

STUDY OF THE ELEMENTAL COMPOSITION OF RHIZOME WITH ROOTS OF HORSE SORRELL

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Introduction. Macro- and microelements are one of the most important groups of biologically active substances, the deficiency of which in the body leads to disruption of the immune system, hematopoietic system, and metabolism [1-4]. In addition, the elements play an important role in the process of plant growth. For normal growth and development, plants need such elements as: carbon, oxygen, hydrogen, nitrogen, phosphorus, potassium, sodium, calcium, iron, copper, zinc, etc. Plants naturally produce such metals as zinc, cadmium, copper, manganese, aluminium, iron and lead in the process of life [1].

The territory of Ukraine is famous for the variety of plants, a significant number of which have long been used in folk medicine. The list of official plant raw materials is expanding every year, as evidenced by the increase in the number of monographs on medicinal plant raw materials in SPhU 2.0. In this aspect, our attention was drawn to horse sorrel. This plant that has long been used in folk medicine, but it is not official on the territory of Ukraine. Horse sorrel is an invasive plant that is widespread and does not require special growing conditions. The underground organs of the plant are used in traditional medicine and they contain tannins, anthracene derivatives, organic acids, polyphenolic compounds, anthocyanins, carbohydrates [5-10].

According to the literature, a study of acetone extracts from the roots of 7 species of sorrel plants was conducted and it was established that acetone removes up to 30% of the elements from the plant raw material [11].

Latvian scientists are actively investigating the influence of the elemental (cationic and anionic) composition of the soil on the growth and development of plants [12]. They conducted a number of studies on the effect of chloride, nitrate and nitrite sodium and potassium fertilizers on the growth and biomass of three coastal species of plants of the sorrel genus in comparison with the endemic species (horse sorrel). As a result, it was established the dependence of plant biomass growth on the content of K^+ and Na^+ cations in the soil and plants. Saturation of the soil with nitrates increased the growth of underground organs of all four species of sorrel, and the addition of nitrites led to a decrease in the mass of organs. Organs of horse sorrel accumulate Na^+ cations from chloride salts, while other species of sorrel accumulate them from nitrate salts. As for K^+ cations, they were accumulated in the largest amount by the horse sorrel, other investigated species of sorrel absorbed much smaller amounts of cation from the soil [12]. Polish scientists conducted research on the influence of the concentration of potassium, nitrogen and phosphorus on the growth and development of leaves of three species of sorrel [13, 14]. Data indicate that plant growth is limited by both nitrogen

and phosphorus. The growth of horse sorrel can be controlled by reducing the available nitrogen and phosphorus content in the soil [15].

So, it is known that the presence of such elements as potassium, sodium, chlorine, nitrogen and phosphorus in the soil effects on the growth of the horse sorrel, but we did not find modern studies on the study of the elemental composition of plant raw materials that grow wild in soils without fertilizers. Therefore, the study of the elemental composition of rhizomes with roots of horse sorrel, which grows in natural conditions in different regions of Ukraine, is relevant.

The purpose of the work is to study the elemental composition of rhizomes with roots of horse sorrel, which grows wild in different regions of Ukraine.

Materials and methods. It was used rhizomes with the roots of horse sorrel for the research. Wild plant raw materials were harvested in the autumn of 2019 in Vinnytsia (series 1), Ternopil (series 2), Kharkiv (series 3), Poltava (series 4), and Khmelnytskyi (series 5) regions.

Elemental analysis was carried out using the atomic emission spectrographic method with photographic registration on the DFS-8 device. Graduation graphs in the range of measured concentrations of elements were built using standard samples of solutions of metal salts (ICOMP-23-27). The samples were evaporated from the graphite electrode craters in an alternating current arc discharge with a power of 16A at an exposure of 60s. IVS-28 was used as a source of excitation of the spectra. Spectra were recorded on photographic film using a DFS-8 spectrograph with a three-lens slit illumination system and a diffraction grating of 600 sp/mm.

Spectral lines at a wavelength from 240 to 347 nm in samples were photometered in comparison with state samples of a mixture of mineral elements, using a MF-4 microphotometer. The relative standard deviation (for five parallel measurements) did not exceed 30% when determining the numerical values of element concentrations.

Results and discussion. The results of studying the elemental composition of rhizomes with roots of horse sorrel are listed in the table. 1.

It was determined the quantitative content of 15 elements: 5 macro- and 10 micro-elements in five series of the wild plant raw material of horse sorrel. It is observed the following pattern of accumulation of macroelements in all series: $K > Ca > Na > Mg > P$. The highest content is characteristic of K and, depending on the harvesting region, it fluctuates by 1.5 times and was within the range of 1754-2640 mg/100g. The content of Ca is also quite high, in comparison with other elements, and fluctuates in different series of plant raw materials within the range of 998-1204 mg/100g. The amount of Na is 2 times lower than Ca and 4 times lower than K. Of the macroelements in 5 series of plant raw materials, the least variable content of Mg which is 1.1 times. The P content in all series was the lowest.

Table 1. Study of the elemental composition of rhizome with roots of horse sorrell

Name of element	Content of element in rhizomes with roots of horse sorrel, mg/100g				
	Series 1	Series 2	Series 3	Series 4	Series 5
Macroelements					
P	140	187	135	154	172
Mg	310	284	298	324	291
Ca	1074	1094	1204	998	1158
Na	511	641	539	620	533
K	2640	2410	1985	2075	1754
Microelements					
Fe	112	124	135	188	144
Si	184	245	308	248	286
Al	93	85	91	104	78
Mn	14	12	17	19	10
Zn	4	5	4	3	7
Sr	5,4	4,8	3,5	6,7	6,0
Mo	<0,02	<0,02	<0,02	<0,02	<0,02
Cu	7	5,6	6,8	4,2	2,1
Ni	0,14	0,17	0,12	0,24	0,11
Pb	<0,03	<0,03	<0,03	<0,03	<0,03

The following regularity is observed in the range of identified microelements for 5 series of plant raw materials: Si> Fe> Al> Mn. The content of Si was almost 2 and 4 times higher than Fe and Al, respectively, and ranged from 184 to 308 mg/100 g. Series 1, 2, 4, and 5 show higher content of Sr than Zn, while series 3 contains more Zn. The amount of Cu was the highest in series 1 (7 mg/100g) and the lowest in series 5 (2.1 mg/100g). The content of Ni in the plant raw materials fluctuated twice (0.11 mg/100g in series 5 and 0.24 mg/100g in series 4). Content of Mo and Pb were in minor amounts in all series of plant raw materials. The amount of as is beyond the sensitivity of the device. The content of toxic elements is within the limits stipulated by the requirements of SPhU 2.0.

Conclusions

1. It was studied the elemental composition of 5 series of rhizomes with the roots of wild species of horse sorrel which grows in different regions of Ukraine.
2. The quantitative content of 15 elements was determined: 5 – macro- and 10 microelements. It was established that the content of macroelements K and Ca and microelement Si dominates in 5 series. The content of Pb was <0.03mg/100g, and As is beyond the sensitivity of the device.
3. The obtained results will be taken into account when a tincture from the rhizomes with the roots of horse sorrel be create.

Conflict of interest. Missing.

Study of the elemental composition of rhizome with roots of horse Sorrell

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the immune system, hematopoietic system, and metabolism. Horse sorrel is an invasive plant that is widespread and does not require special growing conditions. The underground organs of the plant are used in traditional medicine and they contain tannins, anthracene derivatives, organic acids, polyphenolic compounds, anthocyanins, carbohydrates. It is known that the presence of such elements as potassium, sodium, chlorine, nitrogen and phosphorus in the soil effects on the growth of the horse sorrel, but we did not find modern studies on the study of the elemental composition of plant raw materials that grow wild in soils without fertilizers. Therefore, the study of the elemental composition of rhizomes with roots of horse sorrel, which grows in natural conditions in different regions of Ukraine, is relevant. **The purpose** of the work is to study the elemental composition of rhizomes with roots of horse sorrel, which grows wild in different regions of Ukraine. **Materials and methods.** It was used rhizomes with the roots of horse sorrel for the research. Elemental analysis was carried out using the atomic emission spectrographic method with photographic registration on the DFS-8 device. **Results and discussion.** It was determined the quantitative content of 15 elements: 5 macro- and 10 micro-elements in five series of the wild plant raw material of horse sorrel. It is observed the following pattern of accumulation of macroelements in all series: K>Ca>Na>Mg>P. The highest content is characteristic of K and Ca. The P content in all series was the lowest. The following regularity is observed in the range of identified microelements for 5 series of plant raw materials: Si> Fe> Al> Mn. Content of Mo and Pb were in minor amounts in all series of plant raw materials. The amount of as is beyond the sensitivity of the device. The content of toxic elements is within the limits stipulated by the requirements of SPhU 2.0. **Conclusions.** It was studied the elemental composition of 5 series of rhizomes with the roots of wild species of horse sorrel which grows in different regions of Ukraine. The quantitative content of

15 elements was determined: 5 – macro- and 10 microelements. It was established that the content of macroelements K and Ca and microelement Si dominates in 5 series. The content of Pb was <0.03mg/100g, and As is beyond the sensitivity of the device. The obtained results will be taken into account when a tincture from the rhizomes with the roots of horse sorrel be create.

Keywords: horse sorrel, rhizomes with the roots, elemental composition

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