A Study of Changes in Lead Concentrations in Soils in the Andimeshk - Shoosh Highway Margin

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***Abstract*—**Lead from Vehicle Fuels as the Most Important and the Largest Source of Environmental Pollution. Given the daily increasing global pollution and with regard to the stability of heavy metals in soil and their devastating effects on the ecosystems, this research was conducted on Lead pollution in Andimeshk - Shoosh Highway. The purpose of this study was to investigate the spatial distribution of Lead in the soil. In this regard, three stations including Andimeshk, Azadi town and Shoosh were selected. At each station, soil sampling was performed in three replications from distances of 15, 50 and 100 meters from the margin of the road and depths of 0-15 cm. Values for pH, lime percentage, organic matter, CEC, soil texture and absorbable concentration of Lead were measured using graphite furnace atomic absorption spectrometry (GFAAS). The results indicated that the Lead concentrations decreased with taking distance from the margin of the road. The mean Lead concentrations at 15, 50 and 100 meters were measured 3.01, 2.29 and 2.04 (µg/kg), respectively. Moreover, the results showed that the concentrations of Lead declined from Andimeshk to Shoosh so that the mean Lead concentrations in Andimeshk, Azadi town and Shoosh stations were 2.49, 2.24 and 2.45 (µg/kg), respectively.

***Keywords*—**Lead, Absorbable Concentration of Lead, Andimeshk, Azadi Town, Shoosh, Highway Margin.

I. Introduction

MADRID et al (2002), conducted a study and found that soils in urban areas had been severely degraded. Both anthropogenic factors (such as vehicles and broken industrial pipelines) and natural biogenic ones (such as tree leaves and other plant material) play a direct role in dust formation on streets and roads. Subsequently, Han et al (2006), discovered that a set of environmental problems centered on pollution with heavy and toxic metals, especially in soils of urban areas and in roadside soils, would pose a major problem.

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Particles worn from car tires, particles detached from street surfaces, and particles released by car brake pads directly and indirectly increase the heavy metal content of soils. Under these conditions, heavy metals are transported to underground water or soils of other areas with the help of surface runoff, suspensions, and leaching (Venue et al, 2003).

All researchers who have conducted studies on soil pollution by lead believe that its concentration decreases with increasing distance from roads (Alloway et al, 1995).

Studies on soil pollution by lead, especially in roadside soils, have revealed that lead concentration in these soils varies. Lead concentration in soil samples of studied areas had a direct correlation with traffic volume on the related highways (Khadem Haghighat and Ghoddossi, 1985).

Herious et al. (1981) measured concentrations of cadmium, copper, iron, manganese, lead, and zinc in eight roadside soils of urban highways with different traffic flows in Gipuzkoa in Spain. Results indicated concentrations of lead, zinc, and cadmium varied with distance from the highway.

Ward et al. (1977) took soil samples at different distances from the margins of four highways in Iran and found a strong descending trend in soil lead concentration with increasing distance from highway margins.

In a study conducted by Alloway (1990), it was found that metals such as lead, zinc, and copper could be indicators of densities and sources of pollution. Following this research, Abraham et al (2002) and Boca et al. (2004) stated that accumulation of certain heavy metals such as lead, chromium, and cadmium in urban areas would persist for a long time due to the stability, lack of degradation, and long half-lives of these metals. Therefore, these elements are called chemical time bombs.

Researchers have conducted studies that show lead added to gasoline is the most important pollutant of the environment (Khadem Haghighat, 1985).

People, through excessive use of lead, unknowingly expose themselves to pollution caused by this element (Tiller, 1989).

II. Materials And Methods

This research was conducted in Andimeshk - Shoosh Highway in the north of Khuzestan Province. Three stations including Andimeshk, Azadi town and Shoosh were selected. In each station, soil sampling was performed in three replications in three points including distances of 15, 50 and 100 meters from the margin of the road and depth of 0-15 cm

and the coordinates of sampling sites were recorded using GPS. The pH values were measured by pH meter, lime percentage by back titration method, organic matter percentage by Walkley Black (WB) method, CEC using ammonium acetate method, soil texture by hydrometer method and the concentration of absorbable Lead by the DTPA extraction method and graphite furnace atomic absorption. The location of the study area and sampling sites are shown in Figure 1 (Rahmani, 1995).

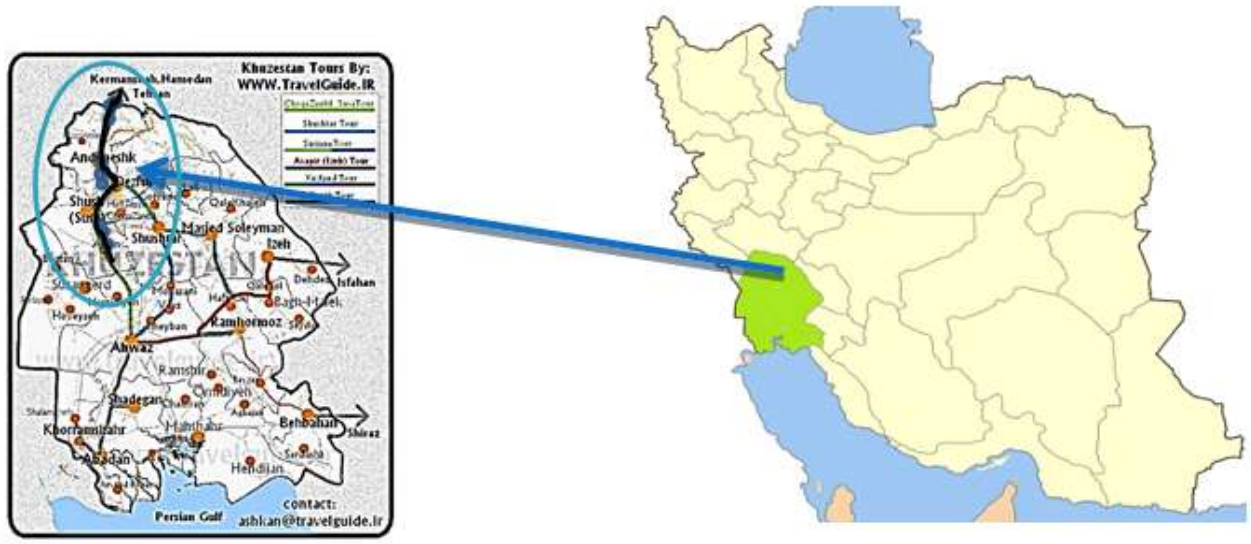

Fig. 1 - The location of the study area and sampling sites.

III. RESULTS AND DISCUSSION

Table 1 and 2 shows the coordinates (UTM) and some of the physicochemical characteristics of the sampled sites (Andimeshk, Azadi town and Shoosh) respectively.

TABLE I
- THE COORDINATES (UTM) OF THE SAMPLING SITES

Distance(m)						Station
100		50		15		
Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	
3590093	0245644	3590092	0245646	3639020	0225206	Andimeshk
3582092	0237960	3582060	0237919	3590142	0245643	Azadi town
3570922	0240396	3570909	0240376	3570908	0240375	Shoosh

TABLE II
SOME OF THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SAMPLED SITES (ANDIMESHK, AZADI TOWN AND SHOOSH)

CEC (meq/100$_{g\ soli}$)	O.M %	T.N.V %	pH	Soil Texture	Distance(m)	Station
17.9	0.072	44.12	8.50	S.L	15	Andimeshk
17.9	0.072	44.10	8.52	S.L	50	
17.9	0.072	44.12	8.51	S.L	100	
24.1	0.164	39.25	8.00	S.C.L	15	Azadi town
24.1	0.164	39.20	8.01	S.C.L	50	
24.1	0.164	39.23	8.04	S.C.L	100	
23.5	0.131	46.14	8.14	S.L	15	Shoosh
23.5	0.131	46.12	8.16	S.L	50	
23.5	0.131	46.15	8.16	S.L	100	

Figure 1. shows the mean Lead concentrations in the depth of 0-15 cm and distances of 15, 50 and 100 meters from the margin of the road in three areas of Andimeshk, Azadi towns and Shoosh, so that the mean Lead concentrations in Andimeshk, Azadi town and Shoosh stations were 3.01, 2.29 and 2.04 (µg/kg), respectively. In the point source pollution phenomena it is expected that the pollutant concentrations decrease with the increase in the distance from the source of pollutant where observation of such behavior in the case of Lead in Chart 1 in the study area confirms the validity of this fact. Lead concentrations at a distance of 15 meters from the margin of the road was higher compared to distances of 50

and 100 meters where the reason can be attributed to the location of the sampling area, because it was located near the road margins. In general, Lead concentrations decreased with taking distance from the road margins. The results showed that the Lead concentrations in the highway margins decreased with the increase in the distance from the road and also it was directly related to the traffic load (Alwi, 1990), (Fuge, 2005) and (Ward et al, 1977).

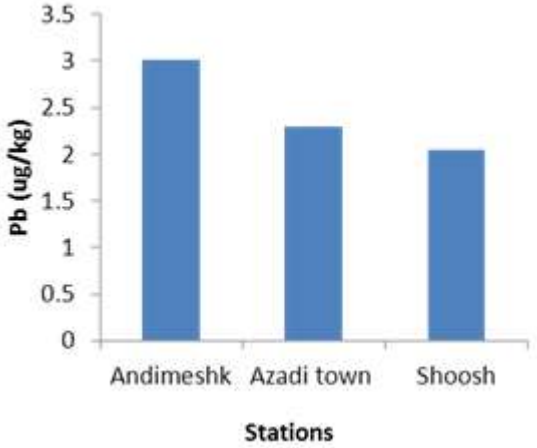

Fig. 1 - Changes in the mean absorbable Lead concentration in soil with taking distance from the roadside of Andimeshk, Azadi town and Shoosh (µg/kg dry mass).

According to Figure 2 which compares the mean Lead concentrations in soil in the three areas of Andimeshk, Azadi town and Shoosh, it is observed that the Lead concentration was decreased from Andimeshk to Shoosh; so that the mean Lead concentrations in Andimeshk, Shoosh and Azadi town stations were 2.49, 2.45 and 2.24 (µg/kg), respectively. This could be due to the location of the sampling area, because in Andimeshk and Shoosh the sampling areas were located near squares where the accumulation of metals is in this range due to the higher traffic load and because vehicles drive with low gear. Therefore, wear and tear of tires is higher and the vehicle exhaust fumes increase which leads to increased concentration of pollutants in urban areas. However, in areas outside the city the traffic volume is lower and vehicles drive with high gear and wear of tires and exhaust fumes of vehicles are lower. Thus, pollutant concentrations are lower compared to the urban areas (Frey et al, 2001)

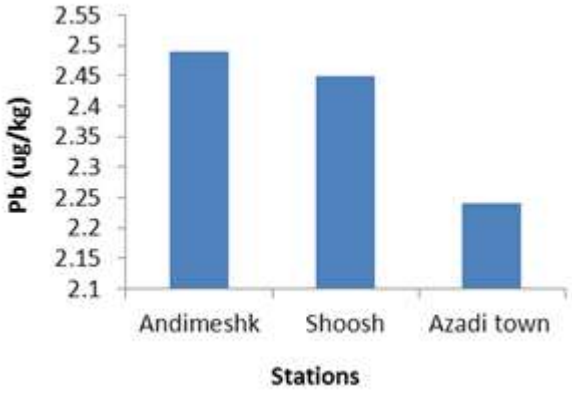

Fig. 2 - Comparison of the mean absorbable Lead concentrations in soil in the three areas of Andimeshk, Shoosh and Azadi town (µg/kg dry mass)

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