BIOGEOCHEMISTRY OF ELEMENTS IN DARK LIGHT GRAY SOILS

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Abstract. *The composition, amount and coefficient of biological absorption of Na, K, Mn, Sm, Re, Mo, Lu, U, Yb, Au, Nd, As, W, Br, Ca, La, Ce, Se, Hg, Tb, Th, Cr, Hf, Ba, Sr, Cs, Ni, Sc, Rb, Zn, Co, Ta, Fe, Eu, Sb in light sierozems and medicinal plants. It has been proved that, according to the coefficient of biogeochemical activity, the elements Se, Re, Br, K, Mo belong to the group of biological accumulation, and the rest of the studied macro- and microelements belong to the group of biological capture* ($A_x<1$).
Keywords: *light gray, biological absorption, biogeochemical activity, element, medicinal plant.*

Introduction. V.I.Vernadsky “the relationship between the composition of organisms and the chemistry of the earth's crust and the huge, most important importance of living matter in the mechanism of the earth’s crust shows us that we cannot get information about life only by studying a living organism. shows. In order to solve it, it is necessary to turn to its main source - the earth’s crust” [1].

Now, living organisms, especially medicinal plants, selectively absorb and accumulate chemical elements from the soil in their bodies, and also allow to characterize the soil. At the same time, due to the ability to choose, the amount of elements in the components of medicinal plants and their organs differs from the amount of elements in the soil.

Accurate quantitative research of macro- and microelements in soil and medicinal plants is an important step in knowing the presence of harmful and toxic concentrations of heavy metals in soils and plants that can be dangerous for living organisms. In addition, the hyperaccumulator is an important step in obtaining information about plants and their organs.

Such plants accumulate high amounts of heavy metals and pose varying degrees of risk to consumers, as hyperaccumulating plants can absorb 50-100 times more metals and non-metals than other plants. If there is a high concentration of heavy metals in the environment, especially in the soil, the phenomenon of hyperaccumulation increases. Today, about 500 plant species in the world are recognized as hyperaccumulators, which is approximately 0.2% of all angiosperms [3].

As we know, mobile macro-and microelements in soils participate in absorption by living organisms. In this case, the general direction is focused on keeping the elements in the biosphere.

Research methodology. South Fergana, where the study was conducted, occupies the southern part of the valley, mountain, foothills, foothills, hills and plains of the desert region. Subtropical region, semi-desert zone, foothills, hilly area, alluvial-proluvial bed consisting of stony-gravel rocks (40º17′56″N71º41′53″E) protected pale gray soils (1/MO) is a research object.

Morphogenetic, physico-chemical methods were chosen as the main method of soil research, as well as today's generally accepted methodologies and methods in soil science were widely used. Elemental analysis of soil and medicinal plants was carried out by the neutron-activation method in the laboratory “Ecology and Biotechnology” of the Research Institute of Nuclear Physics of the Academy of Sciences of Uzbekistan. The samples taken for the analysis were mainly taken during the flowering phase of the vegetation of medicinal plants. Medicinal plant samples were dried at room temperature and 50 and 100 mg were taken. The samples were wrapped in acetone-cleaned film bags and then placed in aluminum foils in the reactor.

In this case, the samples are $5*10^{13}$ neutrons/cm^2 sec in the atomic reactor. Irradiated with a neutron stream, and their amounts were found based on the half-life periods of chemical elements.

Analysis and results. If we evaluate the chemical elements in the soil, including heavy metals and some non-metals, they represent the following limits in light gray soils (Table 1). Barium (Ba), bromine (Br) in the upper layers of the protective pale gray soil section (1/MO-section), and cobalt (Co) in the lower layer, in the 0-10, 30-56 and 56-120 cm layers and it was noted that the amount of zinc (Zn) elements is higher compared to the soil chalk. Heavy metals such as chromium (Cr), iron (Fe), and manganese (Mn) were found to be low compared to soil iron.

B.B. Polinov [4] proposed a biogeochemical index of absorption intensity of chemical elements (Ax) in order to evaluate the ability of living organisms to absorb and accumulate elements. Later, by Academician A.I. Perelman, this indicator was named the coefficient of biological absorption [5]. In this respect, it allows to study biogeochemical properties and properties of the amount of elements contained in medicinal plants distributed in different soil-climatic conditions, to evaluate medicinal plants and their raw materials. This is one of the most important scientific and practical tasks today.

Table 1.

Amount of elements in pale gray soils, % (n=5)

Element classification group. Quantitative correction	Sign	Klarki*		1/MO; deep, cm			
		Soil	Lithosphere	0-10	10-30	30-56	56-120
Circle elements. 10-2	Fe	380	465	133	161	181	205
	Ca	137	296	142	520	136	105
	Na	63	250	70	71	94	68
	K	130	250	111	145	151	145
	Mo	0,02	11,0	0,010	0,016	0,006	0,011
	Mn	8,5	10,0	3,70	4,30	5,20	4,20
	Ba	5,0	6,5	4,83	5,70	5,56	4,42
	Sr	3,0	3,4	2,30	2,40	5,10	8,45
	Zn	0,5	0,83	0,558	0,371	0,598	0,611
	Cr	2,0	0,83	0,443	0,337	0,419	0,449
	Ni	0,4	0,58	1,340	1,520	0,130	0,590
	Co	0,08	0,18	0,047	0,074	0,075	0,086
	As	0,05	0,017	0,183	0,056	0,065	0,092
	Hf	0,06	0,01	0,023	0,022	0,030	0,041
	Sb	0,0024	0,005	0,0311	0,0341	0,0272	0,0099
Scattered elements 10-3	Rb	10,0	15,0	6,12	3,73	6,63	5,64
	Sc	0,7	1,0	0,411	0,508	0,608	0,718

	Cs	0,5	0,37	0,40	0,37	0,40	0,35
	Ta	0,6	0,25	0,050	0,041	0,055	0,052
	Br	0,5	0,21	0,34	0,95	0,25	0,19
Rare elementlar. 10-3	Ce	5,0	7,0	2,50	3,22	4,14	4,15
	Nd	3,7	3,7	1,00	1,00	2,07	1,41
	La	4,0	2,9	1,35	1,52	1,85	2,22
	Sm	0,8	0,8	0,18	0,19	0,28	0,27
	Tb	0,1	0,43	0,050	0,027	0,040	0,050
	Eu	0,01	0,13	0,035	0,039	0,070	0,074
	Lu	0,17	0,08	0,023	0,010	0,012	0,016
	Yb	0,033	0,033	0,25	0,07	0,13	0,16
Rare metall. 10-4	Au	0,0043	0,0043	0,0082	0,0024	0,0051	0,0052
Radiaction elements	Th	0,6	1,3	0,42	0,51	0,63	0,67
	U	0,1	0,25	0,21	0,34	0,27	0,33

* − *According to A.P. Vinogradov, lithosphere clarki* [2].

In the solution of this problem, the use of the biological absorption coefficient (Ax) is considered an important biogeochemical study, not forgetting that Ax is a relative size, when the same medicinal plant grows in different soil-climatic conditions, the composition of elements varies in quantity and quality. also takes into account the change. Biological absorption coefficient (Ax): element characteristic (element biophilicity) - what and how much element is needed by medicinal plant; physiological characteristic of the plant; item availability; in what form; in a certain area, in what natural conditions (climate); does it change depending on the concentration of the element? - answers the questions in a certain sense. In this regard, it is also necessary to study the amount and quality of macro- and microelements in the light-colored gray soils remaining under the influence of natural and anthropogenic degradation in the elementary landscape system, in particular, in the soil-medicinal plant chain.

Of course, the quality of the soil, that is, its chemical composition, directly affects the growth, development, and finally the yield of medicinal plants, as well as the quality of medicinal products made from them, because the soil is the main source that provides medicinal plants with the necessary nutrients is considered It was noted above that this, in turn, depends on the type and characteristics of the plant. In this regard, today, not only the research of biologically active substances included in the composition of soil or medicinal plants, but also the study of chemical elements under the influence of environmental factors is of great scientific and practical importance. In addition, we aimed to determine the coefficient of biological absorption from the point of view of evaluating the ecological purity of medicinal plants [6], which requires special attention to the issue of ecological monitoring of the amount of heavy metals in medicinal plants and the work of hygienic major.

Researches in the hills of Aqbilol, Fergana district, a type of pale gray soil formed on weakly skeletonized alluvial-proluvial rocks from the upper layer, desert mint (Ziziphora tenuior L.), moldy blueberry (Scutellaria comosa Juz.), prickly caper (Capparis spinosa L.) was carried out on medicinal plants (Table 1).

According to the methodology developed by A.I. Perelman, absorption of elements was assessed as being collected by plants if Ax>1, and retained if Ax<1. The most important generalized indicator of the intensity of biogenic migration of an element is its biophilicity. It is found by the ratio of the element clark in the living organism to the lithosphere or soil clark, as well as to the substrate in which the organism is found, i.e. soil [4]. It should not be forgotten that this indicator is also relative.

The intensity of absorption of elements by different communities of organisms is often determined by the coefficient of biological absorption (BSK or Ax). In our conditions, the element composition of medicinal plants was studied based on the composition of the soil where they were spread.

Table 2.

Bioabsorption coefficient of medicinal plants

Element	Desert mint	Moldy blueberry	Prickly pear						
	the upper part of the earth	the upper part of the earth	Root core	Root bark	stem	leaf	bud	flower	fruit
Fe	0,05	0,01	0,02	0,01	0,01	0,01	0,01	0,01	0,02
Ca	0,84	0,29	0,49	0,08	0,23	1,20	0,37	0,26	1,34
Na	0,03	0,11	0,19	0,17	0,01	0,01	0,02	0,02	0,02
K	0,90	1,07	1,53	0,49	1,53	1,17	2,22	2,34	2,56
Mo	0,99	0,19	5,2	0,55	0,29	1,8	0,58	0,5	2,1
Mn	0,07	0,08	0,09	0,02	0,04	0,27	0,07	0,06	0,09
Ba	0,108	0,029	0,081	0,009	0,007	0,011	0,005	0,007	0,008
Sr	0,67	0,28	0,87	0,19	0,32	1,26	0,28	0,14	0,33
Zn	0,48	0,47	0,48	0,09	0,25	0,54	0,59	0,54	0,61
Cr	0,16	0,003	0,14	0,21	0,07	0,01	0,01	0,02	0,05
Ni	0,001	0,0004	0,034	0,054	0,013	0,016	0,012	0,010	0,032
Co	0,08	0,10	0,05	0,03	0,02	0,04	0,03	0,03	0,04
As	0,015	0,005	0,014	0,007	0,001	0,005	0,001	0,007	0,012
Hf	0,152	0,033	0,018	0,014	0,007	0,011	0,006	0,009	0,014
Se	1,0	2,0	16,0	6,0	22,0	36,0	44,0	29,0	51,0
Sb	0,10	0,02	0,05	0,01	0,01	0,02	0,01	0,02	0,03
Re	2,36	1,43	-	-	-	-	-	-	-
Rb	0,08	0,54	0,25	0,06	0,25	0,23	0,39	0,41	0,46
Sc	0,07	0,01	0,03	0,00	0,00	0,01	0,01	0,01	0,01
Cs	0,058	0,024	0,043	0,008	0,015	0,043	0,033	0,028	0,035
Ta	0,019	0,019	0,019	0,019	0,019	0,019	0,019	0,019	0,019
Br	0,53	2,74	0,24	0,06	0,74	1,24	0,59	0,56	1,09
Ce	0,060	0,036	0,022	0,004	0,0004	0,008	0,0004	0,011	0,014
Nd	0,01	0,03	0,01	0,01	0,01	0,01	0,01	0,01	0,01
La	0,039	0,050	0,024	0,004	0,004	0,011	0,004	0,008	0,013
Sm	0,046	0,023	0,025	0,004	0,003	0,012	0,005	0,011	0,029
Tb	0,032	0,014	0,014	0,002	0,002	0,002	0,002	0,002	0,002

Eu	0,029	0,029	0,002	0,003	0,003	0,003	0,003	0,003	0,003
Lu	0,0033	0,0023	0,0008	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004
Yb	0,0090	0,0004	0,0064	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004
Au	0,65	0,12	0,35	0,24	0,07	0,09	0,29	0,11	0,54
Th	0,054	0,200	0,022	0,003	0,003	0,005	0,003	0,005	0,006
U	0,030	0,005	0,071	0,005	0,005	0,005	0,005	0,005	0,005

The results of the study of the bioabsorption coefficient of heavy metals in the medicinal species Capparis spinosa L. are arranged in the following descending order: Zn>Br>Mn>Cr>Co>Fe>Ba.

BCK values constitute biogeochemical characteristics of biological cycles of elements in a certain area, as well as the series of biological absorption of elements that reflect species characteristics of organisms.

According to N.V.Kovalchik, L.I.Smikovich, A.A.Karpichenko, the chemical composition of organisms is an important systematic sign of the studied species. The geochemical characteristic of a living organism is formed in the process of evolution and strengthened by heredity [7]. However, the chemical composition of plant species is not constant, it can change in a certain interval depending on the chemical composition of the substrates where the plants grow. It is studied through the indicator of biogeochemical activity (BKF) of the plant species. This indicator is calculated based on the sum of Ax (Fig. 1).

Biogeochemical activity of natural medicinal plant species: in thorny sedum – fruit (60.48) > bud (49.57) > leaf (44.05) > flower (34.16) > stem (25.93) > root pith (26.39) > rhizome (8.35), with an average of 35.56 ha, 9.97 ha in blueberry and 9.72 ha in desert mint ldi

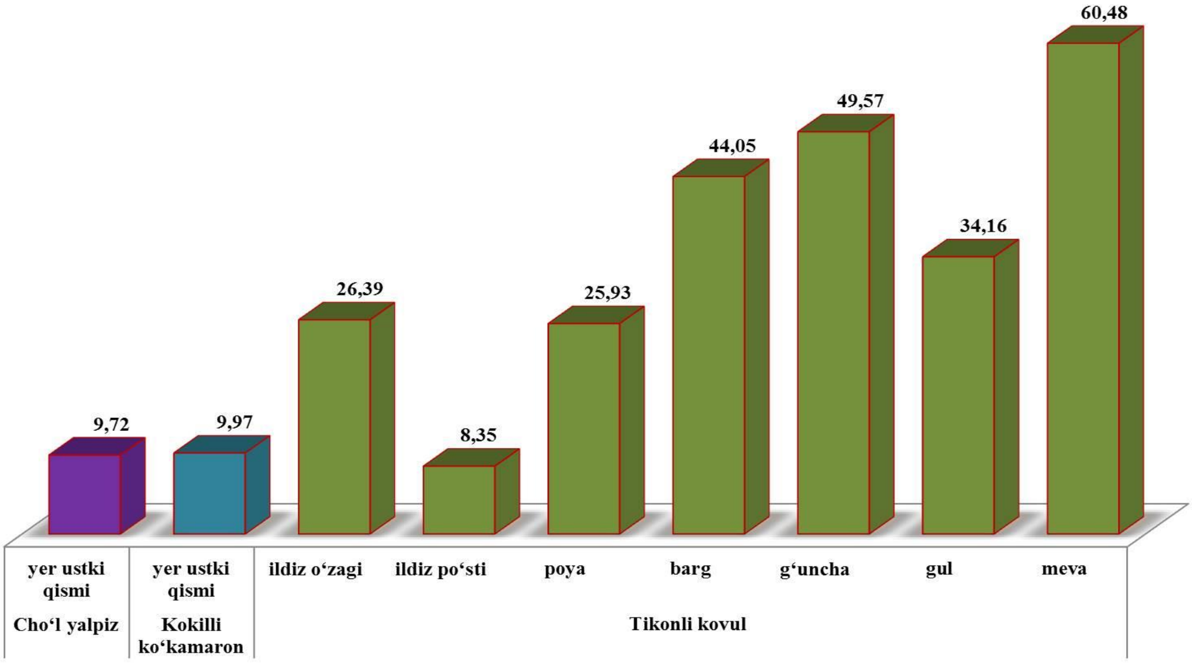

Figure 1. Biogeochemical activity of medicinal plant species

Based on the data on the bioabsorption coefficient of natural medicinal plants, the intensity of bioabsorption was estimated according to A.I. Perelman, in which the following series of elements were formed.

Table 3.

Intensity of biological absorption of chemical elements in medicinal plants

Plant name	Elements					
	Bioaccumulative (Ax>1)			Bioretentive (Ax<1)		
	strongest (10-100)	strong (5-10)	weak (1-5)	middle (0,1-1)	weak (0,01-0,1)	weakest (<0,01)
Desert mint (Ziziphora tenuior L.)			Re	Ca, K, Mo, Ba, Sr, Zn, Cr, Hf, Se, Br, Au	Fe, Na, Mn, Co, As, Sb, Rb, Sc, Cs, Ta, Ce, Nd, La, Sm, Tb, Eu, Th, U	Ni, Lu, Yb
(Scutellaria comosa Juz.) Moldy blueberry			K, Se, Re, Br	Ca, Na, Mo, Sr, Zn, Co, Rb, Au	Fe, Mn, Ba, Hf, Sb, Sc, Cs, Ta, Ce, Nd, La, Sm, Tb, Eu, Th,	Cr, Ni, As, Lu, Yb, U
(Capparis spinosa L.) Capparis spinosa L.	Se		K, Mo	Ca, Sr, Zn, Rb, Br, Au	Fe, Na, Mn, Ba, Cr, Ni, Co, Hf, Sb, Cs, Ta, Nd, Sm, U	Sc, As, Ce, La, Tb, Eu, Lu, Yb, Th

Summary. According to their data, the group of biologically accumulating (Ax>1) elements includes Se, Re, Br, K, and Mo elements. The remaining macro- and microelements belong to the biologically retained (Ax<1) group. 18 of the studied elements are found in desert mint (Ziziphora tenuior L.), namely Fe, Na, Mn, Co, As, Sb, Rb, Sc, Cs, Ta, Ce, Nd, La, Sm, Tb, Eu, Th, U elements belong to the weakly (0.01-0.1) retained biological group. In the rest of the medicinal plants, this same group took the lead, and it was found that 14-15 chemical elements are weakly retained in the organs of medicinal plants in light gray soils.

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