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# The determination of the amount of lead existing in the soil and plant along the roads with the heavy traffic in Nowshar and Chalus cities (North of Iran)

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## ABSTRACT

*The traffic of vehicles which use gasoline containing lead as fuel considered as a source of pollutants for farms which are located in cross town wayside of Nowshar and Chalus cities. In order to determine the rates of the exiting lead in soils and plants in these waysides, the sampling of them in different distances from the road was carried out, and the rates of the existing lead in the samples was determined by international standard method and also by use of Atomic Absorption Spectrophotometer (A.A.S). The results indicate that the most concentration of lead are in soils and plants on waysides (distances less than 30m) than longer distances (100 and 150m) from the road. Significant the results show that there is significant difference in the rates of lead in leaves between Kiwi and Citrus gardens in different distances of roads with reliability of 99% and also there is a meaningful difference between the rate of lead in Kiwi and Citrus gardens with reliability of 95%. There is a meaningful difference in the rate of lead between different parts of rice stew with the reliability of 95%, while there is no meaningful difference in other organs. As the soils and plants of this region is polluted by lead and in view of the cultivation of agriculture and garden product in polluted soils of the cross of Mazandaran Province, there could has been harmful consequences so it is suggested that while using gasoline without lead for car, serious action must be taken for determination of limits of roads and for prevention of the cultivation of the agricultural plants in less than 30 m of the roads.*

**Key words:** Nowshar and Chalus, road, North of Iran, plant, soil, lead, pollution.

## INTRODUCTION

Nowadays the gas consumption in most cases is joined with the spreading of lead in the environment. Now with the increasing numbers of cars on the roads, too much lead has spread in the air, and has increased the pollution in the mentioned areas. In calculable spreading of the

private cars, the lack of prevention of traffic of the old and worn-out cars, and other causes are among the most important factors that now have caused the rate of the lead to increase more than the permissible level in the air in big and tourist cities. This pollution outside the cities has selected on the soil of agricultural and non agricultural plants of roadsides, and in relation to the increasing of traffics, caused heavy pollution in those areas. since the harmful effect of lead and its aromatic compounds to everyone ,being neighbors of agricultural farms with main roads in the north of country and too many cars which nowadays use those roads, accompany with uncontrolled gas consumption, following the spread of lead particles in air and their settling on the farms on roadsides, puts forward this question in the mind that what is the rate of the lead accumulation in the soil of these farms and how much lead the eatable plants in those farms absorb and store in their organs? And if we move away from the road. Whether the rate of the lead in the soil will be reduced? And if it is so, then what is the form of the trend of reduction? Lead for the first time was discovered in Asia Minor in 6500 B.C., and the documents show that the ancient Egyptians were familiar with it and also were well informed of its property which could cause the death. Lead, because of its physical, chemical and mechanical properties and also its alloys from old times has been used by human being .its usage at the flourishing time of roman empire was estimated at thousands which applied in making paints, the pipe of drinking water and dining utensils for noblemen .the researchers show that the noblemen of Rome, because of the usage of the lead utensils and the pipes of drinking water were made by lead, became afflicted with heavy poisoning. Heavy mortality and onset of unknown diseases and repeated abortions caused the extinction of the roman noblemen, while the poor of that time because of the usage of earthen utensils and lack o f piping water were in safety from the danger of the poisoning. The studies of the researchers of the history field of study and roman civilization show that the bones of the corpses of the noblemen were heavily poisoned by lead. The poisonous effects of lead for the first time were discovered by Hippocrates in 730 B.C. he reported the colic attacks in people whose jobs were

Purification and condensation of metals. Lead mainly enters into environment in two ways; the first way is by volcanic activities and other geological activities and erosion which the lead naturally enters into environment. The second way which during recent decays has been accelerated is the entering of the lead into the environment by human activities. The contribution of the natural resources in the pollution of the lead in environment in comparison with the contribution of the human activities is so low that could be ignored. The spreading of lead from industries is 700 times more the natural trend of the spread of the lead. The aromatic compounds of lead as an antichock has been used from 50 years ago. The use of these compounds (tetra ethyl and tetra methyl of lead) especially has been increased from 1973. In every liter of gas as much as 0.4-0.9 gr of tetra ethyl of lead is consumed. Gilbert et al. [4] reported that as much as 0.025 of salts resulted from combustion remained in the engine which much of it enters into the filter of motor oil. Fazeli et al. [2] reported that the amount of lead which has exited from the car is about as much as 60-200 ml per each kilometer., it was determined that rice bushes which were irrigated by sewage sludge contained high level of heavy metals in a research conducted by Fazeli and et al. [2] in Misour state of India, which the accumulation of each metal in relation with different organs is different. As for lead, the most accumulation of lead is observed in roots and then in leaves and rice seeds. World health organization determines the threshold of the permissive limit for the rate of lead in the blood of adults as much as 20-30 mg/dl. Frkovic et al. [3] with the usage of beam lead 203 showed that the lead which is exited from the cars, after breathing, as much as 0.035 of it remained in the lungs. as for the breathing of the lead particles, the researches suggested that the particles with the diameters of more than microns usually deposited, and if breathed, it is absorbed by the mucous membrane, and particles less than 25 microns reached trachea and bronchus, and the particles less than one micron reached the bubble

of lungs, and part of particles less than 0.3 micron exited with exhaled breath. The aromatic compounds of lead caused different cancers so that the generating of malignant tumors in mouse with injection of 0.6 ml of tetra ethyl of lead has been certain. Also pollution by lead caused some behavioral and nervous failures, which during the youth, the lack of success in education is one of its complications. In a research conducted by Frkovick and et al. [3] in Rijeka city, it was determined that the lead in the milk of mothers is absorbed more than the lead in other food stuffs, and also in this research it was determined that the rate of lead in the milk of mother residing in this city is more than the standards of world health organization, which is about 2-16.8 mg/dl. the present research in heavy traffic roads of Nowshar and Chalus townships from Hassan abad area (the beginning of the area under the protection of Nowshar Township in east district up to the beginning of Kelarabad) the end of the area under the protection of Chaloos township) lied at 36 degrees north latitude up to 39 and 39 degrees east longitude up to 30 and 51.

## MATERIALS AND METHODS

With attention to this fact that Nowshar and Chaloos townships have tourist attractions and also have the nearest distances to sea located in north of Iran from Tehran and that the roads of these two townships have heavy traffic, and the existence of gardens and farms on the both sides of this road, the main road of Nowshar and Chalus townships from the beginning of Hassan Abad area in the district of east of Nowshar up to Kelarabad area (The end of area under the protection of Chaloos township) was chosen: As for species under the study since rice ,citrus fruits and kiwi fruit have allocated the most cultivated lands and are used directly, choosing and sampling from those farms carried out [1, 8, 9]. so for conducting this research ,six stations (farms)on the margin of the main roads of Nowshar and Chalus townships were chose and the sampling of the soil of the farms and gardens and their products in the distances of 20,30,40,50 and 150 meters away from the margin of the road was carried out. In every six stations and in three depths of 0-20,20-40 and 40-60 cm of soil, the samples were chosen and as for agricultural and garden plants , in every distance of 20-150 meters of the margin of the road ,the sampling of leaves, stems, fruits and seeds of plants were carried out. For study of the species of the rice plant in every distance of rice bush which were near each others, the sampling was carried out [7]. For the study of the species of citrus fruits and kiwi fruits in every distance in a circle from, the sampling of fruits and complete leaves of sub fruits were carried out [6].

### The stage of laboratory operations

All samples of soil and plant were sent to the laboratory, and the samples of the soil after air drying were sieved under mesh No.240, so that the particles of less than 62 microns could be separated. Then according to the international standard, the samples of soil prepared and digested and the amount of existing lead in the soil samples determined with atomic absorption spectrophotometer. the samples of leaves, fruits and seeds were first washed with distilled water and after drying in the oven at 70 °C, one gram of its dried material for six hours at the temperature 450 °C in the oven changed in to ashes and then according to international standard, the stage of digestion was carried out and the amount of their lead was determined by atomic absorption spectrophotometer [5].

### Observations and conclusions

The table 1 through and the figures No.1 and 2 show the results of the amount of existing lead in soil and present plants in different parts of road. According to the results obtained, the amount of existing lead in different parts from road showed a decline trend, and the more we got away from the road, the more the amount of existing lead in the soil declined .only in the garden of Bonyad

at the distance of 100 meters away from the road, the amount of existing lead in the soil was again increased, which may be the reason of that was overusing of phosphate chemical fertilizer such as super simple phosphate which its impureness including its excess lead caused excess lead in this area. Figure No.2 shows the existing lead in the organs of plants in different soils and in different parts of road, which according to the results obtained, the existing lead on the lands of kiwi gardens followed a natural trend. In rice farms up to the distance of 40 quick and after this distance it followed a natural declining trend. in the Bonyad Kiwi garden, The amount of lead accumulation in kiwi leaves is more than in comparison with the fruit itself, and the more the garden gets away from the road ,the less is the amount of lead accumulation in the kiwi leaves. the amount of lead in Kiwi fruit garden is less than 2 ppm, and in the distances of more than 100 meters, no lead accumulation in kiwi fruit is observed ,so the conclusion is that up to distance of 50 meters ,the pollution resulted from heavy traffic in this area has effects on kiwi gardens, but in distance more than 50 meters, the amount of the lead accumulation has been very low, or no lead accumulation was observed .also in Hassas Kiwi garden ,the amount of lead in the leave was more than as compared with fruits, and with increasing distance from the road, the amount of the lead accumulation in the leaves and fruits reduced. As for the kiwi fruit, the amount of lead up to the distance of 40 meters from the road, the accumulation of the lead was found in the tissues of fruit, but in the distances of more than 40 meters, there was no accumulation of lead .but in the citrus fruit garden of Bonyad also the amount of lead in the leaves of citrus fruits followed a natural declining trend with the increasing distance from the road. The amount of lead accumulation in citrus fruit in the distance of 20 meters is as much as 16.25ppm, but with increasing distance from the road, it reduced severely .so we reached to a conclusion of lead that in this area, the pollutions of lead have strong effects up to the distance of 20 meters from the margin of the road on the amount of the increase of lead accumulation on the tissues of citrus fruits and make it inconsumable. In the Gomi citrus fruit garden, The amount of lead accumulation on the leaves of citrus fruits up to the distance of 30 meters has an increasing trend, but after that it will decline, perhaps the low height of citrus trees on the margin of the road and much height of trees in the distance of 30 meters have caused the trees to act as windbreak in this distance, and the flow of wind has moved the pollution on these leaves in this area ,and has caused the amount of the lead accumulation on the leaves in this area. But the amount of lead on citrus fruits in this garden has reduced with increasing distance from the road. In the Jafari rice farm, the most accumulation of lead observed on the rice stems, and this is because of being unmovable of lead element that has accumulated more in the stem .the amount of lead in the rice leaves in this farm has reduced with increasing distance from the road, and the least accumulation of lead observed in rice seeds in this farm. This accumulation up to 50 meters of distance of the road is observed, but in the distances of more than 50 meters no lead accumulation was observed in the rice seeds. So we concluded that in this area, since the lead is not moveable, it has less accumulation on rice seeds, and in the distances of more than 50 meters away from the road. The pollution of traffic did not show any significant effect of lead accumulation on the rice seeds. In the Alikhah farm, since in view of height it is located lower than the road, the lead pollution resulted from the traffic up to the distance of 100 meters has left effects on the rice seeds and has caused the lead accumulation on the rice seed. but overall the amount of lead accumulation on the stem of rice is more than the leaves and in the leaves and in the leaves is more than the seeds, and also with increasing distance, the amount of the lead accumulation on the stems and leaves of rice is reduced .according to figure No.2, The most accumulation of lead amount is observed in plant organs in different parts of the road in plant leaves and the least accumulation of the lead amount is observed in seeds of the plants.

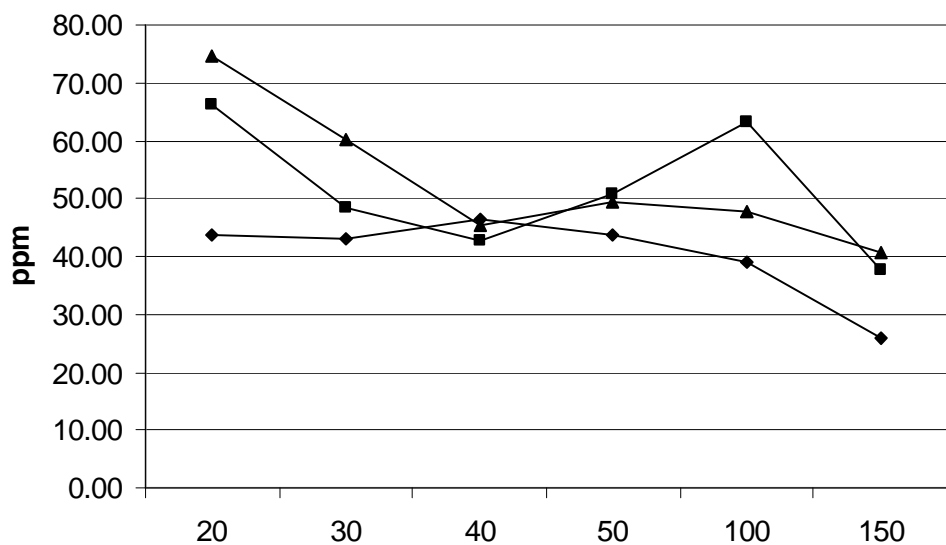


figure1: The rate of soil lead in kiwi ,citrus gardens and rice fields

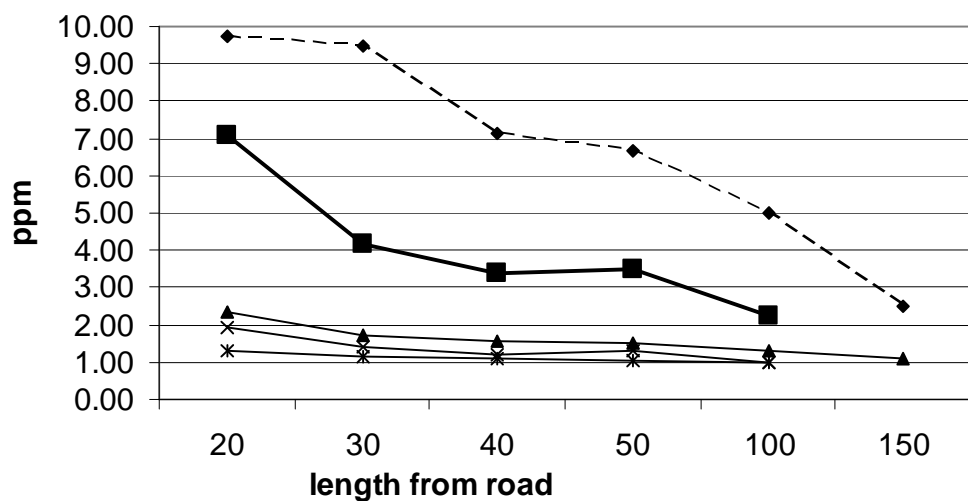


figure 2: The rate of lead in plant organs in different parts of road

Table 1: The rate of lead in the soil of different farms in the different distances of the road

length from road							
total	150	100	50	40	30	20	farm
41.00	26.65	43.00	44.50	42.67	46.17	43.00	kiwi bonyad
39.53	25.33	34.67	42.92	49.92	39.83	44.50	kiwi hassas
40.26	25.99	38.83	43.71	46.29	43.00	43.75	kiwi
50.43	40.08	82.17	48.92	44.67	38.83	47.92	Bonyad citrus
52.54	35.08	44.33	52.83	40.67	58.08	84.25	Qumi citrus
51.49	37.58	63.25	50.88	42.67	48.46	66.08	citrus
53.49	41.25	57.25	41.25	36.83	67.17	77.17	jafari rice
52.54	39.83	38.50	57.42	53.75	53.50	72.25	kolamkah rice
53.01	40.54	47.88	49.33	45.29	60.33	74.71	farm rice
48.25	34.71	49.99	47.97	44.75	50.60	61.51	total

## DISCUSSION AND CONCLUSION

For comparison of the average of the lead accumulation in the soil in between every farm, In between kiwi gardens, citrus fruits and rice farms, the variance analysis was used between different distances of road and different depths of soil. The summary of the results of the variance analysis is offered in figure 4. the results showed that the amount of the lead in the soil in six farms under the study did not have meaningful difference (the level of being meaningful is 0.135), but between three types of farms with reliability of 0.095 (the meaningful level is 0.015) in between different distances of the road with reliability of 0.099 (the meaning level is 0.003), and in between the different depths of soil with reliability of 0.099 (the meaning level is 0.007), we observed meaningful difference between the amount of lead in the soil. for comparison of the average amount of lead in the leaves and fruits in the kiwi and citrus garden and the amount of lead in the leaves, stems and seeds in rice farms and the comparison of the amount of lead in the plant organs in different parts of the road. We used variance analysis. the summary of the results of variance analysis is given in the table 8. the results showed that the amount of lead in the leaves in different parts of the kiwi and citrus garden (the meaningful level is 0.001) with reliability of 0.099 has a meaningful difference. Also with reliability of 0.095 between the amount of lead in the fruits in kiwi and citrus garden, there is a meaningful difference (the meaningful level is 0.039). In rice farms there is only meaningful difference with the reliability of 0.095 between the lead in seeds in between the farms (the meaningful levels is 0.014), while there is no meaningful difference in other cases. The results obtained from the analysis of samples implied that the rate of the lead existing in the soil and plants on the margin of the road is significantly more than the remote areas, and with getting away from the road, the rate of the existing lead in the soil and agricultural products is reduced. the results of analyses indicated that the main accumulation of lead is about 30 meters of the road, and in the distances more than this, the rate of the lead is much less and also with attention to this fact that in different sources, The maximum of the rate in plants is reported differently, so the rate of 2-3ppm is considered as the maximum in comparisons. The results of analysis of the plant samples showed that the rate of the existing lead in the kiwi leaves and fruits and citrus are more than the limit, and as for the samples of rice



farms, also the rate of lead in leaves is more than the rate in stems and seed, and the maximum rate is up to 20 meters distance of the margin of the road. In the distance of more 100 meters, the rate of the lead accumulation is severely reduced and especially in the rice seeds it is reached to zero. also the results of the analysis implied that with getting away from the road ,the trend of the rate of lead is declining .with attention to the results of the above research and also with attention to this fact that the existing statistics which implied that the numbers of means of transportation using gas are nowadays increasing, and with attention to this fact that the lead is kind of a metal that remains for a long time in the soil, it seems that if this trend will continue in this way ,in near future with inaugurating of the Tehran-North high way and the flows of cars to this areas, the rate of the lead accumulation in the soil of the margin of the above roads will go up by far more than the existing rate and in turn, the agricultural and garden products which are cultivated in these areas will contain heavy pollution and products of these areas will be inconsumable. So with attention to these facts these suggestions are offered as follows: 1-there must be some limitations for the traffic of the means of transportation using gas fuels.2-Never use gas containing lead for fuel.3-Refrain from cultivating of agricultural and garden production up to the 30 meters distance of the heavy traffic roads, And instead, the products such as cotton ,hemp and other inedible plants for cultivation are recommended.4-road limits of law must be observed and refrain from the cultivation of agricultural and garden products within the limits of road which is very close to the traffic zone .5-for the prevention of the depositing of the lead which is spreading from the exhaust pipes of cars, planting of some rows of ever green trees on the margins of the heavy traffic roads as a plant barrier against the spreading of the lead is recommended.6-prevent from cattle grazing on the farms of road limits after he harvesting of the products which their fodder contained heavy concentration of lead.

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