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MICROSCOPIC ANALYSIS AND THE CONTENT OF THE METALS OF THE VEGETAL PRODUCT OF *OCIMUM BASILICUM*

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Abstract

Many spontaneous vegetables or even those grown are used in integral form or as extracts in treating various diseases of the human body. Following legal regulation on medical products based on herbals, more and more companies are able now to produce herbal medicines.

The present paper is analyzing the Ocimum basilicum plant grown away from industrial area, in Oradea, Bihor county by using optical microscopy; followed by the determination of twenty-one metals beneficial and also toxic for human body by X-ray fluorescence.

X-ray fluorescence analysis of Ocimum basilicum reveal that the analyzed vegetable product contains useful metals such as: Ca, K, Mg, Zn, Na, Fe in the concentration range that are useful for specific therapeutic effects. Also, it was observed that the product contains toxic elements (As, Ni, Cr, Mo, Sn, Pb), but in small concentrations below the statutory toxicity limits.

Keywords: *Ocimum basilicum*, microscopic analysis, metals content, X ray fluorescence

INTRODUCTION

Phytotherapy is using plants as full or as total extracts (infusion, macerate, decoctions, and tinctures), in contrast to the allopathic medicine which recommends only certain substances extracted from the plants or chemically synthesized (representing pure active substances). Plants' active principles are a well organized biological complex, based on synergistic actions analogues or compatible with living systems to whom our body is better adapted in comparison with semi synthetic food or synthetic drugs. It is desirable to use the plants as they are or some natural extracts containing full active substances.

In contrast to the synthetic drugs, which are acting strictly on the physical body, plants influence both physical body and also energetic structures, emotional and mental, making a truly and long lasting healing.

Across Europe, including Romania, legal regulation of natural herbal drugs has lead pharmaceutical companies to shift the production to the herbal medicines.

Ocimum basilicum L. is a plant from Lamiaceae family known also as Saint Joseph's Wort, including more then 150 species. Basil is a delicate low-growing plant originally from tropical Asia annually cultivated in Romania, being sensitive to cold, with best growth in hot and dry conditions. Tall between 20 and 60 cm, presenting opposite light green silky leaves of 1.5 – 5 cm longs and 1 – 3 cm wide. The Lamiaceae have flowers five with petals. Have a taste similar with anise, with a strong and sweet smell (Saha S et al, 2012, Ciocârlan V, 2000, De Masi L.et al, 2006, Pallag A et al, 2012).

Fig. 1. Ocimum basilicum plant

Starting from the ancient times plants were used as household remedy against various human ailments. Basil (*Ocimum basilicum*) represent such a perfect "natural drug" which can be used as: analgesic, antiinflamatory, antimicrobial, antioxidant, anti ulcerogenic, cardiac stimulant, chemomodulatorym CNS depressant, hepatoprotective, hypoglycemic, hipolipidemic, imunomodulator and also as larvicidal activitires. During centuries basilicum was used as tonic, vermifuge. Used as hot tea is able to treat flatulence, dysentery, and nausea; as oil is benefical for the alleviation of mental fatigue, cold spasm, and rhinitis, symultaneously can be an efficient treatment for wasp stings (Bilal A et al., 2012, Ramesh B et al, 2010, Muralidharan A et al, 2004, Hussain AI et al, 2008, Chang X et al, 2009).

All these effects can be explained by taking in account the complexity of basilicum proved by preliminary studies. All these results are encouraging and can justify the further study of this natural drug (Javanmardi J et al, 2002, Dymock W et al, 2005, Neelam LD et al, 2010, Jayaweera DMA, 1981, Nadkarni KM., 2005).

Present paper is dealing with microscopic analysis of *Ocimum basilicum* leaves correlated with determination of metallic content into the plant. Metals were determinate by using X-Ray Fluorescence Analysis.

MATERIAL AND METHOD

Analyzed *Ocimum Basilicum* was harvested from Oradea, Bihor county where was cultivated as decorative plant and used as spice in various dishes. Basil was grown in an unfortified soil, in an area relatively far from industrialized area and also away from hazards arising from municipal transportation.

Microscopic analysis was realized by using and optical microscope with 100 and 200 X magnification. Basilicum metal content was determinate with Niton X-Ray fluorescence analyzer.

RESULTS AND DISSCUSIONS

Microscopic analysis

In order to perform the microscopic analyze, after the harvest of fresh basilicum, stains were cut crosswise. The obtained samples were analyzed by optical microscopy using 100 magnifications. Based on the image presented in figure 2, it can confirm the presence of tetragonal outline which is a characteristic for Lamiaceae family.

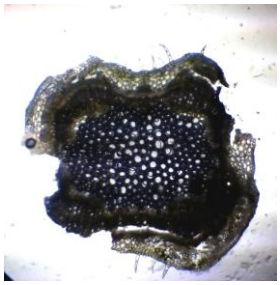
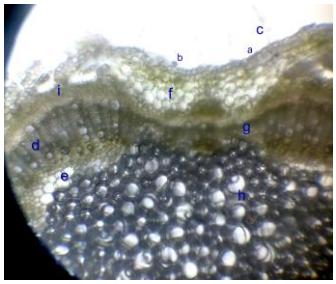


Fig. 2. Cross section through the main stem of Ocimum basilicum L. (100X)

By increasing the magnifications at 200 x it was obtained the crosswise section presented in figure 3 (a, b), where are visible more characteristics. A similar analysis was performed for the leaves cross section, picture not showed in present paper.



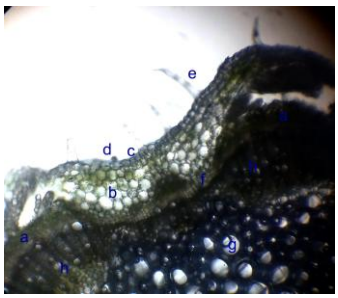


Fig. 3a. Cross section through the main *Fig. 3b. Cross section through the main*

stem of Ocimum basilicum L (200X)
a- single ply epidermis; b- glandular hair; c- multicellular tector hair; d- lyberian elements; e- woody elements; f- cortical parenchyma; g- pericycle; h- meddulary parenchyma; i- angular colenchima.

stem of Ocimum basilicum L (200X)
a- angular colenchima; b-assimilator parenchyma; c- epidermis; d-glandularhair; e-tector hair; f- pericycle; g-meddulary parenchyma; h- lyberian andwoody beam

Detection of metals

Metal detection was realized using Niton XRF techniques on vegetable *Ocimum basilicum* when it was determinate the concentration for twenty-one metals, representing the main components and also the essential traces and possible toxic products. The obtained results are depicted in table 1.

Table 1

Elemental content of three samples containing vegetal product of *Ocimum basilicum*

Sample/Me(µg/g)	Al	Ba	Cu	Ca	Fe	K	Mg	Mn
Sample 1	21.4	0.4	88.6	3554.3	400.4	16879.1	1315.9	13.1
Sample 2	24.3	0.5	87.7	3789.8	398.9	16624.4	1423.7	14.2
Sample 3	22.9	0.4	89.2	4501.1	308.1	16522.2	1310.8	13.7
Sample/Me(µg/g)	Na	Sr	Zn	Cd	Co	Li	Se	
Sample 1	1897.7	60.9	128.9	0.1	0.5	0.7	0.1	
Sample 2	1823.9	62.7	143.1	0.2	0.5	0.7	0.1	
Sample 3	1900.7	63.1	137.6	0.1	0.3	0.8	0.2	

Analyzing the data presented in table 1 can observe that the main metallic component presented in *Basilicum* is potassium. Regarding the human body potassium plays an active role for maintaining the fluids' volume into the body and also represents a great importance for maintaining the equilibrium between acids and electrolytes, keeping in the same time the hearts' health. It can be observed that in all the analyzed samples there was a higher potassium content (figure 4) which it represents a real benefit for the human (and not only) health.

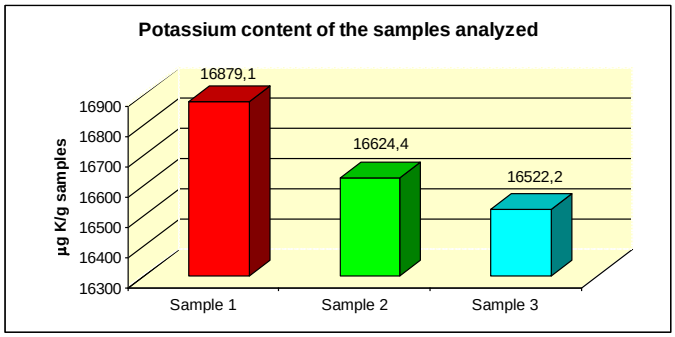


Fig. 4. The potassium content of the three samples analyzed

Also, it can be observed the presence of important quantities of calcium, magnesium and sodium in all there samples. Calcium is presenting an important role in blood coagulation and also in adsorption of Vitamin B12. Laboratory studies reveal that magnesium is a cofactor for more than 300 enzymes, able to regulate some biochemical reactions in the human body, such as: protein synthesis, blood glucose and blood pressure control, and also nerve function (Rude RK. Et al, 2010, Rude RK. Et al, 2012).

Another important metal for the human body is represented by sodium which is regulating the nerve function, and also the blood pressure.

Based on that, it is really important to control carefully the intake of sodium concentrations. Zinc is essential in the human body because of its regulatory activity for the concentration of vitamin A, adjusting the amount in which these vitamins are released in the liver, influencing in this way the body growth and development.

The zinc content in the analyzed samples is into the normal range requirements for humans (4.6 mg day^{-1}) (Senila M et al, 2006), and is not in the range of polluted plants (15 – 100 mg kg^{-1}) (Antal DS., 2005, Antal D.S et al 2005, Humadi S.S. et al, 2009, Saper R.B. et al, 2004).

An important microelement for the human body is represented by copper, which is responsible of the normal development of the brain and nervous system. In the same time it is an antioxidant, defending also the body from free radicals. The presence of cooper in the analyzed samples is in a range of 90 µg for each gram of analyzed product (image depicted in figure 5) it's in the normal range of the daily limit for the human body (900 mg day^{-1}) (https://www.consumerlab.com/RDAs/#Calcium).

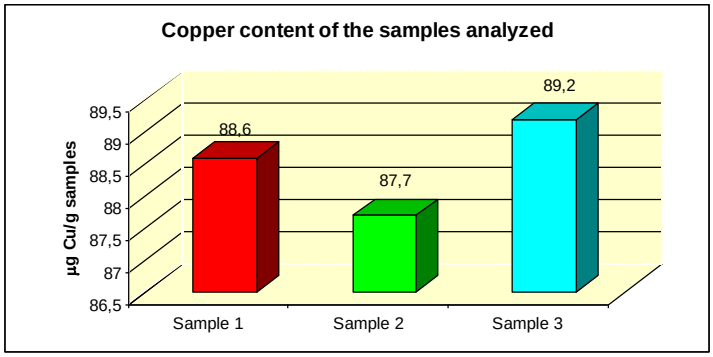


Fig. 5. The copper content of the three samples analyzed

Another important oligoelement, which is present in any cell from the human body, is iron, which influences most of the metabolic processes and it is also important for the respiratory chain (Finberg, K. E., 2008).

Based on the chart presented in the figure 6, it can be observed the presence of this important element in a normal limit for the body consumption (upper daily limit is 40 mg/day) (https://www.consumerlab.com/Calcium).

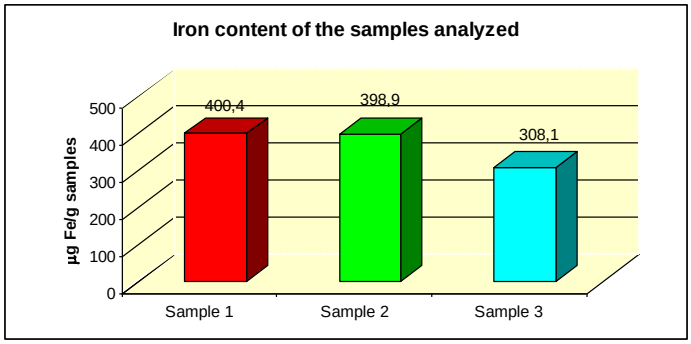


Fig. 6. The iron content of the three samples analyzed

The zinc concentration isn't situated within the range of non-polluting plants (15-100 mg/kg) (Senila M et al, 2006, Antal DS., 2005, Antal D.S et al 2005, Humadi S.S. et al, 2009). The zinc content in medicinal plants is very low, as compared to normative requirements for humans (4,6 mg/day) (Saper R.B. et al, 2004).

In the same time it was analyzed the content of toxic elements in all there samples. The obtained data is presented in table 2. Based on the data presented in table 2, and in conformity with the statutory toxicity limits (Alwakeel S.S., 2008) it can affirm that the content of the studied samples is bellow maximum limit. Based on that it can confirm that *Ocimum basilicum* is safe and it can be recommended for the human daily consumption.

Table 2

Toxic elements content of capsules

Metal (mg/kg)/ sample	As	Cr	Mo	Ni	Sn	Pb
Sample 1	<0.1	0.1	0.2	0.1	<0.1	0.1
Sample 2	0.1	0.1	0.1	0.1	0.1	0.2
Sample 3	0.1	<0.1	0,4	0.1	0,1	0.2

CONCLUSIONS

In the modern human society, the attention to the natural drugs is turning more and more every day. Therefore a lot of “modern” drugs were developed by using plants during the last decades, as a continuation of ancient natural medicine.

The present paper aimed to determine the metal content into three different samples of *Ocimum basilicum*, harvested form unpolluted area of Bihor County.

By analyzing the samples we found that all these contain a big number of metals such as: calcium, potassium, magnesium, zinc, sodium and iron in concentrations which can be beneficial for further human therapeutic effect, also it was observed that the basilicum contains some toxic elements such as As, Ni, Cr, Mo, Sn, Pb but in small quantities, under the statutory toxic limits. Based on that, it can be said that the *Ocimum basilicum* is not harmful for the human health, and also it can be used as a natural medicine, or in daily human consumption.

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