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. Analysis of essential oils. LR and LRS containing essential oils (monoterpenoids). Coriander, lemon balm, peppermint, sage, eucalyptus, valerian, juniper, cumin.»

Course: 3rd Faculty: medico-pharmaceutical

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

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1. The topic of the lesson: "Essential oils. Analysis of essential oils. LR and LRS containing essential oils (monoterpenoids). Coriander, lemon balm, peppermint, sage, eucalyptus, valerian, juniper, cumin. " - 4 years.

2. Relevance of the topic.

Essential oils are a mixture of fragrant volatile substances belonging to different classes of organic compounds, mainly terpenoids, less often aromatic and aliphatic compounds.

They have a wide range of pharmacological action: anti-inflammatory, antiseptic, antispasmodic, expectorant action and are used in medicine, in the food, perfume and cosmetics industry and in other sectors of the economy.

The knowledge and skills acquired in the study of this topic will be used by students to successfully master some sections of pharmaceutical chemistry, pharmacy and factory technology of drugs, pharmacology, pharmacotherapy, as well as in the practical activities of a pharmacist.

3. Objectives of the lesson:

3.1. General goals: To study medicinal plants whose essential oils contain mono- and bicyclic terpenoids, as well as to master the methods of macro- and microscopic analysis of mint leaves, sage, eucalyptus, as well as macroscopic analysis of the rhizome with valerian roots and juniper berries.

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 "essential oils" and "terpenoids", their classification.
2. External signs of medicinal raw materials and possible impurities.
3. Characteristic anatomical features of the studied types of medicinal raw materials, rules and terms of their procurement.
4. Growing places and cultivation areas of the studied species.

5. Formulas of the main components of essential oils related to mono- and bicyclic terpenoids (menthol, cineole, limonene, carvone).

6. Chemical composition of the studied types of raw materials.

7. Ways of using raw materials and its medical application.

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 (peppermint, sage, eucalyptus: ball, ash, twig, valerian, juniper) and distinguish them from possible impurities;

- To determine the authenticity of raw materials by external signs, 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 chemistry	Physical and chemical properties of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles.	Carry out qualitative reactions; purification of organic compounds.
	3. Analytical chemistry	Methods of acid-base titration (neutralization) and permanganatometry	Work with analytical scales, measuring vessels, photoelectro-colorimeter, use methods of chromatography on paper and in a thin layer of sorbent.
2.	The following disciplines: 1. Physical and	Solubility of solids and liquids in	

	colloid chemistry	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.	
	2. Pharmacy technology of drugs	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.	
	3. Industrial technology of medicines	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.	
	4. Clinical pharmacology	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. Methods of qualitative and quantitative study of drugs.	
	5. Pharmaceutical chemistry	Pharmaceutical service management. Storage of medicines. Control and analytical service, organization of its work. Accounting for inventory and cash. Economic analysis of the pharmacy.	

	6. Organization and economics of pharmacy 7. Management and marketing in pharmacy	Management and entrepreneurship. Organization as an object of management. Connecting processes in management. Human Resource Management Pharmaceutical Marketing Management. Pharmaceutical market research. International marketing.	

5. Content of the topic (text and thesis), graphic 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	*Preparatory stage* Organization of classes Setting learning goals Homework check	II	Oral interview on the topic	Methodical works for students, album	1% 2% 25%
2	*The main stage* Conducting a practical lesson	III	Herbariums of medicinal plants, LRS, reagents		50%
3	*The final stage* 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 Providing homework with a reference to the literature	II- III		Tests and situational tasks	15% 3%

7. Materials on methodological support of the lesson

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

Question:

1. Define terpenoids.
2. Write the classification of terpenoids.
3. Define essential oils.
4. Name the families and plants in which the content of essential oils is quite high.
5. In which formations (exogenous or endogenous) are essential oils localized in plants?
6. On what morphological features can be identified plants of the family Yasnotkov in nature? Give examples of plants.
7. What factors affect the accumulation of essential oils in medicinal plants?
8. What is the importance of essential oils for plants?
9. List the methods of obtaining essential oils from plants.
10. Describe the method of obtaining essential oils by steam distillation.
11. What reagent can detect essential oils in medicinal plants?
12. What are the features of drying raw materials containing essential oils?
13. On what anatomical features can be identified plants of the family Yasnotkov?
14. What are the features of drying peppermint leaves?
15. Give the botanical definition of shrubs and semi-shrubs.
16. What are the features of collecting eucalyptus leaves?
17. Write the chemical formulas of the main components of essential oils: coriander, peppermint, eucalyptus.
18. Name the drugs derived from raw materials: mint, eucalyptus, valerian.
19. What external signs allow to distinguish a leaf of peppermint from leaves of a sage?

20. How does light affect the accumulation of essential oil in the plant?
21. How does the phase of plant development affect the quantitative and qualitative composition of peppermint essential oil?
22. What signs are of diagnostic value in determining the leaves of sage and peppermint in appearance?
23. Name the areas of growth of wild eucalyptus and areas of their cultivation in our country.
24. Which sheet is called isolateral?
25. How are formed essential oil containers in eucalyptus?
26. Why eucalyptus trees do not provide shade?
27. What is the basis of medical and economic use of leaves and other parts of eucalyptus?
28. What is the economic effect of mechanized cleaning of valerian?
29. Describe the external signs of valerian raw materials.
30. Indicate possible impurities in valerian. What is the main sign of the difference between valerian and impurities?
31. What protective measures are taken in the procurement of underground parts of plants?
32. What are the features of collecting and drying juniper berries?
33. Name the areas of procurement of raw mint, valerian.
34. Name the unacceptable impurity in the fruit of juniper and indicate signs of their differences.
35. What is the appearance of juniper berries and what are the possible defects of raw materials?
36. Name the drugs derived from valerian.
37. In which habitats will the underground mass of valerian raw materials be more?
38. What are the protective measures taken in the procurement of raw materials from wild valerian?
39. Name the drugs derived from eucalyptus.
40. What raw materials and drugs are used for inhalation?
41. For what purpose are eucalyptus leaves and sage leaves used?

42. Name the active substances of sage and eucalyptus.
43. Draw the structure of the leaves of peppermint and indicate its diagnostic signs (preparation of the leaf from the surface under a microscope).
44. Draw the structure of the eucalyptus leaf (cross section under a microscope) and indicate its diagnostic signs.
45. Give examples of plants in which the inflorescence: folding umbrella, shield, basket, corymbose panicle, beginning, earring, head.
46. What are the ways to use medicinal plant raw materials containing essential oil?

Tests.

1. A letter of this LRS containing monoterpenoid is prescribed in the collection as an digestive aid, choleretic and antispasmodic. The essential oil is used in the confectionery and perfume industries. it:
A. peppermint
B. tansy ordinary
V. stalnik field
Г.ефедрахвощевая
D. horse sorrel

2. What is the name of the method of obtaining essential oils based on their absorption by sorbents (solid fats, activated carbon). This process is carried out in special frames, hermetically assembled 30-40 pieces (one on top of the other) in the battery?
А.анфлераж
B. distillation with water vapor
B. biological standardization
G. sublimation
D. chromatographic analysis

3. To determine the purity of the essential oil in a test tube with peppermint oil was added ethanol and observed turbidity. What impurity is present in peppermint oil?

A. fatty oil

B.phenol

B.acetone

G. ethyl acetate

D. diethyl ether

4. Peppermint leaves and herbs contain 1-3% of essential oil. Choose the best method of obtaining peppermint oil:

A. distillation with water vapor

B. ethanol extraction

B.анфлераж

G. pressing

D. adsorption by activated carbon

5. The pharmaceutical factory received a batch of vegetable raw materials - peppermint leaves. The good quality of this raw material is established using the following methods:

A. distillation with water vapor

B. biological standardization

B. sublimation

G. chromatographic analysis

D. anatomical analysis

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. Examine peppermint and analyze the AND (sections: external signs, microscopy).

1. To study the appearance of peppermint on a herbarium sample (scheme № 1).

scheme №1

DEFINITIONS OF PRODUCING PLANTS By external

SIGNS

- Life form (herbaceous plant, shrub, shrub, tree).
- type of underground organs (root, rhizome, tuber, etc.)
- Stem structure (shape, nature of branching, pubescence, diameter, etc.)
- Sheet placement (regular, opposite, whorled)
- 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 lentils, spines, etc.).

Write down Latin and Russian names produced by plants and families.

2. Carry out a macroscopic analysis of peppermint leaves on the example of a sample of raw materials (scheme № 2).

Scheme № 2

ANALYSIS OF RAW MATERIALS "LEAVES" According to external signs

- Type of leaf and dissection of the leaf blade: (simple: palchatorozsechenna, palchato- or peristorozdelnym, peristolopastnye, three- or five-lobed; complex: even or imparipinnate.
- 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 sheet and leaves
- Odor when rubbing the object or wetting with water.
- Taste (for non-toxic objects)

- Specific features.

Draw the appearance of the letter.

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

   Scheme 3 microscopic analysis of RAW MATERIALS "LEAVES"

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

   Draw and mark diagnostic signs:

   - Winding epidermis, stomata oval, surrounded by two cells located transversely to the stomatal slit;
   - Hairs: simple 2-4-celled with a longitudinal warty, glabrous with an oval head on a unicellular short stalk;
   - Essential oil glands with a rounded head, consisting of 8 secretory cells, diverging radially and short leg

   4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of SF XI, Article 18.

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

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

2. Carry out a macroscopic analysis of a sample of raw materials (see Scheme № 2). Draw the appearance of the letter.
3. Prepare a micropreparation of the leaf from the surface and study it at low and high magnification (see Scheme № 3).
Draw and mark diagnostic signs:
- Cells of the lower epidermis tortuous, upper - straight; stomata with two accompanying cells placed transversely to the dostic slit;
- Hairs: numerous simple, consisting of 1-4 short cells and a long curved end, capped with a small spherical head on a 1-2-cell stalk;
- Essential oil glands, the head of which consists of 8 cells.
4. Note the compliance of the sample of raw materials (external signs and microscopy) to the requirements of SF XI, Article 22.

Task 3. To study eucalyptus ball, gray, rod-shaped, and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of eucalyptus ball, gray and rod-shaped herbarium specimens (see Scheme № 1). Write down the Latin and Russian names of raw materials produced by plants and families.
2. Describe the appearance of eucalyptus leaf on the example of a sample of raw materials (see Scheme № 2). Draw the appearance of juvenile and old eucalyptus leaves.
3. Prepare a micropreparation of the cross-section of the sheet, study it at low and high magnification (see Scheme № 3).
Draw and mark diagnostic signs:
- The epidermis of both surfaces of the leaf with a thick cuticle;
- Palisade fabric on both sides is located in 3-4 rows;
- Spongy parenchyma occupies a small area;
- Essential oil containers are spherical, large, exposed by secretory cells;
- Veins with crystal coating;
- Friends, located both in the front garden and in the spongy parenchyma.

4. Note the compliance of the test sample of raw materials (by external signs and microscopy) to the requirements of SF XI, Article 15.

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

1. To study the appearance of valerian medicinal and possible impurities: poskonnika, core, tavolga vyazolistnaya, freckles on herbarium specimens (see Scheme № 1). Write down the Latin and Russian names of raw materials, plants and families.
2. Describe the appearance of the rhizome with valerian roots on the example of a sample of raw materials (scheme № 4).
Scheme № 4
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, 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. Note the compliance of the sample of raw materials (on external grounds) to the requirements of SF XI, Article 77.

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

1. To study the appearance of juniper ordinary and unacceptable admixture - Cossack juniper on herbarium specimens (see Scheme № 1). Write down the Latin and Russian names of raw materials, plants and families.
2. Describe the appearance of juniper berries 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, 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, matte, etc.).
- The shape and structure 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. Conduct a comparative analysis of the characteristics of the fruits of juniper and Cossack.
4. Note the compliance of the sample of raw materials (on external grounds) to the requirements of SF XI, Article 34.
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. Is it necessary to determine the edge of the leaf when determining the authenticity of raw peppermint; than it is characteristic?
2. What is the structure of essential oils in the leaves of peppermint?
3. What is the veining of sage leaves?
4. What characterizes the shape and edge of the leaf of sage?
5. Why when determining the authenticity of raw eucalyptus should look at the sheet on the lumen?
6. Why in the raw materials of eucalyptus leaves are different in shape?
7. Where is the essential oil localized in the eucalyptus leaf?
8. What reagents are used to stain essential oil in microscopic preparations?
9. What fruit in juniper; on what grounds can it be compared with the fruits of conifers and distinguish?
10. On what grounds can you quickly determine the authenticity of raw valerian?
11. Will the anatomical structure of valerian roots of different diameters be the same?
12. Why hypodermic cells in valerian root have diagnostic value in microscopic analysis of raw materials?
13. What are the microscopic features of the leaves of mint and oregano?

Tests:

1. What process underlies the quantitative determination of the content of essential oil in eucalyptus leaves according to the pharmacopoeial method.

A. distillation with steam

B. extraction with an organic solvent

В.анфлераж а

G. pressing

D. extraction with fatty oil

2. The quality of peppermint oil is determined by the content of menthol. What numerical value determines the content of menthol in peppermint oil.

A. ether number after acetylation

B. acid number

B. foam number

G. ethereal number

D. ionic number

3. Menthol, being the main component of peppermint oil, is included in a large number of combined drugs. How is menthol obtained from essential oil?

A. freezing

B. extraction with organic solvents

V. method Anflerage

G. pressing

D. extraction with fatty oil

4. When instructing on the harvesting and drying of essential oil vegetable raw materials should indicate that this raw material is dried at a temperature of:

A.25-35oC

B.10-15oC

B.50-60oC

G.70-75oC

D.80-85oC

5. The essential oil of peppermint has a characteristic odor. This smell is due to the presence of:

A. menthol

B.carvacrol

B.цимола

G. citral

D. timola

6. A batch of medicinal plant raw materials of peppermint herb was delivered to the pharmacy warehouse. According to which indicator in accordance with the requirements of the Pharmacopoeia conduct an analysis of the content of active substances:

A. essential oil

B. flavonoids

B. extractives

G. Kumarinov

D. saponins

8. Literature

Basic literature

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Additional literature:

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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 (sesquiterpenoids and sesquiterpene lactones). Chamomile, fragrant chamomile, ergot high, wormwood, yarrow, birch, cane, marsh. "

Methodical recommendations were made by _____ associate professor Boyko IA

(Signature)