

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

METHODOLOGICAL DEVELOPMENT

Course: "Pharmacognosy"

practical lesson for students on the topic:

"Essential oils.LR and LRS containing essential oils (sesquiterpenoids and sesquiterpene lactones). Chamomile, fragrant chamomile, ergot high, wormwood, yarrow, birch, cane, marsh. "

Course: 3rd Faculty: medico-pharmaceutical

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



1. The topic of the lesson: "Essential oils. LR and LRS containing essential oils (sesquiterpenoids and sesquiterpene lactones). Chamomile, fragrant chamomile, ergot high, wormwood, yarrow, birch, cane, marsh. " - 8 hours.

2. Actuality of theme.

There are many fragrant essential oil plants in the world flora. The pleasant aroma of fragrant plants is due to the presence of essential oils in them. Essential oils are a mixture of liquid, easily volatile substances that are distilled by water vapor. Essential oils are a mixture of fragrant volatile substances belonging to different classes of organic compounds, mainly terpenoids. Terpenoids are oxygen derivatives of terpenes. Terpenes and terpenoids can be aliphatic, hydrocyclic or aromatic compounds.

They are a very large class of organic compounds and are widely represented in the plant world. Sesquiterpenes (sesquiterpenoids) compare the volatile fractions of essential oils. LRS containing sesquiterpenes include: wormwood flowers, Taurian wormwood grass, chamomile flowers, yarrow grass and flowers, rhizomes and roots of divosila, azalea rhizomes.

3. Objectives of the lesson:

3.1. General goals: to study medicinal plants containing sesquiterpenoids, and to master the methods of macro- and microscopic analysis of LRS of the subject under study.

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. Definition of "sesquiterpenoids".
2. Terms, methods of collection, rules of drying and storage of LRS of the studied subject.
3. Morphological characteristics of plants, their habitats (areas of cultivation), housing.

4. External signs of the types of medicinal raw materials being studied.
5. The main anatomical diagnostic features of wormwood leaf and rhizome of azalea.
6. Chemical composition of LRS species studied.
7. Formulas of the main sesquiterpenoids which are a part of LRS studied: farnesol, bisabolen, selinen, matricin, artabsin, allantolactone, chamazulene, guaiazulene, ledol.
8. Ways of using raw materials and its medical application

Based on theoretical knowledge of the topic and laboratory work:

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

- to recognize by external signs of a plant (a wormwood bitter, an azalea marsh, a divosil high, a chamomile peeled, a yarrow usual, an arnica, a birch, swamp) and distinguish them from possible impurities;
- determine the reliability of raw materials by external features and anatomical structure;

4. Interdisciplinary integration

№ p.p.	discipline	know	be able
1	2	3	4
1.	Previous disciplines: 1. Botany 2. Organic chemistry 3. Analytical chemistry	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. Physical and chemical properties of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles. Methods of acid-base titration (neutralization) and permanganometry	Use a microscope, prepare surface preparations and cross-sections. Carry out qualitative reactions; purification of organic compounds. Work with analytical scales, measuring vessels, photoelectro-colorimeter, use methods of

			chromatography on paper and in a thin layer of sorbent.
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>4. Clinical pharmacology</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 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.</p>	

	<p>5. Pharmaceutical chemistry</p> <p>6. Organization and economics of pharmacy</p> <p>7. Management and marketing in pharmacy</p>	<p>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.

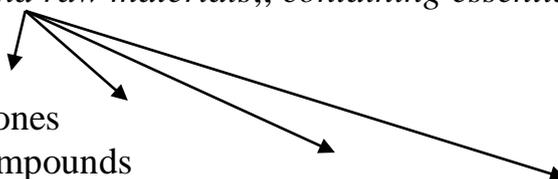
Medicinal plants and raw materials,, containing essential oils

LRS containing sesquiterpenoids

LRS containing sesquiterpene lactones

LRS containing aromatic compounds

LRS containing resins, balms and gums



6. Plan and organizational structure of the lesson.

№№ p.p.	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	<p><i>Preparatory stage</i></p> <p>Organization of classes</p> <p>Setting learning goals</p> <p>Homework check</p>	II	Oral interview on the topic	Methodical works for students, album	1% 2% 25%
2	<p><i>The main stage</i></p> <p>Conducting practical lesson</p>	III	Herbariums of medicinal		50%

			plants, LRS, reagents		
3	<i>The final stage</i> Testing and assessment of practical skills	II- III	Herbariums of medicinal plants, LRS, reagents	Methodical works for students, album	5%
	Checking the final level of knowledge	II- III		Tests and situational tasks	15%
	Providing homework with a reference to the literature				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. Name the class of organic compounds (the number of hydrogen atoms - C₁₅), which are highly volatile fractions of essential oils:

- A. sesquiterpenes
- B. diterpenes
- C. triterpenes
- D. tetraterpenes
- E. monoterpenes

2. What is the optimal period for collecting flowers of wormwood, when its baskets are fully developed, but the buds are not yet open (when the buds bloom, the amount of santonin drops sharply):

- A. August - September
- B. end of September
- C. early July
- D. early October
- E. end of June

3. Which plant containing sesquiterpenes is poisonous:

- A. tsitvarny wormwood
- B. chamomile flowers
- C. lepeha bolotyana
- D. marvelous high
- E. bagulnik

4. Which LRS is processed to obtain santonin:

- A. tsitvarny wormwood
- B. plantain
- C. nettles
- D. sage
- E. motherwort

5. Alcoholic solution of alkali (0.5 n) when heated with santonin turns red. This reaction is used to establish the reliability:

- A. tsitvarnogo wormwood
- B. peeled chamomile
- C. yarrow
- D. bagulnika
- E. wonders high

6. In accordance with the requirements of GF XI gas-liquid chromatography is used for:

- A. determination of ice content
- B. determination of menthol content
- C. determination of arbutin content
- D. determination of atropine content
- E. determination of alizarin content

7. Microscopic analysis of raw materials in the drug revealed: essential oil glands and T-shaped hairs. For which of the following types of raw materials these features can serve as confirmation of authenticity:

- A. wormwood leaf bitter
- B. yarrow leaf
- C. mint leaf
- D. leaf beauties
- E. herbs mountain pepper

8. A batch of raw materials - chamomile flowers - arrived at the pharmacy. Where should this raw material be stored:

- A. separately from all types of raw materials
- B. list A
- C. list B
- D. in a dark place
- E. in a cool place

9. At reception the party of flowers of a camomile was rejected as 30% of raw materials had peduncles in length more

- A. 3 cm
- B. 8 cm
- C. 5 cm
- D. 11 cm
- E. 6 cm

10. At preparation of raw materials of a camomile it is necessary to pay attention of the collector to a morphological sign which is diagnostic for establishment of reliability of a camomile:

- A. inflorescence conical, glabrous, hollow
- B. inflorescence spherical, solid

- C. inflorescence hemispherical, solid
- D. perianth convex, hemispherical, with membranous bracts
- E. globular inflorescence with membranous bracts

Question:

1. Definition of "sesquiterpenoids".
2. Terms, methods of collection, rules of drying and storage of LRS of the studied subject.
3. Measures for the protection and rational use of medicinal plants of the subject under study.
4. Latin and Russian names of LRS, producing plants and families of objects under study.
5. Morphological characteristics of plants, their habitats (areas of cultivation), housing.
6. External signs of the types of medicinal raw materials being studied.
7. Possible impurities in raw materials and their main differences.
8. The main anatomical diagnostic features of wormwood leaf and azalea rhizome.
9. Chemical composition of LRS species studied.
10. Formulas of the main sesquiterpenoids which are a part of LRS studied: farnesol, bisabolen, selinen, matricin, artabsin, allantolactone, chamazulene, guaiazulene, ledol.
11. Ways of use and medical application of medicinal plant raw materials containing sesquiterpenoids.

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 a wormwood hill and to carry out the analysis of raw materials on AND (sections: external signs and microscopy).

1. Examine the appearance of wormwood bitter and possible impurities: wormwood, wormwood Austrian herbarium specimens (scheme № 1). Write down the Latin and Russian names of raw materials, plants and families.

Scheme № 1

DETERMINATION OF THE PRODUCED 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, and so on).
 - Sheet placement (alternate, opposite, annular).
 - Leaves (simple or complex, the shape of the leaf blade or leaves, edge, veining, color, size).
 - Flowers (single or inflorescences, flower structure, color, size, etc.). Fruit (type, shape, color, size).
 - Bark (in woody species) (color, presence, shape and color of lenticles, thorns, etc.).
2. Describe the appearance of grass and wormwood leaves on the example of raw material samples (schemes № 2, 3). Draw the appearance of the letter.

Scheme № 2

ANALYSIS OF RAW MATERIALS "GRASS" BY EXTERNAL SIGNS

- "Commodity type" of raw materials (whole, cut, threshed)
- Stem structure (shape, branching, pubescence, color, size, specific features).
- The nature of the leaf placement (alternate, opposite, annular).
- Leaves (see diagram № 7).
- The location of the flowers on the stem.
- Flowers (see diagram № 8).
- Fruits and seeds.
- Sizes of stems, leaves, flowers.
- Color.
- Запах when rubbing.

- Taste (in non-toxic objects).

Scheme № 3

ANALYSIS OF RAW MATERIALS "LEAVES" BY EXTERNAL SIGNS

- Type of leaf and dissection of the leaf blade: (simple: finger-dissected, glovedo- or pinnate, peristopate, three- or five-bladed); complex: even- or imparipinnate.
 - Leaf petiolate or sessile.
 - Shape (round, elliptical, ovoid, lanceolate, linear).
 - The edge of the leaf (solid, serrated, toothed, crenate, and so on).
 - The nature of veining (arcuate, reticular, finger, feathery, parallel).
 - Smoking.
 - The color of the upper and lower sides.
 - The size of the leaf or leaves.
 - Odor when rubbing the object or wetting
 - Taste (for non-toxic objects).
 - Specific features
2. Prepare a micropreparation of the leaf from the surface, study it at low and high magnification (scheme № 4).

Scheme № 4

MICROSCOPIC ANALYSIS OF RAW MATERIALS "LEAVES"

- Structure (dorsiventral, isolateral).
- Mesophile (nature of palisade and spongy tissues).
- Inclusions are crystalline (single crystals, crystalline coating, friends, raffids, crystalline sand, cystolites); secretory (containers, milk vessels, channels).
- The epidermis of the upper and lower sides of the leaf (the shape and contour of the cells: isodiametric, rectangular, tortuous; oral type: diacytic, paracytic, anisocytic, anocytic; number and location of periosteal cells).
- Trichomes type : hairs, glands.
- Cuticle: thin, thick, smooth, folded, "warty".

Draw and mark diagnostic signs:

- epidermal cells weakly tortuous, stomata, surrounded by 3-5 cells;

- hairs numerous, "T" - figurative;
- oval-shaped essential oil glands, consisting of 8 secretory cells arranged in 2 rows and 4 tiers.

4. Note the compliance of samples of raw materials (by external signs and microscopy), studied, the requirements of GF XI, Article 44.

Task 2. To study the marsh alder and to analyze the raw materials for AND (sections: external signs, microscopy and histochemical reactions).

1. Examine the appearance of aloe vera by herbarium pattern (see diagram № 1). Write the Latin and Russian names of raw materials produced by plants and families (give synonyms).
2. Carry out a macroscopic analysis of the rhizome of azalea on the example of a sample of raw materials (scheme № 5). Draw the appearance of the rhizome.

Scheme № 5

ANALYSIS OF RAW MATERIALS "UNDERGROUND AUTHORITIES" BY EXTERNAL SIGNS

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

1. Prepare a micropreparation of a cross-section of the rhizome, draw scheme of its structure (scheme № 6).

Scheme № 6

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.).
- Containers, milk vessels, secretory passages, etc.
- Crystalline inclusions.
- Spare nutrients (starch, inulin).

Examine the drug at low and high magnification.

Draw and mark diagnostic signs:

- aerenchyma having rounded or oval cells filled with simple starch grains;
 - cells with essential oil;
 - conductive collateral bundles are located in the cortical part;
 - endoderm;
 - centrifugal bundles located in the central cylinder.
1. Carry out a histochemical reaction with Sudan III. Record the results of the observation.
 2. Note the compliance of the sample of raw materials (by external signs and microscopy), the studied requirements GF XI, p.72.

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

1. Examine the appearance of the high-powered divosil and the possible admixture of the British divosil by herbarium specimens (see diagram № 1). Write the Latin and Russian names of raw materials produced by plants and families.
2. Describe the appearance of the rhizome and root of the divosil on the example of a sample of raw materials (see diagram № 5).
3. Prepare a cross section of the root. Draw a diagram of its structure (see diagram № 6). Examine the drug at low and high magnification.

Draw and mark diagnostic signs:

- multi-row plug;
 - large parenchymal cells filled with inulin;
 - clear cambium line;
 - large vessels;
 - essential oil containers located in the bark and wood.
4. Carry out a histochemical reaction on the essential oil.
 5. Note the compliance of the sample of raw materials (by external signs and microscopy), the studied requirements GF XI, p.73.

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

1. To study the appearance of birch drooping and fluffy on herbarium specimens (see scheme № 1). Write down the Latin and Russian names of raw materials, producing plants, and families.
2. Describe the appearance of buds and leaves of birch on the example of samples of raw materials (scheme № 7 and scheme № 3).

Scheme № 7

ANALYSIS OF RAW MATERIALS "BRUNKA" BY EXTERNAL SIGNS.

- Shape (spherical, conical, elongated - ovoid, and so on).
- The nature of the assembly of scales (tiled, spiral, pressed).

- Surface (color, edge of scales).
- Dimensions.
- Запах.
- Taste.

3. Note the compliance of the sample of raw materials (on the basis of external features) of the studied requirements GF XI, p.41.

Task 5. Examine the peeled chamomile and analyze the raw materials for AND (section: external signs).

1. Examine the appearance of chamomile peeled and possible impurities: fragrant lepidotheca, three-ribbed, dog's navel, field and Russian, common queen (see. scheme № 1). Write the Latin and Russian names of raw materials, plants and families (give synonyms).

2. Carry out a comparative study of the morphological structure of baskets of chamomile, lepidotheca and flower bed (longitudinal section) of all species under study.

3. Note the compliance of the sample of raw materials (on the basis of external features) of the studied requirements GF XI, art.7.

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

1. Examine the appearance of yarrow according to the herbarium pattern (see diagram № 1). Write the Latin and Russian names of raw materials produced by plants and families.

2. Describe the appearance of grass and yarrow flowers on the example of a sample of raw materials (see schemes № 2, 8).

Scheme № 8

ANALYSIS OF RAW MATERIALS "FLOWERS" BY EXTERNAL SIGNS.

- Commodity type of raw material (inflorescences, single flowers or their parts).
 - Type of inflorescence (ear, cob, brush, basket, shield, umbrella, etc.), or single flowers.
 - The structure of the flower (features of the perianth, the number of petals, sepals, and so on).
 - The shape and character of the perianth (conical, flat, hollow inside or solid).
 - Dimensions.
 - Color.
 - The presence of bracts.
 - Запах when rubbing.
 - Taste (in non-toxic objects).
1. Note the compliance of the sample of raw materials (on the basis of external features) of the studied requirements GF XI, p.53.

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

1. Examine the appearance of the marsh sagebrush according to the herbarium pattern (see diagram № 1). Write the Latin and Russian names of raw materials produced by plants and families.
2. Describe the appearance of bagulnik shoots on the example of a sample of raw materials (see diagram № 2).
3. Note the compliance of the sample of raw materials (on the basis of external features), the studied requirements GF XI, art.1.

Instructional materials for mastering professional skills:

Methods of work performance, stages of performance:

a) get the necessary LRS

b) to study and describe the appearance of the obtained LRS, to draw LRS

- c) to prepare LRS
- 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.

Question:

1. Why when studying the external signs of raw chamomile it is necessary to view the inflorescence in longitudinal section?
2. On what (one important) basis chamomile differs from impurities?
3. Is chamomile (fragrant) chamomile equivalent to chamomile in medical use? What guidelines on this issue are included in GF XI?
4. What microchemical reactions should be carried out to determine the reliability of the raw material divosil?
5. Why is it easy to detect essential oil in the micropreparation of divosil root? Where is it located?
6. What is the most characteristic feature of mountain arnica raw materials?
7. What part of the wormwood plant is a raw material? What is characteristic in the diagnosis of these raw materials?
8. What type of essential oil glands on the leaves of wormwood wrap?
9. What reagent can be used to detect essential oils in medicinal plants?
10. What are the features of drying raw materials containing essential oils?
11. What protective measures are taken when harvesting the underground parts of plants?
12. Name the areas of procurement of raw mint, valerian, chamomile.
13. What reduces the quality of raw materials in chamomile?
14. What are the features of collecting and drying raw materials of chamomile and fragrant?
15. In what phase of the growing season do plants harvest wormwood inflorescences?
16. Name the impurity to wormwood slide and indicate signs of their differences.

17. What is the chemical composition of inflorescences and essential oil of chamomile?
18. What is the shape of the glands characteristic of the Aster family?
19. Name the technical devices used in the collection of raw materials for underground parts of plants.
20. Where are the raw materials of the miracle divosil high and bagulnik marsh?
21. Name a possible impurity in the azalea marsh and indicate their distinctive features.
22. What are the features of collecting raw materials of marsh azalea and what are the protective measures? Name the external signs of raw marsh marigold. What are the requirements for its quality?
23. What is the peculiarity of collecting birch buds and what are the protective measures?
24. What is the chemical composition of buds and leaves of birch?
25. What is the chemical composition of the raw materials of bagulnik marsh and wonderland high?
26. Describe the appearance of raw marsh bagulnik.
27. Draw the structure of the wormwood leaf and indicate the diagnostic signs (leaf preparation from the surface under a microscope).
28. What is the area of wormwood tsitvarnogo?

Tests:

1. From which plants containing santonin, make anthelmintics:
 - A. Tsitvarny wormwood
 - B. Chamomile flowers
 - C. Divosil high
 - D. Yarrow
 - E. Bagulnik

2. For the treatment of rheumatism, eczema, X-ray burns use the drug "Guayazulen", indicate the source of its receipt:

- A. Tsitvarny wormwood
- B. Sage leaf
- C. Peppermint leaf
- D. Chamomile flowers
- E. Thyme herb

3. The quality of preparations of chamomile flowers depends on compliance with the conditions of harvesting and drying. Chamomile flowers are best dried at a temperature of:

- A. 35 - 40 ° C
- B. 90 - 100 ° C
- C. 60 - 70 ° C
- D. 80 - 90 ° C
- E. 70 - 80 ° C

4. Drugs "Rekutan", "Romazulan" are used as anti-inflammatory and analgesic drugs. The source of these drugs are:

- A. Peeled chamomile
- B. Grass herd three-part
- C. Sage herb
- D. Calendula
- E. Periwinkle herb

5. Which plant is used to make the diuretic "Camiloflan":

- A. Chamomile
- B. Sage
- C. Celandine
- D. Mint
- E. Motherwort

6. Preparations of peeled chamomile are used to treat inflammatory diseases. The reliability of this raw material is carried out according to the content:

- A. Apigenin
- B. Reserpine
- C. Atropine
- D. Vinblastine
- E. Hyosciamine

7. Which of the following plants is part of the bactericidal collection "Elikasol":

- A. Peeled chamomile
- B. Plantain leaf
- C. Tansy flowers
- D. Grass spores
- E. Motherwort grass

8. From the flowers of which plant isolated flavonoid glycoside apein, which is broken down into apigenin, glucose and apiosis:

- A. Peeled chamomile
- B. St. John's wort is perforated
- C. Immortelle flowers
- D. Tansy flowers
- E. Nail flowers

9. Raw chamomile peeled is used for the production of tinctures and ointments. At what stage of the growing season should be harvested these raw materials:

- A. Horizontal arrangement of ligulate flowers
- B. The beginning of flowering
- C. Budding
- D. Fruiting

E. The whole flowering period

10. At all operations of packing and transportation the dried flowers of a camomile easily give a rash of tubular flowers therefore GF XI allows crushing:

- A. Up to 30%
- B. Up to 40%
- C. Up to 50%
- D. Up to 60%
- E. Up to 70%

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.
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.

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:

Essential oils.LR and LRS containing essential oils (aromatic compounds). Anise, fennel, thyme, thyme, oregano.

Methodical recommendations were made by  *associate professor Boyko IA*

(Signature)