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FACTORS WHICH IMPACT THE RELEASING AND BINDING OF HEAVY METALS IN SOIL SOLUTION

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ABSTRACT
Soil is system, where heavy metals, such as lead, cadmium, copper, etc., can be present in higher concentration then it is usual. Heavy metals are usually present in soil, bounded to clay, but if some conditions, such as pH, acidity, have been changed, then they are released to the soil solution.
This work is going to present factors, such as pH, acidity, organic matter content, etc., which have impact on releasing of heavy metals to the soil, and forward to plants. The content of heavy metals in soil solution, such as lead, copper, etc. depend on above mentioned factors, and for different soil conditions, such as organic matter and pH, as the most important factor for binding and releasing of heavy metals from and to soil will be presented.
Key words: heavy metals, lead, copper, organic matte, pH, soil

1. INTRODUCTION

In order to define the ammount of heavy metals which enter the food chain through soil – plant – human beings, it is necessary to define the part of heavy metals which will enter plants. Heavy metals from air can reach into soil either by dry deposition or by rain[1]. When heavy metals reach into soil, they are settled into sediment in the form of carbonates, sulphates and sulphides. Taking into consideration that they are bond to the adsorption complex, and if bonding capacity is reduced, heavy metals are realised to the water soil solution [2].
Total concentrations of heavy metals in soil, water and in food are not useful for the estimating of their bioavailable form. Accoridng to above mentioned, there are some factors which regulate heavy metals' bioavalibilty such as pH, disolved organic carbon, ox-redox potential, capacities of exchange anions and cations, etc., as well as free places for binding of heavy metals [2], [3].
The minkind activiteis through the development of technology, industry have led to the high potential sources of heavy metals, which can reach to the food chain through soil [5].
Critical concentrations of heavy metals in agriculture soil are consequence of the application of agri-technical measures such as watering using industrial and comunal waters, application of different types of pesticides, mineral and organic nutrients [7], [8]. The presence of heavy metals in soil is dependent on type of soil, its physical and chemical activities, as well as on their accumulation in plants [8], [9].

2. MATERIALS AND METHODS

Preparation of samples was performed by conventional methods of digestion; dry burning and wet mineralization. Copper and lead was determined by simultaneous and individual analyses.
Standard solutions for heavy metals determinations used in experiment are suprapure chemicals produced by Merck.

Analyses of copper and lead were performed in various supporting electrolytes, including, KNO_3, KCl with the following instrumental parameters such as Working Electrode (WRK): HMDE; Referent Electrode (REF): Ag/AgCl (1 M KCl), E = 0.22 V, and the equipment which were used in experimental work was:
Electrochemical Cell, Princeton Applied Research (EG & G) model 303A with Working (HMDE), Referent (Ag/AgCl) and Supporting (Pt-wire) Electrode, Potenciostat/Galvanostat, PAR, model 263 A, Computer P II with software Model 270/250 Research Electrochemistry Software, version 4.3.

3. RESULTS AND DISCUSSION

In the next figure, the funcionalty of copper content and pH of soil has been presented.

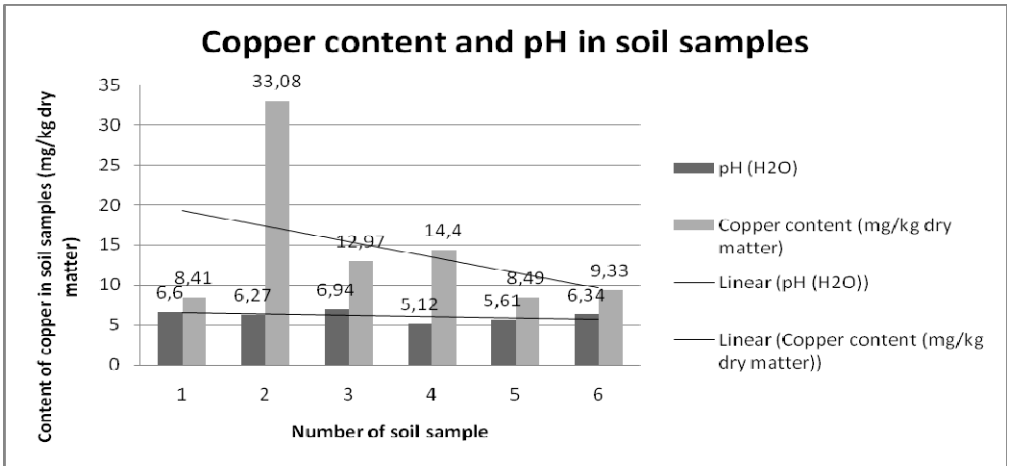

Figure 1. Funcionality of copper content and pH in soil samples

As it is shown, the figure 1. Presents the funcionality of total copper content and pH in soil, and after linerization, the data show the slight reduction of copper content with pH reduction. The highest concentration of copper in soil, was determined in sample no. 2., 33,08 mg/kg of dry matter, and the lowest in soil sample no. 1., 8,41 mg/kg of dry matter. The next figure show the funcionality of copper content and organic matter in soil samples.

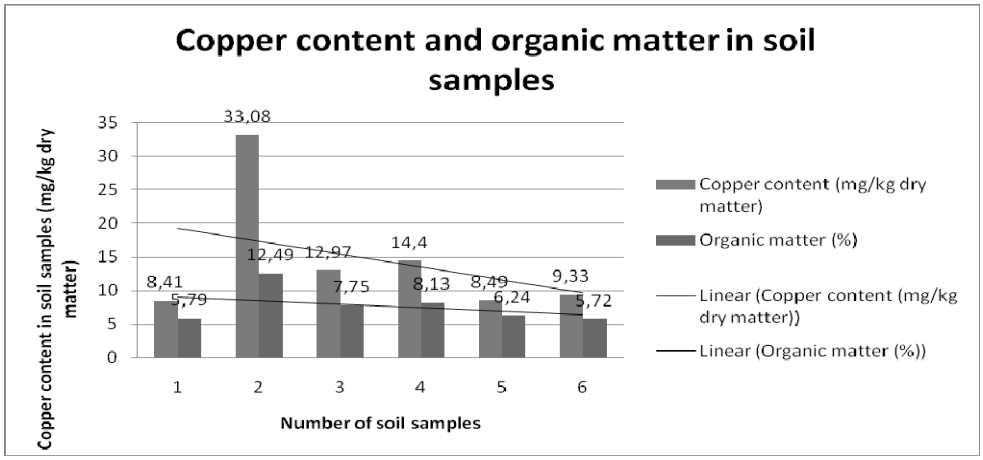

Figure 2. Funcionality of copper content and organic matter in soil samples

As above mentioned, the data presented on figure no. 2., after their linearisation show the reduction of copper content with the reduction of organic matter. The highest value of organic matter, was in soil sample no. 2. 12,49 %, and the lowest in sample no. 6., 5,72 %. The next figure presents the funcionalty of lead and pH in soil samples.

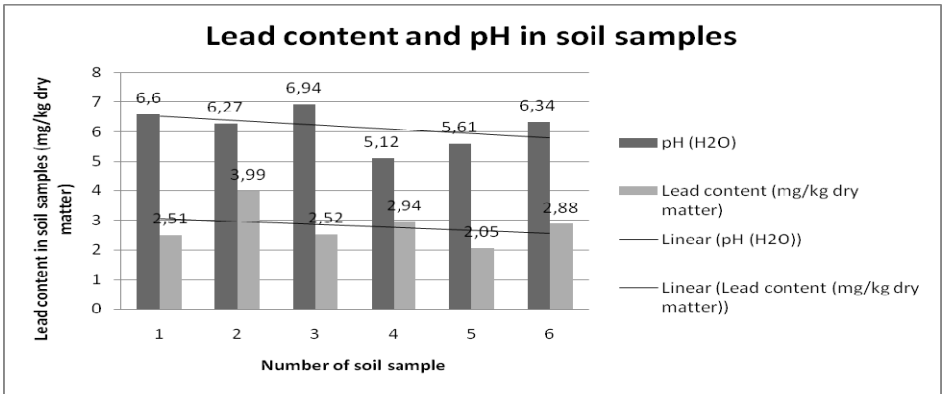

Figure 3. Funcionality of lead content and pH in soil samples

On figure no. 3., functional dependance of lead content and pH in soil samples has been presented. The highest value of pH was in soil sample 3., 6,94, and the lowest in sample 4., 5,12, but the lead content was different, and its value in sample 4, was higher, 2,94 in sample 4, and 2,52 in sample 3, mg/kg of dry matter, resepctively.

In figure 4, there is a funcionality of lead content in soil and organic matter.

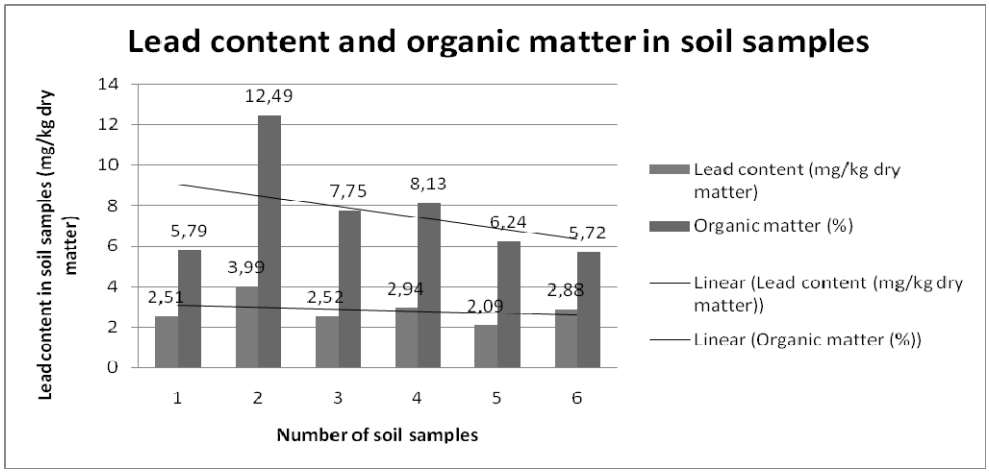

Figure 4. Funcionality of lead content and organic matter in soil samples

The reduction of lead content and organic matter in soil samples has been presented, on figure 4. The highest value of lead content was in soil sample 3,99 mg/kg of dry matter and the lowest in sample 5, 2,09 mg/kg of dry matter.

4. CONCLUSIONS

1. Copper and lead is bond in different forms in soil, and soil conditions must be changed for its binding and realising;
2. The linearisation of data for pH, acidity of soil and organic matter and content fo copper and lead in soil, have shwon the reduction of heavy mateals concentration with the changing of those two soil parameters;
3. The soil is very complex system, including organic matter, clay and soil solution, which has to be researched;
4. The data have shown that heavy metals can bond and released from and to soil solution, depending on two main paramiters, e.g. pH and organic matter.

5. REFERENCES

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