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# Study of Heavy Metals In The Stream of Vehicle Traffic Along National Highway Road-Side Soil

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## ABSTRACT

The toxic metal level of the roadside topsoil collected by National Highway-17, North Maharashtra-India such as Lead, Cadmium, Copper, Nickel, Zinc, Chromium, As, Hg, Co, Fe, Mn and others was determined. The impact of vehicular traffic can thus be undisputedly documented on heavy metal contamination of roadside soil. Road traffic and maintenance pollutes the roadside soil by chromic heavy metals. Some of these pollutants can be scattered into the air or stored on the roadside. The collection of samples from a fire-pollutant site near Highway-17 also determined soil metals collected by Atomic Adsorption Spectroscopy after acid digestion with a control sample that were considerably distant from the road. The heavy metal concentration in the former sites was compared between polluted control sites.

**Keywords:** Heavy metal, NH-17, Soil, Traffic North Maharashtra.

## INTRODUCTION

Due to the numbers of vehicles, the roads of the most developing and developed countries become crowded, and the new technology are also progressing rapidly every day. The social life then quickly expands, but the society and climate are influenced by some negative effects. In our contemporary economy and social life, the most important road communication system is undoubtedly a highway. Nearly every day, the number of cars on our streets, especially on the railways, creates various types of environmental problems that become a big serious problem for our society. One of the problems caused by manmade severs are surface and ground water poisoning by heavy metals 1-3. Synthetic organic products such as petroleum hydrocarbons are also a major environmental pollutant, as they do not easily biodegrade and

 

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settle in the environment like natural organic compounds. Increased petroleum hydrocarbon levels in soil near roads are also reported 4.

The global attention has been drawn during the past three decades to heavy metal soil pollution. In the human and animal body, heavy metals can be accumulated by direct ingestion, inhalation or dermal contact. Using and entering the food chain of heavy metals through edible plants is also one of the most likely ways of accumulating heavy metals in living organisms. The researchers are well aware of the toxicity of heavy metals. Many big biochemical processes of the human body can be influenced. This form of human-made environmental degradation is particularly affected by those who live in the contaminated region. In the most contaminated region of streets, the occurrence of emigrant migraines, vomiting, exhaustion and fatigue and skin disorders is recorded. Long-stage exposure results may contribute to certain deadly conditions, such as cancer, leukemia, kidney, and central nervous system hepatitis harm and failure 5-6. While metals such as Cu and Zn are known to be micro nutrients and essential for metabolic acidities crops, the high levels are poisonous. But low Pb and Cd levels can cause extreme toxicity to living organisms. Although the use of leaded petrol has been phased out, but plum poisoning remains important in other sources such as smelting and the disposal of batteries, lubricant etc.7, high-traffic heavy-metal soils are reported because of traffic on the roads and maintain which causes various pollution types. The chronic emission of pollutants, especially heavy metals, has been caused by abrasion, wear of the brakes and corrosion of the safety closed doors. Unregulated and unregulated disposal of lubricant oil by road often leads to Cd, Cu, Pb, Zn, Ni, Cr, and synthetic hydrocarbon toxic pollutants 8-9.

As these heavy metals and complete synthetic hydrocarbons are very hard to remove from soil after exposure the soil emissions poses an important global environmental problem 10. Although called studies of heavy metal concentrations in roadside soil, much of these tests have been carried out in advanced countries, with a long history of industrialization and widespread use of plumbed gasoline. In developing countries such as India, there have been very few studies of metal intensity and supply results in the developing countries 11. In this work, the researchers try to study part of the National Highway-17 through Maharashtra, India. The National Highway-17 traverses the states of Uttar Pradesh, Rajasthan, Madhya Pradesh and Maharashtra (Mumbai-Agra) in India for the total of 1190 kilometers.

 

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## EXPERIMENITAL

### Material and Methods

The study area is part of the National Highway-17 located in Dhule to Palasner District, the Dhule to Palasner Research Area is 87 km away. And located on the north side of the Tapi River (Figure 1). NationalHighway-17 is packed with cars and many heavy and heavy vehicles that pass through it every day. Five sites, namely S1) Songir toll plaza, S2) Babhale highway, S3) Shirpur toll plaza, S4) Devbhane highway roadside and S5) Dhule Avdhan toll plaza, selected along the National Highway-17 from Dhule to Palasner for the collection of upper soil samples. All of the above seats are exposed to heavy traffic around the clock.

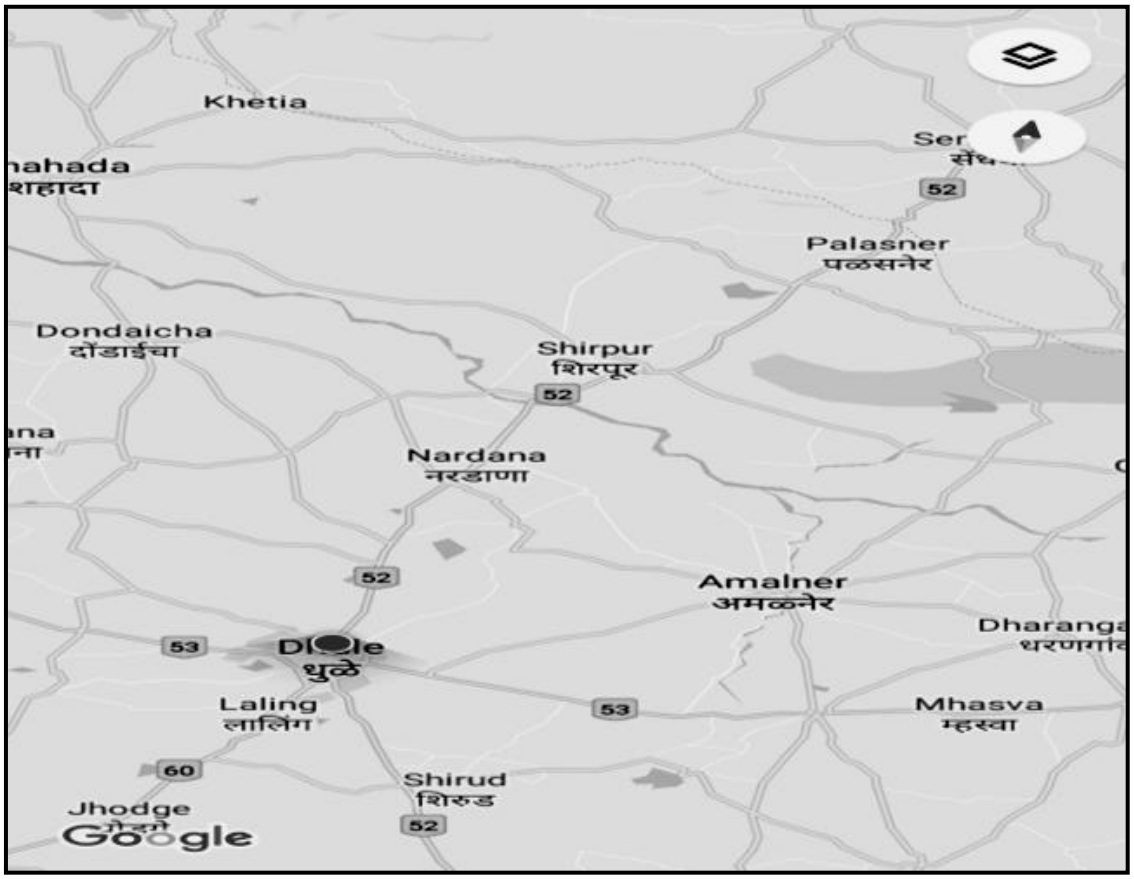


Fig. 1: National Highway-17 Mumbai to Agra across the Tapi River of Maharashtra

National Highway 17, a busy highway with automobiles and many heavy vehicles, including rivers, belongs to the oil and gas company Ltd.

### Sampling procedure

 

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Dry sampling (February 2018) was done to avoid potential rain water flowing. The test was done in dry session. Composite specimens were taken at different locations at random. At different sites at a distance of 2-3 feet from the road, each spot was selected. The sampling device was a locally manufactured soil auger. The samples of soil were placed in plastic labeling bags. They are ground to fine powder and passed through a 2 mm sieve with the air dried samples. For the determination of organic carbons, the samples were further passed through a finer 0.5 mm mesh sieve.

**Analytical Technique**

Soil $P^H$ was measured in 1:5 soil distilled water (w/v) suspension. Organic carbon contents were determined by Walkley Black method modified by Jackson. For analysis of metal the soil samples were digested with 3:1 (v/v) nitric acid: perchloric acid mixture [12]. After digestion the samples were filtered through Whitman-42 filter paper to obtain a clear solution. Then volume of filtrate was made up to 50 mL in volumetric and task. The filtrate was stored in polypropylene boatel prior to total metal analysis by Atomic adsorption spectroscopy (AES)

## RESULTS AND DISCUSSION

The characterization of physic-chemical parameters in the roadside soil are summarized in the table

Table No. 1: Physico-chemical parameters of collected samples

| Name of sampling sites | $P^H$ | EC msm | TDS mg/lit TOC (%) | Soil texture |
|---|---|---|---|---|
| **S1** | 8.64 | 0.46 | 0.70 | Sandy |
| **S2** | 8.07 | 0.72 | 0.65 | Sandy |
| **S3** | 7.83 | 0.98 | 1.08 | Black |
| **S4** | 7.01 | 0.43 | 0.84 | Black |
| **S5** | 7.89 | 0.98 | 0.87 | Sandy |

The pH of the soil samples ranges from 7.01 (S4) to 8.64 (S1). The pH values shows that all the soil samples are Baric in mature from table (1) we can less petroleum hydrocarbon see that all the samples (S1 – S5) contain. The value of petroleum hydrocarbon ranges from 0.11% up to 0.35% sample S4 contains. The highest amount total petroleum hydrocarbon at $P < 0.05$.

Table 3: Heavy Metal by AES methods (Year-2019)

 

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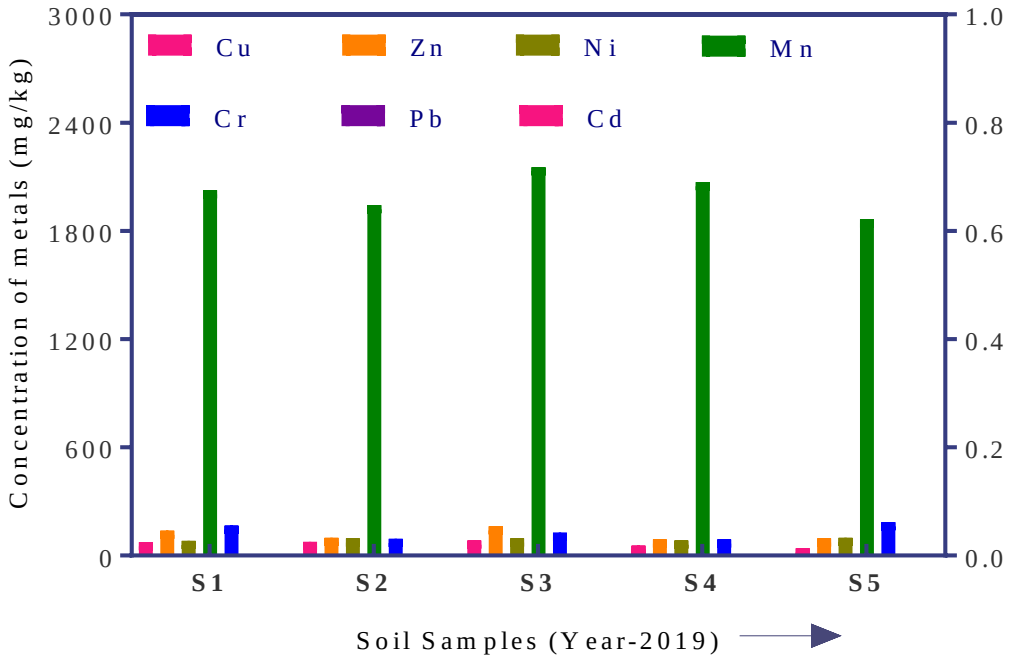
| Soil Sample | Concentration of heavy metals (mg/kg) [2019] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Cu | Zn | Ni | Pb | Cd | Mn | Cr |
| S1 | 75.01 | 138.00 | 82.56 | ND | 1.96 | 2025.93 | 165.85 |
| S2 | 76.70 | 99.17 | 95.75 | ND | 1.71 | 1943.09 | 93.77 |
| S3 | 82.81 | 162.93 | 95.23 | ND | 1.46 | 2153.19 | 127.53 |
| S4 | 55.25 | 89.05 | 82.88 | ND | 1.23 | 2071.04 | 90.15 |
| S5 | 40.67 | 95.79 | 98.48 | ND | 1.71 | 1863.30 | 185.44 |




Graph2: Concentration of metals from different sampling sites

**Pb (Lead):** In the roadside soil near National Highway-17 lead can concentration ranges is normal S2 to S5 with an average. Which is still lower then values of other worldwide studies Table-3 only exception is the concentration of lead reported in the road side of Edrine Turkey 13, which is too low in comparison to our present study. According to world health organization, maximum permissible limit of lead for agricultural soil is 10mg/kg. Our all the sampling sites exceed this limit. The maximum permissible limit of lead for agricultural soil is 300 mg/kg and 250-500 mg/kg respectively by EU and FEPA 14 our findings are significantly lower than this limit. But the levels of lead obtained from the all five sampling locations in our present study are significantly lower (that is not detectable (ND)

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**Zn (Zinc):** The concentration Zinc ranges 1st year sample 71.2741 mg/kg to 105.783 mg/kg (S5 to S3) and second year samples 89.05 mg/kg to 162.93 mg/kg (S4 to S3) but the value in much lower than the findings obtained from present study. The WHO maximum permissible limit for zinc is 200 mg/kg and for EU, it is 300 mg/kg. Our results are within this limit.

**Cu (Copper):** The range of copper concentration in the present study is from (67.096 to 152.68 mg/kg) and (40.67 to 82.81 mg/kg) which is similar to some other reported studies. Though the copper concentration in all sampling sites are lower than the maximum permissible limit except S4 sample having high copper value 152.68 mg/kg for CU set up by EU, which is 140 mg/kg.

**Ni (Nickel):** Nickel concentration ranges from (52.09 to 62.96 mg/kg) and concentration ranges from (82.85 to 98.48 mg/kg) levels Nickel in all samples are exceed with in maximum permissible range set up by EU, which is 75 mg/kg comparing with EU, it has been observed that the roadside samples are more contaminated with Nickel.

**Cd (Cadmium):** In case of cadmium, the concentration ranges from 1.23 to 1.96 mg/kg and 1st year there is no Cd in our samples. Levels of Cd in the roadside soil of NH-17 are still in the safe zone as compared with the maximum permissible limit of WHO (10 mg/kg), FEPA (3.6 mg/kg) increasing trend of Cd. In soil may cause threat to human and animals in near future.

**Cr (Chromium):** The level of Chromium ranges from (66.88 to 228.077 mg/kg) and (90.15 to 185.44 mg/kg) none of the sample contains chromium. More than maximum permissible limit 300 mg/kg recommended by EU. Contamination has been observed in the roadside soil. As compared to other reported research.

**Mn (Manganese):** The maximum available concentration of Mn by WHO is 2000 mg/kg the manganese in some the samples in our study are for high then this limit but the maximum concentration is (1863.30 mg/kg to 2153.9 mg/kg) and minimum (977.43 mg/kg to 1694.3858 mg/kg) in those samples high value of Mn observed.

## CONCLUSION

This research study found that toxins were gradually increasing on the roadside soil near to National Highway 17. The most likely source of this pollution is that vehicle traffic is reported in this way in comparison to background levels with high levels of heavy metals and oil hydrocarbons. In the majority of cases, the levels of contaminants are still within the limits set by certain international organizations, such as the WHO, EU, FAO etc. High heavy metals and

 

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petroleum hydrocarbon have risk for life, as previous researcher's worldwide report, which support our results, so the need for the hour is constantly monitoring those parameters. For greater human interactions, it should be avoided to dump lubricants, plastics and E-wastes uncontrolled and unauthorized. This research work has shown that road traffic has small impacts on heavy metal content of soils. The increased concentrations of Cu, Ni, and Mn in soil close to the road could lead to long-term heavy metal contamination from roadside transport.

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