Vitamins.
Medicinal plants and raw materials containing vitamins

1. Vitamins. Characteristics of vitamins as a group of biologically active substances.
2. History of the study of vitamins. Classifications.
3. Physical and chemical properties of vitamins.
4. Analysis of raw materials containing vitamins.
5. Medicinal plants and raw materials containing vitamins:

- medicinal plants and raw materials containing vitamin K;
- medicinal plants and raw materials, containing carotenes and carotenoids;
- medicinal plants and raw materials containing vitamin C.

Vitamins (from Latin "Vita" - life) are a group of low molecular weight organic compounds of diverse chemical structure that regulate metabolic processes in the body and are necessary in optimal quantities for its normal functioning.

The biological role of vitamins is varied. Vitamins have a strong and specific influence on growth, development, and metabolism, and ensure the normal physiological and biochemical processes. Many of the vitamins are components of coenzymes (B1, B2, PP, etc.), and some of them have specialized functions (A, D, E, and K).

Deficiency of vitamins in food, or their complete absence, leads to the development of a pathological condition called hypovitaminosis (deficiency of vitamins) or avitaminosis (absence of vitamins).

1880 г. - N. I. Lunin, the first mention of substances necessary for the body to function normally.

1910 г. - a substance is isolated from the shells of rice, a deficiency of which causes beri-beri disease, Casimir Funk.

1912 г. - The name "vitamin" (from Latin vita - life, Latin am (monium), Latin suff. -in- letter, "life amine" or "amine of life") was proposed, Casimir Funk.

The works of Hopkins, Stapp, Mc Collum, Melanby and others were of great importance in the development of vitamin doctrine.

Vitamin classification

- The naming of vitamins by letters of the Latin alphabet was suggested in 1913 by the American biochemist Elmer Werner McCollum.

- At the same time, they were given a name corresponding to their biological role in the body.
- Vitamin C - ascorbic acid, an anti-tsyngoic;
- Vitamin D - ergocalciferol, anti-rachitis;
- Vitamin A - retinol, acerophthol (treats xerophthalmia – dryness).

- Vitamin A - retinol
- B1 - thiamine
- B2 - riboflavin
- B3 - nicotinic acid (PP)
- B4 - choline
- B5 - pantothenic acid
- B6 - pyridoxine
- B7 (BT) - carnitine (a vitamin-like substance)
- B8 - inositol (vitamin-like substance)
- B9 (BC) - folic acid
- B12 - cyanocobalamin
- B13 - orotic acid (vitamin-like substance)
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- B15 - pangamic acid
- B17 - laetral
- C - ascorbic acid
- D - calciferol
- E - tocopherols
- H - biotin (vitamin-like substance)
- K1 - phylloquinone
- P - polyphenols (flavonoids, catechins etc.)
- U - methylmethionine sulfonium chloride (vitamin-like substance)
- F - highly unsaturated fatty acids and prostaglandins.

- The classification of vitamins according to which vitamins are divided into **fat-soluble** (A, D, E, K, F) and **water-soluble**.

Chemical classification

1. aliphatic

a) derivatives of lactones of unsaturated polycarboxylic acids (vitamin C).

b) aliphatic unsaturated acids (highly unsaturated fatty acids - vitamin F)

2. alicyclic

a) retinols (cyclohexene compounds - vitamin A)

b) Calciferols (cyclohexane compounds – vitaminD)

3. aromatic

a) naphthoquinones (vitamin K1 is phylloquinone, vitamin K2 is menaquinone)

4. heterocyclic

a) chromanes (tocopherols - E vitamins)

b) phenylchromanes (bioflavonoids - P vitamins)

c) pyridine carboxylic acid (nicotinic acid - vitamin PP or B3)

- d) pyridoxine (pyridoxine - vitamin B6)
- e) pyrimidinothiazine (thiamine - vitamin B1)
- f) pterine (folic acid - vitamin B9 or BC)
- g) iso-alloxazine (riboflavin - vitamin B2)
- h) cobalamin (cyanocobalamin - vitamin B12).

Physical and chemical properties.

- Vitamins are crystalline substances, colourless or yellow in colour. Most vitamins are water soluble, a smaller proportion in fats (A, D, E, K, F).
- The presence of a significant number of double bonds in the molecules of vitamins is the reason why these compounds are easily oxidisable, which is used in the analysis of raw materials.

Analysis of raw materials containing vitamins. Qualitative analysis.

- Qualitative reactions (with silver nitrate solution, Fehling reagents and 2,2,6-solution of sodium dichlorophenolindophenolate) are also sometimes used.
- Thin-layer chromatography is widely used for the detection and identification of vitamins in medicinal plant material.

Quantitative analysis.

- Various methods are used for the quantitative determination of vitamins in medicinal plant material: titrometric, spectrophotometric, often combined with thin-layer chromatography.

Medicinal plants and raw materials containing vitamin K

Guelder rose (Cranberry tree, Cranberry bush) - *Viburnum opulus L.*

- Family **–** *Caprifoliaceae*

- **Guelder rose bark** – *Viburni opuli cortex*
- **Guelder rose fruit fresh**– *Viburni fructus recens*

Viburnum opulus

It is a wild or cultivated shrub or small tree with a brownish-grey bark. The leaves are opposite, broadly ovate or rounded, three- or five-lobed, dark green, glabrous and petiolate.

Viburnum opulus

Flowers are white in corymb-like inflorescences. Fruit consists of an ovoid-spherical, bright red stone with one stone. Flesh of the fruit bitter-sour. Fruits ripen in late August-September and remain on the branches until the first frost, after which they lose their bitter taste.

Cranberry flowers

Viburnum opulus

It grows in the undergrowth of mixed forests, shrub thickets on forest edges, along the banks of rivers and lakes, etc. It is found almost all over the territory of the European part of Russia. In the Middle and Southern Urals, in the south of Western and Eastern Siberia and in the mountainous regions of the Caucasus. Widely cultivated as an ornamental plant.

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- Bark contains vitamin K (28-31 mg%), ascorbic acid (70-80 mg%), carotenoids (21 mg%) and up to 20% choline-like substance.
- Iridoid glycosides (opulusiridoides 1, 2 and acetyl-pulusiridoide 2) of diagnostic value were found in cranberry bark.
- Related substances include tannins of pyrocatechin group (over 4%), triterpene saponins (up to 7%), including ursolic and oleanolic acids, viburnin glycoside, resin (6.5%) of yellow-red colour consisting of saponifiable part (organic acids) and unsaponifiable - phytosterols (β-sitosterol).

- Fruits contain up to 32% of invert sugar, pectins, vitamin C, flavonoids, carotenoids), phenylpropanoids (caffeic, chlorogenic, neochlorogenic acids), saponins (ursolic acid), amino acids, organic acids (up to 3-7%), represented by isovaleric and acetic acids.
- It is believed that the fruit of guelder rose has 2 times more vitamin C than lemon and mandarin, while its raw material exceeds them in iron content by 5-10 times. Cranberry fruit is also rich in potassium salts. The seeds contain up to 20% fatty oil.
- The bitter properties of the fruit and bark are due to the iridoids.

Калина обыкновенная — Viburnum opulus L.

Bark of guelder rose

fresh fruit of guelder rose

Pharmacological effect astringent, hemostatic (bark), diaphoretic and anti-inflammatory (fruit)

- **Uses.** Liquid extract and decoction of cranberry bark is used as a styptic, mainly for uterine bleeding. Astringent effect of raw materials used in diseases of the gastrointestinal tract.
- Cranberry fruit is used in the form of infusion as a vitamin, tonic, diaphoretic, anti-inflammatory, diuretic. Infusion Cranberry fruit also has a mild cardiotonic effect.

- Freshly harvested cranberry fruits are used to make a syrup that is used as a vitamin and anti-inflammatory.

Medicinal plants and raw materials containing carotenes and carotenoids

- **Pot marigold -** *Calendula officinalis L.*

- Family **-** *Asteraceae*

- **Pot marigold flowers -** *Calendulae officinalis flores*
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Calendula officinalis

The medicinal marigold (Calendula officinalis) is an annual, cultivated, herbaceous plant, 30-70 cm high. The entire plant is glandular with a branched upright stem.

Calendula officinalis

Leaves are alternate, oblong-obovate. Golden-yellow and orange flowers clustered in large baskets up to 5 cm in diameter; marginal flowers are pseudolingual, those in the middle are tubular. Fruits are achenes of various shapes and sizes, which develop from marginal reed flowers; medial tubular flowers are sterile. The plant flowers from the second half of summer to late autumn.

The wild forms are not known. The plant is only found in culture. Widely cultivated as a medicinal and decorative plant.

Calendula officinalis

The marigold flowers bloom for a long time (up to 3 months), so the flowers are collected repeatedly (10 to 20 collections as new baskets bloom) from the beginning of flowering until frost.

If collecting by hand, the baskets are cut off without a peduncle or with a pedicel up to 3 cm long during the period when the reed flowers are standing horizontally. During the summer and autumn, 10 to 20 collections are possible as new baskets open. Timely and regular removal of inflorescences from plants encourages setting new buds and ensures high yields. The harvested raw material is cleaned of impurities such as leaves, pieces of stems, and flowering baskets.

Dry marigold flowers in a tumble dryer at 40°C or in a well-ventilated room, spread out on a cloth or paper with a single inflorescence in a layer. The dried raw material should not only retain its natural colouring but also deepen it.

Calendulae officinalis flores

The flower heads contain large amounts of carotenoids: carotene, lycopene and the oxygen carotene derivatives violaxanthin, citroxanthin, rubixanthin, flavoxanthin etc. In marginal flowers the sum of carotenoids can reach 3% (on dry weight). There are flavonoids, in particular glycosides of kaempferol, quercetin and isoramnetin.

The aroma of the flowers is due to the presence of traces of essential oil (up to 0.12%). Inflorescences of marigolds contain ascorbic acid, resins, organic acids (e.g. malic acid up to 6%), mucus (4%), sitosterol. The whole plant is phytoncidal.

- The quality of raw materials is regulated by State Pharmacopia XIV edition. In whole, crushed raw material and powder the content of the sum of flavonoids in terms of rutin should be not less than 1%; extractive substances extracted with 70% alcohol - not less than 35%; extractive substances extracted with water - not less than 35%.

Calendula flowers are a good antiseptic, anti-inflammatory and also have regenerating, wound-healing and immunomodulatory properties.


БИАСК
Масло
Календула
косметическое
50 мл
БИАСК
Масло
Календула
косметическое
50 мл


ЗАО "Московская фармацевтическая фабрика
МосФарма
КАЛЕНДУЛЫ НАСТОЙКА
НАСТОЙКА 40 МЛ
Для получения препарата используют:
Ноготков цветки - 100 г
Этанол (Этиловый спирт) 70 % - достаточное
количество до получения 1000 мл препарата
Хранить в защищённом от света месте при температуре
от 15 до 25 °С. Хранить в недоступном для детей месте.
Способ применения см. инструкцию
Отпускается без рецепта.
Р № ЛСР-009539/09
МосФарма
КАЛЕНДУЛЫ
НАСТОЙКА
АНТИСЕПТИЧЕСКОЕ
И ПРОТИВОВОСПАЛИТЕЛЬНОЕ
СРЕДСТВО
РАСТИТЕЛЬНОГО
ПРОИСХОЖДЕНИЯ
НАСТОЙКА
40 мл

- In medicine the combined preparation Rotokan is used. The flowers are also used to produce Caleflon, which is used as an anti-ulcer drug and in chronic gastritis in the acute phase. The drug is also used internally as a choleretic
- Calendula flowers are part of the chest herbal tea (herbal preparation) number 4, a choleretic herbal tea number 3, herbal tea "Elecasol ".

Sea buckthorn - *Hippophaes rhamnoides L.*

- Family **–** *Elaeagnaceae*

- **Sea buckthorn fruits fresh** - *Hippophaes rhamnoidis fructus recentes* (=Плоды облепихи свежие **-** *Fructus Hippophaes rhamnoidis recentes)*

Hippophaë rhamnoides L.

Hippophaes rhamnoides L.

A branchy shrub with stiff prickles 2-7 cm long. Young shoots are covered with silvery grey bark, older ones with dark brown, almost black bark. Leaves are alternate, simple, linear-lanceolate, tapered into short petioles, dark green above, silvery white below, covered with brown star-shaped scales. Blossoms simultaneously with opening of leaves. Flowers are unassuming and dioecious. Stamen flowers are small, silvery-brownish, aggregated in short spikes. The pistillate flowers are yellowish, set in groups of 2-5.

The fruits are berry-like berry pods, fleshy, yellowish-orange to red in colour; they thickly cover, as if they were covering, the ends of branches.

Harvest during the full ripening period (August to late autumn), when they are yellow-orange or orange in colour, resilient and not damaged during harvesting. Branches with fruit should not be broken off.

In some areas the fruits are harvested in winter as after frosty weather they lose their astringency and bitterness. Their taste becomes sour-sweet with pineapple aroma but the quantity of carotenoids is not reduced.

Frozen fruits are knocked off the branches or shaken off onto litter. Frozen sea buckthorn berries are easily crumbled by one or two light blows on the branches. Strong blows are inadmissible, as they can damage the annual sea buckthorn shoots that produce the next year's crop. Frozen fruit should not be harvested in sunny weather as the sun's rays thaw their skins and when shaken off often separate them from the fruit pulp, which remains on the branches. All this leads to a considerable loss of raw material. Frozen fruit should not be allowed to thaw during harvesting, transportation and storage.

Frozen fruits are harvested at temperatures no higher than -15 °C, and in cloudy weather, harvesting is possible during the whole day, and in clear weather only in the morning hours.

Sea buckthorn fruits fresh

- **Chemical composition.** The sea buckthorn fruit is a multivitamin raw material. Freshly collected sea buckthorn fruits contain carotenoids, the content of which ranges from 6 to 20 mg%.
- Many vitamins, among which fat-soluble vitamins (tocopherols, vitamin K) and water-soluble vitamins (ascorbic acid up to 500 mg%, vitamins B1, B2, B9), P-active compounds up to 100 mg%, choline and betaine up to 700 mg%, organic acids, phenolic compounds, including: leucocyanidins, catechins, flavonoids (rutin, quercetin, etc.), phenolic acids.), phenolic acids (caffeic, chlorogenic).

- Micronutrients: boron, iron, manganese.
- The fruit pulp contains fatty oil, the amount of which varies (depending on the form and area where the plant grows) from 3 to 14%. It consists mainly of triglycerides of palmitic, oleic and palmitoleic acids, the sum of which amounts to 85-90%.
- The oil is rich in carotenoids, tocopherols, sterols and phospholipids.


ГИПОЗОЛЬ


57 г
ГИПОЗОЛЬ


50
ОБЛЕПИХОВОЕ
МАСЛО

- **Uses.** Sea buckthorn oil accelerates granulation and epithelialization of tissues, so it is used in the treatment of gastric and duodenal ulcers, lesions of the esophagus and intestines, as well as externally for burns, ulcers, eczema, pressure sores, radiation lesions of the skin, in gynecological practice - with cervical erosions.
- The direct effect of sea buckthorn oil on the wound stimulates regeneration processes. Sea buckthorn oil is prescribed for inhalations in chronic inflammatory diseases of the upper respiratory tract, as well as a prophylactic agent to reduce degenerative changes in the esophagus during radiation therapy of esophageal cancer.

- On the basis of sea buckthorn oil combined preparations are produced: "Olazol", "Hypozol" and collagen film "Oblekol", used as wound healing agents in infected wounds, burns, trophic ulcers, microbial eczema, itching dermatitis, as stimulating reparative processes in soft tissues.
- From dried sea buckthorn fruits developed anti-ulcer drug 'Tetrafit'. The skimmed fruit is part of a patented remedy called Fitodent.

- **Common mountain ash (Common mountain elder, Common rowan)** - *Sorbus aucuparia L.*

- Family – *Rosaceae*

- **Common mountain ash fruts** - *Sorbi aucupariae fructus*

Sorbus aucuparia L.

Common rowan is a wild and cultivated deciduous tree with grey, smooth bark. Leaves are alternate, unpaired pinnatipartite, with 5-7 oblong leaflets, serrated towards the top. Young leaves are pubescent from below; later leaves are glabrous. Flowers are pentamerous, white, aggregated in dense corymbose inflorescence with peculiar bitter-almond smell. Fruits are globular, berry-like, reddish-orange, sour, bitter, slightly tart, with sickle-shaped seeds. Fruits ripen in August-September and may remain on the tree until frost and sometimes throughout the winter.

Sorbus aucuparia L.

Common rowan is distributed almost all over the forest zone of the European part of Russia, in the Far East, Kamchatka, Siberia, Amur River Region, in the mountain-forest belt of the Caucasus and Kyrgyzstan. It grows in the undergrowth of coniferous and mixed forests, on forest edges and clearings, and on the banks of reservoirs. It grows in parks and gardens as an ornamental plant.

Sorbus aucuparia L.

Harvest the fruit from both wild and cultivated plants in autumn during the ripening phase, before frost. Pruning shears, knives or scissors are used to cut off the fruit shields and separate the fruits before drying. On low trees, the fruit is cut off by hand, bending the branches gently. For higher trees, pruning shears attached to long sticks are best used. Do not cut down rowan trunks or break branches when collecting.

Dry the rowan berries in well-ventilated rooms, in dryers or in ovens (at 60-80°C). In good weather, they can be dried outdoors under sheds by spreading a thin layer on a cloth or paper mat and stirring occasionally. The dried fruit should not be faded or blackened and should not form lumps when squeezed.

Rowan fruit

- Fruits are rich in carotenoids, of which -carotene accounts for 18-20 mg%, there are also vitamins C (up to 200 mg%), P, B2 and E, organic acids (malic, citric), triterpene acids (ursolic, oleanolic). The fruit contains ketosaccharide L-sorbose, sorbic acid, other mono- and disaccharides (up to 8%).

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- In addition, the raw material contains flavonoids (catechin, leucoanthocyanins quercetin, rutin, hyperoside, anthocyanins), tannins, phospholipids, up to 2% of pectins. Seeds contain fatty oil (up to 22%) and amygdalin glycoside.
- The quality of raw materials is regulated by GF XIV edition. In the whole raw material the sum of organic acids in terms of malic acid should not be less than 3.2% (titrimetric method).


50 г
Sorbi fructus
Рябины плоды

- **Medicinal plants and raw materials containing vitamin C.**

- **Rosehip –** *Rosa*
- Family **–** *Rosaceae*
- ***Rosehip fruits*** *- Rosae fructus*

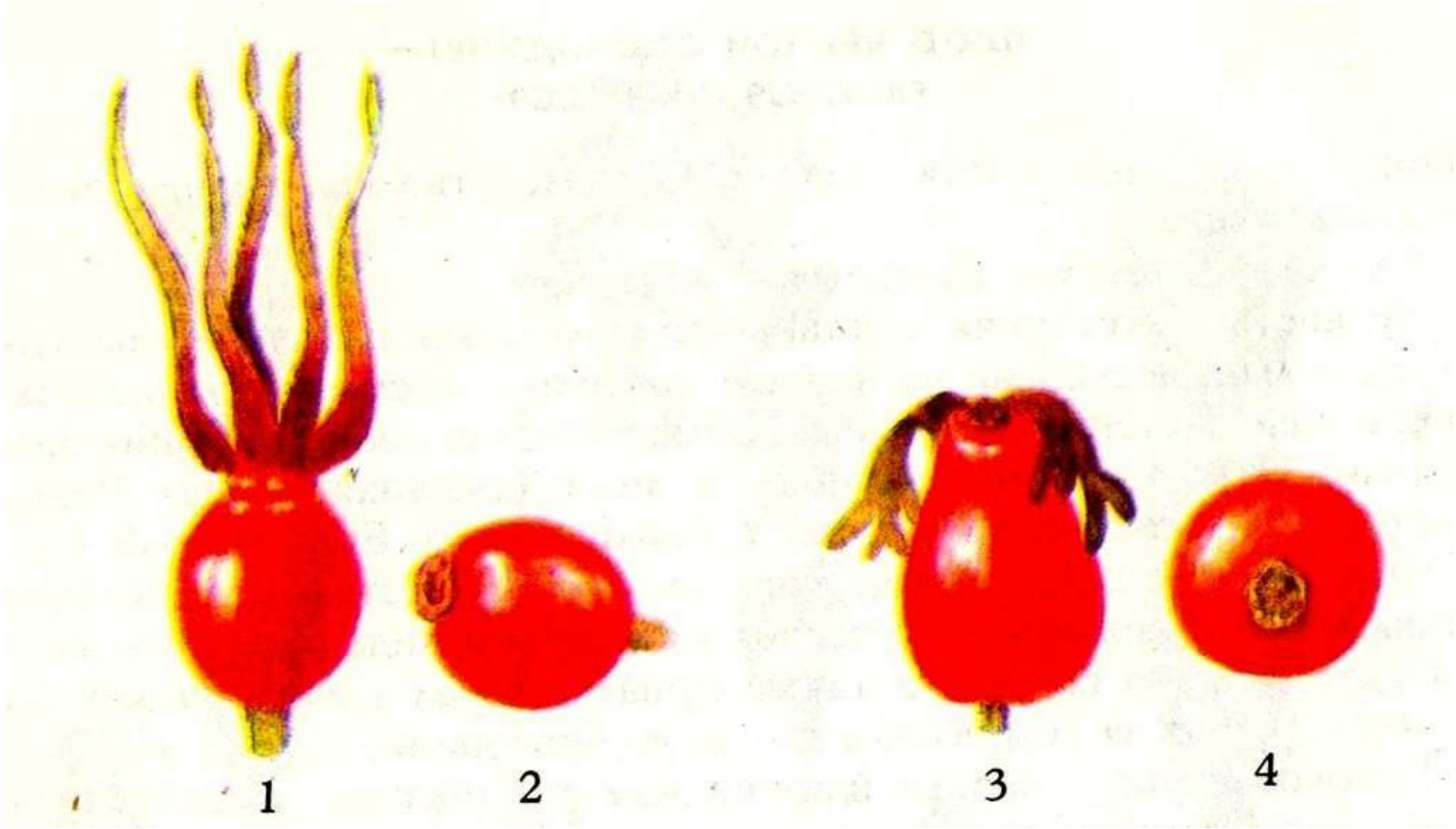
A beautiful wild and cultivated shrub, ranging in height from 0.7 to 2.5 m, studded. Leaves are alternate, unpaired, with elliptic or ovate, acuminate leaflets; the two leaf-like stipules partially fused with the petiole. Flowers large, monopolar, fragrant, solitary or in inflorescences on branchlet ends, with lanceolate bracts; five sepals, longer than corolla, at apex with appendage; petals five, pink-red, less frequently white.

The fruit is globular or elliptical, false, multi-nut. Real fruits are small nuts inside an orange-red false fruit (a succulent sprawling peduncle, the hypanthium). The nuts are angular in shape, with a slightly pointed apex carrying hairs; the inner wall of the hypanthium is covered with longer bristly hairs. Fruits ripen in August-September, but remain on the shrub until winter.

- The genus rose hips is divided into several sections. The largest in number of species are two:

- 1) **Cinnamomea section** rosehips, the fruits of which are the most rich in ascorbic acid;

- 2) **Canina section** - dog rosehips, the fruits of which contain less ascorbic acid.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Rosa majalis Herrm.

Rosa davurica Pall.

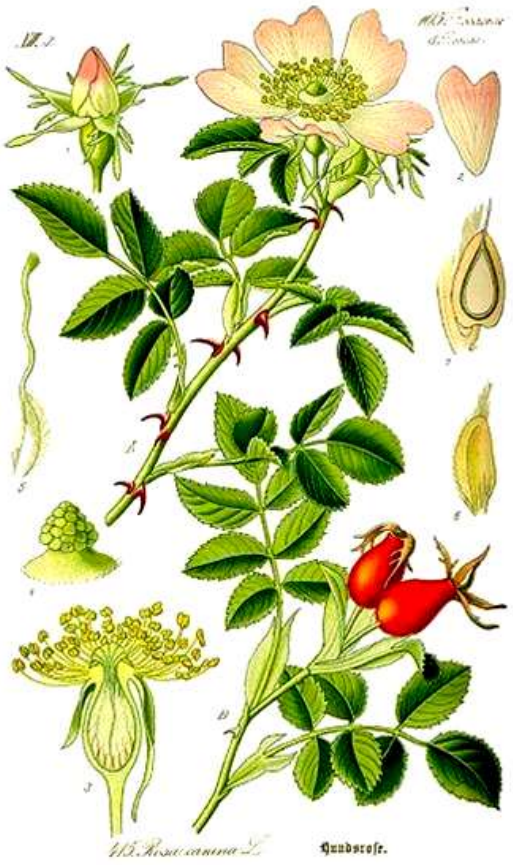
Rosa acicularis Lindl.

Rosa rugosa Thunb.

Rosa beggeriana Schrenk.

Rosa fedtschencoana Regel.

Rosa canina L.



Various species of rosehips are distributed throughout the European part of Russia, in the Urals, Siberia, Central Asia, Kazakhstan, the Caucasus and the Far East. They grow in forests and between shrubs, in meadows, in gullies, but especially in river floodplains, where they form large thickets. Cultivated as an ornamental, medicinal, vitamin and food plant.

The ripe rose hips should be harvested in autumn before frost, when their orange colouring turns to bright red. This is when they contain the maximum amount of vitamin C. If they are overripe and too soft and juicy, they crumple easily and spoil quickly as they dry. Do not collect frozen fruit as it quickly loses vitamins when thawed. It is advisable to wear protective gloves made of thick or canvas cloth and collect in aprons with large pockets in the front. Do not break, much less chop, the branches and stems that are not easily accessible.

It is best dried at 80-90°C, spreading in a 2 - 3 cm layer and stirring frequently. A well-dried rosehip's skins do not crumple when squeezed, but spring.

Fruits of various shapes and sizes, with a hole at the apex after removal of the calyx, partly with the whole sepals still intact, standing upright. The dried fruits are orange-red to dark red. Their outer surface is glossy and wrinkled, while the inner surface is dull. The nuts are hard, yellow, angular; the hairs are white. The taste of the fruit wall is sour-sweet, slightly astringent; there is no smell.

- Rose hips contain ascorbic acid (in cinnamon rose hips it is accumulated from 2 to 5.5%, in dog rose hips - on average about 1%), up to 10 mg% of carotenoids, vitamins K, B2 and P, flavonoids. Mature fruit contains a lot of sugar (up to 18%), pectin substances (up to 4% on average). There are organic acids (malic and citric), salts of potassium (23 mg%), sodium (5 mg%), calcium (26 mg%), magnesium (8 mg%), phosphorus (8 mg%), iron (11.5 mg%).
- The seeds contain a fatty oil rich in carotenoids and vitamin E.

- The quality of fruit regulates GF XIV edition, according to which the whole, crushed raw material in powder ascorbic acid - not less than 0.2%, the sum of carotenoids in terms of B - carotene - not less than 300 mg%; the amount of flavonoids in terms of rutin - not less than 0.4%.
- (titrimetric method - vitamin C, spectrophotometric method - carotenoids).

- **Pharmacological activity** of rosehips depends mainly on the content of the vitamin complex in the plant. Rosehip preparations have a restorative effect, have a regenerating, choleretic properties. Ascorbic acid contained in the fruit increases mental and physical performance, activates the main metabolism.

- The choleretic effect of rosehip preparations (one of the stimulants of which is considered to be magnesium salts present in rosehips in significant quantities) helps to remove cholesterol and its precursors from the body.
- The presence of magnesium in rosehips explained by the reduction of vascular wall stress, improve liver function.
- The essential rose oil has bacteriostatic, antispasmodic, antihistaminic and choleretic properties.
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- **Uses.** Rose hips are used as a multivitamin in the form of infusion, as well as part of a multivitamin and choleretic compounds (hepatophytes, polyphytochol). Infusion of rosehips is indicated in the treatment of various liver diseases, including conditions after hepatitis. From the fresh fruits are made syrup, extract. From the fruit of the dog rose produce drug Kholosas - a thick extract used in cholecystitis and hepatitis. Nuts of all kinds of rosehips produce a fatty oil that is used for burns, dermatitis. A carotenoid-rich preparation, Carotolinum, is also produced.
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- Rosehips are often combined with the fruits of blackcurrant, mountain ash, cranberries, which contain P-vitamin complex, in the presence of which the therapeutic effect of rosehips is enhanced. Rosehips are used in vitamin cocktails for gastrointestinal diseases.


Thanks for your attention