

**MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
faculty for foreign citizens' education
pharmaceutical technology of drugs department**

QUALIFICATION WORK

on the topic: **«DEVELOPMENT OF THE COMPOSITION OF A VITAMINE
MEDICINE IN THE FORM OF AN EFFERVESCENT POWDER»**

Prepared by: higher education graduate of group
Phm18(4,10Д) – 08 English
specialty 226 Pharmacy, industrial pharmacy
educational program Pharmacy
Fatima Zahra SEKKOUM

Supervisor: associate professor of higher education
institution of pharmaceutical technology of drugs
department, Doctor of Pharmacy, associate professor
Kateryna SEMCHENKO

Reviewer: professor of higher education institution of
Department of Technology of Drugs, Dr. of Pharmacy,
Professor Yuliia LEVACHKOVA

ANNOTATION

Qualification work is devoted to the research on the development of the composition of the medicine in the form of effervescent powder with complex composition of vitamins.

The qualification work is laid out on 45 pages of typewritten text, consists of an introduction, three sections, general conclusions, a list of used literary sources and 2 appendixes. The bibliography contains 57 sources. The work is illustrated with 5 tables and 6 figures.

Key words: powder, effervescent, technology, vitamin, extemporaneous.

АНОТАЦІЯ

Кваліфікаційна робота присвячена дослідженням з розробки складу лікарського засобу у формі шипучого порошку з комплексним складом вітамінів.

Кваліфікаційна робота викладена на 45 сторінках машинописного тексту, складається зі вступу, трьох розділів, загальних висновків, списку використаних літературних джерел і 2^х додатків. Список літератури містить 57 джерел. Робота ілюстрована 5^{ма} таблицями та 6^{ма} рисунками.

Ключові слова: порошок, шипучий, технологія, вітамін, екстемпоральний.

CONTENTS

INTRODUCTION.....	4
CHAPTER 1. VITAMINS: IMPACT ON HUMAN LIFE.....	7
1.1 The role of vitamins in human life.....	7
1.2 Vitamin deficiency in adults: manifestations, treatment and prevention	8
1.3 Treatment of vitamins deficiency.....	11
1.4 Vitamins deficiency and hypovitaminosis in children.....	13
Conclusions to chapter 1.....	16
CHAPTER 2. OBJECTS AND METHODS OF RESEARCH.....	17
2.1 Objects of research	17
2.1.1 Excipients.....	17
2.1.2 Active pharmaceutical ingredients.....	20
2.2 Methods of research.....	24
Conclusions to chapter 2.....	24
CHAPTER 3. DEVELOPMENT OF THE COMPOSITION OF EFFECTIVE POWDER OF GENERAL STRENGTHENING EFFECT.....	25
3.1. Selection of auxiliary substances forming effervescent powder.....	25
3.2 Selection of active pharmaceutical ingredients and development of the technology of effervescent powder with a tonic effect.....	30
Conclusions to chapter 3.....	34
GENERAL CONCLUSION.....	35
REFERENCES	36
APPENDIXES.....	41

INTRODUCTION

Relevance. The aim of pharmaceutical development is to design a quality product and its manufacturing process to consistently deliver the intended performance of the product.

Preparation of extemporaneous drugs is conducted in accordance with the relevant regulations, such as: State Pharmacopoeia of Ukraine, laws, guidelines approved by Ministry of Health of Ukraine, handbooks, information letters, etc. In such documents requirements to pharmacy, its equipment, premises and staff, main principles and rules of preparation of different dosage forms and requirements to their quality control are given.

The doctrine of vitamins and their physiological role and importance in the development of a number of diseases has more than 200 years of history. The discovery among food components of the class of substances absolutely necessary for normal life activity belongs to the Russian scientist, pediatrician by profession, M.I. Lunin (1853-1937). Further work on the study of vitamins is associated with the names of Nobel Prize laureates: hygienist Christian Eikman and biochemist Frederick Hopkins (1929) established the cause of beriberi disease; William Murphy, George Whipple, George Maino (1934) worked on the study of vitamin B12, Albert Saint-Geordie (1937) investigated the role of vitamin C in the body, and Eduard Doisy and Henrik Dahm (1940) devoted their research to vitamin K. A significant contribution to the study of vitamins was made by Ukrainian scientists: O.V. Palladin, R.V. Chagovets, U.F. Shamrai, O.Ya. Rozanov, P.G. Podorozhny, Ya.I. Tomashevsky and others.

According to the FDA, about 90% of Americans are vitamin deficient, and nearly 60% of the US population takes multivitamins.

The vitamin and supplement industry is valued at \$140.3 billion. Amazon has accounted for 77% of online vitamin and supplement sales over the past three years.

The best way to replenish the level of vitamins in the human body is a complete balanced diet, which is based on the daily consumption of a large amount

of vegetables, fruits, dairy and meat products, etc. But the seasonality of fruit and vegetable crops, as well as the fast-paced lifestyle, often prevent proper nutrition. In such a situation, complex vitamin and mineral products come in handy.

It is known that in the dissolved state vitamin products are absorbed up to 98%, while solid forms of vitamin products have much lower indicators.

Therefore, the development of multivitamin preparations with a tonic effect is an urgent task of modern pharmacy.

The goal of our work is the development of a medicinal product in the form of an effervescent powder of a complex composition with a tonic effect.

Tasks of the study

To achieve the set goal, we defined the following tasks:

- analyze data from scientific literature on the role of vitamins in the life of an adult and a child;
- to analyze the range of medicines belonging to the group of multivitamins;
- to develop the composition of an effervescent powder of a complex composition with general strengthening effect;
- to conduct research on the study of technological aspects of the production of effervescent powder of a complex composition with general strengthening action in the conditions of pharmacies.

Object of study. Pharmaceutical development of a drug in the form of an effervescent powder with a tonic effect of pharmacy production.

Subject of study. Research on the development of the composition of an effervescent powder with a general strengthening effect of a complex composition of pharmacy manufacture.

Methods of research. When solving the tasks set in the qualification work, bibliosemantic, well-known organoleptic (appearance, color, smell), pharmacotechnological (sieve analysis), organizational-economic and mathematical (statistical processing of results) research methods were used, which allow objectively evaluating the qualitative indicators of the researched samples of effervescent powder of general strengthening action.

Practical significance of the obtained results. A pharmacy preparation in the form of an effervescent powder of a complex composition is proposed, which will allow to expand the range of domestic medicines of general tonic effect, in particular, of extemporaneous production.

Approbation of research results and publication Based on the materials of the qualification work, 1 theses was published and a certificate was obtained (see Appendix A, B).

Structure and scope of qualification work.

The qualification work is laid out on 42 pages of typewritten text, consists of an introduction, three sections, general conclusions, a list of used literary sources and 2 appendixes. The bibliography contains 57 sources. The work is illustrated with 5 tables and 6 figures.

CHAPTER 1

VITAMINS IMPACT ON HUMANS LIFE

1.1 The role of vitamins in humans life

Vitamins are an essential part of life, touching every function of the human body. The human body can produce some vitamins, but most have to be consumed. Supplements are taken to provide extra boosts where needed.

Even at rest, the body is active. Constantly producing and replenishing skin, tissue, muscle and bone, the body requires fuel. The fuel the body needs comes in the form of food. Food is what provides the body with the essential vitamins and nutrients. Vitamins help the body develop and function properly. Every system in the body is dependent on vitamins. The body can manufacture some vitamins, such as vitamin D from the sun and vitamin K produced in the gut. Most of the vitamins a body needs have to be consumed. The body needs 13 essential vitamins: vitamins A, C, D, E, K and the 8 types of B vitamins.

Vitamins and supplements are needed for a healthy body. The body is able to produce a couple of the essential vitamins but must consume the rest. Supplements can bridge the gap or serve as an extra boost for improving a person's health. Speak with a healthcare provider or pharmacist for individual supplement recommendations.

Vitamins all have different jobs and functions. Some heal wounds, some bolster the immune system. And some vitamins keep nerves happy and help the body turn food into energy.

Vitamins are essential nutrients that perform dozens of various roles within the human body.

Examples of vitamins and their benefits :

Vitamin D and calcium

Vitamin D and calcium are both important for strong bones. Vitamin D helps the body absorb calcium into the intestines.

Sodium and potassium

Sodium is an essential nutrient but can be dangerous in high quantities. Potassium instructs the body to expel excess sodium.

Vitamin B12 and folate

Vitamin B12 and folate work together to encourage cell division and replication. The two also promote the metabolization of the amino acid homocysteine.

Niacin and tryptophan

Niacin helps regulate cholesterol. Consuming tryptophan helps avoid niacin déficits.

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1.2 Vitamin deficiency in adults: manifestations, treatment and prevention

Vitamin deficiency anemia is a lack of healthy red blood cells caused by lower than usual amounts of vitamin B12 and folate. This can happen if you don't eat enough foods containing vitamin B-12 and folate, or if your body has trouble absorbing or processing these vitamins. Specifically, 94.3% of the US population do not meet the daily requirement for vitamin D, 88.5% for vitamin E, 52.2% for magnesium, 44.1% for calcium, 43.0% for vitamin A, and 38.9% for vitamin C.

Stages of nutrients deficiency:

- Adequacy.
- Negative Balance.
- Decline in Tissue Stores.
- Loss of Function: Symptoms of Deficiency. Signs of Deficiency. Organ Failure.
- Death.
- **João Victor Ribeiro Rocha[...]**
- **A. Figueiroa Bakuzis**
- **A. Figueiroa Bakuzis**

<div>  Clinically important vitamins and vitamin deficiency states </div>			
Name	Sources	Deficiency	Investigations
Fat-soluble			
Vitamin A	Liver, milk, butter, fish oils	Xerophthalmia, night blindness, keratomalacia, follicular hyperkeratosis	Serum retinol
Vitamin D	Synthesised in skin	Rickets, osteomalacia	Plasma 25(OH)D/1,25(OH) ₂ D
Vitamin E	Vegetables, seed oils	Haemolytic anaemia, ataxia	Plasma vitamin E
Vitamin K	Green vegetables, dairy products	Coagulation disorder	Coagulation assay ± plasma vitamin K
Water-soluble			
Thiamin (B ₁)	Cereals, grains, beans, pork	Beri-beri, Wernicke–Korsakoff syndrome	RBC transketolase, whole-blood vitamin B ₁
Riboflavin (B ₂)	Milk	Glossitis, stomatitis	RBC glutathione reductase, whole-blood B ₂
Niacin (B ₃)	Meat, cereals	Pellagra	Urinary metabolites
Pyridoxine (B ₆)	Meat, fish, potatoes, bananas	Polyneuropathy	Plasma pyridoxal phosphate or RBC transaminase activation coefficient
Biotin	Liver, egg yolk, cereals	Dermatitis, alopecia, paraesthesiae	Whole-blood or urine biotin
Folate	Liver, milk	Anaemia, neural tube defects during gestation	RBC folate
Vitamin B ₁₂	Animal products	Anaemia, neurological degeneration	Plasma B ₁₂
Vitamin C	Fresh fruit, vegetables	Scurvy	Ascorbic acid (plasma: daily intake; leucocyte: tissue stores)

Source : Davidsons Essentials of Medicine, 2e

Fig. 1.1 Clinically important vitamins and vitamins deficiency states

Manifestations of vitamins deficiency in adults

Symptoms of vitamin deficiency include brittle hair and nails, mouth ulcers, hair loss, scaly skin patches, and more. Recognizing these signs can help you adjust your diet accordingly. A well-balanced and nutritious diet has many benefits.

Brittle hair and nails

A variety of factors may cause brittle hair and nails. One of them is a lack of biotin.

Biotin, also known as vitamin B7, helps the body convert food into energy.

A deficiency in biotin is very rare, but when it occurs, brittle, thinning, or splitting hair and nails are some of the most noticeable symptoms.

Other symptoms of biotin deficiency include chronic fatigue, muscle pain, cramps, and tingling in the hands and feet (1).

Pregnant women, heavy smokers or drinkers, and people with digestive disorders like Crohn's disease are at the greatest risk of developing biotin deficiency.

Mouth ulcers or cracks in the corners of the mouth

Lesions in and around the mouth may partly be linked to an insufficient intake of certain vitamins or minerals.

For instance, mouth ulcers, also commonly referred to as canker sores, are often the result of deficiencies in iron or B vitamins.

One small study notes that patients with mouth ulcers appear to be twice as likely to have low iron levels (10 Trusted Source).

In another small study, around 28% of patients with mouth ulcers had deficiencies in thiamine (vitamin B1), riboflavin (vitamin B2), and pyridoxine (vitamin B6) (11).

Bleeding gums

Sometimes a rough tooth brushing technique is at the root of bleeding gums, but a diet lacking in vitamin C can also be to blame.

Vitamin C plays an important role in wound healing and immunity, and it even acts as an antioxidant, helping prevent cell damage.

Your body does not make vitamin C on its own, so the only way to maintain adequate levels of it is through diet (18-20e).

Vitamin C deficiencies are rare in individuals who consume enough fresh fruits and vegetables. That said, many people fail to eat enough fruits and vegetables each day.

This may explain why studies performing routine screenings of healthy populations estimate low vitamin C levels in 13–30% of the population, with 5–17% of people being deficient (21).

Poor night vision and white growths on the eyes

A nutrient-poor diet can sometimes cause vision problems.

For instance, low intakes of vitamin A are often linked to a condition known as night blindness, which reduces people's ability to see in low light or darkness.

That's because vitamin A is necessary to produce rhodopsin, a pigment found in the retinas of the eyes that helps you see at night.

When left untreated, night blindness can progress to xerophthalmia, a condition that can damage the cornea and ultimately lead to blindness (25 Trusted Source).

Another early symptom of xerophthalmia is Bitot's spots, which are slightly elevated, foamy, white growths that occur on the conjunctiva or white part of the eyes. The growths can be removed to a certain extent but only fully disappear once the vitamin A deficiency is treated.

13-Merck Manual. Vitamin A Deficiency.

(<https://www.merckmanuals.com/home/disorders-of-nutrition/vitamins/vitamin-a-deficiency>) Accessed 5/23/2022.

What are the symptoms of vitamin deficiency in adults Fatigue.

Shortness of breath. Dizziness.

Pale or yellowish skin. Irregular heartbeats. Weight loss.

Numbness or tingling in the hands and feet. Muscle weakness.

1.3 Treatment of vitamins deficiency

Vitamin deficiency anemia is treated with doses of whichever vitamin is lacking. For pernicious anemia, vitamin B-12 is usually delivered via injection and may need to be taken regularly for the rest of your life. Vitamin B-12 is available as: Injections into a muscle or under the skin

Based on current research, it usually takes 1-3 months of consistent supplementation to correct a vitamin deficiency. If you're severely deficient in a vitamin, it may take longer to restore optimal levels. Keep in mind, there isn't a

catch-all answer for how long it takes vitamins to kick in.

Common recommendations include 200,000 IU vitamin D3 every 3 months (12), 1,000–2,000 IU vitamin D2 or vitamin D3 daily for several weeks (13), or the administration of a single im injection of 600,000 IU of vitamin D2, repeated after 12 wk (14–16)

The best approach to ensure you get a variety of vitamins and minerals, and in the proper amounts, is to adopt a broad healthy diet. This involves an emphasis on fruits and vegetables, whole grains, beans and legumes, low-fat protein, and dairy products.

Prevention from hypovitaminosis in adults

The best way to avoid or remedy nutrient deficiencies is to make sure you are eating a balanced, nutrient-rich diet, Patton says. “I encourage food first, but if you are at an increased risk of a nutrient deficiency, you may benefit from taking a multivitamin,” she says. The correct option is B Vitamins Vitamins protect the body from deficiency diseases. For example: Vitamin A, Vitamin B, etc.

This type of food protects us from deficiency diseases.

Foods protect us from disease and therefore antibiotics which protect us from disease are also foods.

Types of Vitamins	Deficiency Diseases
A (Retinol)	Night blindness
B1 (Thiamine)	Beri-beri
B2 (Riboflavin)	Retarded growth, bad skin
B12 (Cyanocobalamin)	Anaemia
C (Ascorbic acid)	Scurvy
D (Calciferol)	Rickets
K (Phylloquinone)	Excessive bleeding due to injury
Types of Minerals	Deficiency Diseases
Calcium	Brittle bones, excessive bleeding
Phosphorus	Bad teeth and bones
Iron	Anaemia
Iodine	Goitre, enlarged thyroid gland
Copper	Low appetite, retarded growth

Fig. 1.2 Diseases caused by lack of vitamins

1.4 Vitamins deficiency and hypovitaminosis in children

Vitamins deficiency needs in children:

A child's growing body requires various nutrients that play a critical role in optimal development and preventing nutritional diseases.

The body doesn't produce these micronutrients, or vitamins and minerals naturally; therefore, kids need to get them from their diet.

A nutrient deficiency or micronutrient malnutrition in kids occurs when a child has an inadequate intake of the necessary amount of a specific nutrient intake. They can also occur when the body doesn't absorb a specific nutrient properly.

Which nutrient deficiencies are most common in children?

The most common nutrient deficiencies in children include iron, calcium, vitamin D, zinc, vitamin B12, potassium, and fiber.

Iron Deficiency

As your infant transitions into toddler-hood, food pickiness may take center stage. As a result, your child may be lacking in this essential nutrient.

Your child requires iron for numerous bodily functions. Iron is an important component of hemoglobin, the protein that carries oxygen from the lungs to the rest of the body.

Vitamin D Deficiency

Vitamin D is a fat-soluble vitamin that is essential for the absorption of a variety of nutrients including calcium, iron, magnesium, zinc, and phosphate.

Adequate vitamin D intake is necessary for optimal bone growth, a robust immune system, and heart health.

Zinc Deficiency

Zinc is an important mineral needed for optimal growth, strong immunity, sex hormone development, cognitive functioning, and healthy digestion.

Calcium Deficiency

Calcium is a mineral that supports your child's bone growth, heart health, and nerve and muscle functioning.

The window to build strong bones is relatively short. A child who consumes

adequate calcium in childhood will set the stage for developing strong bones well into adulthood.

It is widespread knowledge that milk and milk products are rich in calcium, but there are many lesser known alternatives. These include calcium-fortified milk alternatives, dark leafy green vegetables, tofu, fish (salmon and sardines), nuts, seeds, white beans, chickpeas, and fortified cereals.

Vitamin B12 Deficiency

Vitamin B12 is an important nutrient needed for healthy red blood cells, cognitive development, enhanced immunity, and converting food into energy.

Vitamin B12 can be found in a variety of animal foods, including meat, dairy and egg products. Plant-based foods are poor sources unless they're fortified with B12.

Disorders affecting the lining of the small intestine, like Crohn's disease or surgical removal of the end of the small intestine, can also lead to a B12 deficiency

36-National Library of Medicine

8600 Rockville Pike

Bethesda, MD 20894

Symptoms of nutritional deficiency in children

Bedwetting.

Persistent colds or infections.

Allergies, wheezing, stuffy noses and sweating. Hyperactivity, irritability, twitching and restlessness.

Digestive issues like constipation, diarrhoea and stomach aches. Fatigue. Poor attention span and difficulty in school.

Hypovitaminosis in children

A disorder that is caused by the deficiency of a vitamin. The deficiency may result from either suboptimal vitamin intake or conditions that prevent the vitamins use or absorption in the body.

Low level of 25-hydroxy vitamin D (25-(OH)-D) is highly prevalent in children worldwide and has been linked to various adverse health outcomes including rickets, osteomalacia, osteomalacic myopathy, sarcopenia, and

weakness, growth retardation, hypocalcemia, seizure and tetany, autism, cardiovascular diseases, diabetes.

33-<https://www.researchgate.net/journal/Brazilian-Journal-of-Pharmaceutical-Science-1984-8250>

Conclusion to chapter 1

Vitamin Deficiency is one of the common forms of nutrient deficiency faced by our bodies. It is very common in individuals, hence needs to be fulfilled by incorporating some food items in one's regular diet.

It plays a key function in regular metabolism, the absence of which in the diet causes deficiency and several diseases. Vitamins are differentiated from the trace elements, also found in the weight-reduction plan in small quantities for health, growth, replica, and other crucial metabolism.

Vitamin deficiency can cause a number of symptoms, including fatigue, dry skin and hair, depression, poor wound healing, and more. While they can vary between deficiencies, many of them overlap. Usually, noticeable effects don't begin to develop until you've had low levels for several months.

CHAPTER 2

OBJECTS AND METHODS OF RESEARCH

2.1 Objects of research

2.1.1. Excipients

Excipient is an inactive substance that serves as the vehicle or medium for a drug or other active substance.

Active Pharmaceutical Ingredient (API) is the biologically active component of a drug product (tablet, capsule, cream, injectable) that produces the intended effects.

APIs are bulk drugs that are pharmaceutically active and generate a desired pharmacological effect, whereas, excipients are pharmacologically inactive substances that are generally used as a carrier of the API in the drug.

Excipients (fig. 2.1) provide bulkiness to formulations, facilitate absorption of the drug, provide stability and prevent denaturation of drugs. Pharmaceutical excipients are cost effective, stable, feasible for handling, and inert in nature. Excipients are used in a variety of medicinal products such as capsules, tablets, oral liquids, inhalers, implants and injections among others.

25-World J Clin Cases. 2014 May 16; 2(5): 120–125. Published online 2014 May 16. doi: 10.12998/wjcc.v2.i5.120

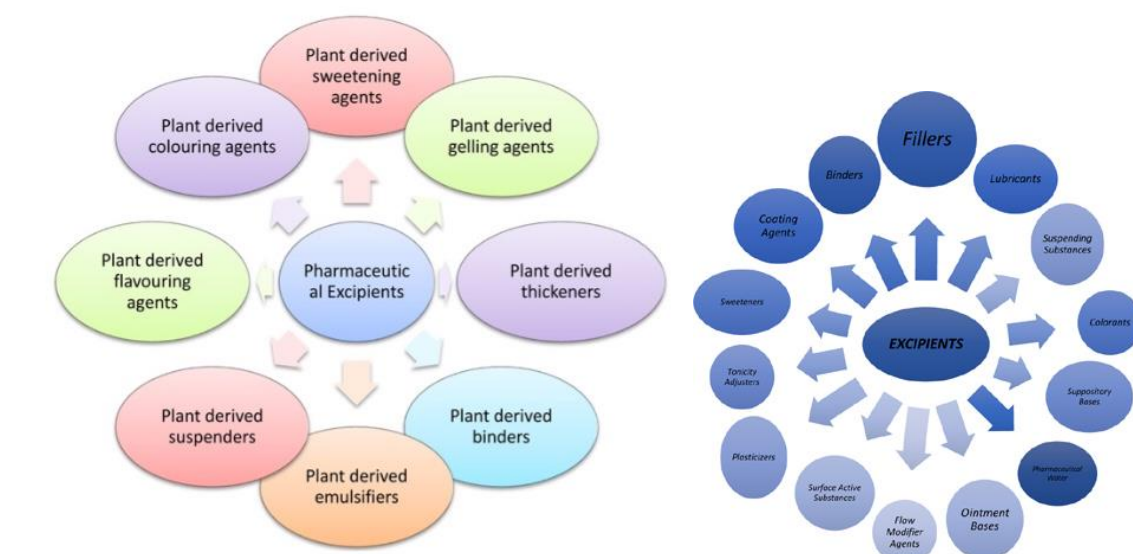


Fig. 2.1 Excipients classification

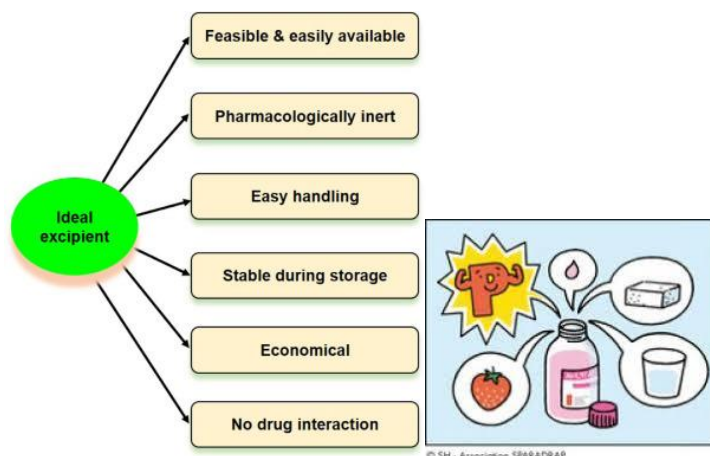


Fig. 2.2 Requirements to excipients

The aim of the research was to study the effect of different groups of excipients on the pharmaco-technological properties of the powder mass for tableting in the development of the composition of the tablets with dry extract of *Sanguisorba officinalis* for complex therapy of the gastrointestinal tract diseases.

The drug-excipient compatibility studies are carried out with an intent to identify, quantify and predict potential interactions (physical or chemical) along with the impact of these interactions on the manufacturability, quality and performance of the final drug product.

The characteristics of excipients used in our studies are given in table. 2.1.

Table 2.1

Characteristics of excipients

Object of research	Documents	Characteristics
1	2	3
Citric acid	SPU 2.0, p. 398	White crystalline powder, colorless crystals or granules, well soluble in water, freely soluble in alcohol.
Potassium dihydrogen phosphate	SPU 2.0, p. 329	White crystalline powder or colorless crystals, freely soluble in water, practically insoluble in alcohol.
Sodium carbonate	SPU 2.0, p. 478	White or almost white slightly granular powder,

		hygroscopic, well soluble in water, practically insoluble in ethanol (96%).
Malic acid	EP 01/2005:0365	White crystalline powder, well soluble in water and ethanol.
Succinic acid	https://compendium.com.ua/info/277317/jantarnaja-kislota/	Pure acid is colorless crystals. A solid substance. Soluble in water and alcohol, poorly in ether, insoluble in benzene, gasoline, chloroform.
Glutamic acid	SPU 2.0, p. 170	White crystalline powder or colorless crystals, well soluble in boiling water, slightly soluble in cold water.
Sodium bicarbonate	SPU 2.0, p. 475	White or almost white slightly granular powder, hygroscopic, well soluble in water, practically insoluble in ethanol (96%).
Basic magnesium carbonate	SPU 2.0, p. 418	Clear yellow viscous liquid or semi-solid. Solubility: well soluble in water, well soluble in methylene chloride, freely soluble in ethanol (96%).

2.1.2. Active pharmaceutical ingredients

The Global Active Pharmaceutical Ingredients (fig. 2.3) market is expected to reach \$198.8 billion by 2022 with a CAGR of 6.4%. Patent expiration of prominent drugs, government initiatives, regional penetration and increasing aged population are some of the factors that are driving the market growth. Strict validation and safety guidelines stated by WHO and fragmented market are the factors that are hampering the API market growth.

18-

http://www.clevelandclinic.org/?_gl=1*jq2l4u*_ga*NDQ3NzM3NzQ4LjE2ODM5NzcyNzM.*_ga_HWJ092SPKP*MTY4Mzk3NzI3Mi4xLjEuMTY4Mzk3ODI2Ni4wLjAuMA

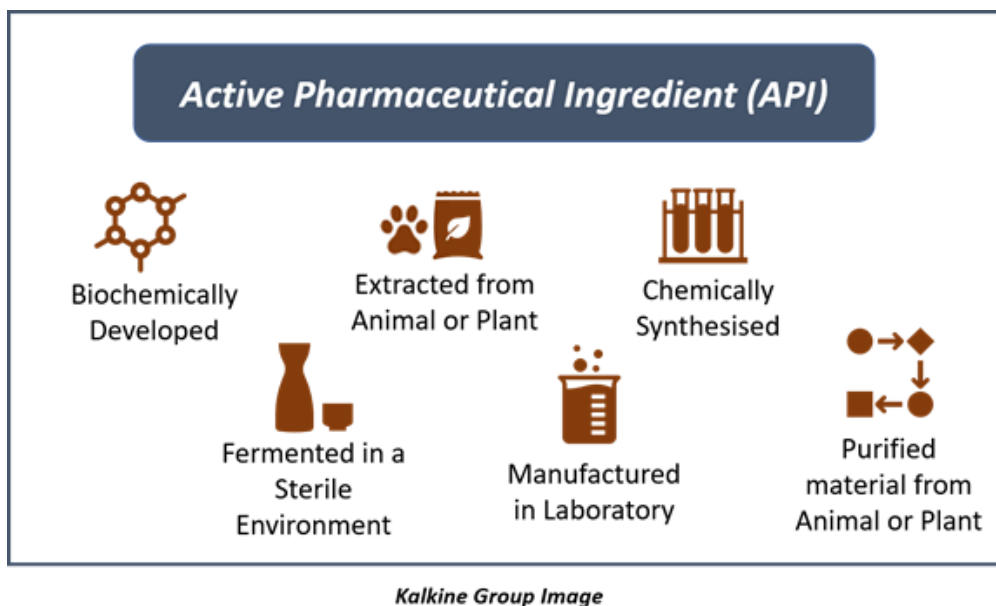


Fig. 2.3 APIs peculiarities

The generic/non- branded segment of the industry witnessed the largest market share during the forecast period due to rising healthcare costs, government prominence on generics for dropping healthcare costs, and decreasing pipelines of global pharmaceutical products. Asia Pacific is expected to be highest market share during the forecast period due to low operation costs and high investments in medical research. Moreover, the high cost of skilled labor and energy are the most significant factors that enforced European market to move its base to developing countries, such as India and China.

The drug-excipient compatibility studies are carried out with an intent to identify, quantify and predict potential interactions (physical or chemical) along with the impact of these interactions on the manufacturability, quality and performance of the final drug product.

The characteristics of API and auxiliary substances used in our studies are given in table. 2.2.

Table 2.2

Characteristics of API

Object of research	Documents	Characteristics
1	2	3
Ascorbic acid (Vitamin C)	SPU 2.0, p. 61	White or almost white crystalline powder or colorless crystals, which discolor on exposure to air and moisture, freely soluble in water, soluble in alcohol.
Thiamine hydrochloride (vitamin B1)	SPU 2.0, p. 625	White or almost white, crystalline powder or colorless crystals. Solubility: well soluble in water, soluble in glycerol, slightly soluble in alcohol.
Riboflavin (vitamin B2)	SPU 2.0, p. 574	Yellow or orange-yellow crystalline powder. Solubility: very slightly soluble in water, practically insoluble in alcohol.
Niacin	EP 01/2005:0459	White crystalline powder, soluble in boiling water and boiling alcohol, sparingly soluble in water. Dissolves in

		dilute solutions of alkali hydroxides and carbonates.
Pantothenic acid	https://www.webmd.com/ingredients/ingredient/mono-853/pantothenic-acid-vitamin-b5	Water-soluble vitamin B is an amide of the amino acid β -alanine and pantoic acid.
Pyridoxine hydrochloride	SPU 2.0, p. 534	Colorless crystals, soluble in water.
Folic acid	SPU 2.0, p. 661	Yellowish or orange crystalline powder, practically insoluble in water and in most organic solvents.
Biotin	EP 01/2005:1073	White crystalline powder or colorless crystals, very sparingly soluble in water and alcohol, practically insoluble in acetone. Dissolves in dilute solutions of alkali hydroxides.
Ergocalciferol (Vitamin D)	SPU 2.0, p. 226	White or slightly yellowish crystalline powder or white or almost white crystals, practically insoluble in water, well soluble in alcohol, soluble in fatty oils. It is sensitive to air, heat and light. Solutions in volatile solvents are unstable and must be used immediately.

Cyanocobalamin (Vitamin B12)	EP 01/2005:0547	Dark red crystalline powder or dark red crystals, sparingly soluble in water and alcohol, practically insoluble in acetone.
Calcium gluconate	SPU 2.0, p. 335	White, crystalline or granular powder, moderately soluble in water, well soluble in boiling water.
Magnesium chloride	SPU 2.0, p. 423	Colorless crystals, hygroscopic, well soluble in water, freely soluble in alcohol.

All substances used met the requirements of the relevant regulatory documentation [2, 6, 9, 10].

33-<https://www.researchgate.net/journal/Brazilian-Journal-of-Pharmaceutical-Science-1984-8250>

2.2 Research methods

Organoleptic control

The analysis of the quality of the obtained powder was carried out in accordance with the requirements of the general article of DFU 2.0 "Powders for oral use".

Sieve analysis

It was carried out using a laboratory sieve SL-300, H=50 mm, n/w, with a cell size of 200 μm .

Statistical analysis of the research results was carried out in accordance with the requirements of SPU 2.1, section 5.3 using methods of statistical and mathematical analysis [53, 55].

Conclusions for chapter 2

1. The properties of the research objects, in particular, the active pharmaceutical ingredients and auxiliary substances, which were used during the experimental part on the development of the composition of the effervescent powder with general strengthening action, are described.

2. Selected and described methods and conditions for conducting economic, pharmacotechnological and statistical tests, which were used during the experimental part.

CHAPTER 3

DEVELOPMENT OF THE COMPOSITION OF EFFECTIVE POWDER OF GENERAL STRENGTHENING EFFECT

3.1 Selection of auxiliary substances forming effervescent powder

The first stage of our work consisted in conducting a patent search and establishing the optimal composition of auxiliary substances that form the basis of effervescent powder.

Effervescent compositions are multicomponent mixtures of solid substances containing biologically active and medicinal substances of the intended purpose, "effervescent" composition, as well as technological and flavor additives. The "effervescent" component vigorously interacts with water, releasing carbon dioxide, which ensures the disintegration of the tablet or granule and creates favorable conditions for the formation of a solution of active ingredients. The "effervescent" composition includes at least two solid substances - metal carbonate or bicarbonate, as well as an organic solid water-soluble acid or its acid salt. During hydration, these substances enter into a neutralization reaction, which is accompanied by gas evolution.

When obtaining "effervescent" tablets, granules and powders, it is necessary to combine at least two rather contradictory requirements:

1. Ensure high reactivity of acidic and carbonate components during hydration of compositions;
2. To ensure the chemical stability of compositions during their production and storage.

The first task can be solved if you create the most developed contact of the solid phases of the reagents (carbonate and acidic) or use well-soluble solid reagents (at least one of them). To solve the second task, it is necessary to ensure the thorough removal of free water from the finished compositions and to prevent its ingress during storage.

25-World J Clin Cases. 2014 May 16; 2(5): 120–125. Published online 2014 May 16. doi: 10.12998/wjcc.v2.i5.120

In known technical solutions for obtaining "effervescent" compositions, four main approaches are used:

1. Acid and carbonate components are separately mixed with excipients and granulated or encapsulated by a wet method. Then the obtained two types of granules (capsules) are mixed together and tableted or used in a mixture [1, 13].
2. The acidic and carbonate components are mixed and moistened with a small amount of water or alcohol. After the start of the neutralization reaction, without allowing intensive interaction, the mixture is quickly dried and granulated. Further, its tableting is possible, etc. [1, 13, 37].
3. Acid and carbonate components are incorporated into an inert water-soluble matrix or covered with an inert water-soluble substance, and then mixed together. Further, it is also possible to take tablets, etc. [18-28].
4. Acidic and carbonate components are mixed with auxiliary substances and active components without adding moisture, then the mixture is tableted or subjected to "dry" granulation [29-33].

The choice between different methods depends on the reactivity of the carbonate and acid components, the physicochemical properties of the target biologically active substances, and the required characteristics of the final product. Thus, bicarbonates and carbonates of alkaline and alkaline earth metals used as carbonate components have different solubility and react with acids at different rates. Among them, potassium and sodium bicarbonates are the most reactive, while calcium carbonate, which is practically insoluble in water, and citric, ascorbic, and tartaric acids show the least activity. In case 2 – active acid (citric) and insoluble calcium carbonate.

26-J Health Popul Nutr. 2022; 41: 10. Published online 2022 Mar 17. doi: 10.1186/s41043-022-00287-w

Disadvantages of processes 1-3 are multistage, the need to use a fairly wide

set of technological equipment, low granulation productivity of equipment, discreteness of technological processes, high cost of equipment. For example, drying of the moistened mixture according to item 2 should take place in a vacuum. Layering of granules and powders of different composition is possible (processes 1, 4) during technological operations of obtaining finished products, as well as during storage. In the technological equipment used, it is very difficult to completely remove moisture during drying, which negatively affects the stability during storage of the finished composition. In all cases, the obtained compositions are overloaded with auxiliary substances - granulating agents, fillers, binders.

Process 4 can only be used for highly water-soluble carbonate components (bicarbonates) and chemically stable target active substances and requires dilution of the "effervescent" components with a large (>50%) amount of filler.

For example, the US patent Effervescent composition and method of making same, US 4,678,661, publ. 21.05.1986, Cl. A 61 To 033/10, describes a method of obtaining an "effervescent" composition comprising a solid organic acid (for example, citric), calcium carbonate and sodium or potassium bicarbonates. To obtain the composition, acid crystals are moistened and mixed with much smaller particles of calcium carbonate. There is a "powdering" of large acid particles by small carbonate particles, which is accompanied by partial interaction. The resulting composition is dried and, if necessary, sodium and potassium bicarbonates are added, which accelerate the interaction with the acid during hydration, as well as auxiliary substances, also in conditions of pre-moistening with subsequent drying. The disadvantage of the prototype invention is the multi-stage technological process, which includes operations of moistening, mixing, drying, as well as limiting the particle sizes of the powders of the original components. At the same time, drying of the composition is carried out in relatively mild temperature conditions to avoid a thermal reaction between acid and carbonates. As a result, there is no complete removal of moisture, which negatively affects the stability of the composition during long-term storage under normal conditions. So, based on the received patent search data, we selected the

following excipients:

- acid components: malic acid, citric acid, ascorbic acid, succinic acid, glutamic acid;
- alkaline components: sodium bicarbonate, potassium dihydrogen phosphate, sodium carbonate, calcium carbonate, basic magnesium carbonate.

15 compositions of effervescent mixtures were created and tested with the outlined substances (Table 3.1). In all cases, the compositions were made by thoroughly grinding the ingredients to form agglomerates of crushed particles of the components with a size of 30-300 μm .

34-Ailton Antonio Sousa-Junior

Francyelli Mello-Andrade

Francyelli Mello-Andrade

João Victor Ribeiro Rocha

João Victor Ribeiro Rocha[...]

A. Figueiroa Bakuzis

A. Figueiroa Bakuzis

35-1993-03-17

Application filed by Cima Labs Inc

1993-03-17

Table 3.1

**Compositions of "effervescent" compositions obtained during processing of
acid and carbonate components**

No.	Acid ingredients. mass. %						Alkaline ingredients. mass. %			
	Malic acid	Citric acid	Ascorbic acid	Succinic acid	Glutamic acid	Potassium dihydrogen phosphate	Sodium bicarbonate	Sodium carbonate	Calcium carbonate	Magnesium carbonate
1	-	-	77.9	-		-	-	-	22.1	-
2	-	-		78.0	-	-	-	-	-	22.0
3	73.0	-	-	-	-	-			-	27.0
4	-	-		-	44.05	-	55.95	-	-	
5	-	79.5	-	-	-	-	-	-	20.5	-
6	73.0	-	-	-	-	-	-	-	27.0	-
7	-	-	-	-	74.5	-	-	-	25.5	-
8	-	80.0	-	-	-	-	-	-	-	20.0
9	55.85	-	-	-	-	-	-	44.15	-	-
10	-	-	-	54.5	-	-	-	-	-	45.5
11	-	50.0	-		-	5	-	45.0	-	-
12	-	-	-	-	-	50.0	-	50.0	-	-
13	15	15	15	15	3	-	-	22	10	-
14	-	-	70	-	-	-	5	5	15	-
15	-	-	-	-	-	15	-	85	-	-

http://www.clevelandclinic.org/?_gl=1*jq2l4u*_ga*NDQ3NzM3NzQ4LjE2ODM5NzcyNzM.*_ga_HWJ092SPKP*MTY4Mzk3NzI3Mi4xLjEuMTY4Mzk3ODI2Ni4wLjAuMA

The quality of the mixtures was assessed by dissolving 1.0 g of the compositions in 200 ml of distilled water at +20°C. It was established that after

dissolving compositions 1, 2, 3, 5, 6, 7, 8, 10, 13, 14, which contained calcium and magnesium carbonates, led to the formation of a precipitate, the final dissolution of which required several hours. Other compositions (4, 9, 11, 12, 15) formed a clear solution within 1-5 minutes.

Since the ultimate goal of our work is the development of extemporaneously produced tonic powder and taking into account the economic expediency in the choice of auxiliary substances, we chose composition 11 (citric acid - potassium dihydrogen phosphate - sodium carbonate).

3.2 Selection of active pharmaceutical ingredients and development of the technology of effervescent powder with a tonic effect

Based on the drugs available on the pharmaceutical market with a general strengthening effect, we have established the following APIs for the further development of the product: vitamins C, B1, B2, B6, B12, D, niacin, pantothenic acid, folic acid, biotin, calcium, magnesium.

Niacin (vitamin B3), riboflavin (vitamin B2), vitamin B6, thiamin (vitamin B1), biotin (vitamin B7), vitamin C, calcium and magnesium contained in the product participate in the processes of normal energy metabolism. In addition, vitamin C, niacin, riboflavin, vitamin B6, vitamin B12 and magnesium help reduce tiredness and fatigue.

22-IEC Material prepared and used for project activities

The content of vitamins C and D, as well as calcium and magnesium in the product helps to maintain a healthy, normal bone structure.

Calcium and magnesium contained in the product support normal muscle activity, and vitamin D helps maintain healthy muscle function.

Vitamins B6, B12, C and D contained in the product contribute to the normal functioning of the immune system.

Vitamins C and riboflavin (vitamin B2) contained in the product contribute to the protection of cells from oxidative stress.

The composition of the proposed agent in the form of an effervescent

powder based on selected APIs is shown in table 3.2.

(<https://www.ncbi.nlm.nih.gov/books/NBK567744/#!po=6.25000>)

[Updated 2021 Jul 27]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. Accessed 5/23/2022.

Table 3.2

Effervescent powder with general strengthening effect

Ingredient	Quantity, g	
	for 1 dose (5.0 g)	for 20 doses (100.0 g)
Vitamin C	0.08	1.6
Thiamine (vitamin B1)	0.0011	0.022
Riboflavin (vitamin B2)	0.0014	0.028
Niacin	0.016	0.32
Pantothenic acid	0.006	0.12
Vitamin B6	0.014	0.28
Folic acid	0.0002	0.004
Biotin	0.00005	0.001
Vitamin D	0.000005	0.0001
Vitamin B12	0.0000025	0.00005
Calcium	0.12	2.4
Magnesium	0.058	1.16
Citric acid	4.85	97.0
Potassium dihydrogen phosphate	0.485	9.7
Sodium carbonate	4.365	87.3

The manufacturing technology consists in mixing the ingredients of the powder in accordance with the general rules of pharmacy drug technology [3, 4, 38, 40] with their careful grinding to a size of no more than 200 μm and subsequent weighing of the resulting powder mass into doses of 5.0 g.

Since the size of the particles plays a significant role in the further

formation of the drinking solution, we conducted studies to determine the optimal time for grinding the powder.

The quality of the powder mass was controlled using a laboratory sieve SL-300, H=50 mm, n/w, with a cell size of 200 μm . The parameters of the grinding process and the obtained results are given in table 3.3.

23-1st-Ever U.S. Clean Label Certified Baby Cereals - Safe from Heavy Metals. 6+ Months. Vanilla / Single

Table 3.3

The results of the research on grinding the powder mass of the proposed composition

Grinding mode	The result of sieve analysis
Porcelain mortar, 15 min, by hand	-
Porcelain mortar, 30 min, by hand	-
Laboratory mill, 15 min	-
Laboratory mill, 30 min	+
Laboratory mill, 45 min	+

As can be seen from the given results (Table 3.4), the sieve analysis meets the requirements of the DFU when grinding using a laboratory mill for at least 30 minutes. Since grinding for 30 minutes ensures the proper quality of the powder mass, this time is set as optimal.

The obtained powder is yellow in color, homogeneous, and has a slight specific smell. Upon contact with water, a clear solution is formed within 2-3 minutes.

To ensure stability during the storage process, we chose such a primary packaging as a sachet made of PET12/ Al-foil7/ LDPE80 material. The metallized film as an intermediate layer significantly increases the barrier properties of the package, which on the one hand expands the range of its application (makes it suitable for products with higher packaging requirements, for example, hygroscopic products), and on the other hand allows to increase the shelf life of the product itself. Packaging with a metallized layer does not allow sunlight, is

moisture-proof, retains the smell, preserving the original qualities of the product. The bag is laser cut for easy opening.

The inner layer is made of polyethylene, which allows you to seal the package, and the absence of a zip lock allows you to significantly reduce the cost of packaging. Laser cutting makes it easy to open the package.

Welding was carried out using a manual welder FS-200/5 (Fig. 3.1).

Arora HA, Dixit VI, Srivastava NI. Evaluation of knowledge, practices of vitamin D and attitude toward sunlight among Indian students. Asian J Pharm Clin Res. 2016;9(1):308. [Google Scholar]



Fig. 3.3 Closed sachets and manual sealer

Sachets were packed in 20 pieces in a pack, which was issued in accordance with the requirements of the Federal Drug Administration and the current legislation of Ukraine.

34-Ailton Antonio Sousa-Junior

Francyelli Mello-Andrade

Francyelli Mello-Andrade

Conclusions to chapter 3

1. The analysis of the pharmaceutical market of drugs of the A11A group showed that among 19 drugs, drugs from manufacturers from Ukraine and the USA are in the lead. At the same time, most of the drugs of the studied group come from abroad (68.4%). The pharmaceutical forms in which the drugs come are presented in the form of coated tablets (most drugs), chewable tablets, soft capsules and hard capsules.

2. A patent search for the establishment of existing bases for the creation of effervescent powders, granules and tablets showed that the most frequently used substances are malic acid, citric acid, ascorbic acid, succinic acid, glutamic acid, sodium bicarbonate, potassium dihydrogen phosphate, sodium carbonate, calcium carbonate, basic magnesium carbonate. Based on them, 15 compositions were studied and the most rational composition 11 (citric acid – potassium dihydrogen phosphate – sodium carbonate) was chosen.

3. Based on the study of literature data, the following composition of AFI with general strengthening effect was proposed: vitamins C, B1, B2, B6, B12, D, niacin, pantothenic acid, folic acid, biotin, calcium, magnesium. With the help of sieve analysis, it was established that the optimal size of powder particles is ensured by grinding with a laboratory mill for at least 30 minutes.

4. A sachet made of PET12/ Al-foil7/ LDPE80 material with subsequent hermetic sealing is proposed as primary packaging.

GENERAL CONCLUSIONS

1. A literary analysis of the data on the role of vitamins in the life of an adult and a child was carried out. The classification of vitamins according to their solubility in water is given and the individual effect of the main groups of vitamins is described. Symptoms, directions for correction and treatment of hypo- and vitamin deficiency in adults and children are described. Factors and risk groups for the development of hypovitaminosis in children of different ages are also described.

2. The properties of the research objects are described, in particular, active pharmaceutical ingredients and auxiliary substances, as well as the methods and conditions of conducting economic, pharmacotechnological and statistical tests, which were used during the experimental part on the development of the composition of the effervescent powder of general strengthening action.

3. A patent search conducted to establish existing bases for creating effervescent powders, granules and tablets showed that the most frequently used substances are malic acid, citric acid, ascorbic acid, succinic acid, glutamic acid, sodium bicarbonate, potassium dihydrogen phosphate, sodium carbonate, carbonate basic calcium, magnesium carbonate. Based on them, 15 compositions were studied and the most rational composition 11 was chosen (citric acid – potassium dihydrogen phosphate – sodium carbonate, 50 : 5 : 45).

4. The proposed composition of AFI with general strengthening effect: vitamins C, B1, B2, B6, B12, D, niacin, pantothenic acid, folic acid, biotin, calcium, magnesium. With the help of sieve analysis, it was established that the optimal size of powder particles is ensured by grinding with a laboratory mill for at least 30 minutes. With this mode of grinding, the dissolution time of 1 dose of powder (5.0 g) is 2-3 minutes, without the formation of sediment.

5. As primary packaging, a sachet made of PET12/ Al-foil7/ LDPE80 material with subsequent hermetic sealing is proposed, which ensures protection of the powder of the proposed composition from the action of air and moisture.

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Appendixes



МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
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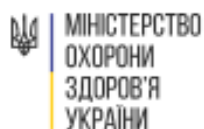
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Кафедра аптечної технології ліків

1. **Порівняльний аналіз складу рідких засобів для лікування акне на основі кліндаміцину промислового та екстемпорального виробництва**
Доповідач: Кметик Юлія
Науковий керівник: Семченко К. В., докт. фарм. н., доцент
2. **Аналіз аптечного виробництва капсул в Німеччині**
Доповідач: Соляник Кристина
Науковий керівник: Вишневська Л. І., докт. фарм. н., професор
3. **Розробка складу, технології та дослідження бальзаму–маски апікаційного нанесення для лікування себореюного дерматиту шкіри голови**
Доповідач: Черкасова Альбіна
Науковий керівник: Коноваленко І. С., докт. філ., асистент
4. **About the prospects of using medicines based on peptides and their compositions**
Доповідач: Мороз Ксенія
Науковий керівник: Ковальова Т. М., к. фарм. н., доцент
5. **Research of raw materials of nightshade for use in pharmacy practice**
Доповідач: Кочнєва Поліна
Науковий керівник: Вишневська Л. І., докт. фарм. н., професор
6. **Опрацювання складу гелю для ясен**
Доповідач: Ладогубець Дмитро
Науковий керівник: Половко Н. П., докт. фарм. н., професор
7. **Розробка складу та технології багатокомпонентного анальгетика**
Доповідач: Варуша Анна
Науковий керівник: Марченко М. В., к. фарм. н., доцент
8. **Розробка складу та технології препарату адаптогенної дії**
Доповідач: Ткаченко Влада
Науковий керівник: Марченко М. В., к. фарм. н., доцент
9. **Development of the composition and technology of antiemetic capsules**
Доповідач: Галайда Юлія
Науковий керівник: Коноваленко І. С., докт. філ., асистент

XXIX Міжнародна науково-практична конференція молодих вчених та студентів
«АКТУАЛЬНІ ПИТАННЯ СТВОРЕННЯ НОВИХ ЛІКАРСЬКИХ ЗАСОБІВ»

20. **Development of topical gel analgesic activities**
Доповідач: Бендіжур Іман
Науковий керівник: Крюкова А. І., к. фарм. н., асистент
21. **Development of the composition of antibacterial soap with a complex of essential oils**
Доповідач: Ель Амрані Худа
Науковий керівник: Семченко К. В., докт. фарм. н., доцент
22. **Development of the composition of emulsion with calamine of pharmaceutical production**
Доповідач: Інуз Нізар
Науковий керівник: Семченко К. В., докт. фарм. н., доцент
23. **Development of the composition of a vitamin medicine in the form of an effervescent powder**
Доповідач: Секкум Фатіма Захра
Науковий керівник: Семченко К. В., докт. фарм. н., доцент
24. **Use of vegetable oil in extemporaneous formulation**
Доповідач: Джаафар Хамза
Науковий керівник: Вишневська Л. І., докт. фарм. н., професор
25. **Research on the development of an ointment base using pharmaceutical factors**
Доповідач: Тазані Шаймає
Науковий керівник: Вишневська Л. І., докт. фарм. н., професор
26. **Research on substantiation of the technology of mahonia extract berries**
Доповідач: Мауелаїнін Мохамед Фадель
Науковий керівник: Половко Н. П., докт. фарм. н., професор
27. **Justification of the composition of the medication for local anesthesia in the form of a cream**
Доповідач: Наїт Іжжа Хансаа
Науковий керівник: Половко Н. П., докт. фарм. н., професор
28. **Development of the composition and technology of the antifungal foot spray**
Доповідач: Харафі Ахмед
Науковий керівник: Половко Н. П., докт. фарм. н., професор
29. **Research on the substantiation of the technology of the dry herb extract of black peppermint**
Доповідач: Укхбуроу Мохамед
Науковий керівник: Марченко М. В., к. фарм. н., доцент

National University of Pharmacy

Faculty for foreign citizens' education

Department pharmaceutical technology of drugs

Level of higher education master

Specialty 226 Pharmacy, industrial pharmacy

Educational program Pharmacy

APPROVED
The Head of
pharmaceutical
technology of drugs
Department

Liliia VYSHNEVSKA

“ 28 ” September 2022

**ASSIGNMENT
FOR QUALIFICATION WORK
OF AN APPLICANT FOR HIGHER EDUCATION**

Fatima Zahra SEKKOUM

1. Topic of qualification work: «Development of the composition of a vitamin medicine in the form of an effervescent powder», supervisor of qualification work: Kateryna SEMCHENKO, Doctor of Pharmacy, assoc. prof.

approved by order of NUPh from “6st” of February 2023 № 35

2. Deadline for submission of qualification work by the applicant for higher education: April 2023.

3. Outgoing data for qualification work: the work is devoted to the development the composition of medicine in the form of effervescent powder with complex of vitamins

4. Contents of the settlement and explanatory note (list of questions that need to be developed): •

- analyze data from scientific literature on the role of vitamins in the life of an adult and a child;
 - to analyze the range of medicines belonging to the group of multivitamins;
 - to develop the composition of an effervescent powder of a complex composition with general strengthening effect;
 - to conduct research on the study of technological aspects of the production of effervescent powder of a complex composition with general strengthening action in the conditions of pharmacies.
-

5. List of graphic material (with exact indication of the required drawings):

Tables – 5, figures – 6

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	28.09.2022	28.09.2022
2	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	17.11.2022	17.11.2022
3	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	19.12.2022	19.12.2022

7. Date of issue of the assignment: «28» September 2022

CALENDAR PLAN

№ з/п	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1	Topic selection	September 2022	done
2	Literature data analysis	October 2022	done
3	Conducting experimental research	October-December 2022	done
4	Work design	January-March 2023	done
5	Submission of finished work to the commission	April 2023	done

An applicant of higher education _____ Fatima Zahra SEKKOUM

Supervisor of qualification work _____ Kateryna SEMCHENKO

ВИТЯГ З НАКАЗУ № 35
По Національному фармацевтичному університету
від 06 лютого 2023 року

нижченаведеним студентам 5-го курсу 2022-2023 навчального року, навчання за освітнім ступенем «магістр», галузь знань 22 охорона здоров'я, спеціальності 226 – фармація, промислова фармація, освітня програма – фармація, денна форма здобуття освіти (термін навчання 4 роки 10 місяців та 3 роки 10 місяців), які навчаються за контрактом, затвердити теми кваліфікаційних робіт:

Прізвище студента	Тема кваліфікаційної роботи		Посада, прізвище та ініціали керівника	Рецензент кваліфікаційної роботи
• по кафедрі аптечної технології ліків				
Секкум Фатіма Захра	Розробка складу вітамінного засобу у формі шипучого порошку	Development of the composition of a vitamin medicine in the form of an effervescent powder	доц. Семченко К. В.	проф. Левачкова Ю. В.

Підстава: подання декана, згода ректора

Ректор

Вірно. Секретар



ВИСНОВОК

**Комісії з академічної доброчесності про проведену експертизу
щодо академічного плагіату у кваліфікаційній роботі
здобувача вищої освіти**

№ 112920 від «3 » травня 2023 р.

Проаналізувавши випускню кваліфікаційну роботу за магістерським рівнем здобувача вищої освіти денної форми навчання Секкум Фатіма Захра, 5 курсу, ^{Фм18(5,0)}_{англ-08} групи, спеціальності 226 Фармація, промислова фармація, на тему: «Розробка складу вітамінного засобу у формі шипучого порошку / Development of the composition of a vitamin medicine in the form of an effervescent powder», Комісія з академічної доброчесності дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (копіляції).

**Голова комісії,
професор**



Інна ВЛАДИМИРОВА

3%

25%

REVIEW

of scientific supervisor for the qualification work of the master's level of higher education of the specialty 226 Pharmacy, industrial pharmacy

Fatima Zahra SEKKOUM

on the topic: «Development of the composition of a vitamin medicine in the form of an effervescent powder»

Relevance of the topic.

The high rhythm of life and changing quality of life of a modern person often create prerequisites for the development of hypovitaminosis. Such a phenomenon leads to deterioration of well-being and reduction of immune status. The most effective way to combat vitamin and mineral deficiency is the use of specialized complexes. The existing market of drugs of this group contains few drugs, while dietary supplements do not ensure adequate bioavailability of APIs.

Practical value of conclusions, recommendations and their validity.

The practical value of the work is based on the study of physical and chemical, pharmaco-technological, economical and statistical studies of the composition for effervescent powder with vitamins. The author successfully justified the composition and technology of effervescent dosed powder with a complex of vitamins.

Assessment of work.

The successful solution of tasks enabled the author of the qualification work to achieve the goal and obtain practical and theoretical results. The work was done at a sufficient scientific level, which indicates the author's ability to work with literary sources, analyze, systematize and generalize the experimental data obtained.

General conclusion and recommendations on admission to defend.

The qualification work of Fatima Zahra SEKKOUM meets all the requirements for qualification works and can be presented for the defense at the Examination Commission of the National University of Pharmacy.

Scientific supervisor _____ Kateryna SEMCHENKO

«12» April 2023

REVIEW

**for qualification work of the master's level of higher education, specialty 226
Pharmacy, industrial pharmacy**

Fatima Zahra SEKKOUM

**on the topic: «Development of the composition of a vitamin medicine in the
form of an effervescent powder»**

Relevance of the topic.

The pharmaceutical market of vitamin products is mostly represented by dietary supplements, while there are few drugs of this group and most of them are of foreign origin and have a high price. Therefore, the development of drugs with such pharmacological activity, including extemporaneous production, is relevant.

Theoretical level of work.

The applicant for higher education conducted analysis of modern scientific literature concerning physical and chemical properties of ingredients for effervescent powder preparation. The author conducted the research in the direction of justification of complex vitamin dosed powder for correction of vitamin lack for adults.

The author's suggestions on the topic of research.

The optimal composition and ratio of substances for the base of effervescent powder was selected experimentally. The composition of the effervescent powder with a complex vitaminl composition of general strengthening effect was substantiated and the technology of its production in pharmacy conditions was worked out.

Practical value of conclusions, recommendations and their validity.

During her work, the student of higher education mastered the methods of analysis and generalization of scientific literature data, pharmacotechnological and statistical research methods that are of practical interest.

Disadvantages of work.

There are incorrect expressions and grammatical errors in the work. The link to references is given awkwardly.

General conclusion and assessment of the work.

The qualification work of Fatima Zahra SEKKOUM based on the results of research and volume of the experiment performed can be presented for the defense at the Examination Commission of the National University of Pharmacy.

Reviewer _____

prof. Yuliia LEVACHKOVA

«19» April 2023

**МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ**

ВИТЯГ З ПРОТОКОЛУ № 9

«26» квітня 2023 року

м. Харків

засідання кафедри

_____ аптечної технології ліків _____

(назва кафедри)

Голова: завідувачка кафедри, професор Вишневська Л.І.

Секретар: докт. філ., асистент Коноваленко І. С.

ПРИСУТНІ:

Богуцька О. Є., Зуйкіна С. С., Ковальова Т. М., Крюкова А. І., Марченко М. В., Половко Н. П., Семченко К. В.

ПОРЯДОК ДЕННИЙ:

1. Про представлення до захисту кваліфікаційних робіт здобувачів вищої освіти.

СЛУХАЛИ: проф. Вишневську Л. І. – про представлення до захисту до Екзаменаційної комісії кваліфікаційних робіт здобувачів вищої освіти.

ВИСТУПИЛИ: Здобувач вищої освіти групи Фм18(5,0д)-англ 08 спеціальності 226 Фармація, промислова фармація Фатіма Захра СЕККУМ – з доповіддю на тему «Розробка складу вітамінного засобу у формі шипучого порошку / Development of the composition a vitamin medicine in the form of an effervescent powder» (науковий керівник доц. Катерина СЕМЧЕНКО).

УХВАЛИЛИ: Рекомендувати до захисту кваліфікаційну роботу.

Голова

Завідувачка кафедри, проф. _____
(підпис)

Лілія ВИШНЕВСЬКА

Секретар

асистент _____
(підпис)

Ілона КОНОВАЛЕНКО

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

**ПОДАННЯ
ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ
ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ**

Направляється здобувач вищої освіти Фатіма Захра СЕККУМ до захисту кваліфікаційної роботи за галуззю знань 22 Охорона здоров'я спеціальністю 226 Фармація, промислова фармація освітньою програмою Фармація на тему: «Розробка складу вітамінного засобу у формі шипучого порошку»

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Світлана КАЛАЙЧЕВА /

Висновок керівника кваліфікаційної роботи

Здобувач вищої освіти Фатіма Захра СЕККУМ представила кваліфікаційну роботу, яка за об'ємом теоретичних і практичних досліджень повністю відповідає вимогам до оформлення кваліфікаційних робіт.

Керівник кваліфікаційної роботи

Катерина СЕМЧЕНКО

«12» квітня 2023 р.

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Фатіма Захра СЕККУМ допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувачка кафедри
аптечної технології ліків

Лілія ВИШНЕВСЬКА

«26» квітня 2023 року

Qualification work was defended
of Examination commission on

« » June 2023

With the grade _____

Head of the State Examination commission,

D Pharm Sc, Professor

_____ / Oleh SHPYCHAK /