ODESSA NATIONAL MEDICAL UNIVERSITY

Department of General and Clinical Pharmacology and Pharmacognosy

METHODICAL DEVELOPMENT OF THE LECTURE

Course: "Pharmacognosy"

Lecture № 16

"Tannins. General characteristics Methods of qualitative and quantitative determination. Medicinal plants and raw materials that contain procyanidins and tannins. "

Course: 3rd Faculty: medico-pharmaceutical

The lecture was discussed
at the methodical meeting
departments
30.08.2024

Head department

MD, prof. JV Rozhkovsky

Odessa - 2024

Lecture № 16 “Tannins. General characteristics Methods of qualitative and quantitative determination. Medicinal plants and raw materials that contain procyanidins and tannins. " (2 hours)

1. ***Actuality of theme. Rationale for the topic.***

This topic continues the study of LR and LRS containing phenolic compounds. The properties inherent in high molecular weight tannins, namely - the ability to interact with proteins, give them medical value as agents with astringent, anti-inflammatory, hemostatic action, as well as antidotes for poisoning by alkaloids and salts of heavy metals. The industry also has a very high demand for raw materials containing tannins, which makes knowledge of these plant sources important not only for the professional training of pharmacist students.

2. ***Objectives of the lecture***

-educational:

- to acquaint students with features of a structure, classification of tannins;

-to form an idea of the relationship between the molecular weight of tannins, their chemical properties and pharmacological action;

-to draw students' attention to the special properties of tannins - antidotes for poisoning.

-educational:

Education of students of professional thinking, conscious attitude to the choice (replacement) of available herbal medicines astringent action

3. ***Lecture plan and organizational structure***

	The main stages of the lecture and their content	Goals in levels of abstraction	Type of lecture, lecture equipment	Time distribution
	2	3	4	5
I. **1.** **2.**	**Preparatory stage** Defining a learning goal Providing positive motivation			5%
II. **3.**	**The main stage** Teaching lecture material Plan: 1. General characteristics of tannins - definition of the concept	 I	Combined, tables, overhead projector, slides, herbarium LR, samples LRS, preparations	90%

	- classification 2. Tannins (DR) that hydrolyze: - classification, - distribution, - ф.-х. properties, - selection and research - activity, application - LR and LRS containing hydrolyzing dr 3. Condensed tannins: - definition of the concept - distribution, - activity, application - LR and LRS, containing condensed d.r.	I I II II II- III II II II III I II II III		
III. 4. 5. 6.	The final stage Summary of the lecture, general conclusions. Lecturer's answers to possible questions. Tasks for self-preparation		References , questions, tasks	5% 2% 2% 1%

4. Contents of lecture material:

-structural and logical scheme of the lecture

-text of the lecture *(attached).*

5. Materials on activating students during the lecture:

Question:

1. What is "tanning"?
2. Which plant's name is associated with the tanning process? tannins
3. What is LRS oak?
4. What other plant species contain tannins and in which organs?
5. What phenolic compounds are part of tannins and cause bactericidal action?

6. What chemicals can not be used to prepare dosage forms containing tannins?
7. What is a galley?

Situational tasks:

1. Explain what physicochemical properties of real tannins are associated with their use in the processing of animal skins in light industry.
2. Choose from the list of plant sources of tannins that grow in Ukraine: downy oak, Lusitanian oak, sumac, blueberries, pistachios, tea bush, bird cherry.
3. Distribute LRS according to the predominant content of A) -Dr. C-Tea leaves; 4- oak bark; 5- cherry fruits; 6-rhizome of the coil.

Solution: A-1.6 B- 2,3,4,5.

General material and methodological support of the lecture:

- educational premises: lecture hall (Malinovsky, 37);
- equipment: overhead projector (or multimedia projector), screen;
- illustrative materials: slides, herbariums of LR, samples of LS, packed up LRS, pharmaceutical preparations.

Question

A. Definition of "tannins".
B. Localization of tannins in plant organisms.
4. Physico-chemical properties of tannins.
5. Methods isolation and research of tannins.
6. What types of raw materials are used for the industrial production of tannin?
7. What phenolic compounds are part of tannins and cause bactericidal action?

Situational and test tasks

1. Tannins are:
   A. Derivatives of polyhydric phenols
   B. Anthracene derivatives
   C. Derivatives of simple phenols
   D. Glycosides of phenol alcohols
   E. Condensed anthracene derivatives

2. Tanninum in medical practice is used as:
   A. Astringent and hemostatic agent
   B. Antispasmodic
   C. Antistatic
   D. Antiviral
   E. Antitumor agent

3. One of the components of the drug "Tanalbin", which has a specific effect on the intestinal tract, is
   A. Tannin
   B. Catechin
   C. Pyrogallol
   D. Floroglucin

E. Pyrocatechol

4. Name the plant, the decoction of the bark of which gives a solution of iron ammonium alum black and blue color:

A. Oak
B. Cherry
C. Buckthorn
D. Guelder rose
E. Zhostir

5. To determine the identity of the raw material to the decoction of the roots of rodovik added a few drops of a solution of iron, ammonium alum. The appearance of black and blue color indicates the presence of raw materials:

A. Tannins
B. Vitamin C
C. Anthracene derivatives
D. Simple phenols
E. Coumarins

6. From LRS tannins are extracted:

A. Hot water
B. Chloroform
C. Benzene
D. Ethyl acetate
E. Diethyl ether

7. Halotanines are

A. Tannins that hydrolyze
B. Tannins that do not hydrolyze
C. Tannins are the fruit of alder
D. Condensed derivatives of catechins
E. Flavonoids

8. Choose from the list of LRS used for industrial tannin production in Ukraine: Turkish Gauls; sumac leaves, birch leaves; bark of common oak; rhizomes of the coil; sumac leaves; blueberries.

9. Identify sources of tannins from the flora of Ukraine and indicate the appropriate LRS:

1. Wild strawberries	A. Cortex Querci
2. Oak is ordinary	B. Fructus Fragariae
Z. Lusitanian oak	B. Rhizomata Bergeniae
4. Tanning sumac	G. Fructus Padi
5. Succulent ordinary	D.Folia Cotini coggygriae
6. Badan thick-leaved	E. Folia Rhus coriariae
7. Common bird cherry	J. Galla Turcicae

The right decision: 2-A; 4-E; 5-D; 7-D

10. Which of the organs of the foxglove is used as a LRS:
A. Rhizomes
B. Leaf
C. Rhizomes with roots
D. Grass
E. Roots

Question

1. Define the term "flavonoids".
2. Describe the distribution of flavonoids in the plant world.
3. On what grounds is the classification of flavonoids based?
4. Which factors affect the accumulation flavonoids in plants?
5. 3 What types of raw materials are obtained on an industrial scale routines?

Test tasks

1.Flavonoids are:
A. Diphenylpropane derivatives
B. Polymeric phenolic compounds
C. Derivatives of simple phenols
D. Anthracene derivatives

2.It is known that the first flavonoids that were isolated were yellow. Colorless flavonoids include:
A. Leukoanthocyanidins
B. Anthocyanidins
C. Flavones
D. Chalconi

3.Rutin shows vitamin P activity. For the industrial production of rutin use raw materials:
A.Alabastra Sophorae japonicae
B.Herba Bidentis tripartitae
C. Fructus Hippophaes rhamnoides
D. Herba Polygoni avicularis

4. Catechins are:
A. Derivatives of flavan
B. Biflavonoids
C. Chromone derivatives
D. Aglycones of isoflavonoids

5. Most often used to detect flavonoids in raw materials
A. Cyanidin reaction
B. General sedimentary reactions
C. Lactone test
D. Foaming reaction

6. The level of flavonoid accumulation in LRS depends on many factors, including the phase of plant development. Their maximum number in the raw material of the field wolf corresponds to the phase

A. Vegetation after fruiting
B. Flowering
C. Vegetation before flowering
D. Fruiting

8. Literature used by the lecturer to prepare the lecture

- additional

1. Фармакогнозія: підручник (I—III р. а.) / І.А. Бобкова, Л.В. Варлахова. – 3-є видання Всеукраїнське спеціалізоване видавництво «Медицина» 2018, 504с.
2. Фармакогнозія: базовий підручн. для студ. вищ. фармац. навч. закл.(фармац. ф-тів) IV рівня акредитації / В.С. Кисличенко, І.О. Журавель, С.М. Марчишин та ін.; за ред. В.С. Кисличенко. – Харків: НФаУ: Золоті сторінки, 2015. - 736 с.
3. Навчальний посібник з дисципліни «Фармакогнозія» / Я. В. Рожковський, Б. В. Приступа, І. А. Бойко, Н. В. Герасимюк, В. В. Черногорюк -: Методична розробка кафедри фармакогнозії ОНМедУ. – Одеса: ОНМедУ, 2019 – 51 с.
4. Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1500 с.

Додаткова література:

1 Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
2. Сербін А.Г., Сіра Л.М., Слободянюк Т.О. Фармацевтична ботаніка. Підручник. – Вінниця: НОВА КНИГА, 2007. – 488 с.
3. Практикум з ідентифікації лікарської рослинної сировини: навч. посіб. / [В. М. Ковальов, С. М. Марчишин, О. П. Хворост та ін.] ; за ред. В. М. Ковальова, С. М. Марчишин. – Тернопіль: ТДМУ, 2014. – 250 с.
5. Pharmacognosy with the basics of phytotherapy A. Pastushenkov, N. Bespalova Phoenix Publishing House 2016.

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

LECTURE TEXT
TANNING SUBSTANCES

General characteristics

Dr. (Tannins, tannins) - a complex of low- and high-molecular polyphenols, genetically related, have a tart taste and show duplicating properties.

The tanning properties of animal skins are based on the interaction of T. with collagen (a skin protein), which results in the formation of structures that are resistant to the process of decay.

The name D.R. plant extracts with this property gave the French. researcher Segen in 1796

Classification

1 - Depending on the molecular weight and tanning ability of the skin, tannins can be divided into:

-Pseudotanins (have a tart taste, but devoid of duplicating properties), have a low molecular weight. mass (up to 1,000) are food tannins, tea tannins;

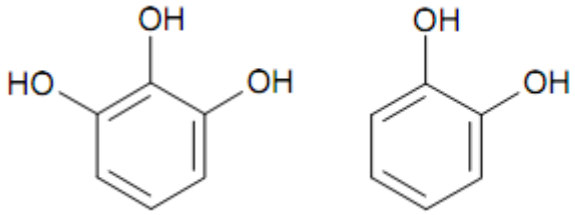
real tannins - dr, able to tan the skin, turning it into skin. Have MM from 1,000 to 20,000;

-high-molecular tannins - compounds with MM more than 20,000, ineffective for tanning, as they cannot pass between the collagen fibers in the animal's skin.

2- (Procter's classification) on the decomposition products when heated to 180-2000 without air access:

- pyrogallol -pyrocatechol

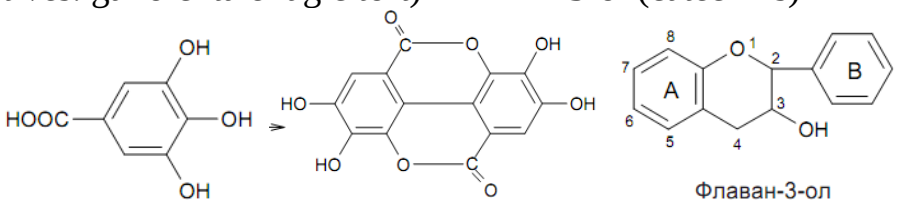
(form pyrogallol) (form pyrocatechin)



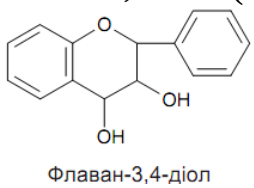
3. (K. Freindberg's classification) by natural composition and chemical properties:

dr. hydrolyzed -dr, hydrolyzable (derivatives: Flavan-3-ol (catechins)

(derivatives. galloic ita ellagic to-t)



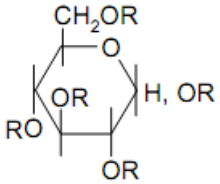
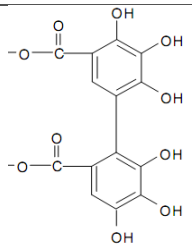
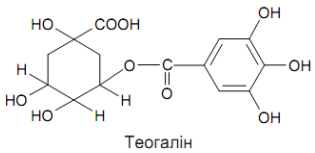
Flavan-3,4-diol (leukoanthocyanidins)



Oskistilbene

DR, hydrolyzed under the influence of acids, enzymes and alkalis are broken down into simple phenolic compounds and the sugar part.

By d.r., hydrolyzed include:

-gallotanins (esters of gall to-you and sugars)	-ellagotanins (complex - nesaccharide esters of ellagic to-you	(non-saccharide esters of phenolic carboxylic acids and sugars)
		 Теогалін
Total f-la gallotannins (R-residue of mono-, di-, tri-, tetra-, penta- or polyhallus)	Alnitanine (Glu-glucose residue)	Ester of gallic and quinic acid - in green tea

The sugar part m.b. represented by: glucose, arabinose, glucose, lactose, fructose, sucrose or instead of sugar - quinic or oxycinnamic acids, flavan.

Condensed dr.under the influence of acids are not hydrolyzed, but form more complex compounds, ie condense. These include derivatives of catechins, leukoanthocyanidins and oxystilbene.

Distribution and localization

Dr. found mainly in higher plants. A lot of them in the pods of cesalpinia (up to 45%). Hydrolyzed drugs (about 64%) accumulate in pathological formations - galls on the leaves of sumac, oak.

Physico-chemical properties

Macromolecular dr. (Real tannins)- amorphous colorless substances, astringent to taste, well soluble in water, etc. Polar solvents (alcohols), insoluble in chloroform, benzene, petroleum ether.

Low molecular weight dr. - crystalline substances that do not interact with the protein of the skin, but have a tart taste.

Most DV optically active, easily oxidized in air, acquiring a darker color. Oxidized condensed tannins are called flobafen.

Dr. form colored complexes with salts of heavy metals.

With gelatin, lead acetate and salts of alkaloids give precipitates.

Methods of selection and research

From the raw material are isolated with hot water, and then purify the extract with chloroform, ether, ethyl acetate. Low molecular weight dr isolated by chromatography.

Qualitative reactions:

1. With iron-ammonium alums: hydrolyzed - dark blue, condensed - dark green color.

2.- With lead acetate (10%): hydrolyzed dr. - precipitate, and condensed dr. - remain in solution (so they can be separated when together in solution)

3. With gelatin (1%) - first there is a mud, which disappears when you add excess gelatin.

4. With salts of alkaloids - an amorphous precipitate is formed.

5. With formaldehyde and hydrochloric acidcondensed dr. In the filtrate - hydrolyzed dr. - When adding lead acetate or iron-ammonium alum - black-blue or purple color.

6. With acetic acid and medium lead acetate: hydrolyzed dr. - precipitate, and in the filtrate - condensed dr., which with the addition of w / a alum and crystalline lead acetate - black and green color.

7. With vanillin and conc. hydrochloric or 70% sulfuric acid: condensed dr give a red color.

Chromatographic analysis used only for low molecular weight tannins.

Quantitative definition: potassium permanganate in an acidic environment in the presence of an indicator of indigosulfonic acid (Leventhal method).

Determination of catechins - photoelectrocolorimetric method.

Biological action and application

1-Directly acting on cell membranes, smooth muscle cells, enzyme proteins and nucleic acids;

2 affect the metabolism of biologically active substances (adrenaline, ascorbic acid, acetylcholine)

3 affect the leading neurohumoral and neuroendocrine systems

The main types of pharmacological activity DV:

- Viscous (for colitis, gastritis, enteritis);

-anti-inflammatory (for inflammation in the mouth, larynx, nose, burns, bedsores, ulcers);

-antibacterial;

-hemostatic (as a remedy for uterine and hemorrhoidal bleeding);

-P-vitamin (catechins and flavanes-3,4-diols);

-radioprotective (isotopes of strontium and cesium are released from the body);

- Antidotes (for poisoning by alkaloids and salts of heavy metals).

LR AND LRS, WHICH CONTAIN TANNING SUBSTANCES

Hydrolyzable tannins of the gallotannin group:

Sumakh leaves- Folia Rhois coriariae (Rhus coriaria, Anacardiaceae). Yu.B.K. Prepare before or at the beginning of the count. Shadow drying.

Chem. storage: dub.rech.-25-33%: gallotannin, head to-tua; flavonoids, essential oils, vit. C, starch, resin

Action and application: Bactericidal, anti-inflammatory, reparative. Source of prom. obtaining tannin. "Tannin" -r-r, "Novikov's liquid".

Sumac leaves - Folia Cotini coggygriae (Cotinus coggygriae, Anacardiaceae)

Chem. storage: oak. substances -20-40%: gallotannin, head to-that; flavonoids, essential oils, camphor

*Action and application:*Anti-inflammatory, capillary-strengthening, reparative, astringent, choleretic, hepatoprotective. Source of prom. obtaining tannin. "Tannin", "galascorbin" -tab., "Flacumin" -tabl., "Neo-Anuzol" -supposit.

Rhizomes of bergamot - Rhizomata Bergeniae (Bergenia crassifolia, Saxifragaceae).

Altai, Transbaikalia, Southern Siberia. Preparation. during the summer to autumn. Drying 40-45 ºC.

Chem. storage: a mixture of gallotannins and condensation. oak. substances (25-27%), catechins, isocoumarin with the remains of gallov.k-ti - bergenin (5%); arbutin (5%), flavonoids, phenolic acids (head to), starch.

Action and application: Astringent, anti-inflammatory, regenerating, hemostatic. Decoction, cream "Talita".

Rhizomes and roots of rodovik - Rhizomata et radices Sanguisorbae, Rosaceae)

Chem. composition: oak. hydrolyzable substances (23%), galva and ellag. to-you, pyrogallol, catechin, halocatechin; flavonoids, Sapon. (sanguisorbin and poterine), starch, essential oils, sterols, calcium oxalate.

Action and application: Anti-inflammatory, hemostatic. Decoction, liquid extract.

Rhizomes of the coil - Rhizomata Bistortae (Polygonum bistorta, Polygonaceae)

Chem. storage: oak. substances that are hydrolyzed (up to 35%), head to-that, ellag to-you; oxymethylanthraquinones, flavonoids (catechins), chlorogenic acid, starch.

Action and application: Astringent, anti-inflammatory, hemostatic. Decoction, liquid extract.

Condensing tannins, elagotanin groups:

The fruit of the alder- Fructus Alni (Alnus incana, A.glutinosa, Betulaceae). in autumn or winter, the fruits are woody.

Chem. storage: oak. substances (up to 30%): elagotanins (alnitanines, etc.), gallotannins (2-3%), ellagic to-head, head to-that; flavonoids, triterpenoids, steroids, w. oil (up to 16%), higher. to you and higher. aliphatic. alcohols.

Action and application: Astringent, anti-inflammatory, wound healing, antioxidant. Decoction, "Altan" -tab., Ointment, "Camilal-suppos.

Condensed dr.

Oak bark - Cortex Quercus (Quercus robur, Q.petreae, Fagaceae) air drying.

Chem. storage: condensation. oak. substances (8-12%), ellagic to-ta, gal to-ta; phenols (resocin, pyrogallol), flavonoids (catechin, quercetin, leukoanthocyanidins), triterpene. saponins of the damaric series, carbohydrates.

Action and application: Astringent, anti-inflammatory. Decoction and complex .: tonsilgon H, Polyfitol-1, Fitulvent, Stomatophyte, balm "Grail".

Rhizomes of foxglove - Rhizomata Tormentillae (Potentilla erecta, Rosaceae)

Chem. storage: oak. condensing substances. (30%), ellagic k-ta, flobafen; free phenols (pyrocatechin, phloroglucin), phenolic acids (gallic, coffee, coumaric), catechin, anthocyanins, triterpene. saponins, EM, starch, resin, gum.

Action and application: Anti-inflammatory, astringent, reparative, wound healing, choleretic. Decoction and complex: "Wundehil" -ointment, Polyfitol-1-tincture, Linkas-syrup and lozenges, hemorrhoid-suppository.

Fruits, leaves of blueberries- Fructus; Folia Myrtilli (Vaccinium myrtillus, Ericaceae). Leaves -during flowering, drying in the air; fruits - 50-70 ° C.

Chem. storage: oak. condensing substances. (L.-up to 20%); fruits: a mixture of anthocyanins, org. to-you, catechin, sugar, pectin, carotenoids; leaves: flavonoids, arbutin (up to 1%), hydroquinone, asc. to (up to 250 mg%).

Action and application: Astringent, antiseptic, hypoglycemic, detoxifying. Decoction, antidiab. Collection "Arfazetin", drops "Chernega".

Cherry fruits - Fructus Padi (Padus racemosa, Rosaceae). Drying 40-500 ° C.

Chem. storage: конденс.дуб. substances (4.5-8%); anthocyanins, monosaccharides, org. to-you, phenolic. to-you (chlorogenic), pectins. substances.

Action and application: Binder. Broth. Infusion.

Tea leaves- Folia Theae (Thea sinensis, Theaceae) Horn. forests of southern China and Indochina. Cultivated! Preparation. flush (3 young leaves). Drying: green tea-shade area, black-in dryers, 40-50 ° C after fermentation.

*Chem. storage:*condensation. oak. substances, catechins, flavonoids, purine alkaloids: Caffeine, theophylline; EM, vitamins SV1, B2, PP.

Action and application: anti-inflammatory, radioprotective, tonic, P-vitamin, antioxidant; antidote. Infusion, "Those Green Health" -capsules, balm "Grail".

Grass cuffs - Herba Alchemillae (Alchemilla vulgaris, Rosaceae)

Chem. storage: condensation. oak. substances, catechins; flavonoids, phytosterols, vit. C (up to 210 mg%), resinous substances, monosaccharides.

Action and application: Anti-inflammatory, hemostatic, antiseptic. Infusion.

Rhizomes and roots of the common viper- Rhizomata et radices Filipendulae hexapetalae (F.hexapetala = F.vulgaris, Rosaceae). All of Ukraine, except the Carpathians.

Chem. storage: condensation. oak. substances (up to 5.9%), phenologlycoside gaulterin (in hydrolyzate-salicylic aldehyde); flavonoids, chalcones, starch.

*Action*and application: Anti-inflammatory, hemostatic, astringent, diuretic, antihemorrhoidal. Infusion.