



## Seasonal Variation Of Heavy Metals In Waste Water Sample By Using ICPMS Method District Janjgir-Champa, (C.G.) India.

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| Article History                                                          | Abstract                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| Received- 27.11.2023.<br>Revised - 15.12.2023.<br>Acceptance- 22.01.2024 | <p>This paper present to study of the Physico-Chemical parameters of three different areas in Janjgir-Champa District, Chhattisgarh. To determine the amount of pollutants released into the environment and measuring the level of heavy metals and Physico-Chemical characteristics in industrial waste water was conducted. Monsoon and post monsoon changes in physical and chemical parameters such as Temperature, pH, Electrical conductivity, Total solids, Total suspended solids, Dissolved solids and Heavy metals (Pb, Fe, Cr, and Hg). Heavy metals were analyzed by ICPMS Method, Temperature, pH and electrical conductivity was analyzed using the Thermometer, pH scale and Electrical conductometer respectively. The concentration of all heavy metals and Physico-chemical parameters studied were below the reference limits set by BIS (Bureau of Indian standard). The values of heavy metals were (Pb, Cr, Fe, Hg) the maximum value of Pb 0.0036 mg/L at BH-HP in monsoon season and minimum value 0.005 mg/L at NR-HP, and the value of Cr in monsoon season the maximum value 0.0004 mg/L at NR-HP and 0.0001 mg/L at BH-HP and the value of Fe the 0.7431 mg/L at NR-HP and minimum value 0.0156 mg/L at BH-HP, while Hg the maximum value 0.00033 mg/L at NR-HP and 0.0011 mg/L at TR-HP. In post monsoon the level of Pb, the maximum value 0.009 mg/L at BH-HP, Cr did not detected. Fe level maximum value 0.6230 mg/L at NR-HP and minimum value 0.0162 mg/L at BH-HP and Hg maximum value 0.0011 mg/L at NR-HP and minimum 0.0005 mg/L at BH-HP. Therefore, it is recommended to the locals that for notable portable purpose prior treatment is required before human consumption. The results indicate that this particular area is non-polluted and can be used for domestic, irrigation and agricultural purpose.</p> |
| CC License<br>CC-BY-NC-SA 4.0                                            | <b>KEYWORDS:</b> - Pollution, Heavy metal, Waste water, ICPMS, Physico-chemical parameter, Ground Water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## ABBREVIATION

**TR-** Taraod , **BH-** Banahil, **NR-** Nariyara, **HP-** Hand pump, **TS-** Total hardness, **TDS-** Total dissolve solids, **TSS-** Total suspended solids, **EC-** Electrical conductivity, **BDL-** below the detection limit, **BIS-** Bureau of Indian Standards.

## INTRODUCTION

Water is one of the five components of life that described in “Shastra”(1). At the beginning of the twenty-first century water is a plentiful yet mishandled resource that is essential to human survival on earth (2). Approximately, 71% of the earth surface is covered with water mainly in the form of oceans. The actual fresh water is available for human consumption is around 1% of the total earth water. Ground and surface water used by man are of different characteristics (3). Ground water is considered one of the most important natural resources in the world since it include minerals that are extremely important for human nutrition(4). Water is the most essential resources for the expansion, advancement and maintenance of life and human civilization. Hence planning, development and management must be done properly when using it. In order to deal with the population growth, there has been an inevitable water issue brought on by growing urbanization, industrialization and development activities (5). Pollution of water is caused by a variety of natural and man-made activities, including agriculture, industry and household chores. WHO (1984) reported that water pollution causes between 30 and 80 % of human diseases (6, 7). The composition of waste water is made up to 99% water and 1% suspended, colloidal and dissolved solids. Waste water has been seen as a “Resources” and an “issue” (8). Water typically includes trace amounts of metals, which are generally safe for human health (9), but high pollution levels are harmful to the ecosystem and public health. This basically means that it is necessary to regularly monitor the qualitative analysis of the main contaminants found in water (10). Anaerobic waste decomposition produces leachate, which can contaminate groundwater and even seep into the aquifer (11). The collection of water samples from ground water, the physicochemical characteristics of each water samples were examined. The current study aimed to investigate the seasonal fluctuations in water quality in the Nariyara, Tarod and Banahil area of Janjgir-Champa district. We conducted a monsoon and post monsoon study of the ground water quality status. We have examined monsoon and post monsoon season finding in light of Physico-Chemical characteristics in the present paper.

## MATERIALS AND METHODS

**STUDY AREA:** - In the present study involves the analysis of water quality in terms of Physico-Chemical parameters and heavy metal determination of Nariyara, Tarod and Banahil area, district Janjgir-Champa. It is located in 21.9706 degree N latitude and 82.4753 degree E longitude. Jaijaipur is the largest tehsil in Janjgir-Champa district covering area of 450.58 km<sup>2</sup> while Janjgir is the smallest tehsil in Janjgir-Champa district covering area of 237.99 km<sup>2</sup>. In our study, we have selected total three sampling spots as the basis of environmentally significant in which three from the hand pump of Nariyara (NR-HP), Banahil hand pump (BH-HP) and Tarod hand pump (TR-HP) respectively.

**SAMPLE COLLECTION :-** Ground water samples were collected monsoon and post monsoon season. Calibration was performed on all instruments and equipment utilized in this study both before to and during the experiments. To oxidize and remove contaminants from the container surfaces, all glassware were cleaned with 1% concentrated HNO<sub>3</sub>. Apparatus such as beaker, volumetric flask, glass rod, and funnel, watch glass, measuring cylinder, burette, sample bottles and pipette were thoroughly washed and rinsed with distilled water. Also filter paper was used. The water samples were collected in two liter capacity of polyethylene jerry canes without any air bubbles previously soaked with 8M HNO<sub>3</sub> and clean with detergent followed by rinsing with double distilled water. The temperature of samples was measured in the field with the help of the thermometer. The collected samples was kept in ice chamber and kept in dark room. (12, 13) Temperature was measured by thermometer, pH was measured by pH-meter and conductivity, Total solids and Total Suspended Solid (TSS) and total dissolve solid (TDS) was measured by digital conductivity meter.



Fig 1 :- <https://maps.app.goo.gl/PBbEt13PqC8zVvT26>

**HEAVY METAL ANALYSIS:-** Heavy metals were analyzed by using ICPMS Method. In this instrument the sample is introduced as the initial step in the analysis process. ICPMS has accomplished this in a number of ways. Using analytical nebulizer is the most widely used technique. Liquids are transformed into an aerosol by a nebulizer, which can subsequently be swept into the plasma to produce ions. Simple liquid samples such as solutions are ideal for nebulizer use. 10 ml of the sample were taken in 100 ml volumetric flask and about 0.1 ml nitric acid (ultrapure) was added and then added 0.1ml internal standards and then solution was allowed to stand for few hours than it was carefully filtered through whattman filter paper 41 and then sample was run into instrument.

## RESULT AND DISCUSSION

The values of temperature, pH and EC, TS, TSS, TDS were measured using Thermometer, pH-meter, conductivity-meter and gravimetrically respectively. Table 1 shows the result of Physico-Chemical parameters and heavy metal concentration at monsoon and post monsoon season.

**Table 1:- Results of Physico-Chemical parameters for monsoon season and post monsoon season.**

| SN. | PARAMETERS | TR-HP | BH-HP | NR-HP | TR-HP  | BH-HP  | NR-HP  |
|-----|------------|-------|-------|-------|--------|--------|--------|
| 1   | Tem        | 28.2  | 26.0  | 24.2  | 16.2   | 16.0   | 17.4   |
| 2   | pH         | 7.5   | 6.5   | 6.6   | 6.54   | 6.82   | 6.31   |
| 3   | EC         | 180   | 260   | 310   | 290    | 320    | 270    |
| 4   | TS         | 162   | 194   | 183   | 153    | 186    | 178    |
| 5   | TSS        | 75.42 | 68.75 | 68.78 | 49.42  | 48.46  | 68.95  |
| 6   | TDS        | 69.92 | 75.24 | 76.67 | 510.53 | 565.80 | 513.81 |

## DISCUSSION

Industries are the primary causes of pollution in the environment, different amounts of pollutants are either directly or indirectly released into the environment (14). In order to protect human and environmental health, it is crucial to analyze waste water for heavy metal pollution. An excessive amount of heavy metals may have a number of short and long term negative consequences on people. In the present study, the result of heavy metals such as Fe, Cr, Pb, Hg are compared with the safe limit set by BIS. The concentration of heavy metal in waste water sample was measured by using ICPMS method and values obtained are given in the table 2.

**Table 2:- concentration of heavy metals at monsoon and post monsoon season and compared with BIS standard value.**

| ELEMENTS | TR-HP   | NR-HP   | BH-HP   | TR-HP  | NR-HP  | BH-HP  | BIS Value  |
|----------|---------|---------|---------|--------|--------|--------|------------|
| Pb       | 0.012   | 0.005   | 0.0036  | 0.008  | 0.006  | 0.009  | 0.05 mg/L  |
| Cr       | BDL     | 0.0004  | 0.00011 | 0.0003 | BDL    | BDL    | 0.5mg/L    |
| Fe       | 0.214   | 0.7431  | 0.0156  | 0.2965 | 0.6230 | 0.0162 | 0.3 mg/L   |
| Hg       | 0.00011 | 0.00033 | 0.00021 | 0.0009 | 0.0011 | 0.0005 | 0.001 mg/L |

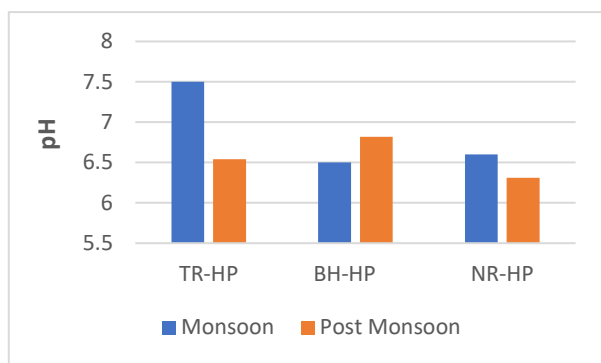


Fig:- (A) Graphical Representation of Observed Value of pH

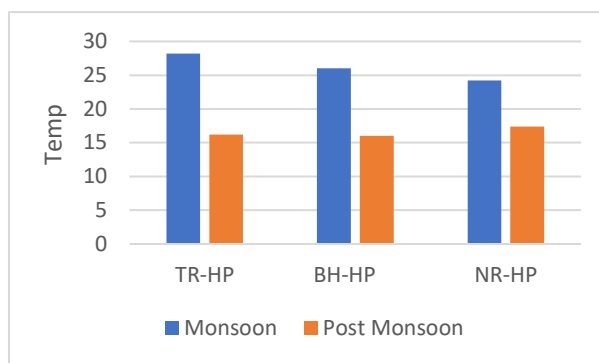


Fig:- (B) Graphical Representation of Observed Value of Temp

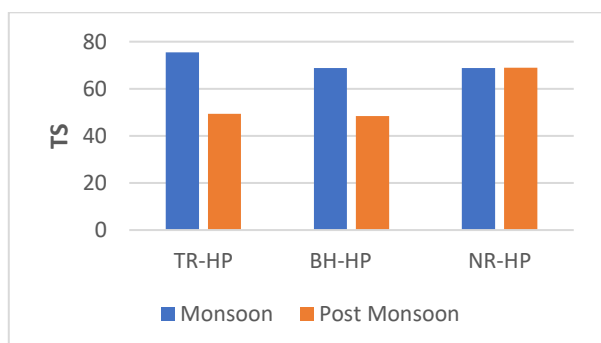


Fig:- (C) Graphical Representation of Observed Value of TS

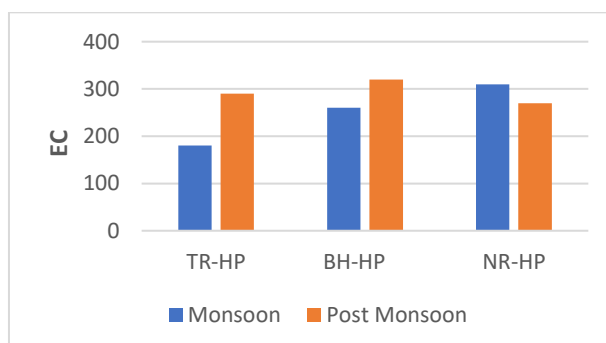


Fig:- (D) Graphical Representation of Observed Value of EC

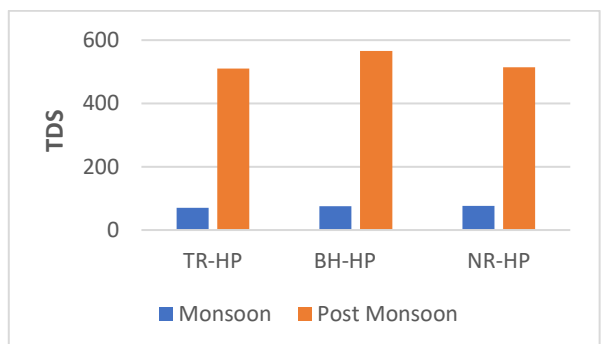


Fig:- (E) Graphical Representation of Observed Value of TDS

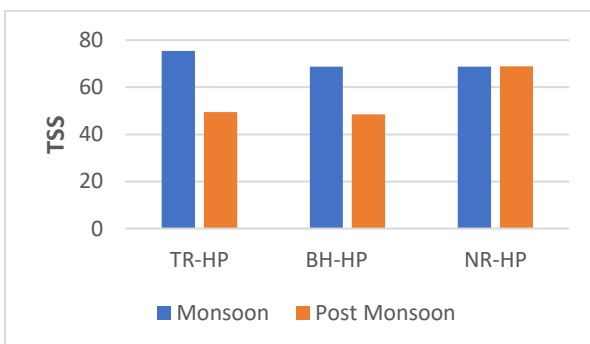


Fig:- (F) Graphical Representation of Observed Value of TSS

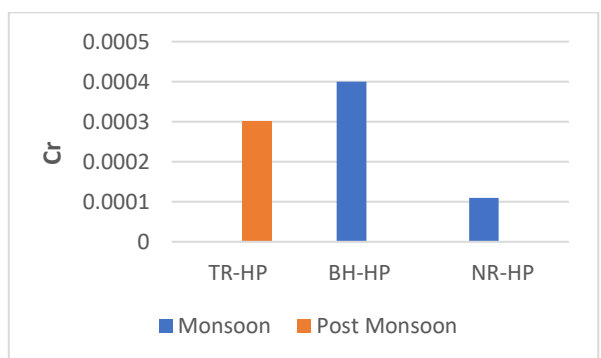


Fig:- (G) Graphical Representation of Observed Value of Cr

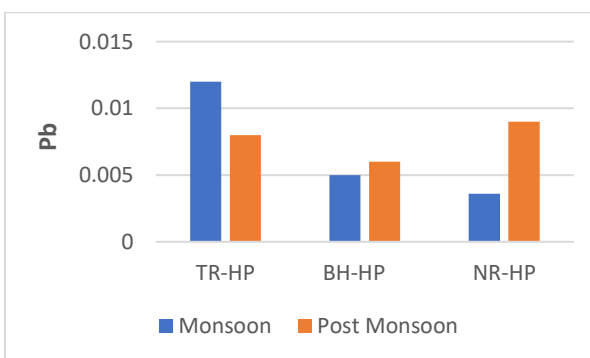


Fig:- (H) Graphical Representation of Observed Value of Pb

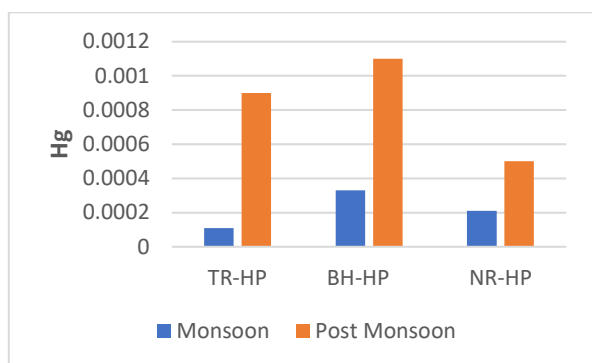


Fig:- (I) Graphical Representation of Observed Value of Hg

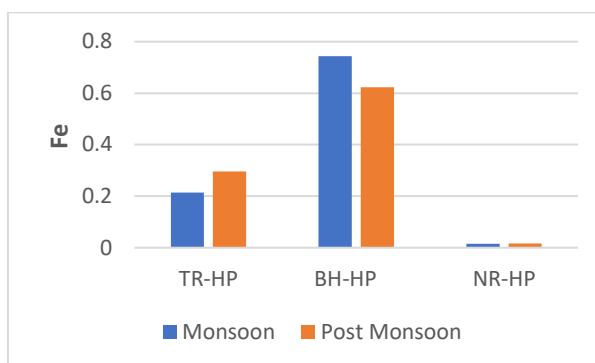


Fig:- (J) Graphical Representation of Observed Value of Fe

**Fig:-Graphical representation of observed values of Temperature (Fig. A), pH (Fig. B), EC (Fig. C), TS (Fig. D), TSS (Fig. E), TDS (Fig. F), Pb (Fig. G), Cr (Fig. H), Fe (Fig. I), Hg (Fig. J).**

The contamination of Cr, which is expected to be from industrial waste, is not applicable to any collected samples. Fe concentration in Nariyara was relatively higher than Taraod and Banahil at both seasons. The concentration of Pb, Cr, Fe, Hg obtained were 0.012 mg/L, BDL, 0.214 mg/L and 0.00011 mg/L at Taraod station respectively and at Banahil station 0.005 mg/L, 0.0004 mg/L, 0.7431 mg/L and 0.00033 mg/L respectively, while at Banahil station 0.0036 mg/L, 0.0001 mg/L, 0.0156 mg/L and 0.00021 mg/L respectively, in monsoon season. In post monsoon season, the heavy metal concentration obtained were 0.008 mg/L for Pb at Taraod station and 0.006 mg/L at Nariyara station and 0.009 mg/L at Banahil station. While the level of Cr in all station side was below the limit. The concentration of Fe obtained was 0.2965 mg/L at TR-HP, 0.6230 mg/L at NR-HP and 0.0162 mg/L at Banahil station. And the level of Hg obtained was 0.0009 mg/L at TR-HP, 0.0011 mg/L at NR-HP and 0.0005 mg/L at BH-HP. The level of Cr and Hg were below the permission limits set by BIS in both season, while the level of Fe ion in all season exceed the detection limit. Cr, Pb and Hg concentration is less than reference limit. The most common elements in the earth crust is iron it can be released into the environment through a variety of industrial processes. (15,16). for the Physico-Chemical parameters analysis, in post monsoon season we obtained that the value of the temperature was 16.2 °C at TR, 16.0 °C at BH-HP and 17 °C at NR-HP, the value of TS was 153 mg/L at TR-HP, 186mg/L at BH-HP and 178 mg/L at NR-HP and the value of TSS was 49.42 mg/L at TR-HP, 48.46 mg/L at BH-HP, 68.95 mg/L at NR-HP. And the values of TDS varied from 510.53 mg/L at TR-HP, 565.80 mg/L at BH-HP and 513.81 mg/L at NR-HP and the value varied for pH was 6.54, 6.82, 6.31 at TR, BH, NR respectively. While the EC value varied from 290 mhos/cm at TR-HP, 320 mho/cm at BH-HP and 270 mho/cm at NR-HP, in post monsoon season, and for monsoon season we found that the result of the temperature 28.2oC, 26.0 o C and 24.2 o C at TR-HP, BH-HP, and NR-HP respectively and 7.5 ,6.5 and 6.6 values for PH at TR-HP, BH-HP and NR-HP respectively, while the EC values was 180 mho/cm, 260 mho/cm and 310 mho/cm at TR, BH and NR respectively. And the values varied for TS,TSS,TDS were 162 mg/L, 194 mg/L and 183 mg/L, at TR-HP, BH -HP, NR-HP respectively and 75.42 mg/L, 68.75 mg/L, and 68.78 mg/L at TR-HP, BH-HP, NR-HP respectively, for TDS values varied from 69.92 mg/L, 75.24 mg/L and 76.67 mg/L at TR-HP, BH-HP, NR-HP respectively.

## Conclusion

waste water collected from Nariyara, Banahil and Taraod area, which is present near Mahanadi power plant located in Janjgir -Champa district was analyzed for the presence of heavy metals and estimation of the Physico-Chemical parameters. The results disclose the presence of raised level of iron while other heavy metals were within the acceptable limits and chromium was not detected in TR-HP area, in both season (monsoon and post monsoon) and also NR-HP and BH-HP area (post monsoon). The pH of waste water in almost all area is acidic except Taraod area in monsoon season and EC values were low. The values of TS, TSS and TDS were low. Industrial waste water should be adequately treated and monitored before being released into streams to protect the environment.

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