MINISTRY OF HEALTHCARE

OF THE REPUBLIC OF UZBEKISTAN

THE TASHKENT PHARMACEUTICAL INSTITUTE

THE CHAIR OF PHARMACOGNOSY

METHODICAL MANUAL

for the 3rd year students of Pharmacy and Industrial pharmacy for conducting laboratory lessons on the pharmacognosy course

REMEDY PLANTS AND RAW MATERIALS CONTAINING ESSENTIAL OIL AND IRIDOIDS (BITTER GLYCOSIDES)"

Sphere of knowledge: 500 000 – Healthcare and social provision
Sphere of education: 510 000 – Healthcare
Branches of education: 5510 500 – Pharmacy
5510600 – Industrial pharmacy

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Total academic hour	- 364 (Pharmacy) 264 Industrial pharmacy
Lectures	- 72 (Pharmacy)/ 54 (Industrial pharmacy)
Laboratory lessons	- 144(Pharmacy)/ 126(Industrial pharmacy)
Self – study	- 148 (Pharmacy) / 84 (Industrial pharmacy)

Methodical manual was discussed and approved at the meeting of CMC of the Institute (record № ___from "___"_____ 2017.)

Vice – rector on Educational affairs: S.U. Aliev

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Scientific Secretary, V. R. Khaydarov
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REMEDY PLANTS AND RAW MATERIALS CONTAINING ESSENTIAL OIL

Aim of the lesson. Highly qualified employees working in the pharmacy branches must know the process of harvesting, drying, storing and analyzing raw materials of remedy plant containing essential oils. For this, the students must consolidate practical skills in the morphological description of the plant, to establish the verification, adequate quality and cleanness of remedy plant`s material.

Terpenoids include natural physiologically active compounds, which structure is based on the isoprene molecule - C_5H_8.

In this large class of compounds are distinguished:

• monoterpenes - $C_{10}H_{16}$ (essential oils)

• sesquiterpenes - $C_{15}H_{24}$ (essential oils, bitter glycosides)

• diterpenes - $C_{20}H_{32}$ (resins, chlorophyll, vitamins of the K group, etc.)

• triterpenes - $C_{30}H_{38}$ (plant sterols, glycosides with triterpene aglycons)

• tetraterpenes - $C_{40}H_{34}$ (carotenoids, vitamin A)

• polyterpenes - $(C_{10}H_{16})$ n (rubber, gutta-percha).

The therapeutic activity of raw materials containing essential oils is associated with the presence in the composition of essential oils of compounds in the different chemical nature, more often quantitatively predominant.

The raw materials containing essential oils are characterized by the content of aromatic phenols (anethole, thymol, etc.) of sesquiterpenes, alcohols, etc.

Essential oils are widely distributed in nature. They accumulate more than 2,5 thousand higher plants. Lichens and ferns do not synthesize essential oils. The essential oils of the plants of the families Lamiaceae, Apiaceae, Asteraceae, Rosaceae are rich in essential oils.

Essential oils are localized in different parts of the plant in special exogenous and endogenous formations. Exogenous formations develop from the epidermal tissue. These include glandular "spots", glandular hairs and essential oil glands. Endogenous formations develop in the parenchyma tissues. These are secretory

cells, receptacles (schizogenous, lysogenic and schizolizogenous), secretory tubules and passages.

Essential oils are clear, colorless or slightly yellowish liquids with a pleasant characteristic odor and a spicy, burning taste. Some have a blue color, caused by the presence of azulene (chamomile oil, milfoil, wormwood, etc.). There are greenish (bergamot), red (caraway), red-brown (cinnamon) oils. The density of the oils lies in the range from 0.700 g / cm^3 to 1.060 g / cm^3. Their reaction is usually neutral or acidic. Most of them are optically active.

Essential oils are distilled with water vapor. As complex mixtures, they do not have a certain boiling point. By distillation at different temperatures, they can be fractionated: monoteronoids constitute a low-boiling fraction, and sesquiterenoids are high boiling. When cooling certain essential oils, a crystalline precipitate (mint, anise, camphor) precipitates.

Essential oils are highly soluble in alcohol, petroleum ether, chloroform, carbon disulfide, fats. They do not dissolve in water, but they give her the smell (fragrant waters). On paper, do not leave greasy stains, unlike fatty oils.

Raw materials containing essential oils are widely used in medical practice since ancient times with various cardiovascular, nervous, gastrointestinal diseases, as well as antimicrobial and other means.

In medicine, raw materials are used that contain essential oils in the form of infusions, dues, tinctures, as well as essential oils, sometimes isolated from them components - stereoptens.

Therefore, the study of raw materials containing essential oils, and essential oils is necessary for the practical activities of the pharmacist.

There are 3 laboratory classes for 4 hours on the topic.

Technological card of laboratory activity

Theme	**Medicinal plants and raw materials containing essential oils**
Aim and tasks	To master medicinal plants and raw materials containing essential oils. Teach students to work independently and make accurate conclusions.
The content of the learning process	The formation of students' ability to consolidate practical skills in the morphological description of plants, to establish the authenticity, good quality and purity, as well as the use,

	medicinal preparations and methods of chemical analysis of medicinal raw materials.
Technology for conducting the educational process	Methods - "Brainstorming", "Conversation", "Explanation", "Boomerang", "Turntable" The form is a laboratory activity, in groups and separately Equipment - tables, handouts, herbarium and raw materials of medicinal plants, slides, microscopes, chemical reagents and devices Control - written and oral questioning, observation, self-control Rating - promotion, according to the 100th rating system
Expected results	Full learning materials and formation of knowledge on the topic, ability to work on new technologies Teacher: to assimilate and introduce into the educational process new pedagogical information technologies, to work on themselves. Student should: 1) learn how to work independently. Defend his\her point of view; 2) find additional literature on this topic, work with it, analyzing your opinion and the opinions of the group, make a decision, develop your knowledge and skills.
Future plans (analysis, changes)	Work with literary sources; ability to work on modern technologies.

Structure and timing of laboratory activity

1. Identification of the baseline - 30 min
2. Correction of the initial level - 10 min
3. Self- study of students - 100 min
4. Results of work performed and control

   registration of students' minutes - during the lesson
5. Final control and discussion results - 15 min
6. Homework for the next laboratory activity - 5 min

I- LABORATORY ACTIVITY

Questions for self-study

1. General conception and classification of terpenoids and essential oils.

2. Physical and chemical properties of essential oils. Localization of essential oils. The role of domestic scientists in the study of essential oils.

3. Methods of obtaining essential oils and quantifying them in plant organs.

4. Chemistry and the determination of aldehydes and ketones, as well as phenols in essential oils.

5. Organoleptic analysis of essential oils.

6. Morphological and anatomical diagnostic features of the family of Lamiaceae, Astroids.

7. Quantitative determination of essential oils according to SPh - XI.

8. Name of plant, raw material and family of coriander. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.

9. The name of the plant, raw materials and a family of mint. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms

10. Name of plant, raw materials and family of sage (salvia). Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms

11. Name of plant, raw material and family of eucalyptus. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms

12. Name of plant, raw material and family of chamomile species. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms

13. Name of plant, raw materials and family of hops. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.

I - LABORATORY ACTIVITY

1. Analysis of raw materials containing essential oils

Character of the work:

A) Determination of phenols, aldehydes and ketones;

B) Organoleptic analysis of essential oils;

C) Determination of the quantitative content of essential oils in plant raw materials according to SPh- XI.

2. Study objects: peppermint, chamomile and green, sage, eucalyptus, coriander, hops.

Character of the work:

A) Morphological study of plants and the appearance of raw materials;

B) Microscopic examination of mint leaves.

ANALYSIS METHODS OF MEDICINAL RAW MATERIAL`S CONTAINING ESSENTIAL OILS

Quantitative determination of essential oils by SPh-XI

The apparatus is suspended on a thin wire to the tube of a vertical refrigerator in such a way that its bent end touches the funnel`s wall and its upper part. Using a good cork plug, the refrigerator with a device hanging to it is connected to an Erlenmeyer flask with a capacity of 1 liter. It is very important that the plug closes tightly the throat of the bulb, and the device does not come in contact with the walls of the bulb.

The apparatus is filled with water. In a flask of Erlenmeyer, 10-20 g of the raw material are placed and 250-300 ml of water is poured. The flask is connected to a refrigerator, installed on an electric oven with an asbestos mesh and heated to a boil. Essential oil, carried away by water vapor, after cooling in the refrigerator is collected in a graduated tube, floating in it over the water, and the excess of the latter leaves through the side tube back into the flask, giving off the dissolved oil to the steam.

Distillation continues until the level of essential oil in the Ginsberg device does not increase. After cooling, the volume of oil is determined. When recalculating on a sample, a volumetric percentage of the essential oil content is obtained in the raw material. To convert into a weight percentage, the resulting volume of oil is multiplied by its density.

$$X = \frac{v.d.100.100}{M(100-W)};$$

V - is the volume of essential oil (ml), d - is the density of the essential oil, M - is the sample (g), and W - is the moisture (%) of the raw material.

Analysis of essential oils

The aim of the study of essential oils:

1. Establish the identity of the testing essential oil.

2. Determine the good quality (to detect the presence of products of chemical changes in the constituent parts of essential oils: oxidation, resinification, etc.), as well as valuable constituents.

3. To detect the presence of oil impurities from other parts of the plant (for example, oil from the leaves may be mixed with oil) or the admixture of other essential oils and in general the presence of impurities of other substances (falsifiers).

Performing the above tasks use the organoleptic, physical and chemical methods of analysis.

Organoleptic analysis of essential oils

Determine the external characteristics of essential oils, that is, appearance, color, transparency, brews and taste, solubility, and physical constants.

External signs of essential oils are very important for the characteristics, to determine their good quality.

The color and transparency are determined by placing the testing oil in a cylinder of clear, colorless glass (diameter 2-3 cm, capacity 10 ml) and observing the transmitted light.

In most cases essential oil is colorless or only slightly colored in greenish or yellow. They must be transparent. Turbidity may depend on mechanical impurities, isolation of stearoptenes, and presence of moisture.

The odor is determined organoleptically as follows: 0.1 ml (2 drops) of oil is applied to a strip of filter paper 12 cm long and 5 cm wide so that the oil does not wet the edges of the paper and compare the smell of the testing sample every 15 minutes with the control sample, applied in the same way to the filter paper. Within an hour, the smell should be the same with the smell of the control sample (due to the evaporation of individual constituents of the essential oil on the paper, its smell gradually changes)

Essential oils should have the smell of those plants from which they are derived.

The taste is determined by applying a strip of paper to the tongue with a drop of oil applied to it, or mixing one drop of essential oil with 1g of sugar powder and try it on the tongue.

Determination of aldehydes and ketones

1. **Bisulfite method.** To determine the amount of aldehydes, most often a bisulfite method is used, because aldehydes readily form compounds with sodium bisulfite, soluble in a hot concentrated solution.

For determination, a special measuring flask is used, the so-called cassia flask.

Technology of determination. 10 ml of a 30% $NaHSO_3$ solution are poured into 10 ml of essential oil in a flask, shaken and heated in a water bath until the mixture is liquefied. After that add another solution to 3/4 of the flask, without stopping the heating and frequent shaking until the liquid is clarified, the solids in it disappear, the transparent oil layer is formed and the smell of aldehyde disappears. Then add a solution of bisulphite, so that the entire layer of oil is in the neck of zero division (on the walls of the bulb it should not be). After cooling, the volume of oil remaining after the separation of aldehydes from it is determined, and the volume percentage of aldehydes is recognized in the oil by difference.

The content of aldehydes and ketones is calculated by the formula:

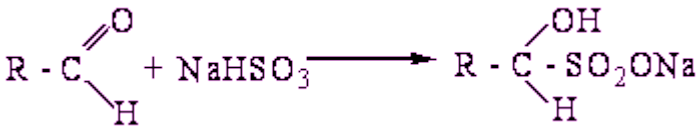
aldehydes % = (10 - a) • 100, where

A - the amount of oil remaining in the flask after the reaction

2. The sulfite method. Many aldehydes and ketones - carvone, pulegon and others can be quantified using sodium sulfite (Na2SO3). The method is based on the fact that the sodium sulfite in water is hydrolyzed to form bisulphite:

$$Na_2SO_3 + H_2O \; NaHSO_3 + NaOH$$

The bisulfite is combined with an aldehyde or ketone:



$NaOH + CH_3COOH\ CH_3COONa + H_2O$

During the reaction the formed NaOH must be neutralized in order to avoid a reversible reaction.

Technology of determination. In a 200-500 ml cassette flask with 5 ml of essential oil, 150 ml of 20% Na_2SO_3 solution, 10 drops of 1% phenolphthalein solution are added and heated in a water bath with stirring. As the pink coloration appears, 3% acetic acid is gradually added drop wise until the color stops to turn after heating for half an hour. Then cool, add water and completely transfer the remaining oil after the reaction to the graduated neck of the flask, where its volume determines it. The reaction lasts 6-8 hours.

The content of aldehydes and ketones is calculated by the formula:

aldehydes % = (5 - a) • 100, where

a - the amount of oil remaining in the flask after the reaction

Determination of phenols

Technology of determination. To 5 ml of the essential oil in a 200-250 ml cassia flask, 150 ml of a 5% solution of NaOH is poured, shaken for 15 minutes, then left until the oily layer is completely separated on the surface of the aqueous solution. If drops of oil adhere to the walls of the vessel in the water layer, they must be separated by tapping on the walls or rotating the vessel and attached to the top layer. After settling the remaining oil in the graduated neck, add 5% solution of sodium hydroxide solution. The temperature of the oil when entering the flask and when counting in the flask should be the same. After an hour, the volume of unreacted part of the oil is counted.

The content of phenols is calculated by the formula:

Phenols % = (5 - a) • 100, where

a - the amount of oil remaining in the flask after the reaction

REMEDY PLANTS AND RAW MATERIALS CONTAINING ESSENTIAL OIL

Acyclic monoterpenoids

Fruits and Coriander oil - Fructus et oleum Coriandri

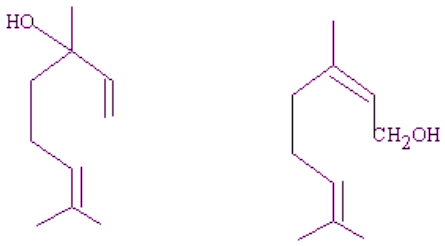
Name of the plant. Coriander seed - Coriandrum sativum L. Family. Celery - Apiaceae

Annual herbaceous plant, height 30-70 cm. Stem is rounded, thinly furrowed, bare. Leaves radical on long petioles, vaginal, three or less often five-parted, with large denticles along the edge, shiny, middle and upper leaves 2-3, pinnately divided with linear acute lobules. Inflorescence - a complex umbrella, unlike other umbelliferous bears only 3-5 rays. Umbrellas with 5-13 flowers wrappers with 3 threadlike leaves directed to one side. The calyx remains with fruits with 5 teeth: 2 external teeth considerably longer than 3 internal teeth. Corolla pink, the marginal flowers outside have larger petals, stamens - 5, alternating with petals, pestle with lower two-cavity ovary. Fruit - globose double-caryopsis, grayish-yellow, consist of two halves - semisolid.

Appearance of raw materials. Spherical double-caryopsis of grayish-yellow color - consist of two halves - on each half of the fetus from the convex side there are 5 sinuous main ribs and 6 direct adnexal ones, of which 4 medium strongly protrude, 2 marginal not noticeable. At the top of the fruit, in addition to the remains of the calyx, there are two closely interlocked columns, the apices of which diverge in different directions. Taste and smell peculiar.

Chemical composition. The fruits contain 0.5-1.7% of essential oil, up to 20% of the non-drying fatty oil and up to 17% of protein substances. Essential oil of unripe fruits of unpleasant odor, which is due to the content in it of decyl and decylenic aldehydes.

There is appears acyclic alcohol from the class of monoterpenes - dextrorotatory linalool (60-80%) in the ripe fruits` oil. there are also 5% geraniol, various aldehydes and other terpenes in the oil.



Linalool Heraniol

Application and medicinal forms. Fruits are used as improving appetite and digestion, as a cholagogue. Fruits are a part of antihemorrhoids and cholagogue collections. From the fruits receive fragrant water - Aqua Coriandri spirituosi, which is used for the aromatization of certain galenic preparations.
Essential oil is obtained by distillation with water vapor. It is widely used in perfumery when getting cologne. Essential oil serves to obtain citral, which is a part of eye drops for the treatment of conjunctivitis.

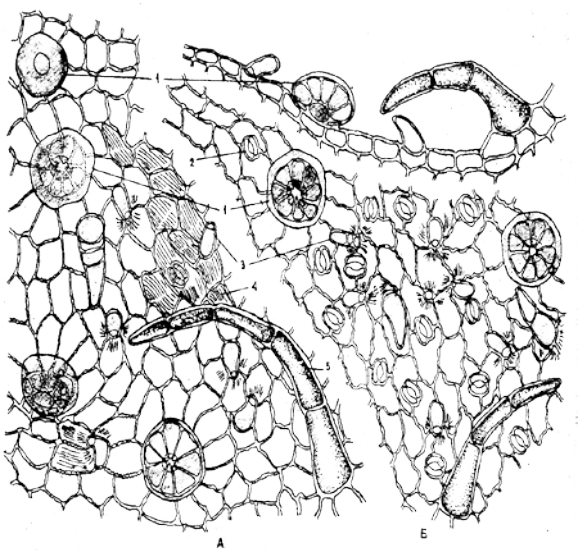
Monocyclic monoterpenoids

Leaves and peppermint oil - Folia et oleum Menthae piperitae

Name of the plant. Peppermint - Mentha piperita L. family. Lamiaceae

When studying a plant, it is necessary to pay attention to the main diagnostic morphological features of the plant. Perennial herbaceous plant, the stem is tetrahedral, leaves are located opposite, short-petioled, oblong-ovate, pointed, irregularly serrate along the margin. Secondary veins emerge from the main vein at an acute angle, anatomized with each other by archs, parallel edges. Flowers small, red-violet, located verticillaster, form spicate inflorescences. The structure of the flower is four-dimensional. Fruits are nuts.
Appearance of raw materials. Leaves are short petiolate, lanceolate or oblong-ovate, apically pointed at apex. Edge of leaf is serrate, denticles of uneven size, large alternating with small ones. Secondary veins emerge from the middle main line at an acute angle; anastomose with each other by arcs, parallel edges. From these arcs to each tooth a vascular bundle, terminating in it. The surface of the leaf is bare, only along the veins are the hairs, which are unseen by the simple eye.
Shiny yellow glands are visible in the magnifying glass. The length of the leaf is up to 8 cm, the widtt is up to 3 cm, the color from the top is dark green, the bottom is slightly lighter. The smell is strong and pleasant. The taste is burning, spicy, causing a prolonged sense of coldness in the tongue and mouth.

Microscopy. Surface preparation in alkali solution.



A - Epidermis of the top leaf;

B - Epidermis of the lower leaf.

1 - Essential oil glands;

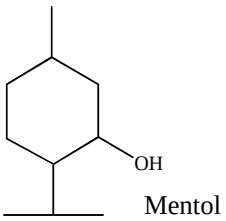
2 - Stomata;

3 - Capitate hair;

4 - Cuticle;

5 - A simple hair.

Chemical composition. Contains essential oil 0.5-2.5%. According to SPh XI, the essential oil content should not be less than 1%. The main component of essential oil is menthol, the content of which in oil is not less than 50%.



Mentol

Mint oil is an easily agile liquid, colorless or colored to slightly yellowish color, with a characteristic mint smell and a burning cold taste without bitter glycosides, it is easily soluble in 95% spirit.

Application and medicinal forms. A leaf of mint is used in the form of infusion and in collections as a gastrointestinal agent for spasms in the intestines and with nausea. The leaf is a part of soothing, carminative, gastric, cholagogue.

Mint oil is used in the form of Aqua Menthae. It is a part of toothpastes and powders.

Menthol is a part of migraine pencils from headache, in drops and ointments from the common cold. Validolum is used in the stenocardia (menthol in isovaleric-menthol ether). Menthol is a part of inhaphene.

Mint oil is used in the food and confectionery industry.

Sage leaves - Folia Salviae

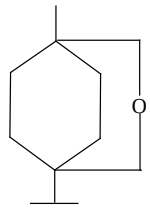
Name of the plant. Salvia officinalis L. – family - Lamiaceae

When studying morphology, we must pay attention to the fact that this plant is a semi-shrub, the stem is tetrahedral, the leaves are opposite, elongated or broadly lanceolate with blunt apex, often at the base with one or two deeply incised

lobes. Edge of leaf small-grained. Flowers are collected on 4-8 in false whorls, forming loose spicate inflorescences. Fruits are nuts.

Appearance of the raw materials. Leaves are long petiolate, oblong or elongate-lanceolate with blunt apex, at the base rounded or slightly cordate, rarely with one or two deeply cut blades. Edge of leaf blade small-grained. Leaves on both sides are strongly pubescent, especially on the underside, following which the leaf color is gray-green. The surface of the leaf is uniformly fine-meshed due to the dense web of veins of the third and fourth order, strongly impressed from above and protruding from below. The length of the leaf is 6-10 cm, width 1.5-2.5 cm. The smell is strong, peculiar, especially when grated, the taste is bitterish-spicy, astringent.

Chemical composition. It contains essential oil 0.5-2.5%, where about 15% of cineol. According to SPH, the essential oil content in the leaves should be at least 1%.



Cineol

Application and medicinal forms. A leaf of Sage is used as a disinfectant and astringent for gargling. Included in the collection composition.

Leaves and eucalyptus oil - Folia et oleum Eucalypti

Name of the plant. Flintwood - Eucalyptus globulus Labill.
Eucalyptus ash - Eucalyptus cinerea F. et Mill.
Eucalyptus roinca - Eucalyptus viminalis
Family. Myrtaceae

Evergreen fast-growing tree in height 60-70m, with a powerful root system and a smooth bluish crust. Young branches are tetrahedral, ribbed, covered with a wax coating. Leaves opposite, soft, covered with a layer of wax, sessile, ovoid. On branches that are more adult the leaves are narrow-lanceolate, petiolate, sickle-shaped. The flowers are large, with the sycophysis of the stamens. Fruit is a rectangular box with small seeds.

Appearance of the raw materials.
Leaves of Flintwood - a mixture of two types of leaves:

1) the leaves of the old branches are petiolate, elongate-lanceolate, less lanceolate, mostly sickle-bent, thick, leathery, gray-green in color, 10-30 cm long, 3-4 cm wide;

2) the leaves of young branches are without petiolate or with short petioles, ovate or elongate-ovate; at the base with a heart-like groove, pointed, thin, dense, gray-green in color with a bluish tinge, 6-16 cm long, 1-9 cm wide at the apex.

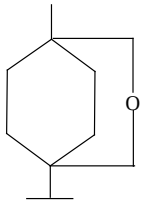
Leaves of eucalyptus ash – (Eucalyptus cinerea F. et Mill.) a mixture of two types of leaves:

1) the leaves of the old branches are petiolate, elongate-ovate 5-13 cm long, 1-5 cm wide, at the base of gray-green color;

2) the leaves of young branches are sessile, rounded ovate, rounded on top 1,5-8cm, 1-7cm wide. The color of the leaves is gray-green with a blue tinge.

All leaves of both species are entire, glabrous, numerous translucent points are visible (containers with essential oil). The smell is strong aromatic, the taste is spicy-bitter.

Chemical composition. The leaves contain an essential oil of 1.5-3%. According to SPh XI, the content of essential oil in whole raw materials is not less than 2.5%, in the raw material not less than 1.5%. In essential oil contains 60-80% of cineol.



Cineol

Eucalyptus oil is an easily agile liquid, colorless or slightly colored in a yellowish color, with a characteristic odor of cineol.

Application and medicinal forms. Infusion of eucalyptus leaves is used for washing wounds and ulcers, with pustular skin diseases, for rinsing the throat with scarlet fever, diphtheria, angina and in the form of lotions in the ophthalmic practice, with pleurisy. Tincture is used for fever, bronchitis, flu and cough.

Essential oil is used internally for diseases of the respiratory tract. It is a part of inhaphene. They are mixed with water in a mixture with water. Eucalyptol, as well as eucalyptus oil serve as a protective against mosquitoes and mosquitoes.

Sesquiterpenes

Chamomile flowers - Flores Chamomillae

Name of the plant. Chamomile common - Matricaria recutita L.
Chamomile odorous (eligulate) - Chamomilla suaveolens Porter. (Matricaria matriacarioides)
Family. Asteraceae

Horse gowan (Matricaria chamomilla) - an annual herbaceous plant up to 50 cm high with a branchy bare stalk and alternate leaves. The plant is odorous. Leaves are bipinnatisect divided into linear segments. Inflorescence - flower anthodium, sitting alone on long peduncles on the tops of branches and consisting of white semiflosculous and yellow tubular flowers. Flowers white semiflosculous with 3 denticles and 4 veins, located along the edge of the anthodium in the number 18 and numerous internal flowers Bisexual with a five-toothed corolla. Flowers sit on the peduncle, which at the end of flowering becomes conical, naked, inside hollow, pitted, ovary inferior. Fruit is the seed.

Chamomile eligulate - differs bored branches and anthodium, sitting on very short peduncles, which hide in the leaves. Tubular flowers are greenish with a four-toothed corolla there are no eligulate flowers.

Appearance of raw materials. Flower anthodiums are hemispherical or conical in shape, without peduncles, it is not longer than 3 cm. Each anthodium has 12-18 edge white flowers and numerous middle yellow tubular flowers. Dried anthodiums usually 4-8 mm in diameter (without eligulate flowers). The wrapper of the anthodium is imbricated, multi-range (2-3 ranges), and its leaves oblong-ovate, obtuse, with a wide filmy margin, yellowish-green. The floral receptacle is naked, finely corrugated, hollow, and its blossoming anthodiums are hemispherical and extend to a narrow-conical by the end of flowering. Semiflosculous flowers pistillate, prostrate with three denticles at the end of the corolla and four veins, bent downward towards the blossom. Due to light scattering, most of the dried anthodiums contain an incomplete number of semiflosculous flowers. Tubular flowers are bisexual, with a five-toothed whisk, all flowers with a lower naked ovary, without a tuft. The smell is strong, fragrant; the taste is spicy, odorous, rather bitter.

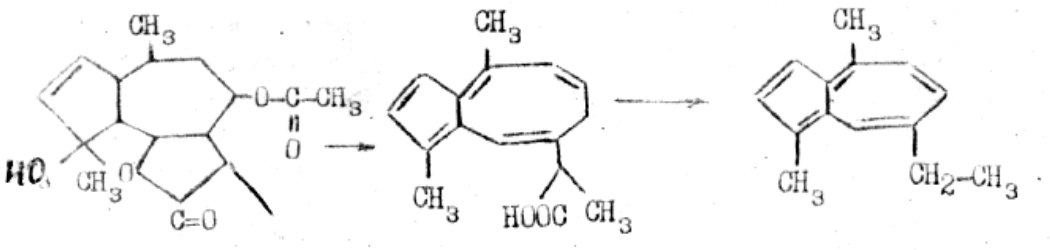
Possible impurities:

1) Matricaria inodora L. – Mayweed - anthodiums large to 12 cm, flower-bearing, dense, solid, raw material is without odor;

2) Anthemis cotula L. – Maise - the size, shape and color of the anthodiums does not differ from the chamomile officinalis, the flower receptacle on top is covered with narrow setiform glumes, dense, the odor is unpleasant;
3) Pyrethrum parthenium (L) Sm. - in size anthodiums do not differ, cucumber convex, pale, raw with a faint smell;
4) Anthemis arvensis L. - the anthodiums are slightly larger, the conifers are conical, pale, seated with spiny glumes, odorless.

Chemical composition. It contains essential oil 0.2-0.8% blue color. A specific component of the oil is chamazulene.

It is established that chamazulene is formed from the matrix contained in flower-bearing guanalide anthodiums, which must be considered as prochamazulene.



Matricin chamazulene carboxylic acid chamazulene

Flower anthodiums of chamomile also contains some flavonoids (apiin, quercimeritrin), coumarins (umbelliferone), triterpenic alcohols, etc.

Application and medicinal forms. Essential oil has a disinfectant and anti-inflammatory property, allay the pain and normalizing the functions of the gastrointestinal tract. Chamazulen and matrices also weaken allergic reactions.

It is used in the form of infusions with spasms of the intestine, flatulence, diarrhea, menstruation disorders, as a diaphoretic, and externally for rinsing the mouth, wounds, baths and enemas too. Chamomile is a part of gastric and softening gathers.

ASSESSMENT OF STUDENTS` KNOWLEDGE

Determine level of training for tasks and the assimilate of the theme in various stages of laboratory activity of students during a written and oral questioning, as well as other methods of pedagogical technology ("Conversation", "Boomerang", "Turntable" "Brainstorming").

Training "Boomerang"

Students are divided into groups and for each group is given its own task on the topic of the lesson. Each group of 3 to 4 students expresses their opinion and make discussions between the groups in the form of questions and answers.

Task for the first group

1. Diagnostic signs of the family of the Lamiaceae.
2. Appearance of raw coriander.
3. Microscopy of peppermint.

Task for the second group

1 The morphology of eucalyptus.
2. Chemical composition of chamomile officinalis.
3 Application of raw sage officinalis.

Task for the III group

1. Morphology of hops.
2. Appearance of raw eucalyptus.
3. Diagnostic signs of the celery family (Apium).

Task for the IV group

1. Morphology of the coriander.
2. Chemical composition of hop`s raw materials.
3. The use of raw mint.

Training "Turntable" (1st LABORATORY ACTIVITY)

In this, training students are divided into 3 - 5 groups, for each group is given the same table. Students fill it themselves, then 3 - 5 times the table goes to other groups in a circle, again the students express their opinion, at the end with the help of the teacher, the material presented in the table is summarized, the correct answers are found during the discussion.

Determine a family of plant data

№	Family of a plant / Plant`s name	Lamium	Celeriac (Apium)	Myrtaceae	Asteraceae	Mulberry
1.	Coriander					
2.	Eucalyptus					
3.	Chamomile					
4.	Hops					
5.	Mint					
6.	Sage					

Determine the raw materials of plants

№	Raw material`s name / Plant`s name	fruit	herb	leaves	cones	flowers
1.	Coriander					
2.	Eucalyptus					
3.	Chamomile					
4.	Hops					
5.	Mint					
6.	Sage					

Situational tasks:

1. Herbaceous plant, stem tetrahedral, leaves oblong-ovate or lanceolate, opposite. Flowers simple, five-dimensional, sometimes four-dimensional, inflorescence verticillasters. Fruit is nuts.

2. Herbaceous plant, stalk cylindrical, leaves pinnately divided, regular. Inflorescence of the anthodium, semiflosculous and tubular. Fruit is an achene with an aigrette.

Indicate for which family the above morphological features are characteristic. Name the medicinal plants belonging to this family.

The student must know the morphological and diagnostic features of the herbaria, as well as the microscopic structure of raw materials containing essential oils.

3. Explain the methods of obtaining essential oils.

4. Explain the methods of analysis of medicinal plants containing essential oils.

II - LABORATORY ACTIVITY

1. Analysis of raw materials containing essential oils

Character of the work:

A) Determination of solubility;

B) Determination of the rotation angle;

C) Determination of the number of refraction;

D) Determination of the quantitative content of essential oils in plant raw materials according to SPh.

2. Study of objects: Valerian officinalis, milfoil, wormwood, juniper, pine, inula, marsh calamus, birch.

Character of work:

A) Study the morphology of plants and the appearance of raw materials;

B) Microscopic examination of the root of valerian, herb of milfoil and common wormwood.

Questions for self-study

1. Physical constants of essential oils and their value.
2. Quantitative determination of essential oils according to SPh - XI.
3. The name of the plant, raw materials and family of pine. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.
4. The name of the plant, raw materials and the juniper family. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.
5. The name of the plant, raw materials and family of wormwood bitter. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms.
6. The name of the plant, raw materials and the family of inula. Morphological description of the plant and the appearance of raw materials. Distribution,

collection and drying. Chemical composition. Application in medicine and medicinal forms.

7. The name of the plant, raw materials and milfoil family. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms.

8. The name of the plant, raw materials and family of flagroot (Acorus calamus). Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.

9. Name of plant, raw material and family of valerian. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms.

10. Name of plant, raw material and family of birch. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.

ANALYSIS METHODS OF MEDICINAL RAW MATERIAL`S CONTAINING ESSENTIAL OILS

Physical constants of essential oils

Physical methods of analysis are aimed at establishing physical constants:

A) Density (pyknometer);

B) Angle of rotation of polarization plane (polarimeter);

C) Refractive index (refractometer);

D) Pour point;

E) Boiling point;

F) Solubility.

The density of essential oils depends most simply on their composition and usually varies for different oils from 0.83 to 1.1. The magnitude of the density can give an idea of the predominance of any of the groups of compounds found in essential oils. The density below 0.9 indicates a significant content of terpenes or fatty compounds in the oil, and the like.

Impurities can change the value of density of essential oils. For example, turpentine and alcohol reduce the density. Products essential oils resinification, formed with prolonged storage of oil, increase its density.

The density of the essential oils is determined by a pyknometer at 20 ° C and is calculated by the formula:

$$d = \frac{20^0}{20} = \frac{P_2 - P}{P_1 - P} = \frac{oil\ weight}{water\ weight}$$

The angle of rotation of polarization plane is determined by means of the field meter and is determined by the formula:

$$[\alpha]_{Д}^{20} = \frac{\alpha}{1 \cdot d}$$

Where, α - is the change in the rotation angle in degrees, 1 is the thickness of the liquid layer in decimeters, *d* - is the density of the liquid.

Refractive index of light. The value of the value of ηe of essential oils helps determine the good quality and determine the presence of impurities. The products of resinification, formed with prolonged storage of essential oils, increase refraction.

Determination of solubility. Essential oils are soluble in many organic solvents, for example, in chloroform, petroleum in ethyl esters, benzene, ethyl alcohol and others.

Great value is the determination of the solubility of ester in the alcohol concentrations of 70-80-90 °. In this case, in the essential oil, it is possible to detect the presence of insoluble in 70-80 ° alcohol impurities (fatty and mineral oils, turpentine).

Determination technique. . In a graduated glass cylinder with a capacity of 15 ml, pipette 1 ml of oil and gradually add 0.1% alcohol from the burette to the specified concentration (or other solvent) with agitation until the oil dissolves completely (until the turbidity disappears). The experiment is conducted at 20 °. The volume ratios found in this way can be listed as weighted by multiplying the amounts of milliliters of oil and alcohol by their density.

MEDICINAL PLANTS AND RAW MATERIALS CONTAINING ESSENTIAL OILS

Monocyclic terpenoids

Fruit of juniper (juniper berries)

Fructus Juniperi (Baccae Juniperi)

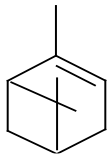
Name of the plant. **Juniperus vulgaris - Juniperus communis L.**

Family. Cypress – Cupressaceae

An evergreen diecious shrub up to 3 m in height, the bark is grayish or reddish-brown, peeling, the branches are pressed or lagging. Needles are spiny, with whorls of three needles in each whorl. Needles are linear, sharp, with a trough gilled with a white stripe, from below glistening. antherous and seed cones sit on different individuals. Spikelets male (cones) almost sessile, yellow, roundish-oblong up to 4 mm long, in the lower part with 2-3 whorled-bracts and at the top with 3-4 whorls of stamens. Female cones are numerous so they sit alone in axils of whorls on very short legs, oblong-ovate. They consist of several whorls with 3 scales in each, but only on the upper whorl fruiting scales are formed, in sinuses of which sits on one ovule. After fertilization, they become thick-walled and coalesce among themselves, forming a juicy berry-like cone. They only ripe in the second year.

Appearance of raw materials. Fruits are spherical, 6-9 mm across, smooth, shiny, less matte, dark brown or almost black, with a gray waxy blaze sometimes. Three converging grooves are visible at the apex of the fetus; at the base of the fetus, two three-leafed whorls from brown scales are noticeable (under a magnifying glass). In the loose greenish-brown pulp, there are 3 seeds. Seeds are yellowish-brown, oblong-trihedral, 4-5 mm in length. The smell is peculiar, aromatic, taste sweetish, spicy.

Chemical composition. Essential oil in an amount of 0.5-2%. On SPH essential oil should be at least 0.5%. The main component of essential oil is α-pinene. Contains other terpenes; sugar 13 - 40%, resin 9%, etc.



α-пинен

Application and medicinal forms. Juniper berries are a part of diuretic collection and coughing. They are used as an appetizer and as a spice in the production of liqueurs and vodkas. Essential oil is occasionally used in ointments for rubbing. Essential oil from pine needles is used as a phytoncid agent.

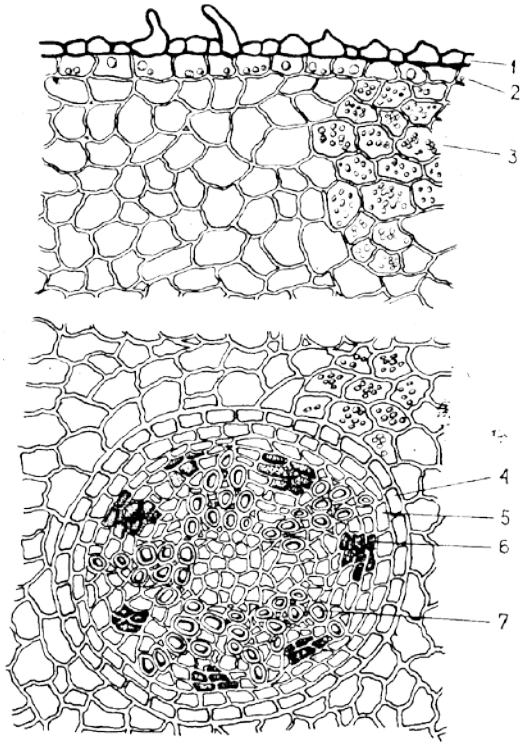
Bicyclic monoterpenoids

Roots and rhizome of Valerian - Rhisoma cum radicibus Valerianae
Name of the plantValerian officinalis - Valeriana officinalis L.
Family. Valerian – Valerianaae

A perennial herbaceous plant with a hollow stem, a vertical rhizome bearing numerous cordlike roots. In the first year, rosettes of radical leaves are formed, and in the second year, the stem grows. The leaves are located opposite, incompletely pinnate, the lower leaves are petiolate, and the upper leaves are sessile. The flowers are small, pale pink or lilac, collected on the top of the stem into large corymbiform panicles. The calyx is hardly noticeable, after flowering it grows into a tuft. Corolla funnel-shaped with five-bladed limb. Fruit - seed, equipped with a ten-ray crest.

Appearance of raw materials. Rhizome short, thick, vertical, 2 - 4 cm long, 1 - 4 cm thick, often hollow. From the rhizome extend numerous thin roots from 6 to 15 cm in length, 1 - 3 mm in cross-section. Outside, the roots are yellowish-brown in color, light brown in color. The smell is strong, peculiar; the taste is spicy, sweetish-bitterish.

Microscopy. Cross section of the root in chloral hydrate.



1 - epidermis;

2 - hypodermis (drops of essential oils);

3 - cells with spitchch;

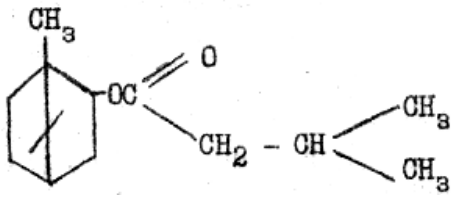
4 - endoderm;

5 - the pericycle;

6 - phloem;

7 - xylem.

Chemical composition. It contains an essential oil of 0.85-2% and free isovaleric acid. The main component of the essential oil is bornylisovalerianate.



bornylisovalerianate.

Application and medicinal forms. Valerian preparations are used as a sedative for nervous excitement, insomnia and other nervous diseases.
Medicinal forms: infusion - Infusum Valerianae, tincture -Tinctura Valerianae, valerian extract - Extraturn Valerianae, etheric-valeric tincture - Extractum Valerianae aethereum is used as a stimulant. The tincture of valerian is a part of the complex preparation Cardiovalenum. Raw material of valerian is a part of sedative and gastric.

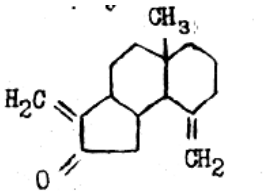
Rhizome and root of inula - Rhizoma et radix Inulae

Name of the plant. The horseheal – Inula helenium L.
Family. The asteraceae – Asteraceae

Perennial herbaceous plant with a thick, fleshy, many-headed rhizome and departing from it with a few thick roots. Radical leaves are long petiolate, with an elliptical or elongated-ovate pointed plate. Stem leaves are also large, short petioled, gradually decreasing, Semi-elongated, the edge is unequal. The anthodiums are round, golden yellow, located singly at the ends of the stems and branches, the envelope of the corpuscle is hemispherical, imbricated -multifoliate, leaves are bent, ovate, felted. The marginal flowers are semiflosculous-flowers, and the median flowers are tubular. Fruit is the seed.

Appearance of raw materials. Pieces of rhizomes and roots of various shapes. Outside, a grayish-brown longitudinal plug is visible. The fracture is coarse, light-grained. The smell is strong, fragrant and so peculiar that it can serve as a diagnostic sign. The taste is spicy, peculiar.

Chemical composition. Contain 1-3% of essential oil, called elecampane oil. This oil at room temperature is an oily crystalline mass, melting at 30-45 ° C in brown liquid with a peculiar smell. The crystalline part is called helenin. It consists of a mixture of bicyclic sesquiterpene compounds - lactones (alanto-lactone, isoalantolactone), which are derivatives of β-selenin.



Allantolactone

Application and medicinal forms. It is used as an expectorant for diseases of the respiratory tract. It is used in the form of a decoction or is a part of different

expectorant charges. Essential oil has antiseptic, anti-inflammatory and anthelminthic properties.

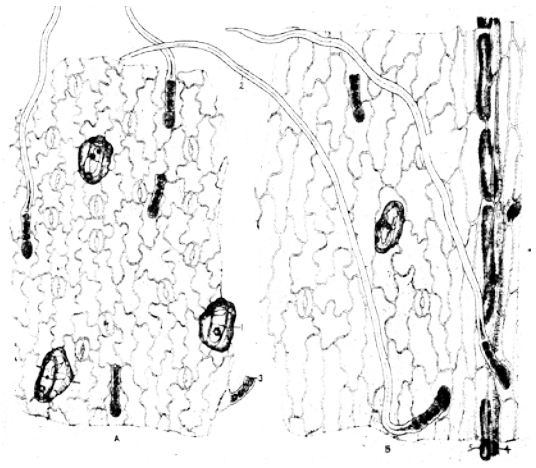
Herb of Milfoil - Herba Millefolii

Name of the plant. Sanguinary - Achillea millefolium L.
Family. Asteraceae

Perennial herbaceous plant. Stems straight through, ribbed, and branched. Radical leaves are large, petiolate, lanceolate in outline, many-semiflosculousately divided. Stem leaves are sessile, smaller, also finely divided. Stems end with an inflorescence - a complex scutal. Fruit is seed.

Appearance of raw materials. Dried cephalic parts of flowering plants consisting of stems, leaves and corymbose inflorescences. Stems are ribbed, branched up to 20 cm in length. Leaves 5 to 15 cm long, generally lanceolate, pinnately divided, with very small lobes. The leaves are gray-green, pubescent with long protruding hairs. The flowers are collected in anthodiums, located with apical complex shields. Anthodiums are small, long lasting ovoid, 3-4 mm long, with 5-7 white margins, sometimes-pink ligula flowers and several medullary tubules. Outside, the anthodiums are clothed with spathe from imbricated, elongated, and greenish, at the edges of webbed leaves. The smell is fragrant and the flavor is brackish.

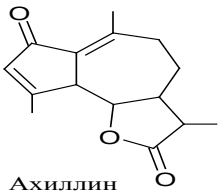
Microscopy. The preparation is superficial, clarified with alkaline solution.

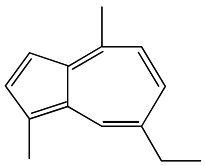


A - The top epidermis of the leaf;
B -The lower epidermis of the leaf.
1 - Essential oil glands;
2 - Hairs;
3 - Base of hairs;
5 - Secretory courses.

Application and medicinal forms. Herb is used as a hemostatic for internal bleeding in the form of infusion, in the form of a liquid extract, often with leaves of Urtica.

Chemical composition. Herb milfoil contains a bitter substance ahillin and essential oil 0.1-0.2%. It is darker due to the content of azulene. Contains vitamin K.


Ахиллин


Chamzulene

Herb of wormwood - Herba Absinthii

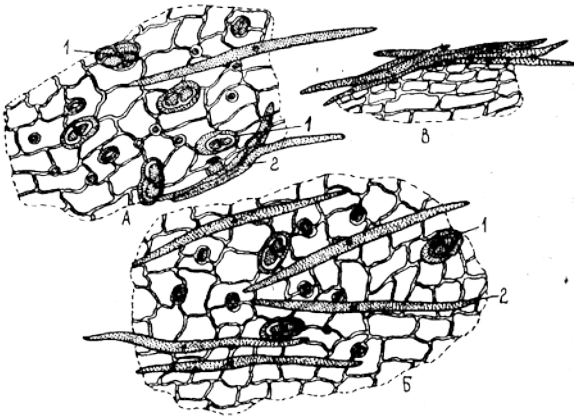
Name of the plant. Wormwood bitter - Artemisia absinthium L.
Family: The asteraceae.

A perennial herbaceous plant, from the rhizome that develops several stems. Radical leaves long petioled, triangular-rounded, thrice pinnatized into lancet-shaped, entire, dulled segments. Stem leaves sessile, gradually simplified. The whole plant is silvery-gray in color. Inflorescence is a complex panicle. Fruit is an oblong, pointed seed.

Appearance of raw materials. The herb consists of flowering tops and radical leaves. The tips of the stems are cut to a length of up to 25 cm. Stems branched, slightly ribbed, small flowers, collected in many-numbered drooping anthodiums, forming on the tops of flowering shoots racemose paniculate inflorescence, with anthodiums coming out one at a time or two of the sinuses of the lanceolate covering leaves. The marginal flowers in the anthodiums are female, narrowly tubular, numerous, silver flowers are bisexual, funnel-shaped, with five denticles. Receptacle is yellow, convex, covered with white hairs. Outside, the flower anthodiums are covered in a double-row wrapper of the skull-chattering set of lice. Flower anthodiums up to 4mm across. Leaves petiolate, triangular-rounded, triple-pinnate, separate lobes lanceolate all-edge, blunt at the apex. All the distribution is silvery-gray in color from the abundance of silky pressed hairs. The smell is fragrant, peculiar, taste bitter.

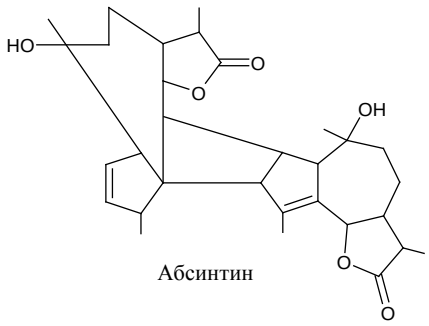
Microscopy. The preparation is superficial, clarified with alkaline solution. Characteristically: 1) Hairs resembling the letter T, consist of a very long two-pointed cell attached to the middle of a perpendicularly short stem consisting of several small cells. The shape of the hairs is more clearly visible along the edge of the leaf, from the surface the stem appears as a translucent circle;

2) Glands, consisting of 8 excretory cells, are located in 2 rows and 4 tiers and are surrounded by an elevated cuticle.



A - The top epidermis of the leaf;
B - The lower epidermis of the leaf.
1 - Essential oil glands;
2 - hairs;

Chemical composition. Wormwood contains bitter glycosides - absintine and anabsintin. The bitter glycosides of herb is 1: 10000, the essential oil is about 0.5%, it is green-blue; the main constituents of its thujol, thujone and azulene.



Абсинтин

Application. Herb wormwood is used, as a bitter taste to excite the appetite in the form of water infusions and tinctures, is a part of gastric drops, gastric pills and mouth-watering tea.

Sesquiterpenoids

Rhizome of Acorus calamus- Rhizoma Calami

Name of the plant. Marsh calamus - Acorus calamus L.
Family: Aroids – Araceae

Perennial herbaceous plant with a thick horizontal branching rhizome with numerous roots. Leaves are oblate, up to 120 cm long, with parallel venation. The stem is unbranched, erect, with a ribbed on one side, bearing a thick fleshy inflorescence - an ear and a blanket leaf. The cob is covered with small greenish-yellow flowers with a simple six-leaved perianth. Fruit is an oblong, multi-seeded red berry.

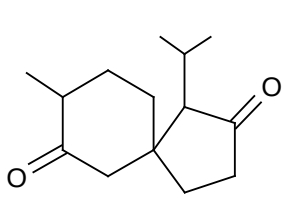
Appearance of raw materials. Raw material consists of pieces of rhizome of different length. On the outer side of the rhizome are visible semilunar adhesion of

dead leaves, on the lower - numerous small, round traces of distant leaves. Outside, the rhizomes are yellowish-brown in color, sometimes with a greyish-green tint. In the fracture rhizomes are whitish-pink with a yellow tinge, the fracture itself is granular. Rhizomes are very fragrant; the taste is spicy-bitter.

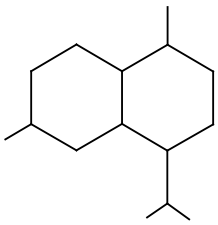
Chemical composition. Essential oil - 1.5% (up to 5%), which contains sesquiterpenes and other terpenoids. D-pinene (1%), D-camphene (7%), D-camphor (up to 9%).

In addition, the oil contains sesquiterpenes elementum, calamens (up to 10%), calicones, acorone.

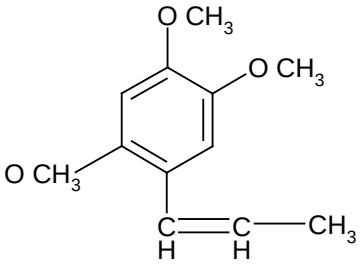
The main carrier of the smell of essential oil is azarone and aromatic aldehyde azarylaldehyde.



Акорон



α-Каламен



Азарон

In addition to essential oil, the rhizome of the *Acorus calamus* contains glycoside acorin (C36H60O6), tannins, ascarbic acid and other substances.

Application and medicinal forms. The rhizome of *Acorus calamus* is used as a bitter-spicy gastric remedy and with a stomach ulcer. It is a part of gastric gather and tincture “Tinctura amara”. In the composition of olemethine, used in nephrolithiasis and cholelithiasis. Powder is included in the drug "Vikalin" and "Vicair", used in case of gastric ulcer in the duodenum.

Buds and pine oil - Gemma et oleum Pini silvestris

Name of the plant. Pine - Pinus silvestris L.

Family: Pine – Pinaceae

Evergreen coniferous tree up to 30-40m high. Crown in old separately standing trees is round, and in young plants in plantations - pyramidal. The bark of the young trees is reddish-brown, the old ones are grayish-brown, fissured, on the branches yellowish, scaly. Needles are found in bunches in pairs, light green, sometimes grayish, pointed. Men's cones are located at the base of the shoots of the current year, the female on 1-3 at the ends of shoots. The cones are ovate-

elongated, 2-7 cm long, 2-3 cm wide, gray, matte, solipitchy, or 2-3 on legs bent downward.

Appearance of raw materials. Buds are single or several in whorls surrounding a larger central bud, without a stem or with the remains of a stem, no more than 3 mm long. The surface of the buds is covered with dry spirally located, pointed fringed scales, glued together by a protruding resin. The outside color is pinkish-brown, in the fracture green or brown. The length of the bud is 1-4 cm. The smell is fragrant, resinous and the taste is bitterish

Chemical composition. Bud contains 0.4% essential oil, which includes pinene, limonene; in addition, resins, tannins, bitter glycosides are contained. Needle contains up to 1.3% essential oil, which contains up to 40% pinene, limonene, borneol acetate, in addition ascorbic acid 0.3%, tannins. Terpentine (gum) represents a solution of resin (rosin) in essential oil, turpentine, the content of which reaches 35%.

Application. Buds are used as a antitussive [cough-depressant] action and disinfectant in the form of a decoction, are part of the diuretic collection; An extract of needles is used for preparing strengthening baths. Terpentine finds applications for the production of ointments, liniments, which have a local irritating, distracting and antiseptic effect.

Medicinal forms. Infusion, decoction, tincture, leaf extract. In addition, resins, turpentine, rosin, pitch, activated carbon.

Products of pine

1. When the pine is poured (Pinus silvestris L., Pine family - Pinaceae), yellow resin emerges from natural cracks and artificial incisions. The resin is found in wood and in the secondary cortex.

Essential oil from pine - turpentine contains about 90% of pinene. Pinene is used for the synthesis of camphor. This camphor is inactive.

Application. Camphor is used internally in the decline of cardiac and respiratory activity (dextrorotatory and levorotatory), and is externally applied for rubbing in ointments and liniments.

Medicinal forms: inside - Camphora trita, subcutaneously – Oleum Camphoratum 20% in ampulis in peach or almond oil, externally - Oleum camphoratum on sunflower oil, Spiritus camphoratus, Unguentum samphoratum (10%).

Camphor is a part of Tinctura Opii bensoica, which is used as an analgesic for diseases of the gastrointestinal tract.

Camphora monobromata is used as a sedative.

When the incisions are applied from the wound, a resin, called gum, flows out, which is a solution of the resin in the essential oil. At the beginning, resin is liquid, but within a few days thickens and turns into a granular mass. To add gum on the trunk of pine, the bark is laid on the benches, equal to 30-50 cm in height and 20-50 cm in width. In the middle of the crust, a vertical groove is applied to the depth of several annual layers, at the lower end, which is attached to the receiver to collect the resin.

Of the gum, a number of prolongates are obtained. The semi-gum is melted, decanted and filtered. Purified gum is an ordinary turpentine (Terebinthina communis), which is part of some patches.

When distilled with water vapor, essential oil is distilled (30-35%), called vital or "sulfuric" turpentine, and in the distillation cube after evaporation of water there is a resin called rosin.

For medical purposes, turpentine is secondarily distilled - Oléum Terebinthinae rectificatum. In turpentine add pinene. Apply externally for colds (ointment, lineage), inside (2-3 drops) on sugar with tuberculosis.

2. When the stumps are dried (after felling), turpentine, pitch (Pix liquida Pini), coal (Carbo ligni) are obtained.

Pitch is included in ointments from eczema, scabies and insects. Coal is used for intestinal diseases as a carminative agent.

3. When using the method of extraction of chips with gasoline, turpentine, cooking oil, rosin are obtained. Resin is used to make soap, patches and rubbing the violin bow.

4. Terrentine - Terebinthina liquid resin, which contains pinewood in the resinous passages. By its nature, turpentine is a typical balm representing a solution of resin (rosin) in essential oil (turpentine).

5. Purified turpentine - Oleum Terebinthinae rectificatum - contains up to 75% of pinene, which is accompanied with other terpenes. Turpentine is used in ointments, liniments and various mixtures as a local irritating and distracting remedy for rheumatism and colds.

6. Rosin - Colophonium after distillation of turpentine in the cube remains 65-70% of resin - crude rosin. After cleaning (melting in a water bath of filtration and complete evaporation of the rest of the water), rosin is obtained in the form of crispy glassy yellow shades of pieces with a shiny wrinkled fracture. Rosin contains up to 95% resin acids (mainly abitinic) and about 5% of rezen. Rosin is a part of sticky (smeared) and liquid patches.

7. Pitch - Pix liquida Pini is obtained as a result of dry distillation of pine wood shavings. Raw materials are pitchred stumps. At the beginning (at a temperature not higher than 170^{O} C) turpentine is distilled. Liquid resinous cut

obtained at a higher temperature is stratified into the lower layer - pitch and the top layer - wood vinegar. The residue in the distillation cube (coal) is further processed into activated carbon. Pitch is administered in ointments with eczema, scabies.

Birch buds - Gemmae Betulae

Name of the plant. Birch warty - Betula verrucosa Ehrh.
Birch fluffy - Betula redsens Ehrh.
Family: Birch – Betulaceae

Large trees with a parchment-white bark, with characteristic black strips, with aging, the cortex acquires a black-gray color (birch warty) with numerous resinous glands. Leaves are regular, on petioles with small decaying stipules. Blossoms simultaneously with the opening of leaves in April-May; flowers are same-sex, monoecious. Stamen flowers are collected in long ament, located at the ends of branches, begin to develop from autumn. Pestle ament small, cylindrical, are located singly on short lateral branchlets. The flowers are collected in 3 in the axils of the trilobate scales, the perianth is absent, the pestle with a two-cavity ovary and two filiform stigmas, in winter they are hidden behind the scales of flower buds, develop in the spring along with the leaves. The fruit is a nutlet, provided with two membranous wings.

Appearance of raw materials. The buds are oblong-conic, pointed, 3-7 mm long, 1.5-3 mm across, covered with tile-shaped, closely pressed edges, slightly ciliate scales. The color is brown or brown, sometimes greenish at the base. The smell is balsamic, slightly astringent, and resinous.

Leaves are triangular-ovate, two-pointed, in birch fluffy - oval-ovoid, leathery. Smell fragrant, taste astringent.

Chemical composition. The bud contains essential oil up to 8%, resin, flavonoids, vitamin C. The composition of the oil includes bicyclic sesquiterpenes, betulen and betulenol alcohol and caryophyllene.

The leaves contain 0.05% essential oil, resinous substances, 2.8% ascorbic acid, 5-9% tannins, 3.2% saponins, flavonoids (hyperoside, myricetin-3-digalactoside, quercetin, apigenin, kaempferol).

Essential oil of the buds is thick, yellow, pleasant balsamic odor.

Leaves and buds have bactericidal action.

Application. Buds and leaves are part of the collection and in the form of infusions are used as a diuretic and choleretic in cholecystitis, for the treatment of acute and chronic eczema in the form of hot baths.

In spring, from birch trees, birch sap is obtained, rich in vitamins. In dry wood fires, birch pitch is produced - Pix liquida Betulae, containing mono- and dihydric phenols, resins. It has a disinfecting property and is used for scabies as an external remedy, as part of Wilkinson's ointment.

When burning birch firewood, coal remains, which, because of the porous structure, easily absorbs liquids gases and pigments. The absorption capacity of the coal is enhanced by steam treatment at high temperature, the product obtained is activated carbon - Carbo ligni activalis. Used in medicine, called carbolen, in powder or tablets in violation of carminative in the gastrointestinal tract.

Medicinal forms. Infusions, decoctions, birch pitch - Pix liquida, carboline, juices.

ASSESSMENT OF STUDENTS` KNOWLEDGE

Determine level of training for tasks and the assimilate of the topic in various stages of laboratory activity of students during the engagement in written and oral questions, as well as other methods of pedagogical technology ("Conversation", "Boomerang", "Turntable" "Brainstorm").

Training "Boomerang" (II-th laboratory exercise)

Students are divided into groups and each group is given its own task on the topic of the lesson. Each group of 3 to 4 students expresses their opinion and make discussions between the groups in the form of questions and answers.

Task for the first group

1. Diagnostic signs of the family of Asteraceae.
2. Appearance of raw milfoil.
3. Microscopy of wormwood bitter.

Task for the II-nd group

1 Morphology of valerian.
2. Chemical composition of birch raw materials.
3 Application of juniper raw material.

Task for the III group

1. Morphology of wormwood bitter.
2. Appearance of raw inula.
3. Microscope of the milfoil.

Task for the IV group

1. Morphology of pine.
2. The chemical composition of the milfoil.
3. Use of raw Acorus calamus.

Task for the V-th group

1. Morphology of the Acorus calamus.
2. Chemical composition of juniper.
3. Microscopy of valerian.

Training "Turntable" (II laboratory activity)

In the training students are divided into 3 - 5 groups, each group is given the same table. Students fill it themselves, then 3 - 5 times the table goes to other groups in a circle, again the students express their opinion, at the end with the help of the teacher, the material presented in the table is summarized, the correct answers are found during the discussion.

Define a family in the Latin language data of plants

№	Plant`s family / Plant`s name	Valeriana-ceae	Cupres-saceae	Betulaceae	Pinaceae	Astera-ceae	Araceae
1.	Pine tree						
2.	Birch						
3.	Juniper						
4.	Milfoil						
5.	Wormwood						
6.	Acorus calamus						
7.	Valerian						
8.	Inula						

Determine the raw materials of plants

№	Raw`s name / Plant`s name	buds	herb	roots and rhizome	roots and rhizome	cone	rhizome	fruits
1.	Pine tree							

2.	Birch							
3.	Juniper							
4.	Milfoil							
5.	Wormwood							
6.	Acorus calamus							
7.	Valerian							
8.	Inula							

Situational tasks:

1. Herbaceous plant, stalk cylindrical, leaves pinnately divided, regular. Inflorescence of the anthodium, semiflosculous and tubular. Fruit is an achene with a floccus.

Indicate for which family the above morphological features are characteristic. Tell about the medicinal plants belonging to this family.

2. The glands, consisting of 8 excretory cells, are arranged in two rows and four tiers and are surrounded by an elevated cuticle.

Indicate for which family the above-mentioned anatomical features are characteristic. Tell about the medicinal plants belonging to this family.

The student must know the morphological and diagnostic features of the herbaria, as well as the microscopic structure of raw materials containing essential oils.

3. Explain the methods of analyzing physical constants.

4. Explain the method for determining the solubility of essential oils.

III - LABORATORY ACTIVITY

1. Analysis of raw materials containing essential oils

Character of work:

A) Determination of the acid and ether number;

B) Determination of the quantitative content of essential oils according to SPH;

C) Determination of impurities.

2. Study of objects: anise, fennel, thyme, thyme creeping, types of oregano, ziziphora.

Characteristics of work:

A) Morphological study of plants and the appearance of raw materials;

B) Microscopic examination of fennel fruits.

Questions for self-study

1. Quantitative determination of essential oils according to SPh
2. Determination of impurities in essential oil.
3. Determination of the acid number in essential oil.
4. Determination of the etheric number in essential oil.
5. The meaning of determining the air number after acetylation.
6. Give morphological and anatomical signs of plants of the umbellate family.
7. Distinctive morphological signs of creeping thyme and common thyme.
8. Name of plant, raw material and family of common thyme. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms.
9. Name of plant, raw material and family of fennel. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms.
10. Name of plant, raw materials and family of anise. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms
11. Name of plant, raw materials and family of oregano species. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms
12. Name of plant, raw material and family of creeping thyme. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms
13. Name of plant, raw material and family of ziziphora. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms

ANALYSIS METHODS OF MEDICINAL RAW MATERIAL`S CONTAINING ESSENTIAL OILS

Determination of the purity of essential oils with the help of qualitative reactions

For the falsification of essential oils, most often used substances such as ethyl alcohol, fatty and mineral oils, turpentine and some other cheap essential oils, etc.

Falsification of essential oils can also consist in the partial isolation of any constituent - a valuable, for example, menthol from mint oil.

The presence of impurities and falsifications can be detected already in the determination of certain certain impurities, for which various qualitative samples are used.

The invention of fatty oils.

1) 1 ml of essential oil is dissolved in 80% alcohol. The appearance of turbidity or fatty drops on the bottom of the tube indicates a possible admixture of fatty oils (also mineral);

2) Apply 1 drop of essential oil to the filter paper and leave for volatilization. Fatty oils leave a fat non-vanishing spot;

3) The remainder of the evaporation of essential oils in a water bath is tested:
A) solubility in alcohol;
B) acrolein test with $KHSO_4$;
C) determine the saponification number (if the saponification number is close to 200, this indicates the presence of fats).

The invention of ethyl alcohol.

1) a few drops of essential oil are added to the water; When in contact with water, a drop of essential oil should not grow dull;

2) put the essential oil in a test tube, then close the tube with a cotton swab, and place some fuchsin crystals on the cotton wool and heat it, and if there is alcohol, the cotton wool should turn red.

The invention of water.

When shaking 3-6 ml of essential oil with benzene saturated with water, the latter should not grow turbid.

Chemical methods for the study of essential oils

In the chemical method of analysis, chemical constants are usually determined: acid number, saponification number, ether number, ethereal number after acetylation, content, phenols, aldehydes and ketones.

Acid number (a.n.). The acid number is the amount of milligrams of caustic potassium required to neutralize the free acids contained in one gram of the testing oil.

Determination technique. . 1.5-2 g of the oil is placed in a 100 ml conical flask, dissolved in 5-10 ml of neutralized ethyl alcohol and titrated with 0.1 M solution of KOH in the presence of 3-5 drops of a 1% solution of phenolphthalein until pink staining.

$$a.n. = \frac{v \cdot 5.61}{P} \qquad X = \frac{a.n.}{1000}$$

Where, v - the number of milliliters of 0.1 m solution of KOH, gone to the titration of free acids; P is a piece.

The acid number gives an idea of the quantitative content of free acids contained in the essential oil (X).

A large content of acids can be as a result of saponification of esters of essential oil, resinification and other processes that change the composition of essential oils during storage or as a result of falsification with various organic acids: benzoic, salicylic, oily, etc., since most essential oils have a small amount of free acids.

Saponification number (s.n.). The number of saponification is called the number of milligrams of caustic potassium necessary to neutralize the free acids and saponification of the esters contained in 1 g of the oil under investigation.

Determination technique. . 1-2 g of essential oil is weighed into a cone with a capacity of 100 ml, dissolves in 10 ml of neutralized alcohol, added 15-25 ml of 0.5 m alcohol solution KOH. A reflux condenser is added to the flask and the mixture is heated in a boiling water bath for 1 hour. The end of saponification is recognized by the onset of complete transparency and homogeneity of the solution, which is retained during the exploration of water.

In parallel, under the same conditions, 25 ml of 0.5 m KOH solution is heated. Then both solutions immediately after the termination of heating are diluted with 25 ml of hot water, add 1 ml of phenolphthaleate solution and titrate with 0.5m hydrochloric acid solution until discoloration.

The calculation is carried out according to the formula:

$$s.n. = \frac{(v_1 - v_2)K\ 28{,}05}{P}$$

Where, V_1 - the number of ml of HC1 solution, gone to titration of KOH in the control experiment; V_2 - the number of ml of HC1 solution, left for titration of

the KOH residue after saponification; K - coefficient of correction with respect to 0.5 m solution of KOH; P is the sample of the essential oil under study.
The saponification number gives an idea of the authenticity and purity of the oil have been studied, since it depends on the molecular weight of the fatty acids.
Etheric number (e.n). The ethereal number refers to the number of milligrams of caustic potassium required for saponification of esters contained in 1 g of the oil under study.

The ether number is determined by the difference between the number of saponification and the acid number:

e.n. = s.n. - a.n.

The ether number gives an idea of the authenticity of the test oil.

Determination of the air number after acetylation (quantitative determination of free alcohols). The ether number after acetylation indicates the amount of milligrams of caustic potassium needed to saponify the esters contained in 1 gram of oil, either formed during acetylation or originally present in the oil.

It gives an idea of the content of free alcohols.

Determination technique. To 10 ml of essential oil, placed in a special acetylation flask with a ground air cooler, about 2 g of anhydrous sodium acetate are added. The mixture is boiled on a sand bath for two hours. After cooling, add 20 ml of water and heat on a water bath with frequent agitation for 10-15 minutes to convert the entered reaction of acetic anhydride to acetic acid. The mixture is transferred then to a separator funnel with a capacity of 100 ml and the oil layer is separated. Oil is washed with agitation of 50 ml of saturated sodium chloride solution (in several steps) until a neutral reaction of washing water (methyl orange indicator). Then the oil is washed with 20 ml of water to remove traces of sodium chloride. The washed oil is dehydrated with anhydrous sodium sulfate and filtered. In a conical flask, weigh 1.5-2g of oil (accurate to 0.01g), dissolve it in 5ml of alcohol and neutralize it with 0.5m alcohol solution of caustic potash (phenolphthalein indicator). After neutralization, add 25 ml of 0.5 m alcohol solution KOH and determine ethereal number.

The content of esters after acetylation is calculated by the formula:

$$\%\ free.alcohol = \frac{(a-в)M}{B\,5{,}61 - 0{,}42\,(a-в)}$$

$$\%\,bound.alcohol = \frac{e.n..\ \ M.м.}{B\,5{,}61}$$

Where, *a* -is the etheric number after acetylation, *b*- is the ethereal number,

M - is the molecular weight of the alcohol (menthol is 156), and *B* - is the atomic power (equal to 1).

Remedy plants and raw materials containing essential oil

Aromatic compounds

Fruit and anise oil (Anisum vulgare)

Fructus et oleum Anisi vulgaris

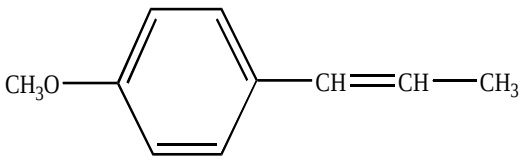
Name of the plant. Anise. - Pimpinella anisum L. (Anisum vulgare Gaerth.)

Family: Celery – Apiaceae

Annual herbaceous plant with branchy, stem up to 60 cm high. The leaves are regular; the lower ones are on long petioles, round-bud-shaped, large-toothed. The middle leaves are triple, with wedge-shaped or rhombic laciniate - dentate leaves; more often, the cephalic leaves are sessile. Inflorescence - complex umbrellas without common wrappings. The flowers are small, white, built like an umbrella. Fruit is a two-parted grain.

Appearance of raw materials. Fruit is a yellowish-gray or brownish-gray two-parted grain, mostly consisting of two half-fruits, not separated from each other, less often broken up. Fruits egg-shaped, flattened from the sides, wider to the base, narrowed toward the apex. At the top, there is a five-toothed calyx and a utricular epigynous disc with the remains of two inclined divergent columns. Most fruits have a long stem. Fruits are covered in glossy, giving them a rough look. The outer side of the half-fruit is convex, flat. Each half-fruit is provided with 5 longitudinal, low-yielding ribs, three of which are on the convex part, and two on the sides. The length of whole fruit 3-5mm, width ¬ 2-3mm. The seed in the semiplodule is one, fused with the pericarp. The odour is characteristic, the taste is sweetish-spicy.

Chemical composition. Fruits of anise contain 1.2-3% of essential oil. The main component is anethole (80-90%), methylglucol (10%) is a significant proportion. In addition, the oil contains anise aldehyde, anise ketone and anisic acid. In fruits, anise is a lot of fatty oil.



анетол

Application. Essential oil is used as a stimulant for the activity of the intestine, and also as an expectorant. Pluses are part of breast and laxatives; Oil is a part of the anatomical anise drops, thoracal elixir, opium-benzoic tincture and butter-sugar.

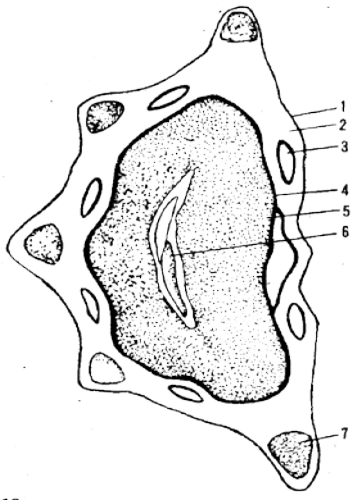
Fennel fruit and oil - Fructus et Oleum Foeniculi

Name of the plant. Spingel (Foeniculum vulgare) - Foeniculum vulgare Mill.
Family: Celery - Apiaceae.

A biennial herbaceous plant. Stem 90-200 cm high, round with unobtrusive grooves and bluish coating, branched at the top. Leaves are alternate, vaginal, lower - petiolate, repeatedly pinnatisected on narrow-lobed lobules. Inflorescence - complex umbels at the ends of stalks and branches of 10-20 rays, wrappers and wrappers absent. The flowers are yellow with five petals. Fruit is a two-parted grain.

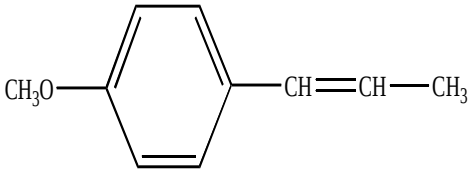
Appearance of raw materials. The fruit is greenish-brown, glabrous, elongated, almost cylindrical, a two-parted granule easily falling into two semis. At the top, there is a five-toothed calyx and a superimposed disk with the remains of two inclined divergent tables. The outside of the half-fruit is convex and the inner side is flat. The length of the whole fruit is 4-10 mm, width 1.5-4 mm. Each half-fruit with five protruding longitudinal ribs: three of them are located on the convex part and two, more developed at the sides. The seed in the semiplodule is one, fused with the pericarp. The smell is pleasant, fragrant, the taste is sweetish-spicy.

Microscopic structure.



1 - epidermis (exocarp);
2 - mesocarp;
3 - tubules of the essential oil;
4 - endocarp;
5 - endosperm;
6 - cotyledon;
7 - conducting beams.

Chemical composition. Fruits contain 3-6% essential oil, up to 20% fatty, proteinaceous substances, fennel essential oil - 60% anethole, 20% fenghona - methylhavicol and other terpenes. The main phenols are crystalline thymol and liquid carvacrol.



анетол

Application. Fruits with meteorism in the form of dill water - Aqua Foeniculi, and also as an expectorant. They are part of the carminative collection and in the compound of a complex licorice powder. Fennel oil differs from the beginning bitter-camphor, then sweet taste, appoint 5-10 drops per reception - with flatulence and as an expectorant.

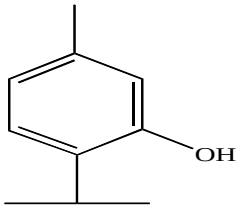
Herb and thyme oil - Herba et oleum Thymi

Name of the plant. Thymus vulgaris L. - Thymus vulgaris L.
Family: Lamiaceae

Semishrubs up to 60 cm high, branched, erect. The stem is woody, branches are herbaceous, tetrahedral, pubescent. Leaves opposite, oblong-obovate, the edges wrapped upward, covered with dotted glands on both sides, shortly pubescent below. Flowers are small, collected in the axils of the apical leaves in the opposite, false half-churns, forming a racemose inflorescence on the tip of the stems. Calyx campanulate, double-hued, corolla bilabiate, dropping light purple or pink, less often white. Stamens 4, 2 of them short, pestle with upper quadruple ovary. The fruit consists of four ¾ nuts imprisoned in the remaining calyx.

Appearance of raw materials. A mixture of leaves and flowers. Leaves are short-petiolate, oblongate-ovate or oblong-lanceolate, 5-10 mm long, covered with point glands on both sides, glabrous on top, shortly pubescent from below; the edges of the leaves are one-piece, turned inside. The smell is fragrant, fragrant, and bitterish.

Chemical composition. Essential oil is up to 2%, where phenols are 40%. The main phenols are crystalline thymol and liquid carvacrol.



thymol

In the oil also contains cymol, linalool, etc. The herb contains ursolic, oleanolic acid and flavonoids.

Application. As an antihelminthic agent, in dental practice, with fungal diseases. Liquid extract is a part of the preparation of pertussin - Pertussinum, used as an expectorant for bronchitis and whooping cough. Essential oil is applied externally in the composition of various mixtures.

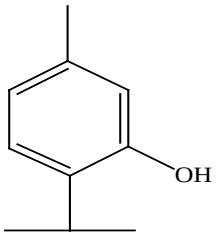
Herb of thyme - Herba Serpylli

Name of the plant. Thyme creeping (thyme) - Thymus serpyllum L.
Family. Lamiaceae

A long half-shrub that forms small turfs. The stem is creeping, locally rooting, branching, in the lower part is woody, red-brown, with numerous ascending leafy and flowering short branches. Leaves opposite, small, ovate or lanceolate, entire, short-petioled, with bristly hairs at the base and glands. The flowers are collected in axillary half-churns, forming the apical capitate inflorescence. Calyx is brownish-red, bilabiate. Corolla pinkish-lilac, bilabiate. The fruit consists of four nuts imprisoned in the remaining calyx.

Appearance of raw materials. The threshed herb represents a mixture of leaves and flowers. Leaves are short-petioled, ovate, elliptical or lanceolate, entire, at the base with several setiform hairs. Flowers bilabiate with a brownish-red cup and bluish-purple corolla. The smell is peculiar, the taste is bitter.

Chemical composition. Essential oil in the range of 0.1-1%, where the content of phenols is up to 35% (thymol, carvacrol, etc.). Contains other terpenoids (cymol, etc.).



thymol

In the herb, thyme also contains ursolic, oleanolic acid, flavonoids, bitter glycosides, and tannins.

Application. As an expectorant for coughing, as well as for flavoring baths, for compresses, lotions. The liquid extract is a part of the remedy for pertussis-pertussin.

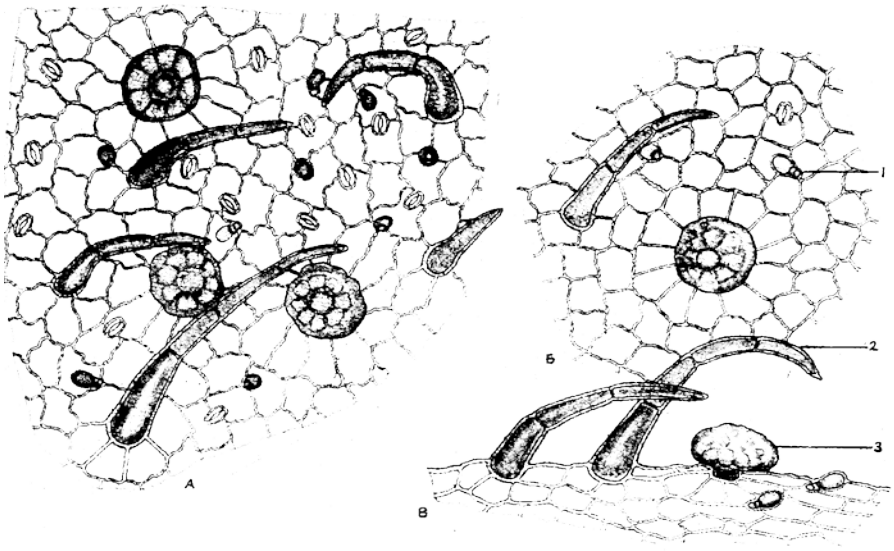
Essential oil is applied externally as an antiseptic.

Herb of origanum - Herba Origani vulgaris

Name of the plant. Common origanum - Origanum vulgare L.
Family. Lamiasee

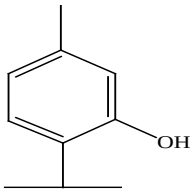
Perennial herbaceous plant up to 60 cm high with a branchy creeping rhizome. Stems quadrangular, straight, branched, softly pubescent. Leaves opposite, petiolate, oblong-ovate, entire, pointed at the apex, dark above, gray-green below. Flowers are small, collected in thick scutums, the latter in turn form a large sprawling panicle. Cup Five-toothed, corolla bilabiate, pale purple, rarely whitish. The fruit consists of 4 nuts imprisoned in the remaining calyx.

Appearance of raw materials. A mixture of leaves and flowers. Leaves are short-petioled, oblong-ovate, entire, 1-3 cm long. On top of the leaves are dark green, from below pale green; the smell is fragrant, the taste is bitterish-spicy, slightly astringent. Bracts are oval, dark purple. The flowers are about 5 mm long; the calyx is the right bell, five-toothed, in throat with a ring of white hairs; corolla pale purple, two-lipped. The smell is fragrant and the taste is bitterish.
Microscopic structure. Surface preparation in alkali solution:



А - the top epidermis of the leaf; Б - the lower epidermis of the leaf; В is the edge of the sheet. 1-head hair; 2-simple hair; 3-essential oil glands.

Chemical composition. Essential oil 0.3-1.2%, containing up to 40% carvacrol and thymol, sesquiterpenes, geranilacetate. In the leaves - ascorbic acid. There are some tannins.



thymol

Application. It is a part of the gastric remedy, as well as of cough, it is included in the collection of breast and sweat. Infusion of herbs is prescribed for intestinal atony.

Essential oil is used externally as an analgesic for thoothache.

Herb Ziziphora - Herba Ziziphorae pedicellatae

Name of the plant. Ziziphora - Ziziphora pedicellata Pazij. Et Vved.
Family. Lamiasee

Perennial half-shrubs or annual herbs with a stilted, thick rhizome. Stems up to 20-40 cm high are covered with short hairs. Leaves ovate, entire or edentate, slightly hairy. The flowers are small, mauve, in numerous false whorls. Very often the upper parts of the stem and the branches are sessile or on the pedicels. Calyx elongate, narrowly tubular with 13 veins, in Shaggy hairy. The corolla is small with hardly noticeable expanded to the top tube without a ring of hairs. Fruit - four nuts.

Appearance of raw materials. Raw material consists of whole or slightly crushed leaves with numerous flowers, stems up to 20 cm in length. Stems quadrangular, thin, unbranched or branched. The leaves are lanceolate, narrow-lanceolate, pointed, with short petioles; the edges are even, opposite. The color of the leaf is gray-green. Inflorescence of the head, flowers bilabiate, light purple. The smell is strong, pleasant, peculiar. The taste is sharp, peculiar.

Chemical composition. Essential oil 0.96%, flonoids 1.04%, coumarins 0.19%, anthocyanins 1.02%, vitamin C 170 mg%, sugars 11.3%, organic acids 4.82%, ursolic acids 0.67% , Polyphenols 3.40%, resins 4.69%, and others.

Application. Infusion of herb is used for hypertension and as a diuretic.

ASSESSMENT OF STUDENTS` KNOWLEDGE

Determine level of training for tasks and the assimilate of the topic in various stages of laboratory activity of students during the engagement in written and oral questions, as well as other methods of pedagogical technology ("Conversation", "Boomerang", "Turntable" "Brainstorm").

Training "Boomerang"

Students are divided into groups and each group is given its own task on the topic of the lesson. Each group of 3 to 4 students expresses their opinion and make discussions between the groups in the form of questions and answers.

Task for the first group

1. Diagnostic signs of the celery family.
2. Appearance of raw thyme creeping.
3 Microscopy of fennel raw materials.

Task for the II-nd group

1. Morphology of thyme common.
2. Chemical composition of origanum raw materials.
3. Application of raw materials anise.

Task for the III group

1. Morphology of anise.
2. Appearance of thyme.
3. Microscopy of origanum raw material.

Task for the IV group

1. Morphology of the ziziphora.
2. Chemical composition of fennel
3. Use of thyme raw materials.

Task for the V-th group

1. Morphology of origanum.
2. Chemical composition of ziziphora.
3. Application of fennel raw materials.

Training "Turntable"

In this training students are divided into 3 - 5 groups, for each group is given the same table. Students fill it themselves, then 3 – 5 times the table goes to other groups in a circle, again the students express their opinion, at the end with the help

of the teacher the material presented in the table is summarized, the correct answers are found during the discussion.

Determine a family in the Latin language data of plants

№	Plant`s family / Plant`s name	Valerian-aceae	Apia-ceae	Lamia-ceae	Pina-ceae	Astera-ceae
1.	Common thyme					
2.	Creeping thyme					
3.	Anise					
4.	Common origanum					
5.	Ziziphora					
6.	Fennel					

Determine the raw materials of plants

№	Raw`s name / Plant`s name	buds	herb	herb and essential oil	leaves and essential oil	fruits
1.	Common thyme					
2.	Creeping thyme					
3.	Anise					
4.	Common origanum					
5.	Ziziphora					
6.	Fennel					

Method "Chainworld"

On which flask is determined the amount of phenols, aldehydes. (▪▪▪▪▪ ▪▪▪▪▪▪)	
The concomitant substance of the leaves of peppermint (▪▪▪▪▪)	
Medicinal form of eucalyptus (▪▪▪▪▪▪▪▪)	
The main component of the essential oil of anise (▪▪▪▪▪▪)	

The main component of the essential oil of coriander (▪▪▪▪▪▪▪▪)	
Peppermint`s raw material **(▪▪▪▪▪▪)**	
The form of the juvenile eucalyptus leaves (▪▪▪▪▪▪▪▪▪▪ ▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪)	
The main component of essential oil of peppermint (▪▪▪▪▪▪)	
The raw material of common thyme (▪▪▪▪▪▪ ▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪)	
Type of analysis of essential oil (▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪)	

Situational tasks:

1. Herbaceous plant, the stem is polyhedral, leaves simple, pinnately divided, regular. Inflorescence umbrella. Fruit is a two-tiered.

Indicate for which family the above morphological features are characteristic. Name the medicinal plants belonging to this family.

2. The glands, consisting of 6-8 excretory cells, are located in a rosette.

Indicate for which family the above-mentioned anatomical features are characteristic. Tell about the medicinal plants belonging to this family.

The student must know the morphological and diagnostic features of the herbaria, as well as the microscopic structure of raw materials containing essential oils.

3. Distinctive features of thyme ordinary from thyme creeping.

4. What do microscopic studies of fennel fruits look for?

5. What is falsification?

TESTS ON THEME

1. Essential oil in raw milfoil is localized

A) in endogenous receptacles

B) in the secretory courses

C) in essential oilseeds

D) in glandular spots

2. The content in the herbal raw material of essential oil, which when distilled with water vapor forms an emulsion, but the pharmacopeia is determined
A) I method
B) only II method
C) I and II methods
D) III method
3. Soft silky threads collected by bundles or partially entangled; brown color, light yellow; weak odor, peculiar; taste is with a sensation of mucus:
A) flowers of marigolds
B) flowers of the Lagochilus inebrians
C) rhizome with roots of cyanotic
D) stalks with stigmas of maize
4. raw materials of medicinal plant containing in the composition of essential oil, cineol
A) herb of oreganus
B) rhizomes and roots of inula
C) rhizome of calamus
D) eucalyptus leaves

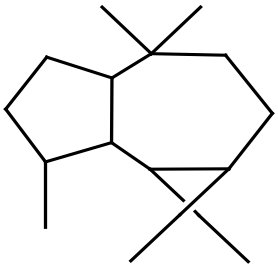
5. Chamomile officinalis` (horse gowan) flowers differ from impurities by the character of the cotyledon
A) conical, hollow
B) convex, along the edge of the filmy
C) naked, filled, expanded
D) solid, flat, filmless
E) naked, finely corrugated, hollow, conical

6. For the anatomical structure of peppermint leaves,
A) Druse of calcium oxalate
B) milk vessel
C) secretory courses
D) rounded glands with radially arranged cells

7. What type of inflorescence in calendula officinalis
A) the anthodium
B) the scutellum
C) cob
D) the head

8. Sage leaves are dried at a temperature of 35-40 ° C, because they contain
A) tannins
B) flavonoids
C) vitamins
D) essential oils

9. Name the substance shown in the picture:



A) an ice
B) geraniol
C) cadinene
D) carvone

10. The main pharmacological action of chamomile flowers:
A) bactericidal
B) antispasmodic
C) diuretic
D) adaptogenic

1. Translate the Russian and Latin name of the plant and family, raw materials of medicinal plant containing the essential oil, the main component of which are acyclic and bicyclic monoterpenoids:

Russian and Latin name of the producing plant and family, raw materials of medicinal plant	Chemical composition	Formula of the aromatic compound	Pharmacological properties, administration, preparations

2. Draw a microscopy and indicate the signs that are of diagnostic importance for a microscopic study of raw materials: rhizome of Acorus calamus, sage leaves, and chamomile officinalis flowers. Translate the Russian and Latin name of the plant and family, raw materials of medicinal plant.

Indicate in the form of a scheme the localization of essential oil in raw materials of medicinal plant.

3. Translate the Russian and Latin name of the producing plant and family, the raw material of the dill garden. What method is used to determine the content of essential oil in raw materials? On what physical and chemical properties of essential oil this method is based. Write in the form of a scheme a methodology for the quantification of essential oil in raw materials. Draw the device. Calculate the content of essential oil in the raw material, if the volume of essential oil in the receiver after distillation is 0.8 ml, the loss in mass when drying is 11%. Make a conclusion. Indicate the chemical composition, structural formula and the use of raw dill (Anethum graveolens).
4. Fill in the table:

"Raw materials of medicinal plant containing essential oil and administration to treat upper respiratory tract diseases"

Russian and Latin name of the producing plant and family, raw materials of medicinal plant	Chemical composition	Formula	Pharmacological properties, administration, preparations

THEME: REMEDY PLANTS AND RAW MATERIALS CONTAINING IRIDOIDS (bitter glycosides)

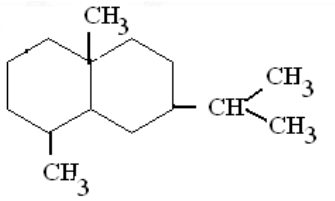
Aim of the lesson. Highly qualified employees working in the pharmacy industry should consider the process of harvesting, drying, storing and analyzing herbal medicinal raw materials containing bitter glycosides. To this end, the student must consolidate practical skills in the morphological description of the plant, to establish the authenticity, purity and purity of medicinal plant material.

Raw materials containing iridoids (bitter glycosides), is widely used in medical practice for a long time with various cardiovascular, nervous, gastrointestinal diseases, as well as antimicrobial and other means.

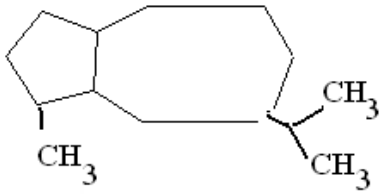
Bitter glycosides refers to glycosides, being oxygen derivatives of sesquiterpene lactones.

According to the existing classification, they are divided into 3 groups:

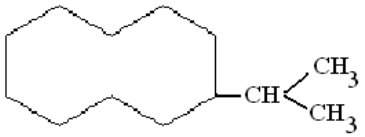
I – Eudesman derivatives



II – Guilane derivatives



III - Derivatives of hermiccrane



Bitter glycosides of the Eudesman group are found in the plants of the gentian and rotational family (gentian, golden sands and trifoles).

Bitter glycosides of the guaiana group is found in the plants of the family of astroids (wormwood, milliliters), the bitter glycosides of the hermiccrane group in the thistle.

Bitter glycosides can be the main biological substances of plants or can be accompanied by essential oils or slimes, so they are further divided into:

• pure bitter glycosides - Amara pura (dandelion, centaury, trefoil);

• bitter glycosides, accompanied by essential oils - Amara aromatica (bitter wormwood, sweet marsh, citrus);

• bitter glycosides, accompanied by slime - Amara mucilaginosa (lichens).

Bitter substances in pure form in medicine are not applied, they are used more often in the form of tinctures or baths. Apply these medicinal substances for 20-60 minutes before meals, 2-4 times a day with a small amount of water.

Bitter glycosides mainly, acting through the taste receptors, enhances the reflex release of gastric juice, which is accompanied by increased appetite and improved digestion. Accepted with hypocidal and chronic atrophic gastritis.

Bitter glycosides is contraindicated in cases of increased gastric secretion, with ulcer of the stomach and duodenum.

To evaluate medicinal raw materials containing bitter glycosides, a biological assessment, called the bitter glycosides indicator, is used. The bitter glycosides indicator is the lowest concentration of a substance in an aqueous decoction, at which a bitter taste is captured.

Control is a comparison with a solution of brucine 1: 4,800,000 or hydrochloric quinine by 1: 100,000.

To determine, take 10 tubes into which the test extract is poured with different concentrations as follows: 9 ml of extraction are poured into the first tube and 1 ml in the last tube, bringing the contents of the tubes to 10 ml. Then the control of the above substances with a bitter taste is put in, filling the test tubes with the same principle.

The contents of each test tube taste, then rinse the mouth with water and check with the control. The test tube, where the lowest concentration of substance with a bitter taste is noted and is taken as a bitter glycosides indicator - according to Vazitsky.

Therefore, the study of raw materials containing bitter glycosides is necessary for the practical activities of the pharmacist.

Technological card of laboratory activity

Theme	**Medicinal plants and raw materials containing bitter glycosides**
Aim and tasks	To master medicinal plants and raw materials containing bitter glycosides. Teach students to work independently and make accurate conclusions.
The content of the learning process	The formation of students' ability to consolidate practical skills in the morphological description of plants, to establish the authenticity, good quality and purity, as well as the use, medicinal preparations and methods of chemical analysis of medicinal raw materials.
Technology for conducting the educational process	Methods - "Brainstorming", "Conversation", "Explanation", "Boomerang", "Turntable" The form is a laboratory activity, in groups and separately Equipment - tables, handouts, herbarium and raw materials of medicinal plants, slides, microscopes, chemical reagents and devices Control - written and oral questioning, observation, self-control Rating - promotion, according to the 100th rating system

Expected results	Full learning materials and formation of knowledge on the topic, ability to work on new technologies Teacher: to assimilate and introduce into the educational process new pedagogical information technologies, to work on themselves. Student: 1) learn how to work independently. Defend his\her point of view; 2) find additional literature on this topic, work with it, analyzing your opinion and the opinions of the group, make a decision, develop your knowledge and skills.
Future plans (analysis, changes)	Work with literary sources; ability to work on modern technologies.

Structure and timing of laboratory activity

1. Identification of the baseline -30 min

2. Correction of the initial level -10 min

3. Self- study of students -100 min

4. Results of work performed and control

registration of students' minutes -during the lesson

5. Final control and discussion results -15 min

6. Homework for the next laboratory activity -5 min

LABORATORY ACTIVITY

1. Study of objects: a dandelion, a shamrock, a gold-thousander.

Characteristics of work:

A) Study of external signs of medicinal plants and raw materials of dandelion, trefoil, centaury;

B) Microscopic examination of the dandelion root (transverse and longitudinal sections);

C) Micro chemical reaction to inulin (Molish reaction);

D) An organoleptic study of the bitter glycosides indicator according to the method of Vazitsky (orally).

Questions for self-study

1. The concept and classification of iridoids.
2. Physic-chemical properties of iridoids. The use of medicinal plant raw materials containing bitter glycosides in medicine.
3. Characterization of monoterpene glycosides, qualitative reactions to arbutin.
4. Methods for determining the indicators of bitter glycosides.
5. The name of the plant, raw materials and family of trefoil. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms
6. Name of plant, raw material and family of dandelion. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Anatomical structure. Chemical composition. Application in medicine and medicinal forms
7. The name of the plant, raw materials and the family of a thousand-thousandths. Morphological description of the plant and the appearance of raw materials. Distribution, collection and drying. Chemical composition. Application in medicine and medicinal forms

Medicinal plants and raw materials containing monoterpene glycosides (bitter glycosides)

Dandelion root and roots with herb - Radix Pitchaxaci et radix Pitchaxaci cum herba

Name of the plant. Dandelion officinalis - Pitchaxacum officinale Web.
Family. The Asteraceae

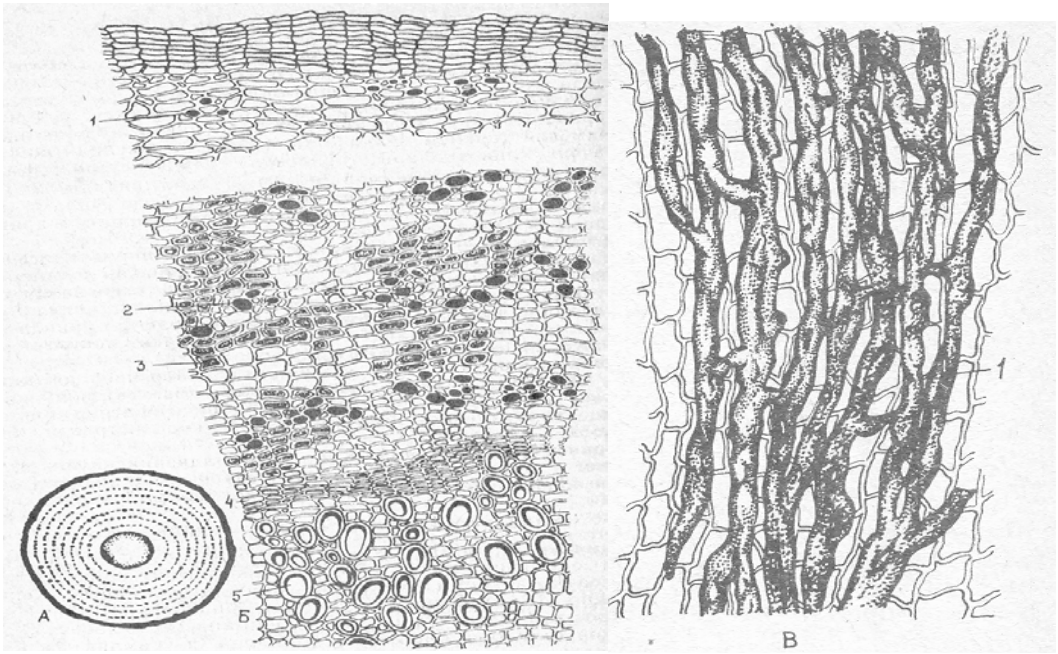
Perennial herbaceous plant up to 40 cm high with stem roots, containing in all parts of the lacteal, very bitter juice. Rosette leaves numerous, pressed to the soil or raised, broadly ovate, large-toothed. There are several flower arrows that they are hollow inside. The inflorescence is an anthodium, the wrap is two-row, the inner row consists of leaves that are lowered, shorter than the upper ones. floral receptacle is naked, pitted. Flowers - semiflosculous, bisexual with a tuft. The fruit is seed, gray-brown, oblong, narrowed at the top in the nose, bearing a long leg flossus.

Appearance of raw materials. Roots are entire, pivotal, simple, up to 12 cm in length, 0.5-1.5 cm in diameter. The surface of the root is longitudinally-

wrinkled, the fracture is even, the color outside of young thin roots is brown, and the old ones have a dark brown color. Odorless, the taste is bitter.

Under the lump on the transverse section of the root, there is a distinction between the whitish bark and the light yellow wood. In the cortex, there are numerous gray concentric lines, representing groups of cut lacrimal tubes. For raw materials - roots with herb - the leaves are also characteristic oblong-lanceolate, narrowed to base, pinnate-pinnately cut, blades inclined downward; inflorescence - apical anthodium. Flowers are all semiflosculous, yellow.

Microscopy. Transverse and longitudinal sections of the root in chloral hydrate.



А - transverse section under the magnifying glass and Б - transverse section under the microscope; В - tangential section.

1 and 2 - latex tube, 3 - cells with inulin; 4 - cambium; 5 - vessels.

Chemical composition. Bitter glycoside is pitchaxacin and pitchaxacerin. In latex tube juice - resinous substances, sterols, triterpene compounds, 40% of inulin and up to 20% of sugars. Inflorescences and leaves contain carotenoids, vitamin B2, triterpenic alcohols.

Application. Applied as bitter glycosides for the excitation of appetite and as a cholagogue. It is part of the appetizing and cholagogue collections. There is also a thick extract - Extractum Pitchaxaci spissum. Dandelion juice is used from freckles and liver spots.

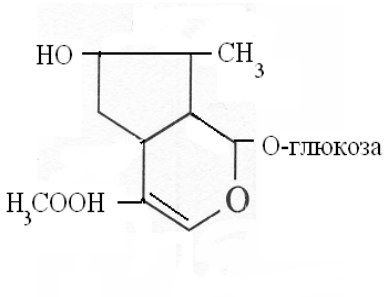
Leaf of the Trefoil - Folium Menyanthidis

Name of the plant. Trefoil (shamrock) - Menyanthes trifoliata L.
Family. Menyanthaceae

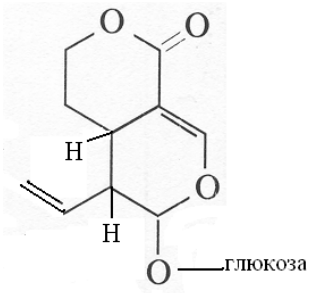
Perennial herbaceous plant with a long, creeping, cocked, thick root. Leaves are simple triple, separate, alternate, long petioled to 30cm. Petioles at the base are extended into long, vaginal cramps with a membranous margin. Leaflets short petiolate elliptical or oblong-obovate, dull, entire or slightly wavy. The flower arrow is leafless, leaves the sinus of one of the leaves and carries a dense brush of flowers on top. Flowers are pale pink or white. Cup with five accrete lobes; Corolla funnel-shaped with five-bladed arching. The fruit is single-caved, round ovoid, with a pointed capsule at the top, which opens with two valves.

Appearance of raw materials. The leaves are simple, deep dividing with the remainder of the petiole about 3 cm in length. The lobes of the plate are elliptical or obovate, obtuse, glabrous, entire; the main vein widens toward the base. The taste is very bitter (pg = 1: 10000), without odour.

Chemical composition. The leaves contain bitter glycosides - loganin, sveroside, flavonoids (rutin, hyperoside), up to 3% tannins, traces of alkaloids, iodine.



loganin



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Application. Assign as bitter glycosides; is included in the collection of appetite, choleretic and soothing. A thick extract is a part of a complex bitter tincture - Tinctura amara.

Centaury herb - Herba Centaurii

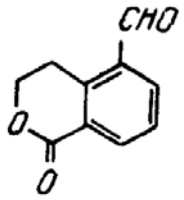
Name of the plant. Common centaury - Centaurium umbellatum Gilib. (Erythraea centaurium Pers.)
Family: Gentianaceae

Annual or biannual herbaceous plant. The aerial part consists of the radical leaves and the unbranched stem. Stem length up to 35-40 cm. The stem is tetrahedral, 2 cm in diameter. The whole plant is naked. Radical leaves are obovate, with 5 curvinervate veins, obtuse, petiolate. Stem leaves are opposite, semi-complex, elongate-ovate or lanceolate, 3-5 parallel veins. Flowers are collected in corymbose inflorescences; Calyx almost twice shorter than tube, dissected into 5 linear-subulate segments. Corolla with long cylindrical tube, nail-shaped, and five separate bright pink, occasionally white bend

Stamens - 5, pestle with a small ovary, short, with a posture that is lagging behind the fetus and a bifid stigma. Fruit - a cylindrical, almost two-cavity box with chalky seeds.

Appearance of raw materials. Whole plants connected to bundles. Steels with leaves. The stem is tetrahedral, up to 25 cm, 2 cm in diameter. Leaves are obovate, lanceolate, with 5 curvinervate veins, obtuse, 3-5 cm long, 1 cm wide. The taste of raw materials is bitter. The bitter glycosides indicator is 1: 2000.

Chemical composition. Contains bitter glycosides, of which the main ones are gentiopicrine and erythrocentaurin.



Erythrocentaurine

Alkaloids in an amount of 0.6-1%. The main alkaloid is erythricin, identical to gentianin. Contains flavonoids.

Application. Administered as bitter glycosides; is part of the bitter gathering and bitter tincture.

ASSESSMENT OF STUDENTS` KNOWLEDGE

Determine level of training for tasks and assimilate of the topic in various stages of laboratory activity of students during the engagement in written and oral questions, as well as other methods of pedagogical technology ("Conversation", "Boomerang", "Turntable" "Brainstorm").

Training "Boomerang" (II-nd laboratory activity)

Students are divided into groups and each group is given its own task on the topic of the lesson. Each group of 3 to 4 students expresses their opinion and make discussions between the groups in the form of questions and answers.

Task for the I st group

1 Morphology of the centaury.
2. Chemical composition of raw trefoil.
3 Use of dandelion raw materials.

Task for the II nd group

1. Morphology of the dandelion.
2. Appearance of a centaury.
3. Microscopy of dandelion raw materials.

Task for the III rd group

1. Morphology of the shamrock.
2. Chemical composition of dandelion.
3. The use of bitter glycosides.

Training "Turntable" (II laboratory activity)

In this training students are divided into 3 - 5 groups, each group is given the same table. Students fill it themselves, then 3 - 5 times the table goes to other groups in a circle, again the students express their opinion, at the end with the help of the teacher, the material presented in the table is summarized, the correct answers are found during the discussion.

Determine a family of these plants in Latin

№	Plan`s family / Plant`s name	Gentianaceae	Lamiaceae	Menyanthaceae	Asteraceae
1.	Dandelion Taraxacum officinale				
2.	Trefoil,				

	shamrock				
3.	Common centaury				

Determine the raw materials of plants

№	Raw`s name / Plant`s name	roots	herb	leaves	fruits
1.	Dandelion Taraxacum officinale				
2.	Trefoil, shamrock				
3.	Common centaury				

Situational tasks:

1. Explain the methodology for determining the indicators of bitter glycosides.
2. What do we pay attention to when studying the root of a dandelion microscopically?
3. Explain the classification of bitter glycosides.