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Quality Assessment of Water and Soil around Thermal Power Plant at Waidhan district, (M. P.)

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ABSTRACT: Industrial boom caused rapid growth of population and pollution which brought enormous problem and degradation of the environment. In order to evaluate the quality of water and soil in study area and its suitability for domestic purposes. Four samples from different places around thermal power plant waidhan were collected in summer and analyze for different physico-chemical parameters such as temperature, conductivity, pH, TDS, turbidity, chloride, total alkalinity, hardness, calcium, magnesium and iron. The analysis of various parameters carried out using standard methods (APHA) and then compared with the standard guideline values. The results suggest that most of the parameters are beyond the permissible limits.

KEYWORDS: Water, Soil, Physico-Chemical Parameters and Thermal Power Plant.

I. INTRODUCTION

In recent years the global energy demand has increased with the advances in industrialization and this has been largely met by fossil fuels. Coal meets 29.6% of global primary energy needs and its share in the worlds electricity generation is about 42%. Coal combustion in thermal power plant contributes to 52.32% of total electricity generation in india. (1) Conventional generation of electricity from fossil fuels based sources like coal results in serious environmental problems reaching local and global implications.

Groundwater quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and sub-surface geochemical processes. Temporal changes in the origin and constitution of the cause periodic changes in groundwater quality. Water pollution not only affects water quality but also threatens human health, economic development and social prosperity. (2)

Soil is a natural body consisting of layers (soil horizons) of mineral constituents of variable thicknesses, which differ from the parent materials in their morphological, physical, chemical, and mineralogical characteristics. It is composed of particles of broken rock that have been altered by chemical and environmental processes that include weathering and erosion. Soil is essential for survival of the living world, especially for human population. Soil is a dynamic medium made up of minerals, organic matter, water, air and living creatures including bacteria and earthworms. (3)

In the present study samples have been collected over a period of one year i.e. 2016 during winter (January-March) seasons from the area nearby to the ash pond of thermal power plant. The ground water quality is being collected from the tube wells and wells available there by used for drinking as well as industrial and agricultural applications. Soil sample is collected in triplicate form by a field located on the main road away from thermal power station.

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II. MATERIALS AND METHOD

Waidhan, Singrauli District is a reflection of proud history of the state of Madhya Pradesh; it makes the North-eastern boundary of the state. Singrauli district is a repository of natural, historical and cultural history. This district is known for luxuriant natural resources. Singrauli district is located on the Northeastern Boundary of the state between 23.49 and 24.42 Degree North Latitude and 81.18 and 82.48 Degree East longitude. The district is also known as the northeastern frontier of the state.

Water samples have been collected from different tube wells. The water level shows a drastically change from January to March. The water samples were collected in stenciled bottles (polyethylene bottles). The test for pH, turbidity, water temperature and alkalinity has been carried out using multi functional water. After the soil sample collection sample was air dried, crushed and passed through a 2 mm mesh sieve and kept at ambient temperature and the collected soil samples were analyzed for the determination that of Fe, Cu & Zn.

III. RESULTS AND DISCUSSION

Water being the vital element of life, maintenance of a good water quality is highly essential for human wellbeing. Ground water has several applications in the field of cooking, domestic uses, industrial applications, agricultural utility and many more. Due to its purity and rich nutrient and mineral contain, ground water is preferred as a major source in the form of purist form of water (4). The most common industrial soil pollutants are strictly connected with mining, smelting, refining of metals, processing industries, combustion of fossil fuels, waste or road traffic. They are introduced into the soil as wet or dry deposition. (5)

The selected Parameters and trace metals in all soil and water samples i.e. pH, conductivity, Mn, Fe, Cu and Cd were analyzed using pH meter, conductivity cell and Atomic Absorption Spectrophotometer. The entire data obtained is being tabulated in Table-1, 2 and 3 as mentioned herewith. pH is a term used to indicate alkalinity or acidity of substance. The pH value of all water samples are recorded within the limits of 6.4-8.1 for drinking water and all soil samples are recorded within the limits of 5.2-7.5.

Turbidity is recorded in higher side for all water samples beside desirable limit of 5.0 NTU. Turbidity is the cloudiness of a fluid by large numbers of individual particles that are generally invisible to naked eye. In drinking water the higher the turbidity level the higher the risk that people may develop gastrointestinal diseases. The conductivity varies between 375-39 $\mu\text{s}/\text{cm}$. The total dissolve solid is found to be in the range of 380-430 mg/l. Total solid ranges from 502-507 mg/l which is higher than (BIS 2012) 300 mg/l for drinking water. The recorded value of chloride is rang 251-253 mg/l for all water samples which is higher prescribed limit 250 mg/l. The recorded value of total hardness in all water samples is higher the prescribed limit of BIS 2012. Value of Ca hardness ranges from 80-85 mg/l and Mg hardness ranges from 85-115 mg/l.

Electrical conductivity of all soil samples are within the range of prescribed limit. Recorded data of organic carbon represents that soil around power plant is rich in carbon. Available K recorded in all soil samples is in high concentration except SS-1 in which 430 kg/h. K ranges from 550-612 kg/h in other samples. Increased concentration of K in soil samples is may be due to the exposure of soil surface with K_2O which is a component of coal ash. The recorded value of S in all soil sample ranges from 25.3 – 70.5 kg/h. S concentration varies with each site SS-4, SS-3 and SS-2 respectively low, medium and high category, only SS-1 is showing high level of S. Coal fired thermal plants are major producer of SO_2 and disposal of coal ash is contaminating these site showing remarkable increase. Recorded value of Fe ranges from 18.2 – 28.3 ppm. All soil samples showing higher concentration of Fe prescribed by IISS standard. Iron oxides are also responsible for the variation of color in soils. Recorded data of available B is under the safe limit prescribed by JNKVV, Jabalpur. Zn concentration in all soil samples ranges from 0.4 – 4.1 ppm. Zn is not in good condition for plant uptake in these sites while in SS-1 and SS-2. Zn is a trace metal and essential for human and plant within the safe limit.

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Table 1 – Parameters of water analysis of waidhan industrial region in winter session (January to March 2016)

Parameters	WS - 1	WS -2	WS -3	WS -4
pH	6.4	7.2	7.4	8.1
Conductivity(μ s/cm)	395	397	392	375
Odour	Not	Not	Not	Not
Temperature	Very high	Mid	Low	Low
Turbidity	7.2	6.5	5.4	5.2
Total solid (mg/l)	502	505	507	504
Total dissolved solid (mg/l)	380	405	410	430
Total hardness of water (mg/l)	302	303	304	305
Ca – hardness (mg/l)	80	82	85	83
Mg – hardness (mg/l)	105	115	85	115
BOD	130	132	125	120
DO	11.3	12.1	9.2	9.0
Nitrate (mg/l)	46	45	44	43
Chlorides (mg/l)	253	251	252	253

Table 2 – Metal Analysis in Water of waidhan industrial region in winter session (January to March 2016)

Metals	WS - 1	WS -2	WS -3	WS -4
Fe	0.4	0.3	0.2	0.4
Mn	0.2	0.1	0.1	0.2
Cu	0.04	0.05	0.04	0.03
Cd	0.02	0.02	0.02	0.02

Table 3 – Parameters of soil analysis of waidhan industrial region in winter session (January to March 2016)

Parameters	SS - 1	SS -2	SS -3	SS -4
pH	5.2	6.3	7.2	7.5
Electrical conductivity (μ s/cm)	0.3	1.2	1.5	1.6
Organic carbon (%)	0.7	1.5	0.5	0.7
N (kg/h)	301	305	306	304
K (kg/h)	430	550	612	605
S (kg/h)	70.5	60.7	35.2	25.3
Fe (ppm)	28.3	30.5	20.5	18.2
Zn (ppm)	3.2	4.1	2.2	0.4
B (ppm)	0.4	0.3	0.1	0.4

IV. CONCLUSION

The above study concluded that the ground water sources near by the ash pond are getting highly contaminated due to the leaching of different metals and toxic elements into the ground water sources. Sample of soil of sites which are near to power plant showing higher contamination of S, Fe, Zn compare to those sites which are not situated near to power

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plant. Keeping in view the health of plants, animals and human beings adequate measures are to be taken to get rid of ground water and soil pollution.

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