

# Accumulation of Toxic Metals in Soils/Dust Along Motorways From Champa To Katghora of Chhattisgarh State

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**Abstract:-** Environmental pollution of Toxic Metals / heavy metals from road vehicle has attained much attention now a day. The vehicular pollution between champa to korba-katghora is increasing day by day and it affects agriculture as well as living beings. This works leads to study of different concentrations of the Toxic Metals / heavy metals like - Hg, Cr, Cu, Cd, Ni, Pb, Zn, Co and As. Toxic Metals / heavy metals accumulation in soils along motorways by mainly due to transportation of coal ash, fly-ash and coal through heavy trucks and other transportation vehicles. - Near the Roadways soil sample from ten locations (champa, saragbundiya, madawarani, urga, korba, darri, gopalpur, chhuri, and katghora) were investigated during different seasons. Concentration of Toxic Metals / Heavy metals were determined by Flame atomic Absorption Spectrophotometric (AAS). Present work indicates toxic effect of toxic/heavy metals

**Keywords:** Toxic metals, environmental pollution, fly-ash, coal dust.

## INTRODUCTION

Korba district is situated in the northern half of the Chhattisgarh state and surrounded by the districts Korea, Surguja, bilaspur, Janjgir etc. The headquarter of Korba districts situated about 200 KM. from the capital city Raipur. The District's total area is 7,14,544 hectare out of which 2,83,497 hectares is forest land. Champa –Korba-Katghora road is the most important road which connects raigarh, shivrinarayan, ambikapur, pendra etc. Korba city is one of the most important industrial area in Chhattisgarh, therefore population density of the korba district has getting increased ( Korba District population in 2021 is 1,334,489 (estimates as per aadhar uidai.gov.in Dec 2020 data). As per 2011 census of India, Korba is also known as Power Hub, The large, moderate and small scaled industrial facilities are intensified along the roadway.

### List of factories in Korba

1. ACB (india) ltd. Chakabura coal washery
2. ACB (india) ltd. Binjhri coal washery
3. ACB (india) ltd dipka coal washery
4. Hasdeo thermal power station, cspgcl korba west
5. Smelter plant bhara aluminium company limited
6. MW chakabura thermal power plant.
7. 270 MW captive power plant bhara aluminium company limited
8. NTPC limited, korba super thermal power station
9. Vandana Power Project Chhuri
10. DSPM Thermal Power Plant Korba
11. Lanco Thermal Power Plant Patarhi
12. Madawa Thermal Power Plant Champa.
13. Open and underground coal mines (Kusmunda, Gevera, Dhelwadih, Bankimogra, Jawali, Rajgamar, Manikpur etc.)

Due to increase in population, Industrialization, and road traffic density, the amount of emission was also increased and accumulation of Toxic/Heavy metals along road gradually increases.

Toxic/Heavy metals such as Hg, Cr, Cu, Cd, Ni, Pb, Zn, Co and As. Are main reasons for this pollution. Block and Dams(1) have reported the presence of mercury in coal dust, fly-ash up-to a level of 0.6 ppm. The concentration level of the toxic/heavy metals in dust, fly-ash have been described by earlier works as follows (3)

TABLE 1

Elements	Concentration (in ppm)
Hg	0.7
Cr	100
Cu	93.5
Cd	3.0
Ni	83.5
Pb	46.5
Zn	115
Co	31.5
As	2.1

Toxic/heavy metals like Cd and Pb concentration cause decrease in glucose-6-phosphate activity, this results in increased oxidative stress and increased lipid per oxidation which causes toxicity in the liver and kidney. Therefore toxic / heavy metals were selected as the topic of this research.

The maximum lead concentration in the soil along roadways is observed in trucks stoppage, petrol/diesel pumps, weighing rooms, speed breakers and rooms, speed breakers and trucks repairing shops. Cu, Cr and Zn elements in soil along the road are the main material of various alloys, pipes cables and tire. Nickel in Gasoline and Cd & Zn in tires and motor oils were found in high concentration earlier (4,5). Study of Pollution along roadways is necessary; the aim of this study is to investigate the environmental pollution due to toxic/heavy metals accumulation in the soil layer along the Champa-Korba-Katghora road (Industrial belt).

#### EXPERIMENTAL

##### Sample location

- 1.Champa railway- champa city-jarway junction (S1)
2. Kothari railway-korba-champa junction (S2)
- 3 Urga weighing room (S3)
- 4 saragbundiya petrol pump (S4)
5. Korba trucks repairing shops (Transport Nagar) (S5)
6. Speed brakers sitamani outer (S6)
- 7 Darri-gopalpur petrol pumps (S7)
- 8 chhuri agricultural area (S8)
- 9 Katghora-Bilaspur-Ambikapur junction (S9)
- 10 Madwarani speed braker (S10)

##### Sample preparation and detection

The sample of soil from different location were collected at a depth of 0 to 0.7 cm reduced to a suitable size (Less than 2 mm) using the method of repeated quartering and dried at 100<sup>0</sup> C and will be wet digested with HNO<sub>3</sub>-HClO<sub>4</sub> mixture, then refluxed with concentrated HNO<sub>3</sub> to solubilize the metals, and stored in polythene bags. Hg, Cr, Cu, Cd, Ni, Pb, Zn, Co and As. were carried out with flame absorption spectrophotometer. Other elements are estimated by usual methods.

#### BULK DENSITY

Weigh exactly 20 gms of powdered soil and fill in a 100 ml measuring cylinder by tapping. Note the reading (volume) of the cylinder which is occupied by the soil.

$$\text{Bulk Density} = \frac{\text{Weight of soil}}{\text{Volume of soil}}$$

TABLE 2

Sample location	Colour	Texture	Water holding capacity	Bulk density gm/cc	Conductivity mho/cm
S1	Blackish	Loamy	70	1.33	167
S2	Brownish	silty	65	1.78	180
S3	Brownish	Silty-loamy	72	2.01	160
S4	Blackish	Loamy	68	1.50	187
S5	Blackish	Loamy	60	1.91	167
S6	Brownish	Loamy	68	1.72	156
S7	Brownish	Silty-loamy	68	1.53	160
S8	Blackish	Silty-loamy	72	1.71	175
S9	Brownish	Loamy	62	1.40	175
S10	Blackish	Silty-loamy	66	1.32	167

TABLE 3

Abundance of elements in the earth crust<sup>4</sup> and their acceptable limits<sup>5</sup>

Elements	Concentration in the earth crust(mg/kg)	Acceptable limits (mg/kg) by NSPCR
Hg,	0.1	1
Cr,	100	100
Cu,	50	50
Cd,	0.15	1
Ni,	75	30
Pb,	12.5	50
Zn,	70	150
Co	20	20
As.	1.8	2.0

TABLE 4

Results of sample collected along the CHAMPA-KORBA-KATGHORA Road

Location	Hg	Cr	Cu,	Cd	Ni	Pb	Zn	Co	As
S1. Champa railway-champa city-jarway junction	0.80	480	70.20	0.50	80	72	77.9	43	15.6
S2. Kothari railway-korba-champa junction	.78	675	72.10	0.42	88	78	56.9	66	14.9
S3 Urga weighing room	.67	532	84.00	1.38	93	86	104.4	58	7.8
S4 saragbundiya petrol pump	0.43	456	50.00	01.35	94	58	203.56	98	13.3
S5. Korba trucks repairing shops (Transport Nagar)	0.33	899	48.20	0.23	80	78	178.8	68	12.89
S6. Speed brakers sitamani outer	0.64	1003	96.60	1.31	98	86	187.54	63	4.9
S7. Darri-gopalpur petrol pumps	0.95	872	42.10	1.35	89	77	199.67	22	16.98
S8. chhuri agricultural area	0.83	522	69.45	0.12	69	64	187.8	32	9.9
S9. Katghora-Bilaspur-Ambikapur junction	1.20	352	24.50	1.60	74	54	132.6	54	11.3
S10. Madwarani speed braker	1.0	476	59.76	1.41	63	78	159.99	33	15.6

## RESULTS AND DISCUSSION

The heavy/toxic metal concentration range and average for soil sample collected from S1,S2,S3,S4,S5,S6,S7,S8,S9, and S10 Roadways for Hg, Cr, Cu, Cd, Ni, Pb, Zn, Co and As. elements are as above. Toxic /heavy metals concentration exceed the permissible limits of these elements in the earth crust. Few elements such as Pb, Cd, Hg, As are toxic in nature.

Concentrations determined along the route are closely associated with the sample location such as residential area and speed breakers on the road. Heavy/toxic metals are those having density higher than the water/soil<sup>6</sup>. They are present in trace amount but they are toxic even at very low concentration.

Soil dispersion along motorways gradually increases due to transportation of coal, fly-ash which causes environmental problem. This metal reduces productivity of crops and change many physic-chemical reactions in human body.

According to Toxic/heavy metals accumulation along the champa-korba-katghora route agricultural activity should be prohibited. For public, children this route is not safe. Residential site should be rearranged. In order to minimize the toxic/heavy metals accumulation in the region, way of transportation of coal Fly-ash should be changed by air, rail, or sea.

## REFERENCES

- [1] Block C and Dams R. (1975) Inorganic composition of Banlgian coal and coal ashes.
- [2] Kumar surendra (1984)Knowing pollution problem atmospheric problems from coal fired power plants.
- [3] Klein D.H. Andreu, A.W. Canter, J.A.Canter(1975) Path way of thirty seven trace elements trough coal fired power plants.
- [4] M.S. Oncel , V.Zedef and S.Mert , J.Fresenius Bull 13, 1525 (2004)
- [5] K.Krauskopf, Introduction to geochemistry, McGrew-hill book company press 43 (1979)
- [6] T.K.K.Y. Toprak25831 Sayili Reshmi Gazetede Ankara 2005
- [7] Banerjee B, and Krishna KUmari (1988) Environment and Ecology
- [8] Bertine K.K. and Golder E.D.(1971) Importgant source of particulate aie pollution Science.
- [9] P.W. Abrahams Soils: their implications to human health Sci. Total Environ., 291 (2002), pp. 1-32
- [10] J. Watt I. Thornton and IC Howells(1993)
- [11] Hassan M.Z. and Pandey S.P.(1978) complexation extraction methods of lead and cadmium (Env. And Health)