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Soil Quality Assessment and Heavy Metal Contamination in Agricultural Soil in and around Toranmal (Triable Region) of Maharashtra

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ABSTRACT

This paper ardently deals with vulnerability assessment of Soil Samples in the region of Nandurbar district of Maharashtra state, in india. The soil assessment of the districts is analysed according to the guidelines providing by central pollution control board, New Delhi, APHE, IHP and WHO. Toranmal is hill station in municipal council of Nandurbar district in Indian state of Maharashtra. It is located in the Satpura Range. This paper advocates habitat conservation and ecological studies with special reference to the physico chemical characteristics and heavy metal contamination in soil along triable area. In the present investigation the P^H, electrical conductivity, alkalinity and chloranity values recorded were observed, during dry season and low during rainy season. The soil sample were also analysed for their heavy metal contents like Ni, Zn, cd, Cu, Fe, As, and Hg. It was observed that the concentration of heavy metal in this season. These heavy metals have a marked effect on the aquatic flora and fauna which through bio magnification enter the food chain and ultimately affect the human being as well. The present experimental data on heavy metal assessment in soil samples collected in and around Toranmal point out to the need of regular monitoring of water resource and further impartment in the waste water treatment. If the present conditions continue for along period.

Keywords : Soil pollution, heavy metal content, physicochemical parameters, flame atomic absorption spectrophotometer food chain.

INTRODUCTION

The problem of environmental pollution due to toxic metal has begun to cause concern now in most major metropolitan cities; the toxic heavy metal entering the ecosystem may lead to geo accumulation, bioaccumulation and biomagnifications. heavy metals like Fe, Cu, Zn, Ni and other trace elements are important for proper functioning of biological systems and their deficiency or excess could lead to a number of disorders, food chain contamination by heavy metals has become a during issue in recent years because of their potential accumulation in bio systems through contaminated water, soil and air. Therefore a better understanding of heavy metal sources, their accumulation in the soil and effect of their presence in water and soil seen to be particularly important issues of percent day research on risk assessments. The main source of heavy metals to vegetable crops is their growth media. (Soil, air, nutrients).

Increase in poverty, hunger, lack of formal employment opportunities, demand for food, and proximity to markets and availability of cheap resource such as urban organic waste. The most common urban Agricultural activities are community gardens (formal & informal) home gardens, institutional garden. Nurseries managed by schools, hospitals, (Mubofu and Bahemuka 1999) despite serious. Environmental and public health effect. The practices are

associated with metals and toxic chemicals. The major entry is through roots and leaves absorbing the chemicals from contaminated soil, water and air. (Zurera et al. 1989).

Some heavy metals e.g. Cu, Se, and Zn are essential to maintain the metabolism of human body. However, studies on the water of Toranmal in Nandurbar District.(M.S.) reval that the presence of trace toxic heavy metals like pb and other metals. Reduce soil fertility and agricultural output. The increasing trend in concentration of heavy metals in environment has created considerable attention amongst ecologist, globally during the last decades. There is need for extensive monitoring efforts over long periods of time in order to describe average metal precipitation and its trend. Which is an essential component of any pollution control management several factors like discharge of agricultural, domestic and industrial wastes. In an attempt to determine the pollution history and to assess the fact of heavy metals along the triable area. Detailed investigation of soil sample for heavy metal content was also performed.

MATERIALS AND METHODS

2.1 Area of the Study:

The study was carried out in and around Toranmal. Toranmal is small plateau in the saputara hills spread over an area of approximately 41.435 sq.km. Toranmal is hill station on the boundary of Maharashtra, M.P. and Gujrat in the municipal council in Akrani Taluka of Nandurbar district in Maharashtra.

Toranmal is located on a small plateau which is cut from south to north by a stream. It is known as the second coolest hill station in Maharashtra state and is covered by dense forest. Toranmal is a predominantly triabal area which got it's name from the goddess Torana located at the top of the hill with considerable salubrious and cool climate during summer season.

Toranmal has several little surprises along Yashwant lake, Khadi point, Toranadevi Temple, Sita Khai, Machindra cave. The Toranmal hill resort the biggest hotel here has mounted several of broken sculptures on raised platform.

2.2 Requirements :

All the glass ware and other pipettes were first cleaned with tap water thoroughly and finally with distilled water. The pipettes and burette were rinsed with solution before final use the chemicals and reagent were used for analysis were A.R.Grade the procedure for calculating the different parameters were conducted in the Laboratory.

2.3 Soil Sampling, Preparation and Analysis:

A total five soil samples were collected at the depth of 0 to 15 cm. and 15 to 30 cm. from different sites stored in plastic bags and transported to the laboratory for heavy metal extraction and analysis.

The soil sample was oven dried at 105^0c for 24 hrs. followed by grinding and sieving using 0.5mm mesh size sieve to remove stones, plant roots, and have soil of uniform particle size soil sample from two different layers were mixed thoroughly packed in polythene bags and kept in dry place until analyses. Well mixed samples of 2.0 gm. Each were taken in 250 ml glass beakers and digested with 8 ml aquaregia on sand bath for 2 hrs. After evaporation to near dryness the sample were dissolved with 10 ml to 2% Nitric acid filtered through Whatman's No.1 filter paper and then dilute with deionized water to give final volumes depending on the suspected level of metals.

2.4 Physico Chemical Study:

The present study provide a detailed description of the physico-chemical criteria of soil sample collected in and around Toranmal (Triabal Area) the sample collected were analysed for moisture content, PH, EC, alkalinity and chlorinity the standard techniques and methods were followed for physical and chemical analysis of soil samples.

1.5 Heavy Metal Analysis :

The analysis for the majority of the trace metals was done by ICP and AES a separate aliquot of the soil sample (0.2 gm) was digested according to a modification of the EPA method for total mercury analysis. Mercury was analysed with cold vapour atomic adsorption spectrophotometer.

2.6 Quality Control / Assurance:

Soil sample were collected with plastic made implements to avoid contamination. Samples were kept in polythene bags that were from heavy metals and organic and well covered while transporting from the environment. Reagent blanks were used in all analyses to check reagent impurities and other environmental contaminations during analyses. All reagents were standardized against primary standards to determine their actual concentration all glass ware used were soaked in appropriate dilute acids overnight and washed with deionised water before use. Tools and

work surfaces were carefully cleaned for each sample during grinding to avoid cross contamination. Duplicate sample were analyzed to check precision of analytical method and instruments.

RESULT AND DISCUSSION

The soil sample collected in and around Toranmal were analyzed for their

Table: 1 Seasonal Variation in Physicochemical parameters in Soil Samples Collected from In and Around Toranmal (Triabal Area)

Parameters	Feb. 2011	Mar. 2011	Apr. 2011	May 2011	June 2011	July 2011	Aug. 2011	Dry Season	Rainy Season
Moisture content %	3.50	3.55	3.65	3.64	3.99	4.05	4.15	3.85	4.06
PH	8.00	8.01	8.02	8.01	7.83	7.91	7.18	8.01	7.64
Electrical Conductivity M.Mhos/cm	60.2	61.1	61.2	61.1	65.8	66.8	68.8	60.86	67.13
Alkalinity mg/100gm	0.92	0.93	1.3	0.99	1.01	1.10	1.2	1.03	1.10
Chloranity mg/lit.	43	46	46.1	44.2	44.3	42.51	42.60	44.82	43.13
Physico Chemical proterties and experimental data are presented in Table-1									

One of the most important factor that serve as an index for pollution is P^H, in our study, that PH of the soil samples collected collected for different sessions ranged from 7.18 to 8.01 WHO reported that PH values of Indian water ranges from 8.0 to 9.0 units. The PH values of soil were observed to be high in dry season. (Average 8.01) and lower during mansoon (average 7.64) the low PH was mainly due to high turbidity and dilution

The % moisture content is soil sample collected for different season were found to be low in dry season. (average 3.85%) and increase sharply during wet season (average 4.06%) starting from June to August.

The conductivity of soil depend upon the concentration of ions and it's nutrient status. In the present investigation of the electrical conductivity values of soil samples varies between average 60.6 m.mhos/cm in dry season 67.1 m. mhos/cm in rainy season.

Alkalinity and P^H are the factors responsible for determining the amenability of water to biological treatment. Total alkalinity values in our observation from average of 1.03 to 1.1 mg/100ml in present investigation alkalinity of soil samples increases gradually in dry season, followed by steep fall in rainy season (19)

Table : 2 Heavy metal content in the soil sample in and around Toranmal (August-Sept.2011).

Samples	Cu	Zn	Mn	Cr	Ni	Pb	Sr	Cd	Hg	As
	ppm	ppm	ppm	ppm	ppm	ppm	Ppm	ppm	ppm	Ppm
SS_1	0.986	0.88	14.938	0.429	0.352	ND	0.614	0.015	ND	ND
SS_2	0.996	0.302	10.422	0.506	0.306	ND	0.177	0.01	ND	ND
SS_3	0.643	0.46	17.501	0.274	0.468	ND	1.329	ND	ND	ND
SS_4	1.22	0.664	15.115	0.39	0.598	1.508	0.887	ND	ND	ND
SS_5	0.546	0.408	9.886	0194	0.346	ND	0.407	ND	ND	ND

(Analytical report of the samples using inductivity coupled plasma, atomic emission spectroscopy)
ND- means less than 0.01ppm.

Heavy metals known to be potentially hazardous substance are present in both natural and contaminated environments. In natural environments they occur at low concentration. However at high concentration as is the case in contaminated environments. They result in the public health impacts. The element that are of concern includes Hg, Cd, As, Zn, Ni, Cu heavy metals may be released into the environment from metal smelting and refilling industries, scrap metals plastic and rubber industries, various consumer products and from burning of waste contains these elements on release to the air the elements travel for large distance and are deposited on to the soil, once deposited , these metals are not degraded and persist in the environment for many years poisoning humans through inhalation, skin absorption, acute exposure leads to nausea, norexia vomiting, gastrointestinal abnormalities and dermatitis [24 – 26]

The experimental data on heavy metals content in soil samples collected for different area. The concentration of Cd, Hg, As, are not found in dry as well as rainy season.

The concentration of Zn in the soil samples was found to be 0.88 ppm (ss_1) in rainy season. In mammals is exposure to Zn cause metal fume fever with symptoms like fever, pain, shivering, sweating etc. in plants excessive Zn-cause necrosis, chlorosis and inhibited growth (27).

Cu, salts are used in water supply systems to control biological growth in reservoirs and distribution pipes. The municipal waste and sewage, corrosion of Cu containing pipelines or fittings are the principal anthropogenic source of Cu. Highly toxic to most fishes, invertibrates and aquatic plants than any other heavy metals except Hg. It reduces growth and rate of reproduction in plants and animals (28) Cu, become toxic for organisms when the rate of absorption is greater than rate of excretion. The aquatic plants absorb three times more Cu was observed to be 1.22 ppm (ss_4) in rainy season.

Arsenic occur naturally or is possibly aggravated by over powering aquifers and phosphorus from fertilizers human activities have also intensified arsenic accumulation in the environments. The concentration of dangerous inorganic arsenic that is currently present in surface water. The chances of alteration of genetic materials of fish plants absorb of arsenic fairly easily. So that high ranking concentration may be present in food and adverse effect on health (30,31) organs most susceptible to arsenic toxicity are those involved with absorption accumulation or excretion, including the skin circulatory systems gastrointestinal tract, liver and kidney. Arsenic associated with multiple health effect including black foot, diseases, diabetes, hypertension, peripheral neuropathy and multiple vascular diseases. Other effect including anemia, liver damage weight loss. In addition to acute toxicity, long-term exposure to inorganic arsenic is associated with certain form of Cancer of skin, lungs, colon, bladder, liver and breast. (32)

In actute lethal dose for most inorganic 'Hg' compound for adult is 1-4 gm for 70 kg person (34) exposure to mercury and its compound therefore can have actule adverse health problems. It may be permanently damage the brain, kidneys, in aquatic plants Hg compounds inhibit cell growth and impair permeability in present investigation the consecration of 'Hg' is less than 0.01 ppm (ss_1- ss_5) in and around Toranmal (Triabal Area)

CONCLUSION

The study assessed the evaluation of soil and water quality in and around Toranmal is comparative study of both soil and water sample i.e. dug well and bore well waters was carried out by taking certain important parameters like PH, EC, moisture alkalinity, heavy metal detection.

In the present investigation it was found that maximum parameters were not at the level of pollution except few parameters in soil & water. So both types are satisfy the requirement for the use in various purpose a need to implement common objectives, compatitable policies and programmers for improvement in soil and water treatment method.

The suggested phyto-remediation measures of soil should also as matter of urgency be started at these location. The WHO (1993, 1996, and 2004) guideline values set for Pb, Cr, Ni, and Cu more investigation is needed to specification the cause of elevated level of Pb (ss_4) in ground water and soil at these locations.

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