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CONTENTS OF Cu AND Zn IN HONEY AND SOIL AS ECOLOGICAL INDICATOR CONDITIONS OF LIFE ENVIRONMENT

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1. INTRODUCTION

Most of copper sedimented in soil comes from the atmosphere, from usage of agricultural measures and waste site. In the ground, is connected to organic solid, also to carbonate minerals iron hydroxides and mangane oxides. Copper absorption increases with the increase of pH soil from 4.91 to 8.48, and decreases with the temperature increase from 5 to 25 C. [1] At the depth of 15 cm almost all copper was organically connected. Organically complexed copper composed of predominant form of copper in soil solution, even at the depth of 50 cm. Oxidated states where copper participates in many biological redox processes and enters in content of enzymic sistems are Cu^{+} and Cu. Zinc is essential microelement necessary for normal bone development. It is essential during the CO_2 transportation through erythrocytes, for normal bone calcification, synthesis and metabolism of proteins and nuclein acids, for development and functioning of reproductive organs, insulin and normal sense of taste. [2] Recomended daily doses of zinc are: little children about 5 mg, children 10 mg, men 15 mg, women 12 mg, pregnant women 15 mg, nursing women 16-19 mg. According to Pauling recomended doses for adults are 5 mg.[4] Increased concentration of zinc can cause anemia, which is caused by the shortage of ferum and cuprum. This causes depresion, reduced appetite, even death.[3]
Accordin to O. Celeshovska and I. Vorlov researches concentrarion of zinc in honey that comes from Czech Republic ranges from 0,2 to 22,9 mg/kg.[5] Availability of zinc for plants is restricted because of very marked absorption to soil colloidal particles, and also because of its small movability.[6] Average content of Zn in soil is about 50 mg/kg. In contaminated soil it can be increased 4-10 times, in relation to its average content.

2. RESULTS AND DISCUSION

Table 1. Physical-chemical caracteristics of analysed honey samples

No.	Honey sort	Location	Colour	Consistention	Crystalisation
1	Meadow	Tuzla I	Dark	Liquid	Two layer
2	Meadow	Tuzla III	Dark	Liquid	One layer
3	Meadow	Tuzla Plane	Dark	Liquid	Two layer
4	Meadow	Kladanj	Transcendentally dark	Liquid	One layer
5	Meadow	Miričina	Transcendentally yellow	Liquid	One layer
6	Meadow	Mramor	Light yellow	Liquid	Two layer
7	Meadow	Fana Srebrenik	Light yellow	Dense	One layer
8	Meadow	Gradačac I	Transcendentally dark	Liquid	One layer
9	Meadow	Čelić	Light yellow	Dense	One layer

In this paper has been analysed 9 samples of meadow honey that comes from Tuzla Canton area (Bosnia and Herzegovina), and 20 soil sample of urban and rural area of Tuzla. Three samples of honey have light colour, six have dark colour. Samples number 7 and 9 have thicker solidity than other samples. After keeping honey in dark bottles lighter samples remained unchanged, while dark samples formed two layers. The picture 1 shows content of cuprum in analysed honey samples:

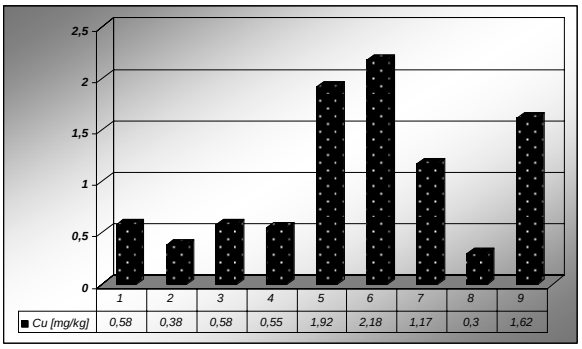

Figure 1. Content of Cu in analysed honey samples

The content of cuprum in honey differs from location where honey is collected. Actually, it depends on kind of plants that bees used for grazing. The content of cuprum in plants depend on the content in soil. The picture 2 shows content of zinc in analysed honey samples:

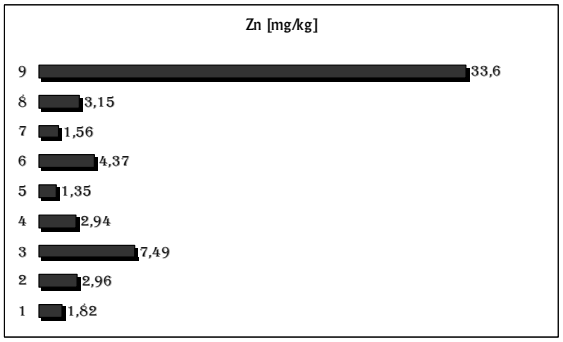

Figure 2. Content of Zn in analysed honey samples

The content of zinc in analysed honey samples, also depends on location where honey is collected, actually, on kind of plants that bees used for grazing. Zinc content in plants depends on the content in soil. In industrial areas, because of the process of technogenesis, soil contains higher quantities of zinc that reflects on its content in plants and honey. Sample number 9 comes from Tuzla Canton area where industry is developed. Due to the content of zinc in this sample is bigger than in other samples. The content of zinc does not go over the limits of toxicity. By consuming the honey, there is no possibility to enter a lot of zinc and cuprum into organism, no matter where samples come from.
The results of experimental soli research are represented in this part of paper. Sites are ranged into two categories: urban (city), rural (outlying area) in order to define difference in soil quality.

Table 2 shows the content of copper and zink in urban area of Tuzla:

Table 2. Content of cuprum and zink in analized soil samples (mg/kg)- urban area of Tuzla

location	Cu (mg/kg)	Zn (mg/kg)
Slavinovići	54	104
Bečarevac	54	150
Stupine	80	216
Bukovčić	58	98
Merkator	30	90
Tušanj	66	112
Goli Brijeg	60	162
Dragodol	52	112
Livnica čelika	121	206
Solana	78	180
Miladije-istok	110	110
Miladije-zapad	92	76

Table 3. Content of cuprum and zink in analized soil samples (mg/kg)- rural area of Tuzla

location	Cu (mg/kg)	Zn (mg/kg)
Bukinje	108	100
Husino	118	105
Moluška rijeka	66	62
Ilinčica	84	61
Kojšino	104	88
Ši-selo	100	80
Donja Grabovica	96	96
Donji Čaklovići	96	72

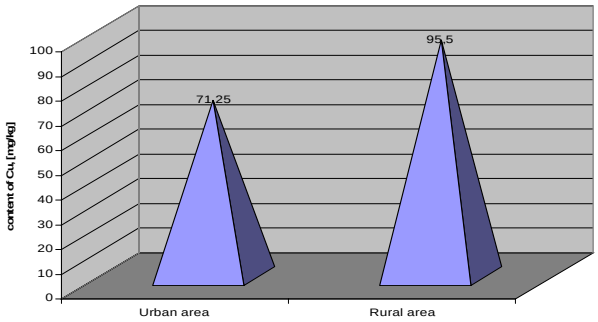

Figure 3. Average content of cuprum in urban and rural area of Tuzla

From the figure 3. we can see that average copper content in rural area is bigger that the average copper content in urban area and, they go over legally permited value limits. For agricultural area this limit amounts 50 mg/kg, for urban (city) area 60 mg/kg (sandy area). This is caused by the usage of fertilizers and agrotechnical protection measures that contain copper and its compounds, and their addition into the soil.All sites in rural parts are agricultural used for organic and conventional production. On the result basis, it can be detected that on all sites noted values of copper content go over value limits (50 mg/kg).

The average value of copper content amounts 96,5 mg/kg, that is 93% more than allowed value limits. The smallest value of copper content is noted on the site Moluška river (66 mg/kg), and the biggest on the site Husino (118 mg/kg).

Concentration of copper in natural and uncontaminated soils ranges from 1-20 mg/kg dryair sample, so it can be detected increased copper content in this parameter. The picture 4 shows average copper content values in Tuzla urban and rural area:

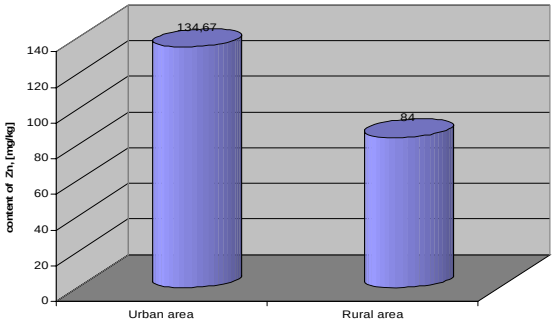

Figure 4. Average content of zink in urban and rural area of Tuzla

We can see that copper content situation is kind of different, actually in urban zone the content is bigger, which can be explained by the bigger number of residental objects and higher degree of traffic. Zinc is mostly transmitted in traffic. This is in accordance with the world researches in this area. [7][8]

Average copper content on urban area site amounts 134,67 mg/kg. The higher copper concentration is noted on Stupine site (216 mg/kg), then on Steel-casting foundry site (206 mg/kg).On that location, content of zink is above value limits (200 mg/kg). [9] The content of zinc in natural, uncontaminated soli ranges from 3-50 mg/kg of dryair sample.

On Solana site copper content value is (186 mg/kg), this is close to value limits. On the rest of site concentrations of zinc are in accordance with allowed concentrations, and they do not go over value limits. Considering that zinc is transmitted through industry work amd also in traffic, high values can be explained by mentioned effects. High zinc content is detected on Stupine site, that is, on sites with big concentration of residental objects. Those objects in its structure have materials that contain zinc (galvanized sheets, gutter,sims, etc.). In contact with acid rain, that are formed as a result of industry work and polution, zinc frees and sediments in soil.

3. REFERENCES

[1] Nicholson F A, Adams M L, Zhao F J, McGrath S P, Chalmers A, Sinclair A H. Cadmium and Lead in British Wheat and Barley: Survey Results and Factors Affecting Their Concentration in Grain. Project report No.256, 2000.

[2] Ivetić B. Sadržaj i dinamika teških metala i sumpora u tlu, vodi (drenažnoj) i biljkama na području opštine Zenica. Zavod za agropedologiju, Sarajevo. 1991;

[3] Bajramović Đ. Ispitivanje sadržaja Fe, Mn, Zn, Co, Pb, Ni i Cd u pšenici, paprici i paradajzu. Doktorska disertacija. Filozofski fakultet, Tuzla. 2001;

[4] Pauling L and Pauling P. *Chemistry.* San Francisco: W H Freeman and Company; 1979.

[5] Vorlova L and Čeleshovska O. Activity of Enzymes and Trace Elements Content in Bee Honey. Acta Vet Brno. 2002; 71, 375-378.

[6] Costerline J L and Yuoh-Ku. Binding of Zinc to Aole Fiber Wheat Bran and Fiber Components. J Food Sci. 58(2), 365.

[7] Keller A, Dasaules A. The Swiss Soil Monitoring Network: regular measurement of heavy metals in soil and field balances, AROMIS, 24-25, p.p. 73-77, 2003.

[8] EKOENERGHOLDING, Emisija onečišćujućih tvari u zrak na području Republike Hrvatske za 2001. godinu, 2001.

[9] Uputstvo o utvrđivanju dozvoljenih količina štetnih i opasnih materija u zemljištu i metode njihovog ispitivanja, Službene novine Federacije BiH, april 1999