Current Research Bulletin
Volume 01 Issue 01 July 2024
Page no: 18-30
Available Url: http://crbjour.org/index.php/crb/index
ISSN(e): Applied
ISSN (p): Applied
Open Access

Assessment of Water Quality Index for the Pond Water in and Around Jabalpur City, Madhya Pradesh, India

Muhammad Hasnain Beg
Reserch Schollar Department Of Chemisty, Government Science College Jabalpur M.P., India, Rani Durgavati University, Jabalpur

Published Online:
12 July 2024

ABSTRACT: The present research work is aimed to know the Water Quality Index (WQI) for the groundwater and pond's water of Jabalpur city and its surrounding areas. For this study groundwater samples were collected and various physical and chemical parameters were determined in the laboratory. For calculating the WQI, the following 13 parameters have been considered: pH, Electrical Conductivity (EC), Total Hardness (TH), Total Dissolved Solids (TDS), Calcium (Ca++) hardness,Magnesium (Mg++) hardness,Chloride (Cl-),Sulphate (SO4- -). Nitrate (NO_3^-),Alkalinity,Biological oxygen demand,Oxygen demand,Total colifrom. Water Quality Index for these samples ranges from 8 to 15. The high value of WQI has been found to be mainly from the higher values of Iron, Total Dissolved Solids, Total Hardness, Fluoride, in the groundwater. The final output of the analyses has been used to suggest models for predicting water quality. Spatial distribution of calculated Water Quality Index was plotted in Arc GIS environment for better visualization. The analysis of groundwater And pond water shows that the groundwater of the area needs great degree of revitalisation before consumption, and it also needs to be protected from the pollution sources of contamination.

KEY WORDS: Groundwater, Water quality standards, Water quality index.

1. INTRODUCTION

Water quality:-Water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species, or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance, generally achieved through treatment of the water, can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact, and drinking water.

Groundwater is utilized for household and modern water supply and water system everywhere throughout the world. Over the most recent couple of decades, there has been an enormous increment in the interest for new water due to fast development of populace and the quickened pace of industrialization. Human wellbeing is compromised by the greater part of the farming advancement exercises especially in connection to exorbitant utilization of chemical fertilizers, composts and unsanitary conditions. Fast urbanization, particularly in creating nations like India, has influenced the accessibility and nature of groundwater because of its overexploitation and inappropriate waste transfer, particularly in urban regions. As per WHO, about 80% of the considerable number of illnesses in individuals is brought about by water. Once the groundwater is sullied, its quality cannot be re-established by preventing the contaminations from the source. It accordingly gets basic to normally screen the nature of groundwater and to gadget available resources to ensure it.Water quality record is one of the best apparatus to convey data on the nature of water to the concerned residents and arrangement creators. It, in this manner, turns into a significant parameter for the appraisal and the executives of groundwater. The moderate permeation of water brings about a delayed contact through the minerals. Numerous minerals are disintegrated by the groundwater as it ignores them and in time semi concoction harmony can be come to between the groundwater and the minerals. By this procedure the groundwater gets soaked by certain broke up solids. The capacity to break down the mineral constituents, decides the concoction idea of groundwater. The WQI can be used to monitor water quality changes

in a particular water supply over time lapses, or it can be used to compare a water supply quality with other supplies in the region or from around the world. The goal of the present work is to determine it a particular stretch of water is considered as wealthy.

2. STUDY AREA

Jabalpur is located in the central part of Madhya Pradesh state. The area for present study falls in the Survey of India Top sheet number 55 M /16. The area is bounded by Latitude 230 15‟ North and 790 45‟ East and Latitude 230 15‟ North 800 00‟ East, Latitude 230 00‟ North and 790 45‟ East and Latitude 230 00‟ North 800 00‟ East shown in (Figure No. 1) covers an area of 708.10 sq.km with a population of approx 20 Laces. The basic feature of Jabalpur is that it has grown on a natural wetland that originally existed below the slope zone of the Madan mahal Granites along the low and relatively flatland of Gondwana rocks (Jha et al 2009,Tignath et al 2007). Groundwater in the study area occurs in the weathered and fractured granite and gneisses. There is Perennial River Narmada gwarighat,baleha pond panagar and supataal pond madan mahal, flowing in the study area. The major ion chemistry of groundwater of Jabalpur has not been studied earlier.

3. METHODOLOGY

Groundwater samples were collected from 6 locations shown in (Figure No. 1).Each of the groundwater samples was analyzed for 12 parameters such as pH, Electrical Conductivity (EC), Total Hardness (TH), Total Dissolved Solids (TDS), Calcium (Ca++) hardness,Magnesium (Mg++) hardness,Chloride (Cl-),Sulphate (SO4- -). Nitrate (NO_3^-),Alkalinity,Biological oxygen demand,Oxygen demand,Total colifrom. using standard procedures recommended by . The chemical parameters obtained were used for regression analysis.The process shows as following mannar.

1 Sample Data:

Locality:- Moulana ward Panagar Jabalpur mp.
Sample site:- Baleha pot, site panagar
place point:-near dhobhi ghat baleha talab
date of sampling:-25 February 2020
Time of sampling:-6.45 A.M.

2. Physical properties of sample:-

colour:-colourless odourless
Electric conductance =110 micro siemens/ppm
Temperature = 24.4 °C
Ph = 7.31.

3. Experiment:-calcium hardness of water.

1 Take 50 ml sample.
add 1 ml 1N NaOH solution.
add Ammonium purpurate.
pink colour apperas.

2 Titrate with 0.01M EDTA solution colour change from pink to ***purple.***

Titrant Reading 1) 1.8 ml 2) 1.6 ml

calcium Hardness = (ml titrant)×1000/(ml sample)

Hardness = 1.6×1000/50
Hardness = 32 mg/L

results :- calcium Hardness of water is 32 mg/L.

4 Total hardness of water.

1. Take 50 ml sample.
2. add 1ml Buffer solution.
3. add EBT INDICATOR.

2.Titrate with 0.01M Standard EDTA SOLUTION untill the last **reddish** colour disappeared.

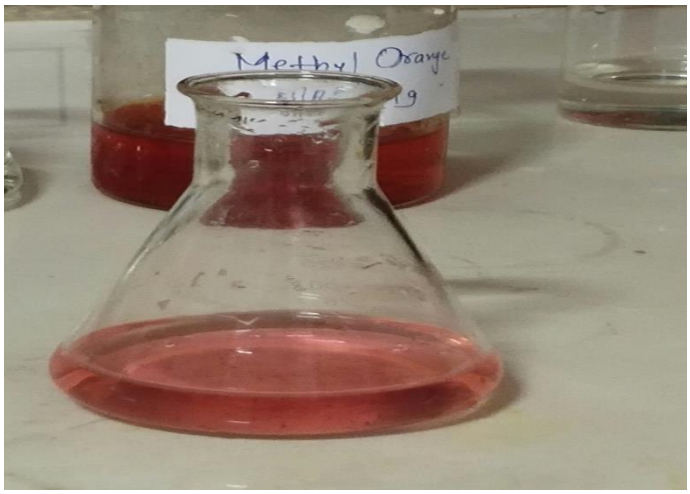
3 Titrant Reading 1) 4.2 ml 2) 4.0ml

Hardness= (ml titrant)×1000/(ml sample)
Hardness = 4 ×1000/50
Hardness = 80 mg/L
Results :- Hardness of water is 80 mg/L.

Magnesium Hardness = total hardness - calcium hardness
mg =80-32= 48 mg/L
Results :- Magnesium Hardness of water is 48 mg/L.

5 To determine the alkalinity of samples.

1 Take 50 ml sample.
add 0.2 ml (Methylorange)
indicator solution.
Orange colour occurred.



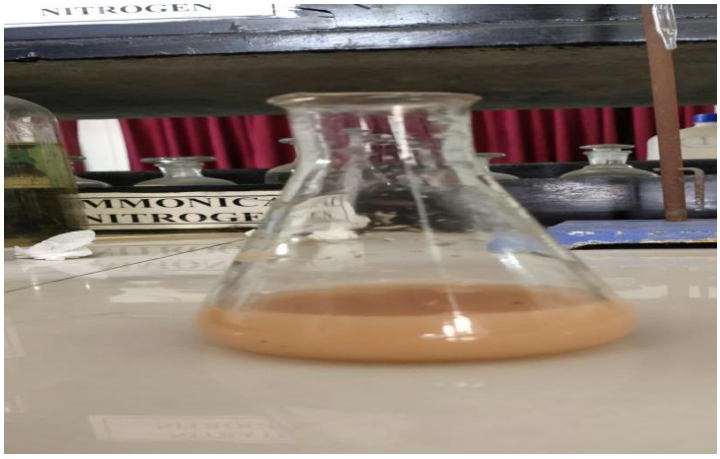
2. Titrate with 0.02N Standard H2SO4 SOLUTION untill the **orange** colour change to pink.

3.Titrant Reading 1)0.1 ml
2)0.1ml
Alkalinity =A×N×50600/ (ml sample)
Alkalinity = 0.1×0.02 ×50600/50

Alkalinity = 2.024 mg/L
Results :- Alkalinity of water is 2.024 mg/L.

6. Experiment :- To determine the chloride of samples

1 Take 100 ml sample.
adjust sample ph to 7 to 10 with h2so4 or NAOH.
add 1ml k2cro4 indicator solution.
yellow colour occurred.



2 Titrate with Standard agno3 SOLUTION a **pinkish yellow** end point.

3 Titrant Reading 1) 1.8 ml 2) 1.6ml
chloride = (ml titrant)×0.0141×35450/(ml sample)
chloride = 1.6×0.0141×35450/100
chloride = 7.997 mg/L
Results :- chloride of water is 7.997 mg/L.

7. Experiment:- To determine the nitrate of samples.
Methods:-
1 Take 50 ml sample.
2 add 1ml HCl solution & mix thoroughly
3 read absorbance against redistilled water set at zero absorbance or 100% transmittance.
4 Measure uv spectroscopy at 220nm wavelength.


3
1
2
3
4

8.Experiment :- To determine the sulfate of samples.
Methods:-
1 Take 50 ml sample.
2 add 10ml buffer solution & mix well.
3 add a spoonful of Bacl2 crystals and being immediately stir for 62 seconds at constant speed.
4 Measure turbidity in nephelometer or uv spectroscopy at 420nm wavelength.

wavelengths reading:-
sulfate = 0.237mg
sulfate (SO4) = sulfate (SO4)×1000/(ml sample)
sulfate= 0.237×1000/50
sulfate=4.74mg/L
nitrate= 0.120mg/l
results:- the sample water contains sulfate 4.74mg/L and nitrate 0.120mg/l.

9 Experiment:-To determine the dissolved oxygen of samples.

1.Methods:- do fixation

1 Take 300 ml sample.

2 add 1.0ml MnSO4 solution & mix well.

3 add 1.0ml alkali iodide azide solution.

4 Mix by inverting bolltle.

5 let the precipitate settle

2.Methods:- analysis

1 add 1.0ml conc. h2so4 solution.

2 mix by inverting untill dissolution is complete.

3 Take 201 ml sample.

4 titrate with 0.025 m na2s2o3(sodium thiosulfate) solution to a **pale** straw colour.

5 add a few drops of starch solution.

6 continues titration to first disappearance of **blue** colour.

3. CALCULATION

On addition of reagent the original sample is lost.

total vol. of water sample = 300mL

Volume of reagent (3)ml = 1mL H2SO4 + 2mL MnSO4+ 3mL KI

200×300/300-3 = 201mL

Hence 201mL is taken for titration which with correspond to 200mL of original sample.

1mL of N/40 Na2S2O3 = 0.2 mg of O2

Where H= volume of hypo solution= 6.2ML

D. O. in mg = 0.2 × 1000 × H/200 =200×6.2/200=6.2 mg of O2

mg do/l =ml 0.025 m na2s2o3

Dissolved oxygen titre value 6.2 ml.

6.2mg /l is total dissolved oxygen in baleha pot water.

10 Experiment:-To determine the biochemical dissolved oxygen of samples.

1 Methods:- do fixation

1 Take 2 300 ml sample bottle . first for intial do and second for final do(27°c &3 day's).

2 add 1.0ml MnSO4 solution & mix well.

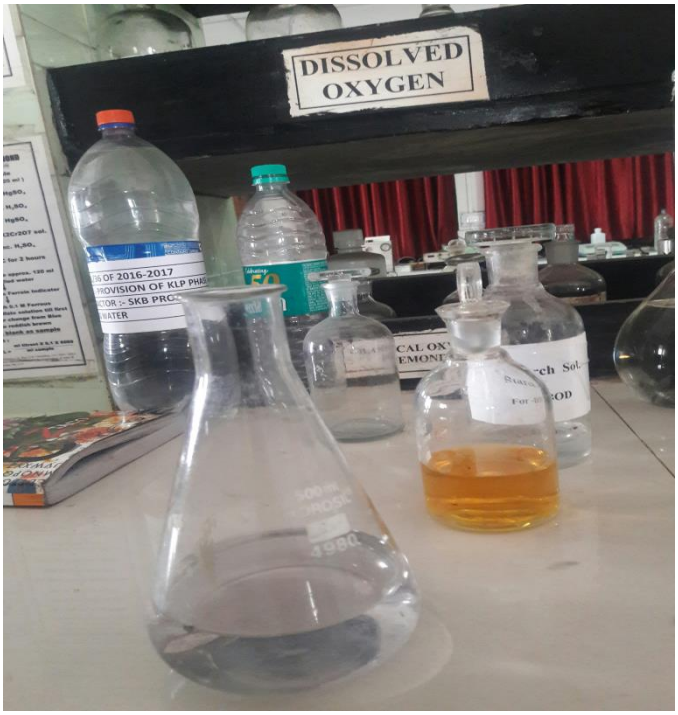
3 add 1.0ml alkali iodide azide solution.

4 Mix by inverting bolltle.

5 let the precipitate settle

2 Methods:- bod analysis

1 add 1.0ml conc. h2so4 solution.
2 mix by inverting untill dissolution is complete.
3 Take 201 ml sample.
4 titrate with 0.025 m na2s2o3(sodium thiosulfate) solution to a **pale** straw colour.
5 add a few drops of starch solution.
6 continues titration to first disappearance of **blue colour.**



3 OBSERVATION
intial do 1)6.8 ml
final do 2)6.3ml
bod=d1-d2×100/p
bod = 6.8-6.3×100/20.1
bod = 2.4875mg/l
results the biochemical oxygen demand of samples water is 2.4875mg/l.

(Figure No.1) Grab sample collection at baleha pot near dhobhi ghat Panagar Jabalpur.

4. RESULTS AND DISCUSSION

Table 2 comprises the chemical parameters of groundwater laid by Bureau of Indian Standards (BIS) and World Health Organization (WHO). Descriptive statistics of water quality parameters of 6 groundwater AND Pond samples are presented in Table 3.

parameters	drinking water without treatment	outdoor bathing	drinking water with treatment	fish culture & wild life activity	fish culture& wild life activity.
pH	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	7.31
total hardness	300mg/L	-	-	-	80mg/L
calcium hardness	200mg/L	-	-	-	32mg/L
alkalinity	-	-	-	-	2.024mg/L
total dissolved solid	600mg/L	-	1500mg/L	2100mg/L	350mg/L
DO	6.0mg/L	3.0mg/L	4.0mg/L	2.0mg/L	6.2mg/L
sulfate	400mg/L	-	400mg/L	-	4.74mg/L
Nitrate	20mg/L	-	-	-	0.120mg/L

chloride	250 mg/L	-	600mg/L	-	7.997mg/L
conductivity	-	-	-	1000us/ppm	110us/ppm
BOD	2.0mg/L	3.0mg/L	3.0mg/L	-	2.4875mg/L
Total colifrom	50mg/L	500mg/L	5000mg/L	-	27mg/L

5. CONCLUSIONS

The WQI for 6 samples ranges from 9 to 15. Almost ninety nine percent of the samples exceeded 100, the upper limit for drinking water. The high value of WQI at these stations has been found to be mainly from the higher values of iron, Total Dissolved Solids, Total Hardness, Fluoride, Bicarbonate, and Chloride in the groundwater. About 91.67% of water samples are poor in quality. In this part, the groundwater quality may improve due to inflow of freshwater of good quality during rainy season.

Magnesium and chloride are significantly interrelated and indicates that the hardness of the water is permanent in nature. The analysis reveals that the groundwater of the area needs some degree of treatment before consumption, and it also needs to be protected from the perils of contamination.

1 5: Water Quality Classifications
1 1 <50 Excellent
2 50-100 Good water 1.18
3 100-200 Poor water 91.67
4 200-300 Very poor water 6.43
5 >300 Water unsuitable for drinking 0.71.

2 analysing sample of baleha pond pathani mohalla Panagar jabalpur with quality control in MP POLLUTION CONTROL BOARD JABALPUR with 14 test ph sulfate nitrate bod do hardness of water etc.
3 water quality of my sample water is comparae with standards water quality data and after this we find this conclusion that water sample is category 1 drinking water without treatment and now ready for domestic use.

REFERENCES

1. APHA (American Public Health Association) (1994) Standard method for examination of water and wastewater, NW, DC 20036
2. BIS (Bureau of Indian Standards) (1991) 10500, Indian standard drinking water specification, First revision, pp 1-8.
3. Chanda D K, (1999) Hydrology J,, 7(5), 431-439.
4. Deininger, R.A and Micaunas J.J (1971), Water quality of environmental and industrial health. School of public health,Michigan University, Ann Arbor, Michigen.
5. Devendra Dohare, Shriram Deshpande and Atul KotiyaResearch (2014) Journal of Engineering Sciences,Vol. 3(5), 26-31,.
6. Gupta S, Kumar A, Ojha C K and Singh G, J Environmental Science and Engineering., (2004), 46(1), 74-78.
7. Harilal C C, Hashim A, Arun P R and Baji S, J Ecology, Environment and Conservation, (2004), 10(2), 187-192.
8. STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTE WATER 22ND EDITION BY ANDREW.D.EATON 2014
9. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
10. Environmental Chemistry, S.E. Manahan, Lewis Publish.
11. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
12. WHO (World Health Organization) Guidelines for drinking water quality, 2nd Ed., (1993), Vol 1, p 188.
13. Jha M. and Tignath S.,(2009) Assessment of Impacts of the Surface Water Environment In and Around Jabalpur City MP, Journal Earth Science India, Vol.2 (II), April, 2009, pp. 111 – 116.
14. Tignath S. and Jha M., (2007), On the Efficacy of Jabalpur Water Supply System‟ Sci-fronts: A Journal of multiple Sciences, vol.1, Dec.2007, p. 141-144