

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

METHODICAL DEVELOPMENT OF THE LECTURE

Course: "Pharmacognosy"

Lecture № 7

"Essential oils. General characteristics Analysis of essential oils. LR and LRS  
containing essential oils. "

Course: 3rd Faculty: medico-pharmaceutical

The lecture was discussed  
at the methodical meeting  
departments

August 30, 2024

Protocol № 1

Head departments \_\_\_\_\_  
prof. Rozhkovsky Ya.V.



*Lecture № 7:* "Essential oils. General characteristics Analysis of essential oils.

**LR and LRS containing essential oils.»(2 years)**

**1. Relevance of the topic. Rationale for the topic.**

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) are heavy fractions of essential oils. LRS containing sesquiterpenes include: wormwood flowers, Taurian wormwood grass, chamomile flowers, yarrow grass and flowers, rhizomes and roots of ergot, azalea rhizomes.

**The purpose of the lecture:**

*-educational - to know*

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 (growing areas), locations.
4. External signs of the types of medicinal raw materials being studied.
5. Chemical composition of LRS species studied.
6. Formulas of the main sesquiterpenoids which are a part of LRS studied: farnesol, bisabolen, selinen, matricin, artabsin, allantolactone, chamazulene, guaiazulene, ledol.
7. Ways of using raw materials and its medical application.

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

### 3. Plan and organizational structure of the lecture.

№	The main stages of the lecture	Goals in accreditation levels	Type of lecture, equipment of the lecture	Time distribution
1	2	3	4	5
1.	Preparatory stage			
2.	Defining educational goals.		Combined,	1%
2.	Providing positive motivation.		tables,	2%
	<b>The main stages</b>		herbariums,	
	Presentation of lecture material.		LRS, drugs	
3.	plan:			
	1. Characteristics of LRS containing sesquiterpenoids.	I		
	2. Characteristics of LRS containing sesquiterpene lactones	II		90%
	3. Characteristics of LRS containing aromatic compounds	III		
	4. Characteristics of LRS containing resins, balms and gums	II		
	<b>The final stage</b>			
	Lecture summary, general conclusions. Lecturer's answers to possible questions.		list of literature, questions, tasks	2%
4.				
5.	Tasks for student self-preparation.			2%
6.				3%

### 4. Content of lecture material:

- *Structural and logical scheme*

Medicinal plants and raw materials that contain essential oils

LRS containing sesquiterpenoids

LRS containing sesquiterpene lactones

LRS containing aromatic compounds

LRS containing resins, balms and gums

- *The text of the lecture is attached*

### 5. Materials of activation of students during the lecture

*Question:*

1. Latin and Russian names of LRS, which are derived from plants and families studied.
  2. Morphological characteristics of plants, their habitats (areas of cultivation), habitats.
  3. Rules of drying and storage of LRS.
  4. Measures for the protection and rational use of medicinal plants of the research topic.
  5. External signs of the studied types of medicinal raw materials.
  6. The main anatomical diagnostic features of the fruits of anise, fennel, creeping and common thyme leaves, oregano leaves.
  7. Chemical composition of the studied species of LRS, formulas of anethole, thymol, eugenol.
- B. Ways of use and medical application of the studied LRS.

***Problem situations:***

1. Alcohol extract of which medicinal plant is an integral part of the drug "Gastrovit", used in gastroenterological practice:
  - A. Oregano is common
  - B. Astragalus woolly

C. St. John's wort is perforated

D. Horsetail

E. Wormwood is bitter

2. The pharmacy prepared the herb oregano. Which drying mode should be used to obtain raw materials that meet the requirements of GF XI:

A. 35-40 ° C

B. 80-90 ° C

C. 20-25 ° C

D. 50-60 ° C

E. 70-80 ° C

3. For the preparation of galenic drug "Pertusin", which has an expectorant effect, use an extract of the herb:

A. *Thymus serpyllum*

B. *Bursae pastoris*

C. *Hyperici*

D. Diffuse erythema

E. *Polygoni avicularis*

4. The extract of which of these plants is part of the drug "Urolesan", which has an antispasmodic effect in renal and gallstone diseases:

A. Oregano is common

B. Peeled chamomile

C. The herd is threefold

D. St. John's wort is perforated

E. Cranberry

5. During the commodity analysis of medicinal plant raw materials it was found that it consists of a branched stem, alternate leaves, cut into narrow linear lobes,

small, yellow flowers, collected in complex umbrellas; the fruit of the umbrella type is the pistil. It is concluded that this LRS:

- A. *Foeniculum vulgare*
- B. *Herba Senecionis*
- C. *Ephedra equisetina*
- D. *Ammi visnaga*
- E. *Anethum graveolens*

6. The main active properties of oregano are thymol and carvacrol. To which class of biologically active substances do they belong:

- A. Essential oils
- B. Flavonoids
- C. Alkaloids
- D. Iridoids
- E. Xanton

7. Which medicinal plant of the family Apiaceae contains essential oil, which includes anethole:

- A. *Pimpinella anisum*
- B. *Coriandrum sativum*
- C. *Anethum graveoleus*
- D. *Allium sativum*
- E. *Allium sulfur*

8. Microscopic analysis of raw materials in the drug revealed: cells of the lower epidermis wavy, numerous pores, porous apparatus of the diacite type, simple hairs, coarse-warty; 1 5 cellular; capped with an oval unicellular head on a unicellular stalk. Essential oil glands are built on the type of labiate. For which of the following types of raw materials these properties can serve as confirmation of authenticity:

- A. Oregano herb
- B. Thyme herb
- C. Creeping thyme herb
- D. Sage leaf
- E. Peppermint leaves

9. Specify medicinal plant raw materials, the fruits of which contain up to 6% of essential oil, the main components of which are anethole (80-90%), methylhavicol; in addition, it contains up to 28% fatty oil. In medical practice, fruits are used and oil is used as an expectorant; with flatulence in the form of infusion, is part of the gastric, choleric and carminative fees:

- A. Fennel is common
- B. Dill
- C. Juniper
- D. Wild carrots
- E. Japanese sophora

10. Specify the timing of procurement of raw fennel:

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

#### **6. General, material and methodological support of the lecture:**

- *Equipment: overhead projector, code charts, slides, tables;*
- *Illustrative materials: medicinal plant raw materials, herbariums.*

#### **7. Materials for self-preparation of students:**

*a) on the topic of the lecture*

*Question:*

1. What is the importance of essential oils for plants?
2. List the methods of obtaining essential oils from plants.
3. Describe the method of obtaining essential oils by steam distillation.
4. What reagent can detect essential oils in medicinal plants?
5. What are the features of drying raw materials containing essential oils?
6. Draw the structure of the fruit of anise and indicate its diagnostic features (cross section under a microscope).
7. Draw the structure of the fruit of fennel (cross section under a microscope) and indicate its diagnostic signs.
8. Name the possible impurities in the fruits of anise and fennel and indicate their distinctive features.
9. How to store anise and fennel in a pharmacy and in a warehouse?
10. What is the chemical composition of raw materials and essential oil of anise and fennel?
11. Describe the appearance of raw oregano.
12. What is the chemical composition of raw oregano and where it is used?
13. Name the life form of thyme and thyme and indicate the external signs of raw materials.
14. On what morphological grounds can be distinguished raw thyme from thyme?
15. What is the chemical composition of raw materials and oils of thyme and thyme?
16. What are the uses of medicinal plant raw materials, the essential oils of which contain aromatic compounds?

*Task:*

1. Make a table of the distinctive features of creeping thyme and thyme.
2. List the main distinguishing features of anise and fennel.
3. Write instructions for harvesting, drying and storage of fruits of plants of the celery family.

4. Specify the localization of essential oil in the fruits of plants of the celery family.
5. Divide the plants of this lesson by the main types of pharmacological action.

***b) on the topic of the next lecture: "Medicinal plants and raw materials containing saponins"***

**List of main issues:**

1. Definition of "saponins".
2. Distribution of saponins in the plant world and resources of the studied raw materials.
3. Terms and methods of LRS collection.
4. Measures for the protection and rational use of wild medicinal plants containing saponins.
5. Latin and Russian names of LRS, derived plants and families of all objects of the research topic.
6. Morphological characteristics of plants, their range (areas of processing), distribution.
7. External signs of the studied types of medicinal raw materials.
8. Chemical composition, uses and medical use of LRS and drugs containing saponins.
9. The value of the work of domestic and foreign scientists to study saponins.
10. What is the type of structure of the root of cyanosis (cross-sectional micropreparation), its diagnostic signs?
11. What is the raw material of horsetail; what are its features from other species of horsetails?
12. Why is ginseng root called "man-root"?
13. What anatomical features are important in determining the authenticity of ginseng root?
14. What are the external signs of the root of Manchurian aralia?

15. What plant derivatives are sources of raw materials for Dioscorea?
16. What is characteristic of the morphological characteristics of the raw material of Dioscorea?
17. What is a foaming reaction?
18. How to conduct a foaming reaction with raw cyanosis, what are its results?
19. What are the methods of discovery of saponins in medicinal raw materials?
20. What is a "foam number" or "saponin index"?

## **8. Literature used by the lecturer to prepare the lecture.**

### **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.



The lecture was composed by \_\_  \_\_ MD, Professor Rozhkovsky  
Ya.V.

## Lecture text

### Medicinal plants and raw materials containing essential oils

#### 1. monoterpenoids. acyclic

<p>Refer to the type of 2,6-dimethylheptane and may have 3, 2 or 1 double bond. They are represented by hydrocarbons (myrcene), alcohols (geraniol, linalool), aldehydes (citral), and others.</p>	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>myrcene</p> <p>(Hops)</p> </div> <div style="text-align: center;"> <p>geraniol</p> <p>(rose, la-Wanda)</p> </div> <div style="text-align: center;"> <p><math>\alpha</math>-linalool</p> <p>(coriander, Melissa)</p> </div> <div style="text-align: center;"> <p>citral</p> <p>(melissa)</p> </div> </div>	

***LRS, the oil of which contains acyclic monoterpenoids:***

***Rose petals -Flores Rosae (R. damascena, Rosaceae)***

Chem. composition: geraniol, citronellol, phenylethyl alcohol, cinnamic aldehyde, stearopten.

Application: essential oil; rosanol; petal infusion - antispasmodic, anti-inflammatory, analgesic, antiseptic effect.

***Fruits of coriander - Fructus Coriandri (Coriandrum sativum, Apiaceae)***

Chem. composition: essential oil 0.7-1.4% ( $\alpha$ -linalool -60-70%, pinene, terpinene, limonene, myrcene, geraniol -up to 5%, geranyl acetate, borneol); fatty oil, proteins, oak substances, coumarins, flavonoids, steroids, phenolic acids.

Action and drugs: anti-inflammatory, antimicrobial, analgesic ("Citral" -alcohol solution of linalool and com  $\therefore$  "Espol" -ointment. "Flora" -balsum., Fees: "choleric №2," antihemorrhoidal ").

***Lemon balm leaves - Folia, Herba Melissa (Melissa officinalis, Lamiaceae)***

Chemical composition: ef.o. (0.2%): citral, (up to 62%), linalool, geraniol, citronellol, myrcene; oak. districts, flavonoids, coumarins, bitters, mucus, phenolic acids, triterpene saponins-ursol to-that.

Action and drugs: sedative, anti-inflammatory, bacteriostatic, analgesic, antihypertensive (infusion and com .: Vitalotonic "Doppelgertz", drops "Carmolis", "drops Nadobranich-sleepy herbs", "Altalex", solution and tablets "Novopassit", table. "Persen", capsules "Persen Forte" and "Sedasen Forte").

***Lavender flowers - Flores Lavandulae (Lavandula angustifolia, Lamiaceae)***

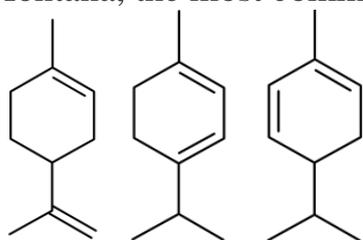
Chemical composition: essential. oil: linalool, linalool esters, geraniol, nerol, 1,8-cineole,  $\beta$ -phelandrene; coumarins, ursolic acid, dub.r-ni, anthocyanins.

Action and drugs: sedative, antispasmodic, antimicrobial, anti-inflammatory, analgesic (infusion, combination: "Livian" aerosol, "Altalex", "Carmolis" -drops, ointment "Espol", cream "venogal").

## 2. MONOTERPENOIDS. MONOCYCLIC

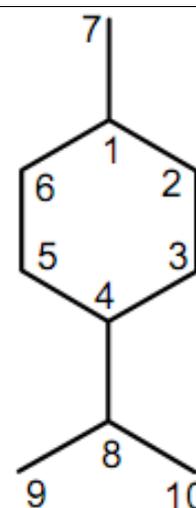
Belong to the n-menthane type

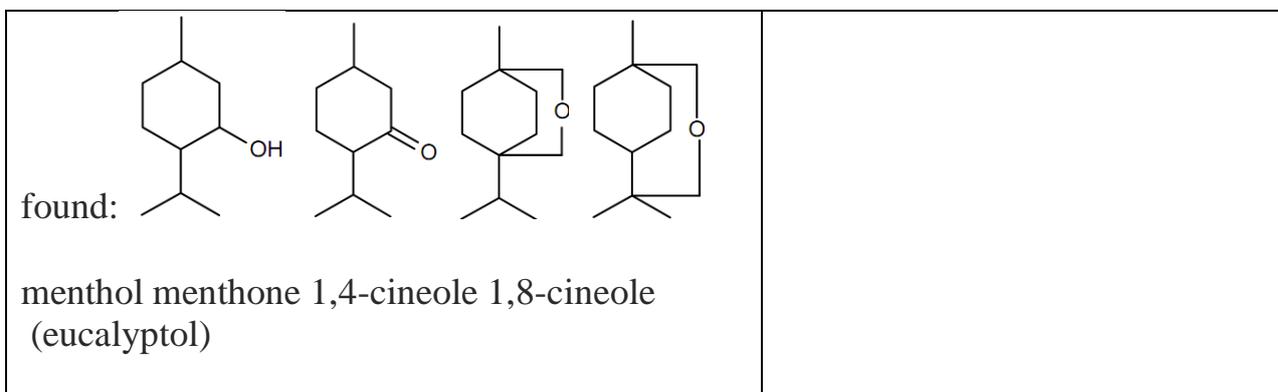
Of the unsaturated hydrocarbons such as Montana, the most common are:



lemon terpinene phelandrene  
( $\alpha$ ,  $\beta$ ,  $\gamma$ ) ( $\alpha$ ,  $\beta$ )

Oxygen derivatives of menthane are often





**LRS, the oil of which contains monocyclic monoterpenes:**

***Peppermint leaves - Folia Menthae piperitae (Mentha piperita, Lamiaceae)***

Chem. composition: essential oil (up to 3%): menthol-50-80%, menthone-12-25%, pulegone, limonene, etc .; flavonoids, oak. tannins, triterpenoids, betaine, carotene.

Action and drugs: antispasmodic, sedative, antihypertensive ("corvaldin", "corvallool", "Corvalment", "valocordin", "validol", "persen", "sedavit"), antiseptic, anti-inflammatory ("Ingalipt", "Altalex" , "Pectussin", "kameton", "septolette", "Pinovit", "pinosol"), antidepressant (mint tablets), distracting, analgesic ("menovazin", "Gevkamen", "evkamon" -ointment, " bromine-bang "-ointment); enhances the secretion of digestive glands (infusion, n-ka, "gastric drops", "peppermint oil"), choleric ("Polyfitol-1", "Carmolis"), menthol oil, menthol alcohol solution, "phytonutrient diabetes", Traskov's medicine, fees: soothing №2, lek.-prof.1,2,4,5, gastric №3.

***Sage leaves - Folia Salviae (Salvia officinalis, Lamiaceae)***

Chemical composition: e.o. (1-2.5%): 1,8-cineole (up to 15%), camphor, camphene, borneol, thujone, salven, limonene, bornyl acetate; di- and triterpenoids, flavonoids. dub.r-ni, phenolic acids.

Action and drugs: anti-inflammatory, antimicrobial, estrogenic, expectorant, hypoglycemic, astringent (infusion, "salvin", table. "Sage extract with vitamin C

by Dr. Theiss", "sage", syrup "broncholitin", Kext-t "Herbogastrin", paste "Phytolysin", drops "Altalex", "Carmolis", district "Stomatofit", collection "BRONHOFIT", "Elekasol").

***Eucalyptus leaves - Folia Eucalypti (Eucalyptus globulus, E.cinerea, E.viminalis, Myrtaceae)***

Chemical composition: e.o. (0.26-4%): 1,8-cineole (not less than 60%),  $\alpha$  and  $\beta$ -pine, n-cinnamon, foam carvone, myrtenol; flavonoids, oak. substances, chlorophyll, aldehydes (isovaleric, etc.).

Action and application: bactericidal, anti-inflammatory, astringent (infusion, tincture, eucalyptus oil, "eucalyptus balm for colds Dr. Theiss", chlorophyll "and com .: liniment" Alor ", aerosol." Ingalipt, "cameton "." Eukazolin "," Pinovit "," pinosol ", tab." Pectusin "," septogal "," septolette ", ointment" efkamon ", collection" Elekasol ", etc.).

***Tea tree leaves - Folia Melaleuca (Melaleuca alternifolia, Myrtaceae)***

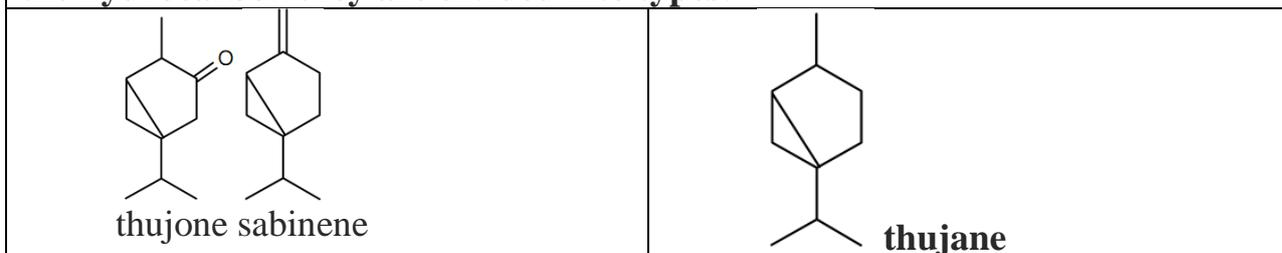
Chemical composition: e.o.: terpeneol, cineole, limonene, dipentene.

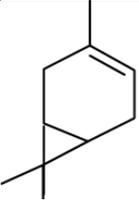
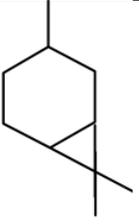
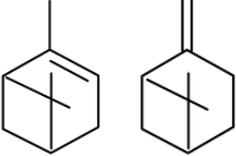
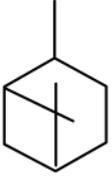
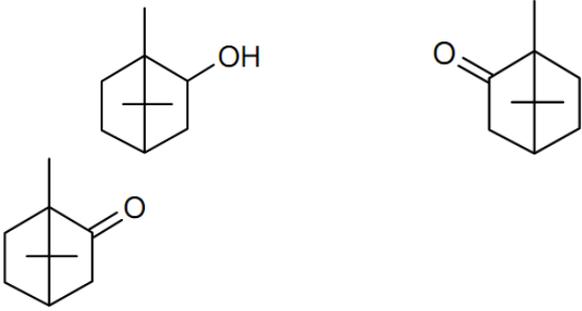
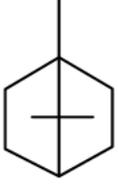
Action and application: bacteriostatic, fungistatic, anti-inflammatory - in pharmacy and cosmetic production.

**And:** III. dill (carvone-antispasmodic., diuretic.), pl. cardamom (limonene, terpeneol, cineole, borneol-spicy bitterness), leaf and pl.

**3. MONOTERPENOIDS. BICYCLIC**

**They have two condensed aromatic rings. Depending on the structure of the hydrocarbon they are divided into types:**



 <p>karene</p>	 <p>karan</p>
 <p><math>\alpha</math> - pinene <math>\beta</math>-pinene</p>	 <p>pinan</p>
 <p>borneol (+) - camphor (-) - camphor</p>	 <p>bell</p>

**LRS, the oil of which contains bicyclic monoterpenes:**

***Rhizomes with valerian roots - Rhizomata cum radicibus Valerianae***  
***(Valeriana officinalis, Valerianaceae)***

Chem. composition: E.O. (0.5-2.4%): bornylisolerianate, borneol, pinene, terpineol, isovalerian to-that; valepotriates (0.8-2.5%); alkaloids, oak. districts, org. to-you.

Action and application: sedative, antispasmodic, analgesic; improves digestion (infusion, extract, tincture, combination: "cardiophyte", "valokormid", "cardiovalen", "persen", "Sedasen", "novopassit", "drops of greens", "drops of acorns.", "drops of teeth ", Fees:" sedative.№2 ", " therapeutic and prophylactic. №1, 5 ", " gastric №3 ", etc.)

***Juniper berries - Fructus Juniperi (J. communis, Cupressaceae)***

Chem. composition: E.O. (0.5-2%):  $\alpha$ -pinene, camphene, borneol, myrcene, Sabina; flavonoids, resins, org. k-ti, monosaccharides, pect. districts, oak. districts.

Action and application: diuretic, disinfectant, choleric, expectorant (infusion, combination: "Kofol" -syrup, lollipops, "venogal" -cream).

### ***Pine buds - Gemmae Pini (P.sylvestris, Pinaceae)***

Chem. composition: E.O. (up to 0.4%):  $\alpha$ -pinene, karene, terpinene, limonene, terpineol; oak. districts, bitter district-podpinipicrin, carotene, vit. C, derivatives of flavonoids.

Action and application: expectorant, mucolytic, antimicrobial, antiviral, anti-inflammatory, diuretic, choleric, antiexudative (decoction and com.: "pinosol", "Altalex", "Phytolysin", "Pinovit", "Traskov's mixture", "eucalyptus" Dr. Theiss's cold"). Vit concentrate is obtained from pine needles. C, coniferous extract,

From resin - turpentine (liquid) or resin (thickened) get rosin (used in technology) and turpentine-essential oil, the main component of which is  $\alpha$ -pinene. Turpentine is used to prepare ointments, liniments (treat colds, rheumatism).

### ***Rosemary leaves; rosemary shoots - Folia Rosmarini, Cormus Rosmarinus (R. officinalis, Lamiaceae)***

Chemical composition: EO: cineole, borneol, camphene; oak, flavonoids, di- and triterpenes.

Action and application: tonic, improves digestion, wind-blown, antispasmodic (e.o. infusion, bath extracts).

### ***Shoots of Siberian fir - Sammitates Abietis (Abies sibirica, Pinaceae)***

Chemical composition: e.o. (up to 3%): camphor, bornyl acetate -30-60%, borneol, camphene,  $\alpha$ - and  $\beta$ -pinene, vitamin C, carotenoids; resinous districts, oak districts, flavonoids (rutin, quercetin), pheophytin, sterols, volatile acids, chlorophyll.

Action and application: antimicrobial, irritating, analgesic (camphor, camphor oil, camphor alcohol, comb .: "camphomen" -aeros., "Camfocin" - liniment, "suprima-Plus" -ointment, "Urolesan", etc.

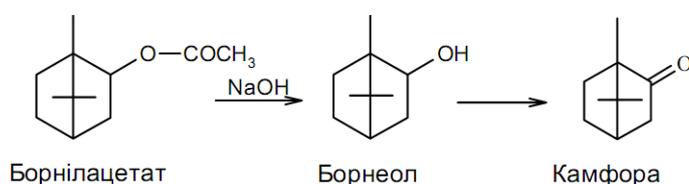
***Camphor laurel wood - Lignum Cinnamomi (Cinnamomum Camphora, Lauraceae)***

Chemical composition: e.o .: camphor; safrole, dub.r-ni.

Action and application: analeptic (camphor, oil extract for injection). Bromocamphor is used internally as a sedative and cardiac agent.

***Camphor***

There are two isomers of camphor: (+) - right-handed, natural, and (-) -left-left -semisynthetic and ( $\pm$ ) racemate, synthetic. Natural camphor (+) is contained in the essential oils of camphor laurel, fir, camphor basil, wormwood, sage. On an industrial scale it is obtained from camphor laurel wood. Semi-synthetic, left-handed camphor is obtained from the shoots of Siberian fir (first by steam distillation to obtain e.o. containing borneol and bornyl acetate (40%), which are then isolated with e.o. distillation, bornyl acetate is saponified to borneol, which is then to (-) camphor:



In industry, racemate-camphor is synthesized from  $\alpha$ -pinene - the main part of turpentine, purified up to 98% of the content of the main product.

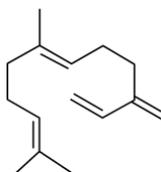
**Sesquiterpenes (one and a half terpenes C 15 H<sub>22</sub>)**

**WITH.**- the most common and diverse group of terpenes. Often found together with monoterpenoids in the composition of e.o.

**WITH.** exist in acyclic and cyclic (mono-, bi- and tri-) forms.

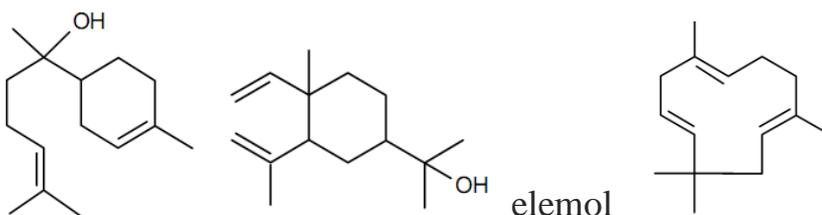
**Acyclic sesquiterpenoids:**

Formed from three isoprene units connected by the type of "head-tail". The most important - farnesol alcohol found in linden flowers:



### Monocyclic sesquiterpenoids

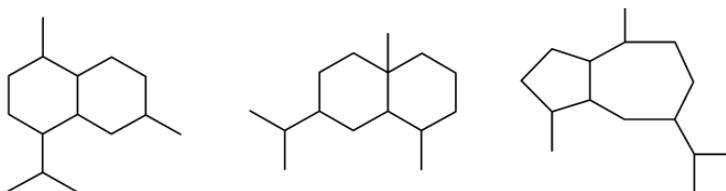
Contain a cyclohexane element, an open hydroaromatic ring and 2-4 double bonds. In nature, common types of compounds: bisabolane (bisabolol alcohol - in e.o. chamomile, lemon, pine), elemol (in e.o. marsh calamus), humulane (in e.o. hops):



humulene bisabolol

### Bicyclic sesquiterpenoids

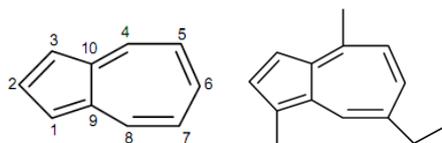
Contain two fused hydrocarbon rings with 2-4 double bonds. Main types: kadinane, eudesmane and guayane:



Kadinane Eudesmane Guyane (chamomile, wormwood, calendula, valerian, oman, birch) yarrow, arnica, eucalyptus)

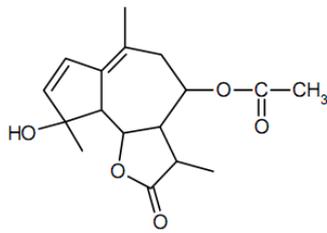
Guyane derivatives: guaiazulene, azulene, chamazulene

/ \



*Azulen*es - liquid, sometimes crystalline substances of blue, violet or green color. By themselves do not occur in nature, but are formed from proazulen

sesquiterpene lactone matricin) under the influence of hot steam during the distillation of essential oil from raw materials (formed chamazulene -blue oil).

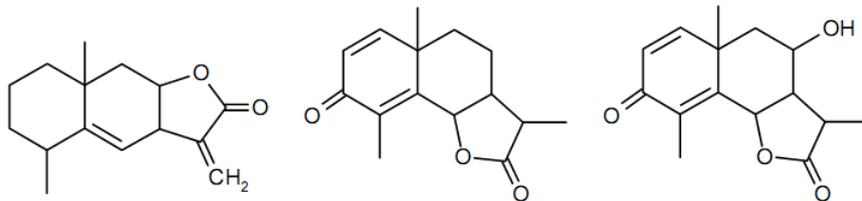


Матрицин

(s.-t. guanolide type lactone)

To increase the yield of azulene raw materials are treated with alkali, and then distilled in an acidic environment.

**Sesquiterpene lactones**- a separate group of sesquiterpenes with very high pharmacological activity. Common in plants genus. Aster, but are also found in others. genus. (magnolia, amaranth, yasnotkovy). The lactone cycle is placed in C6 - C7 or C7 -C8 positions. There are several types. The most interesting for us is the type of evdesman:



Allantolactone  $\alpha$ -santonin Artemisinin

(Oman high) (wormwood tsitvarny, (all types of wormwood)

wormwood santonin)

### Tricyclic sesquiterpenoids

In nature, they are rare. It is a compound with three condensed rings without ethylene bonds. They are found in the essential oil of eucalyptus (aromadendren drain), sandalwood, in the essential oil of marsh marsh (ice):



***LRS, the oil of which contains sesquiterpenoids***

***-mono and bicyclic:***

**Hop fruit - Strobili Lupuli (*Humulus lupulus*, Cannabaceae)**

Chemical composition: ethereal Fr. (0.3-1.8%) of 224 components, including humulene, myrcene, farnesene, caryophyllene, intoxicating to-you; coumarins, flavonoids, dub.r-ni, phenolic acids, vitamins.

Action and drugs: sedative, estrogenic, antibiotic, antispasmodic, choleric, diuretic, improves digestion (infusion, e.o., complex.6 Urolesan, valocordin, corvaldin, passive, sedative ..., treatment and prevention fees. №4, 5, soothing №2).

***Herba Bidentis cernuae (B.cernua, Asteraceae)***

Chemical composition: e.o. (cernuol, phenylheptatrin; geraniol);  $\gamma$ -lactones.

Action and drugs: antimicrobial, antimycotic (ointment "cerbiden")

***Birch buds; birch leaves - Gemmae Betulae; Folia Betulae (B.pendula, Betulaceae)***

Chemical composition: e.o. (3-8%): betulene, betulenol, caryophyllene; saponins, dub.r-ni, resins, vitamins C, PP, carotene, flavonoids.

Action and drugs: diuretic, choleric, reparative, anti-inflammatory, bactericidal (infusion, n-ka and com .: drops "Chernega", Phytolysin).

***Poplar buds - Gemmae Populi (P.nigra, Salicaceae)***

Chemical composition: e.o. (up to 0.5%): humulene,  $\alpha$ -caryophyllene, cineole; phenolglycosides, flavonoids, org.k-ti, vit. C, resins, fatty oils.

Action and drugs: diuretic, antiseptic, antimicrobial (infusion, n-ka, SP. Extract "Adenol forte").

***Rhizomes of azalea - Rhizomata Calami (Acorus calamus, Araceae)***

Chemical composition: e.o. (up to 5%):  $\alpha$ -pinene, camphene, borneol, eugenol, elemol,  $\beta$ -elements,  $\alpha$ -Kalama, akoron, acorenon; sesquiterpene bitter glycoside acorin; phenolic compounds, oaks, vit. WITH.

Action and drugs: litholytic, choleric, reparative, anti-inflammatory (comb.

***Rhizomata Zingiberis (Z.officinale, Zingiberaceae) Cult. in tropical countries, bat .: P-S. Asia, but in the wild is unknown.***

Chemical composition: e.o. resin (gingerol).

Action and drugs: stimulates appetite, wind-blowing, tonic - in cosmetology (powder, tincture, syrup, appetizing drops, stomach drops).

***-tricyclic:***

***Marsh marsh grass -Herba Ledi palustris (L.palustris; Ericaceae)***

Chemical composition: e.o. (up to 2%): ledol + palustrol = 50-60%,  $\beta$ -myrcene,  $\beta$ -pinene, camphene, geranyl acetate, n-cymol; diterpenes, triterpenes, phenolglycosides arbutin, flavonoids, oak. districts, coumarins. Accumulates radionuclides! Poisonous (Sp.B)!

Action and application: antitussive, expectorant, anti-inflammatory (ice; collection BRONCHOFIT).

**LRS, the oil of which contains sesquiterpene lactones:**

***Rhizomes and roots of ergot -Rhiz.et radices Inulae (I. helenium, Asteraceae)***

Chemical composition: e.o. (1-3%): allantolactone, isoallantolactone; fructans-inulin (up to 40%); resins, gums, saponins, org.k-ti.

Action and application: anti-inflammatory, antiulcer, adaptogenic, mucolytic (allanton -tab., Comb .: phyton SD, Pectosol, "Chernega").

***Chamomile flowers - Flores Chamomillae (Ch.recutita = Matt.rec. = M.xham., Aster.)***

Chemical composition: e.o. (0.2-0.8%): chamazulene (7%), farnesene, kadinen, bisabolol, myrcene; polysaccharides; flavonoids, phytosterols, coumarin, dub.r-ni, org.k-ti.

Action and application: anti-inflammatory, reparative, antimicrobial (extra. , fees: Elekasol, therapeutic and prophylactic. № 1, 3, ;; antidiabetic collection "Arfazetin")

***Wormwood herb - Herba Absinthii (Artemisia absinthium, Asteraceae)***

Chemical composition: e.o. (0.5-2%): absinthe, artabsin, tauremisin, thujone, cineole; flavonoids, alkaline, carotene, vitamin C, gr.V.

Action and application: appetizing, choleric (wormwood tincture, bitter tincture, combination: Polyfitol-1, gastric drops).

***Yarrow herb; yarrow flowers -Herba Millefolii; Flores Millefolii (Achillea millefolium, Asteraceae)***

Chemical composition: e.o. (up to 0.8%): monoterpenoid caryophyllene, thujone, borneol, camphor; sesquiterpene lactones: Achilles, Millefin, Matricarin; flavonoids, sterols, dub.r-ni, triterpene.alcohols, alkaline., vit.K.

Action and application: anti-inflammatory, regenerating, hepatoprotective, hemostatic (comb. -Rotokan, Wundehil. Fiton-SD, Fitulvent, LIV 52 (Livolek), tonsilgon H, vitastim, hemorrhoids, fees: cholagogues № 2, medical-pro 4.5, laxative №1, antihemorrhoidal).

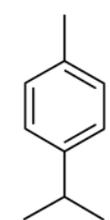
***Arnica flowers - Flores Arnicae (Arnica montana, Asteraceae)***

Chemical composition: e.o. (0.04-0.07%): gelenalin, arnifolin; flavonoids (up to 3%), triterpenoids (faradiol, arnicine 4%), carotenoids, dub.r-ni, inulin, mucus, org.k-ti.

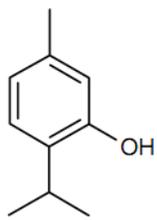
Action and application: hemostatic, bacteriostatic, cholagogue, resorbing (infusion, n-ka, ointment Arnica Dr. Theiss, comb .: Prostalad. Prostapol, Pumpan, Stomatophyte).

## Aromatic compounds

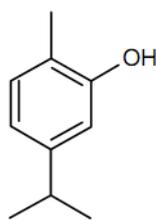
S. A.R. - these are natural compounds that can be attributed to isoprenoids on the basis of biosynthesis, although they have a phenolic structure. Volatile aromatic compounds that are part of essential oils include derivatives of n-cimen:



n-Цимен

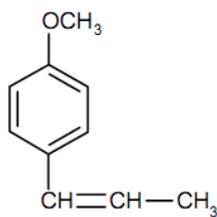


Тимол

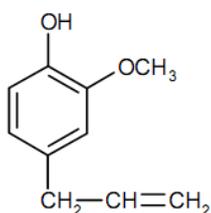


Карвакрол

Phenylpropane derivatives:



Анетол



Евгенол

(nail tree,

(anise, fennel) basil eugen., camellia eugen.)

***LRS, the oil of which contains aromatic compounds***

***- Derivatives of n-cymene:***

***Thyme herb (Creeping thyme) - Herba Serpylli (Th. Serpyllum, Lamiac.)***

Chemical composition: e.o. (Up to 1%): thymol, carvacrol, cymol, pinene, terpineol, borneol; flavonoids, oak. r-ni, gum, triterp. acids.

Action and application: expectorant, antispasmodic (pertusin, comb. Anitos, Altalex, Carmolis, Pinovit, pinosol, Pectosol, eucalyptus, septogal, septolette, bronchophyte, eucamon ...)

***Thyme herb -Herba Thymi vulgaris (Th.vulgaris, Lamiaceae)***

Chemical composition: e.o. (thymol 40%, carvacrol, p-cymol, caryophyllene, linalool, pinene, borneol; flavonoids, triterpene acids, phenolic acids.

Action and application: expectorant, reparative, choleric, analgesic, distracting, antimicrobial, anti-inflammatory. (Pertusin, comb .: Fitulvent, eukamon, pinosol, Pinovit, Kolkhaminova ointment, etc.).

### ***Oregano - Herba Origani (Origanum vulgare, Lamiaceae)***

Chemical composition: ef.o. (up to 1%): thymol, carvacrol, sesquiterpenes, monoterpenoid (geranyl acetate); flavonoids, dub.r-ni, phenolic acids, vit.S

Action and application: litholytic, antispasmodic, choleric, diuretic, anti-inflammatory (comp. Urolesan, bronchovitol, Gastrovitol, Fiton-SD, Dikrasin-1, chest collection № 1.

### ***-derivatives of phenylpropane:***

### ***Fruits of common anise - Fructus Anisi vulgaris (A.vulgare = Pimpinella anisum, Apiaceae)***

Chemical composition: e.o. (1.2-6%): anethole-80-90%, aniseed aldehyde, aniseed acid, agnisone ketone, fatty oil, proteins, furocoumarins.

Action and application: expectorant, mucolytic, anti-inflammatory (anise oil, capsules with an. Oil of Dr. Theiss, ammonia-anise drops, etc .: Carmolis, breast elixir, bronchiflux, Traskova potion, cough medicine for children dry, phyton SD, Anita wasp, Altalex, BRONCHOFIT)

### ***Fennel fruits - Fructus Foeniculi (Foeniculum vulgare, Apiaceae)***

Chemical composition: e.o. (4-6%): anethole -60%, fennel, pinene, anise aldehyde and acid; fat oil, proteins. districts, coumarin, flavonoids.

Action and application: wind-blowing, antispasmodic, expectorant (dill water - on 1000 h. Of water - 1 tsp. Of fennel, plantesk granules, comb .: phyton-SD, Traskov's mix, Altalex, solutan, bronchiflux tea)

***Fruits of Anise stellati (Illicium verum, Magnoliac.)*** Southeast Asia (star anise-8 single-seeded postcards)

Chem. warehouse: e.o. (4-5%) from almost one anethole.

Action and application: expectorant - at the level of Sq. anise called

***Buttons (number) Nails. tree-Alabastra (Fl.) Caryophylli (Eugenia caryophyllata, Myrtaceae) - cult. In Africa. Brazil, Jamaica. Rod.-Moluccas***

Chemical composition: e.o. (up to 20%) - 75-80% eugenol, acetyeugenol, caryophyllene. Oil is heavier than water! Oak. districts (2%).

Action and application: promotes digestion, and as an antiseptic - in dentistry.

***Cinnamon bark - Cortex Cinnamomi zeylanici (Cinnamomum zeylanicum, Laurac.) -Ceylon Cinnamon (there is a Chinese -dr.from) - in the wild no.***

Chem. warehouse: e.o. (1-2%) - almost entirely of cinnamon aldehyde; oak. districts, catechins.

Action and application: excitation. activity of digestive organs, antiseptic, corrective; alcohol. extract - suppresses tuberculosis and viruses (Chinese honey)