Soil Pollution Assessment of Soil Collected from Road side of Ghaziabad City

Bhoopender Singh

M.Tech Scholar, Department of Civil Engineering Lingaya's Vidyapeeth, Faridabad – 121002, Haryana, India

Ankur Rawat

Assistant Professor, Department of Civil Engineering Lingaya's Vidyapeeth Faridabad – 121002, Haryana, India

Dr. Sitesh Kumar Singh

Assistant Professor, Department of Civil Engineering, Lingaya's Vidyapeeth, Faridabad – 121002, Haryana, India

ABSTRACT

Emission from heavy and low vehicle has been found to form one of the major sources of soil pollution. It is investigated the influence of vehicular emissions on the accumulation of heavy metal in the roadside soils of Ghaziabad city and the concentration in high levels of heavy metals in the soil is found. The main objective of this research was to determine the impact of heavy metals due to from vehicular pollution such as copper, cadmium, lead, manganese, nickel and sulphate on the human health in Ghaziabad city. 5 major roads were selected based on their high concentration of vehicular traffic and 1 sample was collected from each road. Samples were taken in a period of dry season. The concentrations of five heavy metals in the samples were determined with an atomic absorption spectrometer. The concentrations of the heavy metals from the 5 main roads were higher than in the control sites. The percentage of moisture content in the soil samples of Hapur road was found 23% which was maximum. And the Ph of all samples was alkaline. The concentration of the Zinc (Zn) is found higher in the sample of Hapur road because of heavy movement of the vehicles. The concentration of Pb in S-5 (146 mg/kg), S-1 (431 mg/kg), S-3 (323 mg/kg), S-2 (139 mg/kg), and S-3(140 mg/kg) also exceeded the SQGs R/P for Pb (85 mg/kg). The enhancement of fuel quality, vehicle pollution devices and the adoption of emission standards to minimize the impact of vehicular emissions on human health should be made mandatory.

Keywords: Heavy metal, Pollution, Environmental impact, Moisture content, Spectrometer.

1. INTRODUCTION

Pollution in roadside soil is serious problem worldwide and specially in India due to the increasing of traffic density and human activities which is leading for pollution. Human activities are the primary cause of soil pollution, urbanization, industrialization is also reason of pollution in roadside soil. Use of pesticides herbicides, ammonia, petroleum hydrocarbons, lead, nitrate, mercury, naphthalene is cause of pollution in road side.

Environmental pollution by heavy metals, even if it is at low concentrations and the long- term cumulative health effects that go with it, is of major health concerns all over the world. For instance, bioaccumulation of lead (Pb) in the human body interferes with proper functioning of the mitochondria thereby impairing respiration as well as causing constipation, swelling of the brain, paralysis and could eventually lead to death [1]. Mercury, lead, cadmium, silver, chromium and many others that are indirectly distributed as a result of human activities could be very toxic even at low concentrations. These metals are non-biodegradable and can undergo global ecological circles [2].

Transportation is major source of roadside soil pollution heavy metal are found along the highways heavy metals are mixed naturally in the soil produced by the heavy vehicle and low motor vehicles. These metals are very harmful to the human being and other living organism. Heavy metals are non-degradable, toxic. The rapid increase in the use of vehicles for day to day transportation in most developing countries, coupled with a lack of emission standards in these countries, has contributed a great deal of concern over vehicular pollution. Vehicular emission is at its peak when there is an increase in population, together with increase in the number of vehicles on roads. Most of the by-products of automobiles comprise of different fraction particles. These fractions include the ultrafine particles which are formed in the engines and tailpipes, fine particles produced mainly by chemical reactions, and coarse particles which are formed mechanically.

Soils are the porous for toxic heavy metals from both natural and human sources. It may be mixed by the product of heavy metals through emissions from the industrial activities, land application of fertilizers, pesticides, deposition of atmosphere, Emission by the vehicles has been found to pollute one of the major sources for pollution in So, roadside soils often contain high concentrations of heavy metals .Metals are released from burning of fuel, wear out of tires, leakage of oils, and corrosion of car metal parts Vehicle exhaust is considered as first line source of heavy metal pollutants. The vital role of traffic emissions in the pollution in soil by Cu, Pb, and Zn. Increasing levels of soil contamination with heavy metals may be transformed and reached to plant and from plants they pass on to animals and human being Lead, cadmium, zinc, and nickel are the most metal pollutants from heavy traffic owing to their presence in fuel.

Objective: To assess the degree of roadside soils contamination by Cd, Pb, Zn, Cu, Ni, lead, etc. to determine the pollution in the soil so that the impact on human health can be identified and advised to minimize the pollution in roadside soil.

To determination of Ph, moisture content electrical conductivity, texture, cation exchange capacity to the identified the level of soil standard.

2. DATA COLLECTION & ANALYSIS

Study area-Ghaziabad the district of Utter Pradesh, is situated at the northern area in Indian map and a part of the National Capital Region of Delhi with its center located at 280 67’ N and 770 42’ E. It was referred as the Gate way of Utter Pradesh. The city is divided in two major divisions , Hindon River, Trans Hindon on the west and Cis-Hindon on the east. Area of Ghaziabad is 1178.92 Sq. Km. The city

is 70th largest district in Uttar Pradesh and 588th largest part of India on the basic of area. As per the 2011 census, Ghaziabad urban agglomeration had a population of 2,358,527 of which males were 1,256,784 and females were 1,101,743. The urban area of Ghaziabad spreads out of in whole area. Its annual average temperature is about 14.30 C in winter and 34.100 C in summer season and the annual precipitation is about 235 mm. Ghaziabad has been undergoing a fast-economic development and urban construction, during which the urban population has reached over 2.95 million.

Sample Collection Ghaziabad the district of Uttar Pradesh, is located at the northern area in Indian map and a part of the National Capital Region of Delhi. A total of 5 top soil samples (0–20 cm) will be carefully collected from the roadside soils of 5 main roads in Ghaziabad with a stainless-steel shovel namely, Meerut road, Rani Jhansi road, Gt road along metro rail, Hapur road and Maharana Pratap Marg The trowel was cleaned with laboratory detergent and distilled water, and then dried with a paper towel between each sample to avoid moisture and other contamination. The soil samples for metals analyses were placed into polythene bags while samples intended to be tested for organic contaminants were placed into glass containers without any air space remaining to prevent any possible further reactions with air. These samples were stored in a cooler in the field and submitted to the lab for further analysis. The coordinates of the sample locations will also be recorded with a mobile GPS. And will be marked in the map of each sampling sites, all the sampling sites will be 1m away from the road and Some of samples are collected from that area where the plants are existing so the comparison can be done accordingly. The length of sampling site Meerut road from Hindon river circle to Kailash medical and research Centre is 2750 Meter and sample was collected from Punjab National Bank location. And another sampling site (GT road) from Shahid Sthal new bus stand having a length of 4180 meter where the sample was taken near Railway station and Hapur which having the length 3395 and sampling was done at Dayanand Chowk .As the Maharana Pratap marge road which is major of Ghaziabad which connect to the industrial area of Lal Kua and 5065 meter length was measured from Rani Jhansi road to connecting the Vivekananda Marg to Delhi-Meerut road Sampling was done at this road at near the Delhi Meerut road where road is merged, and last Rani Jhansi road is considered for sampling from the Dayanand Chowk to Meerut road connecting having the length of 4610 and samples was taken at the near the Bharat petrol pump. Therefore 5 samples were collected from all roads as shown in Table 1 & Fig.1. Moreover, in order to find the relationship between heavy metal concentrations and the distance from the road, additional roadside soil samples may be collected from the other expressway.

Table -1: Sampling sites

S.no	Sampling site	Soil sample	Sample mark	Weight(kg)
1.	Meerut Road	1Nos	S1	1
2.	GT Road	1 Nos	S2	1
3.	Maharana Road	1 Nos	S3	1
4.	Rani Jhansi Road	1 Nos	S4	1

5.	Hapur Road	1 Nos	S5	1

Fig.1. Location of soil samples

3. RESULTS AND DISCUSSION

The concentrations of metals such as Cr, Cu, Pb, Zn, Mn, Fe & Ni in samples from the all major roads of Ghaziabad were higher than the standard. If we compare with the industrial area and commercial area then the concentration of metal like Cr, Cu, Pb, Zn, Mn, Fe & Ni were found higher in sample -5 which is collected from the commercial area from the sample -3 which was taken from the industrial area. but the concentration of the Mn (Manganese) is from industrial area.

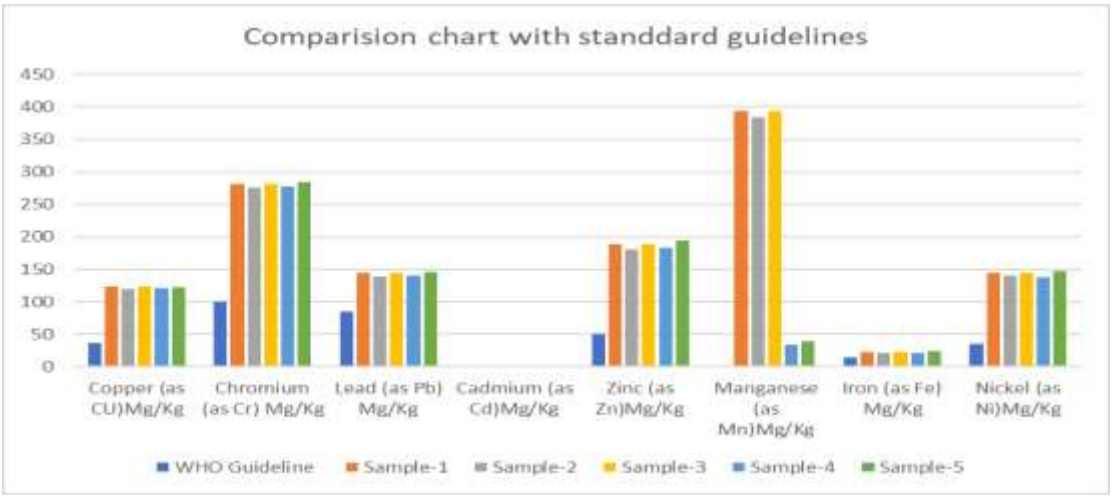

Fig.2. Comparing chart Heavy metals with the standard guidelines.

Lesser then the other three samples which are taken from the commercial and residential area and also The Lowest concentration of metal Cr (276) is found in the sample -2 which is taken from the GT road,

Cu(120) is found in the sample -2 which is collected from the Gol Market GT road from , and Pb(139), Zn(180), Mn(34), Fe(21.24) & Ni(138) is found in sample -2 ,sample -2 sample -4 ,sample -4 sample-4 respectively which were taken from the GT road and Rani Jhansi road. The comparison of heavy metals found with the standard guidelines shown in Fig.2.

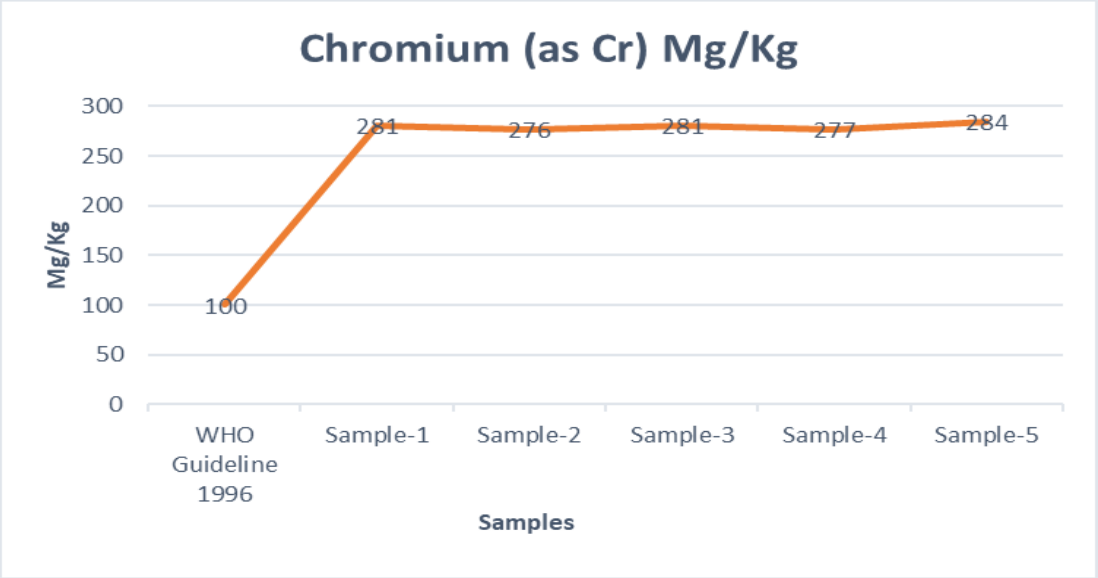

Fig.3. Comparing chart of Chromium (Cr) to the WHO Standard guideline.

The highest concentration of the metal Copper Cu (124) is found in sample 1 and sample 3 in compare to other three site samples and the concentration of the Chromium Cr is found in sample 5 which is 284 mg/kg and if we compare with standard value of the chromium, the value is much higher than the actual as shown in Fig.3.. The concentration of lead (Pb) is higher in the sample 5 with respect to the sample 1, 2, 3 and 4. In the sample -5 the concentration of zinc and cadmium is also higher in all samples. The concentration of all metal contaminants in soil sample exceeded the WHO SQGs in this study. People can be affected by these contaminants through breathing in of dust, having the food or contacting. Terrible impact to some metals has been related with adverse effects on human health. For example, the concentration of Zn in S-5 was 194 mg/kg compared to the WHO SQGs R/P of 50 mg/kg. Showing to Zn in soil can have potential negative impacts on human health including muscles soreness, nausea, fatigue, respiratory effects, gastrointestinal effects, and prostate cancer [3]. The concentration of Pb in S-5 (146 mg/kg), S-1 (431 mg/kg), S-3 (323 mg/kg), S-2 (139 mg/kg), and S-3(140 mg/kg) also exceeded the SQGs R/P for Pb (85 mg/kg).Due to the negative health impacts including acute psychosis, memory deterioration, various cancers [4] and so the possibility of mobilization of the soil borne contaminants through dust and breathing by humans or indirect soil ingestion is very low due to the vegetative cover along most of the roadside right of ways. Hence, risk on human is low.

The results obtained (Table-1)indicated that there was a large variation in the percentage of moisture content in the soil samples and maximum moisture content (23%) was found in Sample S-5 which was

collected from Hapur road (Ingraham Higher Secondary School) Raj Kunj Rajnagar, and the minimum percentage (9 %) which was found in Sample S-2 and sample -3 which were collected from Gol Market GT road and Industrial area Lal Kua respectively .The moisture content for the two other sampling areas Meerut road and Rani Jhansi road : were 10 %, and 13% , respectively as shown in Fig.4.

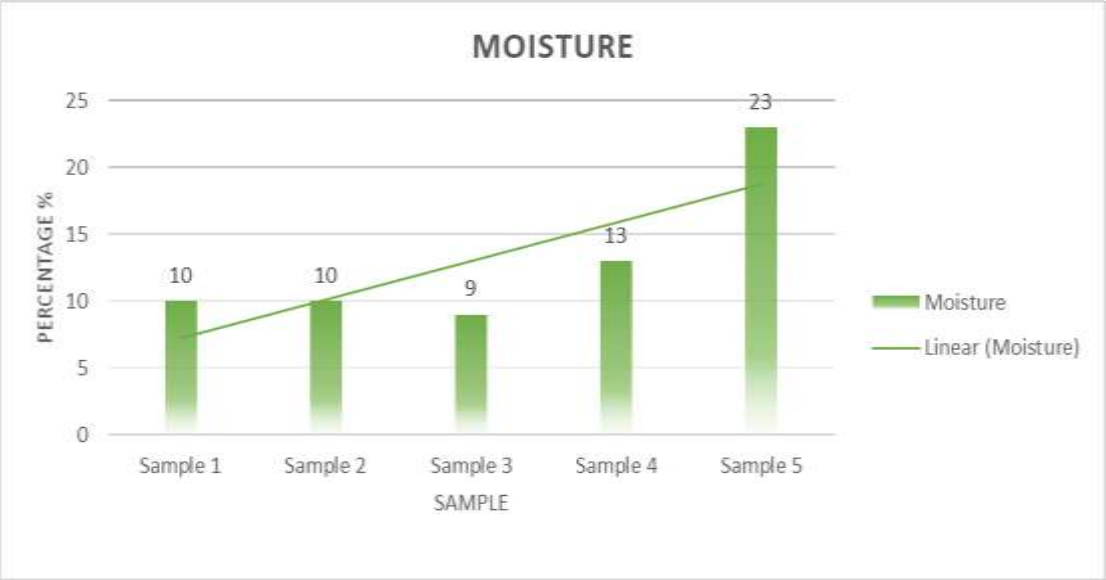

Fig.4. Value of Moisture contents.

The pH of the soil samples ranged from 7.2 to 8.5 (Table-1) and were comparable to the range reported for soils. The results indicated that soils of the study areas in Ghaziabad area were alkaline with an average pH of 7.86. pH of Meerut road samples no-1 (7.6) and industrial area Lal Kua sample (7.2) for the protection of environmental and human health for residential/parkland uses (6 - 8). So, The Ph value of the Ghaziabad city is quite good to protect the environmental and human health as shown in Fig.5.

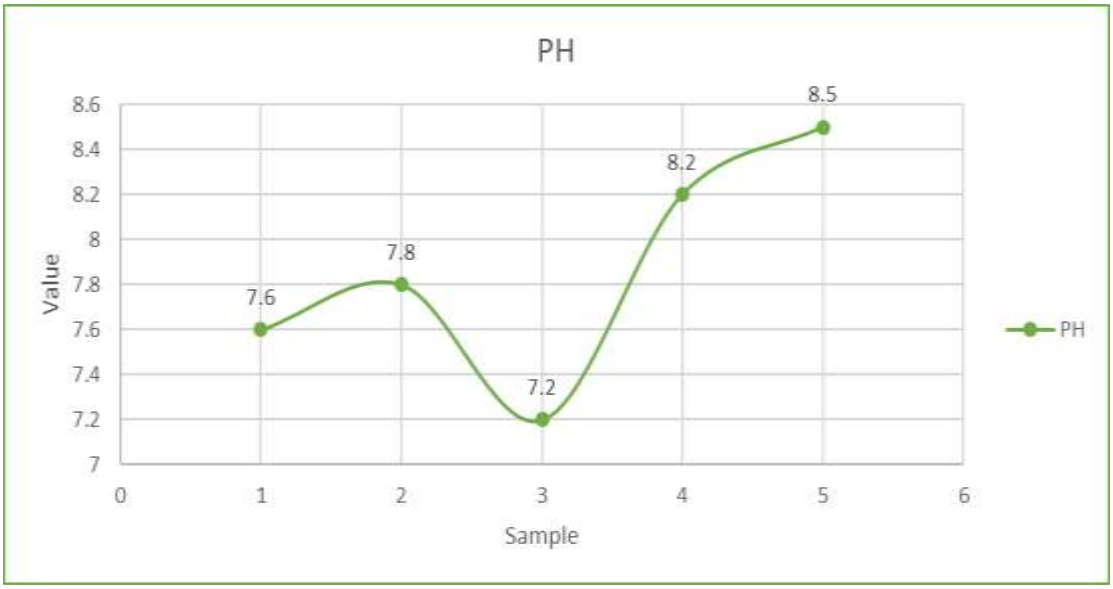

Fig.5. Value of PH

Total Metals in Soil Samples-The World Health Organization (WHO) has established soil quality guidelines (SQGs) for various metals and organic contaminants in the environment [5].

The data given in Appendices C (complete laboratory results). The concentrations of metals that exceeded WHO SQG R/P are highlighted in bold (Cr, Cu, Pb, Zn, Mn, Fe, &Ni). 4.3 Concentrations of Selected Metals (mg/kg) in Soil Samples Table-2, concentration of heavy metal in roadside soil.

Table -2: Sampling sites

Metal in Soil (Mg/Kg)	WHO Guideline 1996	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5
Copper (CU)	36	124	120	124	121	123
Chromium (Cr)	100	281	276	281	277	284
Lead (Pb)	85	145	139	145	140	146
Cadmium (Cd)	0.8	0.4	0.3	0.4	0.5	0.7
Zinc (as Zn)	50	189	180	189	183	194
Manganese (as Mn)	10	394	384	394	34	39
Iron (as Fe)	15	22.14	21.65	22.14	21.24	24.61
Nickel (as Ni)	35	145	140	145	138	147

4. CONCLUSION

This study was conducted in Ghaziabad city. Samples of soil were collected from five Locations each along the roadsides of Roadway (Meerut road, GT road, MP Road and Rani Jhansi road Hapur road) which includes the residential commercial and industrial areas, within 1.5 meters from the roads. The samples were analyzed for metals and Soil quality standards. Soil pH was also determined. The average pH of the soil samples was moderately alkaline (mean pH 7.86). There, were no great differences in pH between the soil samples either the sample from the commercial or industrial, however the concentrations of major metal contaminants increased. The concentrations of Cr, Cu, Pb, Ni, Zn, Mn in all the soil samples collected from all locations exceeded the WHO soil quality guidelines for everywhere. Lead in excess of the WHO guidelines was also found in all commercial Area. The metals data in this study suggested that motor emissions may be a major source of contamination along the Roadway.

This study focused only on the assessment of contaminants in roadside soils a detailed study on other sources of contamination (, previously dumping sites, age of Roadways, speed of vehicles, fuel leakages) will be crucial to determining the contribution of motor emissions to the overall effects of contaminants on the roadside environment. An environmental and human health risk assessment could

then be conducted to determine the impacts of all the contaminants from these activities on the roadside environment.

This investigation was based on a single sampling period. It is recommended that further sampling should be conducted to determine temporal and seasonal variation in contaminant concentrations as well as contaminant variation with distance from the road edge and different depth from the surface. The data obtained could be incorporated into a database and used in an ecological risk assessment to ensure effective protection and management of roadside environments.

REFERENCES

1. E.A. Oluyemi, G. Feuyit, J.A.O. Oyekunle, A.O. Ogunfowokan, Int. J. Environmental Science and Technology, 2008, 2: 5, 89 – 96.
2. F.A. Aekola, N. Salami, S.O. Lawal, Research Communications in chemistry, **2008**, 1:1, 24 – 30.
3. Plum, Rink, & Haase (2010), "The Essential Toxin: Impact of Zinc on Human Health", International Journal of Environmental Research and Public Health 7(4):1342-65 DOI: 10.3390/ijerph7041342.
4. JARUP L. (2003): Hazards of heavy metal contamination. Brazilian Medical Bulletin, 68: 425–462.
5. World Health Organization, Standard maxima for metals in Agricultural soils, 1993.