

MINISTRY OF HEALTH OF UKRAINE  
BOGOMOLETS NATIONAL MEDICAL UNIVERSITY

**HANDBOOK**  
**on manufacturing practice on**  
**standardization of herbal medicines**  
**for auditory and independent students**  
**work**  
**Laboratory handbook**

**Direction:** second (master's) level of higher education

**Specialty:** 226 "Pharmacy, industrial pharmacy"

**Department:** Pharmacognosy and botany

**Name**

---

**Course**

---

**Group**

---

KYIV - 2024

**UDC 615.322(076.5)**

**Handbook on on manufacturing practice on standardization of herbal medicines for auditory and independent students work. Laboratory handbook. /** Minarchenko V. M., Karpiuk U. V., Cholak I. S., , Makhynia L. M., Pidchenko V.T., Kovalska N. P., Dvirna T. S., – Kyiv., 2024. – 62 p.

Approved at the meeting of the department on August 28, 2024, protocol No. 1  
Considered and approved: CMC on specialty 226 "Pharmacy, industrial pharmacy"  
dated August 30, 2024, protocol No. 1

**Reviewers:**

*Zhuravel I.O.*, professor, doctor of pharmaceutical sciences, professor of Pharmacognosy and Nitriciology Department of National Pharmaceutucal University

*Sholoiko N.V.*, Associate Professor, Candidate of Pharmaceutical Sciences, Associate Professor of Department of Organization and Economy of Pharmacy, of Bogomolets National Medical University

The diary is intended for recording the results of research on industrial practice for the standardization of herbal medicines in accordance with the working curriculum and calendar and thematic plan.

The publication is intended to be used for studying the discipline - industrial practice on standardization of herbal medicinal products and studying individual sections of professionally oriented topics in the discipline in order for students to master knowledge on standardization of herbal medicinal products and medicinal products based on it.

The diary is supplemented with topics for extracurricular study for self-study of students

© Minarchenko V. M., Karpiuk U. V., Cholak I. S., , Makhynia L. M., Pidchenko V.T., Kovalska N. P., Dvirna T. S., 2024

## CONTENT

Safety instructions for industrial practice	4
Topic 1: Standardization of the living resources and medicinal products based on them. Problems of standardization of medicinal products and herbal medicines. General provisions and articles of the State Pharmacopoeia on the study of the quality of the medicinal products and herbal medicines.	7
Topic 2. Pharmacopoeial methods of research to confirm the quality of the analyzed herbal medicines. Rapid methods of study of the main groups of BAS.	14
Topic 3. Classification and prescription of herbal remedies (herbal remedies, collections, briquettes, tinctures, extracts, essential oils, teas)	27
Topic 4. Development of quality control methods for herbal medicines for various purposes. Additional quality indicators for herbal medicines and preparations based on it	30
Topic 5: Development of choleric and diuretic herbal preparations and standardization of their components.	37
Topic 6: Development of antiseptic and anti-inflammatory preparations based on raw materials containing essential oils and standardization of their components.	45
Topic 7: Development of hypoglycemic and sedative tea and standardization of their components	50
Topic 8: Development of vitamin tea and standardization of its components..	54
Topic 9: Development of laxative briquettes and tinctures for improving digestion and standardization of their components.	62
Topic 10: Analysis of a thick extract according to the monograph "Extracts".	70
Література	73

## SAFETY PRECAUTIONS

Execution of educational and scientific experimental work at the Department of Pharmacognosy and Botany in educational and research laboratories associated with various chemicals (organic solvents, acids, alkalis), plant materials using, different chemical utensils, equipment and devices. Therefore, in the laboratory spaces there are continuously possible dangerous and harmful factors which can effect on students. These factors can lead to work-related injury and fire hazards.

Students are admitted to practical training in chemical lab only after a detailed briefing on safety and fire precautions.

Each student works in the laboratory must know the location of fire fighting and be able to know where the first aid kit and know how to provide first aid for various injuries.

Experimental part begins only after a thorough acquaintance with chemical dishes, technique experiments, properties, purpose reagents and solvents used, and the rules of work with devices. The workplace should only has necessary reagents, instruments and a notebook to record results.

Before using glass and porcelain tableware check its purity and integrity. Do not work with the dishes that have chips, cracks, deep scratches.

All transactions with flammable liquids, concentrated acids and alkalis, experiments with the formation of gases and work with metallic sodium should be performed only in a fume hood, if necessary, should use personal protective equipment (masks, goggles, mask, gloves, etc.). Smell of substance in a test tube or flask determine carefully directing couples to himself flick of the wrist. Mixing and dilution of chemicals, accompanied by heat, spend with heatproof bowl and porcelain.

Do not allow heat flasks with inflammable liquids over an open fire, avoid getting water on the heated external surface of glass vessels, gently and carefully to treat laboratory glassware and equipment.

Acids and bases to dial in using only the dropper rubber pear, forbidden to absorb acid and alkali liquid in the pipette mouth, because it can cause burns and poisoning.

Heating of substances in hermetically sealed vessels (safety explosion!)is strictly forbidden. To prevent the release of liquid from the reaction vessel should be carried out uniformly heating the to put to the bottom of the vessel 2-3 boiling stones (pieces of porous inorganic material).

Heating tubes of substances should be carried out at periodic shaking, vent tubes should be directed away from yourself and others that work.

Take and carry glass with substances should, covering them with hand from side, not the neck.

Do not leave without supervision laboratory installation, operating and equipment included.

***It is strictly forbidden to drink water from the chemical dishes, eat, smoke at the laboratory.***

After work should be thoroughly washed and put to dry dishes, cups and place shtanhlyasy on their location, wipe the work surface of the table, close the gas and water valves, turn off appliances and exhaust ventilation.

*In case of pouring concentrated acid*, it must first fill with sand so that it is absorbed acid. Sand collect in the container and make out of room to place waste collection. Polluted place pouring rinse with water and wipe dry.

*In case of pouring concentrated and ammonia* - they can fill as sand and sawdust. Pouring place by weak solution of acetic acid after collecting sand or sawdust.

*In case of fire* in a laboratory situation should turn off gas appliances, exhaust ventilation and remove all flammable material from the fire area. Shouting loudly advertise on fire people working together and in neighboring areas.

It is necessary to take urgent measures to eliminate the fire using fire extinguishers or sand. Do not fill the flames with water that in many cases this leads to expansion of the fire. Only water-soluble substances (alcohol, acetone, etc.) quenched with water. In case of fire clothes should not run, you need to throw the victim's robe located in a prominent and accessible place.

**Provision for first aid** is the duty of everyone! In providing assistance priority should be to eliminate the cause of the injury, turn off the power grid, extinguish the flame, remove from the

wound pieces of glass or substance that causes burns, etc. ; the victim must create conditions for the most comfortable position and provide first aid.

If *cuts* must be removed with tweezers glass pieces of glass and wash the wound 3% solution of hydrogen peroxide. The skin around the wound grease 5% solution of iodine and apply a sterile bandage. In severe bleeding tourniquet and attach a note with precisely specified time imposing and send poterpitsloho doctor.

When I degree *thermal burns* (redness) burnt areas should be cool running water, while more severe burns to the provision of skilled care - apply dry aseptic bandage. Do not remove the skin from the burnt remains of clothes that burned.

*Burns by concentrated acids* affected skin should be washed with plenty of water for 10-15 minutes and then process the 2% solution of sodium bicarbonate and again rinsed with water.

*Burns by concentrated alkalis* affected area should be washed with plenty of water, and then - a 1% solution of acetic acid.

When *hit acids or alkalis to the eyes*, they should immediately wash with water for 10-15 minutes, then, if getting acid - 2% solution of sodium bicarbonate, and when it enters the meadow - isotonic sodium chloride solution for 30-60 minutes. After thorough rinsing eyes should consult a doctor.

After *burns by phenol* rub the affected area till restore the natural skin colour.

If poisoning by *gas substances* bring the victim to fresh air and create him complete rest and call a doctor.

When *electric shock* turn off power and, using a wooden or plastic objects poterpioho release from contact with electric wire. It is necessary to ensure the victim calm and bring it to life.

If *breathing or heartbeat stops* it's necessary to carry out artificial respiration and chest compressions and do not stop these operations to full functional recovery or the arrival of the medical workers.

**Safety precautions at work, harvesting, drying, processing and storage of plant material that contains toxic and potent substances (alkaloids, cardiac glycosides, etc.):**

1. Teenagers, students are allowed to collect only under the supervision of the responsible team leader or instructor. By collecting MP, which contain these substances, it is better to include the adult population to collect datura, henbane, hellebore teenagers do not allow!

2. During the assembly should not touch your eyes, the face, not to eat. After collecting wash hands thoroughly with soap and water.

3. During the processing, drying, sorting, packaging protecting mouth and nose with a respirator, wet gauze, eye - protective glasses. Do not take food or smoke.

4. After thoroughly shake out of clothes, wash clothes, wash the face with soap and water, wipe with a dust mask, goggles, gauze.

5. When the need to have a first aid kit.

6. To work with the potent and poisonous MP not allowed zhinkm pregnant and lactating.

**Name and signature of the student** \_\_\_\_\_





Identification C

Add a scheme of the chromatogram. Compare the results with the monograph on this type of MPM.

Mobile phase	Detection
The tested solution	Comparison solution

Chromatogram scheme

---

---

---

---

---

---

---

---

Impurities, %

---

---

Loss weight on drying, %

---

---

General ash, %

---

---



Quantitative determination, %

---

---

«Calendula tincture<sup>N</sup>»

Description

---

---

---

Identification A

Add a scheme of the chromatogram. Compare the results with the monograph on this type of MPM.

Mobile phase	Detection
The tested solution	Comparison solution

Chromatogram scheme

---

---

---

---

---

---

---

**Identification B**

Add a scheme of the chromatogram. Compare the results with the monograph on this type of MPM.

Mobile phase	Detection
The tested solution	Comparison solution

Chromatogram scheme

---

---

---

---

---

Ethanol, %

---

---

---

Dry residue, %

---

---

---

Quantitative determination, %

---

---

---

**Teacher's signature** \_\_\_\_\_

**INDEPENDENT STUDENTS WORK**

**Questions for student self-preparation for the practical lesson:**

1. Name the main documents that regulate the quality standards of medicines.
2. What factors determine the suitability of the drug for use?
3. Name national and international organizations that introduce standards and guidelines necessary to ensure the quality of pharmaceutical products.
4. What is the modern international concept of quality assurance of drugs?
5. What are the functions of the State Pharmacopoeia?
6. What issues are within the competence of the State Enterprise “Ukrainian Scientific Pharmacopoeial Center for Quality of Medicines”?
7. List the characteristics of medicinal products that are included in the main sections of monographs on medicinal products.
8. When did Ukraine start publishing its own pharmacopoeia and how many supplements have been published?
9. Provide a list of names that are classified as medicinal products according to the Law of Ukraine “On Medicinal Products”.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Lined writing area consisting of 30 horizontal lines.

**Teacher's signature** \_\_\_\_\_

**TOPIC 2:** Pharmacopoeial methods of research to confirm the quality of the analyzed herbal medicines. Rapid methods for the study of the main groups of BAS.

**TOPIC 2.1:** Pharmacopoeial methods of research to confirm the quality of the analyzed herbal medicines.

**Task 1.** To analyze pharmacopoeial methods for the study of various groups of BAS in herbal medicines.

a) chemical reactions;

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

б) chromatographic methods of research;

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



## INDEPENDENT STUDENTS WORK

### Questions for student self-preparation for the practical lesson:

1. Name the main documents that regulate the quality standards of medicines.
2. What factors determine the suitability of the drug for use?
3. Name national and international organizations that introduce standards and guidelines necessary to ensure the quality of pharmaceutical products.
4. What is the modern international concept of quality assurance of drugs?
5. What are the functions of the State Pharmacopoeia?
6. List the characteristics of drugs that are introduced in the main sections of monographs on the drug.
7. Name the qualitative reactions to the main groups of BAS.
8. What methods of chromatographic analysis are used to determine the main groups of BAS.
9. Name the physicochemical methods for the quantitative determination of the main groups of BAS.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





**TOPIC 2.2:** Express methods of studying the main groups of BAS.

**Task 1.** Carry out histochemical and microchemical reactions to confirm the presence of different groups of bioactive substances:

The name of the reagent	Conditions	The result of the reaction
<b><i>Reaction on cellulose (fiber)</i></b>		
with chlorine-zinc-iodine	Chlorine-zinc-iodine is applied to the cut of the root and the color is observed	
with iodine and sulfuric acid	Iodine with sulfuric acid is applied to the root section and the color is observed	
with an ammonia solution of copper oxide	An ammonia solution of copper oxide is applied to the cut of the root and the color is observed	
with Lugol's solution	Lugol's solution is applied to the root section and the color is observed	
<b><i>Reaction on mucilage</i></b>		
with methylene blue solution	A section of the altea root is placed for a few minutes in a solution of methylene blue in alcohol (1:5000), then transferred to glycerin	
with copper sulfate and alkali	A section of the altea root is placed for 5-10 minutes in a saturated solution of copper sulfate, washed with water and transferred to a 50% solution of potassium hydroxide	
with mascara solution (1:10)	Flax seed powder is placed on a glass slide in a drop of freshly prepared carcass solution (1:10) and mixed with a needle, covered with a cover glass and observed under a microscope	
with 3-5% sodium hydroxide solution	Flaxseed powder is placed in 1-2 drops of 3-5% sodium hydroxide solution, covered with a cover glass and examined under a microscope.	
<b><i>Reaction on inulin</i></b>		
Molish's reaction	A cross-section of the root of a dandelion or elecampane is placed in 1-2 drops of an alcoholic solution of $\alpha$ -naphthol (or thymol) and a drop of concentrated sulfuric acid is added	
<b><i>Reaction on starch</i></b>		
with Lugol's solution	1-2 drops of Lugol's solution are applied to a section of the altea root, covered with a cover glass and observed under a microscope	
<b><i>Reaction on lignified cell membranes</i></b>		
with 1% alcohol solution of phloroglucin	A section of altea root is placed on a slide in a 1% alcohol solution of phloroglucin and a drop of concentrated hydrochloric acid is applied to the section and a drop of glycerin is added after 1-2 minutes; cover with a cover glass and study under a microscope	
<b><i>Reaction on essential oil</i></b>		

with a solution of Sudan III	A section of the root is placed for several minutes in a solution of Sudan III and a drop of water or glycerin is added. Cover with a cover glass and observe under a microscope	
<b>Reaction on fatty oils</b>		
with a solution of Sudan III	A slice of castor seed is placed for a few minutes in Sudan III solution and washed with 50% alcohol and glycerol is added, covered with a cover glass and observed under a microscope	
<b>Reaction on anthracene derivatives</b>		
with a 5% solution of sodium hydroxide or ammonium hydroxide	A slice of castor seed is placed for a few minutes in Sudan III solution and washed with 50% alcohol and glycerol is added, covered with a cover glass and observed under a microscope	
<b>Reaction on tannins</b>		
with 1% ferric chloride or 1% aqueous solution of iron-ammonium alums	A slice of oak bark is placed in a drop of a 1% solution of ferric chloride or a 1% solution of iron-ammonium alum, covered with a cover glass, and the staining of the drug is observed under a microscope.	

**Task 2.** Carry out chemical reactions to confirm the presence of different groups of BAS:

The name of the reagent	Conditions	The result of the reaction
<b>CARBOHYDRATES. GLYCOSIDES</b>		
<b>Reactions on starch</b>		
preparation of paste	Place 1 g of starch in a 100 ml flask and add 50 ml of water. The mixture is heated for 5 minutes constantly stirring	
with iodine solution	1 drop of Lugol's solution is added to 2 ml of cooled starch paste	
with Fehling's reagent	To 2 ml of starch paste, add 2 drops of an aqueous solution of CuSO <sub>4</sub> (solution A) and 2 drops of an alkaline solution of ferric salt (solution B) and heat in a water bath	
<b>Reactions on cellulose</b>		
with iodine solution	A drop of iodine solution is added to the cellulose powder	
with iodine in a solution of zinc chloride and potassium iodide	Appropriate reagents are added to the cellulose powder	
<b>Reaction on inulin</b>		
with $\alpha$ -naphthol (Molish reaction)	A drop of $\alpha$ -naphthol and a drop of concentrated sulfuric acid are applied to a cross-section of the raw material (chicory root, dandelion, echinacea, amaranth)	
<b>Reactions on mucus</b>		

with a solution of alkali	2 drops of sodium hydroxide solution are applied to a cross section of the althea root	
with concentrated hydrochloric acid	1 ml of 10% infusion of althea root and 2 drops of concentrated hydrochloric acid are added to the test tube	
with a solution of lead acetate	Add 2 ml of a solution of lead acetate to 2 ml of a 10% infusion of althea root	
<b>FATS AND FATTY SUBSTANCES</b>		
<b><i>Reaction on seed oils (Bellier reaction)</i></b>		
with nitric acid and 0.15% resorcinol solution	2 ml of the tested oil is poured into the test tube, 1 ml of nitric acid and 0.15% solution of resorcinol in benzene are carefully layered. The contents are vigorously stirred	
<b><i>Reaction on seed oils (Bieber reaction)</i></b>		
with water and concentrated sulfuric and nitric acids	Place 2.5 ml of oil in a test tube, carefully add 1 ml of a cooled mixture of equal volumes of water and concentrated sulfuric and nitric acids	
<b><i>Reaction on fish oil</i></b>		
with chloroform	0.1 g of fat is dissolved in 1 ml of chloroform and 5 ml of a solution of stibium (III) chloride is added	
<b><i>Reaction on lanolin</i></b>		
with concentrated sulfuric acid	0.1 g of fat is dissolved in 5 ml of chloroform and carefully layered in a test tube with 5 ml of concentrated sulfuric acid	
<b>TERPENOIDS. IRIDOIDS. BITTERS</b>		
with Stahl's reagent	0.5 ml of Stahl's reagent is added to 1 ml of the extract, the mixture is heated in a water bath for 2 minutes.	
with Trim-Hill's reagent	0.5 ml of Trim-Hill's reagent is added to 1 ml of the extract, the mixture is heated in a water bath for 2 minutes.	
<b>ESSENTIAL OILS</b>		
<b><i>Reactions on aldehydes and ketones</i></b>		
obtaining oximes	3 drops of an alcoholic solution of hydroxylamine chloride (15 g of hydroxylamine chloride in 100 ml of 80% alcohol) and a few drops of methylene orange are added to 2 drops of essential oil	
nitroprusside reaction	5-10 drops of essential oil are mixed with the same number of drops of sodium nitroprusside solution and 3 drops of 5% alkali solution	
<b><i>Reactions on phenols</i></b>		
reaction with iron III chloride	3-4 drops of iron III chloride solution are added to 1 ml of concentrated alcohol solution of essential oil	
reaction of the formation of azo dyes	3-4 ml of 25% sodium hydroxide solution and 1-2 drops of diazotized sulfanilic acid are added to 1 ml of essential oil	
<b><i>Reactions on azulenogens</i></b>		

Ehrlich-Muller reaction	5 drops of essential oil are mixed in a test tube with 1 ml of reagent and heated in a water bath	
Sabetay's reaction	Dissolve 5-10 drops of essential oil in 1-2 ml of chloroform and add 0.1-1 ml of a 5% solution of bromine in chloroform drop by drop.	
<b>TRITERPENOIDS. STEROIDS. SAPONINS</b>		
foaming test	2-3 ml of the aqueous extract of the raw material is vigorously shaken for 1 minute.	
<b><i>Precipitation Reactions</i></b>		
with barite water	3-4 drops of barite water are added to 1 ml of aqueous extract in a test tube	
with lead acetate	3-4 drops of 10% lead acetate solution are added to 1 ml of aqueous extract in a test tube	
with cholesterol solution	1 ml of 1% alcohol solution of cholesterol is added to 1 ml of alcohol-water extract in a test tube	
<b><i>Color reactions</i></b>		
the Lafon reaction	1 drop of a 10% solution of copper sulfate, 1 ml of concentrated sulfuric acid is added to 2 ml of the alcohol-water extract in a test tube and heated carefully	
Salkovsky's reaction	1 ml of chloroform and 5-6 drops of concentrated sulfuric acid are added to 2 ml of the alcohol-water extract in a test tube	
reaction with a solution of stibium (V) chloride	0.5 ml of a saturated solution of stibium (V) chloride in chloroform is added to 1 ml of the alcohol-water extract in a test tube	
Vanillin-sulfuric acid assay	1 ml of 0.5% alcohol solution of vanillin, 3-4 drops of concentrated sulfuric acid are added to 2 ml of alcohol-water extract in a test tube and heated in a water bath at a temperature of 60 °C.	
<b><i>Determination on the chemical nature of saponins</i></b>		
foaming reaction	Take 2 measuring tubes of the same diameter with ground stoppers. 5 ml of 0.1 M hydrochloric acid is poured into one of them, and 5 ml of 0.1 M sodium hydroxide solution is poured into the other. Add 0.5 ml of aqueous extract to both test tubes and shake both test tubes with the same intensity for 1 min.	
<b>CARDIOGLYCOSIDES</b>		
<b><i>Reactions on the steroid part of cardioglycosides</i></b>		
Lieberman-Burchard reaction	The dry residue is dissolved in 1 ml of acetic anhydride, transferred to a dry test tube, and 2 drops of concentrated sulfuric acid are carefully added along the wall	
Rosenheim reaction	1 ml of trichloroacetic acid in ethanol is added to 1 ml of chloroform extract	

<b>Reactions on the lactone ring</b>		
the Kedde reaction	The dry residue is dissolved in 2 ml of a 3% solution of 3,5-dinitrobenzoic acid and 1 ml of a 1M sodium hydroxide solution is added	
Raymond's reaction	The dry residue is dissolved in 1 ml of a 3% solution of m-dinitrobenzene in benzene and 2 drops of an alcoholic solution of potassium hydroxide are added	
Legal's reaction	The dry residue is dissolved in 1 ml of 5% sodium nitroprusside solution and 2 drops of 10% sodium hydroxide solution are added	
<b>Reactions on the carbohydrate part of the molecule</b>		
the Keller-Kiliani reaction	The dry residue is dissolved in 1 ml of acetic acid with traces of ferric sulfate (III), and 1 ml of concentrated sulfuric acid is poured over the walls of the test tube. Do not shake the contents of the test tube!	
with Fehling's reagent	0.5 ml of a 1% solution of hydrochloric acid is added to 2 ml of the obtained extract and heated on a water heater for 1 hour. After that, a few drops of a 10% solution of sodium hydrogen chloride are added to the test tube, and then 1 ml of Fehling's reagent and heated in a boiling water bath	
<b>PHENOLIC COMPOUNDS</b>		
<b>Reactions on arbutin</b>		
with iron (II) sulfate	A few crystals of iron (II) sulfate are added to 1 ml of extract	
with sodium phosphoric molybdenum solution	4 ml of ammonia solution and 1 ml of a 10% solution of sodium phosphoric-molybdic acid in hydrochloric acid are added to 1 ml of the extract	
<b>Reaction on salidroside</b>		
with 10% lead acetate solution	2-3 drops of a 10% solution of lead acetate are added to 1 ml of aqueous infusion of raw materials, the precipitate is filtered, 2 drops of a 1% alcoholic solution of 1-nitroso-2-naphthol and 3 drops of concentrated nitric acid are added to the filtrate	
<b>COUMARINS AND CHROMONES</b>		
lactone test	1 ml of alkalized extract is diluted with four times the amount of water, the mixture is neutralized with a 20% solution of sulfuric acid.	
azo dye formation reaction	3-5 drops of freshly prepared solution of diazotized sulfanilic acid are added to 1 ml of alkalized extract	
reaction with potassium hydroxide (on chromones)	Add 15 ml of purified water to 1.0 g of crushed raw material and boil in a water bath for 15 minutes. The resulting extract is filtered through cotton wool into a porcelain	

	cup and evaporated. A crystal of potassium hydroxide is added to the dry residue	
<b>FLAVONOIDS</b>		
cyanidine reaction	2-3 drops of concentrated hydrochloric acid and 1-2 shavings of magnesium metal are added to 1 ml of the extract	
with alkali	1-2 drops of 10% alcohol-water solution of potassium or sodium hydroxide are added to 1 ml of the extract	
with iron (III) chloride	2-3 drops of 10% iron (III) chloride solution are added to 1 ml of extract	
with lead acetate	3-5 drops of a 10% solution of basic lead acetate are added to 1 ml of the extract	
<b>QUINONES</b>		
Borntraeger reaction	Place 1.0 g of crushed raw material in a flask, pour 10 ml of 10% alcoholic NaOH solution, boil for several minutes and filter. After cooling, the filtrate is acidified with 10% HCl to a slightly acidic reaction (according to the universal indicator), transferred to a separatory funnel and extracted with 10 ml of chloroform. After settling, the chloroform layer turns yellow (anthraquinone derivatives). 5 ml of chloroform extract is shaken in a test tube with 5 ml of 5% alcohol solution of NH <sub>4</sub> OH. Note the color of the ammonia layer.	
<b>TANNINS</b>		
with gelatin solution	A 1% gelatin solution is added dropwise to 2 ml of the extract under study, avoiding its excess	
with alkaloid solution	1% alkaloid solution (quinine hydrochloride, cytisine) is added drop by drop to 2 ml of the tested extract	
with iron-ammonium alums	4-5 drops of iron-ammonium alum solution are added to 2 ml of the tested hood	
with lead acetate solution	4 ml of a 10% solution of acetic acid and 2 ml of a 10% solution of lead acetate are added to 2 ml of the tested hood. The precipitate formed is filtered. Add a few drops of 1% iron-ammonium alum solution to the filtrate	
with bromine water	<b><i>The reaction is carried out under a hood!</i></b> A 2% solution of bromine water is added dropwise to 5 ml of the tested extract until the smell of bromine appears.	
<b>ALKALOIDS</b>		
<b><i>General-precipitation reactions</i></b>		
with the Wagner-Bouschard reagent	a solution of iodine in a solution of potassium iodide	
with Mayer's reagent	a mixture of solutions of mercury dichloride and potassium iodide	

with Dragendorff's reagent	a solution of basic bismuth nitrate, potassium iodide and acetic acid	
with Bertrand's reagent	1% aqueous solution of silicon-tungstenic acid	
with Sonnenstein's reagent	1% aqueous solution of phosphoric-molybdic acid	
with picric acid	1% aqueous solution of picric acid	
with tannins	0.1% aqueous solution of tannin	

**Task 3.** Carry out the TLC of rutine according to the requirements of the SPhU. Draw a diagram of the chromatogram. Compare the results with the SFC monograph.

Mobile phase	Detection
The tested solution	Comparison solution

Chromatogram scheme

---



---

**Teacher's signature** \_\_\_\_\_

## INDEPENDENT STUDENTS WORK

### Questions for student self-preparation for the practical lesson:

1. Name the qualitative reactions to the main groups of BAS.
2. What methods of chromatographic analysis are used to determine the main groups of BAS.
3. What types of analysis are used in pharmacognostic practice?
4. What are the histochemical and microchemical reactions for the detection of inulin, essential and fatty oils, tannins, mucus, alkaloids, anthracene derivatives, starch?
5. Explain the essence of the chromatographic method of research.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

















**TOPIC 4.2:** Additional quality indicators for LRS and medicines based on it.

**Task 1.** Provide examples of additional quality indicators for the drug substance and medicinal products based on it

---

---

---

---

---

---

---

---

**Task 2.** Define the “Swelling Index” and select monographs of the State Financial Institution in which the standardization of the drug or drug products is carried out according to this index. Determine the “Swelling Index” according to the SPhU in mucus-containing MPM.

Definition:

---

---

---

Monographs of SPhU:

---

---

---

Observations:

---

---

---

**Task 3.** Define the “Foam Number” and select monographs of the SPhU in which the standardization of the drug or drug products is carried out according to this indicator. Determine the “Foam Number” according to the SPhU for a saponin-containing drug product.

Definition:

---

---

---

Monographs of SPhU:

---

---

---



Observations:

---

---

---

**Task 4.** Define the “Bitter Index” and select monographs of the SPhU in which the standardization of the MPM or drugs by this index is carried out. Determine the “Bitter Index” according to the SPhU in the MPM containing iridoids.

Definition:

---

---

---

Monographs of SPhU:

---

---

---

Observations:

---

---

---

**Teacher's signature** \_\_\_\_\_

## INDEPENDENT STUDENTS WORK

**Questions for student self-preparation for the practical lesson:**

1. Name the main documents that regulate the quality standards of medicines.
2. Define additional quality indicators such as “swelling index”, “foam number”, “bitter index”, etc.
3. What factors determine the suitability of a drug for use?
4. Name national and international organizations that introduce standards and guidelines necessary to ensure the quality of pharmaceutical products.
5. What is the modern international concept of quality assurance of drugs?
6. What are the functions of the State Pharmacopoeia?

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



**TOPIC 5:** Development of choleric and diuretic herbal preparations and standardization of their components.

**Task 1.** Offer a composition of choleric or diuretic herbs

MPM, MP, Family	The main BAS	Pharmacological activity	Daily doses (ratio)
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng.			

Lat			
Eng.			
Lat			
Eng.			
Lat			
Eng.			
Lat			

**Task 2.** Propose quality control methods for the developed fee in accordance with the requirements of the SPhU

Identification A

---

---

---

---

---

---

---

---

---

---

---

Identification B

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Standardization of the qualitative composition and quantitative content of the developed collection of BAS

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Teacher's signature** \_\_\_\_\_



**TOPIC 6:** Development of collections of antiseptic and anti-inflammatory action based on raw materials containing essential oils and standardization of its components.

**Task 1.** Offer the composition of the collection of antiseptic and anti-inflammatory action based on raw materials containing essential oils

MPM, MP, Family	The main BAS	Pharmacological activity	Daily doses (ratio)
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			



Eng.			
Lat			
Eng.			
Lat			
Eng.			
Lat			

**Task 2.** Propose quality control methods for the developed collection in accordance with the requirements of the SPhU

### Identification A

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

### Identification B

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Standardization of the qualitative composition and quantitative content of BAS of the developed collection

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Teacher's signature \_\_\_\_\_





**TOPIC 7:** Development of collections of hypoglycemic action and tea of sedative action and standardization of their components.

**Task 1.** Offer the composition of the collection of hypoglycemic and sedative action

MPM, MP, Family	The main BAS	Pharmacological activity	Daily doses (ratio)
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng.			

Lat			
Eng.			
Lat			
Eng.			
Lat			
Eng.			
Lat			

**Task 2.** Propose quality control methods for the developed collection in accordance with the requirements of the SPhU

Identification A

---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---

Identification B

---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---

Standardization of the qualitative composition and quantitative content of BAS of the developed collection

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Teacher's signature** \_\_\_\_\_





**TOPIC 8:** Development of vitamin tea and standardization of its components.

**Task 1.** Offer the composition of tea with vitamin effect

MPM, MP, Family	The main BAS	Pharmacological activity	Daily doses (ratio)
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			

Eng.			
Lat			
Eng.			
Lat			
Eng.			
Lat			

**Task 2.** Propose quality control methods for the developed tea in accordance with the requirements of the SPhU

Identification A

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Identification B

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Standardization of the qualitative composition and quantitative BAS content of the developed tea

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Teacher's signature** \_\_\_\_\_



**TOPIC 9:** Development of laxative briquettes and tinctures to improve digestion and standardization of their components.

**Task 1.** Offer a composition of briquettes with a relaxing effect or a tincture to improve digestion

MPM, MP, Family	The main BAS	Pharmacological activity	Daily doses (ratio)
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			
Eng. Lat Eng. Lat Eng. Lat			

Eng.			
Lat			
Eng.			
Lat			
Eng.			
Lat			

**Task 2.** Propose quality control methods for the developed briquettes or tinctures to improve digestion according to the requirements of the SPhU

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Standardization of the qualitative composition and quantitative BAS content of the developed briquettes or tincture to improve digestion

---

---

A series of 22 horizontal lines for writing.

**Teacher's signature** \_\_\_\_\_





**TOPIC 10:** Analysis of the thick extract according to the monograph of the SPhU "Extracts".

**Task 1.** Define "Thick extract" in accordance with the SPhU and specify the requirements of the SPhU for obtaining and standardizing such extracts.

Definition:

---

---

Requirements of the SPhU for obtaining and standardization:

---

---

**Task 2.** Standardize the thick extract in accordance with the requirements of the SPhU

Observation:

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Teacher's signature** \_\_\_\_\_

## INDEPENDENT STUDENTS WORK

Questions for student self-preparation for the practical lesson:

1. Technology of preparation of extracts from MPM.



## Рекомендована література

### Базова

1. Фармакогнозія: базовий підручник для студентів вищих фармацевт. 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. – (Національний підручник). [https://gnosy.nuph.edu.ua/wp-content/uploads/2020/10/Фармакогнозія\\_2015.pdf](https://gnosy.nuph.edu.ua/wp-content/uploads/2020/10/Фармакогнозія_2015.pdf)
2. Котов А.Г., Котова Е.Е., Соколова О.О. Атлас ілюстрацій до методів ідентифікації лікарської рослинної сировини в національних монографіях ДФУ. Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2021. - 256 с.

### Допоміжна

1. Державна фармакопея України : введено в дію з 1 січня 2016 року: У 3-х томах. Т. 1 / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-ге видання. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2015. - 1126 с.
2. Державна фармакопея України : у 3-х томах. Т. 2 / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-ге видання. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2014. - 724 с
3. Державна фармакопея України : у 3-х томах. Т. 3 / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-ге видання. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2014. - 730 с
4. Державна фармакопея України : наукове видання / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-е видання - Доповнення 1. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2016. - 360 с.
5. Державна фармакопея України : наукове видання / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-е видання - Доповнення 2. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2018. - 336 с
6. Державна фармакопея України : наукове видання / Український науковий фармакопейний центр якості лікарських засобів [та ін.]. - 2-е видання - Доповнення 3. - Харків : Український науковий фармакопейний центр якості лікарських засобів, 2018. - 416 с.
7. Investigation of water-soluble polysaccharides and pectin substances of fruits and meal of red currant (*Ribes rubrum*), sea buckthorn (*Hippophae rhamnoides*), and feijoa (*Acca sellowiana*) / M. Inylieieva, U. Karpiuk // Ukrainian scientific medical youth journal, 2023, Issue 2 (139), P. 113-120. <http://ir.librarynmu.com/handle/123456789/9294>
8. Minarchenko V, Tymchenko I, Pidchenko V, Dvirna T, Makhynia L, Karpiuk U, Kovalska N. Diagnostic features of raw materials of related *Equisetum* species of Ukrainian flora. J Res Pharm. 2022; 26(6): 1780-1788. <http://ir.librarynmu.com/handle/123456789/9296>
9. Pharmacognostic analysis of *Salvia hispanica* L. seeds / A. Sytryn, I. Cholak, O. Yemelianova, U. Karpiuk // ScienceRise: Pharmaceutical Science. – 2021. – № 2(30). – P. 49-54. <http://ir.librarynmu.com/handle/123456789/9300>
10. V. M. Minarchenko, R. M. Lysiuk, N. P. Kovalska Medicinal plant resources : textbook / V. M. Minarchenko, R. M. Lysiuk, N. P. Kovalska. – Kyiv: PALYVODA A. V., 2019. – 240 p. <http://ir.librarynmu.com/handle/123456789/9264>
11. Molecular Pharmacognosy / ed. Huang, Lu-qi. - 2nd ed. 2019. <https://doi.org/10.1007/978-981-32-9034-1>

### Інформаційні ресурси

1. <https://nmuofficial.com/zagalni-vidomosti/kafedri/departament-botany-pharmacognosy/>
2. <https://likar.nmu.kiev.ua>
3. Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». <http://sphu.org/>
4. Державна Фармакопея України <https://sphu.org/viddil-dfu/pridbati-dfu-v-v-xarkovi-i-ukra%D1%97ni>
5. Сайт бібліотеки НМУ імені О.О. Богомольця <https://librarynmu.com/>
6. Сайт Державної наукової медичної бібліотеки України – <http://Eng.library.gov.ua/>
7. European Scientific Cooperative on Phytotherapy (ESCOP) <https://Eng.escop.com/>
8. European Pharmacopoeia <https://pheur.edqm.eu/home>
9. American Herbal Pharmacopoeia <https://herbal-ahp.com/>