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The proceedings are the papers of students, undergraduates, doctoral students and young researchers on topical issues of natural and technical sciences and humanities.

В сборник вошли доклады студентов, магистрантов, докторантов и молодых ученых по актуальным вопросам естественно-технических и гуманитарных наук.

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Since most organic compounds cannot be obtained by direct synthesis from simple substances, therefore the enthalpies of their formation cannot be experimentally determined. For them, the enthalpy of combustion can be determined experimentally. Knowing the enthalpy of combustion of the substances participating in the reaction, it is possible to calculate the enthalpy of formation of the substance. In our case, in connection with the lack of appropriate equipment for measuring the enthalpy of combustion, the calculation methods most suitable for the test compounds were used. The standard enthalpy of compound formation is a measure of its thermodynamic stability. As can be seen from Table 2, the standard enthalpies of the formation of different derivatives have different values, both negative and positive, as among the investigated compounds the N'-2-octyl-3-phenylallylideneisonicotinohydrazide is relatively stable, and the least stability under standard conditions is possessed by the N'-2-bromo-3-phenylallylideneisonicotinohydrazide.

The obtained energy data by IAH as a result of thermochemical calculations are of interest as initial information arrays for the directed synthesis of new compounds with the participation of the substances under study, and also for loading thermodynamic constants in fundamental banks of data.

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ATMOSPHERIC DEPOSITIONS OF HEAVY METALS AND RADIONUCLIDES IN IRTYSH AREAS OF KAZAKHSTAN

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In Kazakhstan, due to the current socio-economic development, there are disadvantaged regions by state of the environment, which is a unique urbanistic system saturated with varied companies of very different technological orientation. The presence of large number of enterprises and high levels of radiation in Irtysh area of Kazakhstan determine the urgency of these studies.

The use of mosses as biomonitors of atmospheric depositions of trace elements were introduced in Scandinavian countries and shortly after that, usage of the mosses to assess the atmospheric deposition of metals was well proven in the UN Commission of European air [1].

The main natural source of heavy metals is magmatic and sedimentary rocks and their forming minerals. Many elements enter into the biosphere from cosmic dust, volcanic gases, etc. The entrance of heavy metals into the environment due to industrial pollution carried out in various ways. The most important of these is the release of the processes associated with high temperatures (metallurgy, roasting, burning of fuel). Despite the great diversity of heavy metal compounds, a set of elements in the gas-dust emissions of the ferrous and non-ferrous metallurgy enterprises are the same type; mainly oxides represent them [2].

Heavy metals and other toxic elements emitted into the atmosphere from the industrial constructions, mostly distributed locally around the emission sources. In a real natural environment, it is usually observe a good correlation of the shape and size of areas of contamination with the configuration of the wind rose.

Around large enterprises, ferrous and nonferrous metallurgy formed strong technogenic anomalies of metals. "Characterized by the presence of the zone of maximum concentrations of heavy metals at a distance of 5 km from the source and the zones of high grade at a distance of 20-25 km. Further, the content of heavy metals decreases to the values of the local background. Local anthropogenic anomalies generate around the enterprises that process raw materials containing heavy metals and other contaminants in the form of impurities. Around major thermal power plants, there are zones of contamination with metals 10-20 km in diameter. Any urban areas are a significant source of heavy metal pollution. High pollution found near freeways, especially lead, zinc, cadmium" [3].

Since many heavy metals tend to accumulate, the negative effects of their impact on the environment can occur slowly. Elevated concentrations of heavy metals in soils, groundwater, leading to stunted growth of trees, agricultural crops and accumulation in the human body can have a detrimental effect on the health of future generations. Hence, there is the need for monitoring atmospheric deposition of pollutant elements [4].

Morphological and physiological properties of mosses along with their wide distribution make these plants very useful bio-indicators to assess the state of the environment. They have a number of advantages over other plants biomonitors (lichens, tree bark, grass, etc.): the absence or severe change in the cuticle, thin and close-set leaves, and poorly developed conducting tissue, it leads to efficient accumulation of materials carried by air, and the little direct uptake from the substrate. Mosses are the most effective at concentrating heavy metals and other trace elements from air and precipitation. Moreover, they do not have a root system and, therefore, the contribution of sources other than atmospheric deposition, in most cases is limited. Sample collection is simple, the analysis of mosses is much simpler than precipitation, the period of exposure can be determined accurately [5].

Determination of the elemental composition of moss samples was carried out by using instrumental neutron activation analysis (NAA).

Neutron activation analysis - analysis in which the identification and quantitative determination of elements in an irradiated sample is carried out selectively, using the variation of irradiation conditions - (energy of bombarding particles, the exposure time), and consider the nuclear-physical properties of elements and the occurring radionuclides (particularly schema-defined decay of radionuclides, half-life).

NAA of moss samples were carried out at the PFR-2 (pulsed fast reactor) using activation of epithermal neutron along with a full range of neutrons [6, 7].

Important stages in the analysis are sampling, and sample preparation.

Environmentally important element, lead cannot be identified using the method of neutron activation analysis. Due to low contents of mosses in the samples also hampered the detection of copper and mercury, therefore, to identify these elements, and compare the obtained results, it also was used the method of atomic emission spectrometry with inductively coupled plasma (AES with ICP).

Atomic emission spectrometry with inductively coupled plasma is characterized by high sensitivity and ability to detect a range of metals and several nonmetals at concentrations up to 10^{-10}%, i.e. one particle of 10^{12}. The method is based on using inductively coupled plasma as ion source and mass spectrometer for separation and detection. ICP-MS also allows for isotopic analysis of the selected ion.

In compliance with the Moss Manual 2015 (Harmens and Frontasyeva, 2015; http://icpvegetation.ceh.ac.uk/) the three moss species *Hylocomium splendens*, *Pleurozium* *schreberi*, *Pleurochaete squarrosa* were collected over the Irtysh area during the period of autumn and summer of 2015-2016.

The concentrations of 42 elements (Na, Mg, Al, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Ni, Co, Zn, As, Se, Br, Rb, Sr, Zr, Nb, Mo, Ag, Cd, Sb, Ba, La, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Tm, Hf, Ta, W, Au, Th, and U) determined by epithermal neutron activation analysis, also 14 elements (Ba, Ca, K, Mg, Na, Sr, Cr, Mn, Ni, Co, Zn, Cd, Cu, Pb) determined by atomic emission spectrometry with inductively coupled plasma in the moss samples are reported. Multivariate statistical analysis of the obtained results was used to assess the pollution sources in the studied area (Pavlodar, Ust'-Kamenogorsk, and Semey regions).

All values in Table 1, 2 are given in mg kg^{-1}, dry weight. In Table 1 the median values and minimum-maximum ranges for the contents of all elements were compared with the data obtained from Georgia (moss survey in 2014) and the data from Norway considered as a pristine area of Europe.

A comparison of concentrations Kazakhstan-Norway showed the increased values for most of heavy metals (Cd, Sm, Ti, V, As, Mo, Mg, Al, Ca, etc) in the studied samples that apparently are due to the state of the industrial sector of Kazakhstan. The main potential sources of air pollution from the industrial sector of Irtysh area are the Aksu ferroalloy plant, aluminium factory, Kazakhstan electrolysis plant, petrochemical plant in Pavlodar region; Ul'binsk metallurgical plant, titanium-magnesium plant in Ust'-Kamenogorsk region; bus factory, engineering plant, silicate plant in Semey region and etc.; also the production of steel and zinc and etc., coal mining, extraction of natural resources.

Table 1 – Comparison of the median values and ranges of element content in moss from Kazakhstan between data of the moss survey Norway, Georgia and Kazakhstan (2014-2015) (all data are given in mg kg^{-1})

Kazakhstan moss survey 2016-17			Kazakhstan moss survey 2014-15 (Nazarova, et al. 2015)		Georgia moss survey 2014 (Shetekauri, et al. 2015)		Norway moss survey (Shetekauri, et al. 2015)	
№ of sample	n=30		n=23		n=16		n=100	
Element	Median	Range C(min.)-C(max.)	Median	Range C(min.)-C(max.)	Median	Range C(min.)-C(max.)	Median	Range C(min.)-C(max.)
^{24}Na	2929	312-6920	2000	424-17100	721	268-1990	nd	nd
^{27}Mg	5329	918-8480	6060	1710-24800	4410	2720-11600	1730	940-2370
^{28}Al	14197	2240-26500	9510	33,8-35100	5195	2450-20800	200	67-820
^{38}Cl	143	36,8-508	180	95,5-1270	225	140-465	nd	nd
^{42}K	8540	1450-16900	10800	3820-23200	5875	3080-9040	nd	nd
^{49}Ca	8636	1100-22800	12500	2340-24000	11800	7140-15300	2820	1680-5490
^{51}Ti	779	111-1460	603	99-3920	547	216-2070	23.5	12.4-66.4
^{52}V	18,7	3,74-34,4	13	1,7-56,7	11.8	6.2-54.0	0.92	0.39-5.1
^{56}Mn	247	30,8-907	178	70,5-1260	158	70-592	256	22-750
^{76}As	1,68	0,0909-4,89	1,92	0,80-8,1	0.88	0.33-2.87	0.093	0.020-0.505
^{82}Br	3,46	1,39-7,52	4,67	2,3-31,3	4.545	2.3-9.8	4.5	1.4-20.3
^{99}Mo	0,34	0,0639-	0,69	0,21-2,03	0.35	0.24-0.77	0.135	0.065-

		1,4						0.70
^{115}Cd	0,17	0,0055-0,7865	0,75	0,02-2,74	0.25	0.12-0.56	0.058	0.025-0.171
^{140}La	6,9	0,922-15,4	6,4	1,35-37,3	59.28	18.8-138	17.1	5.6-50.5
^{153}Sm	1,66	0,169-3,95	1,05	0,198-7,09	2.13	0.92-6.28	0.189	045-2.56
^{187}W	0,25	0,00208-0,847	0,44	0,12-1,42	0.43	0.035-0.945	0.33	0.05-1.34
^{198}Au	0,00584	0,0012-0,0137	0,00145	0,00023-0,00441	0.13	0.06-0.27	0.127	0.009-1.23

The average concentrations of elements are given in table 2 to compare two different methods: NAA and AES with ICP, and was found a correlation coefficient, which is 0,7784.

Table 2 – The average concentrations of elements, determined by two different methods

Elements	Ba	Ca	Cd	Co	Cr	K	Mg	Mn	Na	Ni	Sr	Zn
C(average), mcg/kg by NAA	170	8909	0,3	4,9	19,9	8762	5716	247	3178	9,1	86,6	146,2
C(average), mcg/kg by AES	114	12720	2,0	5,4	33,7	5316	2971	473	1868	172,3	76,6	225,1

The performed preliminary investigation shows that the moss biomonitoring of atmospheric deposition of heavy metals is an efficient technique to study the environmental situation in the Kazakhstan. The experience of this study can be successfully used in the other regions of the Kazakhstan.

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