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HEAVY METAL ACCUMULATION IN ROADSIDE PLANTS, CERTAIN CROPS AND THEIR EFFECT ON CONSUMERS

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ABSTRACT

The ficus, grass and commercially important crop plants (sugarcane, wheat & maize) were evaluated as a phytotool of heavy metals such as Lead (Pb), Copper (Cu), Cadmium (Cd), Manganese (Mn), Zinc (Zn), Chromium (Cr) and Nickel (Ni) around Jamkhandi. The soil samples at a depth (0 – 20cm) and test plant leaves were taken from different sampling sites viz, S_1, S_2, S_3,S_4, S_5 and S_6 on state highway with high traffic roads passing through the Jamkhandi (Karnataka) were determined by AAS (Atomic Absorption Spectrophotometer). Results showed that both soil and test plant species contained elevated levels of the metals. It was found that the primary source of the contamination occurs mainly by the vehicular emissions. The increased circulation of toxic metals in soil , ficus & other test plant species may result in the inevitable build up of such xenobiotics in food chain. The variation in heavy metal concentrations is due to changes in traffic density and anthropogenic activities. The increased circulation of toxic metals in soil, grass, ficus, and crops results in the inevitable buildup of xenobiotics in the food chain. From the results it is concluded that ficus , grass and crop plants can be used as phytotool to monitor heavy metal pollution in roadside plants.

INTRODUCTION

Vehicular emissions cause heavy metal pollution and exert negative impact on environment and roadside vegetation. Wild plants growing along roadsides are capable of absorbing considerable amounts of heavy metals; thus, could helpful in reducing heavy metal pollution (Ur Rehman, et al., 2021). It is found that environmental pollution has increasing in tremendous rate and global industrialization has negative impacts on human health and ecosystem services (Ur Rehman, et al., 2021).

Now a days the toxic effect of heavy metals are burning issues and has been studied by many researchers (Yang, et al., 2002; Nordberg, 2003), the entrance of heavy metals occur in food chain, as a result of their uptake by roadside plants, agricultural crops which were grown in contaminated soil (Bakidere and Yamam, 2007). The toxic and hazardous effects of some heavy metals on human health are very significant and may cause many fatal diseases. Lead (Pb) is one of the heavy metal, that is responsible for anemia. neurological disorder, hyperactivity and changes in blood enzymes in human body (Mortula and Rehman, 2002). Cadmium and zinc are important toxic metals but longtime exposure may cause renal, pulmonary, hepatic skeletal, reproductive and may also other carcinogenic effects (Arora, et al., 2011; Bhuiyan et al., 2011). It is widely recognized that the principel reasons of heavy metals (Pb, Cd, Cu) derived from traffic congestion, long range transport and household heating (Viard, et al., 2004). The spreading of contaminants is influenced by meteorological parameters such as rainfall, wind and traffic intensity (Bakirdere and Yaman, 2007). The same meteorological conditions affect the concentration of the same contaminants in the roadside soil (Viard, et al., 2004), the trace density determines the Pb (Lead) level in soil and vegetation (Othman, et al., 1997: Grigalaviciene et al., 2005). Accumulation of heavy metal in roadside soil can alter biological activities in soil and affect the enzymatic activity of microorganisms such as urease and phosphate (Kumar & Kumar, 2017). Heavy metals have complex relation with plant, Histidine, citric acid, malic acid and oxalic acid present in the plant form complexes with heavy metals and convert the metals into nontoxic form (Mc Grah, 1994, Agarwal et al.,

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2007) Consumption of such contaminated crops may pose a health risk to human beings as metals form complexes with CaOH, NH_2, -SH, >NH groups present in protein to catalase the function of enzyme (Kumar & Kumar, 2017). The new biological complexes, thus, formed loose their function which results in breakdown and even damage to the cell also (Kumar & Kumar, 2017). Due to nonbiodegradable and persistent nature of heavy metal, they easily accumulated in soft tissues of human being and can cause biological disturbances and can cause cardiovascular, kidney, liver and bone diseases (Momodu & Anyakosa, 2013)

The soil samples and vegetation is the most economic and reasonable ways for assessing heavy metal status in the atmosphere (Onder and Dursan, 2006). The effects of vehicular pollution appear on the physiological aspects of plants (Rai, 2016: Singh et al., 2020). The pH of soil is gradually altered by the absorption of heavy metals that affect anatomical, physiological and reproductive attributes of plants. Ramos-Montano,2020: Farahzadi, et al., 2020).

Heavy metal pollution affects seedling growth and germination of roadside vegetation (Azab and Hegazy, 2020; Bai et al., 2020). The germination rate of seeds decreases due to Pb toxicity (Wu et al., 2020; Wang et al., 2020). Remediation is mandatory to control heavy metal for recovery and restoration of ecosystem (Ahn et al., 2020; Algul and Beyhan, 2020). Phytoremediation is a low cost and healthy useful technique for the reduction of heavy metals pollution. Different types of plants with high absorbance capacity for heavy metals can be used in phytoremediation (Devi and Kumar, 2020: Yan et al., 2020). Few tree viz, *Ficus benghalensis*, L., *Ficus pinnata*, *Dulbergia sissoo, Holoptela integrifolia* etc. are used to control air pollutants (Uka et al., 2021: Ighalo and Adeniyi, 2020). In order to assess contamination by metals in the vicinity of a highway. Several studies havde been carried out dealing with different (Nabuloa et al., 2006: Ondre and Dursan, 2006) compartments: study of global deposit, roadside soil and vegetation (Viard, et al., 2004). Information on accumulation of heavy metal on roadside soil of this city due to high traffic and vehicles is very limited (Aktaruzzaman, et al., 2013). But this could be the new threat for agriculture. Determination of heavy metal accumulation in roadside accumulation in roadside soil may be an index of the environmental pollution of Jamkhandi city. Keeping this view in mind, the research was conducted to know the heavy metal accumulation of roadside soil ,grass ficus & crop plants along the roadside of Jamkhandi.

MATERIAL AND METHODS

Jamkhandi is the city of Northern region of Karnataka at latitude $16^0 04^1$ N to $16^0 21^1$ North and longitude 75^0 26^1 E to 76^0 02^1 Eastern. The city is suffered from high traffic density caused by vehicles. The ficus, grass and crops viz, wheat, maize, sugarcane and soil were collected during October 2022, which were three meters away from the state high way (Fig. 1 and Table. 1). passing through bypass of Jamkhandi city, Ficus (*Ficus benghalensis* L,) Grass Cynodon dectylon (L) Pers, Wheat (*Triticum aestivum* L), Sugarcane (*Saccharum officinarum* L) & Maize

Table. 1 Sampling stations along state highway of Jamkhandi

Station No.	Sampling station	Nature of station
Control	Jamkhandi (Royal Palace Group of Insti-tutes)	Unpolluted area- Vehicular movement is negligible, unpolluted area with less disturbance
1	Jamkhandi Bypass road	Vehicular movement is high
2	Hulyal	Vehicular movement is high – Agricultural fields on either side of the road
3	Siddapur	Vehicular movement is high- Agricultural fields on either side of the road but Prabhulingeshwar sugar factory is far away from the state highway
4	Shirol cross	Vehicular movement is high- Agricultural fields on either side of the road
5	Malapur	Vehicular movement is high- Agricultural fields on either side
6	Mudhol	Vehicular movement is high- Agricultural fields on either side and Nirani sugar factory is far away from the state highway.

(*Zea mays* L) & soil samples were collected from each site at three random spots that were spaced approximately at one meter interval. The leaves were clipped with stainless steel scissors. All the samples of each site were then combined to give composite samples of about 300 to 500 gm. The test plant samples were dried at 80^0C for 48hrs fine by powdered and sieved through 0.2mm sieve. One gram sample was digested using Gerhardt digestion unit using mixed acid digestion method (Allen et al., 1974). The digested material was diluted with double distilled water and filtred through Whattman paper 41 and made upto 100ml. Similarly soil was dried, powdered and sieved through 0.2mm sieve. One gm of sample was digested Gerhardt digestion unit according to Allen et al., (1974) method (mixed acid digestion method). The resulting extracts were diluted filtered through Whattman No 41 paper and made upto 100ml using double distilled water and analyzed for heavy metals viz, Lead (Pb) 217.O nm, Cadmium (Cd) 228.8nm, Copper (Cu)324nm, Zinc (Zn)213.9nm, Manganese (Mn)279nm, Nickel (Ni)232.nm and Chomium (Cr)221.8nm with GBC-932 plus Atomic Absorption Spectrophotometer (Austrelia) with an air / acetylene flame and metal hollow cathode lamps by using their respective wavelengths. The solutions for heavy metals were purchased from Siscochemical

Laboratory Bombay (1000 mg/lt). the working standards were prepared by serial dilution of standard stock solutions and were used for the calibration of the instrument (Allen *et al*., 1974).

RESULTS AND DISCUSSION

Pollution of heavy metals viz, Cd, Pb, Ni, Cr etc. are the major concern (Onder and Duesan, 2006). In view of this it is necessary to conduct this study to exhibit and determine the kind of environmental pollution and how far they exhibit and efficient as the bioindicators in reducing the degree of pollution in environment. Different plant species are known to absorb, detoxify and tolerate higher levels of heavy metal pollution (Bian, et al., 2020: Shang et al., 2020). The level heavy metals in the plant samples collected along the roadside (Fig. 1) correlation coefficient of heavy metals in roadside soil, grass and ficus plant samples are given in the table 2 and 3.

Fig. 1 Map showing the state highway (SH) of Jamkhandi to Mudhol

Table 2 Correlation coefficient of heavy metals in roadside soil and grass

S. No.	Metal	r-value
1	Lead (Pb)	0.629*
2	Copper (Cu)	0.483
3	Zinc (Zn)	0.830*
4	Cadmium (Cd)	0.749*
5	Manganese (Mn)	0.531
6	Nickel (Ni)	0.332
7	Chromium (Cr)	0.217

*Significant at 5% level ($P < 0.05$)

Table. 3. Correlation coefficient of heavy metals in roadside soil and ficus

S. No.	Metal	r-value
1	Lead (Pb)	0.630*
2	Copper (Cu)	0.480
3	Zinc (Zn)	0.827*
4	Cadmium (Cd)	0.741*
5	Manganese (Mn)	0.531
6	Nickel (Ni)	0.322

Table. 4. Heavy metals in roadside Ficus grass and soil

S. No.	Heavy metals	Control group ($\mu g\ g^{-1}$ dry wt.)	Roadside Ficus ($\mu g\ g^{-1}$ dry wt.)		Control group ($\mu g\ g^{-1}$ dry wt.)	Roadside grass ($\mu g\ g^{-1}$ dry wt.)		Control group ($\mu g\ g^{-1}$ dry wt.)	Roadside soil ($\mu g\ g^{-1}$ dry wt.)	
			Range	Mean ± SE		Range	Mean ± SE		Range	Mean ± SE
1	Lead	18.45	20.32-28.38	23.39 ±1.82	19.42	20.18-28.1	23.72±1.79	70.50	84.92-140.8	94.91±8.71
2	Copper	2.13	3.90-5.72	4.70±0.34	2.0	3.5-5.46	4.87±0.32	34.89	38.54-58.51	49.2 1±3.51
3	Zinc	15.18	24.40 -34.9	32.74±3.09	16.14	24.50-35.2	31.23±2.90	29.80	32.25-390.29	188.1±54.2
4	Cadmium	0.79	1.09-1.76	1.22 ±0.09	0.81	1.0-1.82	1.594±0.04	2.14	1.72-2.91	2.4 ±0.18
5	Manganese	15.69	28.02-69.10	56.10 ±7.29	15.89	27.48-73.51	56.80±6.92	1251.1	1256.8-2024.3	1547.3±26.4
6	Chromium	ND	1.18-7.9	4.62 ±2.20	ND	1.18-8.4	4.89 ±2.18	110.39	131.7-957.2	326.5±2.44
7	Nickel	6.68	7.9-14.7	9.12 ±1.39	7.16	8.5-15.98	9.04±1.41	70.01	70.51-108.6	88.98±5.90

ND*-Not detectable

Table. 5 Mean concentration of heavy metals (µg/g) and ± standard deviation in crops at Shirol

Met-als	Sugarcane (Distance in mt)				Maize (Distance in mt)				Wheat (Distance in mt)			
	5	25	50	100	5	25	50	100	5	25	50	100
Pb	22.72±1.81	16.42±0.02	8.10 ±0.02	0.08±0.02	18.18 ±0.03	10.21±0.02	4.25±0.02	0.08±0.01	15.70±0.02	8.21±0.02	333.27±0.07	0.7±0.01
Cu	4.92±0.02	4.24±0.02	3.02 ±0.02	2.15±0.01	4.92±0.02	4.32±0.02	3.84±0.01	2.92±0.01	4.84±0.07	4.28±0.02	3.91±0.01	2.94±0.01
Zn	32.84±0.01	20.21±0.02	22.02±0.02	14.02±0.01	30.92±0.02	24.2±0.02	16.04±0.04	12.02±0.01	31.0±0.02	22.04±0.02	18.42±0.04	12.08±0.01
Cd	1.51±0.02	1.22±0.02	1.02±0.04	0.88±0.01	1.64±0.01	1.24±0.02	0.86±0.01	0.62±0.02	1.32±0.03	1.24±0.02	0.84±0.01	0.64±0.06
Mn	54.12±0.01	38.72±0.02	28.12±0.04	15.28±0.04	52.08±0.02	46.82±0.01	36.26±0.02	18.28±0.01	53.28±0.02	41.28±0.01	32.18±0.01	16.22±0.02
Cr	4.63±0.01	4.02±0.03	3.84±0.04	1.81±0.03	4. 280.01	3.84±0.04	2.5 8±0.04	1.20±0.05	4.24±0.02	3.84±0.04	2.54±0.02	1.24±0.05
Ni	4.7 9±0.02	2.62±0.02	0.74±0.01	0.07±0.01	2.90±0.02	1.62±0.02	0.82±0.01	0.071±0.01	2.84±0.01	1.58±0.03	0.74±0.01	0.68±0.03

7	Chromium (Cr)	0.212

*Significant at 5% level (P < 0.05)

The ranges and arithmetic mean of heavy metal concentration of soil, grass and Ficus samples of state highway and control sites are presented in the Table 4.

Lead is one of the major heavy metal and considered as an environmental pollutant (Sharma and Dubey, 2005). Lead is considered as a general protoplasmic poison which accumulate and acting slowly. The main source of lead(Pb) is exhaust fumes of automobiles, chimneys of factory, roadside vehicles pollution (.Eick, et al., 1999). The results of our analysis show that there are significant differences for lead between sampling sites in control and pollutant area. The results shows that soil tends to accumulate more lead than the grass and Ficus leaves. The highest Pb level found in the roadside soil was 141.8µg/g, while the ficus it was found that 23.39µg/g. similarly in grass, it was 23.39µg/g. the mean soil Pb level of 94.91 µg/g indicated considerable contamination of metal in the roadside environment, whereas, control soil has baseline level of 70.50 µg/g. Much of the lead is rapidly washed onto the soil by rainwater from the surface and also by the death and decomposition of the plant. The lead deposited in soil and vegetation can also cause enhanced levels of lead in soil microorganisms (Harrison et al., 1981., Aiyesanmi et al., 2012, Khattak et al., 2013), F.R.Sulaiman et al., 2018.

The roadside soil has higher copper concentration due to industrial pollution near to the sampling location. The source of Cu may be originates from tires, engine oil consumption, brake wean and road surface material (Chen et al., 2010, Zang et al., 2012, Ugolini et al., 2013). The mean Copper level in roadside soil (49.71 µg/g) was found to be much higher than the grass (4.87 µg/g) and ficus (4.70 µg/g).

The source of Zn in relation to automobile traffic is wearing of break lining, looses oil and cooling liquid (Saeedi et al., 2009). Arithmetic mean of Zn of the roadside around Jamkhandi shows relatively high level of 188.3µg/g with range of 32.29 - 390.54µg/g. The range of Zn found in the ficus 24.403µg/g and 24.50-35.703µg/g, grass 24.50-34.83µg/g (roadside) is not much higher. This can be attributed to the fact that Zn as an essential element is normally present in uncontaminated plants upto 100 µg/g (Ho and Tai, 1988).

Complex changes has been induced by Cd in plants genetical, physiological and biochemical levels. Cd level in roadside soil averaged about 2.4 µg/g and was the lowest among the seven metals analyzed. The mean Cd in Ficus is about 1.22 µg/g and in grass 1.594 µg/g. Our findings were in confirmation with findings of Ho & Tai (1988).

The soil, grass and ficus contained much higher levels of Mn than other metals examined. Roadside soil, grass and ficus had average 1542 µg/g, 56.804 µg/m and 56.10 µg/g of Mn content of the roadside soil may be attributed to the lithogenic factor apart from the vehicular pollution as indicated by the high values of Mn of control soil. Chromium is considered as a serious pollutant due to wide industrial use (Shankar et al., 2005). Chromium compounds are highly toxic to plants and are determined to their growth and development. Significant differences in our analysis for Cr in soil and in plant samples are found. Chromium level too was very high in roadside soil (326.5 µg/g) against the control value of 124.42 µg/g. In grass it was 4.89 µg/g and in ficus it was found to be 4.62 µg/g against control (Zero). Nickel level was considerable and was in roadside soil (88.98 µg/g) against control value (71.0 µg/g). In grass it was 10.94 µg/g and in ficus it was found that 9.12 µg/g against control (7.16 µg/g).

Simple linear regressions between the metals viz, Pb, Cu, Ni, Mn, Zn, Cd and Cr present in the soil, grass and ficus were calculated and are given in the Tables 3 & 4.

According to simple linear regressions between the metal levels in roadside soil and ficus were found in Zn, Cd and Ni are significant at 5% level ($P < 0.05$). It may be indicating the bioconcentration of these metals in the ficus, in addition to serial deposition. This may be attributed to the favorable root environment (Sahu & Warrier, 1985) i.e soil condition might have favored their absorption.

Simple linear regression in case of chromium, nickel, manganese and copper contents between the soil, grass and ficus are not significant at 5% level, were low due to low bioavailability of these metals owing to unfavorable root environment. Whatever excess content of these metals found in soil, grass and ficus was pressured to be due to aerial deposition contributed by motor vehicles and other anthropogenic activities.

The order of increment of heavy metals in roadside is as follows:

Soil: Mn > Cr > Zn > Pb > Ni > Cu > Cd
Grass: Mn > Zn > Pb > Ni > Cr > Cu > Cd
Ficus: Mn > Zn > Pb > Ni > Cu > Cr > Cd

The elevated levels of heavy metals in the roadside soil and ficus is an indication of airborne pollutants of roadside environment of the urban area of Jamkhandi city and along the road soil has high retention capacity for the heavy metals (Yassoglos et al., 1987) due to there cation exchange capacity (CEC), Complexing organic substances, oxides and carbonates. Thus, contamination levels increase continuously as long as the nearby sources remain active. During the last two decades, the city of Jamkhandi to the extent has witnessed sharp increase in vehicle number due to urbanization. Similar observation in Neem and Caesalpinnia in Madhurai city of Southern region of Tamil Nadu (Thambavani & Vanthana 2013).

In soil, the lesser mobility of metals and its accumulation on a long term basis, leads to overall higher contamination level of metals. Whereas, in roadside grass, ficus represents more accumulation due to turnover of plant materials (like new growths, the senescence followed by the abscission of old parts) and meteorological influence (Kabata-Pendias, 2005). Thus, the study of metal concentration of roadside soil, grass and ficus reflects the extent of aerial contamination of roadside environment. The penetration of heavy metals into the food chains due to vehicular emission may cause a long-range ecological and health hazard.

Accumulation profile of heavy metals in Crops

There are significant differences between the distribution of heavy metals in the crops at different sampling station with varying distances (Table 5). The accumulation of heavy metals was found to be high in all test crops at different locations compare to control and found in the order of 5 mt > 25mt > 50mt > 100mt (control) . The mean concentration of Pb level in test sugarcane collected from 5 to 50mt from the edge of road was recorded as 22.72 ±1.81 µg/g to 8.10 ±0.02 µg/g in maize it was recorded as 18.18 ± 0.03 µg/g to 4.25 ± 0.02 µg/g and in wheat it was recorded as 15.70 ± 0.02 µg/g to 3.27 ± 0.07 µg/g, which was significantly higher than Indian standard (2.5 µg/g) recommended by Awasthi, (2000). The permissible tolerable limit in agricultural crops is 10.0 µg/g and normal is varying from 5.0 to 15.0 µg/g (Kabata-Pendias, 2005) Table. 5.

Lead is a poisonous metal, in human it is directly absorbed into blood stream and is stored in soft tissues, bones and teeth. Due to bioaccumulation it leads to chromic damage to central nervous system (CNS) and peripheral nervous system (PNS) and also brings difficulties in pregnancy (Peokjoo et al, 2008). It includes aberrant gene transcription (Boutan et al., 2001). The mean concentration of Cu level in test sugarcane collected from 5 to 50mt from the edge of the road was recorded as 4.94 ± 0.02 µg/g to 3.02 ± 0.02 µg/g, in maize it was recorded as 4.91± 0.02 µg/g to 3.84 ± 0.01 µg/g and also in wheat it was recorded 4.82 ± 0.07 µg/g to 3.92 ± 0.01 µg/g which was significantly lower than tolerable limit in agricultural crops for Cu is 50µg/g and normal limit is about 5 - 30µg/g (Kabata- Pendias, 2005) copper is essential element but higher concentration intake leads to severe mucosal irritation, widespread capillary damage (Salmeron and Pozo, 1989).

The tolerable limit of agricultural crops for Zinc is 300µg/g and normal is 27 – 150µg/g. The mean concentration of Zinc level in sugarcane collected from 5 to 50 mt from the edge of the road was recorded as 32.84 ± 0.01 µg/g to 22.02 ± 0.03 µg/g, in maize recorded as 30.92± 0.02 µg/g to 16.04 ± 0.04 µg/g and also in wheat it was 28.04 ± 0.02 µg/g to12.08.42 ± 0.02 µg/g respectively.

Zinc is considered to be relatively nontoxic, however, excess amount can cause system dysfunctions that results in impairment of growth and reproduction (Dubey et al., 2007). Excess concentration of metal in the body bound in various transcription regions such as polymerase enzymes (Wang et al., 1997).

Manganese is micronutrient, essential for physiological functions. The tolerable limit for Mn in agricultural crops is 300 µg/g and normal value is 30to 300 µg/g (Kabata-Pendias, 2005). The mean concentration of Mn level in sugarcane collected from 5 to 50 mt from the edge of road was recorded as 54.12 ± 0.01 µg/g to 28.12 ± 0.04 µg/g, in maize it was recorded as 52.08 ± 0.02 µg/g to 36.26 ± 0.02 µg/g and also in wheat it was recorded as 53.28 ± 0.02 µg/g to 32.18 ± 0.01

µg/g respectively. Mn concentrations in test crops lower than upper limit recommended by Kabata-Pendias (2005). But higher concentration is toxic causing neuropsychiatric disorder characterized by irritability, difficulty in walking and speech disturbances (Singh and Kalmadhad, 2011).

The permissible tolerable limit in agricultural crops for Cd is 3.0 µg/g and normal is varying from 0.05 to 0.2 µg/g (Kabata-Pendias, 2005). In control (1000 mt) crop plants maximum accumulation is recorded in sugar (0.88 ± 0.01 µg/g) and minimum is 0.64 ± 0.06 µg/g in wheat. Cadmium accumulate in the human kidney, respiratory system, cardiac failure and is also associated with bone diseases (Singh & Kalmadhad, 2011). (Wang & Crowley, 2005) also reported that disruption in the transcription of genes in coding ribosomal proteins explain molecular mechanism of Cadmium toxicity, Cd level in sugar cane collected from 5 to 50mt from the edge of the road was recorded as 1.52 ± 0.02 µg/g to 1.02 ± 0.04 µg/g, in maize it was recorded as 1.62 ± 0.01 µg/g to 0.84 ± 0.01 µg/g and also it was recorded to about 1.32 ± 0.03 µg/g to 0.88 ± 0.04 µg/g in wheat respectively.

Chromium is considered as a serious environmental pollutant, due to industrial (wide) use (Shanker et al., 2005), Chromium compounds are highly toxic to plants and are detrimental to their growth. The mean concentration of Cr level in sugarcane collected from the edge of the road was recorded as 4.63 ± 0.01 µg/g to 3.84 ± 0.04 µg/g, in maize it was recorded as 4.28 ± 0.02 µg/g to 2.54 ± 0.02 µg/g respectively.

Nickel has been considered to be an trace essential element for human (Animal) health (Zhuang et al., 2012). The permissible tolerable limit in agricultural crops is 50 µg/g and normal is about 0.1 to 5.0µg/g. The mean concentration of Ni level in sugarcane collected from 5 to 50 mt from the edge of the road was recorded as 4.27 ± 0.02 µg/g to 0.74 ± 0.01 µg/g, in maize it was 2.90 ± 0.02 µg/g to 0.82 ± 0.01 µg/g and also in wheat it was 2.84 ± 0.01 µg/g to 0.74 ± 0.01 µg/g respectively. Nickel occurs mainly in the form of Sulphide and Silicate minerals. Ni when administrated to animals is rapidly distributed to kidneys, pituitary, lungs, skin, adrenals, ovaries and testis (Sundaman, 1989). Ni is carcinogenic to human and risks are highest for lung and nasal cancers. Ni also damages DNA directly through reactive oxygen species (McCoy and Kinney, 1992).

CONCLUSION

Based on the analysis and results, it could be concluded that study on roadside soil, test plants and crops confirmed that vehicular emission is potential source of environment pollution. The high level concentration Lead, Cadmium and Nickel concentration in soil will affect the health of the residents as well as surrounding communities, which may also affect soil fertility too. The consumption of these crops can considered safe with no risk to human health. The average intake of metals in long time low level body accumulation of heavy metals and detrimental impact becomes apparent only several year of exposure. These findings also suggest that special attention should be taken to this traffic related environmental issue and further suggest that serious affords required to reduced to high level of soil remediation and before the consumption of crops /vegetables should washed to remove significant amount of aerial accumulation from the surface of crops / vegetables. Finally, it is recommended that economical plant (vegetables /crops) should not be cultivated along the roadside and especially in high traffic density areas.

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