MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
Pharmaceutical Chemistry Department

«PHARMACEUTICAL BROMATOLOGY»
WORKBOOK
FOR PRACTICAL CLASSES AND INDIVIDUAL WORK

for students speciality «Pharmacy, industrial pharmacy»

Student _____ year _____ group

_____
(Name, Surname)

_____
(academic year)

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The workbook was created according to the approved program in bromatology. It contains data on qualitative, quantitative and instrumental methods of food analysis, educational tasks, information on the rules of work in the laboratory, safety measures during work in the laboratory and methods of first aid.

Designed for classroom and extracurricular work of students educational program 'Pharmacy', 'Technologies of pharmaceuticals', 'Clinical Pharmacy', 'Technologies of perfumes and cosmetics', 'Biotechnology'.

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INTRODUCTION

Practical training is one of the forms of educational process during which students under the guidance of a teacher personally conduct experiments to confirm practical knowledge of the discipline ‘Pharmaceutical bromatology’, acquire skills to work with laboratory equipment and instruments, experimental research methods and process research results.

Practical classes are held in specially equipped training laboratories, for the organization and conduct of which the following items are necessary:

- special equipment and facilities;
- educational and methodological support;
- providing practical classes with research objects and reagents;
- providing graduates with normative and methodological literature for experimental research.

The workbook is designed for individual preparation of students for practical classes in order to meaningfully perform experimental tasks during classroom work. The protocols clearly formulate algorithms for food analysis in accordance with regulations.

According to the methods of analysis protocols, the student must give the appropriate reaction equations of qualitative and quantitative determination of chemical components of food and record the results of control, make calculations and give a qualified assessment of food quality.

How to work in the pharmaceutical chemistry lab

1. At the beginning of each term, before starting to perform laboratory tasks, students must familiarize themselves with the rules of work in the pharmaceutical chemistry lab, instructions on safety and labor protection, fire safety plan.

2. Before the start of classes, students on duty receive laboratory equipment, which must be handed in at the end of the class.

3. Students must maintain cleanliness and order in the lab. It is allowed to work only in a white coat and a special headdress. Only the items needed for research should be on the desktop.

4. Performing of the laboratory task is allowed after preliminary preparation. The teacher monitors the readiness of students to perform laboratory work.

5. The working and reference solutions required for the analysis, special reagents are on the shelves on laboratory tables, and titrated solutions and chemical glassware – in special cabinets. The indicators are located near the titration unit. Concentrated acids and volatile compounds are stored in fume hoods.

6. Before conducting experiments, it is necessary to carefully inspect the equipment and glassware, make sure that the installation or device is assembled correctly, the chemicals taken meet the requirements.

7. Used solutions containing concentrated acids, alkalis, organic solvents, reagents with toxic substances and precious metals, are poured into special glasses for their collection.

8. It is not allowed to take out of the laboratory any reagents and conduct additional experiments without the consent of the teacher.

9. At the end of the work it is necessary to thoroughly wash used glassware, tidy up the workplace, turn off gas, water and electrical appliances.

10. It is necessary to remember that cleanliness, accuracy and diligent work are a guarantee of successful performance of a laboratory task.

Informed_____

Precautions while working in the lab and ways of providing first aid

1. All safety precautions must be strictly observed in accordance with the rules and instructions when working in the lab.

2. Operations with concentrated acids and other substances that emit corrosive or toxic fumes, as well as substances and solutions that have a strong odor is carried out under the fume hood.

3. All operations with diethyl ether and other flammable substances must be carried out with extreme caution away from open flames, hot surfaces, electric and electrostatic sparks.

4. When working with harmful and toxic substances (salts of barium, arsenic, lead, copper, metallic mercury, cyanide compounds, hydrogen sulfide, etc.), care must be taken to ensure that these substances do not enter the human body. Consumption of food in the chemical laboratory is prohibited.

5. In case of cuts, make sure that no glass fragments remain in the wound, treat it with an alcoholic solution of iodine and bandage.

6. For burns, make long-term lotions with a solution of potassium permanganate or a compress of an alcoholic solution of tannin.

7. If concentrated sulfuric acid gets on the skin, wipe the affected area first with a dry cotton swab, handkerchief or napkin, and then rinse with plenty of water (do not rinse with water at once – thermal burns will be added to the chemical). For burns of the skin, mucous membranes or eyes with acids, first rinse the affected area well with water, and then with 2% sodium bicarbonate solution. Sodium carbonate working solution diluted 10 times can be used for emergency care.

8. For burns with caustic alkalis, rinse the affected area well with water, and then with 1% solution of acetic or citric acid (working solution of dilute acetic acid is 30%).

9. For skin burns with phenol, bromine and other similar caustic substances, the affected area should be washed off with plenty of alcohol and lubricated with special ointment.

10. In cases of poisoning by chlorine, bromine, nitrogen oxides and other similar substances, the student should be allowed to smell the ammonia solution, and then taken out into the fresh air, drink milk.

11. In case of severe burns, injuries and poisonings, the student should be sent to hospital immediately after receiving first aid.

12. The first-aid kit should always contain bandages, solutions and medicines necessary for first aid.

13. In case of danger of fire it is necessary to immediately shut off the gas supply, turn off the exhaust ventilation and circuit breaker of the power supply, warn the teacher or laboratory assistant and take measures to eliminate the fire.

14. Slight flames are covered with sand, covered with a fire blanket or extinguished with a fire extinguisher.

15. In the event of a fire, it is necessary to leave the laboratory quickly and in an organized manner, remove the victims and provide them with first aid, call the fire brigade by 101.

Informed_____

Date «_____» _____ 20_____

TOPIC: Drinking and mineral water: chemical properties, quality control and interaction with medicines.

Fill in the table:

«Interaction of medicines with drinking and mineral water»

Medicine	The name of the product or component with which it interacts	The result
Sulfanilamides* Medicines with an acid-resistant shell	Alkaline mineral waters:**	

*- write a rection equation
** - give examples of mineral waters

LABORATORY PRACTICE №_____
ANALYSIS OF DRINKING WATER OF CENTRALIZED WATER SUPPLY SYSTEMS

1. Determination of chlorides:

Add 5 mL of test water and three drops of 10 % silver nitrate solution to the test tube.

Reaction equation:

The approximate content of chloride ion is calculated by the formation of sediment or turbidity in accordance with the requirements of the table:

Characteristics of sediment or turbidity	Chloride ion content mg/l
opalescence or weak turbidity	1-10
strong turbidity	10-50
flakes are formed	50-100
white precipitate	More than 100

Conclusion

2. Quantitative determination of chloride ions:

To 10,0 mL of test drinking water, add 2 mL of *potassium chromate solution R* and titrate with *0,1 M silver nitrate solution R* to an orange-yellow color.

Reaction equation:

Quantitative content of chloride ions (X), g/l, is calculated by the formula::

$X\,g/L = \frac{V \cdot 0{,}00355 \cdot K \cdot 1000}{V_{sv}} = \frac{V \cdot 3{,}55 \cdot K}{V_{sv}}$ $X =$ ——————————— $=$ *Permissible chloride content is not more than 0,25-0,35 g/l*	*where V – is the volume of 0,1 M silver nitrate solution used in the titration, ml;* *K – is the correction factor to the molarity of 0,1 M silver nitrate solution;* *0,00355 – is the titre of 0,1 M silver nitrate by chloride-ion, g/ml* *V_{sv} – is the sample volume, ml*

Conclusion:

3. Determination of residual chlorine in drinking water as an indicator of the effectiveness of its disinfection (express method):

Before taking the sample, tap water is drained for 2 minutes. To 100 mL of the tested water sample, add 5-6 drops of 10 % potassium iodide solution, 5-6 drops of freshly prepared 0,5 % starch solution and shake the flask thoroughly with rotational movements. The content of residual free chlorine in the water is determined by the intensity of the blue color:

Colour	Residual chlorine (mg/l)
No	0,0
Light blue	0,1–0,3
Dark blue	More than 0,3

* *The permissible content of residual free chlorine in drinking water is 0.3-0.5 mg/l.*

Conclusion:

4. Determination of total hardness:

To a conical flask add 50 mL of test drinking water, 10 mL of ammonium chloride buffer solution pH 10,0 and 0,1 g of mordant black indicator mixture II P, the solution is heated to a temperature of about 40 °C and titrated at this temperature with 0,1 M sodium edetat solution before the transition of purple color of the solution to blue.

Reaction equation:

The total water hardness (Mg), g/l is calculated by the formula:

$X_{g/L} = \frac{V \cdot K \cdot 0{,}0024305 \cdot 1000}{V_{sv}} = \frac{V \cdot K \cdot 2{,}4305}{V_{sv}}$ $X =$ ——————————— $=$ *The permissible content of magnesium salts is not more than 0.007-0.010 g/l*	*where V – is the volume of 0,1 M sodium edetate solution used in the titration, ml;* *K – is the correction factor to the molarity of 0,1 M sodium edetate solution;* *0,0024035 – is the titre of 0,1 M sodium edetate by magnesium-ion, g/ml;* *V_{sv} – is the sample volume, ml.*

Conclusion:

LABORATORY PRACTICE №_____

ANALYSIS OF MEDICINAL MINERAL WATER OR MEDICINAL-TABLE MINERAL WATER.

1. ***Determination of the quantitative content of calcium salts***:

A. Sample preparation: removal of carbon (IV) oxide, carbonate and bicarbonate ions and neutralization of the sample – 20 mL of the test sample is placed in a flask with a volume of 250 mL, 80 mL of distilled water is added, the mixture is neutralized with 0,1 M hydrochloric acid solution in the presence of methyl red indicator to pink colour. The resulting solution is boiled for 5 minutes to completely remove carbon (IV) oxide. When the color turns yellow, a few drops of hydrochloric acid are added to preserve the pink color. After cooling, the test solution is neutralized with 0,1M sodium hydroxide solution until a yellow color appeares.

B. Analysis: 20 mL of neutralized solution is placed in a 250 mL flask, 2 mL of concentrated sodium hydroxide solution is added, then – 15 mg of murexide and the obtained solution is titrated slowly with 0,1 M sodium edetate solution until the transition of orange-pink color to purple.

Reaction equation:

Determination of the content of calcium salts (X) in g/l is made by the formula:

$$X_{g/L} = \frac{V \cdot K \cdot 0{,}004007 \cdot 1000}{V_{sv}} = \frac{V \cdot K \cdot 4{,}007}{V_{sv}}$$

X = ——————————— =

The content of calcium salts should be from 0.020-0.150 g/l

where V – is the volume of 0,1 M sodium edetate solution used in the titration, ml;
K – is the correction factor to the molarity of 0,1 M sodium edetate solution;
0,00400 – is the titre of 0,1 M sodium edetate by calcium-ion, g/ml;
$V_{f/a}$ – is the sample volume, ml;
1000 – is recalculation in g/l.

Conclusion:

2. ***Determination of the total mass concentration of sodium bicarbonate:***

Place 50 mL of the test beverage liberated from carbon (IV) oxide in a 250 mL conical flask, add 2-3 drops of methyl orange solution and titrate with 0,1 M hydrochloric acid solution until slightly pink colour is observed. The test solution is then boiled for 2-3 minutes and cooled to 20 °C. In the case of a yellow color presence, the titration is continued until the transition from yellow to pale pink colour.

Reaction equation:

The total mass concentration of sodium bicarbonate (X) g/l, is calculated by the formula:

$X_{g/L} = \frac{V \cdot K \cdot 0{,}0084007 \cdot 1000}{V_{sv}} = \frac{V \cdot K \cdot 8{,}4007}{V_{sv}}$ X = ——————————— = *The mass concentration of sodium bicarbonate should be 0.060-0.085 g/l*	*where V – is the volume of 0,1 M hydrochloric acid solution used in the titration, ml;* *K – is the correction factor to the molarity of 0,1 M sodium edetate solution;* *0,0084007 – is the titre of 0,1 M sodium edetate by sodium bicarbonate, g/ml;* *$V_{f/a}$ – is the sample volume, ml;* *1000 – is recalculation in g/l.*

Conclusion:

Data «_____» _____ 20_____

TOPIC: Food products that contain proteins: chemical properties, quality control and interaction with medicines.

Class 1. Milk and dairy products – chemical composition, adulteration and quality indicators. Recommendations for the rational use of medicines and dairy products.

Fill in the table:

«Interaction of medicines with foods products that contain proteins (milk and dairy products)»:

Medicine	The name of the product or component with which the interaction occurs	The result
Calcium-contained medicines		
Glucocorticosteroids (Prednisolone, Dexamethasone, etc.),		
Non-steroidal anti-inflammatory drugs (Ibuprofen, Indomethacin, etc.)		
Tetracycline antibiotics *		
Antibiotics of the penicillin group		
Cephalosporin antibiotics		
Antimicrobials of the fluoroquinolone group *		
Vitamin D		
Caffeine		
Iron-contained medicines		
Bismuth-contained medicines		
Medicines with acid-resistant cover (Pancreatin, Pankurmen, Bisacodyl)		
Antidepressants (Amitriptyline, Fluoxetine, etc.), psychostimulants, isoniazid, MAO inhibitors		

*- write down reaction equation

LABORATORY PRACTICE №_____
ANALYSIS OF MILK, DAIRY AND SOUR MILK PRODUCTS

1. ***Determination of the presence of soda in the tested sample of milk:***

1.1. Test with bromothymol blue. In a dry test tube add 5 mL of a sample and carefully add 7-8 drops of bromothymol blue solution. After 10 minutes, observe the color change on the verge of division of 2 liquids, preventing shaking of the tube. Yellow color indicates the absence of soda in milk. The appearance of green color of different shades (from light green to dark green) indicates the presence of soda in milk.

The color of the ring layer	The amount of soda added to milk , %
Yellow	No soda
Yellowish-green	0,05
Green	0,07 – 0,1
Dark green	0,2
Blue-green	0,3

Conclusion:

1.2. Test with acetylsalicylic acid. To the flask add 10 mL of milk, 10 mL of water P and 0,5 g of acetylsalicylic acid, then the contents of the flask are stirred and heated in a water bath for 20 minutes. Cool, filter the contents of the flask through a cotton filter to a clear filtrate, then add 8-10 drops of 10 % iron (III) chloride solution. The appearance of a color from dark pink to reddish-yellow, followed by the formation of a precipitate, indicates the presence of soda in milk.

Conclusion:

2. Determination of the presence of ammonia in the tested milk sample:

Measure 20 mL of milk into the flask and heat for 2-3 minutes in a water bath.

In heated milk add 1 mL of 10 % aqueous acetic acid. Left the mixture for 10 minutes (to precipitate casein). Filter the contents of the flask through a cotton filter to a clear filtrate, take 2 mL and add 1 mL of potassium tetraiodomercurate alkaline solution (Nessler's reagent) and mix the contents immediately, observing for no more than 1 min color change of the mixture. The formation of lemon-yellow color indicates the presence of ammonia, normal to milk. The appearance of such a color of varying intensity indicates the presence of ammonia above its natural content.

Reaction equation:

Conclusion:

3. Determination of the presence of hydrogen peroxide in the tested sample of milk:

In a test tube add 1 mL of milk, without stirring add two drops of sulfuric acid solution and 0,2 mL of starch solution of potassium iodide. After 10 minutes, observe the color change of the solution, preventing it from shaking. The appearance of individual blue spots indicates the presence of hydrogen peroxide in milk.

Conclusion:

4. Detection of water in the tested milk sample:

a) Test with ethyl alcohol. Mix 2 mL of milk and 4 mL of alcohol in a test tube, shake the mixture and quickly pour into a glass beaker. If the milk is not diluted, flakes appear in the liquid no later than 5-7 seconds. If the flakes appear after a longer period of time, it means that the milk is diluted with water. The more water is in the milk, the more time it takes for the flakes to appear.

Conclusion:

b) By the appearance. Milk with water impurities forms a wide blue layer near the walls of the vessel, does not form a convex drop on human nails, it blurs, and in the presence of solid impurities (flour, starch, chalk, etc.) the precipitate remains on the nails.

Conclusion:

5. Determination of lactic acid in fermented milk products:

In a porcelain cup add 5-10 drops of fermented milk product or its whey, and dropwise add phenolic reagent. In the presence of lactic acid, there is a change in color from purple-blue to straw-yellow due to the formation of iron (II) lactate.

Conclusion:

6. Determination of acidity in kefir:

Measure 10 mL of the test product with a pipette into a 250 mL conical flask, rinse the pipette with 20 mL of water, and add the remainder of the pipette to the flask. Mix the contents of the flask thoroughly, add 3 drops of phenolphthalein solution

and titrate with 0,1M sodium hydroxide solution until pink colour appears.
A control experiment is carried out simultaneously.
The difference between the parallel definitions should not exceed 2° Turner

Reaction equation:

The acidity of kefir (X) in Turner degrees is calculated by the formula:

$X(\circ \mathrm{T}) = V \cdot 10 =$ *The acidity of fermented milk products varies between 60-130 °T. The higher content of lactic acid has a negative effect on the taste of the product.*	*where V – the volume of 0,1 M sodium hydroxide solution used in the titration, ml.*

Conclusion:

7. Determination of the presence of starch in cottage cheese.

A few drops of Lugol's solution (iodine solution in potassium iodide) are applied to the test sample, in case of starch content a blue or black-blue color is formed on the surface of the cottage cheese.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Protein-containing food: chemical properties, quality control and interaction with medicines.

Class 2. Meat, fish and eggs – chemical composition, quality indicators. Recommendations for the rational combination with medicines.

Fill in the table:

«Interaction of medicines with protein containing food (meat, fish, eggs)»:

Medicine	The name of the product or component with which it interacts	The result of the interaction
β-blockers (propranolol), carbidopa / levodopa		
Metformin, levothyroxine, digoxin, penicillins		
Antibiotics (oxacillin, ampicillin, tetracycline, griseofulvin, neomycin sulfate)		
Glucocorticosteroids and steroid hormones		
Anorexigenic, antidiabetic medicines, biguanides, MAO inhibitors, tetracyclines, chlorpromazine		
Carbidopa / levodopa *		
MAO inhibitors, psychostimulants, vasoconstrictors		
Isoniazid *		

*- write drown reaction equation

LABORATORY PRACTICE №_____
ANALYSIS OF MEAT, FISH AND EGGS

1. Color reactions on proteins:

Preparation of protein solution: Separate the protein of one chicken egg from the yolk, dissolve in 15-20 excess of the volume of distilled water, filter the solution through a filter (3-4 layers), store in the refrigerator.

1.1. Biuret reaction. Measure 5 drops of protein solution into a test tube, add 10 drops of 10 % sodium hydroxide solution, add 1-2 drops of copper sulfate solution and mix. A reddish-purple color appears.

Reaction equation:

Conclusion:

1.2. Xanthoprotein reaction. Measure 5 drops of protein solution into a test tube, carefully add 3-4 drops of concentrated nitric acid along the walls of the test tube. Then the mixture is carefully heated, a yellow precipitate is formed. The tube is cooled and 10 drops of 30 % sodium hydroxide solution are carefully added, the yellow color turns into orange.

Reaction equation:

Conclusion:

1.3. Reaction for sulfur-containing amino acids (Fol's reaction). In a test tube, mix 5 drops of egg white solution, 5 drops of 30 % alkali solution and 2 drops of lead acetate solution. The mixture is gently heated and then boiled. After a while, a brownish-black or black color appears.

Reaction equation:

Conclusion:

1.4. Reaction with ninhydrin. Put 5 drops of 1 % solution of egg white in a test tube, add 3 drops of 0,5 % solution of ninhydrin and heat to boiling. After 2-3 minutes, pink, red, and then blue-purple color appears.

Reaction equation:

Conclusion:

2. Determination of meat freshness by protein breakdown products:

Place 5 g of the test sample in a 100 mL conical flask, add about 20 mL of freshly boiled and cooled to room temperature

distilled water, infuse for 15 minutes with shaking three times and filter. In a test tube to 1 mL of the obtained filtrate add 10 drops of alkaline solution of potassium tetraiodomercurate (Nessler's reagent). The contents of the test tube then are shaken and the color of the solution is visually observed.

Reaction equation:

Conclusion of compliance with the requirements is based on the results of observations:

Observations	Conclusion of the protocol
Meat is considered fresh if the contents of the test tube have a greenish-yellow tinge, while the contents remain transparent or there is a slight turbidity in 15 minutes.	Qualitative test with Nessler's reagent - negative
If the contents of the test tube become intensely yellow, sometimes with an orange tinge, and there is significant turbidity with the loss of a thin layer of sediment within 15 minutes, this indicates the initial stage of protein breakdown.	Qualitative test with Nessler's reagent - positive (I)
If the contents of the test tube immediately after shaking becomes yellowish-orange and there is a rapid (1-2 min) deposition of flakes that precipitate, it indicates a stage of significant decomposition of proteins.	Qualitative test with Nessler's reagent - positive (II)

Conclusion:

3. Determination of the products of primary decomposition of proteins in broth:

The hot broth, which was prepared from a portion of minced meat, is filtered through a layer (0,5 cm) of cotton wool into a test tube. If protein flakes remain in the broth, the broth is further filtered through filter paper. 2 mL of filtrate are placed in a clean test tube and 3 drops of 5 % copper sulphate solution are added. The tube is shaken 2-3 times and placed in a tripod. After 5 minutes note the result:

Characteristics of freshness	Observations
Fresh	transparent broth
Doubtful freshness	turbidity of broth, frozen meat – intense turbidity, flakes
Stale	formation of a jelly-like precipitate, the presence of large flakes

Conclusion:

4. Determination of hydrogen sulfide content in fish:

Place 15-25 g of minced fish and a strip of filtered paper in a 50-100 mL flask in an upright position, with 3-4 drops (2-3 mm in diameter) of lead (II) acetate reagent applied to it. A strip of paper is placed at a distance of 1 cm from the minced fish. Leave the flask with the stopper closed for 15 minutes, then evaluate the results. In the case of spoilage of fish, hydrogen sulfide is released and at the sites of application of lead (II) acetate, dark spots are formed.

Preparation of lead (II) acetate reagent:	to a solution of 40 mg/mL of lead (II) acetate add a solution of 300 mg/mL of sodium hydroxide to dissolve the precipitate (it is necessary to avoid excess alkali), then the solution is filtered.

Reaction equation:

The intensity of the reaction is estimated according to the table:

negative	slightly positive	positive	highly positive
traces / ±	brown color along the edges of the drop / +	brown color all over the drop / ++	intense dark brown color of the entire drop / +++

Conclusion:

5. Method for determining the quantitative content of amino-ammonia nitrogen *(method of formalitration according to Serensen, indicator method):*

Transfer 20 g of minced meat to a 100 mL volumetric flask, fill up to the mark with distilled water, mix vigorously, infuse for 30 minutes and filter through a paper filter. Place 10 mL of the filtrate in a flask, add 40 mL of distilled water and 0,3 mL of phenolphthalein solution P neutralized with 0,1 M sodium hydroxide solution in a volume of 100 mL. Then add 10 mL of 40 % formaldehyde solution, neutralized with 0,1 M sodium hydroxide solution, and titrate with 0,1 M sodium hydroxide solution until pink colour appears.

A control experiment is carried out in parallel.

Reaction equation:

The content of amino-ammonia nitrogen (X mg/100g) is calculated by the formula:

$$X_{mg/100g} = \frac{(V_m - V_b) \cdot К \cdot 0{,}0014 \cdot V_{vf} \cdot 100 \cdot 1000}{m \cdot V_p}$$

$$= \frac{(V_m - V_b) \cdot К \cdot 0{,}0014 \cdot 100 \cdot 100 \cdot 1000}{m \cdot 10} =$$

$$= \frac{(V_m - V_b) \cdot К \cdot 1400}{m}$$

$$X_{mg/100g} = \text{——————————} =$$

where V_m – is the volume of 0,1 M sodium hydroxide solution used in the main titration, ml;
V_b – is the volume of 0,1 M sodium hydroxide solution used in the blank titration, ml;
K – is the correction factor to the molarity of 0,1 M sodium hydroxide solution;
0,0014 – is the titre of 0,1 M sodium hydroxide by nitrogen, g/ml;
m – is the sample weight, g;
V_{vf} – is the volume of a volumetric flask, ml;
V_p – is the volume of a pipette, ml.

Permissible limits of amino-ammonia nitrogen content:
- in 10 mL of fresh meat extract does not exceed 1,26 mg,
- in meat of suspicious freshness – from 1,27 to 1,68 mg, - in stale meat – more than 1,69 mg.

Conclusion:

6. Determination of starch in sausages:

A few drops of Lugol's solution (iodine solution in potassium iodide) are applied to the test sample, in case of starch content a blue or black-blue color is formed on the surface.

Conclusion:

7. Determinination of the difference between natural fish caviar and simulated caviar.

7.1. Reaction with an alcoholic solution of iodine. 1 g of the test sample is placed on a glass slide, then 1 drop of 5 % alcoholic iodine solution is added.
Natural caviar does not change its color. Simulated caviar turns blue.

Conclusion:

7.2. Test with hot water. 2 g of the test sample is placed in a test tube, 3 mL of hot distilled water are added.
Natural caviar turns white. Simulated caviar – dissolves.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Food products that contain carbohydrates and vitamins: chemical properties, quality control and interaction with medicines.

Class 1. Fruits and vegetables – chemical composition, falsification and quality indicators. Recommendations for the rational use of medicines with fruits and vegetables.

Fill in the table:

«Interaction of medicines with food containing carbohydrates and vitamins» (fruits, vegetables, juices):

Medicine	The name of the product or component with which it interacts	The result of the interaction
Antidepressants, psychostimulants, MAO inhibitors, isoniazid		
Ampicillin, macrolides		
Furosemide, calcium chloride, ibuprofen, isoniazid, metamizole sodium		
Iron-containing medicines		
Anticoagulants of indirect action		
Calcium-containing medicines*		
Antihypertensive medicines		
Anticonvulsants		
Diuretics		

*- write down reaction equation

«Interaction of medicines with grapefruit juice»

Medicine	Effect	Comment

*- write down reaction equation

LABORATORY PRACTICE №_____

ANALYSIS OF FRUITS, VEGETABLES AND NATURAL JUICE

1. Qualitative reactions for vitamin C (ascorbic acid):

1.1. Reaction with 2,6-dichlorophenolindophenol (cabbage, red pepper or potato juice).

0,5 mL of 2,6-dichlorophenolindophenol solution, 2 drops of 2 % hydrochloric acid solution and 1 mL (dropwise) of test raw material are added to the test tube. The solution is discolored.

Reaction equation:

Conclusion:

1.2. Reaction with potassium ferricyanide.

To 1 mL of the solution of the investigated raw material 1 mL of 1 % solution of potassium hexacyanoferrate (III) and 0,5 mL of 1 % solution of iron (III) chloride are added. The formation of blue-green color (Turnbull's blue) is observed.

Reaction equation:

Conclusion:

2. Qualitative reaction to vitamin PP (nicotinic acid):

Put 2 mL of tomato juice in a test tube and add 1-2 mL of 10 % acetic acid solution. The same volume of 5 % copper acetate solution is added to the solution heated to boiling. The liquid becomes cloudy and turns blue, and after a while a blue precipitate (precipitate of copper salt of vitamin PP) is formed.

Reaction equation:

Conclusion:

3. Qualitative reaction to vitamin B6 (pyridoxine) in garlic, avocado, strawberry:

In a test tube mix 1 mL of strawberry juice or 1 g of garlic puree or avocado and two drops of 1 % solution of iron (III) chloride. The liquid turns red due to the formation of a complex salt such as iron phenolate.

Reaction equation:

Conclusion:

4. Qualitative reaction for the determination of nitrates:

On the surface of a fresh slice (vegetable or fruit) apply a few crystals of diphenylamine and moisten them with two drops of concentrated sulfuric acid.

Intense blue color – a large amount of nitrites.	Pink color – a small content of nitrites.	No color – nitrites are absent or their content is very low.

Maximum permissible concentrations of nitrates in food products of plant origin

Plant product	***The amount of nitrites, mg/kg***	***Plant product***	***The amount of nitrites, mg/kg***
Potato	80	Melon	45
Beet	1400	Tomatoes	60
White cabbage	300	Onions	60
Carrots	300	Pumpkin	45
Cucumber	150	Sweet pepper	200
Apple	60	Greenery	2000
Avocado	200	Garlic	600

Conclusion:

5. Quantitative determination of vitamin C (ascorbic acid) in vegetables and fruits, iodometry.

20 ml of juice placed in a conical flask and add a few drops of starch solution and titrate with 0,1 M iodine solution until blue coloration appears

Reaction equation:

$$\mathrm{X}(mg/100g) = \frac{V \cdot K \cdot \mathrm{T} \cdot 100 \cdot 1000}{V_{sv}}$$

$$X(mg/100g) = \text{———————————}$$

where V – is the volume of 0,1 M iodine solution, ml;
K – is the correction factor to the molarity of 0,1 M iodine solution;
T – is the titre of 0,1 M iodine solution by ascorbic acid, g/ml;
V_{sv} – is the sample volume, ml.

Conclusion:

6. Determination of natural anthocyanins in berry juices (plum, strawberry-banana, cherry, pomegranate):

6.1. To 10 mL of the test sample add 2 mL of dilute sodium hydroxide solution. Natural juice changes color to dirty green.

Conclusion:

6.2. Determination of anthocyanins in sweet drinks – cherries, black currant, plums, pomegranates.

To 5 mL of the test beverage add 4 mL of dilute sodium hydroxide solution and shake vigorously to the formation of a dark green color.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Food containing carbohydrates and vitamins: chemical properties, quality control and interaction with medicines.

Class 2. Bread, bakery products and cereals – chemical composition, detection of adulteration and quality indicators. Recommendations for rational use with medicines.

Fill in the table:

«Interaction of medicines with food containing carbohydrates and vitamins» (bread, cereals):

Medicine	The name of the product or component with which it interacts	The result of the interaction
Sulfanilamides, antibiotics (macrolides, cephalosporins, tetracyclines)		
Iron containing, calcium containing medicines		
Cardiac glycosides, antidepressants		
Acetylsalicylic acid		
Levodopa *		
Glucocorticoids and steroid hormones		

*- write down reaction equations

LABORATORY PRACTICE №_____
ANALYSIS OF BREAD, BAKERY PRODUCTS, FLOUR AND CEREALS

1. Determination of acidity in bakery products:

Sample preparation: A 100 g sample of a bakery product with a crust and subcrust layer of approximately 1 cm thick is crushed and mixed.

Analysis: Place 25,0 g of the crushed test sample in a 500 ml dry bottle with a well-fitting stopper. A 250 ml volumetric flask is filled to the mark with distilled water at 20 °C. About 60 ml of water is poured into the sample bottle and quickly mixed until a homogeneous mass is obtained. Add all the distilled water from the measuring flask to the mixture. The bottle is closed with a stopper and shaken vigorously for 3 min, the mixture is left to stand for 10 min and the procedure is repeated. The settled liquid is carefully poured into a dry beaker through a frequent sieve or cheesecloth. From the beaker, 50,0 ml of the solution is pipetted into two 150 ml conical flasks and titrated with 0,1 M sodium hydroxide solution until the solution turns slightly pink, using 0,3 ml of phenolphthalein solution as an indicator.

The acidity is calculated as the arithmetic mean of the two tests.

Reaction equation:

Acidity X (°) is calculated by the formula:

$$X(\circ) = \frac{V \cdot K \cdot V_{vf} \cdot 100}{m \cdot V_p} \cdot \frac{1}{10} = \frac{V \cdot K \cdot 250 \cdot 100 \cdot 1}{m \cdot 50 \cdot 10} = \frac{V \cdot K \cdot 50}{m}$$

$X(°) =$ ——————————— =

max acidity (°)	
Flour type	*Acidity*
rye	10-12
peeled off	9-10
sown	6-7
wheat 1 grade	3-3,5
wheat 2 grade	4-4,5

where V – is the volume of 0,1 M sodium hydroxide solution used in the titration, ml;
K – is the correction factor to the molarity of 0,1 M sodium hydroxide solution;
m – is the sample weight, g;
V_{vf} – is the volume of a volumetric flask, ml;
V_p – is the volume of a pipette, ml;
1/10 - recalculation of 0,1 M sodium hydroxide solution to 1 M sodium hydroxide solution;
100 – is recalculation per 100 g of weight.

Conclusion:

2. Methods for determination of the the mass fraction of salt in bread and bakery products:

12 g of the test sample is placed in a dry thick-walled flask with a volume of 250 mL, with a well-fitted stopper. Then 60 mL of water is added and the solution is grinded with a wooden spatula until smooth state, without noticeable lumps of wholemeal bread, then another 60 mL of water is added. Close flask with a stopper and shake the mixture vigorously for 2 minutes After that, the mixture is left to stand at room temperature for 10 minutes The mixture is then shaken vigorously again for 2 minutes and left for 8 minutes. The settled liquid is filtered. Take 12 mL of the filtrate into two conical flasks of 150 mL each, add 1 mL of potassium chromate solution and titrate with 0,1 M silver nitrate solution until the color changes from yellowish-white to reddish-brown.

Reaction equation:

The salt content X (%) is calculated by the formula:

$$X(\%) = \frac{V \cdot К \cdot 0{,}005845 \cdot V_{vf} \cdot 100}{m \cdot V_p}$$

$X(\%) =$ ——————————— =

Calculations are made with an 0,1% accuracy.
The final result is the arithmetic mean of two parallel titrations for one filtrate, the allowable differences between which should not exceed 0,1%.
The norm of table salt content in bread and bakery products is from 1,6% to 1,8%.

where V – is the volume of 0,1 M silver nitrate solution used in the titration, ml;
K – is the correction factor to the molarity of 0,1 M silver nitrate solution;
m – is the sample weight, g;
V_{vf} – is the volume of a volumetric flask, ml;
V_p – is the volume of a pipette, ml.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Food containing carbohydrates: chemical properties, quality control and interaction with medicines.

Class 3. Sugar, honey, chocolate – chemical composition, quality indicators, methods of detecting counterfeit products and rational use of medicines.

Fill in the table:

«Interaction of medicines with food containing carbohydrates» (sugar, honey, chocolate):

Medicine	The name of the product or component with which it interacts	The result of the interaction
Medicines for the treatment of cardiovascular diseases		
Anti-inflammatory medicines		
Anidepressants, psychostimulants, MAO inhibitors isoniazid		

LABORATORY PRACTICE №_____
ANALYSIS OF SUGAR, HONEY AND CHOCOLATE

1. Identification of a honey sample by thin layer chromatography

Test solution. 0,6 g of the substance is dissolved in 50 mL of ethanol (30 %, v/v) R.
Reference solution. 0,5 g of fructose P, 0,5 g of glucose P and 0,1 g of sucrose P are dissolved in 100 mL of ethanol (30 %, v/v) R.
Plate: TLC plate with a layer of silica gel R.
Mobile phase: water – acetonitrile (13:87).
Sample volume: 5 µl, stripes.
Distance to be passed by the mobile phase: 3 times 15 cm from the starting line.
Drying: in warm air.
Detection: spray with a mixture prepared as follows: Dissolve 2 ml of aniline P and 2 ml of diphenylamine P in 100 ml of methanol P, add 15 ml of phosphoric acid P and mix; heat the plate at 130 °C for 10 min.

Results: The following is the sequence of zones on the chromatograms of the reference solution and the test solution. The chromatogram of the test solution may also show a faint brown zone corresponding to sucrose on the chromatogram of the reference solution. One or more other weak zones may also be detected on the chromatogram of the test solution.

The upper part of the plate

_____ fructose: intense brown area glucose: intense grayish-blue area _____ sucrose: brown area	_____ intensive brown area (fructose) intense grayish-blue area (glucose) _____ from 2 to 3 brownish-gray areas
Reference solution	**Test solution**

Conclusion:

2. Determination of refractive index of honey sample.

100 g of the substance is homogenized and transferred to a flask. Close the flask tightly and place in a water bath at (50±0.2)°C until all the sugar crystals are dissolved. The resulting solution is cooled to 20°C and re-homogenized. Immediately after rehomogenization, the surface of the refractometer prism is evenly covered with the sample. The refractive index is determined after 2 minutes if an Abbe refractometer was used and after 4 minutes if a digital refractometer was used. Use the average of two measurements.
The refractive index must be at least 1,487 (corresponds to a maximum water content of 20%).

Conclusion:

3. Optical rotation of the honey sample (2.2.7). Not more than + 0.6°.

Using the obtained value of the refractive index and Table 2051.-1 determine the water content of the substance. Using the above-mentioned data, the amount of substance equivalent to 20,0 g of dry honey residue is dissolved in water R and the volume of the solution is adjusted to 50,0 mL. To the resulting solution add 0,2 mL of ammonia concentrated solution R and adjust the volume of the solution with water R to 100,0 mL. If necessary, the solution is decolorized with activated carbon R.

Table 2051.-1

Correlation between water content in honey and refractive index

Water content (% (m/m))	Refractive index at a temperature 20°C	Water content (% (m/m))	Refractive index at a temperature 20°C
15.0	1.4992	17.6	1.4925
15.2	1.4987	17.8	1.4920
15.4	1.4982	18.0	1.4915
15.6	1.4976	18.2	1.4910
15.8	1.4971	18.4	1.4905
16.0	1.4966	18.6	1.900
16.2	1.4961	18.8	1.4895
16.4	1.4956	19.0	1.4890
16.6	1.4951	19.2	1.4885
16.8	1.4946	19.4	1.4880
17.0	1.4940	19.6	1.4875
17.2	1.4935	19.8	1.4870
17.4	1.4930	20.0	1.4865

Conclusion:

4. Determination of 5-hydroxymethylfurfural impurity: - qualitative Selivanov-Figue reaction to hydroxymethylfurfural. To 1,5 g of the tested honey sample add 7 mL of medical ether and mix thoroughly in a dry porcelain mortar for 2-3 minutes. The ether extract is transferred to a dry porcelain cup with a diameter of 50 mm. In the porcelain mortar add 7 mL of medical ether and repeat the mixing of honey with a new portion of ether. The ether extracts are combined, the ether is evaporated at room temperature. To the residue add 2 drops of 1 % resorcinol solution and observe the color change for 5 minutes

Negative reaction	Positive reaction
There is a greenish-yellow, yellow or dark yellow color (hydroxymethylfurfural content not more than 25 mg/kg)	*There is a cherry color* (hydroxymethylfurfural content not less than 25 mg/kg)

Reaction equation

Conclusion:

Data «_____» _____ 20_____

TOPIC: Beverages containing alkaloids: chemical properties, quality control and interaction with medicines.

Class 1. Tea and coffee, energy drinks that contain caffeine – chemical composition, quality indicators, methods for determining counterfeiting. Recommendations for rational use with medicines.

Fill in the table:

«Interaction of medicines with beverages containing alkaloids» (coffee, tea):

Medicine	The name of the product or component with which it interacts	The result of the interaction
NSAIDs (paracetamol, metamizole sodium, acetylsalicylic acid)		
Theophylline		
Insulin		
Antipsychotics		
Iron containing medicines		
MAO inhibitors		
Nervous system stimulants		
Hypnotics and sedatives		
Antibacterial medicines (ciprofloxacin, enoxacin, norfloxacin, sparfloxacin, trovafloxacin and grepafloxacin)		
Birth control medicines		
Medicines that reduce blood clotting		
Medicines that contain alkaloids		

LABORATORY PRACTICE №_____
ANALYSIS OF TEA AND COFFEE

1. Qualitative reactions to caffeine: the release of caffeine from tea. In a porcelain cup place 2 g of ground in a mortar sample of tea and 2 g of magnesium oxide, mix thoroughly. Place the cup on the heating plate, the heating should be moderate. A porcelain cup is placed on top of this cup and cold water is poured into it. In the presence of magnesium oxide, caffeine will be sublimed and deposited on the walls of the porcelain cup in the form of colorless crystals. Stop heating and carefully remove the crystals from the walls of the porcelain cup.

1.1. 0,01 g of caffeine is placed in a porcelain cup, 10 drops of dilute hydrochloric acid, 10 drops of bromide-bromate mixture are added and the solution is evaporated in a water bath to dryness. The residue is moistened with 1-2 drops of ammonia solution R; appears purple-red color.

Reaction equation:

Conclusion:

1.2. 0,05 g of caffeine is dissolved in 5 mL of hot water R, cooled, then add 10 drops of iodized potassium iodide solution; there should be no sediment or turbidity. When adding a few drops of dilute hydrochloric acid R, a brown precipitate is formed, soluble in excess of alkali.

Reaction equation:

Conclusion:

2. Quantitative determination of caffeine content in tea by iodometric method:

Place 7 g of tea (exact weight) in a 250-mL conical flask, add 200 mL of hot water, infuse for 15 minutes, cool and filter into a 250-mL volumetric flask, and make up the volume of the solution with purified water.

Cool to room temperature and filter through a cotton filter into the flask. Add 10 ml of dilute sulfuric acid, 25 ml of 0,1 M iodine solution to 10 ml of the resulting solution and mix thoroughly. After 15 minutes, the excess iodine is titrated with 0,1 M sodium thiosulfate solution using 1 ml of starch P solution as an indicator, which is added at the end of the titration.

A control experiment is performed in parallel.

Reaction equation:

The caffeine content (X g/100 ml) is calculated by the formula

$$X_{g/100ml} = \frac{(V_b - V_m) \cdot К \cdot 0{,}0097095 \cdot V_{vf} \cdot 100}{m \cdot V_p}$$

$$X_{g/100ml} = \text{———————————————}$$

where Vm – is the volume of 0,1 M sodium thiosulfate solution used in the main titration, ml;
Vb – is the volume of 0,1 M sodium thiosulfate solution used in the blank titration, ml;
K – is the correction factor to the molarity of 0,1 M sodium thiosulfate solution;
0,0097095 – is the titre of 0,1 M sodium thiosulfate by caffeine, g/ml;
m – is the sample weight, g;
Vvf – is the volume of a volumetric flask, ml;
Vp – is the volume of a pipette, ml.

Conclusion:

3. Detection of impurities in tea and coffee

3.1. *Determination of baking soda in tea*

In an alkaline environment, the intensity of the color of the tea increases. Therefore, adding baking soda to the brew can mask the lack of dry tea or the use of alcohol.

Cool the tea to room temperature. Apply a drop of tea on a strip of universal indicator paper.

- Infusion with soda will turn the indicator paper green.
- In the absence of soda in the teapot, the yellow color of the paper will not change.

Conclusion:

3.2. *Determination of coffee beverage in natural coffee, method of starch determination:*

Pour 10 mL of the tested coffee sample into a porcelain cup, add 2-3 drops of Lugol's solution.

- If the coffee was made with the addition of a coffee beverage, the liquid will turn purple-blue.
- If the coffee was made from natural beans – the yellowish color gradually disappears.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Alcoholic beverages: chemical properties, quality control and interaction with medicines.

Class 2. Analysis of alcoholic and low-alcoholic beverages – chemical composition, falsification. The effect of alcohol on the human body and pharmaceutical aspects of interaction with medicines.

Fill in the table:

«Interaction of medicines with alcoholic beverages»:

Medicine	The name of the product or component with which it interacts	The result of the interaction
CNS depressants (sedatives, tranquilizers, antiallergic, neuroleptics, analgetics, antipyretics, NSAIDs)		
Hypnotics and tranquilizers benzodiazepine series		
Paracetamol		
Acetylsalicylic acid		
Antidepressants and MAO inhibitors		
Antihypertensive medicines		
Nitroglycerin, coronarolytics, antispasmodics		
Indirect anticoagulants		
Oral contraceptives		
Metronidazole, furazolidone, cephalosporins, hypoglycemic medicines, sulfonylureas		
Vitamin B3, tryptophan, zinc containing medicines		
Thiamine, ascorbic acid, antioxidants, unithiol, acetylcysteine, methionine		

LABORATORY PRACTICE №_____

ANALYSIS OF GRAPE WINES, BEER

1. ***Determination of sugar in wine by refractometry.***

Refractometer for quantitative determination of sugar 0-90 % BRIX
Refractometer for sugar content measurement – an optical instrument designed to measure the concentration of sugars in aqueous solutions. The concentration is measured by the degree of refraction of light in solution. BRIX refractometer 0-90% shows degrees on the Brix scale, which are equal to the percentage of sugar in solution.

min division: 0,5 % Brix; Brix degree range: 0-90 % Brix

The procedure of the analysis

Calibration – using a pipette for application of test samples, place a drop of distilled water on the prism of the refractometer, close the lid, wait 30 seconds. Aim the refractometer at the light source and look into the eyepiece, the measurements are taken using the line between the blue field and the light field. This line indicates the degree of the Brix scale observed in the eyepiece. Using a calibration screwdriver, ensure that the refractometer shows 0 Brix in distilled water. After calibration, the prism is cleaned, the test sample is applied to it and the measuremsnt is made. After calibration, wipe the prism and transparent plate with a soft cloth.

How to measure the refractive index.

A drop of liquid is applied to the prism of the refractometer with a pipette for the test samples application and its density is determined in units of BRIX (Bx).

To determine the sugar in the wine, calibrate the refractometer with water, then apply a few drops of wine on the surface of the refractometer prism and rub evenly over the entire surface to remove air bubbles, then find the refractive index on the scale. Wipe the prism with a dry cloth and measure the refractive index 3-4 times. The average of all measurements is used to calculate the quantitative content.

Rules of operation.

After working with the device, the surface of the prism should be cleaned with special care with a soft cloth. When wiping the polished faces of the prism, special care must be taken to avoid damaging the polish. The prism is then wiped with a soft cloth until the surface shines. To ensure evaporation of the liquid, after cleaning, the refractometric unit must be in the open state.

Alcohol, vol. %	SG	Density, %	Volume and mass fraction,% (g/l)	Alcohol, vol. %	SG	Density, %	Volume and mass fraction,% (g/l)
0,00	1.002	0,51	0,51	7,25	1.058	14,27	15,10
0,25	1.004	1,02	1,03	7,50	1.060	14,74	15,62
0,50	1.006	1,53	1,54	7,75	1.061	14,97	15,88
0,75	1.008	2,05	2,06	8,00	1.063	15,43	16,41
1,00	1.010	2,56	2,58	8,25	1.065	15,90	16,93
1,25	1.012	3,06	3,10	8,50	1.067	16,36	17,46
1,50	1.014	3,57	3,62	8,75	1.069	16,82	17,98
1,75	1.016	4,07	4,14	9,00	1.071	17,28	18,51
2,00	1.018	4,58	4,66	9,25	1.073	17,74	19,03
2,25	1.020	5,08	5,18	9,50	1.075	18,19	19,56
2,50	1.022	5,58	5,70	9,75	1.076	18,42	19,82
2,75	1.024	6,07	6,22	10,00	1.078	18,87	20,35
3,00	1.026	6,57	6,74	10,25	1.080	19,33	20,87
3,25	1.028	7,06	7,26	10,50	1.082	19,78	21,40
3,50	1.030	7,55	7,78	10,75	1.084	20,23	21,93
3,75	1.032	8,04	8,30	11,00	1.086	20,67	22,45
4,00	1.034	8,53	8,82	11,25	1.088	21,12	22,98
4,25	1.036	9,02	9,34	11,50	1.090	21,57	23,51
4,50	1.038	9,50	9,87	11,75	1.092	22,01	24,03
4,75	1.040	9,99	10,39	12,00	1.093	22,23	24,30
5,00	1.041	10,23	10,65	12,25	1.095	22,67	24,83
5,25	1.043	10,71	11,17	12,50	1.097	23,11	25,35
5,50	1.045	11,19	11,69	12,75	1.098	23,33	25,62
5,75	1.047	11,67	12,22	13,00	1.100	23,77	26,15
6,00	1.049	12,14	12,74	13,25	1.102	24,21	26,68
6,25	1.051	12,62	13,26	13,50	1.104	24,64	27,20
6,50	1.053	13,09	13,79	13,75	1.105	24,86	27,47
6,75	1.055	13,56	14,31	14,00	1.107	25,29	28,00
7,00	1.056	13,80	14,57	14,25	1.109	25,72	28,53

Conclusion:

2. Determination of acidity in beer:

Preparation: opaque beer is filtered through a paper filter. 150-200 mL of the test sample is poured into a 500 mL

flask. Shake the flask with the palm of your hand, periodically opening it until the feeling of pressure from within ceases. Transfer 50 mL of beer to a 100 mL conical flask, heat on an electric stove to a temperature of 35-40°C and keep at this temperature for 30 minutes. shaking periodically. Then the beer is cooled with water to a temperature 20°C. Dark beer before determination is diluted in a measuring cylinder with distilled water in a ratio of 1:3.

Test: Place 10,0 mL of the prepared sample in a 100 mL conical flask, add 40 mL of water P and 4 drops of phenolphthalein, titrate with 0,1 M sodium hydroxide solution until slightly pink colour appears.

Permissible active acidity is calculated by the formula:

$X = V - K_1 \cdot K_2$ $X =$ Acceptable active acidity 4,0-4,6	*where V – is the volume of 0,1 M sodium hydroxide solution used in the titration, ml;* *K_1 – is the correction factor to the molarity of 0,1 M sodium hydroxide solution;* *K_2 – is the dilution factor (for dark beer K_2=4, for light beer K_2 = 1).*

Conclusion:

3. Tests for the difference between natural beer and powdered beer:

3.1. *Foaming.*

50 mL of the test sample is quietly poured into a measuring cylinder (or a glass with a diameter of 70-75 cm, height 150 mL) at 150 mL. Immediately take a ruler and measure the height of the foam from the edge of the glass to the boundary between beer and foam. At the same time turn on the stopwatch, until such time as the foam does not fall to form a film. Foam resistance is expressed as an integer number of minutes.

Result: in natural beer the foam is dense, white and rises to a height of 4-5 cm, lasts at least 3 minutes. Powdered beer has a yellow foam, with lots of bubbles, coagulates quickly.

The result of measuring the height of the foam is expressed in millimeters, the value is measured to the last significant digit 0 or 5.

Conclusion:

3.2. Determination of hops in beer:

To 50 mL of the test sample, add 10 mL of 9 % table vinegar, after 10 min a precipitate is formed.

In the case of a beer without the addition of hops, no precipitate is formed.

Conclusion:

3. ***Determination of the presence of furfural in ethyl alcohol (method is based on the reaction of furfural with aniline in the presence of hydrochloric acid with the formation of colored solutions):***

Place 10 drops of aniline, 3 drops of 1,188 g/mL of hydrochloric acid and 10 mL of test alcohol into a 25 mL test tube with a ground stopper. The tube is closed with a stopper, its contents are mixed and kept at room temperature. If the solution remains colorless for 10 minutes, it does not contain furfural. The appearance of a red color indicates the presence of furfural.

- *The presence of furfural is determined in rectified alcohol obtained from grain and potato raw materials.*
- *The presence of furfural is not determined in rectified alcohol obtained from sugar-containing raw materials, as well as in raw alcohol.*

Reaction equation:

Conclusion:

4. ***Determination of natural dyes in wine:***

To a few milliliters of wine add a few milligrams of sodium bicarbonate. If the wine changes color to brown, it contains natural dyes. If it does not change, this wine contains synthetic dyes.

Conclusion:

Data «_____» _____ 20_____

TOPIC: Analysis of oils and fats of plant and animal origin – chemical properties, quality control and interaction with medicines.

Fill in the table:

«Biological value of plant and animal oil»:

Origin	Examples	Biological value
Animal oil		
Plant oil		

LABORATORY PRACTICE №_____

ANALYSIS OF PLANT OILS

1. ***Description***	**Appearance**
Olive oil	Transparent liquid of yellow or greenish-yellow color
Refined sunflower oil	Transparent light yellow liquid
Refined coconut oil	Oily mass of white or almost white color
Refines sesame oil	Transparent, light yellow, almost colorless liquid
Refined soybean oil	Transparent pale yellow liquid

2. ***Determination of the refractive index of a sample of vegetable oil:***	
Refined sunflower oil	≈1,474
Refined coconut oil	≈1,449 (t=40°C)
Refines sesame oil	≈1,473
Refined soybean oil	≈1,475
Restorative density of olive oil ≈0,913	

3. ***Determination of peroxide number.***

About 5 g (exact portion) of the substance is placed in a conical flask with a ground glass stopper with a volume of 250 mL, 30 mL of a mixture of chloroform R - glacial acetic acid P (2:3) is added. Shake the flask to dissolve the substance, add 0,5 mL of potassium iodide saturated solution R, stir for 1 min and add 30 mL of water R. The resulting solution is titrated with 0,01 M sodium thiosulfate solution, slowly adding the titrant with continuous stirring until yellow colour disappearance. Then add 5 mL of starch solution R and continue to titrate, stirring vigorously until the solution is discolored.

A control experiment is carried out in parallel.

The volume of 0,01 M sodium thiosulfate R solution spent on titration in the control experiment should not exceed 0,1 mL. The peroxide number is calculated by the formula:

$I_p = \frac{10 \cdot (n_1 - n_2)}{m} = \text{\_\_\_\_\_} =$ *Peroxide number:* Refined coconut oil - no more than 5,0 Refined sesame oil - no more than 10,0 Not refind olive oil - no more than 20,0 Refined olive oil – no more than 10,0 Refined soybean oil - no more than 5,0	$where: n_1 -$ *volume of* 0.01 M *sodium thiosulfate solution, used for titration, mL;* $n_2 -$ *volume of* 0.01 M *sodium thiosulfate solution, used for titration in the control, mL;* $m -$ *sample mass, g.*

Conclusion:

4. ***Detection of palm oil in dairy products:***

A sample of butter or cheese is placed under a UV lamp (wavelength 364 nm) and is observed. If the sample glows bright yellow, no impurities of palm oil are found. If the sample has white or blue light, it contains plant oil and the more intense the glow is, the more the amount of it.

Conclusion:

5. ***Determination of falsification of cold pressed plant oils:***

To 2 mL of the tested oil sample add a few drops of phenolphthalein. If the oil is cold pressed, there will be no visible changes. Refined oil turns pink

Conclusion:

Data «_____» _____ 20____

TOPIC: Food additives – chemical properties, quality control and interaction with medicines.

LABORATORY PRACTICE №_____
ANALYSIS OF FOOD ADDITIVES

1. ***Sodium benzoate (E211)-preservative***

1.1. To 10 mL of a colorless test beverage add 5 mL of 0,5 M of sulfuric acid, mix vigorously and evaporate in a porcelain cup to a volume of 3 mL.
To 1 mL of the test solution (the reaction of the solution should be neutral), add 0,5 mL of iron (III) chloride solution; a pale yellow precipitate of basic iron (III) benzoate is formed.

Reaction equation:

Conclusion:

1.2. To 2 mL of the test solution add 2 mL of hydrochloric acid, a white precipitate of benzoic acid is formed.

Reaction equation:

Conclusion:

2. ***Sorbic acid (E200) - preservative***

2.1. 0,2 g of food additive is dissolved in 2 mL of ethanol (96 %) and 0,2 mL of bromine water is added; the solution is discolored.

Reaction equation:

Conclusion:

3. ***Glutamic acid (E620)-flavor enhancer (salts Na (E621), K (E622), Ca (E623), NH4+ (E624), Mg (E625))***

3.1. 0,4 g of the food additive is dissolved in 1 M hydrochloric acid solution under low heat and the volume of the solution with the same acid is adjusted to 10,0 mL. To 2,0 mL of the resulting solution, add 0,1 mL of phenolphthalein solution, from 3,0 mL to 3,5 mL of 1 M sodium hydroxide solution until a red color appears. Then add a mixture of 3 mL of formaldehyde solution, 3 mL of water, and 0,1 mL of phenolphthalein solution, to which was previously added 1 M sodium hydroxide solution until pink colour appears; the solution is discolored. To the resulting solution is added 1 M sodium hydroxide solution until a red color appeares. The total volume of 1 M sodium hydroxide solution consumed should be between 4,0 mL and 4,7 mL.

Reaction equation:

Conclusion:

3.2. 0,02 g of glutamic acid is dissolved by heating in 1 mL of freshly boiled water, 1 mL of freshly prepared ninhydrin solution is added and heated; a blue-violet color appears.

Reaction equation:

Conclusion:

CONTENTS

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Educational edition

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