



# “IMPACT OF DETERGENT ON WATER QUALITY IN SIDHI CITY DISTRICT-SIDHI, MADHYA PRADESH, INDIA”

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## ABSTRACT:

Hydrosphere constitutes all type of water likewise oceans, seas, rivers, streams and glaciers etc. The findings of this laboratory work to confirm ground water quality by help of water quality parameters and proposed experimental area is District-Sidhi. It is a method of check water quality is an effective tool to assess spatial and temporal changes in ground water quality. Five (5) groundwater samples were collected from open areas during the Monsoon and Post Monsoon season in the year 2020-2022. Experiment was done by considering the 5 groundwater samples collected to comprehensive physical and chemical analysis using standard parameters of experiment. Data obtained from the experiment, the water quality index was carried out by adopting the method. Water quality index rating was carried out to quantify overall ground water quality status of the area. For calculation of index the following parameters have been considered such as temperature, pH, turbidity, conductivity, total solids, total dissolved solids, total suspended solids, DO, BOD, COD, Nitrates, Ammonia, Phosphate, Sulphates, Chlorides, total alkalinity, Calcium hardness, Magnesium hardness, total hardness, Fluorides, Iron and Coliform colonies. It may be due to more seepage and movement of ground water during postmonsoon.

**KEY WORDS:** Hydrosphere, turbidity, parameters, physio-chemical and evapotranspiration.

## INTRODUCTION

Water is essential for the survival of any from life. Today water resources have been the most exploited natural system since man strode the earth. Only two to three percent of total water on earth is fresh water. Water pollution is classified into four classes likewise- physical, chemical, biological and physiological pollution of water. Physical water pollution brings about changes in water with regard to its color, density, test, turbidity and thermal properties etc. The chemical pollution of water causes changes in acidity, alkalinity/pH, and DO. Biological pollution is caused by bacteria, virus, algae, protozoa etc. Physiological pollution of water is caused by several chemical agents such as chlorine, sulphur dioxide, hydrogen sulphide, ketones, phenols amines etc. According to WHO organization, about 80% of all the diseases in human beings are caused by water.

Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. Contamination of groundwater by domestic, industrial effluents and agricultural activity is a serious problem faced by developing countries. The industrial waste water, sewage sludge and solid waste materials are currently being discharged into the environment indiscriminately. These materials enter subsurface aquifers resulting in the pollution of irrigation and drinking water<sup>1</sup> (2007). High rates of mortality and morbidity due to water borne diseases are well known in India. Access to safe drinking water remains an urgent necessity, as 30% of urban and 90% of rural households still depend completely on untreated surface or groundwater (2005). While access to drinking water in India has increased over the past decade, the tremendous adverse impact of unsafe water on health continues (WHO, 2004)<sup>2</sup>.

Water quality index is defined as a rating reflecting the composite influence of different water quality parameters. The water quality<sup>3</sup> of this study samples was assessed using the weighted arithmetic index method, taking into account the nine important parameters such as temperature, pH, Total Hardness, TDS, DO, BOD, COD, Calcium, Magnesium, Sulphates, Chlorides, Fluorides, Nitrates. WQI is calculated from the point of view of the suitability of groundwater for human consumption. Water quality index is one of the most effective tools to communicate information on the quality of any water body. WQI is a mathematical equation used to transform large number of water quality data into a single number.

## OBJECTIVE

To determine the physico-chemical characteristics of various water quality samples in Sidhi city district Sidhi India.

## MATERIALS AND METHODS

### Study area

Sidhi is a district of Madhya-pradesh an image of proud history and culture. It forms the northeastern boundary of the state. Sidhi is well known for its natural beauty, historical importance and rich cultural roots. Sidhi possesses abundant natural resources with the river Sone draining the district, and with coal deposits which feed major industries across the country.

- The Vindhyachal Super Thermal Power Station supplies electricity over a wide area. On one side the spectrum of its floristic socio-cultural diversity and ethnic history of tribal, the district has a panoramic view of the Kaimur, Kehejua and Ranimunda hills blazing with flowers of flame of forest and intoxicated by the sweet smell of mahua flowers. The whole of sidhi district was part of Rewa state. In 2006 the Ministry of Panchayati Raj named Chamba one of the country's 250 most backward districts (out of a total of 640).
- It is one of the 24 districts in Madhya Pradesh currently receiving funds from the Backward Regions Grant Fund Programme (BRGF). Sidhi district is located on the northeastern boundary of the state between 22475 and 24.4210 north latitudes, 81.1840 and 824830 east longitudes. The district has Singrauli district in the east and Korea district of Chhattisgarh on the south and the Rewa district on the north. Sidhi district is sharing border with Korea district to south, Satna district to the west, Shahdol district to the south-west. It is sharing border with Chhattisgarh state to the south.

## METHODOLOGY

### Sample Collection and Processing

The water samples were collected from 10 different tube wells (underground water) during monsoon and post monsoon season ground water sampling locations were located on the basis of above areas. The water samples were collected in acid washed plastic container to avoid unpredictable changes in characteristic as per standard procedures<sup>4</sup> (2012).

The WHO (2004) standards for drinking purposes have been considered for the calculation of WQI. The Parameters were analyzed for WQI such as pH, TDS, Total Hardness, Calcium, Magnesium, Sulphates, Chlorides, Fluorides, and Nitrates. Water quality index (WQI) is defined as a technique of rating that provides the composite influence of individual water quality parameter on the overall quality of water. The standards for drinking purpose<sup>5</sup> (2009) have been considered for calculation of WQI. In this method the weight age for various water quality parameters is assumed to be inversely proportional to the recommended standards for the corresponding parameters<sup>6</sup> (2012).

The methodology includes, data collection, household survey for understanding the quality of water by people, collection of three water samples from each ward, testing the water samples, collection of secondary data, validation of secondary data. (Kate and Jamale 2018). In the city, there are eight ESRs; capacity of ESR is given in proposed study, also six ESRs are proposed, capacity of WTP, daily hours of operation is 2 h, 1 h at morning and 1 h of evening in all wards, minimum water tax collected per household is Rs 750, and number of private connections are 12,000 (Kate et al. 2018)<sup>7</sup>.

The whole study was under study throughout the year including all season and sample taken from different site for the analysis. The analysis of the water sample done as per the standard analytical methods for the various parameters illustrated in the study. The thresholds limit for various parameters has been consistent according to the WHO norms fixed for. The detergent analysis has been done using spectrophotometer by making various sample solutions various detergent with various water of the study area.<sup>8</sup>

Various physio-chemical and biological parameters for measuring and monitoring the Water quality index (WQI) exist worldwide. The assessment procedure of WQI is analyzed and summarized in this section. Analyses of various water quality measurement parameters have been made using traditional methods that help to calibrate the physical changes. (Wu et al., 2021)<sup>9</sup> Carried out experimental work on the critical parameters that affect water quality. Fifteen physio-chemical parameters were evaluated to assess the WQI and categorized into three groups. These helped establish the results with minimum error and good accuracy. This detection benefits low-cost and fast-track water quality evaluation in adjacent basins. Based on the statistical values, the spatially evaluated distribution pattern and different models of WQI are classified. Given the expansive implications of water quality prediction utilizing a complex methodology, our review aims to address fundamental research questions, making significant contributions to the field. The recognized research questions directing our examination are as per the following (Kar & Varsha, 2023) R1: How do integrating internet of things (IoT), AI, and Geographic data system (GIS) functionalities add to the headway of water quality expectations<sup>10</sup>.

R2: What strategies can be figured out by associations to develop robust water quality forecasts using machine learning models that align with sustainability objectives? The answer to the above questions is that the present study focuses on the intersection of IoT, A.I., and GIS in water quality expectations. This review surveyed 67 articles from driving diaries in the Scopus data set (Sharma et al., 2021).<sup>11</sup> This strategic methodology permits us to introduce thorough bits of knowledge and exploratory discoveries. Sections 2 and 3 focus on literature reviews and comparison of various Review methodologies. Section 4 illustrates the findings of the systematic literature review on GIS, and Section 5 discusses the machine learning algorithms and multiple techniques implemented in various applications in the research area. Section 6 is the conclusion. (Uddin et al., 2021) have developed the traditional methods of WQI models<sup>12</sup>. Due to its

generalized structure, the evaluation cites the conversion substantial data on water quality into a single value or index as one of the valuable techniques. They divided WQI models into four consecutive steps: selection of parameters of water sub-indices generation, parameters weighting values, and overall WQI calculation. Therefore, the large volume of water quality data is compressed into a single index with a comparison between various traditional WQI Index related to selecting parameters, sub-index procedure, weighting, aggregation techniques, and rating scale. (Nayak et al., 2020) analyzed the water quality status of Indian rivers.<sup>13</sup> (Bui et al., 2020) Assessed WQI and concluded that traditional WQI calculations consumed more time and identified few errors by calculating sub-indices<sup>14</sup>. Numerous statistical and visual evaluation indicators were used to evaluate the models. The machine learning algorithm divided the data into training and testing sets, used hybrid algorithms, and estimated WQI Values. (Wu et al., 2017) to obtain WQI an analysis<sup>15</sup>, the research work was carried out in Lake Poyang, China, where 24 samples of water quality values were classified into three groups. This work considered 20 different water quality parameters for analyzing Total Nitrogen (TN) and Total Phosphorus (TP), whereas hazardous metals and other criteria were rated low in the WQI Analysis. (Wang et al., 2017) worked with a broad classification of different fractional deviation methods referred to difference, ratio, and normalized difference index. The obtained WQI values vary from 56.61 to 2886.51. The above index was estimated using the slope of the curve and the root means square error values<sup>16</sup>.

## RESULT AND DISCUSSION

- **pH**

The reference value of pH in drinking water is 6.5-8.5 according to Bureau of Indian Standard. The value of pH in samples of the study area is between 7.0-8.1. The seasonal variation shows the pH values fluctuating minimum during monsoon and maximum in post monsoon at all locations.

- **Total dissolved solids**

Solids may affect water or effluent quality adversely in a number of ways. Waters with high dissolved solids generally are at inferior waters. The reference range of TDS of the study area is from 412.8-623.0 mg/l in samples. The seasonal fluctuation shows that dissolved solids are higher in monsoon due to leaching of surrounding rain water and minimum in post monsoon in most of the locations.

- **Total Hardness**

The values ranged from 243.8-281.5mg/l of all type of hardness were quiet high with their prescribed standards. The seasonal fluctuation in total hardness of the region shows minimum in monsoon and maximum in post monsoon. The higher value is mainly found owing to abundant availability of limestone rocks in the surrounding area consequently more solubility of  $\text{Ca}^{++}$  and  $\text{Mg}^{++}$  salts under anaerobic conditions.

- **Calcium**

The maximum concentration of calcium in drinking water in study area ranges between 163.6-233.7mg/l. Calcium is a major constituent of various types of rock. Calcium is a cause for hardness in water and incrustation in boilers. Calcium is an essential constituent of human being. The low content of calcium in drinking water may cause rickets and defective teeth. It is essential for nervous system, cardiac function and coagulation of blood.

- **Chlorides**

The Chloride concentration in the study area ranges from 7.52-24.82mg/l. The permissible limit of chloride is 250 mg/l. Chlorides in excess imparts the salty taste to water and people are not accustomed to high chloride are subjected to laxative effect<sup>17</sup> (2011). The seasonal average of chloride values shows maximum in monsoon and minimum in post monsoon in most of the locations.

- **Magnesium**

The concentration of magnesium in the study area ranges between 40.2-89.5mg/l. chemical softening, reverse osmosis, electro dialysis, or ion exchange reduces the magnesium and associated hardness to acceptable levels.

- **Nitrates**

The concentration of nitrate in the study area ranges from 15-4 mg/l. The reference limit of nitrate is 45 mg/l. Nitrates generally occur in trace quantities in surface waters but may attain high levels in some ground waters. The seasonal average of nitrate values shows maximum in monsoon and minimum in post monsoon in most of the locations.

- **Fluorides**

The fluoride concentrations were found to be in the range of 0.13-1.41mg/l. In study area fluoride concentrations vary with the type of rock that the water flows through but do not usually exceed 10mg/l. The maximum seasonal value of fluoride in the area was post monsoon and the minimum in monsoon.

- **Sulphates**

Sulphate may contribute to the corrosion of distribution systems. The sulphate concentrations were found to be in the range of 84.2-159.0mg/l. The seasonal average of sulphate values shows maximum in monsoon and minimum in post monsoon in all water sample stations.

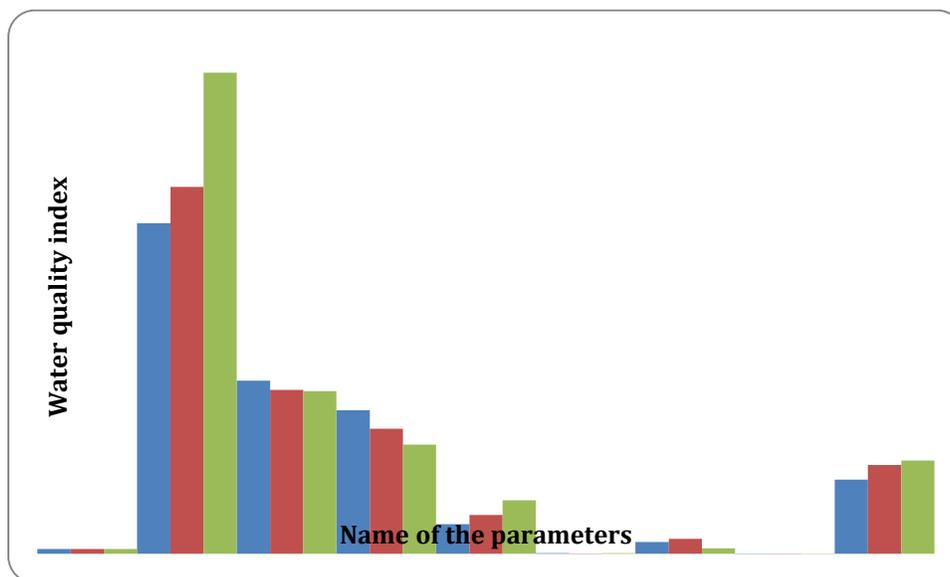


Fig no. 1: Plot of WQI vs. Parameters

Table no.-1

Shows the average water quality in various seasons classification based on WQI value

Parameters with units	Winter	Summer	Rainy
pH in negative log	7.30	7.58	7.57
TDS in mg/l	514.12	570.74	748.26
Total hardness in mg/l	269.04	254.94	252.7
Calcium in mg/l	223.08	194.58	169.52
Magnesium in mg/l	45.96	60.44	83.18
Nitrates in mg/l	0.88	0.33	1.18
Chlorides in mg/l	18.16	23.11	8.44
Fluorides in mg/l	0.66	0.66	0.29
Sulphates in mg/l	115.44	138.0	145.16

## CONCLUSION:

The ground water samples were taken from the various sites of Sidhi district area were analyzed and the analysis reports that the water quality parameters like pH, total dissolved solids, total hardness, calcium, magnesium, nitrate, chloride, fluoride and sulphate lies within the maximum permissible limit prescribed by WHO and ICMR.

The analysis of experimental investigation on quality of groundwater using nine physico-chemical parameters of the study area indicate that in general about the water quality is low for drinking purpose. The Percentage of water quality index<sup>18</sup> shows that maximum in post monsoon and minimum in monsoon period.

The overall view of the Water Quality Index of the present study zone had a higher WQI value indicating the deteriorated water quality. Apart from ground water assessment, the WQI model can be used for wide ranging of applications. Among other uses, it can help the planner and policy maker when selecting is as for waste disposal and industrial sites.

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