HEAVY METALS CONTAMINATION LEVEL OF BLACK LOCUST FLOWERS

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Abstract

Because of the important, major honey producer species, but also herbal medicine and culinary plants, the quality of the black locust flowers should be qualitatively veryfied. The contamination of the flowers with heavy metals may appear especially around some industrial platforms that emit polluting agents in the environement. Although the S. C. Sometra S.A.stopped its major activity in January 2009 the vegetation from sourrounding area is still accumulating important quantities of heavy metals in high concentrations that overpass the acceptable maximum limits.

Key words: heavy metals, toxicity, health promoting species, black locust, honey producer species.

INTRODUCTION

In a last few decades the natural cycling of trace elements has been perturbed by anthropogenic causes due to growing human acivities. Elements from anthropogenic sources cause athmosphere, soil and water pollution. The main soil polluters in order to food chain contamination are:fertilizers,agricultural chemicals,compost,sewage sluge, and waste disposal. Atmospheric deposition derives from traffic, combustion emissions, smelting and mining processes causing long distance pollution. Airborne particles achieve soil or plant surfaces by dry or wet deposition. Transport of particles depend on the source and on meteorological conditions (Mamiroli, N.et al, 2008). Herbal drugs derive from terrestrial or aquatic origin. Herbal medicines ,labeled products that contain active health promoting ingredients come from a plant or multiple plants. Herbal medicines mai mountain addition of ingredients to the active ingredient.Natural medicinal products are highly demended in developing and developed countries due to affordable prieces, nontoxicity and minimum side effects (Prasad M.N.V, 2008).

Various plants know as medicinal herbs have been used for a very long time in therapeutics to cure illness or as dietary supplements.(Caldas E.D,2004, Kabata-Pendias, A, 2011). Accordind WHO, 80% of the population of developing countries still use tradicional medicines in plant drug forms (Prasad M.N.V, 2008). According to this autor millions of rural household worldwide use medicinal plants collected directly from environement, many people seeking remedies and health approaches free from the side effects of chemical synthesized drugs. In bioaviabilities studies metals of major interest are :Al,As,Be,Cd,Cr,Cu,Hg,Ni,Pb,Se,Sb because of their potential for human exposure and increased health risk (John D. et al, 1995).

Heavy metals toxic effects concerning human health. Lead toxicology

Lead is accumulated over a lifetime and relesed wery slowly, with a half-life in blood around 25 days. Lead can accumulate in human tissues and organs though it is no needed nutritionally. In human body inhibit hematopiesis, causing anemia, affects kidneys inducing renal tubular dysfunction. Affecting the gastrointestinal tract, exhibit nausea, anorexie, abdominal colics. Pb poisoning can also manifest muscle aches and joint pain and lung damage (Ming H.Y., 2005).

Cadmium toxicology

The toxic effects of Cd has been observed after the Second World War and in the early 70's from the "itai-itai" diseases appeared in a district of Japan. The pathology of "itai-itai" disease was severe bone deformation, osteomalacia, frecvent bone fractures. The factor that cause the disease was the Cd containing river water contaminated from mining activities, used for irrigation of rice fields. Cd has no known functions in the human body. The acute effects of intake are vomiting and diarrhea. Chronic poisoning exhibit slight kidney damage which results in proteinuria, followed kidney by severe damage, osteomalacia and osteoporosis. The International Agency for Research on Cancer(IARC) has classified Cd as carcinogenic for humans with allot of evidence for lung cancer and limited evidence for kidney, liver and prostate cancer (Jorhem L.2003).

Cooper role in human body

Copper is an essential metal component of several copper-enzymes acting as a cofactor and as an allosteric component. Dietary copper intake and total copper exposure, should consider that copper is an essential nutrient with potential toxicity if the load exceeds tolerance. A range of safe intakes should be defined to prevent deficiency and toxicity(Uauy R.et al.,1998).

Cu deficiency in humans is a rare exception. The National accepted limit for Cu in tea is 50mg·kg⁻¹product.(G.O. 975/1998.)

Zinc essentiality for human organism

Zinc play an important role especially in protein, carbohydrate and DNA metabolism, entering also in the composition of 300 enzymes and proteins (Stef et al.,2010). The ingestion of high quantities of Zn affects the gastrointestinal tract producing diarrhea and fever.(Kabata-Pendias A.,et al., 2007). The National accepted limit for Zn in tea is 50 1mg·kg⁻¹ product.(G.O. 975/1998,*WHO, 2011).

Heavy metals in herbal medicines

Most medicinal plants can accumulate large amounts of trace elements than other plants.Ernst,2002,quoted by Kabata-Pendias, 2011 report high Hg,Pb,As levels in Asian herbal medicines. Zhang R. et al., 2007 report high trace metal concentrations in tea leaves: 0,06mg·kg⁻¹ Cd,0,43mg·kg⁻¹ Cr,12,8mg·kg⁻¹ Cu,3,13mg·kg⁻¹ Ni,1,56mg·kg⁻¹ Pb and 17,2mg·kg⁻¹ Zn. In 2002 the Medicines Safety Authority of the Ministry of Health din New Zealand withdrew from the market several traditional Chinese medicines because they had a considerable content of toxic substances in particular As. A total of 54 samples of Asian remedies from Vietnam, Hong Kong, Florida and New Jersey were analyzed for heavy metal contamination and the conclusion was that 74 % samples were over published guidelines and 49 % presented toxic concentrations (Aronson J., 2007).

Black locust's health promoting importance. Uses of black locust flowers

The black locus flowers are therapeutically used, and they also have healing purpose in treating the psycho-somatic affections connected with emotional tension conditions, nervous exhausting conditions, insomnia, depressions, the anxiety state, the uncontrolled reactions to stress, the headaches, the balance disorder visual and memory disorder.

Grigorescu in 1986, quoted by Beldeanu E.C. 2004, showed that used under infusion form, the black locust flowers fight against the rheumatical diseases, stomach hyperacidity, viroses, flu, asma, breathing and pulmonary affections, convulsive cough, having anti-coughness and stimulatory properties of the bronchitis secretions.

The black locust flowers represent the raw material for the perfume industry owed to the aromethical components. They are also used in gastronomy, they are put in the dough of some panification products (pie dough) or the black locust flowers are also used in the preparation of the jam, jelly, salads, syrup or different drinks, cold and warm tea, and cider.

Major honey producer reputation of black locust

Being a food product as well as a medicine, the black locust honey is recommended to be used in asthenia, nevroses, in the convalescence condition, for the lack of apetite especially at children, is also a stimulator of the imunatory system, having energetical, antiseptical, antiacides, antibactherial properties and facilitate digestion.

MATERIALS AND METHODS

Black locust flowers were sampled in June 2010. Unwashed flowers was dried at 60°C and grinded. 0,3-0,5 grams of each dry sample were dryashed in concentrated HNO3 Merck extra pure (65%concentration) + H2O2 (30% concentration) using the mineralization microwave, Berghof MWS-2. Pb, Zn, Cd and Cu concentration samples were estimated by an atomic absorption spectrometer Perkin Elmer AAnalyst 800, acetylene-air flame. The analysis was repeated two times. The absorbance was measured at a wavelength of 283,5 nm for Pb, 228,8 nm for Cd, 213,9 nm for Zn and 324,8 nm for Cu using background correction.

RESULTS AND DISCUSSIONS

Through the statistical processing of the preliminary data it has been observed the evident contamination of the black locust flowers from the sampling areas located around the industrial platform at Copsa Mica, the most heavy polluted area(Alexa B.et al, 2004).

Localisation of sampling plots is reprezented in fig.1



Fig. 1 Localisation of sampling areas around Copsa Mica city

Figure 2 compares the quantities of the studied heavy metals accumulated in black locust flowers according the sampling plots, noticing ascendental trend of the Zn concentration between S1-S3 and S8-S13. The highest Cd value being recorded in the S5 sampling area, while the variation amplitude of the Cu is small.



The highest concentration of acumulated Pb is recorded in S5, the Pb concentrations from S8-S13 being closed to one another(fig.3).



Fig.3 Pb accumulation in black locust flowers according to sampling plots

In the Cd case (fig.4), the maximum concentration is noted in S4,S10 and S13 at a distance from the polluting source which shows a large dispersion of the pollution agents with Cd.



Fig. 4 Cd accumulation in black locust flowers according to sampling plots

The Zn accumulation shows an irregular trend with the maximum concentration in S3 situated west of the main polluting source(fig.5).



Fig. 5 Zn accumulation in black locust flowers according to sampling plots

The maximum concentration for the Cu can be observed in S2, S5, S7 while the values from the S11, S12, S13 (at westerly direction from the main pollution source) have an almost lineary trend (fig.6).



Fig. 6 Cu accumulation in black locust flowers according to sampling plots

CONCLUSIONS

Although the major activity of the main polluting agent stopped in January 2009, the historical pollution reflects itself in the quality of some health promoting an economically important forest products. The concentrations of the selected heavy metals are taking into consideration the sampling plots the distance, and the geographical orientation of the sampling plot.

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** Excerpt from Romanian Ministry of Public Health Ordinance no 975/1998. Maximum limits accepted for heavy metal in foods.