Slovak Geol. Mag., 9, 2 – 3(2003),177 – 179

The Environmental Risks in Regard to Production and Collection of Selected Medicinal Plants Species

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Abstract. The important and complex environment problems for very longtime are a pollution of fair, soil and water by xenobiotics. There are anorganic (heavy metals) and organic components (pesticide residues), which are not the natural origin or their quantity in ecosystem can be effected from unhealthy to toxic. The largest catastrophe in history of civil using of nuclear energy was in Chernobyl, Ukraine, in April 26th, 1986. The radioactivity has effected to vegetation in the Slovak Republic even if the Chernobyl crash was many years ago. The medical quality and effect of medicinal plants are depended on the conditions of environment, which is influenced direct to their grow on the place of an occurrence and cultivation.

Environmental risks (content of heavy metals, pesticide residues and radioactivity) in regard to production and collection of medicinal plants (Chamomile, Calendula, Linden, Mallow, Peppermint) was determined by the analytical methods. In spite of the results, the trace xenobiotic values and radioactivity of medicinal plants were stated. The results were compared by the Slovak Republic legislation. The heavy metal, pesticide residues contents and radioctivity of medicinal plant samples are not higher than the maximum permissible concentration and radiation in regard to the Regulation No. 14/1996 & No. 12/2001 of the Ministry of Healthy Service in Slovak Republic. These raw materials can be accepted on the market with medicinal plants in the world.

Key words: medicinal plants, heavy metals, residue pesticides, radioactivity

Introduction

The important and complex environment problems for very longtime are a pollution of fair, soil and water by xenobiotics. There are anorganic (heavy metals) and organic components (pesticide residues), which are not the natural origin or their quantity in ecosystem can be effected from unhealthy to toxic. The largest catastrophe in history of civil using of nuclear energy was in Chernobyl, Ukraine, in April 26th, 1986. The radioactivity has effected to vegetation in the Slovak Republic even if the Chernobyl crash was many years ago. The medical quality and effect of medicinal plants are depended on the conditions of environment, which is influenced direct to their grow on the place of an occurrence and cultivation. In regard to medicinal plant market, it is very important to determine the hazard values of herb goods to domestic and foreign customers and compare their with the regulation on the highest permissible toxic effects in food, which are notified by the Slovak legislation.

The aim of contribution is determination of heavy metal and pesticide residue contents and radioactivity in selected medicinal plants, which are collected and produced in Slovak Republic during last years.

Material and Methods

The conserve plant parts (flowers and herbs) by drying of Chamomile (*Matricaria recutita* L.), Calendula (*Calendula officinalis* L.), Linden (*Tilia cordata* L.), Mallow (*Malva mauritiana* L.) and Peppermint (*Menta piperita* L.) were used to our measurement. This plant material was originated from a wild plant collection and large-scale cultivation of these medicinal plants in Slovak Republic in years: 2000, 2001 and 2002.

Determination of Heavy Metals

The herbal samples for the heavy metal determination were decomposed by 10 ml HNO_3 and 1 ml H_2O_2 into vessels, which were given in a pressure autoclave. Mineralization was taken place at the temperature 150 ^{0}C during 5 hours. The AAS results for Cd, Pb, Cr, Ni, Cu and Zn were obtained using SHIMADZU, model 660, with Graphite fumace, deuterium background corrector and auto-sampler. Sample volumes were 20 ul. The AAS resutls for Hg were obtained using hydride vapor generation technique SHIMADZU, model HVG-1.

The quantity values of heavy metal and element contents obtained in the single medicinal plants are compared with the highest permissible concentrations according to the Regulation No. 14/1996 from the Ministry of Healthy Service in Slovak Republic.

Determination of Pesticide Residues

The pesticide residues were determined by the GC-method with an application of equipments: type Varian Star, model 3,400, and Varian Star, model 3,800; the detector ECD after plant sample arrange. Identification of

these risky components was made on base of retentive characteristics comparing between them and standard compound. All these chemical analysis were carried out in the Ecological & Veterinary Laboratories in Spisska Nova Ves, Slovakia.

The quantity values of pesticide residues obtained in plant materials are compared with the highest permissible concentrations according to the Regulation No. 14/1996 from the Ministry of Healthy Service in Slovak Republic.

Radioactivity Tests

The conserve plants were used to determination of the mass radio-nuclide activities. The gama-spectrometric determination of selected medicinal plants by the HPGe detector with using of Cesium (^{134}Cs & ^{137}Cs), Americium (^{241}Am), Potassium (^{40}K), Radium (^{226}Ra) and Thorium (^{232}Th) radio nuclides was carried out at the Special State Health Institute, Department of Health Protection against the Radioactivity in Banska Bystrica, Slovakia.

The quantity values of radioactivity obtained in these flower and herbal materials are compared with the highest permissible concentrations according to the Regulation No. 12/2001 from the Ministry of Healthy Service in Slovak Republic.

Results and Discussion

The heavy metals, as one from foot element groups, have a very important ecological significance, which is given their toxicity and accumulation ability. Influence of heavy metals for environment is more expressive their any degradation. The determined heavy metal contents and additional microelements in the medicinal plant drugs (note: substances used as or in medicine) are presented in table 1.

Table 1:Determination of heavy metals and additional microelements quantities in selected medicinal plants.

	Cadmium [Cd]	Lead [Pb]	Mercury [Hg]	Chrome [Cr]	Nickel [Ni]	Cuprum [Cu]	Zinc [Zn]
	[mg.kg^{-1}]						
Chamomile flower drug	0.180	0.315	0.002	0.267	1.67	13.08	12.90
Calendula flower drug	0.078	0.225	0.003	0.154	0.87	15.05	20.89
Linden flower drug	0.095	0.756	0.011	0.360	0.55	10.89	10.21
Mallow flower drug	0.028	0.158	0.002	0.095	1.90	19.02	21.18
Peppermint herbal drug	0.021	0.086	0.005	0.102	1.55	18.77	23.52

Table 2:Results of residue pesticide determination into the medicinal plant drugs.

Residue pesticides [mg.kg^{-1}]	Chamomile flower drug	Calendula flower drug	Linden flower drug	Mallow flower drug	Peppermint herbal drug
aldrine + dieldrine	< 0.0005	< 0.0005	0.0023	0.0020	0.0007
alfa-hexachlorecyclohexane	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
beta-hexachlorecyclohexane	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
delta-hexachlorecyclohexane	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
eldrine aldehyde	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
endrine	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
endrine ketone	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
endosulphane sulphate	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
endosulphane I	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
endosulphane II	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
gama-hexachlorecyclohexane	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
hexachlorebenzene	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
chloreepoxide+heptachlore	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
heptachlore	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
metoxychlore	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
sum DDT	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005

Table 3:The flower and herbal drugs of selected medicinal plants and their radioactivity.

	natural radionuclides			artificial radionuclides		
[Bq.kg^{-1} of plant sample]	^{232}Th	^{226}Ra	^{40}K	^{241}Am	^{137}Cs	^{134}Cs
Chamomile flower drug	< 5.9	< 4.0	44	< 4.7	< 1.7	< 1.8
Calendula flower drug	< 3.5	< 0.5	25	< 1.3	< 0.8	< 0.9
Linden flower drug	< 6.4	< 3.4	365 ± 35	< 4.3	4.4 ± 0.6	< 4.3
Mallow flower drug	< 2.1	< 0.8	10 ± 5	< 2.0	< 0.5	< 0.6
Peppermint herbal drug	< 3.6	< 1.7	330 ± 30	< 2.1	< 0.8	< 0.8

The very unfavourable comparative of heavy metal concentration (Cd and Pb) in medicinal plant rawmaterials, which were obtained from the cultivation in Scotland, Findland and in the Central Europe was published in 1994 (Svoboda & Gough). The medicinal plant drugs from our area (the Central Europe) were contamined by double quantities of Cadmium and Lead concentrations more than another rawmaterials.

The need of better preparations to manage of wide range of the harmful gents (weeds, diseases and pests) of cultivate crops is determined the massive character of the synthetic chemical preparations, which use very often in regard to medicinal plant cultivation. The very problematic question is a metabolism and degradation of pesticides in the single plant species. (Schuphan, Schmidt & Veit, 1990). The present production of the special crops is not possible without direct pesticide application. On the other hand, a control of pesticide residues in individual phases of ontogenetic plant development and into the final product or yield is inevitable (Oravec, Buben, Černaj, Repčák & Hončariv, 1981). Table 2 illustrates the values of determined residue pesticides in the medicinal plant drugs.

Characteristics of mass radio-nuclide activities of ^{232}Th, ^{226}Ra, ^{40}K, ^{241}Am, ^{134}Cs, and ^{137}Cs in $Bq.kg^{-1}$ of plant materials are presented in table 3.

Measures of mass radio-nuclide activities of medicinal plant drugs have not carried out yet; the results are original. It was determined that radioactivity of individual medicinal plant species are dependent on time and exposure in a space. The flowers of Linden are growth in tree height, where their exposure is very high. The radioactivity results of Linden flowers were confirmed this predication.

There are medicinal plants, which exposure on the high places is continued several years. Icelandic Lichen, *Cetraria islandica* /L./Ach., can be a good example. This thallophytic plant is occurred on the rocks in the High and Low Tatras (the Slovak parts of Carpathian Mountains). In regard to radioactivity determination of Icelandic Lichen thallus were gotten at from 350 to 600 $Bq.kg^{-1}$ of ^{134}Cs & ^{137}Cs mass radio-nuclide activities.

Conclusion

Legislation of state in regard to hazardous interactions in environment is connected with human consciousness, control and measurement of chemical, physic-chemical and physical measurement and their influence for biological systems. At present is very important to introduce the Europe environment recommendations.

Environmental risks (content of heavy metals, pesticide residues and radioactivity) in regard to production and collection of medicinal plants (Chamomile, Calendula, Linden, Mallow, Peppermint) was determined by the analytical methods. The results were compared by the Slovak Republic legislation. In spite of the results, the trace xenobiotic values and radioactivity of medicinal plants were stated. These raw materials can be accepted on the market with medicinal plants in the world.

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