast and wood, located in separate radial sections, - Vessels, arranged in triangular areas, facing- them base to the cambium, with the apex elongated to the center; - Single-row core rays; - Friends of calcium oxalate; - Starch grains. 4.

Task 4. To study a foxglove upright and to carry out the analysis of raw materials on AND (section: external signs).

1. To study the appearance of the foxglove upright on the herbarium sample (see Scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families (give synonyms).
2. Describe the appearance of the rhizome of foxglove on the example of a sample of raw materials (see Scheme № 4).
3. Note the compliance of the test sample of raw materials (external signs) requirements of NTD.

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

1. To study the appearance of gray alder 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 alder fruits on the example of a sample of raw materials (scheme № 5).

Scheme № 5

ANALYSIS OF RAW MATERIALS "FRUITS AND SEEDS" BY EXTERNAL SIGNS

- Commodity type of raw materials.
- Type of fruit (berry, box, perianth, drupe, achene, bean).
- The shape of the fruit (spherical, oblong, crescent-shaped, etc.).
- The nature of the surface (smooth, pitted, ribbed, wrinkled, shiny, matte, etc.).
- The form and features of the pericarp (pericarp).
- The number of seeds or seeds, their shape and structure, surface structure.
- Color.
- Dimensions (length, thickness).
- Smell (when rubbing or scraping).
- Taste (for non-toxic objects).

3. Note the compliance of the investigated sample of raw materials (on external grounds) to the requirements of GF-XI, Article 28.

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

1. To study the appearance of bergamot 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 the rhizome of bergamot on the example of a sample of raw materials (see Scheme № 4).
3. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF-XI, Article 70.

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

1. Examine the appearance of sumac leather on a herbarium sample (see Scheme № 1).
2. Write down the Latin and Russian names of the raw materials that produce plants and families.
3. Describe the appearance of a sumac leaf on the example of a sample of raw materials (scheme № 6).

Scheme № 6.

ANALYSIS OF RAW MATERIALS "LEAVES" BY EXTERNAL SIGNS

1. - Type of leaf and dissection of the leaf blade: (simple: palchatorassechennaya, palchato- or peristorozdilnym, peristolopastnye, three- or five-lobed) .- Leaf stem or sessile.- Shape (round, elliptical, ovoid, lanceolate, linear) .- Edge of the leaf. solid, serrated, toothed, crenate, etc.) .- The nature of veining (arcuate, reticular, finger, pinnate, parallel) .- pubescence.- The color of the upper and lower sides.- The size of the leaf or leaves.- Smell when rubbed object or wetting- Taste (for non-toxic objects) .- Specific features

2. Note the compliance of the test sample of raw materials (on external grounds), the requirements of GOST 4564-79.

Task 8. Examine the tannins and analyze the raw materials for AND (section: external signs).

1. To study the appearance of sumac tanning 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 a sheet of sumac on the example of a sample of raw materials (see Scheme № 6).
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of GOST 4564-79.

Task 9. To study a bird cherry and to carry out the analysis of fruits of a bird cherry on AND (section: external signs).

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

1. Describe the appearance of cherry fruits on the example of a sample of raw materials (see Scheme № 5).
2. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF-XI, Article 36.

Task 10. To study blueberries and to analyze raw materials for AND (section: external signs).

1. To study the appearance of blueberries on the herbarium sample (see Scheme № 1). Write the Latin and Russian names of the raw materials that produce plants and families.
2. Carry out a comparative macroscopic analysis of blueberries and possible impurities: - Acceptable: blueberries, black currants, wild cherries - Inadmissible: black elderberry, juniper, laxative, buckthorn alder. Write down their Latin and Russian names and families.
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of GF-XI, Article 35.

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 LRS, draw LRS;
- c) to conduct ARS training;
- d) to study the anatomical and diagnostic features of roots and rhizomes;
- e) record the observations in a laboratory journal.

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

Question:

1. From which parts of the tree oak bark is collected for medical purposes; what instructions on this issue are in GF XI?
2. What external signs can be judged on the benignity of oak bark?
3. What characterizes the transverse fracture of oak bark?
 1. The presence of which anatomical elements is due to the longitudinal ribbing of the inner surface of the oak bark?
 2. What mechanical tissues are found in oak bark?
 3. Why in the presence of a mechanical belt in an oak bark it is possible to judge good quality of raw materials?
 4. In what order are the mechanical elements in the oak bark (cross-sectional micropreparation)?
 5. What instructions does GF XI give about possible impurities in oak bark?
 6. Why is the rhizome of the coil called "cancer necks"?
 7. What color should be the rhizome of a snake on a fresh fracture?
 8. What type of conductive bundles in the rhizome of the coil?

9. What is the structure of the main tissue of the rhizome of the coil; What is the biological feature of the plant due to such a structure?
10. What is "wild galangal"? What kind of medicinal raw materials belongs to this common folk name?
11. What is the shape, color of the rhizome of foxglove erect?
12. What is the result of the reaction of scraping or powder of the rhizome of foxglove with a solution of ferric oxide?
13. What is the name of the raw material rodok-vernoy? What external feature is most characteristic of the definition of authenticity?
14. Can mechanical elements in the root of the rootstock (cross-sectional micropreparation) be an important feature in the definite authenticity of raw materials?
15. What reactions can prove the authenticity of blueberries?
16. What characterizes the fruits of blueberries in appearance?
17. What are the permissible impurities in blueberries?
18. The fruits of which plants are inadmissible impurities to the fruits of blueberries?
19. What is the botanical name of the fruits of bird cherry; than they are characteristic?
20. On the surface of the cherry fruit is a white plaque; is this a sign of poor quality? What is the nature of this substance?
21. What is the fruit of an alder? Are they correctly called "alder cones"? The main external features of this raw material?
22. What is the result of the reaction of the raw material of the rodovik with a solution of iron-ammonium alum?
23. Why raw materials containing tannins, during storage becomes brown or dark brown? What is the reason for this?
24. What are the general reactions used in determining the authenticity of medicinal raw materials containing tannins?
25. What reagents are used to divide tannins into groups (hydrolyzable and condensed)?
26. What reagents can be used in the study of the localization of tannins in plant tissues?
27. What method of quantitative determination of tannins is included in GF XI; what is it based on

Tests:

1. When wetting the inner surface of oak bark with a drop of a solution of iron-ammonium alum, a black-blue color is observed. This reaction is confirmed by the presence of which class of compounds:
 - A. Tannins
 - B. polysaccharides
 - S. Alkaloids
 - D. Essential oils
 - E. iridoids

2. To identify the raw material to the decoction of the rhizomes of mountain snake was added a few drops of ferric chloride solution. A black and blue color is formed, which indicates the presence of raw materials:
 - A. hydrolyzable tannins

- B. condensed tannins
- S. condensed anthracene derivatives
- D. Steroid saponins
- E. triterpene saponins

3. When diagnosing raw materials in the outer bark revealed a mechanical belt consisting of alternating groups of bast fibers and stony cells, which is a diagnostic feature:

- A. Oak bark
- C. Viburnum bark
- C. Buckthorn bark
- D. Cory joster
- E. Cherry bark

4. Fructus Alni accumulates hydrolyzable tannins. You can confirm their presence by the reaction:

- A. With a solution of iron-ammonium alum
- B. With a solution of iodine in potassium iodide
- C. With a solution of potassium hydroxide
- D. With a solution of hydrochloric acid
- E. With concentrated sulfuric acid

5. Compliance with the conditions of procurement of raw materials affects the qualitative and quantitative composition of active substances. The optimal time for harvesting oak bark:

- A. During juicing
- B. During fruiting
- C. During November
- D. During flowering
- E. At rest

6. What biologically active substances of plant origin give a positive reaction with a solution of ferric ammonium kvass-ends:

- A. Tannin materials
- V. Saponins
- C. Polysaccharides
- D. Bitterness
- E. Fatty oils.

7. Name the substances that are derivatives of polyhydric phenols (pyrogallol, pyrocatechol and floroglucin):

- A. Tannin materials
- V. Coumarins
- C. Vitamins
- D. Alkaloids
- E. Saponins

8. Name the plant sources of medical tannin:

- A. Leaves of sumac and sumac
- B. Birch leaves
- C. Nettle leaves
- D. Plantain leaves
- E. The leaves are pale

9. In medicine Tanninum is used as:

- A. Astringent and hemostatic agent
- B. Anti-inflammatory and analgesic
- C. Antitumor and anti-radiation agent
- D. Antispasmodic
- E. Antifungal agent

10. The source for the preparation of the drug "Tanalbin", which has a specific effect on the intestines are:

- A. Tanin
- V. Catechin
- S. Pyrocatechol
- D. Pyrogallol
- E. Floroglucin

11. Name the plant, an aqueous decoction of the bark of which gives a solution of iron-ammonium alum black and blue color:

- A. Oak
- V. Krushina
- S. Kalina
- D. Joster
- E. Birch

8. Literature for the teacher.

1. Antonyuk VO A practical course of pharmacognosy (Laboratory manual) / VO Antonyuk, RM Lysyuk, L. Ya. Antonyuk. - Lviv: LNMU, 2011. - 499 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / State Enterprise "Ukrainian Scientific Pharmacopoeial Center for Quality of Medicines". - 2nd type. - Kharkiv: State Enterprise "Ukrainian Scientific Pharmacopoeial Center for Quality of Medicines", 2015. - Vol. 1. - 1500 p.
3. European Pharmacopoeia. - 8th ed. ; - Druckerei CH Beck, Nordlingen (Germany), 2013.- 3655 p.
4. Workshop on the identification of medicinal plant materials: textbook. way. / [B. M. Kovalev, SM Marchyshyn, OP Khvorost and others]; for order. VM Kovaleva, SM Marchishin. - Ternopil: TSMU, 2014. - 250 p.
5. Kislichenko VS, Dyakonova YV, Kuznetsova VY, Zinchenko IG, Kislichenko OA Pharmacognosy. Kharkiv, NFAU, 2011

6. Medicinal plant raw materials and phytomedicines under Society. ed. Wednesday PI, Kiev, VSI "Medicine", 2010
7. Pharmacognosy. Medicinal raw materials of plant and animal origin. Ed. Яковлева Г.П. St. Petersburg, Spetslit 2013
8. Pharmacognosy: a textbook (University of I-III years) / VP Khodakivska, IA Бобкова, Л.В. Варлахова All-Ukrainian specialized publishing house "Medicine" 2018.
9. Pharmacognosy: textbook (I-III years) / I.A. Бобкова, Л.В. Варлахова. - 3rd edition All-Ukrainian specialized publishing house "Medicine" 2018, 504p.
10. Pharmacognosy with the basics of phytotherapy A. Pastushenkov, N. Bepalova Phoenix Publishing House 2016.

9. Literature for students:

- *basic*

1. Фармакогнозія: підручник (I—III р. а.) / І.А. Бобкова, Л.В. Варлахова. – 3-є видання Всеукраїнське спеціалізоване видавництво «Медицина» 2018, 504с.
2. Фармакогнозія: базовий підручн. для студ. вищ. фармац. навч. закл.(фармац. ф-тів) IV рівня акредитації / В.С. Кисличенко, І.О. Журавель, С.М. Марчишин та ін.; за ред. В.С. Кисличенко. – Харків: НФаУ: Золоті сторінки, 2015. - 736 с.
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.

Додаткова література:

- 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. Сербін А.Г., Сіра Л.М., Слободянюк Т.О. Фармацевтична ботаніка. Підручник. – Вінниця: НОВА КНИГА, 2007. – 488 с.
3. 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:

Alkaloids. Proto- and pseudoalkaloids. General characteristics Methods of qualitative and quantitative determination. LR and LRS, which contain proto- and pseudoalkaloids: lobelia hellebore, annual pepper, horsetail ephedra, late-flowering species.

Methodical recommendations were made by

A handwritten signature in black ink, appearing to be 'Boyko IA', written in a cursive style.

associate professor Boyko IA