

PROSPECTS OF USING THE FRUITS OF *VIBURNUM OPULUS* FOR OBTAINING MEDICINAL PRODUCTS OF VARIOUS DIRECTIONS OF ACTION

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Introduction. *Viburnum opulus* L. is a wild deciduous shrub widely distributed in Europe, North Africa and North Asia [1, 2]. The fruits contain vitamin C, carotenoids, organic acids, iridoids, phenolic compounds: phenolcarboxylic acids (gallic, chlorogenic, neochlorogenic), flavolignans, flavonol derivatives (quercetin-3-glucoside, rutin, isorhamnetin, isorhamnetin-3-rutinoside), catechin ((+)-catechin, (-)-catechin), procyanidins (procyanidin B1, procyanidin B2), anthocyanins (cyanidin-3-glucoside, cyanidin-3-rutinoside, cyanidin-3-sambubioside) [1,3,4], essential oil and fatty acids [5]. The composition of macro- and microelements of viburnum leaves, shoots and fruits is known [6].

The plant is popular in Turkey as a source of antioxidants and dyes. [7].

The antioxidant properties of various extracts from viburnum fruits are known [8-10]. The anticancer effect of fresh juice is also known [11]. Fresh fruit juice and extracts containing phenolic compounds showed potent cytoprotective activity against generated intracellular oxidative stress. [12].

Fruit extracts have a positive effect on bone metabolism and exhibit potent anti-inflammatory effects [13]. Phenolic fruit extracts are effective in the treatment of obesity [14-15]

Research is being conducted on the introduction of viburnum fruit extract into food products [16]. Also, the study of the chemical composition and nutritional value of the fruits of a number of viburnum varieties cultivated in Ukraine confirmed the value and usefulness of this raw material [17]. According to Turkish researchers, the yield of viburnum fruits is 4.7-6.2 kg per bush, which confirms the prospects for its cultivation in horticulture [7].

Viburnum opulus is widely cultivated as an ornamental, often with the use of biostimulants [18]. Unfortunately, there is a risk of pollinosis when growing *Viburnum opulus* in cities [19]. *Viburnum opulus* bark also contains phenolic compounds [20] and also exhibits antioxidant activity [21].

The leaves of *Viburnum opulus*, like the fruits and bark, are rich in phenolic compounds and exhibit anticancer properties. [22].

But, despite the fact that the SPhU 2.4 contains the monograph "*Viburnum Fruits*", the prevalence of the plant in Ukraine and the wide diverse spectrum of pharmacological activity, a medicinal product has not been created yet [23].

Therefore, the aim of this work was conduct an analysis of the domestic pharmaceutical market of raw materials - fruits of *Viburnum opulus*, products based on

them, and to offer several original substances from this type of raw material.

Material & methods. The range of viburnum fruits on the domestic pharmaceutical market and products based on it was studied through content analysis of a number of Internet platforms. Fruits of viburnum for the development of the technology for obtaining funds were harvested during 2020-2022 in the Chuguyiv district of the Kharkiv region in the mass fruiting phase. The development of the technology for obtaining liquid and dense extracts was carried out according to generally accepted methods [24-25].

Results & discussion. The domestic market contains raw materials such as fruits of viburnum, products of the food and cosmetic industries, and dietary supplements (Fig. 1).

Fruits of viburnum are produced by 42 domestic producers (36 offer dried fruits, 6 - frozen). The food sector offers 14 options for jams and jellies, 3 syrups, including those with fructose, 2 juices, in particular, blended viburnum-apple juice "Kalinonka", 1 apple-honey-viburnum vinegar "Okimel". For cosmetic purposes, they offer 4 types of handmade soap, 2 hydrolates and 1 oil from seeds, as well as 4 extracts (one CO₂ extract, dry powdered without information about the extractant and liquid (1000 ml for masks, tonics, ointments, baths), viburnum concentrate extract produced by Simona Life is used in cosmetology as an antiseptic, tonic, cleansing, rejuvenating, whitening, astringent, moisturizing). There is also information about 31 dietary supplements, 87% of which are domestically produced (Fig. 2): 13 in the form of teas, 13 liquid: 2 in the form of drops, 3 in the form of biologically active liquid (BAL), 3 in the form of elixirs, 1 liquid extract, 4 in the form of phytosyrup, 6 in the form of solid dosage forms (5 tablets and 1 capsule). The following teas are available on the market: herbal tea "Healing Power" viburnum/linden/raspberry, p/p No. 20 "Tabula vita", 3 teas produced by "Carpathian Coloring" ("Fruits of the Carpathians", 100 g, "Carpathian Colors", 240 g, 27 components; "12 Flavors of the Carpathians", 400 g, 50 components), Carpathian viburnum tea for colds (Karpaty, No. 20 f/p); 100% natural concentrate of the drink "Meal Time" with the taste of viburnum with tarragon, 50 g; viburnum tea "Red viburnum" No. 563, 50 g, produced by Newtea, India; black tea "Red viburnum" No. 563, with viburnum, heather and thyme, 100 g, produced by "Teahouse", Kenya; viburnum tea-concentrate (1 l) produced by Bon Classic; natural tea concentrate in sticks viburnum and blackcurrant, 50 g, produced by TM "Smakujte"; natural tea concentrate in sticks viburnum and redcurrant, 50 g, produced by TM "Smakujte"; viburnum-raspberry tea of unknown origin; concentrated Welvart viburnum tea with grains, 50 g.

Biologically active liquid (BAL) are bioactive liquids with increased bioavailability, obtained by vacuum extraction at a minimum specific heat capacity (up to 37°C). At the same time, the maximum medicinal properties of plants are preserved. Manufacturers actually position the composition as an intercellular and intracellular fluid.

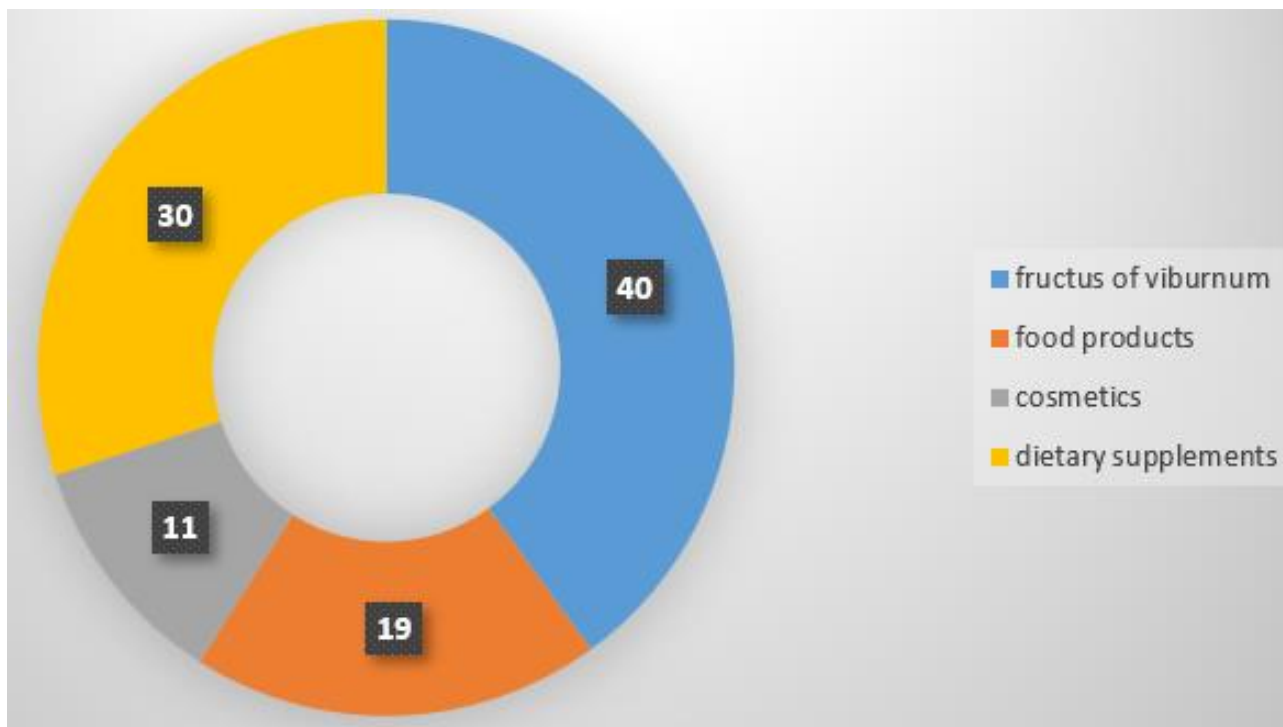


Fig. 1 Segmentation of the domestic market by product types

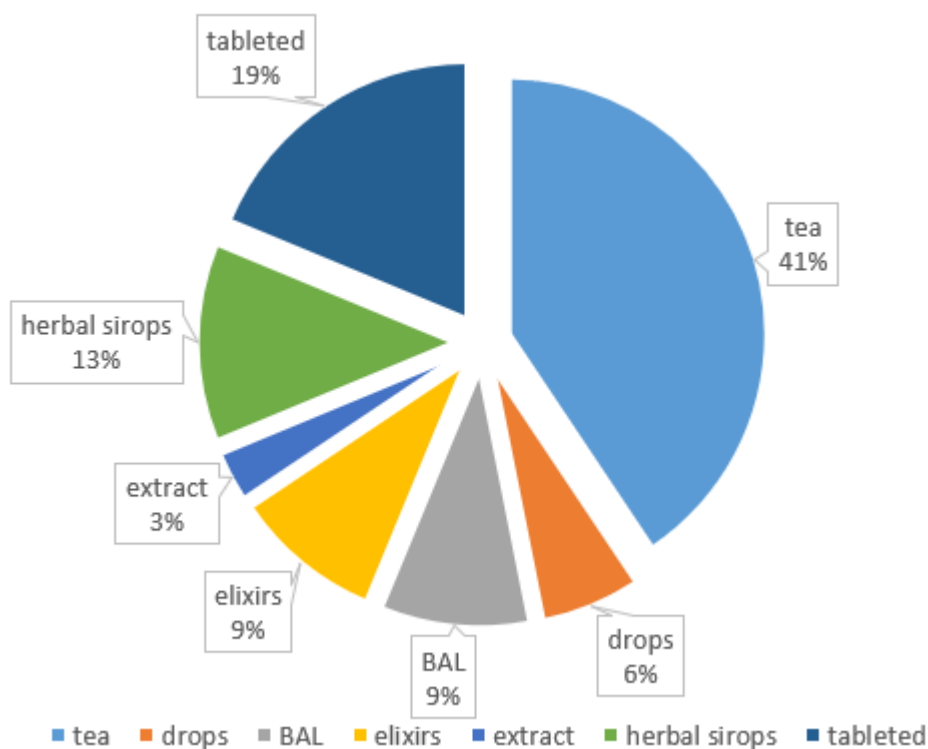


Fig. 2. Assortment of dietary supplements based on Viburnum fruits

The market includes BAL "Red Viburnum", 100 ml, produced by Danikafarm, BAJ "Viburnum" produced by Biola, BAL "Red Viburnum" produced by GreenSet, which are offered as a dietary supplement for the prevention of colds as an antipyretic, expectorant, and as a component of a balanced diet for a number of diseases: upper respiratory tract, gastrointestinal tract (antacid

gastritis, stomach ulcer, colitis); as well as for hypertension, edema of cardiac origin; bleeding, including uterine, postpartum, climacteric; with subinvolution of the uterus in the postpartum period; as a sedative for neuroses; epilepsy, convulsive syndrome; in the complex therapy of alcoholism.

There is information about complex elixirs: "Elixir for the Heart", 30 ml and "Elixir for Vision", 30 ml - both produced by "New Life" and the elixir produced by TM "Primaflora" "Health", 200 ml, for the lungs and respiratory system.

Viburnum extract, 30 ml, produced by Nature Life, is recommended for neurasthenia, hysteria, epilepsy, hypertension, increases the power of heart contractions, increases diuresis, and improves bowel function.

Also on sale are tableted combined vitamins of domestic production by the domestic company Palianytsia: Zinc citrate with viburnum extract No. 50 and Vitamin C with viburnum extract No. 30.

They offer 2 complex homeopathic remedies:

Sedative PC No. 40 manufactured by Boiron, France (1 tablet contains: *Aconitum napellus* 6CH 0.5 mg; *Belladonna* 6CH 0.5 mg; *Calendula officinalis* 6CH 0.5 mg; *Chelidonium majus* 6CH 0.5 mg; *Abrus precatorius* (jequirity) 6CH 0.5 mg; *Viburnum opulus* 6CH 0.5 mg) is used in the complex treatment of neuroses and psycho-emotional arousal (state of restlessness, increased emotional sensitivity and irritability, sleep disorders as a consequence of stress, anxiety in children and the elderly).

Oral drops Gynecoheel, 30 ml, manufactured by Biologische Heilmittel Heel GmbH, Germany (100 g of the drug *Ammonium bromatum* D4 – 10 g, *Apis mellifica* D4 – 10 g, *Aurum iodatum* D12 – 10 g, *Chamaelirium luteum* D4 – 10 g, *Lilium lancifolium* D4 – 10 g, *Melilotus officinalis* D3 – 5 g, *Naja naja* D12 – 10 g, *Palladium metallicum* D12 – 10 g, *Platinum metallicum* D12 – 10 g, *Vespa crabro* D4 – 10 g, *Viburnum opulus* D2 – 5 g) are used in the complex treatment of inflammatory diseases of the female genital organs (adnexitis, oophoritis, salpingitis, parametritis, myometritis, endometritis, colpitis).

Viburnum complex in capsules No. 60 produced by Pihta TM is crushed viburnum fruits in gelatin capsules. It is recommended for the prevention of diseases of the cardiovascular, gastrointestinal, nervous, respiratory, reproductive systems, for the prevention of atherosclerosis, urolithiasis, hypertension, reduction of edema, and liver diseases.

Aminofit "Cardiophytam" tablets (0.5 g No. 30, manufactured by TM "Primaflora") are a combined remedy for the treatment of heart diseases, which includes 11 components, including viburnum fruits. Aminofit "Pulmophytam" tablets (0.5 g No. 30, manufactured by TM "Primaflora") with 9 components are offered as anti-inflammatory, antispasmodic, antimicrobial, expectorant and vitamin.

Of the 4 syrups available on the market, the herbal syrup "Viburnum" 200 ml, produced by Farmakom, is offered for coughs and colds. The anti-cold syrup for children viburnum/linden/raspberry, 200 ml (Keys to Health), has a similar effect. There is also a multivitamin, tonic, soothing herbal syrup from hawthorn fruits, viburnum and stevia leaves, 200 ml (Soyuz Afghan) and a multivitamin herbal syrup viburnum-rowan bush Carpathian, 200 ml (Carpathian Health).

But, taking into account the aspects of pharmacological action, a significant number of producers of raw materials - fruits of viburnum, there is a small number of dietary supplements on the market.

However, the results of the analysis convincingly indicate that in the modern pharmaceutical market of Ukraine there is a need for new broad-spectrum drugs created on the basis of the fruits of viburnum common and on the basis of substances from this raw material.

In this regard, in the conditions of the laboratory of physicochemical research of the Department of Pharmacognosy and Nutriciology of the National University of Pharmacy, we developed and standardized substances based on the fruits of common viburnum in the form of liquid and dense extracts [24, 25].

All technological parameters in the extraction process were determined experimentally, taking into account the biological activity of the resulting product, the effectiveness, availability and harmlessness of reagents, as well as the practical reproduction of obtaining an extract from plant raw materials in industrial conditions.

During the development of the industrial technology of the obtained extracts - liquid and dense from the fruits of *Viburnum opulus*, the requirements of Appendix 7 "Production of herbal medicinal products" of the Guidelines ST-N MOZU 42-4.0:2020 "Medicines. Good Manufacturing Practice", which regulate the production of PMP [26], were taken into account. The production process of the obtained plant substances was carried out in compliance with the relevant hygienic and sanitary requirements aimed at preventing microbial contamination of both the starting raw materials and the finished product, which are set out in the draft technological regulations. Currently, the created products are at the stage of preclinical research.

Liquid extract from the fruits was obtained by maceration of the raw material with 50% ethanol for 48 hours. A technology for obtaining "Viburnikor" tablets with cardioprotective action was developed from the liquid extract [27, 28].

A dense extract was obtained from the fruits of *Viburnum opulus* by extraction with 90% ethanol. The significant content of organic, in particular, phenolcarboxylic acids (not less than 10.0%) and anthocyanin aglycones determines a powerful antimicrobial and antioxidant effect, which further provides for the creation of gels and sprays for the treatment of inflammatory processes of the oral cavity and skin [29, 30].

Conclusions. Considering the aspects of the biological action of viburnum fruits, the breadth of their sale in Ukraine, the range of dietary supplements based on them in the domestic pharmaceutical market, we did not find any information about the medicinal product.

Therefore, the creation of medicinal product with antimicrobial, anti-inflammatory, antioxidant, membrane-stabilizing effects based on the original liquid and dense extracts from the fruits of viburnum is promising. Further introduction into the industrial production of pharmaceutical enterprises in Ukraine of tablets with liquid extract "Viburnikor" with cardioprotective action is relevant.

Prospects for using the fruits of *Viburnum opulus* to obtain medicines of various directions of action

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Introduction. *Viburnum opulus* L. is a wild shrub, widely distributed in Europe, North Africa and North Asia. The fruits contain vitamin C, carotenoids, organic acids, iridoids, phenolic compounds, etc. BAC. But, despite the fact that the SPH 2.4 contains the monograph "*Viburnum fruits*", the prevalence of the plant in Ukraine and a wide diverse spectrum of pharmacological activity, a medicinal product has not been created yet. **Therefore, the aim of this work was** conduct an analysis of the domestic pharmaceutical market of raw materials - fruits of *Viburnum opulus*, products based on them, and to offer several original substances from this type of raw material. **Material & methods.** The range of viburnum fruits on the domestic pharmaceutical market and products based on it was studied through content analysis of a number of Internet platforms. Fruits of viburnum for the development of the technology for obtaining funds were harvested during 2020-2022 in the Chuguyiv district of the Kharkiv region in the mass fruiting phase. The development of the technology for obtaining liquid and dense extracts was carried out according to generally accepted methods. **Results & discussion.** The domestic market contains the raw material fruits of viburnum of 42 domestic producers, products of the food industry (20 products), cosmetic industry (11 products) and 31 dietary supplements, of which 87% are domestically produced. In this regard, we have developed and standardized substances based on fruits of viburnum in the form of liquid and dense extracts, which are at the stage of preclinical research. The liquid extract from the fruits was obtained by maceration of the raw material with 50% ethanol for 48 hours, from which the technology for obtaining "Viburnikor" tablets with cardioprotective action was developed. The dense extract was obtained from fruits of viburnum by extraction with 90% ethanol. The significant content of organic, in particular, phenolcarboxylic acids and anthocyanin aglycones determines the antimicrobial and antioxidant effect, which further involves the creation of gels and sprays for the treatment of inflammatory processes of the oral cavity and skin. **Conclusions.** Considering the aspects of the biological action of fruits of viburnum, the breadth of their sale in Ukraine, the range of dietary supplements based on them in the domestic pharmaceutical industry, the creation of medicines with antimicrobial, anti-inflammatory, antioxidant, membrane-stabilizing action based on original liquid and dense extracts from fruits of viburnum is promising. Further introduction into the industrial production of pharmaceutical enterprises in Ukraine of tablets with liquid extract "Viburnikor" of cardioprotective action is relevant.

Keywords: fruits of viburnum, analysis of market, liquid and dense extracts from fruits of viburnum, medicinal products, antioxidant effect.

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