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Inquiry of Heavy Metals from various Laterite Profiles in Kanyakumari District, Tamil Nadu

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Abstract: Environmental pollution with heavy metals is a global problem. Living organisms are not able to prepare and adapt rapidly to a sudden and huge environmental load with different toxic compounds, thus the accumulation of such toxic compounds, especially of heavy metals having highly hazardous effect, can cause undesirable changes in the biosphere with hazardous consequences. In the present study Laterite soil samples from five stations of Kanyakumari district in Tamil Nadu were collected and used for the analysis of heavy metals. The range of various parameters in the soil were analyzed by suitable methods. The heavy metals were determined by atomic absorption spectroscopy. The trace metal abundance in the study area was in the order Zn>Cr>Cu>Co and most of them were within the safer limit. So they are suitable for irrigation and agricultural uses.
Keywords: Laterite soil, toxic compounds, hazardous effect, atomic absorption spectroscopy

I. INTRODUCTION

Soil may be defined as material of variable depth with considerable solid content at the Earth's surface which is undergoing change as a result of chemical, physical and biological developments. Soil is a multifaceted medium which both responds to and impacts, environmental processes and conditions. Consequently, they are exposed to a number of pollutants due to unalike anthropogenic activities (Industrial, agricultural, transport etc.) [4]. Heavy metals constitute a natural module of the earth's crust. They are biodegradable, hence endure in the environment. Heavy metals may emanate from natural sources, percolated from rocks and soils according to the geochemical suppleness or from anthropogenic sources [1], [8]. Anthropogenic sources of heavy metals embrace: discharges from vehicle deplete, pipe, tyre wear particles, weathered street surfaces, brake lining wear particles, power plant combustion, metallurgical industry, auto repair shops, chemical plants, weathering of buildings and road surfaces, atmospheric deposits, excavating, smelting, waste disposal, urban effluents, pesticides, fertilizers, sawdust disposal, herbicides, pharmaceuticals, batteries, fungicides, paints, pigments and dyes, leather tanning, photographic films, bangers, printer and photocopier toners, cement, candles, rubber, etc. Heavy metal contagion allusions to the excessive accumulation of toxic heavy metals in the soil caused by human activities. Heavy metals in the soil incorporate some significant metals of biological toxicity, such as mercury (Hg), cadmium (Cd), lead (Pb), chromium (Cr) and arsenic (As), etc. They also include other heavy metals of certain biological toxicity, such as zinc (Zn), copper (Cu), nickel (Ni), vanadium (V), and so on. In small concentrations, the traces of the heavy metals in plants or animals are not noxious [2]. Lead, cadmium and mercury are exceptions; they are venomous even in very low concentrations [5]. Heavy metal contamination has become a noteworthy problem in several community and agrarian areas over the years due to the application of salable agrochemicals on agricultural production [12], [9]. Chemical and physical and chemical kinship of metal ions for various waste materials may reduce their reachability, however, metal ions mobility upsurges over time as acidic and oxidizing conditions prevail [13]. Because of its environmental consequence, investigations to determine risk caused by metal quantities in soil on human health and forest ecosystem have incriminated attention in modern years [11], [7].

II. MATERIALS AND METHODS

A. Study Area

Kanyakumari is a coastal town in the state of Tamil Nadu on India's southern tip. The district of Kanyakumari is the southernmost districts in the state of Tamil Nadu. It is situated between 77°15' and 77°36' east longitude and 8°03' and 8°35' north latitude. The district has borders with Tirunelveli district, the Gulf of Mannar, the Indian Ocean, the Arabian Sea and the Thiruvananthapuram District . (Fig.1). In Kanyakumari District Laterite soil is found at Thiruvattar, Killiyoor, Munchirai, Rajakkamangalam, Thuckalay blocks.

Fig. 1: Kanyakumari district map

Fig. 2: maps representing location sites

B. Sample Collection And Analysis

Soil samples were collected during October 2014 to September 2015 from five stations (Munchira, Melpuram, Killiyoor, Rajakkamangalam, Thuckalay) representing the study area (**Fig. 2**).

The soil samples were air-dried at normal laboratory temperature. Soil samples were ground using pestle mortar and sieved to pass through 2 mm sieve and stored safely into polyethylene bags, labeled and taken to the laboratory for pre-treatment and analysis. Concentrations of heavy metal ions, in the extracts were analyzed with AAS with addition calibration.

III. RESULT AND DISCUSSION

A. Copper

Copper is a vital element for numerous metabolic processes. Since it is necessitated only in trace amounts, Cu becomes toxic at high concentrations [3]. Levels of copper (Cu) rarely occur naturally in soils. However, copper may accumulate due to application of sewage sludge, pig slurries or mine slag, or more commonly through persistent use of copper-containing fungicides or fertilizers. High soil copper levels can happen as a result of extreme use of copper containing fungicides industrial activity.

The Monthly deviation of copper is shown in Chart-1. Higher concentration is observed in Station -2(Melpuram) and lower concentration is observed in Station -4(Rajakkamangalam). The safer limit value of copper is below 100mg/kg. In the present study the concentration is vacillated from o.43-25.65 mg/kg.

B. ZINC

Zinc (Zn) is a micronutrient essential for normal healthy growth and breeding of plants, animals and humans. In soils, the total concentration of Zn was conveyed to be in the range of 10-300 mg Zn kg-1. Laterite soils recorded lower mean obtainability but higher total Zn content. Zinc and copper appear to be seized up by plants through the same mechanism so when one is in excess, plants don't engross enough of the other.

Monthly values of variation of Zinc is shown in Chart-2. Higher concentration is observed in Station -2(Melpuram) and lower concentration is observed in Station -5(Thuckalay). Idyllically, healthy and prolific soil the concentration of zinc should be 1-200mg/kg. In the present study the concentration is fluctuated from 52.07-96.76 mg/kg.

C. Chromium

Chromium is a key component of steel alloys (10–26%) and used for coating steel as chrome plating. Chromates and dichromates, containing Cr^{6+}, are sometimes discharged in industrial effluents, particularly from leather tanning and electroplating operations, and are highly poisonous and readily soluble. The concentration of Cr in the soils may vary significantly according to the natural opus of rocks and sediments that compose them [6]. The amounts of chromium in the soil may increase predominantly via anthropogenic deposition, as for example atmospheric accumulation [10].

Monthly values of deviation of Chromium is shown in Chart-3. Higher concentration is observed in Station-5(Thuckalay) and lower concentration is observed in Station-4(Rajakkamangalam). The global average of Cr in surface soil has been estimated to be 54 mg/ kg. In the present study the concentration is oscillated from o.43-25.65 mg/kg.

D. COBALT

Cobalt is sorted as an essential micronutrient and shows a risky role in the complete growth process of plants. It is a primary component of vitamin B12 and propionate. It is a critical element required for a plant to reach maturity and for healthy bud enlargement. Small amounts are found in most rocks, soil, surface and underground water, plants and animals. Cobalt soil concentrations depend on a number of factors including local geology, atmospheric deposition of cobalt-containing dust, land use and associated amendments, etc [14].

Monthly values of variation of Cobalt is shown in Chart-4. Higher concentration is observed in Station-2(Melpuram) and lower concentration is observed in Station -4(Rajakkamangalam). The average cobalt concentration is between 1-20mg/kg dry weight. In the present study the concentration is from 4.8 -21.08 mg/kg. All the stations except the station-2(Melpuram) in the month, March are in the safer limit. The higher value is due to the use of fertilizers, agricultural run-off from the nearby fields and from detergents from the river.

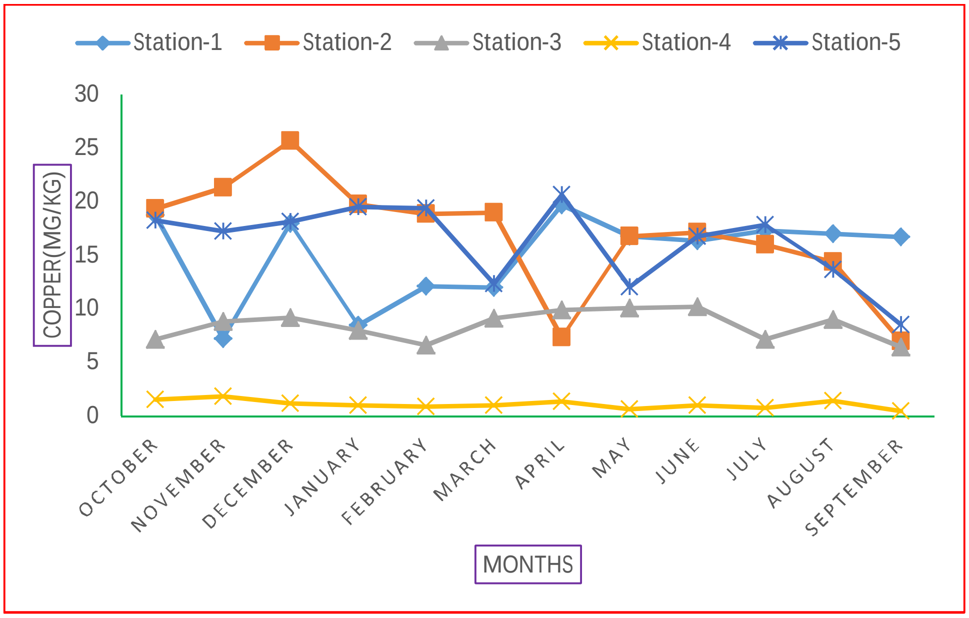

Chart-I Variation of Copper from October 2014 to September 2015

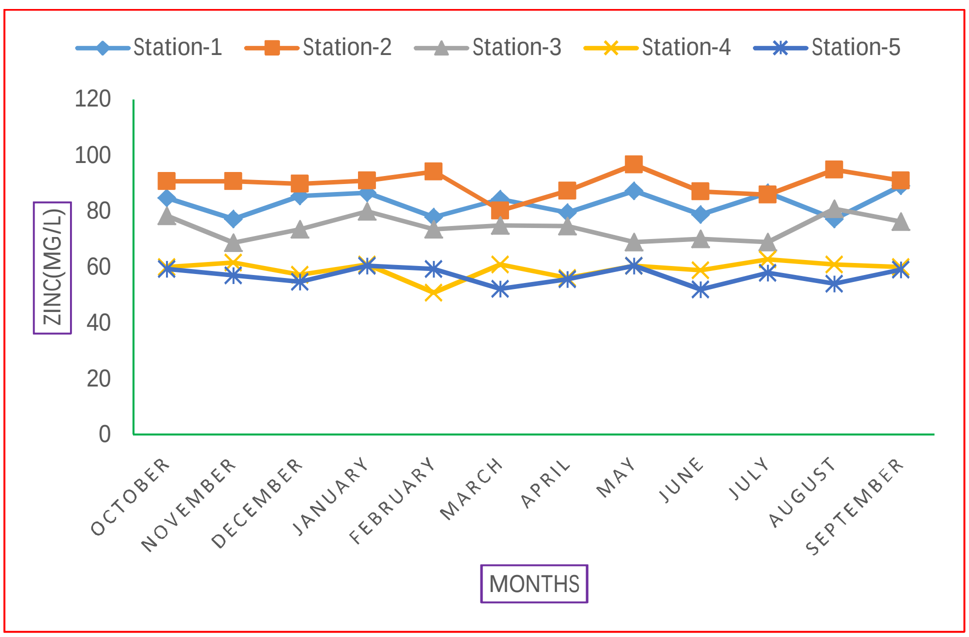

Chart-2 Variation of Zinc from October2014 to September 2015

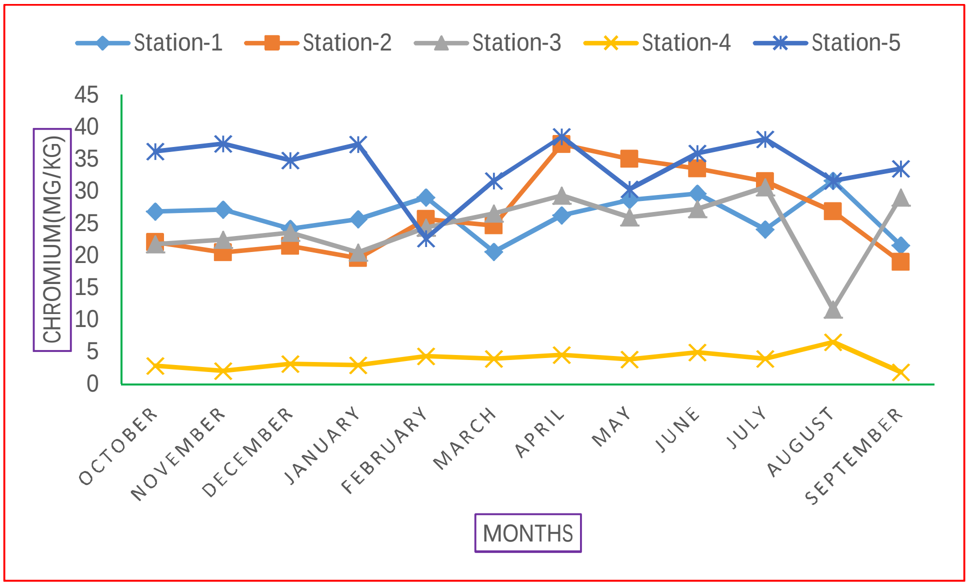

Chart- 3 Variation of Chromium from October 2014 to September 2015

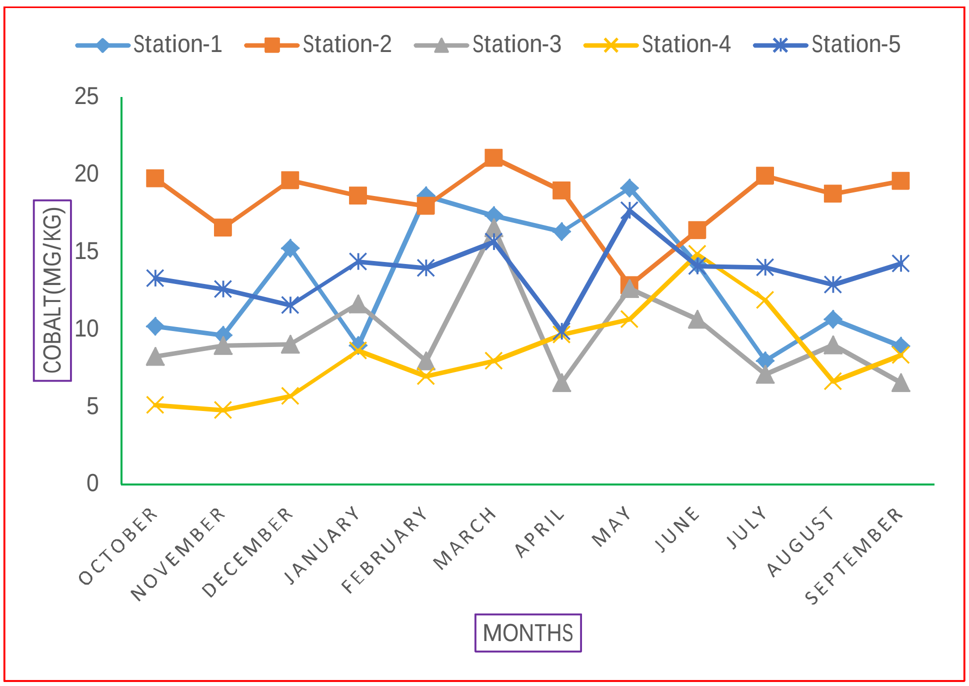

Chart- 4 Variation of Cobalt from October 2014 to September 2015

IV. CONCLUSION

This paper scrutinized heavy metals investigation in five stations in Kanyakumari district and the order of enrichment are: Zn>Cr>Cu>Co. The amount of heavy metals in all the stations are in the safer limit except the concentration of cobalt in station-2 for the month of March are in the critical limit. The value is 21.08 mg/kg, but the safer limit value of Cobalt is below 20mg/kg. The higher value is due to the Anthropogenic sources such as discharges from vehicle deplete, pipe, tyre wear particles, weathered street surfaces, auto repair shops, weathering of buildings and road surfaces, atmospheric deposits, excavating, waste disposal, urban effluents, pesticides, fertilizers, sawdust disposal, herbicides, batteries, fungicides, paints, pigments and dyes, cement, candles, rubber, etc. The heavy metals are also leached into groundwater by rainfall. But there was no risk for agriculture and irrigations carried out in the soil present in the five stations.

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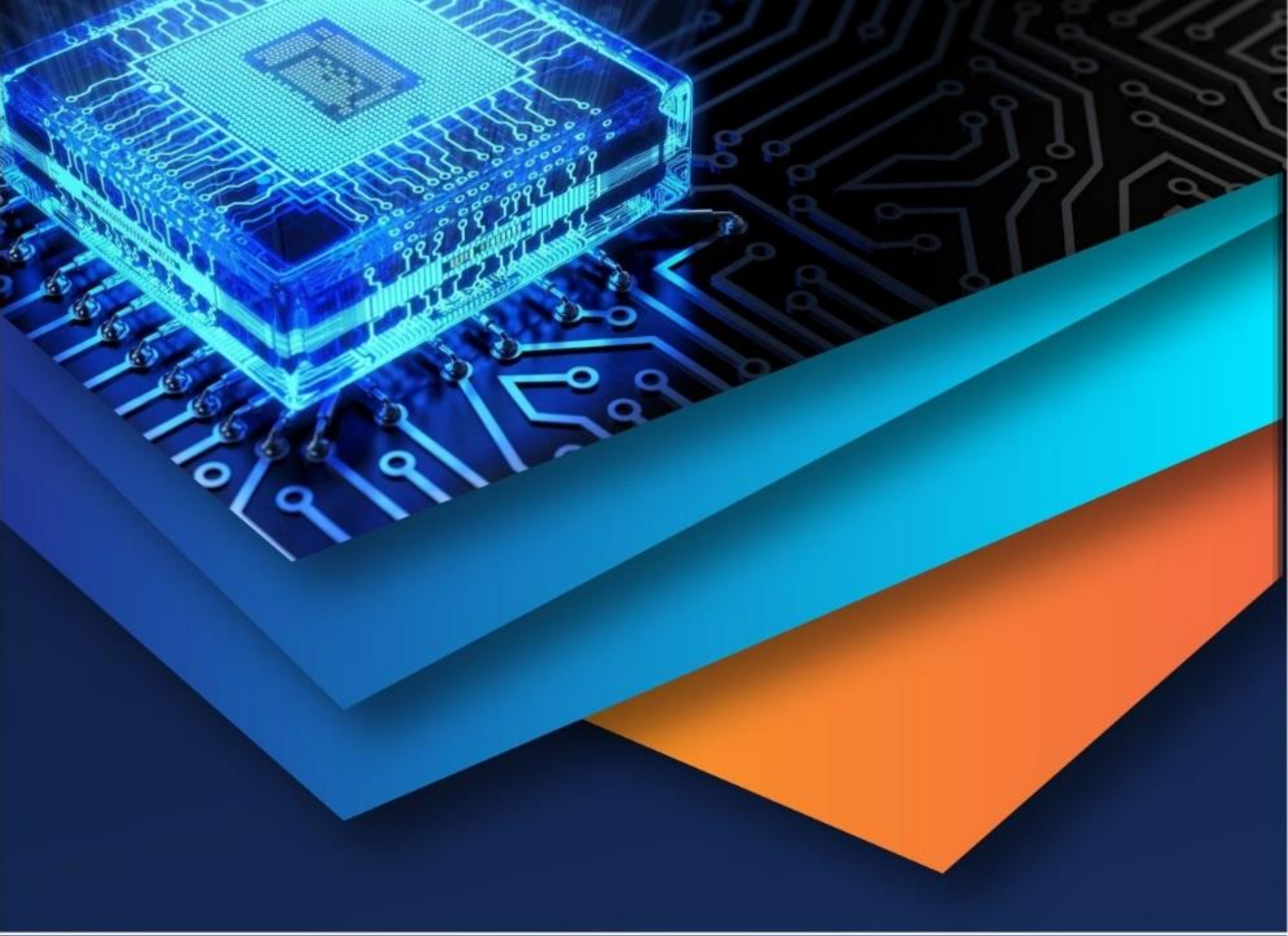

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