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Transport of pb in soil columns and ground water (Case study: Gorgan site)

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ABSTRACT
Nowadays, the quality of soil and water sources is affected by Different Contaminants. One of the important polluting chemicals is pb. pb is a heavy metal whose illegal amounts in soil and underground water is a sever threat to human life, and it causes health problems such as breathing problems as well as lung and kidney cancer. Golestan province, according to received reports, has illegal amount of pb in its soil and ground water. Regarding the importance of the issue, this study has been done in time and distance interval in boths horizontal and vertical directions for the purpose of analyzing pb movement in soil column and ground water. For this purpose, 250 liters of influent solution containing 0.5 and 3 mg.l-1 pb were injected in two pieces of land in Gorgan site. The results of this research showed that in both vertical and horizontal dimension the concentrations of pb decreases by the increase of time and distance. And, by regarding the decreasing speed of concentrations in horizontal dimension, it can be said that pb is not distributed horizontally in this region.
Key words*: movement, soil column , ground water*

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INTRODUCTION

Pb is considered one of the least plentiful but most toxic element in the earth's crust. pb is mobilized in the environment through natural prosses of weathering ,disposal of human,animal,and plant wastes, emission of volcanic ashes and fossil fuel burning. Lead is in group IV A of periodic table, and is found in both organic and inorganic form; the inorganic forms are mostly 2-atomicity while its organic forms are often 4-atomicity.Main chemical types of lead in acid soil in order of density reduction are:pb^{+2}, organic lead complexes, $pbso_4$, $pbHCO_3^+$; and in alkaline soil: $PbCO_3$, $PbHCO_3$, organic lead complexes, $pb(CO_3)_2^{2-}$,$pbOH^+$.Existence of unauthorized amount of lead causes destruction of neurotic bounds in human, kidney-blood disease, belly pains, and different kinds of cancer. many geophysics-chemical processes such as absorption cause lead release from soil and precipitate in ground water [1].
Modeling of different kinds of contaminant was studied by several researchers,Nasiri [2], Hooshmand [3], Alemi,*et al* [4, 5], Hutson and Wagenet [6], Ahlrichs and Hossner [7], Mirbagheri [8-10], Copoulos,et al,[11], Tayfure *et al*, [12].
Regarding contaminating soil and ground waters of Golestan province to this toxic element, the purpose of this paper is to addressed the spatial and temporal distribution of pb in soil column of Gorgan site.

MATERIALS AND METHODS

In this research, two pieces of land of 1.5 × 2m were chosen as pilot in waste water treatment of Gorgan city. Then, lengthwise, a pit of 160m depth and 1m width was caved, and 30, 60, 90, 120, and 150m depth of its wall was marked.
In next level, two influents of 250 liters solution containing 0.5 and 3 mg.l-1 pb in the form of pb $(No_3)_2$ was poured in two pieces of land chosen as pilots. After a few hours, when the solutions had the time to penetrate into the soil and to reach the deep down of the pit, sampling was done simultaneously in vertical marked points and at the bottom of pit and in horizontal distance of 30, 60, and 90cm as well as depth of 0 and 30cm. Then, the samples with time and place label were transferred to soil lab in order to examine.

In next step in waste water lab, 20gr of soil from each sample was mixed with 40cc of DTPA and was put on a shaker by the speed of 160rpm for 2 hours. Then, the samples passed from 42-micrometer paper filter, and later from 0.45-micrometer syringe filter so that a pure solution is gained to read by atomic absorption spectrometry.

All sampling procedures were repeated in fourth, seventh, and tenth days after pouring the influent solutions for both concentrations.

RESULTS AND DISCUSSION

In this research, before starting the pouring the solutions, soil's characteristics and its texture's details for different depths were determined as the following table.

Table l : The soil texture details

Sand%	Silt%	Clay%	Organic Carbon %	Total saturated acidity	Electric Conductivity EC*10^3
39	41	20	1.5	6.9	8.1

After determining soil's characteristics, concentrations of pb were measured in 30cm distances and 3-day times in horizontal and vertical dimension.

These results show that arsenic's concentrations in both horizontal and vertical dimension has decreasing process, and by passage of time the concentrations decreases in each point which is shown in following figures.

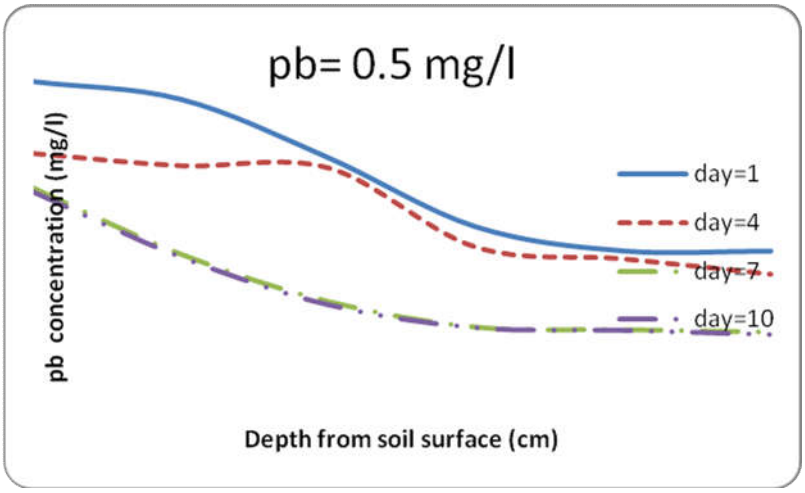

Figure 1- Concentration of pb for different depths (pb_0 =0.5 mg/l)

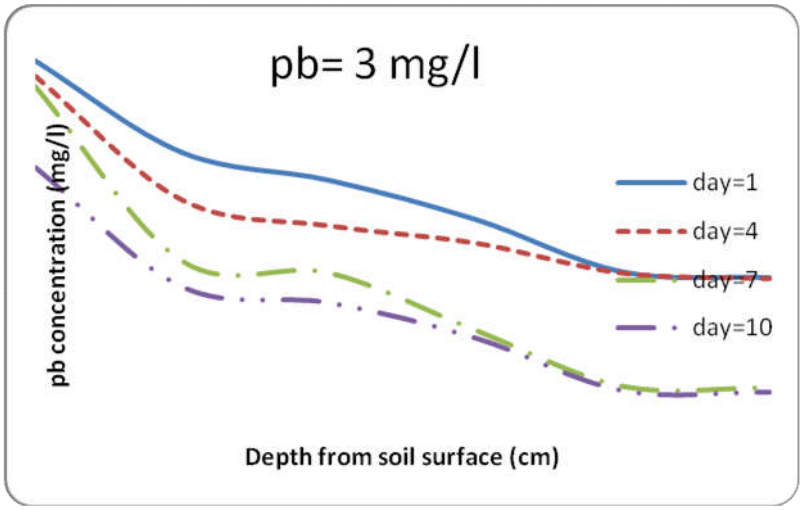

Figure 2- Concentration of pb for different depths (pb_0 =3 mg/l)

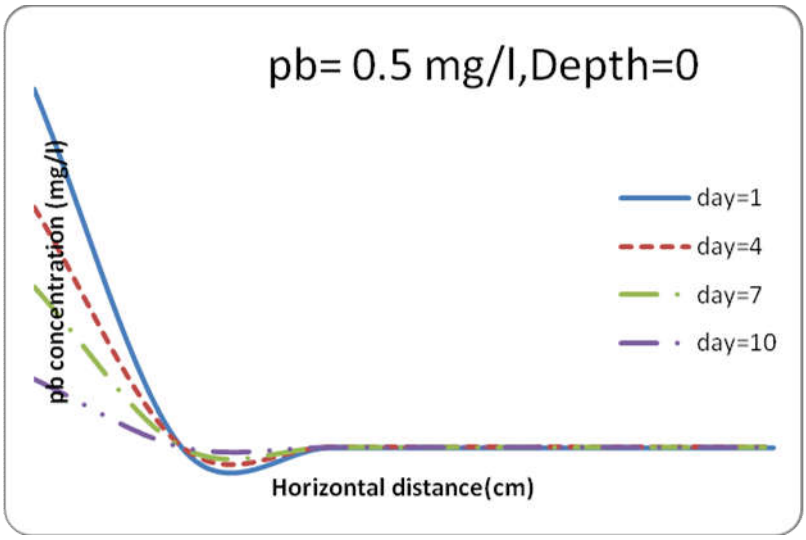

Figure 3- Concentration of pb for different horizontal distances (pb_0 =0.5 mg/l ,depth =0)

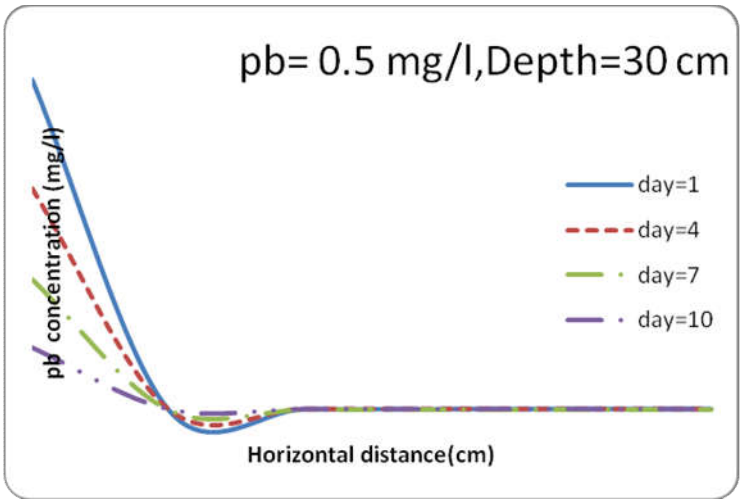

Figure 4- Concentration of pb for different horizontal distances (pb_0 =0.5 mg/l ,depth =30 cm)

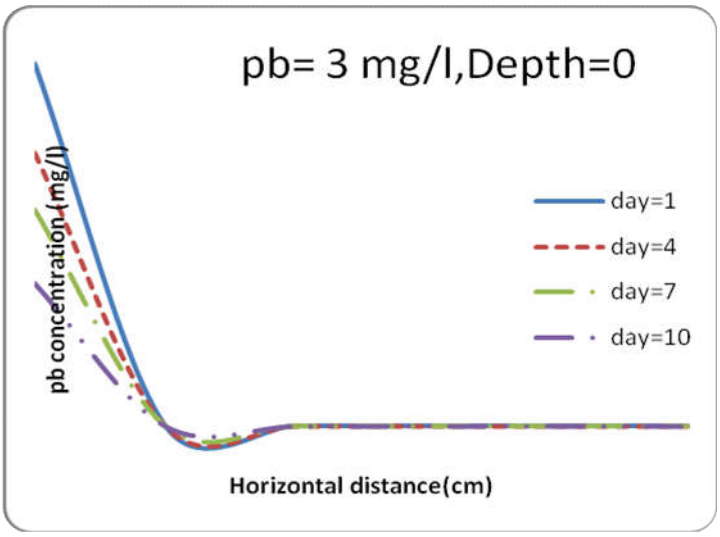

Figure 5- Concentration of pb for different horizontal distances (pb_0 =3 mg/l ,depth =0)

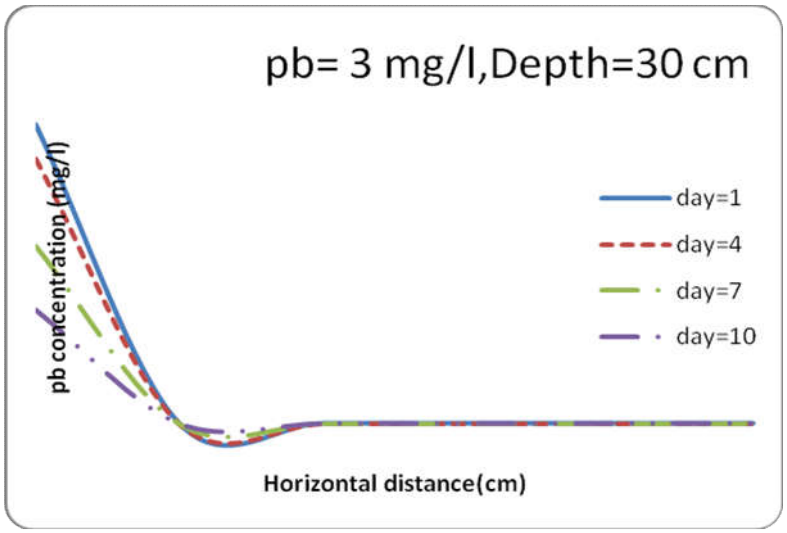

Figure 6- Concentration of pb for different horizontal distances (pb_0 =3 mg/l ,depth =30cm)

CONCLUSION

By this research, the process of pb movement was analyzed in vertical and horizontal dimension. After applied the influent solution containing 0.5 and 3 mg.l -1 pb to the soil, the concentrations of pb were measured in soil and groundwater. The results indicate the measured concentrations on soil surface were 530 times the input concentrations for 0.5 mg.l -1 and 500 times for 3 mg.l -1 on the first day. However, after 10 days, the concentrations were 380 and 370 times in the same point. Therefore, according to the figures, it is clear that pb concentrations decreases by the increase of depth. In addition, in a certain depth, the concentrations decreases by increasing the horizontal distance; and it reaches zero at half a meter distance. It can be concluded, then, that pb did not transport the soil in this area horizontally; therefore, one-dimensional model can be used in order to simulate pb's movement in soil column and underground water in this area.

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