Study of Physico-Chemical Analysis of the Quality of Water level from rivers, boreholes and wells

Dr. PUSHPENDRA SHARMA [1], KASINATHAN A [2]

[1]Research Guide, Dept. of CHEMISTRY

Sri Satya Sai University of Technology and Medical Sciences,

Sehore Bhopal-Indore Road, Madhya Pradesh, India.

[2]Research Scholar, Dept. of CHEMISTRY

Sri Satya Sai University of Technology and Medical Sciences,

Sehore Bhopal-Indore Road, Madhya Pradesh, India.

Abstract

Boreholes and wells are the primary water sources for residents of Rivers state, which is known for having abundant unrefined petroleum reserves and predisposes both water sources to potential contamination with heavy and non-heavy metals with accompanying health recommendations regarding the quality of bore well water used for drinking purposes and at the household level in Jath city of Maharashtra. Water that is found underground is the most significant source of water. As a result, the current project handles the valuation of bore well water from varied 10 locations in Jath City that was finished in the years 2016–2017. The Physico-Chemical Limits, such as pH, Electrical Conductivity, Broken up Oxygen, Absolute Disintegrated Strong, Alkalinity, Temperature, and Complete Hardness are taken into account to measure water quality.

One of the most important natural resources on the world is water. Every living thing, the majority of environmental systems, human welfare, food production, and financial developments all depend greatly on it. The security of drinking water is vital for the wellbeing. Different impurities, including chemical and microbiological ones, have an effect on the safety of drinking water. Such pollutants cause major medical disorders. The quality of the drinking water decreases as a result of these alien materials.

The evaluation of the physical and chemical properties of a number of frequently utilized water sources, Streams, wells, boreholes, etc. in the Pregnant region of Mali. Thirty water samples were collected and the physical and chemical limits of each sample were evaluated. These limits include temperature, conductivity, pH, nitrates, nitrites, fluorides, chlorides, ammonium, and zinc.

Keywords: Water Quality Level, Wells, Boreholes, Rivers Comparative Investigation, Physico-Chemical Analysis.

1. Introduction

Perhaps the most fundamental and significant regular resource is water. Every single biological living thing requires it to exist. Water is on a very fundamental level essential to all plants, wildlife and man. Due to its unique physical and chemical characteristics, it is enormous. Water is the most prevalent component (70%) on the surface of the earth. It is composed of two hydrogen atoms mixed with one oxygen molecule. All throughout the world borewell water addresses the biggest and most substantial wellspring of fresh consumable water. Borewell water is a fantastic source of clean water in both urban and rural areas. Due to the rising need for water, a lot of people in rural areas turn to boreholes and other well water sources as a secondary water supply. As a result, for contemporary, rural, and domestic use, a borehole is drilled into the spring and used to access bore-well water. However, borewell water resources are typically not exposed to contaminants, which could degrade their quality. The idea of soils, shakes, and surfaces through which it moves generally indicates how borewell water quality varies from one place to another. Additionally, human activities can alter the natural formation of bore-well water by removing chemicals and microbiological matter from the surface of the ground and from soils, or by directly introducing waste materials into borewell water.

Farming, urban activities, and modern discharges can all affect the quality of borewell water. Pesticides and manures used on lawns and crops can accumulate and move to nearby water tables, affecting the water's physical, chemical, and microbiological qualities. The key to managing water resources is to ensure that they are of a quality that is appropriate for their intended uses while also allowing for some use and creation. The main source of water supply in Jath city is surface water. However, Jath City is a water-focused city whose demand is quickly shifting toward readily available inventory because to unpredictable precipitation, high dissipation rates, and little conversion of precipitation to spillover. Expanding expectations are being placed on the city's current water resources as a result of this and increased water usage.

Industrialization and urbanisation, which have advanced throughout time without objecting to their impact on the climate, have been blamed for the poisoning of groundwater. The quality of groundwater is by and large in view of the diverse physical and chemical bounds associated to enduring workouts from encompassing rocks and manmade exercises. In both urban and rural settings, groundwater is a valuable resource for most developing countries like Nigeria. Pipe-borne water, which runs erratically, is also available in some of the major urban areas of some emerging countries. In areas where rivers and streams are far from rural areas and in some cases evaporate during the dry season, they mostly rely on hand-dig wells or boreholes for the provision of drinkable water." This valuable resource is in danger of being contaminated by human existence as seen by the subpar standards of hygiene followed in developing nations. Given the recent surge in interest in the impact of water quality on human wellness, groundwater security is a crucial natural concern. Some experts believe that the main causes of the decline in ground water quality are the high rate of groundwater double-dealing rather than its re-energizing, unethical unloading of strong and fluid wastes. The next step is to look for a few useful markers, both chemical and physical, that can be used to monitor drinking water activity and performance ". "There has been extensive research into the value of groundwater resources for human use, rural and modern uses, as well as its purity. Expanded information on processes that controls chemical constructions of groundwater can operate on the perception of their convenience state".

All life depends on water, which is also essential for improving general well-being and the monetary growth of human networks. Two major reservoirs of human activity are surface water and groundwater. Surface water is defined as water that moves across the surface of the earth as streams, springs, rivers, or collects to form lakes, lakes, and oceans. Groundwater is organized at groundwater sources and, unlike the latter, is connected to surface water by infiltration, wells and springs.

2. Material and methods

2.1. Field of study

The Pelengana Provincial Cooperative in the Segou district hosted the evaluation. Located between 12° 30' and 15° 30' north latitude and 4° and 7° west longitude in central Mali, the region has a total area of 62,504 km2 and a population of 2,338,349 according to the 2009 census. The Segou region has 118 communities, including 3 metropolitan communes and 115 rural cooperatives (Segou, San and Niono). Her two main rivers, the Niger and "one of her tributaries," the Bani, flood the region. The Niger River flows over Mali for over 1660 kilometers and terminates in the Segou region 292 kilometers away. The Segou Department belongs to the Sudano-Sahel climate and has two seasons. There is a dry season of eight months (October to May) and a windy season of four months (June to September). Typical annual rainfall in this area is 200-800 mm and the average annual temperature is 28 °C. Agriculture, animal husbandry and fishing are the main occupations in this region.

2.2. Sample gathering

From July 2016 to April 2017, testing was carried out once per month at each water station. Tests were performed using fully randomized devices with 3 drugs each and 10 redundancy to ensure representativeness. A total of 30 water tests were collected for physicochemical evaluation. In Niger, water from streams, wells and wells has been used as a source of medicines. Test results from wells were collected using weighted cans (50 cm below water table). The well test was performed after 5 minutes of siphoning and the stream water test was performed at a depth of 30 cm below the surface, so 100 m is the typical depth of the well (source of crushed sandstone). is. The faucet and container were cleaned prior to testing and care was taken to avoid any splashing. Water test results were collected in a 1 liter PET bottle. These jars were washed with detergent only, after which he was rinsed three times with tested spring water, and then again with normal water. Water samples were accurately marked and cooled in a cool box from 0°C to 4°C. They were then delivered to the research center for testing, along with a sample sheet containing all relevant details such as the start and end dates of the selection process and the orderly environment of the test site.

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2.3. Methods

Nine boundaries were estimated for each example after research centre and field examination; 3 of them are physical and 6 are chemical. Temperature, electrical conductivity (EC), pH, nitrates (NO_3^-), nitrites (NO_2^-), fluorides (F^-), chlorides (Cl^-), ammonium (NH_4^+), and zinc (Zn^{2+}) are Lower bounds for the following variables. Temperature, pH, and EC (actual) results for water testing are still determined using portable devices (Table 1). On the other hand, the chemistry section was performed at the research center using the method described in the manual. (Table 2).

Table: 1. Techniques and methods for physical parameters.

Parameters	Unit	Materials and methods	
		Materials	**Analytical method**
Temperature	°C	electronic thermometer (portable hand-held DC powered Hanna HI 88129)	Analysis in situ
Electrical conductivity	µs/cm	WTW conductivity meter	
pH		WTW pH metre	

Table: 2. Techniques and methodology for chemical parameters

Parameters	Unit	Materials and methods	
		Materials	**Analytical method**
Nitrate	mg/L	Spectrophotometer, ANACHEH 220 model.	using sodium salicylate
Nitrite			N-1 naphthylethylenediamine method
Fluoride		Model pH/ION 340i with probe F800 of the ionometer WTW.	Potency measurement
Chloride		Spectrophotometer, ANACHEH 220 model.	Mohr method
Ammonium			Indophenols blue method
Zinc		Photometer WTW, model Photo flex Turb Set	Photometric method

2.4. Data processing and statistical analysis

To determine how many tests didn't meet the standard values, Using WHO recommendations, the drinking water quality and degree of water contamination were evaluated.

Using SPSS software version 21.0, the quantitative analysis was performed. One-way analysis of change was used to distinguish between DUNCAN's alternative examination test, The comfort variable is 95% and the opportunity threat level is 5%. (ANOVA). XLSTAT 2015.4.01 programming was used for the header component (PCA) analysis. Correlation coefficients between different water quality limits were determined using the Pearson connection test.

3. Results and discussion

Practical limit pH: Well water quality does not meet WHO requirements (6.5 to 8.5). This finding indicates that these waters tend toward an acidic pH. (pH less than 7). Activities related to agriculture and horticulture can be designed to release acidic substances into water sources (wells) with pH values below 6.5. Studies have shown that well locations and topographical concepts of the terrain they pass through are associated with 98% of the world's groundwater, confirming this. Both well and river water pH readings are within acceptable limits for WHO drinking water standards. These results are in contrast to well water from other African countries and Malawi.

Temperature: As a physical and natural aspect, water temperature greatly influences both biotic and abiotic climatic factors and influences the functioning of organisms and the environment. The ideal temperature range for water is between 6°C and 12°C. (TABLE 3). The geothermal slope of the region and the impact of the environment's heat on the water that had accumulated could also help to explain the high temperatures. These outcomes are comparable to those reached when taking a refreshing swim in the Logone Valley (Chad-Cameroon). The fact that fresh water typically tastes better than heated water presents a moral conundrum even though high temperatures wouldn't be hazardous to people's health.

Electrical conductivity: Electrical conductivity can be used to evaluate a solution's limit for a direct electric flow. It also enables the measurement of the rate of salt evaporation from water. The conductivity of a normal body of water ranges from 50 to 1500 S/cm. Well water's electrical conductivity (617.28 125.52 S/cm) is substantially higher than that of fluids from boreholes (288.36 158.50 S/cm) and flux (274.63 132.58 S/cm) (p0.05). (Table 3). The lowest and highest EC values for well and borehole waters (90.7 and 778.0 S/cm, respectively) were recorded separately. There is a clear contrast between the conductivity benefits of well water and the conductivity benefits of well and river fluids. A high conductivity indicates an advanced mineralization of the water. Geomorphological context, depth of collected levels, and geographic composition of soil development all affect conductivity variability. Furthermore, a study by Sajidu et al. Chikwawa (1450 S/cm-2800 S/cm), Nsanjae (2150 S/cm-6600 S/cm), Mangochi (295 S/cm- 6800 S/cm) and Zomba (129 S/cm-805 S/cm). Chad, on the Chari River in Ngaram)

Table: 3. variations in the samples' primary physical properties.

Parameter	**Sample location**	**N**	**Mean ± St. Dev**	**Min**	**Max**	**WHO GV**
PH	Borehole water	20	5.47 ± 0.20^{a}	5.22	6.20	5.4-7.4
	River water	20	6.16 ± 0.32^{b}	5.54	6.80	
	Well water	20	5.02 ± 0.54^{c}	4.16	5.77	
Temperature (°C)	Borehole water	20	21.34 ± 3.84^{a}	36.8	26.0	34
	River water	20	38.80 ± 3.13^{ab}	34.4	23.4	
	Well water	20	37.35 ± 0.63^{b}	36.5	37.6	
Conductivity (µs/cm)	Borehole water	20	377.63 ± 247.40^{a}	80.6	440.4	60-1600
	River water	20	363.36 ± 213.47^{a}	100.0	400.5	
	Well water	20	518.37 ± 234.41^{b}	283.0	667.0	

3.1. Chemical parameters

Nitrate ion (NO_3-): The excessive use of inorganic manures, plant and animal degradation, and There are several potential origins of nitrates in a water sample, including wastewater discharge and other natural waste. The average stimulation in well water was 32.01 Mg/L ± 6.75 Mg/L, lower than in rivers (46.64 Mg/L ± 9.75 Mg/L) and wells (41.94 Mg/L ± 10.75 mg/L). (Table 4). The nitrate concentrations of well water and river water were different between 21.20 mg/L and 65.23 mg/L. Too high nitrate levels can lead to the so-called "blue child disease" (methemoglobinemia), which usually affects breastfed infants. The average quality of the tested waters always corresponded to the WHO standard (50 mg/l), even if it occurred sporadically. This is consistent with previous studies conducted in the Dova-Chad field and other African countries.

Nitrite ion (NO_2-): Since nitrogen will frequently occur in more subdued (alkali) or more oxidised (nitrate) structures, nitrates are although they are often not present in surface waters, their occurrence in groundwater is theoretically plausible. According to WHO GV, 3 Mg/L is an appropriate value for drinking water. When compared to borehole and well water, the average incentive for stream water is significantly lower (p0.05) (TABLE 4). Although these sources comply with WHO GV drinking water requirements, they might not be safe to use with domestic animals and cattle raised at home. Lagnika et al. discovered that the midpoints were, respectively.

Fluoride: Fluoride contamination of Groundwater is caused by geographic factors such as mineral alteration and degradation of certain earth minerals. High levels of fluoride in groundwater severely damage human teeth and bones, causing dental and skeletal fluorosis. 0.01 mg/L to 0.84 mg/L fluoride was detected in well and river water. There is a significant discrepancy (p 0.05) between the stream averages and those from wells and boreholes. (Table 4). Nevertheless, all these measurements are below the WHO GM guidelines for drinking water (1.5 mg/L). These results indicated that the Benin Pobe population, with mean well water values of 0.142 ± 0.13, was a comparable case to previous studies. A fixation above 1.5 μg/L or below 0.7 μg/L is not desirable. General health benefits of drinking water with a fluoride concentration of about 1 mg/L.

Ammonium ion (NH_4^+): The average amount of NH4 + contamination varies across Various sources ranging from 0.25 mg/L to 0.33 mg/L in well water, 0.26 mg/L to 0.22 mg/L in well water, and 0.97 to 0.19 mg/L in river waterways. Apparently, the river water test shows greater convergence of NH4+ than the well water and borehole tests (p 0.05). (Table 4). However, the average value of river water samples exceeds the safe drinking water standard (0.5 Mg/L) permitted by the WHO GV (World Health Organization). These extraordinary qualities are attributed to anthropogenic activities, biological waste pollution (e.g. sewage use, livestock farming, use of animal waste as fertilizer for agricultural lands adjacent to water sources), and inadequate supply of these sources. can be explained by the safety Midpoints of 0.193 0.28 and 39.8 13.31, respectively, were found by Lagnika et al. In the waters of the Senegal Current, Abdoulaye et al. Measured ammonium particle concentrations ranged from 0.02 mg/l to 1.29 mg/l in November and from 0.03 mg/l to 0.36 mg/l in July.

Chloride ion (Cl-): Faction's appearance in the waterways is largely explained by the concept of terrains travelled. They are present in almost all typical waters. In the event that there is still some chlorine in the drinking water, the WHO GV suggests ranges between 0.5 and 2 mg/L. Fluxes were calculated using a baseline value of 0.31 Mg/L, while the borehole water had a maximum value of 0.91 Mg/L. Average water quality from wells is 0.57 mg/L (0.13 mg/L), from boreholes is 0.67 mg/L (0.18 mg/L), and from rivers is 0.69 mg/L (0.16 mg/L). There are no discernible differences between the various attributes (p0.05) (Table 4). They are within the values recommended by the WHO GV and do not adversely affect the health of our customers.

Zinc ion (Zn^{2+}): Humans require zinc, but excessive consumption of the mineral can make people feel sick. In any event, zinc is probably one of the least toxic metals, and concerns about deficiency are more common and serious than concerns about toxicity. (Appearance, taste) recommends a limit of 3 Mg/l zinc in water for human consumption. Well water averages are significantly different than stream and well averages (p 0.05). (TABLE 4). Despite the fact that this range of values exceeds the WHO GV by a wide margin, it has no detrimental consequences on people's welfare.

Table: 4. variations in the samples' primary chemical characteristics.

Parameter	Sample location	N	Mean ± St. Dev	Min	Max	WHO GV
Nitrate	Borehole water	20	52.49 ± 20.57^{a}	20.26	53.37	40
	River water	20	37.46 ± 8.57^{a}	25.35	54.32	
	Well water	20	23.02 ± 5.57^{b}	12.30	34.84	
Nitrite	Borehole water	20	0.79 ± 0.53^{a}	0.13	3.20	2
	River water	20	2.55 ± 0.44^{b}	0.73	3.45	
	Well water	20	0.35 ± 0.20^{a}	0.13	2.06	
Fluoride	Borehole water	20	0.15 ± 0.15^{a}	0.02	0.63	2.4

	River water	20	0.58 ± 0.62^b	0.22	0.57	
	Well water	20	0.12 ± 0.21^a	0.22	0.43	
Chloride	Borehole water	20	0.76 ± 0.17^a	0.23	0.98	0.4-3
	River water	20	0.96 ± 0.15^a	0.32	0.82	
	Well water	20	0.75 ± 0.12^a	0.42	0.82	
Ammonium	Borehole water	20	0.35 ± 0.11^a	0.15	0.52	0.4
	River water	20	0.79 ± 0.18^b	0.96	2.14	
	Well water	20	0.34 ± 0.22^a	0.08	2.08	
Zinc	Borehole water	20	2.96 ± 0.26^a	3.79	3.52	4
	River water	20	2.04 ± 0.42^a	3.63	3.12	
	Well water	20	5.77 ± 2.23^b	3.23	6.53	

3.2. Correlation patterns between several parameters using PCA

The relationship between physicochemical boundaries was established using nuclear component analysis (PCA). A total of nine different variables were used, including pH, EC, temperature, NO3-, NO2-, NH4+, Cl-, F, and Zn2+. timid. 2a shows the connecting circles and their nine water quality boundaries. timid. 2b compares PCA results of various water tests (individuals) from the Pelengana population with the first (F1) and second (F2) heads (tomahawks). The individual contributions of F1 and F2 headers accounted for 39.96% and 16.27%, respectively, compared to 56.23% for the inactive total. Table 5 illustrates the importance of factor-to-factor (Tomahawk) correlations as indicated by PCA. Finally, Table 6 shows the Pearson relationships between various water quality boundaries in the study area.

pH, nitrite and nitrate were particularly strongly associated with F1 in descending order, whereas EC and zinc were negatively associated according to PCA analysis. This hub transfers corrosive and chemical pollution of natural or man-made origin through filtration of manure introduced into the ground or release of sewage. Fluoride, ammonium and zinc were strongly associated with hub F2 in descending order, whereas nitrate, nitrite, chlorine and temperature had unfavorable correlations. This hub has light mineralization. The reported discrepancy rates were higher than those reported by other acquaintances, with 66.8% and 49.25% in the waters of water from municipal wells in the test (Benin) and similar sound word use. Reported complete fluctuations. Feathers under moist, hot and humid conditions: The reported differential rates are lower than those reported by Lagnika et al. higher than that of others known as et al. Illustration of the Abengolou Division in southeastern Ivory Coast. A quantifiable analysis using his Pearson at p0.05 revealed a borderline only moderate and weak association. At p0.05, there was a statistically significant positive association between pH and nitrate (0.455), nitrite (0.558), ammonium (0.605) and fluoride (0.401). (Table 6). In general, there was a significant relationship between EC and zinc (p 0.05) and a favorable relationship between nitrate and nitrite (0.466). Finally, ammonium and fluoride had virtually p0.05 in the collected water samples. It should be emphasized that temperature and specific limits are not directly correlated (Table 6). We were able to distinguish three groups Based on PCA analysis, three groups can be distinguished. Bundle 1 contains pH, fluoride, and ammonia, all of which are strongly related to hubs F1 and F2. The elements of bundle 2 are negatively connected to hub F2 and hard connected to hub F1 (nitrate, nitrite, chlorine, and temperature). Last but not least, Lot has 3 components (EC, Zinc) which are fixed to Hub F2 and negatively related to Pivot F1. Overall, this study shows that the mineral composition of water is essentially constant at all test locations.

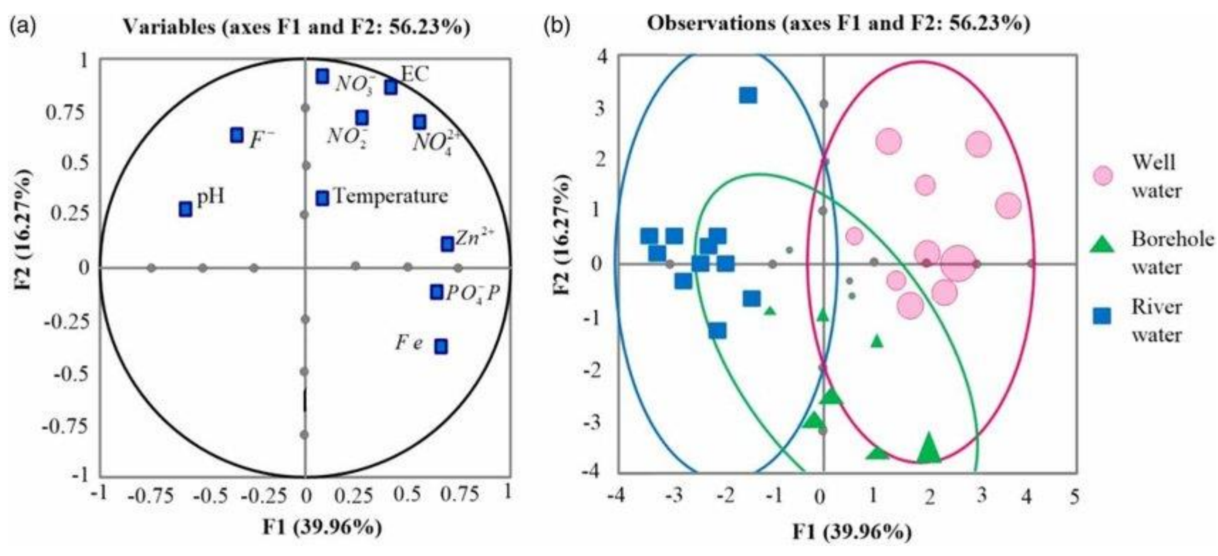

Figure: 2. Distribution of physicochemical parameters based on the first and second principal components of sample water from wells, rivers and boreholes. Correlation circle and principal component analysis results.

Table: 5. Principal component analysis shows a correlation between the variables and the axes (PCA)

Axes / Parameters	F1	F2
Temperature	0.223	-0.450
PH	0.722	0.229
EC	-0.575	0.068
Nitrate	0.556	-0.068
Nitrite	0.678	-0.288
Ammonium	0.576	0.452
Chloride	0.206	-0.320
Fluoride	0.380	0.621
Zinc	-0.565	0.436

4. Conclusion

The physicochemical limits of several water sources, including streams and boreholes used by residents of the Pelengana community, have been estimated. All dissected margins meet WHO GM requirements, except for levels of zinc particles that are higher than WHO GM in all sources. The highest concentrations of ammonium particles occur along the course of the river.

Despite the benefits of trimming boundaries to stay within planned WHO criteria, in practice many of the water sources discussed in this work include sources of contamination because of their conditions and operational strategies. may have been This approach requires the users of these various sources to be made aware of the hazards associated with using water from these various sources for human consumption. Education should also address potential water treatment methods such as the use of carbon dioxide and chlorinated tablets to avoid potential adverse health effects. By shielding the area's drinking water sources from pollution, the population can be included while also helping to improve the water situation overall and maintain a stable climate. A few examples of regulations managing activities in the area include the best administration techniques for cultivating, general hygiene, and suitable storing practises at the household level.

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