Ф А 2.2.1-32-367

MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
faculty for foreign citizens' education
department of pharmacognosy

QUALIFICATION WORK

on the topic: **« STUDY THE CHEMICAL COMPOSITION OF CARROT UNDERGROUND PART»**

Prepared by: higher education graduate of group
ФМ18(5.0д)англ-01
specialty 226 Pharmacy, industrial pharmacy
educational program Pharmacy
Fulya KORKMAZ
Supervisor: associate professor of higher education institution of department of pharmacognosy, PhD, associate professor
Victoria Mashtaler
Reviewer: professor of higher education institution of department pharmaceutical chemistry, PhD, associate professor Amzhad I. ABU SHARK

Kharkiv – 2023 year

ABSTRACT

Korkmaz F. «Study the chemical composition of carrot underground part».

The qualification work is devoted to the phytochemical study of the herb of *Daucus carota* L. of variety Bolivar F. The qualitative composition of biologically active substances of raw materials was established and their quantitative content was determined.

Key words: carot, herb, biological active compounds, identification, mineral elements.

АНОТАЦІЯ

Коркмаз Ф. «Дослідження хімічного складу надземної частини моркви звичайної»

Кваліфікаційна робота присвячена фітохімічному дослідженню трави *Daucus carota* L. сорту Болівар F. Встановлено якісний склад біологічно активних речовин сировини та визначено їх кількісний вміст.

Ключові слова: морква, трава, біологічно активні речовини, ідентифікація, мінеральні елементи.

CONTENT

LIST OF CONVENTIONAL ABBREVIATIONS

BAC – biological active compounds;

cm – centimeter;

D. carota – *Daucus carota*;

EuPh – Europea Pharmacopoeia;

FAO – Food agriculture organization;

NUPh – National university of Pharmacy;

PC – paper chromatography;

Rt – retentional time;

UV- light – ultra violet light;

vit. C – vitamin C.

INTRODUCTION

The topic actuality. Raw sources of wild plants are significantly reduced. To expand the resource base of plant sources of biologically active compounds (BAC) is a topical the study of agricultural plants which are widely cultivated. The plants belongs the family *Apiaceae* L. widely used in official and folk medicine. Carrot is widely cultivated agricultural crop, it perfect growing in different conditions and has many varieties. It is one of the important root vegetables rich in bioactive compounds. Pharmacopeia (*EuPh*) raw materials are *Dauci carotae* fructus are used like sourses of volatile compounds and piranocoumarines, but scientific interest has carrot herb like as available raw materials after harvesting root crops. From the literature information, the chemical content of above-ground parts of carrot practically not been studied. So, using of it herbs we can to expand the resource base of BAC. Given the above, we thinking that to study the *Daucus carota* herb BAC composition is interesting for the modern science.

The aim of investigation was study the chemical composition of carrot underground part.

To achieve the goal, the following **tasks** should be completed:

- To analyze the existing scientific primary sources regarding the botanical characteristics and use of carrot in official and folk medicine;
- To analyze information on the current state of phytochemical research on *Daucus carota* and compile an overview of this issue;
- To establish the qualitative composition and quantitative content of biologically active compounds of *Daucus carota* herb;
- To investigate its trace element composition.

The object of study was herb of *Daucus carota,* varity Bolivar F.

The subject of study was identification and determination of the content of different classes of BAC in raw materials (amino acids, polysaccharides, organic acids, carotenoids, chlorophylls, flavonoids, procyanidins).

Methods of study: physical - determination of loss in mass during drying; physical and chemical - chromatography in a thin layer of sorbent, paper

chromatography; chemical - BAC identification reactions, their quantitative determination; instrumental, physical and chemical – chromate-mass-spectrometry, photocolorimetry.

Practical significance of the obtained results.

The practical value of the qualification work is due to the fact that as a result of the conducted research, the acquirer expanded the information on the chemical composition of *Daucus carota* herb, variety Bolivar F with the aim of further introducing as additional source of biologically active substances, in particular volatile compounds. In view of the classes of identified substances and their pharmacological activity, described in the literature, it is possible to assume the perspective of *Daucus carota* herb in the development of antibacterial and antifungal agents for external use.

Elements of scientific research. Based on the analysis of scientific literature, the acquirer compiled an overview and formulated the main issues of the research, experimentally carried out identification and determination of the quantitative content of BAC in raw materials.

Approbation of research results and publication. The results of the research are presented at the V International Scientific and Practical Internet Conference «Current achievements of pharmaceutical science in the creation and standardization of medicines and dietary supplements containing components of natural origin», April 14, 2023, National university of Pharmacy. Based on the materials of the qualification work, 1 abstract of the report was published.

Structure and scope of qualification work. The work consists of an introduction, an abstract in English and Ukrainian, a literature review, two chapters of own research, general conclusions, a list of used literature, which includes 59 foreign languages sources and appendices. The content of the work is laid out on 44 pages of the main text and illustrated with 12 tables and 12 figures.

CHAPTER 1. CURRENT STAGE OF STUDY OF CARROT (LITERATURE REVIEW)

1.1 Botanical characteristics of *Daucus carota*

Daucus carota is a root vegetable, usually orange in colour. The most commonly eaten part of a carrot is ataproot, although the greens are sometimes eaten as well. It is a domesticated form of the wild carrot *Daucus carota*, native to Europe and southwestern Asia [42].

The Food and Agriculture Organization of the United Nations reports that world production of carrots and turnips (these plants are combined by the FAO for reporting purposes) for calendar year 2011 was almost 35.658 million tonnes [5]. Almost half were grown in China. Carrots are widely used in many cuisines, especially in the preparation of salads, and carrot salads are a tradition in many regional cuisines.

The plant appears to have been introduced into Europe via Spain by the Moors in the 8th century and in the 10th century, in such locations in West Asia, India and Europe, the roots were purple.

The modern carrot originated in Afghanistan at about this time [16]. Cultivated carrots appeared in China in the 14th century, and in Japan in the 18th century.

Some very old Man there did remember their first bringing hither. European settlers introduced the carrot to Colonial America in the 17-th century [6].

Purple carrots, still orange on the inside, were sold in British stores starting in 2002.

Daucus carota is a biennial plant, it grows a rosette of leaves in the spring and summer, while building up the stout taproot that stores large amounts of sugars for the plant to flower in the second year. Soon after germination, carrot seedlings show a distinct demarcation between the taproot and the hypocotyl.

The latter is thicker and lacks lateral roots. At the upper end of the hypocotyl is the seed leaf. The first true leaf appears about 10–15 days after germination. Subsequent leaves, produced from the stem nodes, are alternating (with a single

leaf attached to a node, and the leaves growing in alternate directions) and compound, and arranged in a spiral. The leaf blades are pinnate. As the plant grows, the bases of the cotyledon are pushed apart [10].

The stem, located just above the ground, is compressed and the internodes are not distinct. When the seed stalk elongates, the tip of the stem narrows and becomes pointed, extends upward, and becomes a highly branched inflorescence. The stems grow to 60–200 cm (20–80 in) tall.

Most of the taproot consists of parenchymatous outer cortex (phloem) and an inner core (xylem).

High-quality carrots have a large proportion of cortex compared to core. Although a completely xylem-free carrot is not possible, some cultivars have small and deeply pigmented cores; the taproot can appear to lack a core when the colour of the cortex and core are similar in intensity.

Taproots typically have a conical shape, although cylindrical and round cultivars are available [28]. The root length ranges from 5 to 50 cm, although most are between 10 and 25 cm.

Flower development begins when the flatapical meristem changes from producing leaves to an uplifted conical meristem capable of producing stem elongation and an inflorescence. The inflorescence is a compound umbel, and each umbel contains several umbellets.

The primary umbel occurs at the end of the main floral stem; smaller secondary umbels grow from the main branch, and these further branch into third, fourth, and even later-flowering umbels.

A large primary umbel can contain up to 50 umbellets, each of which may have as many as 50 flowers; subsequent umbels have fewer flowers. Flowers are small and white, sometimes with a light green or yellow tint, has five petals, five stamens and an entire calyx. The anthers usually dehisce and the stamens fall off before the stigma becomes receptive to receive pollen [32].

The anthers of the brown male sterile flowers degenerate and shrivel before anthesis. In the other type of male sterile flower, the stamens are replaced

by petals, and these petals do not fall off. A nectar-containing disc is present on the upper surface of the carpels.

Flower development is protandrous, so the anthers release their pollen before the stigma of the same flower is receptive.

The arrangement is centripetal, meaning the oldest flowers are near the edge and the youngest flowers are in the center.

Flowers usually first open at the periphery of the primary umbel, followed about a week later on the secondary umbels, and then in subsequent weeks in higher-order umbels.

The usual flowering period of individual umbels is 7 to 10 days, so a plant can be in the process of flowering for 30–50 days [38]. The distinctive umbels and floral nectaries attract pollinating insects.

After fertilization and as seeds develop, the outer umbellets of an umbel bend inward causing the umbel shape to change from slightly convex or fairly flat to concave, and when cupped it resembles a bird's nest.

The fruit that develops is a schizocarp consisting of two mericarps; each mericarp is anachene or true seed.

The paired mericarps are easily separated when they are dry. Premature separation (shattering) before harvest is undesirable because it can result in seed loss.

Mature seeds are flattened on the commissural side that faced the septum of the ovary. The flattened side has five longitudinal ribs.

The bristly hairs that protrude from some ribs are usually removed by abrasion during milling and cleaning.

Seeds also contain oil ducts and canals. Seeds vary somewhat in size, ranging from less than 500 to more than 1000 seeds per gram.

The carrot is a diploid species, and has nine relatively short, uniform-length chromosomes [42].

1.2 Resource base of *Daucus carota*. Rational methods of raw materials harvesting and storage

In 2012, according to the Food and Agriculture Organization of the United Nations, 36.917 million tonnes of carrots and turnips were produced worldwide for human consumption, grown on 1,196,000 hectares (2,955,000 acres) of land [43].

About 62% of world carrot production occurred in Asia, followed by Europe (22.6%) and the Americas (North, Central, and South America and the Caribbean) (9.4%). Less than 6% of the world's 2012 total production was grown in Africa.

The rate of increase in the global production of carrots has been greater than the world's population growth rate, and greater than the overall increase in world vegetable production. Europe was traditionally the major centre of production, but was overtaken by Asia in 1997 [48].

The growth in global production is largely the result of increases in production area rather than improvements in yield.

Modest increases in the latter can be attributed to optimised agricultural practices, the development of better cultivars, and increased farm mechanisation.

Carrots are grown from seed and take around four months to mature. They grow best in full sun but tolerate some shade.The optimum growth temperature is between 16 and 21 C.

The ideal soil is deep, loose and well-drained, sandy or loamy and with a pH of 6.3 to 6.8.

Fertiliser should be applied according to soil type and the crop requires low levels of nitrogen, moderate phosphate and high potash.

Rich soils should be avoided, as these will cause the roots to become hairy and misshapen. Irrigation should be applied when needed to keep the soil moist and the crop should be thinned as necessary and kept weed free. Like many other vegetables, carrot varieties can be divided into early, main-crop, and storage varieties [51]. Carrot is separated into two classes - eastern carrots and western carrots.

Specimens of the eastern carrot that survive to the present day are commonly purple or yellow, and often have branched roots. It origin is Iran and Afganistan. The purple colour common in these carrots comes from anthocyanin pigments. The western carrot emerged in the Netherlands in the 17th century, its orange colour. The orange colour results from abundant carotenesin these cultivars.

Western carrot cultivars are classified by their root shape: chantenay; danvers carrots; imperator carrots; nantes carrots. These have sparse foliage and are cylindrical, being shorter with a blunt tip [46].

The most spred varities are «Scarlet Nantes», «Bolero», «Nelson», «Yaya», «Napa», «Touchon», «Parano», «White Satin», «Purple Dragon», «Merida», «Cosmic Purple» [43].

Rational methods of Daucus carota raw materials harvesting and storage

Work with root crops of *Daucus carota*. Carrots root crops can be stored for several months in the cold place (0 °C to 5 °C). For long term storage, unwashed carrots can be placed in a bucket between layers of sand, a 50/50 mix of sand and wood shavings. To preserve their flavour and texture, carrots should be refrigerated. Keep them in the coldest part of the refrigerator , in their original plastic bag. If they were purchased loose, place them in a perforated or loosely closed plastic bag.

Harvest of *Dauci carrotae* Fructus. It can be harvested by cutting entire flowering top as umbels begin to dry. allow to mature in cool, dry location for an additional 2-3 weeks. Seeds can be stored in dry places [50].

1.3. Biological active compound of *Daucus carota*

The carrot seeds and root crops are content the protein (0.7 %), fat (0.5 %), carbohydrate (6 %), total sugars (5.6 %), crude fiber (2.4 %), Ca (34 mg/10 g), Fe (0.4 mg/100 g), P (25 mg/100 g), Na (40 mg/100 g), K (240 mg/100 g), Mg (9 mg/100 g), Cu (0.02 mg/100 g), Zn (0.2 mg/100 g), carotenes (5.33 mg/100 g), thiamine (0.04 mg/100 g), riboflavin (0.02 mg/100 g), niacin (0.2 mg/100 g), vitamin C (4 mg/100 g) [2].

The edible portion of carrots contains about 10% carbohydrates having soluble carbohydrates ranging from 6.6 to 7.7 g/100 g and protein from 0.8 to 1.1 g/100 g in 4 carrot cultivars.

Was reported 1.67–3.35% reducing sugars, 1.02–1.18% non-reducing sugars and 2.71–4.53% total sugars in 6 cultivars of carrot.

Simon and Lindsay reported that reducing sugars accounted for 6–32% of free sugars in 4 hybrid varieties of carrot [15, 55].

The free sugars identified are sucrose, glucose, xylose and fructose (Kalra et al. The crude fiber in carrot roots consist of 71.7, 13.0 and 15.2% cellulose, hemicllulose and lignin, respectively [30].

The cellulose content in 4 carrot varieties varied from 35 to 48%. The average nitrate and nitrite content in fresh carrot have been 40 and 0.41 mg/100 g, respectively [11, 18].

The taste of carrots is mainly due to the presence of glutamic acid and the buffering action of free amino acids. Trace amounts of succinic acid, α-ketoglutaric acid, lactic acid and glycolic acid have also been reported. Caffeic acid is the predominant phenolic acid in carrots.

Thiamin, riboflavin, niacin, folic acid and vit. C are present in appreciable amounts in carrot roots [3, 19, 36]. The anthocyanins content in roots may vary from trace amounts in pink cultivars to 1,750 mg/kg in black carrots.

The major anthocyanins have been identified as cyanidin 3- (2-xylosylgalactoside), cyanidin 3-xylosylglucosylgalactoside and cyanidin 3-ferulylxyloglucosyl galactoside [17].

In seeds content (mg/100 g) the saturated and unsaturated fatty acids: palmitic (9.23±0.13), palmitoleic (0.45±0.02), stearic (2.34±0.01), oleic (0.15±0.05), linoleic (10.50±0.03), petroselinic (62.7±0.05), arachidic (0.35±0.04).

The *Dauci carotae* seeds are sources of essential oil. In % Their content in raw materials (in %): α-pinene 0.5, camphene 0.03, sabinene 0.09, α-pinene 0.45, myrcene 0.14, limonene 0.34, terpinolene 0.05, linalool 0.43, carveol 0.10, *p*-cymene-8-ol 0.06, α-terpineol 0.08, daucene 0.8, cis-α-bergamotene 0.15, β-

caryophyllene 1.09, α-farnesene 0.23, trans-α-bergamotene 0.26, α-farnesene 5.12, germacrene 2.45, β-bisabolene 0.67, carotol 30.87, daucol 0.65 [14, 33, 37].

A new eudesmane type sesquiterpene was isolated from the fruits of *D. carota* , it is the first example for a naturally occurring eudesmane sesquiterpene with a hydroxymethyl group on a methine carbon and not a usual quaternary carbon in the two fused sixmembered ring systems.

The brassinosteroids brassinolide, castasterone and 24-*epi*-castasterone was isolated and identified from seeds of *Daucus carota*, a new pregnanolone glucoside was identified as β-D-glucopyranosyl-(1-2)-β-D-glucopyranosyl-3β-hydroxy-5α-pregnane-20-one (sophorosylpregnanolone) by nuclear magnetic resonance spectroscopy, liquid chromatography-mass spectrometry and gas chromatography-mass spectrometry.

Carotenoid pigments are important components of the human diet and carrots are the main dietary sources of the vitamin A precursors α- and β-carotene.

Carrots are one of the best sources of β-carotene. The carotene content of carrots ranges from 60–120 mg/100 g, but some varietes can contain up to 300 mg/100 g. Carotens contain mainly β-carotene, i.c. about 80% . The pigments are bound by proteins. Carrots can provide a significant amount of vitamin A.

Carotenoids play essential biological roles in plants and the genes coding for the carotenoid pathway enzymes are evolutionarily conserved, but little information exists about these genes for carrot.

1.4 Application of carrot in official and folk medicine

In the official medicine *Dauci carotae* Fructus are used as a diuretic prepareation and for the correction of cystitis. It has been evaluated for a wide spectrum of activity like analgesic andanti-inflammatory, hepatoprotective, hypoglycemic, antiulcer, antifertility, anticancer, anti-tumor.

Carrot is a source of phenolics and carotenoids. Carrot is rich in β-carotene, ascorbic acid and tocopherol and is classified as vitaminized food [4, 12, 13].

Carotenoids are inhibitors of monocyte adhesion and platelet activation [39, 41]. These biological effects are independent of the pro-vitamin A activity and

have been attributed to the antioxidant property of carotenoids, through deactivation of free radicals and singlet oxygen quenching [9, 47, 49].

In general, carotenoids in foods are classified into carotenes and xanthophylls, which give attractive red or yellow colour and contribute to food quality. Structurally, the carotenoids may be acyclic or contain a ring of 5 or 6 carbons at one or both ends of the molecule [52, 53].

The β-carotene have attracted considerable attention because of their possible protective effect against some types of cancers. In human system, the physiological activity of α- and β-carotene has been 50 and 100% of the pro-vitamin A activity, respectively and one molecule of β-carotene yields two molecules of retinol in human system [7, 8, 9]. Carotenoids decreased risk of cancer and cardiovascular disease [44, 45, 57]. Carotenoids are potential inhibitor of Alzheimer's disease [35].

Plants polyphenolic compounds are primarily derived from phenylalanine via the phenylpropanoid metabolism [12, 13, 21]. The chlorogenic acid was a major hydroxycinnamic acid, representing 42.2–61.8% of total phenolic compounds detected in different carrot tissues [19].

The carrot seeds due to the content of essential oil reveal antiseptic, antioxidant, anticarcinogenic, carminative, depurative, tonic, diuretic, emenagogue, stimulant and cytophylactic effects [34, 54]. The antioxidants protect the skin from wrinkles, keep hair from turning white [25, 26, 27].

Essential oils has antiseptic properties, effective in curing gangrene, psoriasis, ulcers and carbuncles. It is effective in fighting other viral infections as well, including the flu, mumps, coughs, colds, and measles [40].

Carrot seed oil has the ability to detoxify the blood, tissues, muscles and internal organs like the liver and kidneys. It can neutralize excess bile secreted from the liver and can help cure infections in the liver in cases of jaundice. It removes toxins enter to body [31]. Carrot seeds oil is diuretic.

In folk medicine seeds use like carminative and stimulant, used for treatment of worms. Roots are used for to reduce the level of sugar in the blood. Decoction of

roots is used for treatment of ulcers and wounds. The juice of the root is applied to carcinomatous ulcers of the neck and uterus, cancer of the bowels and stomach cancer. Scraped roots are used to stimulate indolent ulcers.

Conclusions

Scientific literary sources on the given topic were analyzed. A literature review on the given issue was compiled, was provided information on botanical characteristics of *Daucus carota*, its varieties, chemical composition and use in official and folk medicine. It has been established that the most studied chemically are *Daucus carota* Fructus like sources of volatile oil and crops root like sources of mineral elements, polyphenolic compounds, carotenoids and natural fibers.

It was established that in modern literature there is no systematized information on the chemical composition of herb of *Daucus carota*. This indicates that there is a scientific interest in research aimed at studying the composition of the BAC of the above-ground part – herb of *Daucus carota*.

EXPERIMENTAL PART

CHAPTER 2. STUDY OF QUALITATIVE COMPOSITION OF BAS OF *DAUCUS CAROTA* HERB

The object of the study became the above-ground part (herb) of *Daucus carrota*, variety Bolivar F (Fig. 1). This variety is hardy, does not require special growing conditions and belongs to high-yielding varieties.

Fig. 2.1 *Daucus carota*, variety Bolivar F

For the study we are used the raw materials, collected in August 2021. We are used air dry herb.

For identification of BAC used qualitative chemical reactions and chromatographic methods. Chromatographic research were carried out using two-dimensional paper chromatography in solvent system: I direction - ethyl acetate-formic acid-water (10:2:3); II direction - 2% acetic acid.

2.1. Polysaccharides

For extraction of polysaccharides cutting 1.0 g of raw material to the particle size of 2 mm. Sample was placed in a flask with 50 ml shliftom. Poured raw material 10 ml of purified water.

We closed flask air refrigerator and boil in water bath for 20 minutes. Cooled extract and percolated through cotton wood. To 1 ml of the filtrate add 3 ml of 96% ethanol. There was an amorphous precipitate in observation.

The presence of polysaccharides in the studied raw material was detected.

2.2. Iridoids

The reaction with the reagent Stahl: in a test tube add 1 ml of herbal extracts and 0.5 ml of reagent Stahl, the mixture was heated in a water bath for 1-2 minutes (Stahl reagent 5 ml of concentrated hydrochloric acid, 1.0 g of p-dymetylaminobenzaldehidu dissolved in 96% ethanol solution in volumetric flask containing 100 ml.

The reaction with the reagent Trim-Hill: test tube add 1 ml of the extract and 0.5 ml of reagent Trim-Hill.

The mixture was heated in a water bath for 1-2 minutes (Trim-Hill reagent: a mixture of of acetic, concentrated hydrochloric acid and 0.2% aqueous solution of copper sulfate) [20].

After the reaction the specific blue-green color is formed (Fig. 2.2.)

Fig. 2.2 The results of iridoids identification in Daucus carota herb

Chromatographic identification

0.1 ml of the extract was applied to the start line on a plate covered with a layer of silica gel and chromatographed in the solvent system ethyl acetate-formic acid-glacial acetic acid-water (100:11:11:26).

The chromatogram was dried in a fume hood, treated with Stahl's reagent and kept in a drying cabinet at a temperature of 100 ± 5 °C for 5 minutes.

For comparison were used viburnum bark extract and large plantain extract (Fig. 2.3).

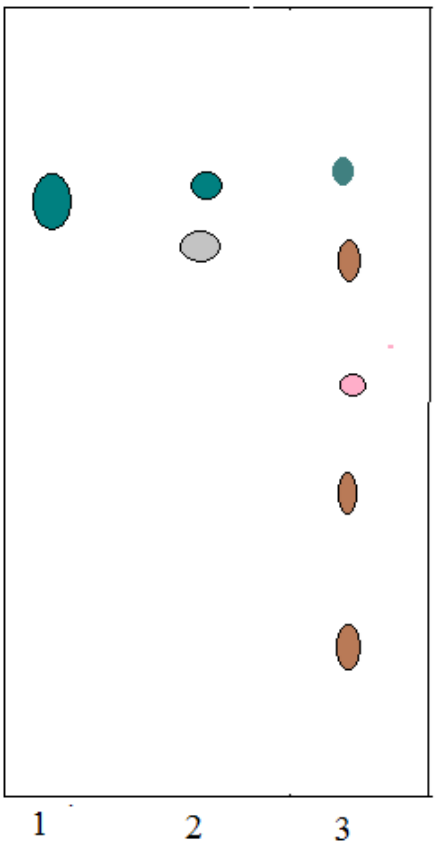

Fig. 2.3 Scheme of the chromatogram of *Daucus carota* herb in comparison with viburnum bark and plantain leaf extracts

Note: 1 - viburnum bark extract; 2 - plantain leaf extracts; 3 – Daucus carota herb extract.

Based on the color of the spots after processing the chromatogram with the Stahl reagent, it can be assumed that the herb of *Daucus carota* contain iridoids, which appeared on the chromatogram as blue-green spots. It can also be assumed that the raw materials contain catechins, which gave a crimson-red color on the chromatogram and flavanones - a brown color.

2.3. Phenolic compounds

2.3.1. Simple phenols

0,5 g of powdered material was placed in a flask and add 10 ml of water, boil for 2-3 minutes, filtered after cooling. To 1 ml of the filtrate add crystal iron chloride.

Observation. As a result of the reaction formed gray tint of solution.

To 2 ml of the filtrate was added 4 ml of ammonia solution and 1 ml of 10% sodium phospho-molybdenum in hydrochloric acid.

This reaction is specific for members of simple phenols.

Observation. Formed a dark green solution.

The results of the reaction established the presence of simple phenols, in particular arbutin in herb.

2.3.2. Coumarines

Reaction with alkali and diasoreagent: 3-5 ml alcohol solution extract was added 5 drops of 10% potassium hydroxide solution and heated in a water bath for several minutes. After you have added 3-5 drops diasosulfanilic acid. In observation the red color of the solution.

Lactone test: 3-5 ml of extract was added 5 drops of 10% alcohol solution of potassium hydroxide, heated in a water bath, was added 5.10 ml of distilled water, mixed well, add 10 drops of 10% hydrochloric acid [37]. The formation of a white precipitate, it showed that the raw materials contains coumarins.

The results of the qualitative determination some of BAC are given in Table 2.1.

Table 2.1.

The results of the qualitative determination of BAC in *Daucus carota* herb

Class of compound	96% ethanol	$FeCl_3$	Sodium phospho-molybdenum in hydrochloric acid	Alkali and diasoreagent	Lactone test
Polysaccharides	amorphous precipitate	-	-	-	-
Simple phenols	-	gray tint of solution	dark green solution	-	-
Coumarines	-	-	-	red color	white precipitate

2.3.3. Flavonoids and hydroxycinnamic acids

For preliminary identification of flavonoids used cyanidine reaction by Briant, the reaction with 10% alcohol-water solution of alkali, reaction with lead acetate, reaction with $FeCl_3$ [19, 37].

Obtaining the extract for investigation. Cutting 3.0 g of raw material to the particle size of 2 mm. Sample was placed in a flask with 100 ml. To raw material added 35 ml of 70% ethanol. Closed flask air refrigerator and boil in water bath for 20 minutes, stirring occasionally. After cooling, the conducted filtration. The filtrate was used for further study.

Cyanidine reaction.

To 1 ml of purified extract was added 2-3 drops of concentrated hydrochloric acid and a few pieces of metallic magnesium powder.

After the end of the allocation of gas bubbles to the colored solution was added butanol, diluted with water to the separation of layers and shaken.

Observation: The formation of the organic phase pink color and yellow color of the aqueous phase.

Reaction with alkali.

To 1 ml of the extract was added 1-2 drops of 10% alcohol-water solution of potassium hydroxide.

Observation: The formation of a yellow precipitate.

Reaction whith $FeCl_3$.

To 1 ml of the extract was added 1-2 drops of 10% solution of ferric chloride

Observation: Dark solution.

Reaction with lead acetate.

Observation: The formation of intense yellow amorphous precipitate.

The results of the qualitative determination of flavonoids are shown in Tab. 2.2.

Table 2.2

Results of the qualitative determination of flavonoids in *Daucus carota* herb

Raw material	Reagent			
	Cyanidine reaction	Solution KOH	$FeCl_3$	Lead acetate
Daucus carota herb	pink color of the organic phase and the water phase yellow	yellow precipitate	yellow-green color of solution	yellow amorphous precipitate

As a result of qualitative reaction, the presence flavonoids in studied raw materials was estabiliched. Cyanidine reaction is specific for this type of compounds shown, that herb contains aglycones and glycosides derivatives of flavonoids.

For identification of phenolic compounds used chromatographic methods. Chromatographic research were carried out using two-dimensional paper chromatography in solvent system: I direction - ethyl acetate-formic acid-water (10:2:3); II direction - 2% acetic acid. Chromatograms were analyzed in daylight and UV- light after processing of ammonia pairs and an alcoholic solution of alkali. Also used chromatography in compared whis standard compounds [19, 20].

The results of chromatographic studies are shown in Fig. 2.4 and Table 2.3.

Table 2.3

Chromatographic characteristic of phenolic compounds from *Daucus carota* herb

№ of spot	Rf·100		Fluorescence in UV-light	
	I direction	II direction	before processing the reagent	after processing of ammonia pairs
1	2	3	4	5
1	85	70	Blue	Blue
2	82	33	Light blue	Light blue

1	2	3	4	5
3	62	65	Light blue	Turquoise
4	80	10	Yellow	Yellow
5	90	7	Yellow	Yellow -green
6	55	40	Yellow	Yellow
7	95	50	Blue	Blue
8	50	10	Yellow	Brown

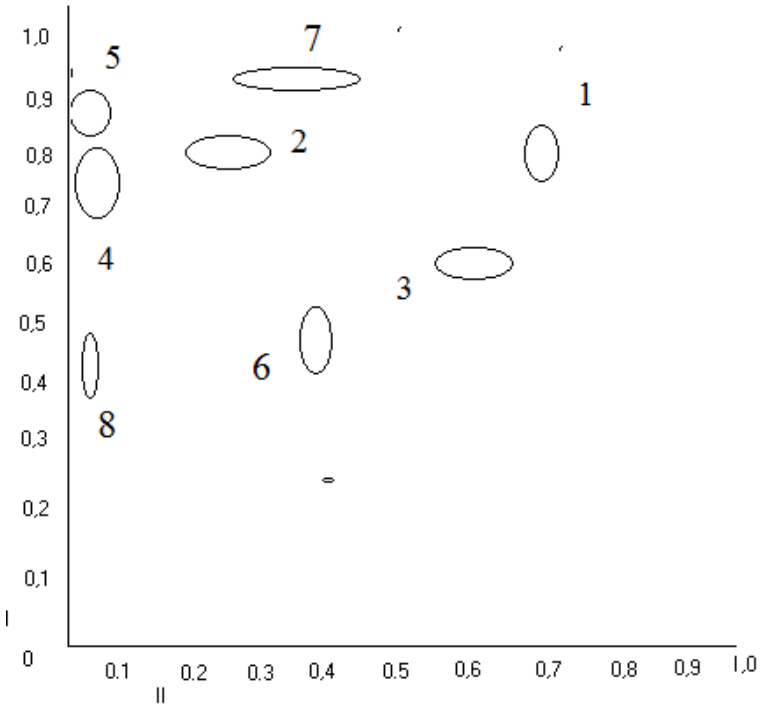

Fig. 2.4 Chromatogram of phenolic compounds of *Daucus carota* herb

As the shows Tab. 2.3., in *Daucus carota* herb presence of at least 8 compounds of phenolic nature, among wham according Rf values compounds 4, 5, 6 and 8 have flavonoid nature and compounds 1, 2, 3, 7 are derivatives of hydroxycinnamic acids.

When compared with standart sample compound 3 identified as chlorogenic acid, 4 - as quercetin.

2.3.4. Tannic compounds

Extraction

Cut raw materials and sifted through a sieve with 1 mm diameter holes. 1 g of sample material was placed in a flask containing 250 ml, add 100 ml of water and heated in boiling water bath for 20 minutes. Cooled hoods and percolated cotton wool.

Reaction 1. To 2 ml of purified extract was added a few drops of 1% solution of quinine chloride [39]. In observation we detected the formation of a white precipitate.

Reaction 2. To 2 ml of extract was added 4 drops of iron-ammonium alum. We saw the olive color of the solution.

Reaction 3.To 1 ml of extract was added 2 ml of 10% acetic acid and 1 ml of salt lead acetate. We saw the formation of brown precipitate.

Reaction 4. To 2 ml of extract was added a few crystals of sodium nitrate and 2 drops of 0.1 N hydrochloric acid. Was formed light yellow color solution.

Reaction 5. Up to 2 ml of extract was added 2 drops of ferric chloride. Observed black -green color.

The results of the qualitative determination of tannic compounds are given in Table 2.4.

Table 2.4.

The results of the qualitative determination of tannic compounds in *Daucus carota* herb

Reagent				
iron-ammonium alum	1% solution of quinine chloride	CH_3COOH+ $(CH_3COO)_2Pb$	$NaNO_2$+ HCl	$FeCl_3$
olive color of the solution	white precipitate	brown precipitate	light - yellow	yellow - brown

According to the study identified the presence of oxidation of polyphenolic compounds in the tested raw materials.

2.3.5. Saponins

For the study we placed 50 g of powdered plant in a conical flask of 100 ml reflux and poured 50 ml of 50% alcohol. Content of the flask heated in a boiling water bath for 15 minutes. Extract cooled and filtered. 20 ml of the filtrate was evaporated in a water bath to 10 ml. The aqueous extract was used for qualitative reactions.

1. Test of foam formation

Place 2-3 ml of the obtained water extract in a test tube. Shake during 1 minute.

Observation: a foam forming.

2. *Laphone reaction* (color reaction).

To 2 ml of alcohol-water extract was added 1 ml of 10% solution of copper sulfate and 1 drop of concentrated sulfuric acid and gently heated. Formed blue-green precipitate.

3. To 1 ml of extract was added 3-4 drops of *barite water*. We so white opalistsents.

4. Up to 1 ml of extract was added 3-4 drops of 10% lead acetate solution. The formation of a yellow precipitate finaly.

The results of qualitative research of saponins are shown in Table 2.5.

Table 2.5.

The results of qualitative research of saponins in *Daucus carota* herb

Reagent/reaction		
Laphone reaction	Barite water	$(CH_3COO)_2Pb$
Blue-green opalistsents	White opalistsents	Yellow precipitate

Conclusions. As a result of qualitative reactions determined presence of saponins in *Daucus carota* herb.

2.3.6. Alkaloids

For extraction of alkaloids place 1.0 g of powdered herb in a glass conical flask, add 25 ml of 1% hydrochloric acid. Attach a reflux condenser to the flask and boil on a water bath for 30 min. Cleaned the filter the solution through a paper filter. For reactions used the filtrate.

To establish the presence of alkaloids qualitative chemical reactions and chromatography methods were used.

Methods of carrying out qualitative reactions

1 drop of extraction was placed on a glass slide, 1 drop of the reagent was applied. The result was evaluated by the formation of colored precipitates.

The following reagents were used for the analysis: Wagner's reagent, Dragendorff's reagent, Sonnenstein's reagent, picric acid, Lugol reagent (Fig. 2.5, Table 2.6).

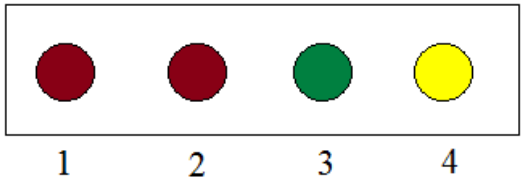

Fig. 2.5 Results of alkaloids identification in *Daucus catota* herb by using general alkaloid reagents

Note: 1 – Wagner's reagent, 2 – Dragendorff's reagent, 3 – Sonnenstein's reagent, 4 – picric acid.

Table 2.6

Results of identification of alkaloids in raw materials

Reagent	Results of reaction
Wagner's reagent	brown precipitate
Dragendorff's reagent	dark-brown precipitate
Sonnenstein's reagent	green precipitate
1% picric acid	yellow precipitate

Chromatographic study of alkaloids.

For research, thin-layer chromatography (TLC) was used on Silufol plates, in the hexane-acetone (6:4) solvent system, and the chromatograms were treated with Dragendorff's reagent. The results were evaluated by the color of the spots after treatment with a chromogenic reagent. The scheme of the chromatogram is shown in Fig. 2.6.

Fig. 2.6 Scheme of TLC alkaloids of *Daucus carota* herb

The presence of alkaloids is indicated by brown spots on a yellow-brown background.

As a result of qualitative general reactions and TLC determined presence of alkaloids in *Daucus carota* herb.

Conclusions

1. By used the qualitative chemical reactions and chromatographic methods the qualitative composition of BAC of *Daucus carota* herb of variety Bolivar F was carried out. In herbal drugs was determined the compounds of different chemical structure: polysaccharides, phenolic compounds, saponins, alkaloids.

2. According the results of PC whis standard samples in *Daucus carota* herb detected 8 phenolic compounds, among which 4 compounds (4, 5, 6, 8) had flavonoid nature and compounds 1, 2, 3, 7 are derivatives of hydroxycinnamic acids.

CHAPTER 3. Quantitative determination of BAC of *Daucus carota* herb

3.1. Determination of *Daucus carota* loss in mass during drying

Analytical samples of raw materials cuted to particle size of about 10 mm, mixed and taken two sample weight 3-5 g, with an error 0,01g. Each sample was placed in dried bottle with cover and put in heated to 100-105 ˚ C drying cabinet. Drying time recalculated from the time when the temperature in the closet again reached 100-105 ˚ C. The first weighting conducted after 2 hours. Drying was performed to constant weight. Constant weight was considered reached when the difference between two subsequent weighting after 30 minutes of drying and cooling for 30 minutes in a desiccator did not exceed 0.01 g [24].

Determination of the in mass during drying recalculation the number of active substances on the absolutely dry raw material was carried out in a sample of 1-2 g (accurate weight) while the difference between weighing not more than 0,0005 g (Table 3.1).

Loss in mass during drying of *Daucus carota* herb (in %) 7,15±0,05.

3.2. Obtaining of *Daucus carota* herb lipophilic fraction. Research of fatty acids composition

Raw materials sample crushed and sieved to the particles of 3 mm, separated from the dust through a sieve number 18, were placed in a bag of filtering paper and weighed on an analytical balance. Prepared in this way substance extracted in Soxclet apparatus. Extractants - chloroform. Extraction was carried out in a water bath to extract discoloration.

The flask receiver were weighed before and after extraction. To remove a pair of extractant flask was dried in an oven at 60 º C for 30 minutes.

These fractions have the form of resinous liquid, dark-green color, with a characteristic odor, insoluble in water and alcohol, soluble in chloroform and ethyl

acetate.

Output of the lipophilic fraction recalculated by the formula:

$$X = \frac{m_{l.f.} \cdot 100 \cdot 100}{m_s \cdot (100 - W)}$$

$m_{l.f.}$– mass of the lipophilic fraction; m_s – mass of sample; W– moisture of raw material.

The output of lipophilic fraction considering moisture of raw material is 17,5%.

Research of fatty acids

In vial added 50 mg of raw materials and added internal standard (50 mg tridecane in hexane) and 1,0 ml methylated agent (14% BCl3 in methanol, Supelco 3-3033). The mixture was kept in hermetically sealed vial 8 hours at 65°C. The reaction mixture was poured from the sediment and plant material was diluted with 1 ml of distilled water.

To remove the methyl esters of fatty acids were added 0,2 ml of dichlormethane, shaken several times an hour, obtained extract of methyl esters chromatographed.

Investigation was carried out by use chromato-mass-spectrometry method in chromatograph Agilent Technologies 6890 and mass-spectrometry detector 5973 [56].

Chromatography parameters: samples input (2 mcl) in chromatographic column conducted in splitless mode.

Speed of samples input 1,2 ml/min. during 0,2 min.; chromatographic column – capillary INNOWAX diameter 0,25 mm and length 30 m; speed of carrier gas (helium) 1,2 ml/min.; heater temperature – 250°; temperature thermostat programmed from 50 to 320 °C with a speed 4°C/min.

For components identification used a library of mass-spectrs NIST05 and WILEY 2007 with the total number more 470000 spectra in combined with programs of the identification AMDIS and NIST. For a quantitative calculation

used method of internal standard. Fatty acid composition of *Daucus carota* herb showed in Tab. 3.2.

Table 3.2

Fatty acid composition of *Daucus carota* herb

№	Name of acid	Rt, min.	Content (mg/kg)
1	Lauric	19.08	76.18
2	Myristic	20.45	298.83
3	Pentadecanoic	22.23	49.58
4	Palmitic	28.26	287.45
5	Palmitoleic	29.20	11.02
6	Heptadecanoic	31.30	28.65
7	Stearic	31.73	1108.54
8	Oleic	31.99	809.26
9	Linoleic	33.92	650.65
10	Linolenic	34.28	486.11
11	Arachinic	34.97	708.65
12	Behenic	38.10	287.34
13	Hexadicarbonic	36.37	476.08
14	Tetracosanoic	37.96	352.87
15	Hexacosanoic	40.84	28.09

As shown in Tab. 3.2 in raw material founded 15 fatty acids, from which 3 (oleic, linoleic and linolenic) are unsaturated and essential. In raw material are dominant saturated fatty acids. The chromatogram of *Daucus carota* herb fatty acid shown in Fig. 3.1.

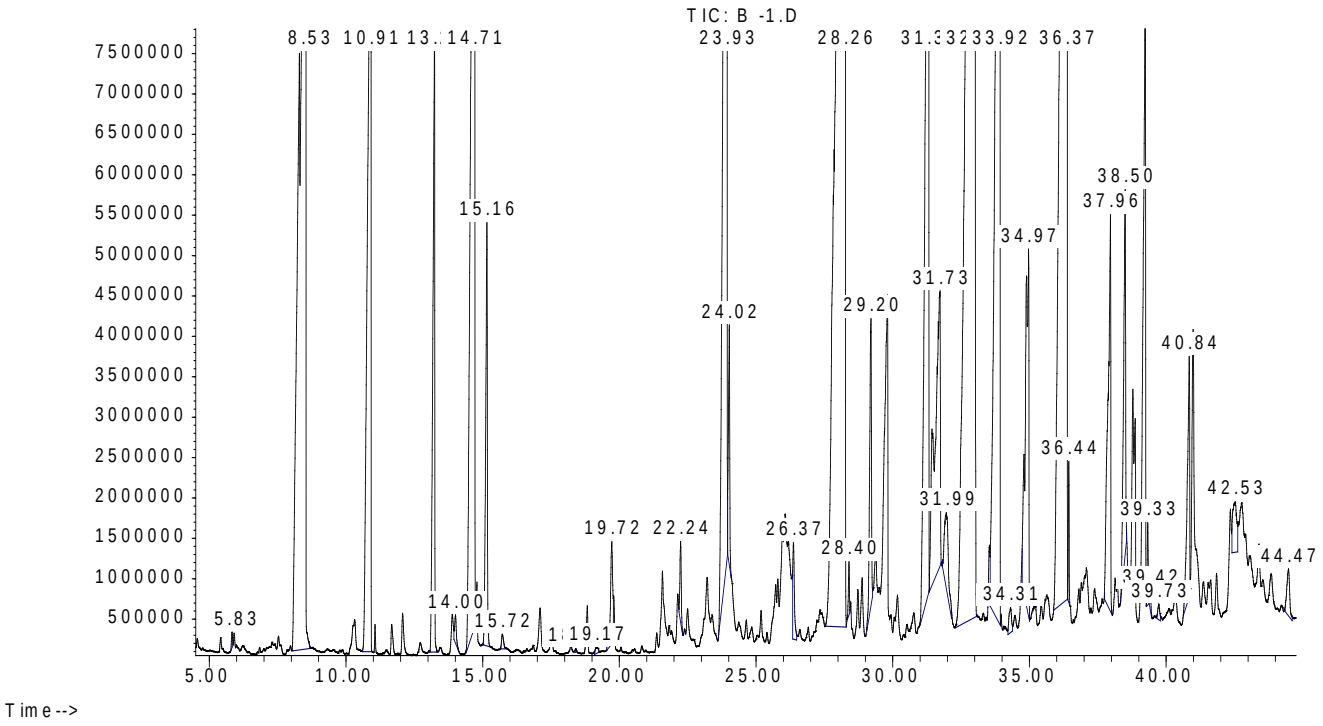

Fig. 3.1 Scheme of chromatogram of fatty acids
of *Daucus carota* herb

3.3. Research the essential oil components of *Daucus carota* herb

3.3.1. Obtaining and quantitative determination essential oil from *Daucus carota* herb

Quantitative determination of essential oil in raw material is carried out by steam distillation in a Ginsberg's apparatus. The distillate is collected in the graduated tube, the aqueous phase is returned to the distillation flask.

Place 10 g of cut crude drug (weigh out with precision ±0,01 g) into a flask and add 300 ml of water, introduce the receiver in to the flask and attach the reflux condenser, heat to the temperature of boiling and distil for the prescribed time. Stop the heating, allow to cool and read the volume of volatile oil collected in the receiver [31].

Calculate the result as millilitres per 100 g of drug from the expression:

$$X = \frac{a \times 100 \times 100}{b(100 - w)}$$

a - volume of a volatile oil, ml;

b - mass of vegetable drugs, g; w – loss on drying, %

Was obtained essential oils from *carrot* herb. The quantitative content of essential oil was 0,25%.

Determination the physical-chemical properties of Daucus carota herb essential oil

Refraction index. Get acquainted with the employment of a Refractometer. Refraction index of essential oil of *Daucus carota* herb at 20˚ is 1,28.

Solubility. Essential oil soluble in 96% alcochol, unsoluble in water.

Determine colour and transparency. Place 5 ml of a volatile oil into a cylinder (d= 2-3 cm). It is light green liquid.

Odour. Placed two drops of a volatile oil on a strip of a filtrate paper (12x5 cm) and compare the odour with the odour of the (for 1 h in every 15 min). Essential oil with characteristic smell.

Taste. Placed one drop of a volatile oil on a sugar and with the help of tongue determined its taste. Essential oil has characteristic sweet-bitter taste.

As a result of the conducted research, it was established that *Daucus carota* herb essential oil is oily, light green, clear liquid, with a characteristic, pleasant smell and sweet-bitter taste.

3.3.2. Chromatography - mass - spectrometry research of components of essential oils from *Daucus carota* herb.

Qualitative and quantitative determination of essential oil components conducted chromatography-mass spectrometric method in gas chromatography-mass spectrograph company "Hewlett-Packard" (NC), United States, consisting of the brand chromatograph HP6890 GC and mass - selective detector 5973N.

The components were separated on a silica capillary column HP company (HP 19091J-433 HP-5) length of 30 m and an inner diameter of 0.25 mm, filled

with 5% phenilmethylsyloxanom.

Column temperature programming was used: initial temperature 600 final - 2400. Distillation period (from the initial to the final temperature of isothermal sections of the program) 1 hour. Sweep The speed 3 hrad/1hv. Sample volume was 0.3 ml with a coefficient of flow separation and 1:15 inlet pressure of 40 kPa column; carrier gas - helium. Recording time - 0.5 sec. [1, 59].

The resulting spectra are seen as based on the general laws of fragmentation of molecules of organic compounds under electron impact, or by searching mass spectral library databases «Flavor2.L.» And «NIST98 L.».

Before carrying out the search for each chromatographic peak calculated average mass spectrum from which the background subtracted spectrum .

The identification of compounds was performed by comparison of mass spectra of the chromatographic peak of the mass spectra of reference compounds with high probability recognition program identified in the array spectra database [58].

The quantitative content of the compounds was calculated by the ratio of the peak component to the sum of the areas of all peaks in the chromatogram (method of normalization).

Research conducted chromatography-mass spectrometric method using the built-processing program of mass spectra.

Mass spectra corresponding chromatographic peaks were identified by comparing their mass spectra with reference compounds.

Chromatogram of essential oil components are shown in Fig. 3.2.

Resurts of chromate-mass-spectrometry research of *Daucus carota* herb essential oil shown in Table 3.3.

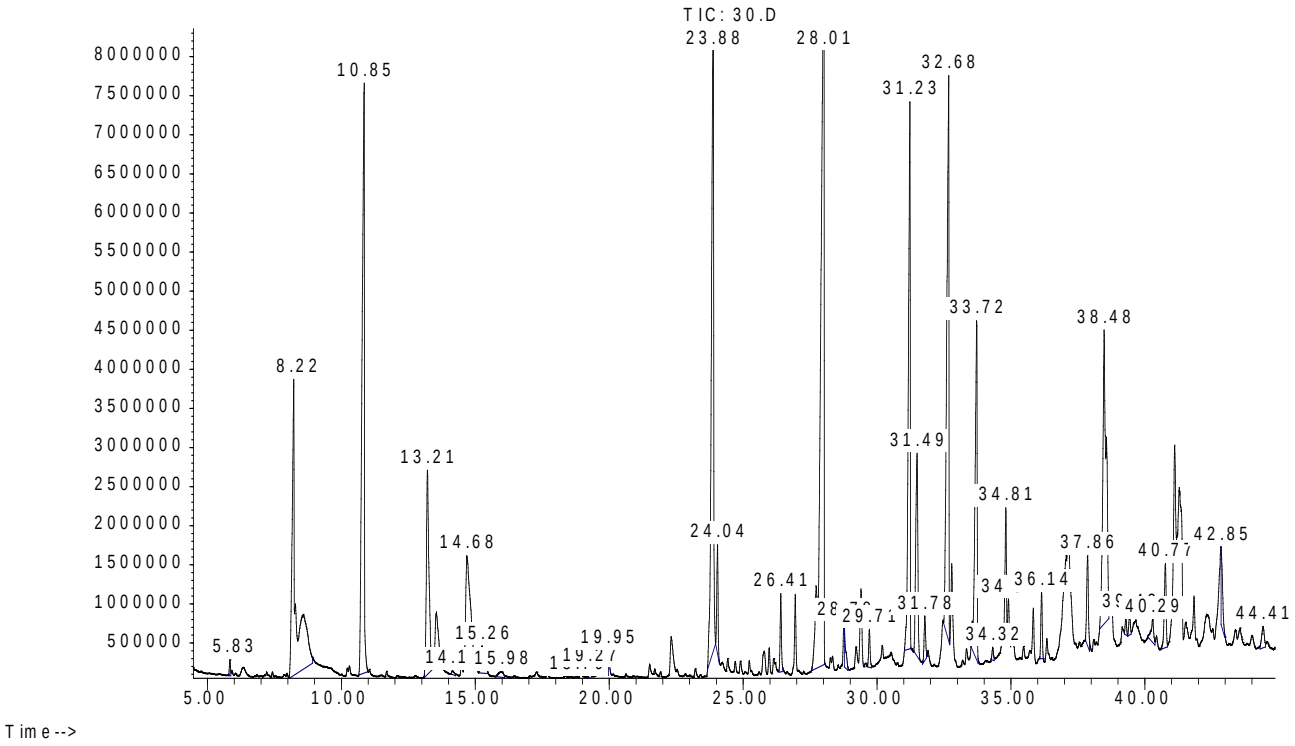

Fig. 3.2. Chromatogram of essential oil *Daucus carota* herb components

Table 3.3.

Resurts of chromato-mass-spectrometry research of *Daucus carota* herb essential oil

№	Rt, min.	Compound	Content, (mg/kg)
1	5.83	α-Pinen	0,54
2	8.22	Sabinene	10.25
3	10.86	β-Pinene	7.76
4	13.21	β-Phelandren	9.24
5	14.68	*trans*-Cymen	11.48
6	19.95	Carvacrole	3,92
7	24.04	Miristicine	487.86
8	28.01	Apiole	8.12
9	40.7	Squalen	245.56

As seen from Table 3.3 in essential oil identified 9 compounds. Dominated in quantitative content are miristicine (487.86 mg/kg), squalen (245.56 mg/kg) and apiole (98.12 mg/kg) [29].

3.4. Determination the chlorophylls in *Daucus carota* herb

Quantitative determination of chlorophyll

For quantitative analysis of chlorophylls used photocolorimetric determine the amount of pigment. For chlorophyll extraction using 96% ethanol.

Methods. Sample of the lipophilic fraction leaves 0.1569 g dissolved in 10 ml of 96% ethanol. The solution was filtered, the volume of solution driven to 10 ml of 96% ethanol.

From obtained solution taken away by pipette 5 ml, driven to 10 ml of 96% ethanol, were double dilution. Optical density determined in photoelectriccolourimeter with a red filter with a thickness of 10 mm absorbent filter. Reference solution was 96% ethanol.

At the same time was measured optical density of the standard solution Guthrie under the same conditions [29].

To prepare the standard solution Guthrie used 4% solution of potassium dichromate - 50 ml; 1% solution of copper sulfate – 28,5 ml; ammonium hydroxide - 10 ml; distilled water - 100 ml. 1 ml of obtained solution corresponds to 0.000085 g color of chlorophyll.

Chlorophyll content in lipophilic fraction in percentage (x) in terms of absolutely dry raw material was calculated using the formula:

$$X = \frac{D_1 \cdot P \cdot A \cdot 100}{D_2 \cdot a},$$

D_1 – optical density of the investigated extract; D_2 – optical density of standart; P – dilution; A – amount of chlorophyll, g in 1 ml, according in color 1 ml of standard solution of Guethrie; a - the mass of raw materials, g; a. = 0,1569; p = 10 ml; D_1 = 0,20; D_2 = 0,59

Quantification of chlorophyll content in lipophilic fraction of *Daucus carota* herb was 0,17%.

Table 3.4.

Metrological characteristics average results of chlorophyll determination

n	f	X_i	X_{cep}	S^2	$S_{cep.}$	P, %	t(P,f)	Interval	ε, %
1	2	3	4	5	6	7	8	9	10
5	4	0,1726 0,1765 0,1781 0,1703 0,1726	0,1725	0,00004586	0,002354	95	2,78	0,1725±0,0041	2,08

3.5. Determination the free and associated amino acids in *Daucus carota* herb

This group of compounds was determined on paper chromatography with the subsequent processing 10% solution of ninhydrin in acetone and heated in an oven at 80-100 º C.

The appearance of red and red-purple of spots indicating the presence of amino acids in herb.

Quantitative analysis of amino acids in the samples were determined using method of highly efficient liquid chromatography on the chromatograph Agilent Technologies (model 1100) equipped with a flowing vacuum degasser G1379A, 4-channel gradient pump low pressure G13111A, G1313A automatic injector, column oven G13116A, diodnomatrichnym detector G1316A [22, 23].

For analysis of the chromatographic column used was 4,6 × size of 50 mm, filled sorbent grained 1.8 microns, «ZORBAX-XDB-C18.

Free amino acids. Using analytical balance weigh in a 10 ml viala

weighed 0.3 g of finely powdered plant material.

Then to vial put 3 ml 0,1 N aqueous hydrochloric acid solution containing 0,2% β-mercaptoethanol. Viala hermetically closed and placed for 2 hours in an ultrasonic bath at 50 ° C.

The total content of amino acids (associated + free). Using analytical balance weigh in vial weighed 0.20 g of finely powdered plant material. Then 3 ml vial of 6 N aqueous hydrochloric acid solution containing 0,4% β-mercaptoethanol. Viala hermetically closed and kept for 24 hours at 110 ° C. Vials with sample preparation was centrifuged and filtered. The reaction vial is taken up in 2 ml of filtrate and 20 ul 100 ul and placed in a vacuum desiccator at a temperature and pressure 40-45ºS 1.5 mmHg to completely remove hydrochloric acid(Table 3.5).

Table 3.5.

Mode of chromatographic conditions (gradient chromatography mode)

Time min.	A% 0.05M water solution of sodium acetate, pH 6.5	B% 0.10 M water solution of sodium acetate:ACN= (23:22, v/v), pH 6.5	C % H_2O	D% acetonitril	feed rate of the mobile phase ml/min.;
1	2	3	4	5	6
0	70	30	0	0	1.5
3.87	27	73	0	0	1.5
5.73	0	100	0	0	1.5
7.83	0	100	0	0	1.5
1	2	3	4	5	6
8.17	0	0	15	85	1.5
10.00	0	0	2	98	2.0
10.10	70	30	0	0	2.0
11.00	70	30	0	0	2.0

Then, to analyze the vial were added successively an automatic dispenser -

200 mcl 0.8M borate buffer, pH 9.0, 200 mcl of 20 mM solution of 9-fluorenylmethoxycarbonyl chloride in acetonitrile, after 10 min incubation the reaction vial is added 20 mcl 150 mM sodium amantadine hydrochloride in 50% aqueous acetonitrile.

Process pressure eluent 220-275 kPa; column temperature 50 ° C; volume of sample 2 l. detection parameters : the scale measuring 1.0, 0.5 scan time sec., wave detection at 265 nm.

Identification of amino acids was performed by the retention times of standards.

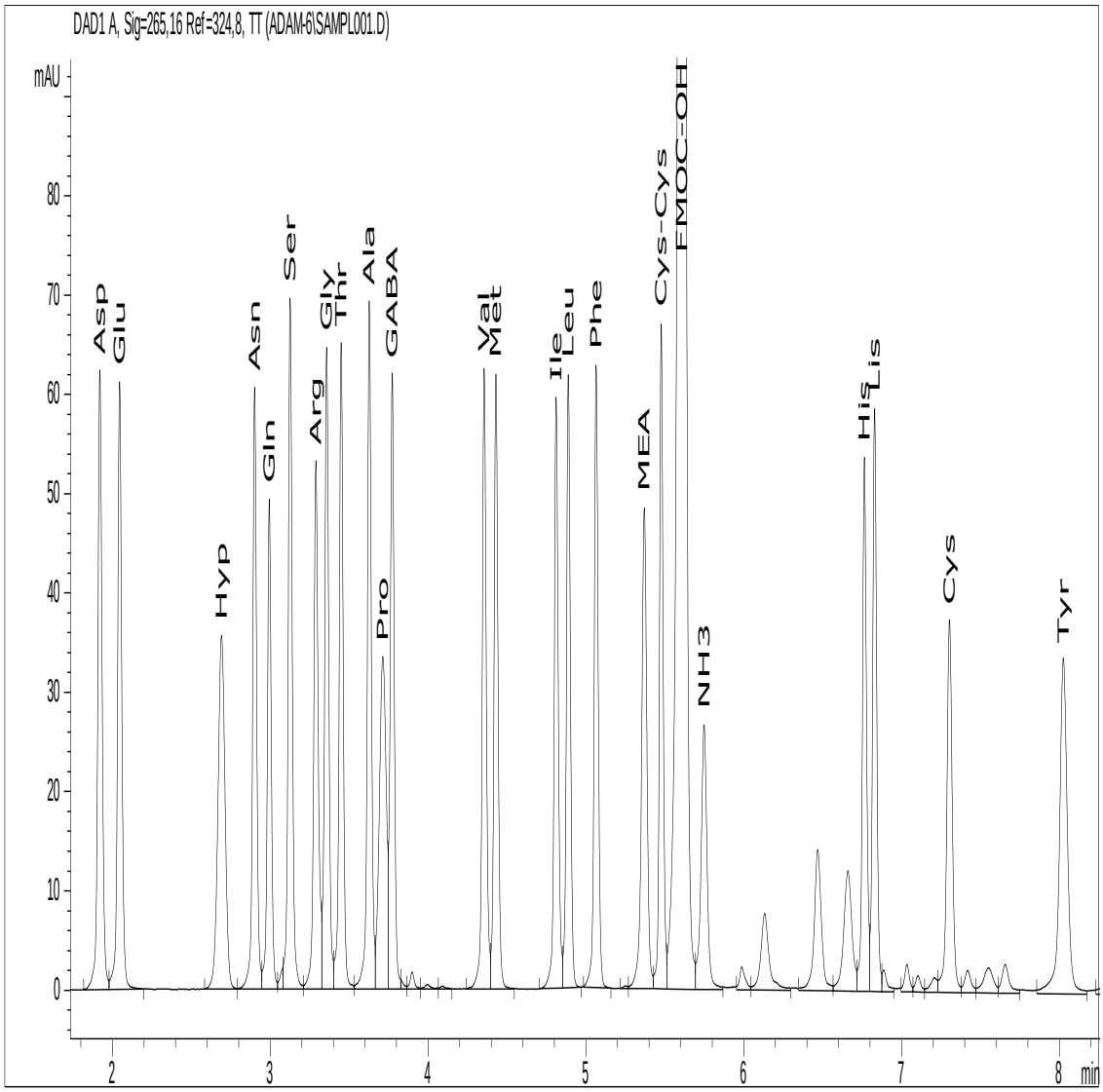

Fig. 3.3 Chromatogram of amino acids standards

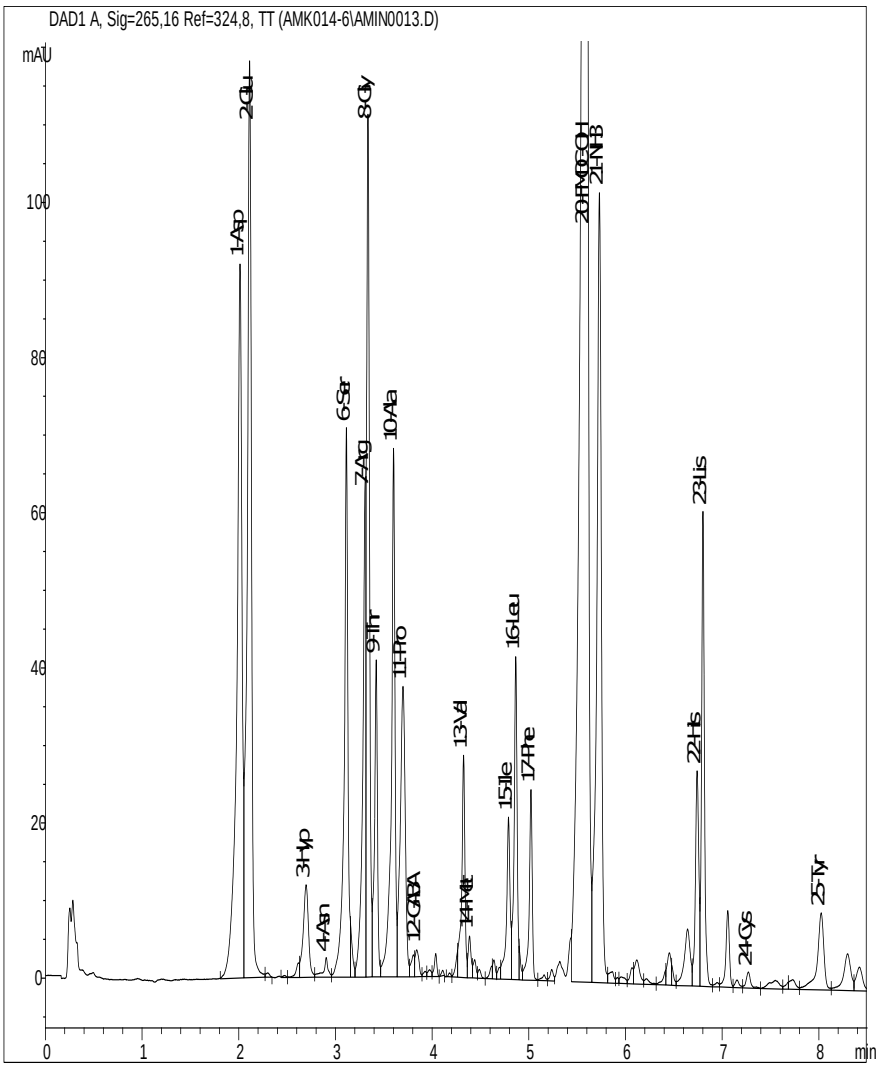

Fig. 3.4 Chromatogram of general contents of *Daucus carota* herb amino acids

In associated condition most accumulated asparaginic acid, glutaminic acid, arginine, lisine.

Among free amino acids are dominated asparagine and histidine.

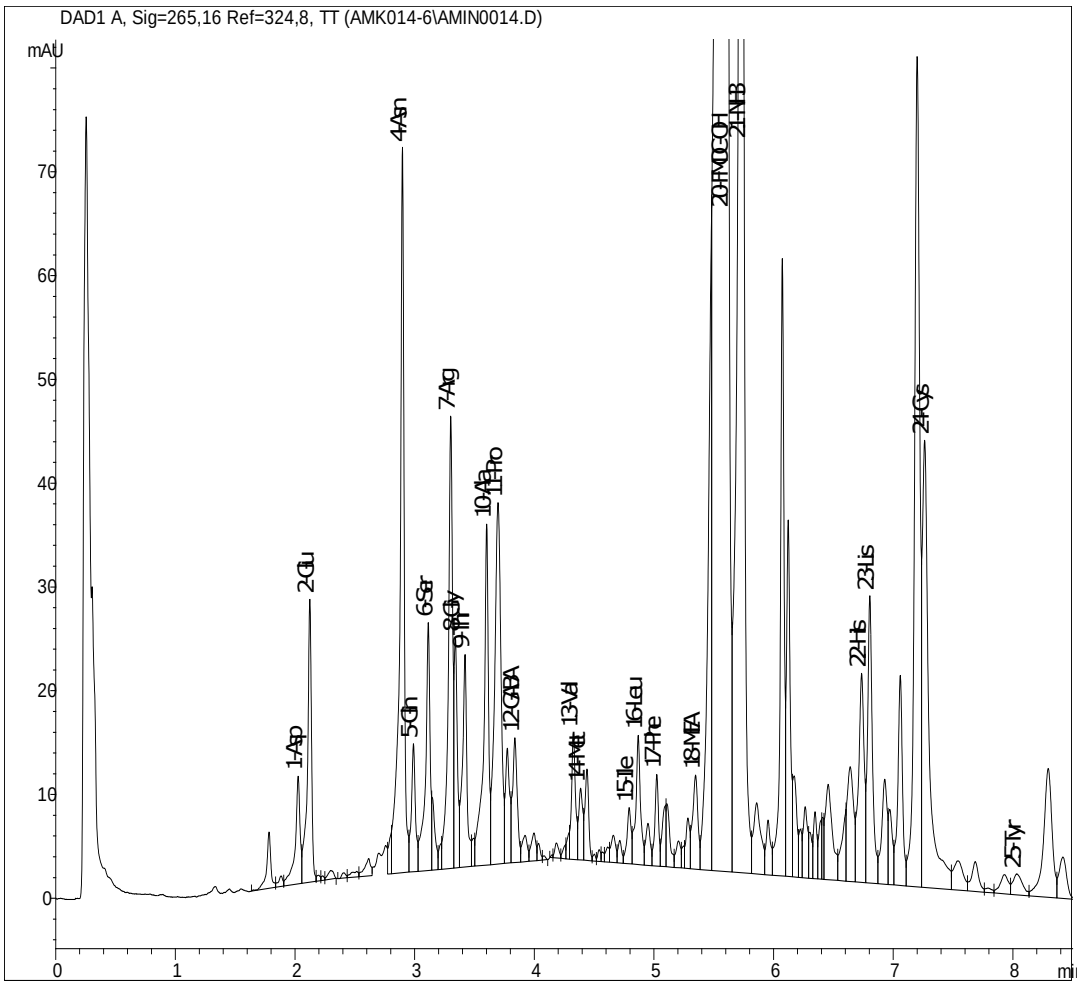

Fig. 3.5. Chromatogram of free amino acids from *Daucus carota* herb

Table 3.6

Amino acids from Daucus carota herb

№	Amino acid	Rt, min.	Content, mg/100g	
			General conent of amino acids	Free amino acids
1	Asparaginic	2,01	1420,2	7,3
2	Glutaminic acid	2,11	2234,7	28,9
3	4-hydroxyproline	2,70	254,4	10,18
4	Asparagine	2,90	79,6	11,10
5	Glutamine	2,99	11,8	3,5
6	Serine	3,11	678,8	16,7
7	Arginine	3,30	890,7	55,4

8	Glycine	3,34	787,1	10,3
9	Treonine	3,42	398,5	22,5
10	Alanine	3,60	708,3	25,8
11	Proline	3,70	809,3	56,0
12	Valine	4,33	177,0	6,5
13	Methionine	4,39	90,2	7,7
14	Isoleucine	4,79	239,8	5,2
15	Leucine	4,86	560,1	17,9
16	Phenylalanine	5,02	345,5	8,7
17	Cystine	5,42	2,0	-
18	Histidine	6,74	123,9	18,9
19	Lisine	6,80	456,8	17,9
20	Cysteine	7,27	41,2	19,6
21	Tirosine	8,02	176,9	4,8

3.6. The study of microelement composition of *Daucus carota* herb.

Study of qualitative and quantitative elements was performed using the method of atomic emission spectrophotometry.

Samples were evaporated to craters of graphite electrodes in the discharge the arc alternating current power at 16 and 60 seconds of exposition.

As a source of excitation of spectra using IBC-28.

The spectra were recorded on film using a spectrograph DFS-8 diffraction grating 600 str / mm and threelens lighting slit.

Conducted photometry line of spectra at wavelengths from 240 to 347 nm in the samples compared with standard samples of mixture of mineral elements with mikrophotometr MF-4.

The results of elemental analysis of *Daucus carota* herb shown in Table 3.7.

Table 3.7.

The results of elemental analysis of *Daucus carota* herb

Element	The quantitative contents (mg/100 g)
Macroelements	
Potassium (K)	350
Sodium (Na)	49
Calcium (Ca)	145
Phosphorus (P)	70
Magnesium (Mg)	65
Silicon (Si)	80
Microelements	
Iron (Fe)	12
Manganese (Mn)	3
Aluminium (Al)	11
Lead (Pb)	<0,01
Strontium (Sr)	0,3
Nickel (Ni)	0,03
Molybdenum (Mo)	<0,03
Copper (Cu)	0,2
Chromium (Cr)	<0.03
Cobalt (Co)	<0.01
Cadmium (Cd)	<0.01
Arsenic (As)	<0.01
Surma (Sb)	<0.01

Detected 6 macro – (K, Na, Ca, P, Mg, Si,) and 9 microelements (Fe, Mn, Al, Pb, Sr, Ni, Mo, Cu, Cr). Potassium and calcium a contents in most higher.

In herb are missing or are outside possibilities of the method of determining emission spectrometry microelements: cobalt (<0.01), cadmium (<0.01), arsenic

(<0.01) and antimony (<0.01). Are most accumulate (mg/100 g) macroelements: potassium, calcium, silicon.

Conclusions

1. A loss in mass during drying for *Daucus carota* herb was established, it was 7,15±0,05.

2. By chlorophorm extraction was obtained lipophilic fraction of *Daucus carota* herb, it output is 17,5%.

3. By use a gas chromatography method in raw material founded 11 fatty acids, dominant (mkg/100 mg) are palmitic, oleic, and linoleic acids.

4. By steam distillation was obtained the essential oil from *Daucus carota* herb and recalculated it quantitative content, it was 0,25 %.

5. Was determined the physical-chemical properties of *Daucus carota* essential oil: refraction index, solubility. colour and transparency, odour, taste.

6. By use chromate-mass-spectrometric method in essential oil identified 9 compounds. Dominated in quantitative content are miristicine, squalen and apiole.

7. The chlorophyll content in the raw material was determined by the colorimetric method, which was 0,1725±0,0041.

8. The composition and quantitative content of amino acids was established in the raw materials.

9. Detected 6 macro – (K, Na, Ca, P, Mg, Si,) and 9 microelements (Fe, Mn, Al, Pb, Sr, Ni, Mo, Cu, Cr).

GENERAL CONCLUSIONS

1. Analyzed the current state of Carrot research and complited analytical review of phytochemical and pharmacological study. The main active compounds of carrot are terpenoids, carotinoids and phenolic compounds was detected.

3. The chemical composition of carrot herb insufficiently studied that makes this a promising raw material for further study.

4. Qualitative composition BAC of *Daucus carota* herb was carried out. For investigations used qualitative chemical reactions and chromatographic methods. In herbal drugs was determined presens of polysaccharides, simple phenols, coumarins, flavonoids, hydroxycinnamic acids, tannic compounds, saponins, alkaloids. The composition of mineral elements was study.

5. Quantitative content of chlorophylls, amino acids, fatty acids and essential oil was established. For tye essential oil some physical chemical characteristics was study.

7. Taking into account the results of phytochemical screening, it is possible to draw conclusions about the future prospects of using the herb of *Daucus carota* variety Bolivar F.

Since the raw material has a high content of fatty acids and squalene, it can be suggested to use the lipophilic fraction as a substance for the manufacture of an antimicrobial, antifungal agent for external use.

According to the literature, the components identified by us in the essential oil obtained from the herb of *Daucus carota* have a bactericidal effect against *Staphylococcus aureus*.

Thus, in the future, we consider it appropriate to use essential oil from herb of *Daucus carota* for the production of ointments or liniments for external use for the treatment of dermatitis, eczema and other skin diseases caused by *Staphylococcus aureus*.

References

1. Adams R.P. Identification of essential oil components by gas chromatography mass spectroscopy. Allured Publishing. USA. 2010. 250 p.

2. Afzal M. Comparison of protective and curative potential of Daucus carota root extract on renal ischemia-reperfusion injury in rats. Pharm Biol. 2013. 51(7). 856-62.

3. Aiyelaagbe O.O., Osamudiamen P. M. Phytochemical screening for active compounds in Apiaceae. Plant Sci Res. 2009. 560 p.

4. Alves-Silva JM, Zuzarte M, Gonçalves MJ, Cavaleiro C, Cruz MT, Cardoso Sm and Salgueiro L. New claims for wild carrot (Daucus carota subsp. carota) essential oil. Evidence-Based Complementary and Alternative Medicine 2016. 2. 35-48.

5. Babic I, Amiot MJ, Ngugen-The C, Aubert S. Changes in phenolic content in fresh, ready-to-use and shredded carrots during storage. J. Food Sci. 1993. Vol. 58. P. 351–356.

6. Banga R., Bawa A.S. Studies on dehydration of grated carrots. J. Food Sci Technol. 2002. Vol. 39. P. 268–271.

7. Bast A., Van den Berg H., Van der Plas M., Haenen GRM β-Carotene as antioxidant. Eur J Clin Nutr. 1996. Vol. 50. P. 554–556.

8. Bendich A. Carotenoids and the immune system. Carotenoids chemistry and biology. 1990. Vol. 23. P. 323–335.

9. Bendich A., Olson J.A. Biological action of carotenoids. FASEB J. 1989. Vol. 3. P. 1927–1932.

10. Bourne M.C. Effect of blanch temperature on kinetics of thermal softening in carrots and green pea. J. Food Sci. 2012. Vol. 52. P. 667–668.

11. Carle R., Schiber A. Recovery and characterization of functional compounds from by-products of fruit and vegetable processing—effect of processing on the nutritional quality of food. Karlsruhe. 2001. Vol. 75. P. 21–23.

12. Dias J.S. Major Classes of Phytonutriceuticals in Veg and Health Benefits: A Review. J of Nutritional Therapeutics. 2012. 1. 31-62.

13. Dixon R.A., Paiva N.L. Stress induced phenolpropanoid metabolism. Plant Cell. 1995. Vol. 7. P. 1085–1097.

14. Faulks R.M., Southon S. Carotenoids, metabolism and disease. In: Handbook of nutraceuticals and functional foods. 2001. CRC Press, Florida. p. 9.

15. Gorinstein S., Zachwieja Z., Folta M. Zember M. Comparative content of active compounds in carrot. J Agric Food Chem. 2001. Vol. 49. P. 952–957.

16. Hager T.J., Howard LR. Processing effects on carrot phytonutrients. Hortic Sci. 2006. Vol. 41. P. 74–79.

17. Harborne J.B. A unique pattern of anthocyanins in *Daucus carota* and other Umbelliferae. Biochem Syst Ecol. 2000. Vol. 4. P. 31–35.

18. Hashimoto T., Nagayama T. Chemical composition of ready-to-eat fresh carrot. J Food Hyg Soc Japan. 2004. Vol. 39. P. 324–328.

19. Intake and Bioaccessibility of Total Polyphenols in a Whole Diet.Food Chemistry. 2007. 101. 492-501.

20. Introduction to Organic Chemistry. New York. 2012. 650 p.

21. Jagdish A., Shrivastava B., Deshmukh S.P. A Review: Pharmacological Actions of Daucus carota. J.Human. 2021.Vol. 21 (2). 302-314.

22. Jámbor A., Molnár-Perl I. Quantitation of amino acids in plasma by high performance liquid chromatography. Journal of Chromatography. 2009. P. 6218–6223.

23. Jámbor A., Molnár-Perl I. Amino acid analysis by high-performance liquid chromatography. J. of Chromatography. 2009. P. 3064–3077.

24. Jayaraman K.S., Dasgupta D.R. Development and storage ability of intermediate moisture carrot. J Food Sci. Vol. 43. 1880–1881.

25. Kahkonen M.P., Hopia A.I. Antioxidant activity of plant extracts containing phenolic compounds. J Agric Food Chem. 1999. Vol. 47. P. 3954–3962.

26. Kalt W. Effects of production and processing factor on major fruit and vegetable antioxidants. J. Food Sci. 2005. Vol.70. P.11–19.

27. Karakaya S. Antioxidant activity of some food containing phenolic compounds. Int J Food Sci Nutr. 2001. Vol. 52. P. 501–508.

28. Kidmose U., Hansen S. Effects of genotypes, root size, storage and processing on bioactive compounds in organically grown carrots (*Daucus carota* L). J Food Sci. 2004. Vol. 69. P. 388–394.

29. Korkmaz F., Mashtaler V.V., Sydora N.V. Essential oil composition of carrot herb. Current achievements of pharmaceutical science in the creation and standardization of medicines and dietary supplements containing components of natural origin: materials V International Scientific and Practical Internet Conference, April 14, 2023, NPhaU. P. 22.

30. Krishan D. S., Swati K., Narayan S. Chemical composition, functional properties and processing of carrot—a review. J Food Sci Technol. 2012. 49(1). 22–32.

31. Kumar M. Ethnobotanical studies on some medicinal plants: a review. World Journal of Pharmaceutical Research 2014. 3(8). 342-361.

32. Manjunatha S., Kumar B., Mohan G. Development and evaluation of carrot *kheer* mix. J Food Sci Technol. 2003. Vol. 40. P. 310–312.

33. Mehmet M. Ö., Chalchat J. C. Chemical composition of carrot seeds (Daucus carota L.) cultivated in Turkey: characterization of the seed oil and essential oil. GRASAS Y ACEITES. 2007. Vol. 58 (4). P. 359-365.

34. Moure A., Cruz J. Natural antioxidants from residual sources //Food Chem. 2001. Vol. 72. P. 145–171.

35. Nocolle C., Cardinault N. Effect of carrot intake on cholesterol metabolism and antioxidant status in cholesterol fed rats. Eur J Nutr. 2003. Vol. 42. P. 254–261.

36. Oviasogie O., Okoro D. Determination of total phenolic amount of some edible fruits and vegetables. Afr J Biotechnol. 2009. Vol. 8. P. 2819–2820.

37. Patil M.V. Pharmacological Evaluation of Ethanolic Extract of Daucus carota Linn Root Formulated Cream on Wound Healing Using Excision

and Incision Wound Model. Asian Pacific J. of Tropical Biomedicine. 2012. 2. 646-655.

38. Salwa AA, Galal EA, Neimat A, Elewa Carrot yoghurt: sensory, chemical, microbiological properties and consumer acceptance. Pak J Nutr. 2004;3:322–330.

39. Santo M., Leka L. Natural killer cell activity in elderly men is enhanced by β-carotene supplementation. Am J Clin Nutr. 1996. Vol. 64. P. 772–777.

40. Schieber A., Stintzing F. By-products of plant food processing as a source of functional compounds—recent developments. Trends Food Sci Technol. 2001. Vol.12. P. 401–405.

41. Schweiggert U. Carrot pomace as a source of functional ingredients. Fluss Obst. 2004. Vol. 71. P.136–140.

42. Seidemann L. World Spice Plants: Economic Usage, Botany, *Taxonomy.* 2005. 1200 p.

43. Seo A., Yu M. Toxigenic fungi and mycotoxins. Handbook of industrial mycology. 2003. P. 233–246.

44. Sharma G., Semwal A., Arya S. Effect of processing treatments on the carotenoids composition of dehydrated carrot. J Food Sci Technol. 2000. Vol. 37. P. 196–200.

45. Sharma H., Kaur J. Effect of pre-treatment conditions on physico-chemical parameters of carrot juice //Int J Food Sci Technol. 2009. Vol. 44. P. 1–9.

46. Sharma R. Agrotechniques of medicinal plants. New Delhi: Daya Publishing House. 2014. p. 3–8.

47. Simova E.D., Frengova G.T. Synthesis of carotenoids by *Rhodotorula rubra* cultured with yoghurt starter whey ultra filtrate. J Soc Dairy Technol. 2004. Vol. 31. P. 115–121.

48. Singh H. Osmotic dehydration of carrot shreds for g*azrailla* preparation. J Food Sci Technol. 2001. Vol.38. P. 152–154.

49. Sulaeman A, Keeler L, Giraud DW, Taylor SL, Wehling RL, Driskell JA. Carotenoids content and physiochemical and sensory characteristics of carrot chips deep-fried in different oils at several temperatures. J Food Sci. 2001. Vol. 66. P. 1257–1264.

50. Suvarnakuta P., Devahastin M., Arun S. Drying kinetics and β-carotene degradation in carrot undergoing different drying processes. J. Food Sci. 2005. Vol.70. P. 520–526.

51. Tavares A. C., Maria J. Essential oil of *Daucus carota* subsp. halophilus: Composition, antifungal activity and cytotoxicity. J. Ethnopharmacology. 2008. 119. 129–134.

52. Torronen R., Lehmusaho M. β-carotene response to supplementation with raw carrots, carrot juice or purified β-carotene in healthy non-smoking women. Nutr Res. 2000. Vol. 16. P.565–575.

53. Vasudevan M. Anticonceptive and Anti-Inflammatory Properties of Daucus carota Seeds Extract. J. of Health Science. 2006. 52. 598-606.

54. Velioglu YS, Mazza G, Gao L, Oomah BD. Antioxidant activity and total phenolics in selected fruits, vegetables and grain products. J Agric Food Chem. 1998. 46. 4113–4117.

55. Villanueva-Suarez M. J. Characterization of non-starch polysaccharides content from different edible organs of some vegetables, determined by GC and HPLC: comparative study. J. Agric Food Chem. 2003. Vol. 51. P. 5950–5955.

56. William W. Christie Gas chromatography of fatty acids derivatives**.** Phyto Chem. 2012. Vol. 5, № 2. P. 122 – 132.

57. Yoon K., Cha M. Enzymatic production of a soluble fiber hydrolysate from carrot pomace and its sugar composition. Food Chem. 2005. Vol. 92. P. 151–157.

58. Zenkevich I. G. Chromato-mass-spectrometric identification of BAS Structural chemistry. 2009. Vol. 50, №5. P. 895-909.

APPENDICES

MINISTRY OF HEALTH OF UKRAINE
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL ACADEMY OF HIGHER EDUCATION
OF SCIENCES OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF CHEMISTRY OF NATURAL
COMPOUNDS AND NUTRICIOLOGY

CERTIFICATE

№ 30

This is to certify that

Korkmaz F.

has participated in the V International Scientific and Practical Internet-Conference

"CURRENT APPROACHES OF PHARMACEUTICAL SCIENCE IN DEVELOPMENT AND STANDARDIZATION OF MEDICINES AND DIETARY SUPPLEMENTS THAT CONTAIN COMPONENTS OF NATURAL ORIGIN"

(Duration - 6 hours)
April, 14, 2023, Kharkiv, Ukraine

Rector of the NUPh, prof. — **Alla KOTVITSKA**

Vice-Rector for scientific and pedagogical work of the NUPh, prof. — **Inna VLADIMIROVA**

Head of the department of chemistry of natural compounds and nutriciology of the NUPh, prof. — **Viktoriia KYSLYCHENKO**

Appendix D

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНА АКАДЕМІЯ НАУК ВИЩОЇ ОСВІТИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
КАФЕДРА ХІМІЇ ПРИРОДНИХ СПОЛУК І НУТРИЦІОЛОГІЇ

MINISTRY OF HEALTH OF UKRAINE
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL ACADEMY OF HIGHER EDUCATION OF SCIENCES OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF CHEMISTRY OF NATURAL COMPOUNDS AND NUTRICIOLOGY

СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ НАУКИ В СТВОРЕННІ ТА СТАНДАРТИЗАЦІЇ ЛІКАРСЬКИХ ЗАСОБІВ І ДІЄТИЧНИХ ДОБАВОК, ЩО МІСТЯТЬ КОМПОНЕНТИ ПРИРОДНОГО ПОХОДЖЕННЯ

CURRENT APPROACHES OF PHARMACEUTICAL SCIENCE IN DEVELOPMENT AND STANDARDIZATION OF MEDICINES AND DIETARY SUPPLEMENTS THAT CONTAIN COMPONENTS OF NATURAL ORIGIN

Матеріали V Міжнародної науково-практичної інтернет-конференції

The Proceedings of the V International Scientific and Practical Internet-Conference

ХАРКІВ
KHARKIV
2023

ESSENTIAL OIL COMPOSITION OF CARROT HERB

*Korkmaz F., Mashtaler V.V., Sydora N.V.**
National university of Pharmacy, Kharkiv, Ukraine
*University of Turku, Turku, Finland

Introduction. Under the influence of differents factors raw sources of wild plants are significantly reduced. To expand the resource base of plant sources of biologically active substances (BAS) is a topical the study of agricultural plants. Carrot is widely cultivated agricultural crop, it is growing in different conditions, has many varieties and used in the food industry [4].

Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties [2]. According to literature sources, the chemical composition of above-ground parts practically not been studied. The output of dry material from one plant is quite significan, so use of agricultural herbs can expand assortment of herbal medicines provided with resource base.

Given the above said, we believe that *Daucus carota* herb is a promising source of BAS and interesting subject for phytochemical investigation.

Materials and methods. Quantitative determination of essential oil in raw material is carried out by hydrodistillation in a Ginsberg's apparatus [3]. Was obtained essential oil from *Daucus carota* herb. Qualitative and quantitative determination of essential oil components conducted chromatography-mass spectrometric method in gas chromatography-mass spectrograph company "Hewlett-Packard" (NC), United States, consisting of the brand chromatograph HP6890 GC and mass - selective detector 5973N [1]. The components were separated on a silica capillary column HP company (HP 19091J-433 HP-5) length of 30 m and an inner diameter of 0.25 mm, filled with 5% phenilmethylsyloxanom. Column temperature programming was used: initial temperature 600 final - 2400. Distillation period (from the initial to the final temperature of isothermal sections of the program) 1 hour. Sample volume was 0.3 ml with a coefficient of flow separation and 1:15 inlet pressure of 40 kPa column; carrier gas - helium. Recording time - 0.5 sec.

The resulting spectra are seen as based on the general laws of fragmentation of molecules of organic compounds under electron impact, or by searching mass spectral library databases «Flavor2.L.» and «NIST98 L.». Before carrying out the search for each chromatographic peak calculated average mass spectrum from which the background subtracted spectrum.

The identification of compounds was performed by comparison of mass spectra of the chromatographic peak of the mass spectra of reference compounds with high probability recognition program identified in the array spectra database [5].

The quantitative content of the compounds was calculated by the ratio of the peak component to the sum of the areas of all peaks in the chromatogram (method of normalization). Research conducted chromatography-mass spectrometric method using the built-processing program of mass spectra. Mass spectra corresponding chromatographic peaks were identified by comparing their mass spectra with

ЗМІСТ CONTENT

National University of Pharmacy

Faculty for foreign citizens' education
Department pharmacognosy

Level of higher education master

Specialty 226 Pharmacy, industrial pharmacy
Educational program Pharmacy

APPROVED
The Head of Department
Pharmacognosy

Olga MALA

«28» of September 2022

ASSIGNMENT
FOR QUALIFICATION WORK
OF AN APPLICANT FOR HIGHER EDUCATION

Fulya KORKMAZ

1. Topic of qualification work: «Study the chemical composition of carrot underground part», supervisor of qualification work: Victoria MASHTALER, PhD, assoc. prof.

approved by order of NUPh «6» 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 study of biological active compounds composition of carrot herb.

4. Contents of the settlement and explanatory note (list of questions that need to be developed): study of qualitative content of BAC – polysaccharides, iridoids, simple phenols, flavonoids, coumarins, tannic compounds, alkaloids, saponins; quantitative determination of fatty acids, essential oils, chlorophylls, amino acids, microelements.

5. List of graphic material (with exact indication of the required drawings):
Tables – 12, figures – 12.

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1	Victoria MASHTALER, PhD, assoc. prof., associate professor of higher education institution of department pharmacognosy	Victoria MASHTALER 9.2022-10.2022	Fulya KORKMAZ 9.2022-10.2022
2	Victoria MASHTALER, PhD, assoc. prof., associate professor of higher education institution of department pharmacognosy	Victoria MASHTALER 10.2022-11.2022	Fulya KORKMAZ 10.2022-11.2022
3	Victoria MASHTALER, PhD, assoc. prof., associate professor of higher education institution of department pharmacognosy Amzhad I. ABU SHARK, PhD, assoc. prof., associate professor of higher education institution of department pharmaceutical chemistry	Victoria MASHTALER 1.2023 Amzhad I. ABU SHARK 1.2023	Fulya KORKMAZ 1.2023 Fulya KORKMAZ 1.2023

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

CALENDAR PLAN

№ з/п	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1	Writing a review on a given issue	October-December 2022	**done**
2	Conducted of qualitative identification of phenolic compounds	January 2023	**done**
3	Conducted of qualitative identification of polysaccharides, alkaloids, iridoids	February 2023	**done**
4	Conducted of quantitative study of fatty acids and essential oil	March 2023	**done**
5	Study of amino acids content and content of minerals component	April – May 2023	**done**
6	Preparation of a master's manuscript for official defense	May 2023	**done**

An applicant of higher education Fulya KORKMAZ

Supervisor of qualification work Victoria MASHTALER

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 фармакогнозії**				
Коркмаз Фулья	Дослідження хімічного складу надземної частини моркви звичної.	Study the chemical composition of Carrot underground part.	доцент Машталер В.В.	доцент Абу Шарк Амжад Ібрагім

Підстава: подання декана; згода ректора

Ректор

Вірно. Секретар

Ф А2.8-47-110

ВИСНОВОК

Комісії з академічної доброчесності про проведену експертизу

щодо академічного плагіату у кваліфікаційній роботі

здобувача вищої освіти

№ 112773 від « 30 » квітня 2023 р.

Проаналізувавши випускну кваліфікаційну роботу за магістерським рівнем здобувача вищої освіти денної форми навчання Коркмаз Фулья, 5 курсу, _____ групи, спеціальності 226 Фармація, промислова фармація, на тему: «Дослідження хімічного складу надземної частини моркви звичної / Study the chemical composition of Carrot underground part.», Комісія з академічної доброчесності дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (компіляції).

Голова комісії,
професор **Інна ВЛАДИМИРОВА**

20%

34%

REVIEW

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

Fulya KORKMAZ

on the topic: «Study the chemical composition of carrot underground part»

Relevance of the topic. The plants belongs the family *Apiaceae* L. widely used in official and folk medicine. Carrot is widely cultivated agricultural crop, it perfect growing in different conditions and has many varieties. From the literature information, the chemical content of above-ground parts of carrot practically not been studied.

Practical value of conclusions, recommendations and their validity. The practical value of the qualification work is due to the fact that as a result of the conducted research, the acquirer expanded the information on the chemical composition of *Daucus carota* herb, variety Bolivar F with the aim of further introducing as additional source of biologically active substances, in particular volatile compounds.

Assessment of work. The work was performed at a high scientific level, the performer showed himself as a disciplined, erudite person. All conclusions are logical, the work is well illustrated and structured.

General conclusion and recommendations on admission to defend. The obtained research results in terms of relevance, scientific and practical significance meet the requirements for qualification works of this level and therefore work of Fulya Korkmaz «Study the chemical composition of carrot underground part» can be presented for official defense in the State Examination Commission of National University of Pharmacy.

Scientific supervisor _____Victoria MASHTALER

«7th» of April 2023

REVIEW

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

Fulya KORKMAZ

on the topic: «Study the chemical composition of carrot underground part»

Relevance of the topic. Raw sources of wild plants are significantly reduced. To expand the resource base of plant sources of biologically active compounds (BAC) is a topical the study of agricultural plants which are widely cultivated. The plants belongs the family *Apiaceae* L. widely used in official and folk medicine. Carrot is widely cultivated agricultural crop, it perfect growing in different conditions and has many varieties. It is one of the important root vegetables rich in bioactive compounds. Pharmacopeia (*EuPh*) raw materials are *Dauci carotae* fructus are used like sourses of volatile compounds and piranocoumarines, but scientific interest has carrot herb like as available raw materials after harvesting root crops. From the literature information, the chemical content of above-ground parts of carrot practically not been studied. So, using of it herbs we can to expand the resource base of BAC.

Theoretical level of work. The qualification work was performed at a high scientific level, modern methods and techniques of phytochemical research (chromato-mass spectrometry, gas chromatography) were used in the research. Scientific primary sources are well developed and structured by the acquirer. The presented work is performed at a high theoretical and practical level, well illustrated. Based on the research materials, 1 theses of reports was published.

Author's suggestions on the research topic. In view of the classes of identified substances and their pharmacological activity, described in the literature, it is possible to assume the perspective of *Daucus carota* herb in the development of antibacterial and antifungal agents for external use.

Practical value of conclusions, recommendations and their validity. The

practical value of the qualification work is due to the fact that as a result of the conducted research, the acquirer expanded the information on the chemical composition of *Daucus carota* herb, variety Bolivar F with the aim of further introducing as additional source of biologically active substances, in particular volatile compounds.

Disadvantages of work. The text contains unsuccessful phrases.

General conclusion and assessment of the work. The material of the qualification work of Fulya Korkmaz is logically and consistently, which testifies to the author's ability to structure the received information, use scientific primary sources and summarize experimental data. The presented work meets the requirements for qualifying papers and can be recommended for defense at the State Examination Commission of National University of Pharmacy.

Reviewer _____ assoc. prof. Amzhad I. ABU SHARK

«10th» of April 2023

Ф А2.2.1-91-287

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'ЯУКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ВИТЯГ З ПРОТОКОЛУ №13
засідання кафедри фармакогнозії

«19» квітня 2023 року
м. Харків
засідання кафедри
фармакогнозії

Голова: завідувач кафедри, канд. фарм. наук, доцент Мала О.С.
Секретар: канд. фарм. наук, ас. Комісаренко М. А
Присутні: зав. каф. доц. Мала О.С., проф. Ковальова А. М., проф. Гонтова Т.М., проф. Кошовий О.М., проф. Криворучко О.В., доц. Бородіна Н.В., доц. Демешко О.В., доц. Очкур О.В., доц. Машталер В.В., ас. Гончаров О.В., ас. Комісаренко М.А.

ПОРЯДОК ДЕННИЙ:

1. Представлення кваліфікаційних робіт до захисту в Екзаменаційній комісії НФаУ.

СЛУХАЛИ: Про представлення до захисту в Екзаменаційній комісії НФаУ кваліфікаційної роботи здобувача вищої освіти Фм18(5.0д)англ-01 групи Фульї КОРКМАЗ на тему «Study the chemical composition of Carrot underground part».

Науковий керівник : к.фарм.н., доц. Вікторія МАШТАЛЕР.

Рецензент: к.фарм.н., доц. Амжад Ібрагім АБУ ШАРК.

В обговоренні кваліфікаційної роботи брали участь зав. каф. доц. Мала О.С., доц. Машталер В.В., проф. Кошовий О.М., проф. Криворучко О.В., доц. Демешко О.В., ас. Гончаров О.В.

УХВАЛИЛИ: Рекомендувати до захисту у Екзаменаційній комісії НФаУ кваліфікаційну роботу здобувача вищої освіти Фульї КОРКМАЗ на тему «Study the chemical composition of Carrot underground part», науковий керівник: к.фарм.н., доц. Вікторія МАШТАЛЕР.

Голова
Завідувачка кафедри фармакогнозії **Ольга МАЛА**
Секретар **Микола КОМІСАРЕНКО**

Ф А2.2.1-32-042

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ПОДАННЯ
ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ
ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ

Направляється здобувач вищої освіти Фулья Коркмаз до захисту кваліфікаційної роботи
за галуззю знань 22 Охорона здоров'я
спеціальністю 226 Фармація, промислова фармація
освітньою програмою Фармація
на тему: «Study the chemical composition of carrot underground part»

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Світлана КАЛАЙЧЕВА /

Висновок керівника кваліфікаційної роботи

Здобувачка вищої освіти Фулья Коркмаз успішно виконала поставлені завдання, засвоїла роботу з науковими першоджерелами, методами та методиками фармакогностичного аналізу рослинної сировини, які вона застосовувала при виконанні своєї роботи.

Отримані результати досліджень за актуальністю, науковим та практичним значенням відповідають вимогам, які висуваються до кваліфікаційних робіт, тому представлена робота може бути рекомендована до публічного захисту у Екзаменаційну комісію Національного фармацевтичного університету.

Керівник кваліфікаційної роботи

_____ Вікторія Машталер

«7» квітня2023 року

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Фулья Коркмаз допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувач(ка) кафедри
фармакогнозії

_____ Ольга МАЛА

«19» квітня 2023 року

Qualification work was defended

of Examination commission on

« ____ » of June 2023

With the grade _____

Head of the State Examination commission,

DPharmSc, Professor

_____ / Oleh SHPYCHAK /