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CHEMOMETRIC STUDIES OF UNDER-GROUND WATER OF PUNCHKULA DISTRICT, HARYANA

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ABSTRACT

Water is essential to the continued existence of all living things. In the context of contemporary development activities, water is one of the natural resources that is being put under strain by activities that are caused by humans. In hilly regions, it is also polluted as a result of anthropogenic activities and the direct mixing of filthy water with fresh water as a result of the passage of polluted water through fissures and joints. An investigation on the water quality in Morni town, which is situated on Lower Siwalik hill, has been carried out in this study. During the month of June 2018, a total of five water samples were collected and analyzed using a field water testing kit that was created by the Tamil Nadu Water Supply and Drainage Board in Chennai. The kit was used to analyze twelve different chemical parameters. According to the findings of the chemical analysis of water samples, the pH ranges from 6.5 to 7, the alkalinity ranges from 100 mg/l to 150 mg/l, the hardness ranges from 140 mg/l to 230 mg/l, the chloride ranges from 20 mg/l to 50 mg/l, the total dissolved solids (TDS) ranges from 336 mg/l to 516 mg/l, the fluoride ranges from 0.5 mg/l to 1.5 mg/l, the iron ranges from 0 mg/l to 10 mg/l, the ammonia ranges from 0.5 mg/l to 2.0 mg/l, the nitrate ranges from 20 mg/l to 45 mg/l, the phosphate level is nil in all water samples, and the residual chlorine ranges from 0 mg/l to 0.5 mg/l. It has been determined that the water quality in three of the water samples is potable, whereas in two of the water samples (Kila Ghat and Handpump-2) it is not potable. A useful use of the study is to assess the quality of water that is intended for consumption.

Keywords Water, quality, potable, Morni, Haryana.

INTRODUCTION

The state of Haryana relies on groundwater for both drinking and agricultural purposes. Due to the rapid development of population and the quickened pace of industrialization, there has been a great increase in the demand for fresh water over the course of the last few decades. The majority of agricultural development operations pose a risk to human health, particularly in relation to the excessive application of fertilizers and conditions that are not sanitary. The health and well-being of a society can be measured by the quality of its water supply. There is a clear relationship between the water resources and the processes of industrialization, urbanization, and modern agricultural techniques. The water resources are negatively impacted, both quantitatively and qualitatively, by these issues. It is estimated by the World Health Organization that water is responsible for around 80 percent of all diseases that affect human beings. The quality of the groundwater cannot

be restored once it has been poisoned since it is impossible to stop the pollutants from entering the source. In light of this, it is of the utmost importance to do routine checks on the quality of groundwater and to devise strategies and methods for its protection. At the same time as it is one of the most effective instruments for communicating information about the quality of water to concerned individuals and policy makers, the water quality index is becoming increasingly popular. As a result, it becomes an essential criterion for the evaluation and administration of groundwater. For this reason, it is necessary to search for some relevant indicators, both chemical and physical, that may be utilized for the purpose of monitoring the operation and performance of drinking water water systems. The discharge of animal excrement in an irresponsible manner in close proximity to hand pumps, tube wells, wells, and ponds results in the leaching of contaminants into the water supply. In addition to causing major issues, the harmful organisms that are present in these wastes are able to spread to the water. For drinking and other household needs, water from hand pumps and tube wells is utilized in the villages that are located within the Jind District. The purpose of this research is to provide an overview of the quality of the drinking water supply sources in a selection of the villages located within the Narwana Block of the Jind District in the Indian state of Haryana.

OBJECTIVE

1- The primary purpose of this research was to investigate the quality of drinking water in Morni town, which is located in the Panchkula district of Haryana.

2- For the purpose of the study, chemometric tests of the underground water in the Panchkula district of Haryana were conducted.

Chemo-metric Method of Analysis:

When it comes to monitoring water quality and providing regulatory organizations, such as regional councils and governmental agencies, with information that is helpful, chemometric analysis is a technique that can be utilized. The technique of chemometric analysis is utilized all over the world for the purpose of determining a wide range of parameters, including but not limited to pH, electrical conductivity, total alkalinity, total dissolved salts, total hardness, chlorides, calcium, magnesium, fluoride, chemical oxygen demand, biological oxygen demand, and salinity, amongst others. The level of contamination caused by trace elements as well as the capability of groundwater to be used for drinking purposes have both been evaluated. Chemometric analysis of water samples was performed for a variety of quality parameters, including temperature, pH, electrical conductivity, total dissolved solids (TDS), dissolved oxygen (DO), and salinity. This was done in accordance with the standard procedure described in the article "Standard methods for the examination of water and waste water American public Health Association (APHA)" [16]. During the process of collecting the samples, the temperature was measured twice. At the S.D. College in Ambala Cantt, Lahore, India, these characteristics were determined with the help of a digital portable analyzer kit that was manufactured by Electronics India in Panchkula, India.

Table 1: Sampling Locations of Ambala

Sr. No.	Sampling Locations	Code	Sources
1.	Vill. Subhri	V1	Hand pump
2.	Vill. Sarsheri	V2	Hand pump
3.	Vill. Rampur	V3	Tube well
4.	Ambala City	V4	Hand pump
5.	Vill. Tandwal	V5	Hand pump
6.	Vill. Mojgarh	V6	Hand pump
7.	Barara	V7	Hand pump
8.	Vill. Ugala	V8	Tube well
9.	Vill. Ghelri	V9	Hand pump
10.	Vill. Rajokheri	V10	Hand pump
11.	Dhulkot	V11	Tube well
12.	Vill. Dhkola	V12	Hand pump
13.	Vill. Boh	V13	Tube well
14.	Vill. Rampur (Kalpi)	V14	Hand pump

Temperature:

The acceptability of a number of different inorganic elements and chemical pollutants that may affect taste is influenced by temperature. In general, cool water is more palatable than warm water. Temperature also helps determine the acceptance of certain contaminants. An increase in the temperature of the water encourages the growth of microbes, which can lead to an increase in problems with taste, odor, color, and corrosion. One of the most important parameters that is taken into consideration while conducting a study of the physicochemical quality of pipe water samples is temperature. It has an effect on a wide variety of reactions, including the rate at which disinfection degrades and the creation of chemical byproducts. The demand for disinfectants and the generation of byproducts, nitrification, microbiological activity, algae development, taste and odor events, and the solubility of lead and copper all increase as the temperature of the water rises. Additionally, there is an increase in the precipitation of calcium carbonate in sand. Temperature variations in space and time are caused by the interaction of solar radiation with the temperature of the atmosphere. These interactions also result in the formation of convection currents and thermal stratification. A number of characteristics, including alkalinity, salinity, dissolved oxygen, electrical conductivity, and others, are all influenced by temperature, which plays a significant part in the dynamic nature of wetland environments. All of these characteristics have an impact on the chemical and biological processes that take place in an aquatic system. Some examples of these reactions include the solubility of oxygen, carbon dioxide, carbonate, bicarbonate equilibrium, an increase in metabolic rate, and the physiological reactions of organisms. In regard to fish life, the temperature of the water is a significant factor. When it comes to the flavor of drinking water, the temperature has a significant role. A thermometer of the standard type was utilized in order to measure the temperature in degrees Celsius (°C) at the various sampling locations.

pH Estimation:

Adjusting the pH of water is a frequent technique in the water treatment industry. pH is one of the most significant operational parameters for water treatment processes such as disinfection or coagulation-flocculation.

Because dissociation is not very effective at pH levels below 6, a nearly full dissociation of HClO takes place between pH levels of 6 and 8.5. Because of this, maintaining pH control is essential when using chlorine for disinfection. Because of this, an increase in the pH of the drinkable water necessitates an increase in the amount of chlorine that is used to achieve the same level of disinfection effectiveness. On the other hand, the microbiological activity of chlorine is significantly diminished when the pH is high. This is most likely due to the fact that the major species of chlorine at an alkaline pH is OCl-. There is a correlation between the pH of the water and the equilibrium concentrations of HClO and OCl-. There is a correlation between the pH of the water and the effectiveness of chlorine in eliminating germs.

Electrical Conductivity (EC):

The conductivity of water is an expression of its ability to conduct an electric current and takes into account the mineral salts that are present in the water. The significance of conductivity measurements that are simple to carry out is readily apparent due to the fact that this feature is connected to the ionic content of the sample, which is in turn a function of the concentration of dissolved (ionisable) materials. Conductivity is a quality that is of little relevance to a water analyst in and of itself; but, it is an extremely valuable indicator of the range into which hardness and alkalinity values are expected to fall, as well as of the order in which the dissolved solids content of the water is likely to fall.

Total Dissolved Solids (TDS):

The term "dissolved solids" refers to solids that are in a state of dissolution in a solution. Generally speaking, water samples that have a high concentration of dissolved solids have a worse palatability and have the potential to cause an undesirable physiological reaction in the temporary consumer.

Dissolved Oxygen:

One of the most essential parameters in water analysis is the amount of oxygen that is dissolved in water. This is because it acts as an indicator of the physical, chemical, and biological activities that are taking place in the water body. The two primary sources of dissolved oxygen are the production of oxygen through photosynthetic activity and the diffusion of oxygen from the air. The solubility of oxygen is a factor that determines the diffusion of oxygen from the air into water. This process is also affected by a wide range of other parameters, including the flow of water, temperature, salinity, and so on. There are a variety of approaches of calculating dissolved oxygen.

Salinity:

The amount of salts that are present in water or soil is denoted by the term "salinity." With the movement of water, salts are able to be transferred since they are highly soluble in both surface water and groundwater. Salt deposits of a significant size are a natural feature of huge sections of the Australian terrain. These salt deposits can be found deep within the soils or on the surface as salt lakes and salt deposits. 'Primary salinity' is the term

used to describe the natural distribution of salt throughout the landscape. Under typical conditions, the deep roots of native plants are responsible for absorbing the majority of the water that is introduced into the soil before it reaches the salt solution that is present in the groundwater below the plant root zone. However, the removal of a large amount of vegetation, improper land management, irrigation, and industrial practices have all contributed to the ease with which salt can be brought to the surface of the soil or carried to streams. Secondary salinity is the term used to describe the additional salt that is being produced as a result of these altered land use and management methods.

Natural processes, such as the weathering of rocks and the accumulation of salt by wind and rain over the course of thousands of years, are responsible for the production of primary salinity. Dryland salinity and irrigation-induced salinity are two types of secondary salinity that emerge as a result of significant land clearing and changes in land use. Secondary salinity can also be caused by irrigation. When native plants with deep roots are removed or replaced with plants with shallow roots that require less water, a phenomenon known as dryland salinity begins to develop. This imbalance in the vegetation causes more water to go through the soil and into the groundwater, which raises the water table and brings salt to the surface, where it can be left behind as the water evaporates. All of these factors contribute to the water table rising. The phenomenon known as irrigation-induced salinity takes place when an excessive amount of water that is applied to crops makes its way to groundwater, thereby elevating the water table and bringing salt to the surface. Groundwater networks are another potential route for the transportation of salt.

Results and Discussions:

Table 2 has a report that details the characterization of the chemometric characteristics of groundwater collected from fourteen distinct locations in Ambala, Haryana, India. Figures 1 through 5 display the findings in a more clear and concise manner. The results of the experiment are compared to the standard limits [16-18] that have been recommended by the Bureau of Indian Standards (BIS), the Indian Council of Medical Research (ICMR), and the World Health Organization (WHO). When compared to the standard limits, the water quality parameters have been found to exhibit significant variations.

Table 2: Chemo-metric parameters of groundwater from fourteen locations of District Ambala, Haryana (India)

Parameters →						
Sample Site ↓	Area Code	Source	Colour	Temperature (C)		
pH						
EC (ms/cm)	TDS (ppt)	DO(ppm)	SALINITY(ppt)			
WHO Standards	7-0 - 8.5	-	.5-1.5	-	-	

ICMR Standards		6.5 - 9.2	-	.5-3.0	-	-			
BIS (IS 10500-91)		6.5 - 8.5	-	.5-2.0	-	-			
Vill.-Subhri	V1	H	Colourless	22.5	7.72	0.57	0.37	4.6	0.3
Vill.- Sarsheri	V2	H	Colourless	22.5	7.77	0.49	0.31	5.6	0.2
Vill.-Rampur	V3	T	Colourless	23	8.47	0.40	0.26	5.4	0.2
Ambala City	V4	H	Colourless	22.5	7.50	0.34	0.22	5.9	0.1
Vill.-Tandwal	V5	H	Colourless	23.5	7.42	2.63	1.73	2.9	2.1
Vill.-Mojgarh	V6	H	Colourless	23	7.43	1.56	1.02	6.4	1.2
Barara	V7	H	Colourless	23	7.76	0.95	0.62	5.9	0.7
Vill.-Ugala	V8	T	Colourless	22.5	8.18	0.36	0.23	4.7	0.1
Vill.-Ghelri	V9	H	Colourless	24	7.66	1.97	1.31	5.6	1.6
Vill.-Rajokheri	V10	H	Colourless	23.5	7.72	0.78	0.51	5.6	0.5
Dhulkot	V11	T	Colourless	23.5	8.24	0.65	0.42	4.4	0.4
Vill.-Dhkola	V12	T	Colourless	23	8.75	0.67	0.43	6.2	0.4
Vill.-Boh	V13	T	Colourless	23	8.27	0.64	0.46	6.4	0.4
Rampur(Kalpi)	V14	H	Colourless	23	7.35	2.26	1.49	4.4	1.8

H Handpump,T Tubewell

6.5 to 8.5 is the target range for the pH value of drinking water, which is considered to be the ideal range. The pH value of the water samples that were measured goes anywhere from 7.35 to 8.75. The pH values exhibit a tendency that is slightly alkaline. It has been determined that the samples have an electrical conductivity that ranges from 0.34 mS/cm to 2.26 mS/cm. According to the BIS, the legal maximum level of total dissolved solids (TDS) is 2000 ppm, whereas the optimum limit of TDS is 500 ppm. The TDS value might get as high as 1.73ppt or as low as 0.22ppt. Both 2.9ppm and 6.4ppm are included in the range of DO values.Between 0.1 and 2 parts per thousand, the salinity value is found.

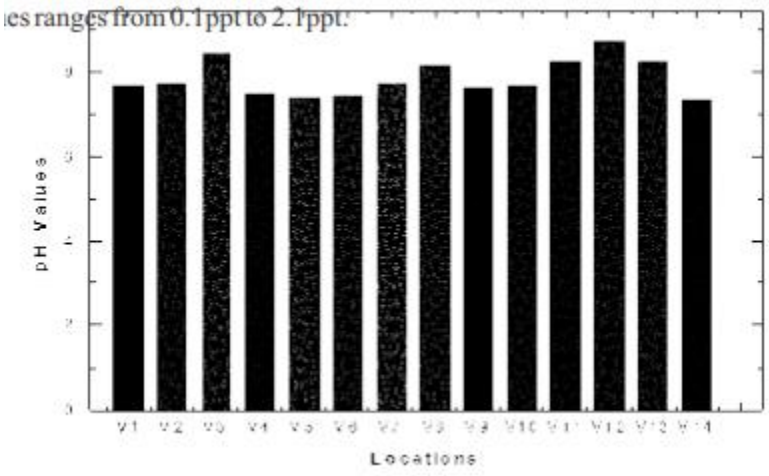
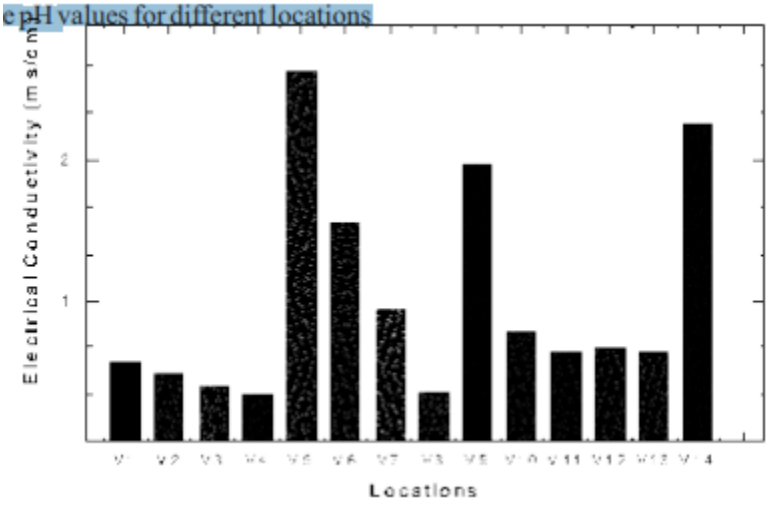


Figure 1: The pH values for different locations



Correlation Studies

The range of uncertainty that is connected with decision making can be reduced through the study of correlation analysis. Using the relation, the correlation coefficient, denoted by the letter 'r', was generated.

According to Table 3, which can be found below, the correlation matrix for the water quality measures is as follows:

Table 3: Correlation matrix for the water quality parameters

Parameters	pH	EC	TDS	DO	Salinity
pH	1	-0.59695	-0.59319	0.275033	-0.45603
EC		1	-0.62317	0.261083	-0.29363
TDS			1	0.268854	0.904216
DO				1	0.914129
Salinity					1

*Significant at 5% level, r > 0.575

CONCLUSIONS

An examination of the physiochemical characteristics was performed on groundwater samples taken from twenty different villages located in the Narwana block of the Jind district in Haryana, India. The dangerous substances that are found in drinking water are directly related to the quality of the water. There is a minor trend toward an alkaline pH in the water samples that were taken throughout the entire region. At certain sites, the values of alkalinity and total dissolved solids have been discovered to be within the limits that are considered advantageous. In comparison to the WHO standard, it was discovered that the amount of fluoride present in several of the

groundwater samples was exceedingly high. However, in certain regions, there is a requirement for treatment in order to limit the contamination, particularly with regard to hardness, chloride, and fluoride. The groundwater in the villages that are located in the Narwana block of the District Jind is appropriate for drinking and domestic purposes. When it comes to safeguarding and conserving water supplies, it is difficult to conceive that a one person can make a difference; but, every single person may actually be of great assistance to the environment. On the other hand, the ground water samples have not been found to contain any evidence of the potentially harmful impacts of fertilizers, pesticides, animal waste, deposits, or sediments. The disposal of garbage from residential and animal sources should be avoided in close proximity to water sources, since this is the recommendation. The use of fertilizers and pesticides in agricultural production ought to be restricted and carried out in an appropriate manner, and the pesticides that are employed ought to be of the standard quality.

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