

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

METHODOLOGICAL DEVELOPMENT

Course: "Pharmacognosy"

practical lesson for students on the topic:

"Quinones. Methods of qualitative and quantitative determination. LR and LRS containing anthraquinones: alder buckthorn, laxative, tangut rhubarb, horse sorrel, aloe species, cassia sharp-leaved and narrow-leaved, madder, species of St. John's wort. "

Course: 3rd Faculty: Medical and Pharmaceutical

**Approved on methodical
meeting of the department
"30" 08.2024
Protocol № 1
Head department
MD, prof. JV Rozhkovsky**



1. Topic: "Quinones. Methods of qualitative and quantitative determination. LR and LRS containing anthraquinones: alder buckthorn, laxative, tangut rhubarb, horse sorrel, aloe species, cassia sharp-leaved and narrow-leaved, madder, species of St. John's wort. " - 8 hours.

2. Relevance of the topic.

Anthracene derivatives are natural compounds based on anthracene of various oxidation states. Anthraquinones and their reduced forms - anthrones, anthranols, as well as dimeric compounds in the form of glycosides - are most common in plants.

Herbal raw materials containing anthracene derivatives are used as laxatives (hay leaf, buckthorn bark, ragweed, rhubarb root), kidney and liver diseases (madder root), as well as herpes, conjunctivitis, bronchial asthma and as biogenic stimulants. A recent achievement has been the discovery of the antitumor activity of anthraquinones and their ability to stimulate antitumor immunity.

The knowledge and skills acquired by students in the study of this topic will be used by them in mastering some sections of ATL, pharmaceutical chemistry, ZTL, pharmacology, pharmacotherapy, as well as in the practical activities of the pharmacist.

3. Objectives of the lesson:

3.1. General goals: to study medicinal plants containing anthracene derivatives and to master the methods of macro- and microscopic analysis of raw materials (hay leaf, buckthorn bark, rhubarb root, horse sorrel root, aloe leaf, ragweed fruit, rhizome and madder root).

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:

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

1. Distribution of anthracene derivatives in the plant world and resources of the studied raw materials.
2. External signs of the studied types of medicinal raw materials.
3. Possible impurities in raw materials (buckthorn bark, ragweed) and their main differences.
4. The main anatomical diagnostic features of hay leaf, buckthorn bark, rhubarb root.
5. Ways of use and medical application of LRS containing anthracene derivatives.

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 (buckthorn alder, laxative, cassia sharp-leaved, cassia narrow-leaved, rhubarb Tangut, aloe vera, horse sorrel, madder dye) and distinguish them from possible impurities;
- Determine the identity and good quality of raw materials containing anthracene derivatives, by external features, anatomical structure, qualitative and histochemical reactions. Know the ways of using raw materials and their medical application.

4. Interdisciplinary integration

№ p.p.	discipline	know	be able
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 permanganatometry</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. Kononov'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>	

3. Industrial technology of medicines	<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>
4. Clinical pharmacology	<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>
5. Pharmaceutical chemistry	<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>
6. Organization and economics of pharmacy	<p>Management and entrepreneurship. Organization as an object of management. Connecting processes in management. Human Resource Management Pharmaceutical Marketing Management.</p>
7. Management and marketing in pharmacy	<p>Pharmaceutical market research. International marketing.</p>

5. Content of the topic, graphological 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	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 What is the therapeutic effect of plants containing various derivatives of anthracene and its oxygen compounds - anthraquinones, anthranols and others.

- A. laxative effect
- B. Anti-inflammatory
- S. Antitumor
- D. Zhovchoginna
- E. Diuretic

2. In the families of which plants are most common anthraglycosides:

- A. buckwheat, buckthorn-like
- B. thick-leaved, heather
- S. lingonberry, shift
- D. compound-flowered, aroid
- E. pine, labiate

3. Name the primary anthraglycoside that has the emetic property contained in the freshly harvested bark of brittle ragweed:

- A. Frangularoside
- B. Glucofrangulin
- S. Frangulaemodin
- D. Fiston
- E. Chrysophanol

4. Laxative, which is prescribed in the form of a decoction or in combination with other laxatives (fees). The industry produces liquid and dry extracts, as well as dry standardized drug RAMS.

Name this plant:

- A. bark beetle
- C. Seni's letter
- S. rhubarb root
- D. aloe leaf
- E. St. John's wort

5. In which medicinal plant the total content of oxymethylantraquinones does not exceed 1%, contains a number of flavonols, including rhamnocitrin, ramnetin, quercetin and kaempferol, as well as sugars and pectin:

- A. gentian laxative
- B. rhubarb root
- S. aloe leaf
- D. St. John's wort
- E. horse sorrel

6. In the decoction of which plant the presence of anthraglycosides is proved by a qualitative reaction of Borntrreger:

- A. buckthorn bark
- B. Yarrow
- C. peppermint
- D. Nettles
- E. Chamomiles

7. The roots of which plant contains anthraglycosides, tannins, resinous substances, which cause its laxative effect:

- A. rhubarb root
- B. dandelion root
- S. burdock root
- D. barberry root
- E. azalea root

8. On the basis of anthraquinones of which medicinal plant developed domestic technology for the production of the drug chrysarobin, which is the sum of reduced derivatives of anthracene, emodin, fission and chrysophanol:

- A. rhubarb Tungut
- B. barberry leaf
- S. escape securinegi
- D. Horns
- E. parsnip fruit

9. The roots of which plants contain anthraglycosides and tannins of the pyrocatechol group, have bactericidal properties and are used as a decoction for dysentery and disorders of the gastrointestinal tract:

- A. horse sorrel root
- B. belladonna root
- S. the root of the ancestor
- D. licorice root
- E. ginseng root

10. At incorrect preparation of broths of a leaf of hay irritation of intestines is observed. What chemical compounds of hay leaves have this effect:

- A. resinous substances
- B. Carotenoids
- S. Phenoglycosides
- D. Saponins
- E. sinigrin

Question:

1. Definition of "anthracene derivatives".
2. Distribution of anthracene derivatives in the plant world and resources of the studied raw materials.
3. Terms, methods of collection, rules of drying and storage of LRS.
4. Measures for the protection and rational use of wild medicinal plants containing anthracene derivatives.
5. Latin and Russian names of LRS, which produce plants and families of all objects of the research topic.
6. Morphological characteristics of plants, their habitats (areas of cultivation), habitats.
7. External signs of the studied types of medicinal raw materials.
8. Possible impurities in raw materials (buckthorn bark, ragweed) and their main differences.
9. The main anatomical diagnostic features of hay leaf, buckthorn bark, rhubarb root.
10. Ways of use and medical application of LRS containing anthracene derivatives.

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 laboratory lesson:

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

1. To study the appearance of cassia sharp-leaved and narrow-leaved 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, shrub-nickname, 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 a leaf blade or leaf-points, 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, check, thorns, etc.).

2. Describe the appearance of a sheet of hay on the example of a sample of raw materials (scheme №2). Draw the appearance of a leaf of cassia and cassia.

Scheme 2.

ANALYSIS OF RAW MATERIALS "LEAVES" According to external signs

- Type of sheet and dissection of the leaf blade:
(Simple: palchatorassechennaya, palchato- or pinnate, peristolopastnye, three- or five-lobed; complex: even or Even-pinnate).
- Stem stem or sessile;
- Shape (round, elliptical, ovoid, lanceolate, linear).
- The edge of the leaf (solid, serrated, toothed, crenate, etc.).
- The nature of veining (arcuate, reticular, finger, pinnate, parallel).
- pubescence;
- Color of the upper and lower sides;
- The size of the leaf or leaves;
- Odor when rubbing the object or wetting with water;
- Taste (for non-toxic objects);
- Specific features.

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

Scheme 3.

Microscopic analysis of RAW MATERIALS "LEAVES"

- Structure (dorziventral, isolateral);
- Mesophile (nature of palisade and spongy tissues);
- Inclusions are crystalline (single crystals, crystalline cover, friends, Rafida, crystalline sand, cystolites); secretory (containers, milk vessels, canals);
- Epidermis of the upper and lower sides of the sheet (shape and contour of the cells: isodiametric, straight-walled, tortuous; stomatal type: diacytic, parasitic, anisocytic, anocytic; number and location of periosteal cells.
- Type of trichomes: hairs, glands.
- Cuticle: thin, thick, straight, folded, warty.

2. Draw and mark diagnostic signs:

- Straight epidermis, the cells of which around the base of the hair-are located radially in the form of a socket, in place of annealed water. lisku - roller. The stomata are surrounded by 2-3, rarely 4 cells of the epidermis;
- Hairs unicellular, short, curved, coarsely warty;
- Veins with crystal-bearing coating;
- Friends of calcium oxalate.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of GF XI, Article 23.

Task 2. Examine alder buckthorn and analyze raw materials on AND (sections: external signs, microscopy, qualitative reactions).

1. Examine the appearance of buckthorn alder in a herbarium pattern (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 buckthorn bark on the example of a sample of raw materials (scheme №4).

Scheme 4.

ANALYSIS OF RAW MATERIALS "bark" On external signs

- Commodity type of raw materials.
- Shape (pieces of tubular, grooved or flat, etc.);
- The nature of the outer surface (smooth, rough, etc. ; presence and shape of lentils). Stopper color, shape of lentils.
- Internal surface (smooth, longitudinal-ribbed, etc.). Color.
- Fracture (smooth, rolling, granular, fibrous, bristly etc.).
- Dimensions (length, thickness);
- Taste (for non-toxic objects);
- Characteristic features.

Carry out a comparative analysis of the external signs of buckthorn bark and possible impurities of the bark of other plants, alder gray, black alder, ragweed, cherry, willow.

3. Prepare a cross section of the bark, study the micropreparation at low and high magnification (scheme №5).

Scheme 5.

Microscopic analysis of RAW MATERIALS "bark"

- 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 table-bearing deposition, stony cells).

Draw and mark diagnostic signs:

- cortical layer of 15-20 rows of brick-red or cells dark crimson color, lamellar collenchyma;
- in the outer bark, single or groups of mechanical fibers with slightly thickened or almost non-woody shells;
- in the inner cortex 1-2, rarely 3-row, often curved core rays and between them small groups of woody darkened bast fibers with thick walls, surrounded by crystal-bearing coating, tangentially elongated and arranged 1-4 concentric belts;

- in the cells of the parenchyma friends of calcium oxalate

4. Carry out qualitative reactions:

- When applying a drop of alkali solution on the inner surface buckthorn bark has a dark red color

(Anthracene derivatives);

- When wetting the inner surface of the buckthorn bark with a drop solution of ferric ammonium alum gradually appears brown stain (lack of tannins).

Carry out similar reactions with possible impurities of buckthorn bark.

Record the results of observations in a laboratory journal.

5. Note the compliance of the sample of raw materials (by external signs, microscopy and qualitative reactions) to the requirements of GF-XI, Article 2.

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

1. Examine the appearance of rhubarb Tangut herbarium pattern (scheme №1). Write down the Latin and Russian names of the raw materials that produce plants and families.

2. Describe the appearance of rhubarb root on the example of a sample of raw materials (scheme № 6).

Scheme 6.

ANALYSIS OF RAW MATERIALS "UNDERGROUND ORGANS" By external signs

- Commodity type of raw material (unharvested, cut, cleaned or uncleaned of traffic jams, etc.);
- Type of underground organs (roots, rhizomes with roots, rhizomes higher, tubers, bulbs, 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 lateral roots, etc.);
- Color on the outside, at the break;
- The nature of the fracture (granular, fibrous, smooth, splintered Stiff, bristly, etc.);
- The presence of the core;
- Type of structure of the conducting system (beam, beamless);
- Odor when scraping or wetting with water;
- Taste (in non-toxic objects).

3. Prepare a micropreparation of rhubarb powder and study it at low and high magnification (scheme № 7).

Scheme 7.

Microscopic analysis of RAW MATERIALS "UNDERGROUND ORGANS"

- Structure: primary, secondary; (Beam, bundleless

type);

- Integumentary tissue (plug, epidermis);
- Elements of xylem, phloem (histological composition, location position);
- The shape and structure of the core rays;
- The main parenchyma (dense, loose, aerenchyma, etc.);
- Crystal inclusions;
- Spare nutrients (starch, inulin).

Draw and mark diagnostic signs:

- Fragments of wide vessels;
- Numerous great friends of calcium oxalate;
- Simple and complex oval starch grains with the center of growth in the form of a point.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of GF-XI, Article 68.

Task 4. Examine aloe vera and analyze raw materials on AND (section: external signs).

1. To study the appearance of aloe tree (scheme № 1). write latin and the Russian name of the raw material that produces plants and families.
2. Describe the appearance of fresh aloe vera leaves.
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of FS 42-2191-84.

Task 5. Examine laxatives and analyze raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of ragweed on a herbarium sample (scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the external signs of the fruits of ragweed laxative on the example raw material sample (scheme № 8);

Scheme 8.

ANALYSIS OF RAW MATERIALS "FRUITS AND SEEDS" By external signs

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

3. Carry out a comparative analysis of a sample of raw fruits of ragweed laxative and possible impurities of buckthorn fruit alder (scheme № 8). Write in the journal distinctive features.
4. Note the compliance of the test sample of raw materials (morphological signs) the requirements of GF-XI, Article 37.

Task 6. Examine horse sorrel and analyze raw materials on AND (section: external signs).

1. To study the appearance of horse sorrel on a herbarium sample (scheme № 1). Write down the Latin and Russian names of the raw materials that produce plants and family.
2. Describe the appearance of horse sorrel root on the example of a sample of raw materials (Scheme № 6).
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of FS 42-1077-81.

Task 7. Examine the madder dye and analyze the raw materials on AND (section: external signs).

1. To study the appearance of madder dye by herbarium sample (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 and rhizomes of madder dye on the example of a sample of raw materials (scheme № 6).
3. Note the compliance of the test sample of raw materials (on external grounds) to the requirements of GF-XI, Article 76.

Instructional materials for mastering professional skills, abilities:

Methods of work performance, stages of performance:

- a) get the necessary LRS;
- b) to study and describe the appearance of the obtained LRS, draw LRS;
- c) to prepare LRS;
- d) to study the anatomical and diagnostic features of roots and rhizomes;
- e) draw sketches and record them in a laboratory journal;

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

Question

1. How to determine the suitability of buckthorn bark for medical use?
2. What color is the inner surface of the bark of buckthorn? What is the reason for this?
3. Impurities in the bark of buckthorn can be identified by one feature. What is this sign?
4. What two types of mechanical fibers can be seen in the micropreparation of buckthorn bark?
5. What is the botanical name of the fruit of ragweed, what are its external features?
6. Impurities of the fruit of which plant is unacceptable to the fruits of ragweed, how is it recognized?

7. What is the qualitative response of GF XI to the content of anthracene derivatives in the fruits of ragweed?
8. Why rhubarb root at the break is heterogeneous, variegated?
9. Why rhubarb root when chewing crunches on the teeth?
10. What external sign of rhubarb root powder is very specific?
11. What are the characteristics of starch grains of rhubarb root?
12. What microscopic features of rhubarb root are important for authenticity?
13. What are the raw materials for cassia? Indicate its characteristic external features.
14. What is the characteristic veining of a leaf of hay?
15. Are there differences in the structure of the epidermis of the upper and lower sides of the hay leaf?
16. What characterizes the veins of hay leaves (micropreparation)?
17. What are the two forms of calcium oxalate crystals found in hay leaves?
18. Why is the plant called "perforated St. John's wort"?
19. What are the characteristics of the stem and leaf arrangement of St. John's wort?
20. What plants are listed in GFHI as possible impurities to the herb St. John's wort perforated?
21. What is the name of the raw material of madder dye? What external signs is it characterized by?
22. What is characteristic of fracture of the root of madder?
23. What crystals are visible in the micropreparation of madder root dye?
24. What microchemical reaction can be used to determine the localization of anthracene derivatives in medicinal raw materials?
25. What are the general reactions to the discovery of anthracene derivatives in medicinal raw materials?
26. What is the result of the analysis of raw materials containing anthracene derivatives in a fluorescent microscope (for example, madder root, rhubarb, buckthorn bark, etc.)?
27. What are the results of micro-distillation of raw materials containing anthracene derivative?

Tests:

1. At microdistillation the plaque of anthraglycosides in the form of yellow crystals or droplets is formed; from the addition of an alcoholic solution of alkali, painted in cherry red. Name the plant:
 - A. leaf shadow
 - B. leaf of bearberry
 - S. oregano
 - D. thyme
 - S. you argue

2. The fruits of which of these plants contain anthraglycosides (about 0.75%), during hydrolysis emodin is cleaved; they contain dyes, pectin, sugar and flavonoids; used as a laxative:
 - A. gentian laxative
 - B. chokeberry

- S. viburnum
- D. sea buckthorn
- E. blueberries

3. A batch of hay leaf was delivered to the Senade tablet factory.

Specify the method of quantitative standardization of this vegetable raw material:

- A. photoelectrocolorimeter
- B. densitometry
- C. refractometry
- D. polarimetry
- E. acidimetry

4. For the production of the drug RAMS use buckthorn bark. What method of quantification of anthracene derivatives in this raw material is used:

- A. photoelectrocolorimeter
- B. densitometry
- C. refractometry
- D. polarimetry
- E. acidimetry

5. Ketamine is used as a laxative. Specify the medicinal plant that is the source of its receipt:

- A. Ricinus communis
- B. Rhamnus cathartica
- C. Frangula alnus
- D. Linum usitatissimum
- E. Ononis arvensis

6. To identify the buckthorn bark, an authenticity reaction was performed: a drop of 10% potassium hydroxide solution was applied to the inner surface of the buckthorn bark. Cherry-red color of the bark indicates the presence of raw materials:

- A. anthracene derivatives
- B. tannins
- C. flavonoids
- D. saponins
- E. cardiac glycosides

7. Macroscopic analysis of raw materials on the outer surface revealed whitish lentils. For which of the following species, their presence can serve as confirmation of authenticity:

- A. buckthorn bark
- C. viburnum bark
- S. oak bark
- D. rhubarb root
- E. marshmallow root

8. To determine the authenticity of the raw material to the decoction of rhubarb root acquired a few drops of 5% potassium hydroxide solution. Observed cherry-red color, which confirms the presence in the raw material:

- A. anthracene derivatives
- B. flavonoids
- C. tannins
- D. polysaccharides
- E. coumarins

9. It is known that freshly harvested buckthorn bark contains toxic langouamine laxative action. Choose the optimal mode of drying buckthorn bark:

- A. 1000 C for an hour
- B. 25-300 C for an hour
- Pr. 40-500 C for an hour
- D. 60-700 C for 2 hours
- E. 25-300 C for 2 hours

10. The pharmaceutical factory received a batch of raw materials - ragweed bark. To determine the quality of these raw materials use the method:

- A. colorimetry
- B. chromatography
- C. densitometry
- D. titrometry
- E. microscopy

8. Literature for the teacher.

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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.
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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.
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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:

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 erect, blueberries, bird cherry.

Methodical recommendations were made by



associate professor Boyko IA