CHEMICAL CONTAMINATION OF BEE HONEY – IDENTIFYING SENSOR OF THE ENVIRONMENT POLLUTION

CONTAMINAREA CHIMICĂ A MIERII DE ALBINE – SENZOR DE IDENTIFICAREA A MEDIULUI POLUAT

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ABSTRACT

Changes in the quality of bee honey are also caused by the contamination with micro-polluting agents, toxic to consumers. This research is about chemical contamination of honey. The honey used in this study was harvested from beehives situated in Copșa Mica (Sibiu region), famous for the ecological unbalances induced by the non-ferrous metal industry through pollution produced by SC Sometra SA. The amount of Pb, Cd and Zn contained in the samples harvested in the area specified above have been determined using an atomic absorption spectrometer AAS.

Amounts of heavy metals above the admitted limit by the OMS 975/88 have been discovered.

The results suggested that honey could be used to detect contaminating agents from the environment.

KEY WORDS: honey, contamination, heavy metals, environment pollution indicator

DETAILED ABSTRACT

The researched area Copşa Mică is known on national and international level for the ecological lack of balance induced by the non-ferrous metallurgy.

The Pollution produced by S. C. Sometra S. A. Copşa Mică is of a complex nature, because of SO_2 emissions and heavy metals (Pb, Cd, Zn, Cu, As). The activity type which is carried on is the production of lead and zinc from mining concentrations and the capitalization of other metals like Sb, Bi, Cd and other derivations of these. The researches made, tried to point out the relationship between the concentrations of heavy metals found in honey from the studied area compared with the one found in the unpolluted areas. In the honey batches of different types taken from the Beekeepers Association from unpolluted areas of Sibiu district, was pointed out the presence of heavy metals, their concentration was framed in the accepted limits. The exception is made by the dark honey, where the Zn and Cd concentration is a little bigger then the maximum admitted. The obtained results are showed in chart 1.1. and 1.2. The zinc presence in honey is benefic, being a micro-nourishment of everything that is alive, of course with the condition of being in the imposed limits. The presence of cadmium and lead is a signal which points out the presence of micro-pollutants in the environment. Another aspect of this research was the analysis of some honey samples, donated by the individual manufacturers from Copşa Mică area – Mediaş – Dumbrăveni. It has been chosen 5 places where the beehives were positioned, at different distances from the polluted area. In this case it was determined the content of hard metals in ploy-flora and acacia honey samples (see chart 1.3., 1.4., 1.5.). After analyzing the results we found out that the content of hard metals outruns the accepted limits in both types of honey resulted from the Valea Viilor and Baraj Ighiş area. These findings let us appreciate that the pollutions with heavy metals is felt in these areas and that the impact is negative over all types of factors: environment, vegetation, fauna and food stuff. Even if in the analyzed samples from other areas, the content of heavy metals is in the accepted limits, the presence of these micro-pollutants in honey shows the fact that the cloud of pollution produced by the emanation from Sometra Copşa Mică is felt at larger distances like Slimnic, Ruşi, Şeica Mică and Dumbrăveni area, being a part from the lower polluted area. Thru comparative analysis of honey samples resulted from the same areas but for different types of honey: poly-flora and acacia, it can be pointed out that the acacia honey gathers heavy metals in larger quantities. We comparatively present the content of hard metals in poly-flora and acacia honey resulted from the same area, from the same beehives. The storage of heavy metals thru primary or secondary contamination of the atmosphere and ground has negative repercussions and affects the trofic chain.

INTRODUCTION

Honey possesses numerous nutritional, healing, and prophylactic properties. These are a direct consequence of its chemical composition. In order to have a beneficial effect honey must be free of any contaminating agents.

Any heavy metals present in honey above the admitted levels by pollution standards, are threats to human body through the possible negative effect of the contaminants. Even though a lot of research focuses on pollution in general, not a lot of work has been related to pollution with heavy metals.

The chosen research area is already known nationally and internationally for the ecological unbalances produced by the non-ferrous metal industry. The pollution produced by S.C. Sometra S.A. Copşa Mică is of a complex nature particularly because of SO_2 emissions and heavy metals (Pb, Cd, Zn, Cu, As). The company mainly refines Zn and Pb from ore but also synthesise other metals like Sb, Bi, Cd and related compounds. Honey samples were collected from hives situated at least 8-25km away from the polluting source.

The purpose of this study was to find a link between the amount of heavy metals found in the samples from the possibly contaminated area and the samples from the pollution free areas.

MATERIALS AND METHODS

The natural honey samples were donated by the Sibiu Apiculture Association and by private farmers from Ruşi, Valea Viilor, Şeica Mare, Ighiş, Dumbrăveni areas.

The hives from the areas mentioned above were kept in the same position during this study [1, 2, 3]. Data presented in the tables below is an average of 10 honey samples from each area.

The sample analysis have followed standard methods for detecting heavy metals approved by STAS 784/2-1989, in Romania [7]. Atomic absorption spectrophotometry (AAS) was used for heavy metal detection [4, 5].

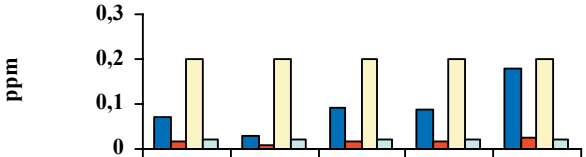
Sample preparation

5 g of honey were placed in a small container and heated until turned into caramel and then placed on the flame and burned further until the sample stops smoking. The container is then placed in an electric oven and heated to 700^{o}C until calcinated for 3 hours. The resulted ash is

cooled to room temperature and then dissolved in 5 ml solution of nitric acid (1:6). The solution is then heated until evaporated to half its volume. The solution is then poured into a volumetric and topped up to 25 ml with distilled water.

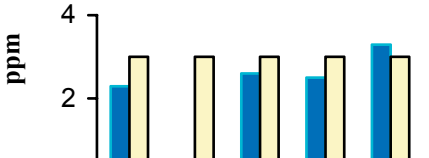
RESULTS AND DISCUSSIONS

In the tables below the results of the samples from the Apiculture Association of Sibiu pollution free areas are presented. Also the maximum admitted levels (MAL) of Pb, , Cd, and Zn set by OMS 975/88 are shown for comparison (see figure 1.1 and figure 1.2).



	Mixed flowers	Rape	Linden tree	Acacia tree	Dark
Pb	0,07	0,03	0,09	0,089	0,18
Cd	0,015	0,008	0,018	0,017	0,027
MAL Pb	0,2	0,2	0,2	0,2	0,2
MAL Cd	0,02	0,02	0,02	0,02	0,02

Figure 1.1. Pb and Cd content in honey samples from the unpolluted areas.



	Mixe	Rape	Linde	Acaci	Dark
Zn	2,3	0,2	2,6	2,5	3,3
MAL Zn	3	3	3	3	3

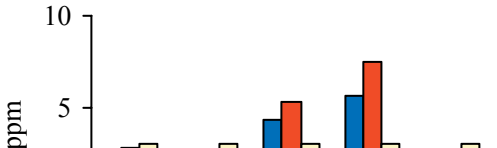
Figure 1.2. Zn content in honey samples from the unpolluted areas.

As seen in the figures above, the levels of Pb, Cd and Zn are below the (MAL) for all tested honey samples except Dark honey which has a slightly higher level of Zn and Cd than the (MAL). Another result is that Linden Tree honey and Acacia Tree honey contain higher levels of microelements than Rape honey. This might be due to the fact that perennial plants store heavy metals differently in comparison with trees. The presence of Zn in the biota is beneficial, being one of its micronutrients, as long as it does not exceed (MAL). The presence of Cd and Pb in honey is already an evidence of micropolluting agents in the environment.

Higher content of Cd and Zn in Dark honey than the (MAL) could be used to assess the qualitative changes induced by pollution to honey [1].

The second study was the analysis of honey samples donated by private farmers from Copşa Mică – Mediaş - Dumbrăaveni. Samples from 5 different locations with hives were chosen, situated between 8-25 km away from the polluting source. The amount of Pb, Cd, and Zn was determined in two types of honey, Mixed flowers and Acacia tree honey.

The results are presented in figures 1.3, 1.4, 1.5, below.



	Slimnic-Ruşi	Şeica-Mare	Valea Viilor	Baraj Ighiş	Dumbră veni
Mixed Flowers	2,5	2,2	4,3	5,6	1,8
Acacia Tree	2,8	2,4	5,3	7,5	2,3
MAL Zn	3	3	3	3	3

Figura 1.3. Zn content in honey samples from the polluted areas.

	Slimnic-Ruşi	Şeica - Mare	Valea Viilor	Baraj Ighiş	Dumbră-veni
Mixed Flowers	0,015	0,018	0,028	0,032	0,016
Acacia Tree	0,02	0,024	0,03	0,12	0,018
MAL Cd	0,02	0,02	0,02	0,02	0,02

Figure 1.4. Cd content in honey samples from the polluted areas.

The amount of heavy metals exceeds the (MAL) in Mixed Flowers honey and in Acacia Tree honey coming from the hives situated in Valea Viilor and Baraj Ighiş (closest to the polluting source). Even though in the analysed samples from the other research areas, the content of heavy metals is below the (MAL), the presence of these micro polluting agents proves that the effect of the polluting clouds produced by Sometra Copşa Mică is still present even at larger distances like Slimnic Ruşi, Şeica

Mare and Dumbrăveni.

Following a comparison of the results from figures 1.3, 1.4 and 1.5 of Mixed Flowers honey and Acacia Tree honey, it is evident that in most cases the latter accumulates significantly more Cd, Pb, and Zn.

CONCLUSIONS

- The results of this study also confirmed the pollution present in Copşa Mica area and prove another method of assessing the degree of pollution of the environment at a particular distance from the polluting source.
- In all analysed honey samples the presence of heavy metals like Cd, Zn, and Pb was detected [5].
- These results also confirm the dispersion away from the source of the polluting clouds.

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