

Study of Ground Water Quality

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Abstract:

The present study based on the quality of drinking water supplied to the different areas in Nagpur city, Nagpur, Bore wells, which includes tests, pH value, total solids, hardness, conductivity, chloride, and DO. Nagpur is second capital in the state of Maharashtra which has Integrated Nagpur Steel Plant, a number of sponge iron industries, cement manufacturing unit, chemicals, explosives, ceramics and distillery units and large number of small and medium industries. A water quality standard is a rule or law comprised of the uses to be made of a water body or segment and the water quality criteria necessary to protect that uses.

The average concentration of pH, turbidity, DO (Dissolved Oxygen), total hardness, conductivity and chloride are found to be 7.37, 2.438 NTU, 156.8 mg/l, 2.653 mg/l, 42.156 mg/l, 3.6 mg/l, 8.65 mg/l, 102.3mg/l and 21.2 mg/l respectively. The results obtained from the water quality criteria parameter are within the drinking water standard. (IS: 10500).

Keywords: Water quality, IS: 10500, pH, hardness, turbidity, conductivity, dissolved oxygen, chloride.

1. INTRODUCTION

All biological reactions occur in water and it is the integrated system of biological metabolic reactions in an aqueous solution that is essential for the maintenance of life. Most human activities involve the use of water in one way or other. It may be noted that man's early habitation and civilization sprang up along the banks of rivers. Although the surface of our planet is nearly 71% water, only 3% of it is fresh. Of these 3% about 75% is tied up in glaciers and polar icebergs, 24% in groundwater and 1% is available in the form of fresh water in rivers, lakes and ponds suitable for human consumption (Dugan, 1972). Due to increasing industrialization on one hand and exploding population on the other, the demands of water supply have been increasing tremendously. Moreover considerable part of this limited quality of water is polluted by sewage, industrial waste and a wide range of synthetic chemicals. Fresh water which is a precious and limited vital resource needs to be protected, conserved and used wisely by man. But unfortunately such has not been the case, as the polluted lakes, rivers and streams throughout the world testify. According to the scientists of National Environmental Engineering Research Institute, Nagpur, India, about 70 % of the available water in India is polluted (Pani, 1986).

2. STUDY AREA

Pollution is commonly regarded as the result of the industrial revolution. Environmental quality of the area deteriorates mainly as a result of the increasing industrial activity. In order to find out the current status of the pollution in the area, due to the increasing trend in the industrial activities, it is very much essential to identify the various sources of pollution. Water is essential for the survival of any form of life. On an average a human being

consume about 2 liter of water every day during his whole life period. The exploding population, increasing industrialization and urbanization causes water pollution. The water pollution by agricultural, municipal and industrial sources has become a major concern for the welfare of mankind. The following is the list of few industries which are the main sources of pollution generating unit in the area:

a) Bhandewadi hand pump no. J-614



b) Pardi Hand Pump, plot no.61



c) Itwari, hand Pump No. 170



Nagpur is located at 79.09E longitude and 21.15N latitude of Nagpur at an elevation of about 310 meters above mean sea level. The area of Nagpur is 217.56 square kilometers approximately.

Black cotton soils are found here which are quite rich for Agriculture. Nagpur is situated in a hilly region which adds to the natural beauty of the city. Nagpur flow as a single river called Nag. Hence name of city is Nagpur.

Nagpur comes under tropical wet and dry climate prevailing for most of the year. It receives about 163 mm of rainfall in June. The amount of rainfall is increased in July to 294 mm. Gradual decrease of rainfall has been observed from July to August (278 mm) and September (160 mm). The highest recorded daily rainfall was 304 mm on 14 July 1994. Summers are extremely hot, lasting from March to June, with May being the hottest month. Winter lasts from November to January, during which temperatures drop below 10 °C (50 °F). The highest recorded temperature in the city was 48 °C on May 19, 2015, while the lowest was 3.9 °C.

The average number of heat wave days occurring in Nagpur in the summer months of March, April & May is 0.5, 2.4 and 7.2 days respectively. May is the most uncomfortable and hottest month with, for example, 18 days of heat waves being experienced in 1973, 1988 and 2010. The summer season is characterized by other severe weather activity like thunderstorms, dust storms, hailstorms and squalls. Generally, hailstorms occur during March and dust storms during March and April. These occur infrequently (0.1 per day). Squalls occur more frequently with 0.3 per day in March and April rising to 0.8 per day in May. Due to the heat waves in the city the Indian Government with the help of New York-based National Resources Defense Council has launched a heat wave program from March 2016.

3. EXPERIMENTAL METHODS

3.1 WATER SAMPLING PROCEDURE AND ANALYSIS

The water samples were analyzed for various parameters in the laboratory of Environmental Engineering, Priyadarshini college of Engineering. Various physical and chemical parameters like conductivity, pH, Turbidity, Hardness, Dissolved Oxygen (DO), Chloride have been monitored for the tap water of different locations. Plastic bottles of 1 liter capacity with stopper were used for collecting samples. Each bottle was washed with 2% Nitric acid and then rinsed three times with distilled water. The bottles were then preserved in a clean place. The bottles were filled leaving no air space, and then the bottle was sealed to prevent any leakage. Each container was clearly marked with the name and date of sampling.

3.2 SAMPLING POINTS

In institute campus samples collected from the sampling point as marked in fig.1 and are as follows:

1. Bhandewadi hand pump no. J-614,
2. Pardi Hand Pump, plot no.61,
3. Itwari, hand pump No. 170.

3.3 WATER QUALITY PARAMETERS

1. pH value of the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.
2. Conductivity of the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.
3. Dissolved oxygen in the water samples of the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.
4. Turbidity of the water samples from the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.
5. Total hardness of the water samples from the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.
6. Presence of chloride in the water samples from the hand pump of Bhandewadi hand pump no. J-614, Pardi Hand Pump, plot no.61, Itwari, hand pump No. 170.of Nagpur city.

The results of the analyzed parameters of hand pumps of the different locations of Nagpur city are compared with the related standards for drinking water prescribed by IS:10500 and USPHS. The drinking water standard is given in the table no.3.1

4. RESULTS AND DISCUSSIONS

4.1 pH VALUE

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples is from 6.7 to 7.20.

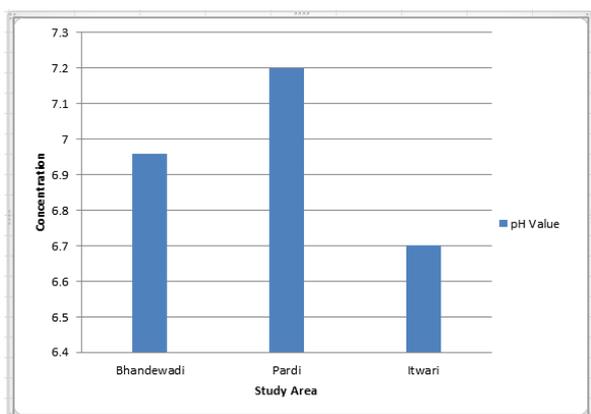


Fig.4.1 Average pH of the water samples from different areas.

4.2 TURBIDITY

Measurement of Turbidity reflects the transparency in water. It is caused by the substances present in water in suspension. In natural water, it is caused by clay, silt, organic matter and other microscopic organisms. It ranged from 2.3 to 4.4 NTU. However the prescribed limit of Turbidity for drinking water is 5 NTU (IS: 10500). Turbidity was found within the permissible limit in all the water samples.

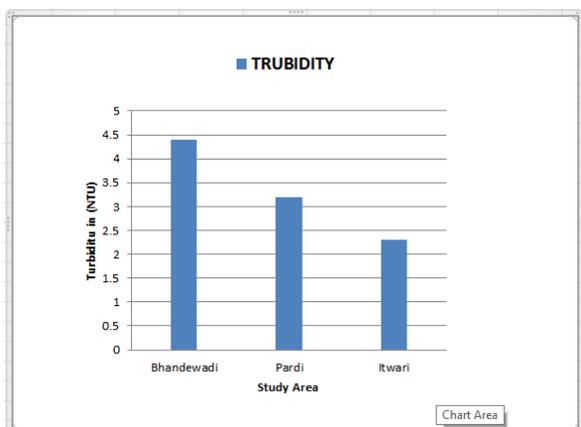


Fig.4.2. Average Turbidity of the water samples from different areas.

4.3. TOTAL HARDNESS

Hardness of water is objectionable from the view point of water use for laundry and domestic purposes since it consumes a large quantity of soap. Based on present investigation, hardness varied from 452 to 592 mg/l. However the permissible limit of Hardness for drinking water is 300 mg/l (IS 10500). According to Hardness classification (Durfor and Backer, 1964), the no of water samples of the study area can be classified as given in table 4.1. It is found that the water supplied to the respected areas for domestically and industrial purpose in Nagpur city.

Table 4.1. Classification of the water according to hardness.

TDS Range	Description
0-60	Soft
61-120	Moderately hard
121-180	Hard
>180	Very hard

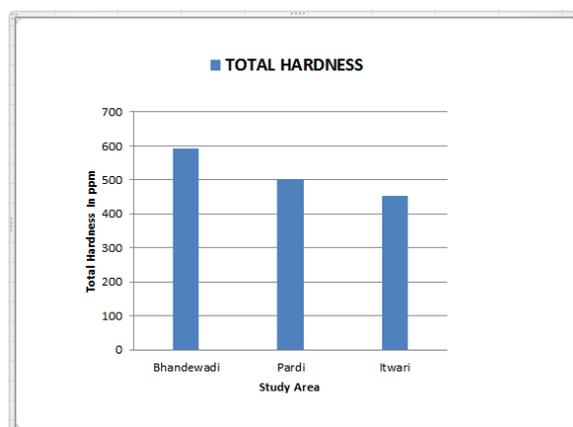


Fig.4.3 Average hardness of the water samples from different areas.

4.4 DISSOLVED OXYGEN (DO)

Dissolved oxygen content in water reflects the physical and biological processes prevailing in water and is influenced by aquatic vegetation. Low oxygen content in water is usually associated with organic pollution. DO is ranged from 7.6 to 9.87 mg/l in the study area, where as the prescribed limit for DO is 5.0 mg/l.

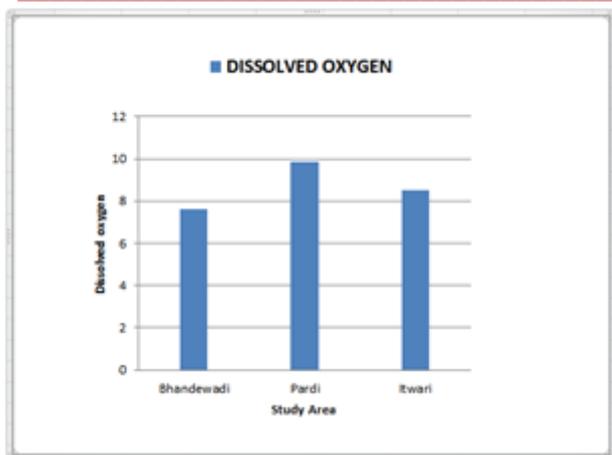


Fig.4.4. Average DO of the samples from different areas.

4.5 CHLORIDE

In the study area there has significant change in chloride concentration and it ranged from 32.9 to 55.98 mg/l. Chloride which have been associated with pollution as an index are found below the permissible value set at 250 mg/l in most of the study area. Chloride in excess (> 250 mg/l) imparts a salty taste to water and people who are not accustomed to high Chlorides can be subjected to laxative effects.

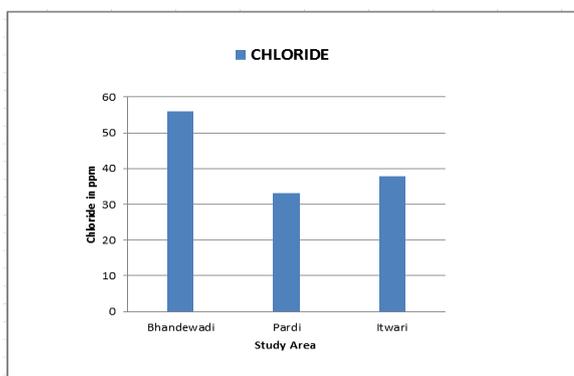


Fig.4.5. Average chloride present in the samples from different areas.

4.6 CONDUCTIVITY

The underground drinking water quality of study area can be checked effectively by controlling conductivity of water and this may also be applied to water quality management of other study areas. It is measured with the help of EC meter which measures the resistance offered by the water between two platinized electrodes. The instrument is standardized with known values of conductance observed with standard KCl solution.

Table 4.6. The ranges of conductivity

Solution	$\mu\text{S/cm}$
Totally pure water	0.055
Typical DI water	0.1
Distilled water	0.5
RO water	50-100
Domestic tap water	500-800
Portable water	1055
Sea water	56000
Brackish water	100000

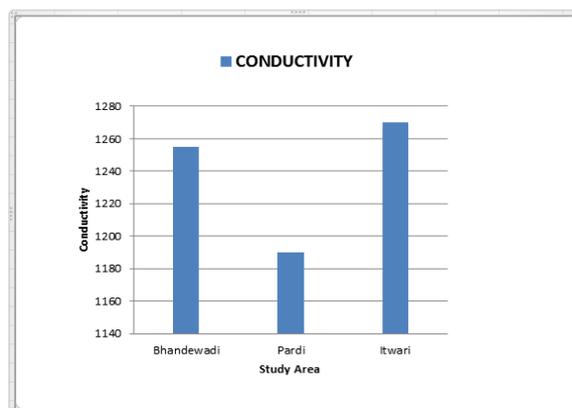


Fig.4.6 Average EC in the samples from different areas.

5. CONCLUSIONS

The average ranges of physical, chemical and characteristics of water quality are as per the ground water quality. The pH ranges from 6.7 to 7.2 hence safe. The Turbidity ranged from 2.31 to 4.4 mg/l. The value of Turbidity was found to be within the permissible limit in all the. Hardness, ranged

From 452 to 592 mg/l and it is found that the ground water of the respected area is hard. The DO was in the range of 7.68 to 9.8 mg/l. The Chloride were in the range of 37.99 to 55.9 mg/l. The conductivity ranges from 1190 to 1285 $\mu\text{S/cm}$ hence it is portable water. The parameters studied resemble the ground water quality.

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