

## EVALUATION OF THE CONTENT OF SELECTED ELEMENTS IN HERBS CULTIVATED IN ORGANIC FARMS IN THE LUBLIN REGION

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### ABSTRACT

Herbal raw materials are widely used in the food, pharmaceutical and cosmetic industries. In the presented studies the content of selected elements in the herbs originating from organic farming in the Lublin region was determined. The research was done for three different herbs: common thyme, pink rock-rose, and nettle by means of an ICP OES SpectroBlue spectrometer. It was shown that the content of heavy metals in the tested samples does not exceed generally accepted norms. The amount of trace in the tested herbs is too low for human health to be the main source to meet the demand. However, they may be a supplement of a daily diet.

### INTRODUCTION

According to the latest research interest in herbal medicine has continued to grow. It is a result of a rapid development of diseases such as cancer, neuroses and allergies, which until recently were considered as incurable. Properly selected herbs bring relief during these diseases and lead to their inhibition or even extinction. The use of herbal blends helps to regenerate the human body, regulate the intestinal flora, purify the blood and all endocrine glands, strengthen the nervous and digestive system. The therapeutic value of herbs is in place due to the presence of specific biologically active substances in them, which are characterized by different chemical compositions and they are located in varying amounts in different parts of plants. Sometimes, herbal plants may exhibit toxic properties, and the difference between therapeutic dose might be very similar to the toxic one. For this reason, the use of herbs requires both expertise and caution (Kozak et al. 2016). Herbal raw materials are widely used in the food, pharmaceutical and cosmetic industries. Herbs can be used in the form of dried, whole or ground/shredded plant parts, their blends, essential oils, herbal extracts, or microcapsules. Because of their aromatic and preservative properties, they are used as natural agents for extending the shelf life of food and as spices. By the term spice plants one refers to plants and parts thereof such as: root, rhizome, bulb, bark, flower, fruit, seed, which due to the specific taste and aroma are used as additives to foods in order to enrich its taste and for medicinal benefits. They are used fresh, dried, or after mechanical treatment, as spices. The intense flavour of some spices is only sensed by sensitive cells located in the mouth, while the lower part of the digestive tract, for example the stomach, has vegetative nervous system, which reacts differently, e.g. pepper is not sensed there at all, but it stimulates secretory function. Considering the important role that selected elements play in human body, as well as their toxicity, the World Health Organization (WHO) has developed daily norms of their consumption. For a human being weighing 70 kg their amounts are equal to: CU-1.5 to 4 mg, Ni-25 to 35 g, Fe-10 to 15 mg, Zn-15 mg, Mn 2.5-6 mg. (Bielecka et al. 2009). Herbal

spices cause secretion of digestive juices that stimulate digestion and intensify secretion of bile from the liver. Choleric action is necessary in the process of digestion of fats, which are frequently present in the diet in excessive quantities. Herbs are used for medicinal and supporting purposes, but principles of proper nutrition are essential as well. Meals flavoured with spices are easier to digest for the body, and in the further part of the digestive system they are not causing bloating, pain, digestive gases, constipation and diarrhoea. Several herbs combined together in appropriate quantities have medical effects in case of many diseases, and regenerate the whole body. In addition, they provide the body with vital substances of medical and nourishing nature. They also possess detoxifying properties, and strengthen the nervous and digestive systems (Górnicka 2011).

Heavy metals are defined as elements with atomic number greater than 20 and having metallic properties (Neri M., et. al. 2003). Within this group there are macro- and micro-elements, necessary for the proper functioning of living organisms e.g. copper, zinc, chromium, iron, as well as those which are unnecessary for the body, for instance, cadmium, lead, and mercury. However, it should be noted that beyond a certain limit they become toxic and are very dangerous for people, animals, and plants (Cicmanec 1996). Toxicity of heavy metals depends primarily on the degree of contamination, but also on the species and the age of the given organism, the way they have been introduced into the body, their chemical form, the type of interaction with other metals, and the physiological state of the body (Maciejewska 2003). Digestive and respiratory systems are the main ways of penetration of metals into the body. Bioaccumulation of metals in a living organism takes place through transfer by blood, and then retaining and accumulation in cell components, mainly nucleus, mitochondria and cell membrane. Therefore, systematic exposure to heavy metals has a negative effect on the morphological parameters of blood, enzyme activity, protein transport activity, and the structure and function of cells, tissues, and organs (Damek-Poprawa et.al. 2000).

## **OBJECTIVES**

The purpose of this work was to evaluate the content of selected heavy metals in three popular herbs originating from organic farming in the Lublin region (Poland). Studied material was used as an addition to the organic herbal and fruit teas.

## **MATERIAL AND METHODS**

The test material consisted of three herbs originating from organic farming in the Lublin region (Poland): common thyme (Latin *Thymus vulgaris*), pink rock-rose (*Cistus L.*), and common nettle (*Urtica dioica L.*)

Content of the following elements was determined: Cu [ppb], Fe [ppm], Mn [ppm], Zn [ppb], Co [ppb], Cd [ppb], Pb [ppb], Ni [ppb], and Cr [ppb].

Samples of herbs were mineralised by acid digestion in concentrated nitric acid and hydrochloric acid using a microwave furnace from Anton Paar company. Microwave power of 800W was used at the max. temperature of 200°C. Mineralization procedure according to Multiwave PRO Classified list of applications, Anton Paar.

The solution obtained was analysed by means of SpectroBlue ICP OES spectrometer. Applied standard: VHGS68-1-500 Element Multi Standard 1 in 5% HNO<sub>3</sub>.

## RESULTS

Table 1. Contents of selected heavy metals in the three herbs from organic farming

	Cu [ppb]	Fe [ppm]	Mn [ppm]	Zn [ppb]	Co [ppb]	Cd [ppb]	Pb [ppb]	Ni [ppb]	Cr [ppb]
common nettle	0.114	0.012	136.9	1.408	0.378	0.08	9.195	0.942	7.514
common thyme	0.114	686.6	259.8	1.408	0.378	0.08	9.195	0.942	7.514
pink rock-rose	0.114	192.3	183.7	1.408	0.378	0.08	9.195	0.942	7.514

The content of heavy metals (Cu, Zn, Co, Cd, Pb, Ni, Cr) was determined in ppb (parts per billion) but Fe and Mn in ppm (parts per milion). Cu content was determined at the same level of 0.114 ppb in all tested herbs. A similar relationship was obtained at the Zn - 1.408 ppb. The content of Co was 0.378 ppb and the Ni content was 0.942 ppb in the tested herbs. Pb content and Cr content were determined at the level of respectively 9.195 ppb and 7.514 ppb independently of the species of herb tested. The Cd content was evaluated at the level of 0.08 ppb for all tested herbs. The content of Fe and Mn metals differed in particular herbs was determined. In the case of iron they fluctuated from 0.012 ppm (Fe) determined in the case of common nettle to 686.6 ppm determined in common thyme, as well as 192.3 ppm determined in the case of pink rock-rose. While, in the case of manganese these values were 136.9 in the case of common nettle, 259.8 ppm in the case of common thyme, and 183.7 ppm in the case of pink rock-rose.

## DISCUSSION

At the present state of the development of inorganic biochemistry heavy metals are considered to be unnecessary or even toxic. Introduced into the body in small individual doses over a longer period of time they may cause acute or chronic poisoning. However, a number of heavy metals is a permanent and indispensable component of any living organism (iron, zinc, copper, manganese, cobalt). Others, such as mercury, lead, cadmium, thallium, and barium are harmful for the body (Maciejewska A. 2003). The results obtained exceed neither the acceptable standards specified in the Ordinance of the Minister of Health of 13 Jan, 2003 (Ordinance of the Minister of Health of 13 Jan, 2003), nor the reference values provided by the WHO (WHO 2007; Commission Regulation (EC) No 1881/2006, 2006), and they were comparable to the results obtained previously by other researchers (Gajewska R., et.al. 2000; Florczak J., et. al. 1996; Łozak A., et.al. 2002).

## CONCLUSION

It has been attested that the content of heavy metals in the tested samples did not exceed the generally accepted standards. In the tested herbs, the amount of trace elements necessary for proper functioning of the body is too low to be the main source to satisfy the demand. However, these herbs can supplement daily diet. There are many researches to develop a suitable method for treating herbal raw materials in the world to eliminate valuable bioactive compounds to protect the consumer from potential biological or chemical toxins are conducted. Unfortunately, these methods are still not satisfactory. It is able to prevent the formation of harmful microbes and parasites as well as heavy metals and other elements toxic for human by using of a suitable controlled cultivation method.

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