ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Study Of Macro- And Microelement Composition Of Rye And Barley.

[1]Ganna S Tartynska*,[2]Moeen F Dababneh, Naeem Shalan, [1]Iryna O Zhuravel, [1]Viktoriia S. Kyslychenko, and [1]Andrii I Popyk.

[1]National University of Pharmacy, Kharkiv 61002, Ukraine.
[2]Al-Ahliyya Amman University, Jordan.

ABSTRACT

Using them ethodofatomic-emission spectro graphy with photographic registration the analysis of macro- and micro element composition of spikes, stems and leaves (booting stage) ofrye (Khamarkahybrid) and barley (Shedevrcultivar) was carriedout. Not less than 19 elements, among which potassium prevailed, were identified in all types of the studied plant material, while silicon, calcium and magnesium dominated in the leavesofbothplants, and magnesium and phosphorus dominated in barley (Shedevrcultivar) leaves and spikes. As the results of the analysis have shown, the highest content of macro- and micro elements was observed in ryeleaves, and the lowest – in barley stems and ryespikes.

Keywords: rye, barley, macro- and micro elements, atomic-emission spectro graphy.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Enrichment of daily nutrition with food rich in macro- and micro elements is essential for normal functioning of human body, strengthening of immunity and decreasing the risk of various disorders, especially in winter and spring. Macro- and micro elements are ubiquitous components of almost all physiological processes in the body, take partin various metabolic reactions, in particular blood formation, elimination of metabolites, etc. Muscle contraction, nerve conduction, tissue respiration are impossible without mineral elements, the lack of which might lead to pathological changes in the body.

Potassium takes part in heart rate maintenance. Sodium activates enzymes of pancreas and salivary glands, regulates blood, lymph, renal functions. Together potassium and sodium regulate the body ion balance, assist blood clotting, take part in neurotransmission and muscle contraction, activation of enzymatic processes.

They are used for normalization of arterial pressure and electrolyte balance. Silicon promotes vessel strengthening, supports tissue elasticity, lowers risk of contagious diseases. Magnesium has an influence on the work of nervous system, shows sedative activity, boosts immunity and phagocytosis, takes part in protein, lipid and carbohydrate metabolism.Calcium is an important element which maintains the integrity of cell membranes and bone tissue. Iron is included into more than 70 enzymatic systems, being of great importance in human body, takes part in oxygen transport and regulates blood circulation; it is also essential for erythrocyte formation and has an influence on the state of immune system. Zinc stimulates muscle contraction, takes part in vitamin synthesis, redox reactions, influences blood formation and energy metabolism, being essential for normal functioning of reproductive system and cell development[2, 5, 10].

In continuation of pharmacognostic research onrye (Khamarkahybrid) and barley (Shedevr cultivar) we have studied the micro- and macro element composition of their plant material. These plants are popular grain crops with sufficient raw material base. They have been used for centuries for culinary purposes in bread production, as well as in folk medicine in inflammatory disorders of the gastro-intestinal tract, cough, skin conditions, etc. Decoctions of their bran are used as demulcent agents[1, 6, 7].

Thescope of our research was to study the macro-and micro element composition of spikes, stems and leaves (booting stage) of rye (Khamarka hybrid) and barley (Shedevr cultivar).

MATERIALS AND METHODS

Identification and quantitative content determination was carried out using atomic emission spectro graphy with photographic registration[3, 4, 8, 9].

Sample preparation included carbonization of plant material in amuffle furnace (temperature max. 500°C)with preliminary pretreatment with diluted sulfuric acid. Samples were evaporated from graphite electrode cratersin AC arc discharge at 16 A current and 60 sec exposure. DFS-8 spectrograph with diffraction grating of 600 grooves/mm and three-lens slit illumination system was used for spectra obtaining and registration. Intensity of the lines in spectra of analyzed samples and calibration specimens (CS) was measured using micro photometer MP-1.

Such photography terms were followed: AC arc current 16A, ignition phase 60°C, ignition pulse frequency – 100 discharges per second, analytical gap 2 mm; spectrograph slit width 0,015 mm; exposure 60 s. Spectra were photographed at 230-330 nm range.

Photo plates were developed, dried, then the following lines (in nm) were photo measured in spectra of samples and graduated specimens as well as their background.

According to the photometry results, for each element differences in blackening of lines and background ($S=S_{l+b}- S_b$) for spectra of samples (Se) and of calibration specimens (Scs) were calculated. Then the calibration plot in such coordinates was drawn: mean value of lines and background blackening difference (Scs) – calibration specimens element content logarithm (lg C), where C is expressed in per

ISSN: 0975-8585

cent relative to base. From this plot we found an element content in ash (a, %). The element content in plant material (x, %) was found by formula: $x = \frac{a \cdot m}{M}$,where m – ash mass, g; M – crude material mass, g;a – element content in ash, %.

The lower limits of impurities content which comprised for Cu – $1 \cdot 10^{-4}$;Co, Mo, Mn, – $2 \cdot 10^{-4}$; Ni, Pb – $5 \cdot 10^{-4}$; Sr, Zn – $1 \cdot 10^{-4}$%were considered during the analysis.

RESULTS AND THEIR DISCUSSION

Not less than 19 elements were found in spikes, stems and leaves of rye (Khamarka hybrid) and barley (Shedevr cultivar) as a result of the comparative analysis of element composition. The content of heavy metals did not exceed the limits of maximum allow able concentrations. Results of the research are given in Table 1.

As a result of the experiment all types of the plant material studied were found to contain potassium as a prevailing element, and it is worth mentioning that this element dominated by quantity in rye leaves(3800.00mg/100 g), while in the lowest quantity was found in barley stems and rye spikes (1050.00mg/100 g and 1020.00mg/100 g respectively). The potassium content was almost equalin barley leaves and spikes and rye stems (2500.00mg/100 g, 2100.00mg/100 g and 2300.00mg/100 g respectively).

Silicon (1010.00mg/100 g and 800.00mg/100 g), calcium (890.00mg/100 g and 800.00mg/100 g) and magnesium (330.00mg/100 g and 220.00mg/100 g) dominated in rye and barley leaves respectively. In smaller amount in this plant material sodium (95.00mg/100 g and 200.00 mg/100 g), phosphorus (83.00 mg/100 g and 100.00mg/100 g), aluminum (47.00mg/100 g and 22.00mg/100 g), iron (36.00mg/100 g and 25.00mg/100 g) and zinc (15,40mg/100 g and 12.00mg/100 g) were found respectively.

Barley stems almost in equal amounts accumulated silicon (265.00mg/100g), calcium (260.00mg/100g) and sodium (210.00mg/100g). Rye stems differed by the presence of lower amount of above mentioned elements, silicon and calcium were found in equal quantity –140.00mg/100g each, and the content of sodium comprised 55.00mg/100g.

Rye spikes, unlike other types of the plant material studied, accumulated phosphorus in high quantity (210.00mg/100g).

All the types of plant material studied except rye and barley leaves, iron, aluminum, zinc, manganese, strontium and copper in small amount.

Table 1: Results of macro-and micro element analysis of spikes, stems and leaves (booting stage) of rye (Khamarka hybrid) and barley (Shedevr cultivar)

Sl.No.	Element	Sample №					
		1	2	3	4	5	6
		Element content, mg/100 g					
1.	K	1020.00	2100.00	2300.00	1050.00	3800.00	2500.00
2.	Na	76.00	36.00	55.00	210.00	95.00	200.00
3.	Ca	127.00	60.00	140.00	260.00	890.00	800.00
4.	P	71.00	210.00	27.00	45.00	83.00	100.00
5.	Mg	100.00	210.00	92.00	100.00	330.00	220.00
6.	Si	245.00	150.00	140.00	265.00	1010.00	800.00
7.	Fe	1.30	21.00	0.80	5.20	36.00	25.00
8.	Al	1.00	4.80	1.40	3.50	47.00	22.00
9.	Mn	0.81	2.10	1.60	0.26	7.10	4.00
10.	Mo	0.04	0.07	0.05	<0.03	0.06	0.05
11.	Cu	0.51	0.48	0.37	0.23	0.59	0.50

12.	Zn	4.10	5.80	9.20	3.80	15.40	12.00
13.	Sr	0.20	0.30	0.82	0.63	4.10	3.00
14.	Pb	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
15.	Ni	<0.03	0.15	<0.03	<0.03	0.12	<0.03
16.	Co	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
17.	Cd	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18.	As	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19.	Hg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: 1 – rye spikes; 2 – barley spikes; 3 – rye stems; 4 – barley stems; 5 – rye leaves; 6 – barley leaves.

CONCLUSIONS

Using them ethodofatomic-emissions pectrography with photo graphic registration the analysis of macro-and micro element composition of spikes, stems and leaves (booting stage) of rye (Khamarka hybrid) and barley (Shedevr cultivar) was carried out. Not less than 19 elements, among which potassium prevailed, were identified in all types of the studied plant material, while silicon, calcium and magnesium dominated in the leaves of both plants, and magnesium and phosphorus dominated in barley (Shedevr cultivar) leaves and spikes. As the results of the analysis have shown, the highest content of macro- and microelements was observed in rye leaves, and the lowest – in barley stems and rye spikes.

The results obtained will further be used for the development of projects of quality control methods for rye and barley plant material as well as creation of new medicines on their basis.

REFERENCES

[1] Andreasen MF, Landbo AK, Christensen LP, HansenA, Meyer AS. Journal of Agricultural and Food Chemistry. 2001; 49(8):4090-4096.
[2] Bashkirova L, Rudenko A. LikyUkraiiny / Medicationsof Ukraine.2004; 10: 59-65.
[3] BurdaNYe, DababnehMF, KlivniakBM, Zhuravel IA. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016; 7(6): 2200-2202.
[4] DababnehMF, GrinenkoUV, AlmuaikelNS, Zhuravel IO. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2017; 8(2): 1830-1832.
[5] DerechaLM,. M'yasojdovVV.ExperimentalandClinicalMedicine. 2007; 4: 21-27
[6] Gallaher DD, LocketPL, Gallaher CM. TheJournalofnutrition. 1992; 122(3): 473-481.
[7] Hrodzynskyi AM. Medicinal plants: Encyclopedic guide. Publishing House "Ukrainian Encyclopedia". 1992; 544p.
[8] Kyslychenko OA, Protska VV, Zhuravel IO. Medical and Clinical Chemistry. 2018; 1: 117-122.
[9] Petrovska UV, Zhuravel IO, Hutsol VV. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018; 9(6): 530-534.
[10] Visochanska TP, Denisenko OI. Ukrainian Journal of Dermatology, Venereology, Cosmetology.2008; 3: 9-13.