



PHYSIOCHEMICAL AND TRACES METALS ASSESMENT OF SELECTED POINTS OF SEHORE DISTRICT, MADHYA PRADESH FOR GROUND WATER

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Abstract: In present study physicochemical characteristics of ground water samples of in and around Sehore city of M.P. India were studied to evaluate its fitness for public drinking. Water samples were collected from four different collecting points of selected area. Physicochemical parameters were analyzed and values obtained were compared with standard values recommended by WHO and ISI. Discusses the results obtained in due course of research work done along with the expected consequences. The whole research work is given containing the impact of pollution in human beings with some suggestion by which intrusion of pollutions into water can be prevented and prescribed some simpler indigenous technologies for purification.

Key-Words: Drinking Water, Correlation Analysis, Sehore, Traces Elements.

Introduction: Water pollution in India presents a pathetic state. In India, groundwater is polluted to varying degrees at different industrial regions as evidenced by recent reports. According to Central Pollution Control Board-India, 90% of water supplied in India to the town and cities are contaminated, out of which only 1.6 % gets treated by suitable methods¹⁻³. In India almost 80% of the rural population

depends on untreated ground water for potable water supplies⁴. In India, it is reported that about 70% of the available water is polluted. The chief source of pollution is identified as sewage constituting 84% to 92% of the waste water. Industrial waste water comprised 8% to 16%⁵. According to National water policy⁶ 2002, regular water quality monitoring program for both surface and groundwater will be undertaken with particular emphasis on pollution control at source, so that both underground and surface water is undertaken for investigation⁷. So, we investigate in present study, physicochemical analysis of groundwater of selected site of sehore district of Madhya Pradesh.

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Received on: December 2018

Accepted after revision: March 2019

DOI: 10.30876/JOHR.7.1.2019.01-06

Materials and Methods

Choosing Appropriate Sampling Spots:

Sampling spots had been selected as the background of the degree of pollution around the

Sehore. The locations of sampling spots are given in Table No 1 name was coded from SD1 to SD4. These were orderly Amlaha(SD1), Ashta (SD2), Bayan (SD3), Heerapur (SD4).

Table No.1: Locations of Sampling Spots and Their Code Name

S. No.	District	Block	Location	Latitude	Longitude	Name Code
1	Sehore	Ichhawar	Amlaha	23.118	76.903	SD1
2		Ashta	Ashta	23.023	76.716	SD2
3		Budni	Bayan	22.734	77.556	SD3
4		Sehore	Heerapur	23.143	77.173	SD4

Method for Sample Collection: Grab water samples were collected at fixed time viz. 1st date of every month between 9:00 am to 4:00 pm in stopper polyethylene bottles of 2L capacity, for physico- chemical analysis while glass bottles were used for heavy metals. Before sampling containers were washed in order of 6N HNO₃, Tap water, DD water and finally with watersamples⁸.

Experimental Method: In order to develop a clear perception, water samples were analyzed into three sections viz. Physical, Chemical and Heavy metals. These parameters were determined by performing relevant experiment in sampling spots and in laboratory. Sampling were start from August 2016 to July 2018 and analysis done on three slot i.e. monsoon, pre-monsoon and post-monsoon.

- 1. Temperature:** Temperature of the collected water sample was measured on the sampling spot as it changes frequently¹⁴ using analyzer kit manufactured by Electronic India Model172⁹.
- 2. pH (Potentia Hydrogenii):** Regulatory guidelines given by BIS IS : 10500:2004, Sec – 3025, Part – 11 was used for computation of pH. Hydrogen ion concentration of the contaminated water sample was recorded at the time of sampling in situ using analyzer kit. The instrument had been calibrated before testing by using buffer solution of pH 4, pH 7 and pH 9 in order to minimize errors¹⁰.
- 3. Electrical Conductance:** It was measured by the analyzer kit using a conductivity cell on

the sampling spot. The instrument was first calibrated according to the instruction given by manufacturer and then measurement was being taken¹¹.

- 4. Turbidity (IS: 10500:2004, Sec – 3025, Part – 10):** Turbidity sampler embedded in analyzer kit was used for the observation of turbidity of the polluted sample. The turbidity meter was calibrated using stock turbidity suspension of hydrazine sulphate [(NH₂)₂.H₂SO₄] and hexamethylene tertamine [(CH₂)₆H₄]. Mixing in the ratio of 1: 1, the above suspension, standard solution was prepared whose standard value is 1.0 ml = 40 NTU; subsequently reading was recorded from collected samples from different locations¹².
- 5. Total Solids (TS):** It was determined gravimetrically in laboratory within 24 hour of sampling.
Principle: Total residue was the material left in the vessel after evaporation of a sample and subsequent drying in oven at appropriate temperature. Well – mixed sample evaporated in weighted dish and dried to a constant weight in an oven at 103° – 105°C. The increase in weight over that of the empty dish represents the total solids¹³.
- 6. Total Dissolved Solid (TDS):** It was determined with the help of Indian standard method of BIS (IS : 10500:2004, Sec – 3025, Part – 16)
Principle: Well – mixed water sample was filtered through standard filter paper, evaporated to dryness in a pre – weighted

china dish and dried at 180°C. The increase in the weight represents the TDS¹⁴.

7. **Total Suspended Solid(TSS):**It was determined mathematically as a difference of value of total solids and total dissolved solids as follows¹⁵:

$$\text{TSS} = \text{TS} - \text{TDS}$$

Total suspended solid = Total Solid – Total Dissolved Solids

8. **Total Acidity:** It may be defined as the power of the water to neutralize or to assimilate hydroxyl ion¹⁴. Titrimetric method had been preferred due to its simplicity. It is expressed as CaCO₃ in mg/L¹⁶.

Principle: Hydrogen ions presents in mineral acids such as carbonic acid, acetic acid, hydrolyzing salts such as iron, aluminum sulfates reacts with hydroxyl ions of the alkali added in the process of titration. Mineral acid present can be calculated at pH 4.3 while CO₂ and carbonic acid can be determined at pH8.¹⁷.

9. **Total Alkalinity:** Alkalinity is mainly due to carbonates, bicarbonates, borates, phosphates, silicates hydroxide and other bases, as a result of dissociation or hydrolysis of solutes reacts with addition of standard acids¹⁵. It was determined volumetrically using customary method of BIS, IS : 10500:2004, Sec – 3025, Part –23¹⁸.

Principle: Alkalinity of the sample can be estimated by titrating with standard solution of HCl. Titration to pH 8.3 or decolorization of phenolphthalein indicator will indicate complete neutralization of OH⁻ and ½ of CO₃²⁻ while to pH 4.3 or sharp changes from yellow to orange of methyl orange indicator will indicate total alkalinity.

10. **Total Hardness:** Hardness in water is caused by dissolved calcium and, to a lesser extent, magnesium. It is usually expressed as the equivalent quantity of calcium carbonate. EDTA Complexometric Titration Method approved by BIS (IS: 10500:2004, Sec-3025, Part – 21) was used as guiding principle forestimation¹⁹.

11. **Metal Analysis using ICP – AES:** For measurement of under consideration Heavy metals Fe, Mn, As, Zn and Al (light metal), Inductively Coupled Plasma – Atomic Emission Plasma (ICP-AES) Spectrophotometer method was used. BIS 10500: 2004, Sec-3025 (part-2) describes the procedure to determine the dissolved, particulate and trace metals in raw, potable and waste water with the help of Inductively Coupled Plasma – Atomic Emission Plasma (ICP-AES) Spectrophotometer²⁰.

Assessment of Statistical Parameters:

Statistical calculation were done using M.S Excel¹³ using various standard inbuilt function. Correlation Matrix was prepared with special Data Analysis Tool in Excel.

Results and Discussions

Temperature: Estimation in the year August 2016 to July 2017 evaluated highest %CV was SD2 [30.083] while in August 2017 to July 2018 the %CV was recorded as SD3 [22.565]. In pre – monsoon April to July 2017 the %CV was noted SD2 [10.122] however this parameter obtained SD4 [7.230] in the same season for the April to July 2018.

In the assessment year August 2016 to July 2017 lowest evaluated %CV was SD3 [19.100] while in August 2017 to July 2018 the %CV was recorded as SD4 [19.816]. In pre – monsoon April to July 2017 the %CV was noted SD3 [3.871] however this parameter obtained SD1&2[5.236] in the same season for the August 2017 to July 2018

pH: In the assessment year August 2016 to July 2017 lowest evaluated %CV was SD4 [5.658] while in August 2017 to July 2018 the %CV was recorded as SD3 [4.338].In pre-monsoon April to July 2017 the %CV was noted SD3 [5.014] however this parameter obtained SD2 [1.856] in the same season for the April to July 2018.% CV was calculated for monsoon in August to November 2016 as SD1 [1.155] while SD2 [1.743] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD3 [3.348] however this

parameter was recorded SD4 [1.460] for post – monsoon in December 2017 to March 2018.

EC: Examining the year August 2016 to July 2017 gave highest evaluated %CV was SD2 [28.979] while in August 2017 to July 2018 the %CV was recorded as SD2 [25.931]. In context of %CV these variations are high in EC different observation. In pre-monsoon April to July 2017 the %CV was noted SD1 [38.5741] however this parameter obtained SD3 [32.007] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD4 [20.147]

Turbidity: In the post-monsoon December 2016 to March 2017, the %CV was evaluated SD1 [25.91] however this parameter was recorded SD3 [25.909] for post–monsoon in December 2017 to March 2018. This statistical data indicated in both sessions, among various observation the changing in the concentration are high.

TS: In the analysis year August 2016 to July 2017 highest assessed %CV was SD4[41.491] while in August 2017 to July 2018the %CV was recorded as SD4 [38.146]. In pre – monsoon April to July 2017 the %CV was notedSD3 [80.108] however this parameter obtained SD2 [39.287] in the same season for the April to July 2018

TDS: In the monitoring year August 2016 to July 2017 highest evaluated %CV was SD2 [40.506] while in August 2017 to July 2018 the %CV was recorded as SD4[39.994]. In pre – monsoon April to July 2017 the %CV was notedSD1 [45.543] however this parameter obtained SD4[25.528] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD2 [54.79] while SD4 [32.78] in the same season of the assessment year August to November 2017.

TSS: In the assessment year August 2016 to July 2017 lowest evaluated %CV was SD4 [42.198] while in August 2017 to July 2018 the %CV was recorded as SD3 [46.041].In pre-monsoon April to July 2017 the %CV was noted SD8 [4.212] however this parameter obtained SD1 [28.197] in the same season for the April to July 2018. % CV

was calculated for monsoon in August to November 2016 as SD4 [19.05] while SD3 [25.63] in the same season of the assessment year August to November 2017.

Total Acidity: In the monitoring year August 2016 to July 2017 highest evaluated %CV was SD4 [32.729] while in August 2017 to July 2018 the %CV was recorded as SD6 [23.649]. In pre – monsoon April to July 2017 the %CV was noted SD8 [28.597] however this parameter obtained SD4 [40.732] in the same season for the April to July 2018. % CV was calculated for monsoon in August 2016 to November as SD1 [48.388] while SD1 [25.249] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD7 [43.477] however this parameter was recorded SD5 [48.969] for post –monsoon in December 2017 to March 2018.

Total Alkanity: In the monitoring year August 2016 to July 2017 highest evaluated %CV was SD3 [38.096] while in August 2017 to July 2018 the %CV was recorded as SD3 [55.996].In pre-monsoon April July 2017 the %CV was notedSD4 [62.417] however this parameter obtained SD3[77.147] in the same season for the April to July 2018.% CV was calculated for monsoon in August to November 2016 as SD3 [31.13] while SD1 [65.943] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD1 [57.35] however this parameter was recorded SD9[104.887] for post –monsoon in December 2017 to March 2018.

TH: In the monitoring year August 2016 to July 2017 highest evaluated %CV was SD4 [55.982] while in August 2017 to July 2018 the %CV was recorded as SD2 [55.292]. In pre-monsoon April to July 2017 the %CV was noted SD9 [90.643] however this parameter obtained SD3[131.43] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD7[30.47] while SD9[31.76] in the same season of the assessment year August to November 2017. In the post –

monsoon December 2016 to March 2017, the %CV was evaluated SD1 [41.86] however this parameter was recorded SD1[42.5] for post – monsoon in December 2017 to March 2018.

Mn: In the assessment year August 2016 to July 2017 lowest evaluated %CV was SD1[21.921] while in August 2017 to July 2018 the %CV was recorded as SD8[37.174]. In pre – monsoon April to July 2017 the %CV was noted SD1 [15.184] however this parameter obtained SD2[16.291] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD1 [18.652] while SD3 [16.61] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD1[11.79] however this parameter was recorded SD4[38.422] for post – monsoon in December 2017 to March 2018. %CV in case of Mn, large variations have been obtained between different observations in above.

As: In the monitoring year August 2016 to July 2017 highest evaluated %CV was SD4[186.740] while in August 2017 to July 2018 the %CV was recorded as SD2[221.337]. In pre – monsoon April to July 2017 the %CV was noted SD4 [592.488] however this parameter obtained SD4[95.743] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD2[189.297], while SD4 [408.25] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD2 [678.528] however this parameter was recorded SD3 [262.996] for post – monsoon in December 2017 to March 2018.

Zn: In the study year August 2016 to July 2017 highest evaluated %CV was SD1[139.22] while in August 2017 to July 2018 the %CV was recorded as SD1[152.976]. In pre – monsoon April to July 2017 the %CV was noted SD2 [197.41] however this parameter obtained SD1[119.386] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD7 [92.23] while

SD5[141.87] in the same season of the assessment year August to November 2017. In the post – monsoon December 2016 to March 2017, the %CV was evaluated SD5 [48.18] however this parameter was recorded SD2 and SD3[48.18] for post –monsoon in December 2017 to March 2018.

Al: In the assessment year August 2016 to July 2017 lowest evaluated %CV was SD4 [77.835] while in August 2017 to July 2018 the %CV was recorded as SD3 [53.539]. In pre-monsoon April to July 2017 the %CV was noted SD3 [9.911] however this parameter obtained SD1[23.0007] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD3, SD3 [32.692] while SD1 [30.63] in the same season of the assessment year August to November 2017. In the post-monsoon December 2016 to March 2017, the %CV was evaluated SD4 [18.220] however this parameter was recorded SD2, SD3 [35.766] for post –monsoon in December 2017 to March 2018. Likewise other metallic elements, the concentration of Al showed broad variations in different observations.

Fe: In the estimation year August 2016 to July 2017 highest evaluated %CV was SD2[94.706] while in August 2017 to July 2018 the %CV was recorded as SD2[51.074]. In pre-monsoon April to July 2017 the %CV was noted SD2[961.713] however this parameter obtained SD5, SD6[194.027] in the same season for the April to July 2018. % CV was calculated for monsoon in August to November 2016 as SD3 [81.756] while SD4 [51.57] in the same season of the assessment year August to November 2017.

Conclusion: This piece of research work clearly indicates that areas around waste are severely polluted. Surface water is more polluted than ground water. It is recommended that ground water is more suitable for use than surface water, even ground water get pollutants from leach ate.

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