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Accumulation of lead in the soil and vegetable crops along Darna District

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Lead pollution causes a big problem to the environment, and it was the core of many studies by workers who are concerned and care about clean environment. In this work we have studied the effect of lead concentration in soil and vegetables crops among Darna city highways with high traffic density. Soil and vegetables samples a long highway were collected from 10 sites in Darna district (Libya) and analyzed for lead using flame atomic absorption spectrophotometer (FAAS). Decrease in the concentration of this metal was related to the distance away from the highway. Higher accumulation of this metal have been observed on soil and vegetables sample near to the highway than one a little farther away (5-15m) which showed no significant accumulation of this metal. This could be explained mainly to the aerial deposition of the metal particularly from motor vehicles.

Keyword: Pollution, Environment, Lead, Soil, Vegetables, Spectrophotometer Introduction.

1. Introduction

In the last decades much attention has been directed towards lead in the roadside environments as a result of its widespread use as an antiknocking agent in gasoline used motors [1]. Automobiles created a source of serious environmental damage which causes the pollution of soils by heavy metals [2]. The tremendous increase in the number of motor vehicles in Darna city is leading to increase in the levels of some heavy metals such as lead. Results showed that roadside soil near motorways is heavily and highly polluted by this metal which released during combustion, component wear, fluid leakage and corrosion of metals. Lead and other heavy metals are the major metal pollutants of these roadside environments. The levels of these heavy metals in Darna areas are mainly attributed to automobiles exhaust particularly from leaded gasoline, tires, and lubricated oil [3]. Recently several studies revealed that 80% of heavy metal toxins which found in human bodies in industrial areas in the developing countries were the results of consuming contaminated crops rather than air pollution in which a great part of metal pollutants that accumulated on soil where they may be transformed and transported to other parts of environment to vegetation [4-6].

2. Experimental

Darna is one of the most beautiful spots of the Jabble Alakhther in Libya. The city is situated in the eastern part of the country overlooking the Mediterranean Sea, Darna has modest climate, The summer is warm and dry with temperature ranging from 25^{o}C to 35^{o}C, and the temperature in winter ranges from 10^{o}C to 20^{o}C.The atmospheric pollution is low but vehicular exhaust accounts for more than 50% of the total pollution in Darna city.

3. Collection of samples

Samples were collected from highway (ten sites), this highway carrying an average of 500 vehicles per day. Many sites (10) were selected for the study, at each site, two samples of soil and two

samples of vegetables were collected at different distance from the edge of the main road (0-5m, 5-15m). These locations were particularly suitable because the traffic density is very high and no industrial activities nearby or no other major road intersection which can cause asignificant decrease in traffic density to and from Darna city.
Sample preparation for flame atomic absorption and analysis [7,8].
Soil samples were collected, dried, and grounded. 1 gm of soil was accurately weighed and transferred into a 100ml conical flask and 5ml of conc. HNO_3(AR 70%) was added and kept overnight. The flask then heated at temperature of 70°C for 1 hr and was allowed to cool to room temperature, 5ml of mixture of conc. HNO_3 and $HClO_4$ (AR70%) in ratio of 4:1 was added and again the flask was heated at 80°C for 2hrs. After that it was cooled then filtered and the final volume was made up to 100ml with double distilled water and let settle for 15hr.The resultant solution was analyzed by flame atomic absorption spectrophotometer, The instrument was calibrated using Pb standard for the element being analyzed, blanks were prepared by adding 10% aquaregia to a conical flask containing none of these samples. All soil and blank samples were analyzed for total trace metal levels. The pH and electric conductance were measured.
Leaves of vegetables from different sites have been collcted by hands carefully washed with tap water and oven dried at 100°C for 48 hr, grounded and 1gm of these dried samples were placed in a small beaker and 10 ml of conc. HNO_3 was added and allowed to stand overnight then it was carefully heated until the brown fumes of NO_2 has ceased, then a small amount 3 ml of 70% $HClO_4$ was added to the cold solution. This solution was them heated and transferred to a 50 ml flask and made up with double distilled water. The metallic content of lead in the prepared samples was estimated using (FAAS, Perkin Elmer, analyst 100).

3. Results and Discussion

The pH of the soil at roadside agriculture sites in Darna and the electric conductance are presented in table 1.

Table 1: Soil properties in Darna road side

Site	pH	EC(dm/m)
1	7.55	0.42
2	**7.56**	**0.28**
3	**7.41**	**0.20**
4	**8.10**	**0.82**
5	**7.08**	**0.18**
6	**6.44**	**0.16**
7	**7.30**	**0.21**
8	**6.62**	**0.17**
9	**6.88**	**0.18**
10	**6.78**	**0.18**

Maximum pH of the roadside soil was found to be 8.10 at site 4 and minimum pH of value 6.62 at site 8, the electric conductance (EC) was also measured and maximum electric conductance value for roadside soil was 0.82 ds/m at site 4 which is approximately five times higher than the minimum EC at site 8.

Lead: The amount of lead in roadside soil is strongly but inversely correlated with the increase in the distance from road. Table 2 showed the lead content in roadside soil at different distance. At site 4 the lead concentration is the highest (12.40 ± 0.8) mg/kg but it decreased with the increasing distance from roadside 8.0 ± 0.99 mg/kg (5-15m), In the present study, and considering the general range of the total lead content it appears that the total lead content in 95% roadside soil was very much below the critical concentraltion in terms of distance from the main road there were high correlation between Pb content and distance, The mean values of lead obtained from all the soil samples at different distances away from the highway were significantly different. Lead content in soil was still within the acceptable limits as reported.

The range of lead accumulated in uncontaminated soil reached 15-106 ug/g dry weight. In polluted soil, lead content ranges limit from 100 to 400 ug/g dry weight lead content in soil near road was lower than EU upper limit of 300 mg/kg although lead is not readily soluble in soil but absorbed mainly by root hairs and stored in the cell walls. The translocation of lead from roots to tops is greatly limited [9]. Lead mobility is controlled by several soil factors such as pH, redox potential organic matter and other chemical factors [10]. Air borne lead, a major source of lead pollution is also readily taken up by plants through foliage. The epidermal cells absorb lead deposited on the leaf surface. Cabbage, spinach, cauliflower, parsley and radish, contain high concentration of Pb (Table 3). The concentration of lead showed a decreasing trend as the distance increased from the roadside. At site 4 the lead concentration in cauliflower beside the roadside was found to be the highest (4.30 ± 2.12). but it is decreased with the increasing distances from roadside (3.1±1.9 mg/kg) at (5-15m) the lowest lead concentration in cauliflower near road was (± 6.25) mg/kg which decreased to (0.8 ± 0.5) at (5-15m) simple analysis revealed that heavy metal pollution in roadside vegetable leaves may be due to other sources in addition to vehicular exhaust [11]. Thus in terms of environment hazards and polluted city environment, it is suggested that the study on heavy metal contamination in soil and several crops specially those grown along the main road should be conducted. Thus in terms of environment hazards and polluted city environment.

Table 2: Lead (mg/kg) in road side agricultural soil at selected sites

Site	0- 5m	5-15m
1	9.10 ± 0.3 (8.90-10.10)	6.20 ± 0.90 (6.30-6.01)
2	10.80 ± 2.0 (10.88-10.12)	6.12 ± 2.60 (6.21-5.66)
3	9.73 ± 0.2 (9.83-9.23)	3.65 ± 0.72 (3.70-3.11)
4	12.40 ± 0.8 (12.44-11.87)	8.03 ± 0.99 (8.22-7.65)
5	2.09 ± 0.39 (2.32-2.10)	0.19 ± 0.02 (0.23-0.18)
6	2.89 ± 0.21 (2.91-2.71)	0.19 ± 0.01 (0.22-0.18)
7	2.32 ± 0.50 (2.36-2.11)	1.02 ± 0.12 (1.11-0.98)
8	8.30 ± 0.70 (8.39-7.56)	2.2 ± 0.77 (2.12-2.06)
9	3.20 ± 0.32 (3.43-3.01)	2.8 ± 0.31 (2.65-2.33)
10	2.23 ± 0.39 (2.32-1.95)	1.10 ± 0.50 (1.02-0.99)

Table 3: Lead (mg/kg) in vegetable leaves at selected site

Site	Vegetable	Distance from road (m)	
		0-5m	5-15m
1	Cabbage	3.80 ± 0.20 (3.0-2.25)	2.20 ± 1.1 (2.3-2.00)
2	Spinach	3.90 ± 1.12 (3.2-2.40)	2.80 ± 1.3 (2.9-2.2)
3	Cabbage	3.10 ± 0.35 (2.9-3.25)	2.6 ± 0.05 (2.8-1.99)
4	Cauliflower	4.30 ± 2.12 (4.60-3.89)	3.1 ± 1.9 (3.2-2.8)
5	Cabbage	1.09 ± 1.20 (1.2-1.8)	2.0 ± 1.20 (2.9-2.0)
6	Parsly	1.20 ± 0.32 (1.2-1.9)	1.50 ± 0.22 (1.6-0.8)
7	Radish	1.0 ± 0.15 (1.2-0.95)	1.00 ± 0.5 (1.2-1.0)
8	Spinach	2.12 ± 0.61 (2.25-2.0)	1.90 ± 0.8 (1.99-1.1)
9	Cabbage	1.22 ± 0.39 (1.6-0.88)	1.0 ± 0.10 (1.2-0.80)
10	Cauliflower	1.0 ± 0.25 (1.2-0.85)	0.8 ± 0.5 (1.2-0.98)

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